**IN THE UNITED STATES DISTRICT COURT**
**FOR THE EASTERN DISTRICT OF TEXAS**
**MARSHALL DIVISION**

| | |
|---|---|
| EYESMATCH LTD.,<br><br>Plaintiff,<br><br>v.<br><br>SAMSUNG ELECTRONICS CO., LTD., SAMSUNG ELECTRONICS AMERICA, INC., and SAMSUNG RESEARCH AMERICA, INC.,<br><br>Defendants. | Case No. 2:23-cv-00363-JRG-RSP |

**DEFENDANTS' INVALIDITY CONTENTIONS AND**
**P.R. 3-3 AND 3-4 DISCLOSURES**

Pursuant to Local Patent Rules ("P.R.") 3-3 and 3-4 and the Order Setting Scheduling Conference (Dkt. No. 11), Defendants Samsung Electronics Co., Ltd. ("SEC"), Samsung Electronics America, Inc. ("SEA"), and Samsung Research America, Inc. ("SRA") (collectively, "Defendants") provide Defendants' Invalidity Contentions and P.R. 3-3 and 3-4 Disclosures ("Invalidity Contentions") concerning U.S. Patent No. 8,982,109 (the "'109 Patent") and U.S. Patent No. 8,982,110 (the "'110 Patent") (together, the "Asserted Patents"). These contentions set forth Defendants' preliminary Invalidity Contentions with respect to the claims that were identified by Plaintiff EyesMatch Ltd. ("Plaintiff" or "EyesMatch") in its Plaintiff EyesMatch Ltd.'s Disclosure of Asserted Claims And Infringement Contentions as to Samsung Electronics America, Inc.; Plaintiff EyesMatch Ltd.'s Disclosure of Asserted Claims And Infringement Contentions as to Samsung Electronics Co., Ltd.; Plaintiff EyesMatch Ltd.'s Disclosure of Asserted Claims And Infringement Contentions as to Samsung Research America, Inc.; served December 4, 2023 ("Infringement Contentions").

Defendants are also producing, concurrently with these Invalidity Contentions, documents required by P.R. 3-4, including copies of prior art references required by P.R. 3-4(b).

## I. INTRODUCTORY STATEMENT

Plaintiff has asserted the following claims against Defendants in Case No. 2:23-cv-00363-JRG-RSP (E.D. Tex.):

| U.S. Patent No. | Asserted Claims |
|---|---|
| 8,982,109 | 1, 2, 7, 8, 9, 11 |
| 8,982,110 | 1, 2, 3, 4, 5, 6, 10, 11, 12, 16, 17 |

(*See* Plaintiff's Disclosure of Asserted Claims and Infringement Contentions (P.R. 3-1).) These claims are collectively referred to as "the Asserted Claims." The Asserted Claims of the '109 and '110 Patents, however, are neither novel nor non-obvious in view of the state of the prior art and the understanding of a person of ordinary skill in the art at the time of the alleged inventions ("POSITA"). The Asserted Claims are also invalid for lack of written description, lack of enablement, and/or indefiniteness under 35 U.S.C. § 112, as explained herein.

In accordance with P.R. 3-3(a)-(d), Defendants hereby: (a) identify each currently known item of prior art that either anticipates or renders obvious each asserted claim; (b) specify (i) whether each such item of prior art anticipates each asserted claim and/or renders it obvious, and (ii) if a combination of items of prior art renders a claim obvious, identify each such combination and the motivation to combine such items; (c) submit a chart identifying where each element in each asserted claim is disclosed, described, or taught in the prior art, and the identity of the structure(s), act(s), or material(s) in each item of prior art that performs the claimed function in the case of means-plus-function elements under 35 U.S.C. § 112, ¶ 6; and (d) identify the grounds for invalidating the Asserted Claims based upon indefiniteness under 35 U.S.C. § 112, ¶ 2 or



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enablement or written description under 35 U.S.C. § 112, ¶ 1, with respect to each asserted claim and based upon Defendants' investigation to date.

The initial Invalidity Contentions provided herein by Defendants are preliminary and subject to revision as provided in the Local Rules, the Federal Rules of Civil Procedure, and/or any Order of this Court. For example, these Invalidity Contentions are based on Defendants' current knowledge, understanding, and belief as to the facts and information available at this time. Defendants have not yet completed their investigation, collection of information, discovery, or analysis relating to this action, and additional facts and information may require Defendants to supplement or modify these Invalidity Contentions.

Furthermore, Defendants intend to diligently seek documents from third parties in discovery to demonstrate such third parties' earlier dates of invention under 35 U.S.C. § 102(g) and/or prior art offers for sale and public uses of products embodying the claimed invention under 35 U.S.C. § 102(b) or under 35 U.S.C. § 102(a). Defendants therefore reserve the right to supplement these Invalidity Contentions with further information and documentation, if and when it becomes available.

Defendants also reserve their right to supplement and/or amend these Invalidity Contentions after the Court has construed disputed claim terms. Defendants' contentions concerning the validity of the Asserted Claims may change based upon the Court's construction of the claims or positions that EyesMatch takes concerning infringement or validity issues after such construction. Moreover, given the inadequacies in EyesMatch's Infringement Contentions, Defendants have used their best efforts to understand how EyesMatch is construing the Asserted Claims for purposes of identifying invalidating prior art. Nothing contained in these Invalidity Contentions or any accompanying Exhibits, however, should be understood or deemed to be an



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express or implied admission or contention with respect to the proper construction or scope of any terms in the Asserted Claims, nor should they be understood to adopt EyesMatch's stated claim construction or its proposed scope of the Asserted Claims. Defendants' Invalidity Contentions merely consider EyesMatch's apparent application of the Asserted Claims to the accused products under the principle that the scope of the claim must be the same for invalidity as it is for infringement.

Defendants provide the information below and in the attached charts and document production in order to comply with P.R. 3-3 and 3-4. Defendants reserve the right to prove the invalidity or unenforceability of the Asserted Claims on bases other than those required to be disclosed in these Invalidity Contentions pursuant to P.R. 3-3. The production of documents that have been identified in these Invalidity Contentions shall not be deemed an admission that such documents are admissible or that Defendants have waived any objections regarding the admissibility of such documents.

Pursuant to the provisions of P.R. 3-3, Defendants identify specific portions of prior art references that disclose the elements of the Asserted Claims. Although Defendants have identified exemplary disclosures for each reference, each and every disclosure in the reference is not necessarily identified. The lack of a citation for an element should not be deemed an admission that the element is not disclosed or is not inherent in the reference. In an effort to focus the issues, Defendants identify only exemplary portions of cited references. It should be recognized that persons of ordinary skill in the art generally read a prior art reference as a whole and in the context of other publications and literature and in light of the knowledge of one of ordinary skill in the art. To understand and interpret any specific statement or disclosure within a prior art reference, such persons would rely on other information within the reference, along with other publications and



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their scientific or engineering knowledge. Defendants consequently reserve the right to rely upon other unidentified portions of the prior art references and on other publications and expert testimony as to the knowledge of a person of ordinary skill in the art to provide context, and as aids to understanding and interpreting the portions of that art identified. Defendants also reserve the right to rely on other portions of the prior art references, other publications, and the testimony of experts to establish that a person of ordinary skill in the art would have been motivated to modify or combine certain of the cited references so as to render the claims obvious. Further, where Defendants identify a particular figure in a prior art reference, the identification should be understood to encompass the caption and description of the figure and any text relating to the figure in addition to the figure itself. Similarly, where an identified portion of text refers to a figure, the identification should be understood to include the figure as well. Defendants further reserve the right to rely upon any applicable industry standards and prior art cited to the patent office as invalidating references or to show the state of the art.

Prior art not included in these Invalidity Contentions, whether known or unknown to Defendants, may become relevant based on subsequent events. In particular, Defendants are currently unaware of the extent, if any, to which Plaintiff will contend that limitations of the Asserted Claims are not disclosed in the prior art identified by Defendants. To the extent that such an issue arises, Defendants reserve the right to identify other known references that would disclose or render obvious the allegedly missing limitation(s) of the Asserted Claims.

Defendants further intend to rely on inventor and EyesMatch admissions concerning the prior art relevant to the Asserted Patent found in, *inter alia*: the Asserted Patents, the patent prosecution histories for the Asserted Patents and related patents and/or patent applications; any deposition testimony of the named inventors on the Asserted Patents; and the papers filed and any



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evidence submitted by Plaintiff in connection with this litigation or other of its past, current, or future litigations or administrative proceedings concerning or relating to one or more of the Asserted Patents.

Because Defendants are continuing their search for and analysis of relevant prior art, Defendants reserve the right to seek to amend or supplement the information provided herein, including identifying, charting, or relying upon additional prior art references, relevant disclosures, and bases for Invalidity Contentions. Additional prior art and disclosures, whether or not cited in this disclosure and whether known or not known to Defendants, may become relevant as investigation, analysis, and discovery continue. Defendants incorporate by reference, and intend to rely on, each reference, disclosure, or argument served in any prior or concurrent matter involving the same patents but not yet produced to Defendants by Plaintiff.

Additionally, because fact discovery has not yet commenced, Defendants reserve the right to present additional prior art references, disclosures, or assertions for prior art identified below under 35 U.S.C. §§ 102(a), (b), (e), (f), or (g), or § 103, located during the course of discovery or further investigation, and to assert invalidity under 35 U.S.C. §§ 102(c), (d), or (f), if future discovery or investigation yields information that supports additional bases of invalidity.

## II. INVALIDITY CONTENTIONS—P.R. 3-3

### A. Identity of Each Item of Prior Art—P.R. 3-3(a)

Under P.R. 3-3(a), and subject to Defendants' reservation of rights as articulated above, Defendants identify each item of prior art that anticipates or renders obvious one or more of the Asserted Claims in the attached Prior Art Index submitted herewith. *See* Section V below. For references listed in Section V that are not identified as items of prior art that anticipate or render obvious an Asserted Claim, Defendants intend to rely on these references as *inter alia* background and evidence of the state of the art at the time of Plaintiff's alleged inventions and the level of skill



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and knowledge of a person of ordinary skill in the art at that time. *See Koninklijke Philips N.V. v. Google LLC*, 948 F. 3d 1330, 1347 (Fed. Cir. 2020) ("Regardless of the tribunal, the inquiry into whether any 'differences' between the invention and the prior art would have rendered the invention obvious to a skilled artisan necessarily depends on such artisan's knowledge.").

Additionally, the prior art references cited by Defendants include references that are related patent applications and issued patents that contain substantially the same subject matter (e.g., published U.S. patent applications, issued U.S. patents, foreign applications, or foreign issued patents). Any citation to or quotation from any of these patent applications or patents, therefore, encompasses any parallel citation to the same subject matter in other related or corresponding applications or patents. For example, where a claim chart cites a published patent application that ultimately issued as a patent with substantially the same written description, Defendants may rely upon the published patent application or the issued patent as prior art.

Defendants also reserve the right to later rely upon all references or portions of references provided in Section V to supplement or amend these disclosures. Defendants incorporate by reference (1) any and all prior art contained or identified in documents produced thus far by Plaintiff in this or any other proceeding, (2) any and all additional materials regarding or bearing upon invalidity in Plaintiff's possession or control that have not been produced to date, if any exist, and any and all prior art cited by or invalidity contentions served by defendants in any prior case or concurrent case.

Each disclosed item of prior art describing a product, system, or other implementation made in the United States is evidence of a prior invention by another under 35 U.S.C. § 102(g), as evidenced by the named inventors, authors, organizations, and publishers involved with each of these references. Defendants further intend to rely on admissions of the named inventors

concerning the prior art, including statements found in the Asserted Patents, their prosecution histories, related patents or patent applications, any deposition testimony, and the papers filed and any evidence submitted by Plaintiff in conjunction with this litigation.

**B. Whether Prior Art Anticipates or Renders Obvious—P.R. 3-3(b)**

Pursuant to P.R. 3. 3(b), and subject to Defendants' reservations of rights, Defendants identify in the attached Exhibits A-00 through A-30 and B-00 through B-29 prior art references that anticipate the Asserted Claims under at least one or more of 35 U.S.C. §§ 102(a), (b), (e), and (g), either expressly or inherently, and/or render obvious the Asserted Claims under 35 U.S.C. § 103 either alone or in combination with other references identified herein. Each Asserted Claim is anticipated by, or obvious in view of, one or more items of prior art identified in these disclosures, alone or in combination. A table identifying ways in which the prior art references cited herein anticipate or render obvious the Asserted Claims is provided in Section II. B. 2 below.

Much of the art identified in the attached Exhibits (i.e. claim charts) reflects common knowledge to persons of ordinary skill in the art and the state of the relevant art at the time of the earliest filing date of each Asserted Patent. Defendants may rely on additional citations, references, expert testimony, and other material to provide context or to aid in understanding the cited portions of the references or cited features of the systems. Defendants may also rely on expert testimony explaining relevant portions of references, relevant hardware or software products or systems, and other discovery regarding these subject matters. Additionally, Defendants may rely on other portions of any prior art reference for purposes of explaining the background and general technical subject area of the reference.

Where an individual reference is cited with respect to all limitations of an Asserted Claim, Defendants contend that the reference anticipates the claim under one or more of 35 U.S.C. §§ 102(a), (b), (e), or (g) and also renders obvious the claim under 35 U.S.C. § 103, both by itself



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in view of the knowledge of a person of ordinary skill in the relevant art and in combination with the other references in Exhibits A-00 through A-30 and B-00 through B-29, including to the extent the reference is not found to disclose one or more claim limitations. A single prior art reference, for example, can establish obviousness where the differences between the disclosures within the reference and the claimed invention would have been obvious to one of ordinary skilled in the art. For example, "[c]ombining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap of inventiveness." *Boston Scientific Scimed, Inc. v. Cordis Corp*., 554 F. 3d 982, 991 (Fed. Cir. 2009). If Plaintiff contends that an embodiment within a particular item of prior art does not fully disclose all limitations of a claim, Defendants reserve the right to rely on other embodiments in that prior art reference, or other information, to show single reference obviousness under 35 U.S.C. § 103(a).

Where an individual reference is cited with respect to fewer than all limitations of an Asserted Claim, Defendants contend that the reference renders obvious the claim under 35 U.S.C. § 103(a) by itself in view of the knowledge of a person of ordinary skill in the relevant art or in view of admitted prior art in the Asserted Patents and further in view of each of the other references in Exhibits A-00 through A-30 and B-00 through B-29 and combination of references that discloses the remaining claim limitation(s), as indicated in the claim charts submitted herewith as Exhibits A-00 through A-30 and B-00 through B-29. Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined." *KSR Int'l Co. v. Teleflex Inc.,* 550 U.S. 398, 406 (2007) (quoting *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17 (1966)). Exemplary motivations to combine references are discussed below in Section II. B. 3.



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Defendants reserve the right to rely upon any references or assertions identified herein in connection with Defendants' contention that each Asserted Claim is invalid under 35 U.S.C. § 103 and to rely upon expert testimony addressing these references and assertions. The fact that prior art is identified to anticipate the Asserted Claims does not prevent Defendants from also relying on the same reference as rendering the Asserted Claims invalid as obvious. *Realtime Data, LLC v. Iancu*, 912 F. 3d 1368, 1373 ("anticipation is the epitome of obviousness"). If any cited prior art item does not fully disclose a limitation of an Asserted Claim or is alleged by Plaintiff to not disclose a limitation, the limitation is present and identified in another prior art item, or is admitted prior art by the Asserted Patents, as shown in the attached claim charts.

Many of the cited references cite or relate to additional references or products, services, or projects. Many of the cited references also cite hardware or systems. Defendants may rely upon these cited additional references and copies or exemplars of the cited hardware or systems. Defendants will produce or make available for inspection any of these cited references, hardware, or systems that they intend to rely upon. Defendants may also rely upon the disclosures of the references cited or discussed during the prosecution of the Asserted Patents or the assertions presented by the inventor about those references.

Defendants reserve the right to reduce the number of anticipation or obviousness references relied upon with respect to a given Asserted Claim and to exchange or otherwise modify the specific references relied upon for anticipation and within each obviousness combination for each Asserted Claim.

Discovery is at an early stage and Plaintiff has not provided any contentions or documentation with respect to any alleged pre-filing invention dates or with respect to claim limitations that are allegedly lacking in the prior art or not obvious over the prior art. Each



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limitation of the Asserted Claims was well known to those of ordinary skill in the art before the relevant priority date for each Asserted Claim, as detailed below.

### 1. Priority

Plaintiff's P.R. 3-1(e) disclosures allege that the claimed inventions are entitled to the following priority dates:

| U.S. Patent No. | Priority Date |
|---|---|
| 8,982,109 | December 18, 2012 |
| 8,982,110 | December 18, 2012 |

Defendants' analysis and selection of prior art is based on, and assumes *arguendo*, the above priority dates. Defendants note that EyesMatch has provided no evidence to support its contentions that the Asserted Claims are entitled to claim priority back to these dates, a number of which rely on U.S. provisional patent application priority dates, and Defendants therefore reserve the right to argue that a later priority date is appropriate based on any findings as to the priority date of the Asserted Claims by the Court, information learned through discovery, or otherwise. Should EyesMatch fail to establish that any Asserted Claim is entitled to the above priority dates or should EyesMatch improperly later assert a different invention or priority date, Defendants reserve the right to add additional prior art references to these Invalidity Contentions.

### 2. Application of the Prior Art to the Claims

The charts below identify references or exemplary combinations of references that either anticipate or render obvious the Asserted Claims. The discussion below sets forth rationales and motivations for combining the respective references with respect to the claimed features they disclose. For each of the Asserted Patents and for each of the references or combinations identified, Defendants may also rely on "admitted prior art," which include statements in the specification or during prosecution identifying the work of others as "prior art" are admissions that can be relied



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on for anticipation and obviousness purposes. *See Riverwood Int'l Corp. v. R. A. Jones & Co.,* 324 F. 3d 1346, 1354 (Fed. Cir. 2003).

| | Asserted Claims of the '109 Patent | | | | | |
|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **7** | **8** | **9** | **11** |
| '109 Patent References | **X** | **X** | **X** | **X** | **X** | **X** |
| Enstad | **X** | **X** | **X** | **X** | | **X** |
| Francois I | **X** | **X** | **X** | **X** | | |
| Francois II | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois III | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner | **X** | **X** | **X** | **X** | **X** | **X** |
| Goto | **X** | **X** | **X** | | | **X** |
| Haan | **X** | **X** | **X** | **X** | **X** | **X** |
| Hamamoto | **X** | **X** | | **X** | **X** | **X** |
| Hatanaka | **X** | **X** | **X** | **X** | **X** | |
| Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** |
| Kurtz | **X** | **X** | **X** | **X** | **X** | **X** |
| Lin | **X** | **X** | | **X** | | **X** |
| Lizee | **X** | | **X** | **X** | | **X** |
| Miyamoto | **X** | **X** | | **X** | | |
| Miyaoku | **X** | **X** | **X** | **X** | | |
| Ohba | **X** | **X** | **X** | **X** | | **X** |
| Okumura I | **X** | **X** | | | | |
| Okumura II | **X** | **X** | | | | |
| Ooi | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg | **X** | **X** | **X** | **X** | **X** | |
| Rowles | **X** | **X** | **X** | **X** | **X** | |
| Shen | **X** | **X** | **X** | **X** | | **X** |
| Shiseido | **X** | **X** | **X** | | | **X** |
| Straka I | **X** | **X** | **X** | | **X** | **X** |
| Straka II | **X** | **X** | **X** | | **X** | **X** |
| Suggs | **X** | **X** | | | **X** | **X** |
| Tan | **X** | **X** | | **X** | | |
| Tripathi | **X** | | **X** | **X** | **X** | **X** |

| | Asserted Claims of the '109 Patent – Combinations | | | | | |
|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **7** | **8** | **9** | **11** |
| Francois II in view of Geisner | **X** | **X** | **X** | **X** | **X** | **X** |



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| | Asserted Claims of the '109 Patent – Combinations | | | | | |
|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **7** | **8** | **9** | **11** |
| Francois II in view of Haan | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois II in view of Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois II in view of Kurtz | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois II in view of Lin | **X** | **X** | | **X** | | **X** |
| Francois II in view of Lizee | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois II in view of Rosenberg | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois II in view of Rowles | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois II in view of Suggs | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois II in view of Geisner and/or Haan and/or Iwabuchi and/or Kurtz and/or Lin and/or Lizee and/or Rosenberg and/or Rowles and/or Suggs | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Francois II | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Haan | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Kurtz | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Lin | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Lizee | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Rosenberg | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Rowles | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Francois II and/or Haan and/or Iwabuchi and/or Kurtz and/or Lin and/or Lizee and/or Rosenberg | **X** | **X** | **X** | **X** | **X** | **X** |

| | Asserted Claims of the '109 Patent – Combinations | | | | | |
|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **7** | **8** | **9** | **11** |
| and/or Rowles | | | | | | |
| Haan in view of Francois II | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Geisner | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Hatanaka | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Kurtz | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Lin | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Lizee | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Miyaoku | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Ooi | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Rosenberg | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Rowles | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Francois II and/or Geisner and/or Hatanaka and/or Iwabuchi and/or Kurtz and/or Lin and/or Lizee and/or Miyaoku and/or Ooi and/or Rosenberg and/or Rowles | **X** | **X** | **X** | **X** | **X** | **X** |
| Kurtz in view of Lizee | **X** | **X** | **X** | **X** | **X** | **X** |
| Kurtz in view of Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** |
| Kurtz in view of Lin | **X** | **X** | **X** | **X** | **X** | **X** |
| Kurtz in view of Lizee and/or Iwabuchi and/or Lin | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg in view of Geisner | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg in view of Haan | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg in view of Hatanaka | **X** | **X** | **X** | **X** | **X** | |
| Rosenberg in view of Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg in view of | **X** | **X** | **X** | **X** | **X** | **X** |

| | Asserted Claims of the '109 Patent – Combinations | | | | | |
|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **7** | **8** | **9** | **11** |
| Kurtz | | | | | | |
| Rosenberg in view of Lin | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg in view of Lizee | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg in view of Miyaoku | **X** | **X** | **X** | **X** | **X** | |
| Rosenberg in view of Ooi | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg in view of Rowles | **X** | **X** | **X** | **X** | **X** | |
| Rosenberg in view of Suggs | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg in view of Geisner and/or Haan and/or Hatanaka and/or Iwabuchi and/or Kurtz and/or Lin and/or Lizee and/or Miyaoku and/or Ooi and/or Rowles and/or Suggs | **X** | **X** | **X** | **X** | **X** | **X** |
| Rowles in view of Francois II | **X** | **X** | **X** | **X** | **X** | **X** |
| Rowles in view of Geisner | **X** | **X** | **X** | **X** | **X** | **X** |
| Rowles in view of Haan | **X** | **X** | **X** | **X** | **X** | **X** |
| Rowles in view of Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** |
| Rowles in view of Kurtz | **X** | **X** | **X** | **X** | **X** | **X** |
| Rowles in view of Lin | **X** | **X** | **X** | **X** | **X** | **X** |
| Rowles in view of Lizee | **X** | **X** | **X** | **X** | **X** | **X** |
| Rowles in view of Rosenberg | **X** | **X** | **X** | **X** | **X** | |
| Rowles in view of Francois II and/or Geisner and/or Haan and/or Iwabuchi and/or Kurtz and/or Lin and/or Lizee and/or Rosenberg | **X** | **X** | **X** | **X** | **X** | **X** |
| Straka II in view of Kurtz | **X** | **X** | **X** | **X** | **X** | **X** |
| Straka II in view of | **X** | **X** | **X** | **X** | **X** | **X** |



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| | Asserted Claims of the ’109 Patent – Combinations | | | | | |
|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **7** | **8** | **9** | **11** |
| Geisner | | | | | | |
| Straka II in view of Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** |
| Straka II in view of Hatanaka | **X** | **X** | **X** | **X** | **X** | **X** |
| Straka II in view of Lin | **X** | **X** | **X** | | **X** | **X** |
| Straka II in view of Kurtz and/or Geisner and/or Iwabuchi and/or Hatanaka and/or Lin | **X** | **X** | **X** | **X** | **X** | **X** |

| | Asserted Claims of the ’110 Patent | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **3** | **4** | **5** | **6** | **10** | **11** | **12** | **16** | **17** |
| ’110 Patent References | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Enstad | **X** | **X** | **X** | **X** | **X** | **X** | | **X** | **X** | **X** | |
| Francois I | **X** | | **X** | **X** | **X** | **X** | | | | | |
| Francois II | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois III | **X** | | **X** | **X** | **X** | **X** | | | | | |
| Geisner | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan | **X** | **X** | **X** | **X** | **X** | **X** | **X** | | | | |
| Hatanaka | **X** | **X** | **X** | **X** | **X** | **X** | | **X** | **X** | **X** | |
| Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** | | **X** | | | |
| Jeon | **X** | **X** | **X** | **X** | **X** | **X** | | **X** | **X** | | |
| Kurtz | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Lizee | **X** | **X** | **X** | **X** | **X** | **X** | | **X** | **X** | **X** | **X** |
| Magic Mirror | **X** | **X** | | | **X** | | **X** | **X** | **X** | **X** | |
| Miyaoku | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Ooi | **X** | | **X** | **X** | | | | **X** | **X** | **X** | |
| Ohba | **X** | **X** | **X** | **X** | **X** | **X** | **X** | | | | |
| Okumura I | **X** | **X** | | | | | | | | | |
| Okumura II | **X** | **X** | | | | | | | | | |
| Rosenberg | **X** | **X** | **X** | | **X** | | **X** | **X** | **X** | **X** | **X** |
| Rowles | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | | **X** | |
| Shen | **X** | **X** | **X** | **X** | **X** | **X** | | **X** | | | |
| Suggs | **X** | **X** | **X** | **X** | **X** | | | | | | |
| Straka I | **X** | **X** | **X** | **X** | **X** | **X** | **X** | | | **X** | **X** |



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| | Asserted Claims of the ’110 Patent | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **3** | **4** | **5** | **6** | **10** | **11** | **12** | **16** | **17** |
| Straka II | **X** | **X** | **X** | **X** | **X** | **X** | **X** | | | **X** | **X** |
| Tojo | **X** | **X** | **X** | **X** | **X** | **X** | | **X** | **X** | | |
| Tripathi | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Wolf | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | | |

| | Asserted Claims of the ’110 Patent – Combination | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **3** | **4** | **5** | **6** | **10** | **11** | **12** | **16** | **17** |
| Francois II in view of Haan | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois II in view of Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Francois II in view of Wolf | **X** | **X** | **X** | **X** | **X** | **X** | | **X** | **X** | | |
| Francois II in view of Geisner and/or Haan and/or Iwabuchi and/or Kurtz and/or Lizee and/or Rosenberg and/or Rowles and/or Wolf | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Geisner in view of Francois II and/or Haan and/or Iwabuchi and/or Kurtz and/or Lizee and/or Rosenberg and/or Rowles and/or Wolf | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Geisner | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Jeon | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | | |
| Haan in view of Ooi | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Haan in view of Wolf | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | | |
| Haan in view of Francois II and/or Geisner and/or Haan and/or Lizee and/or Kurtz and/or Enstad and/or Miyaoku and/or Iwabuchi and/or Hatanaka and/or | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |

| | Asserted Claims of the '110 Patent – Combination | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Prior Art** | **1** | **2** | **3** | **4** | **5** | **6** | **10** | **11** | **12** | **16** | **17** |
| Rosenberg and/or Rowles and/or Wolf and/or Jeon | | | | | | | | | | | |
| Kurtz in view of Lizee | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Kurtz in view of Iwabuchi | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Kurtz in view of Wolf | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Kurtz in view of Lizee and/or Iwabuchi and/or Wolf | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Rosenberg in view of Lizee and/or Kurtz and/or Enstad and/or Miyaoku and/or Iwabuchi and/or Hatanaka and/or Geisner and/or Francois II and/or Wolf | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Straka II in view of Wolf | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Straka II in view of Kurtz and Geisner | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Straka II in view of Kurtz and/or Geisner and/or Wolf | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |

### 3. Obviousness and Motivations to Combine

As shown in the prior art matrices above, each cited prior art reference may be combined with one or more other prior art references to render obvious the Asserted Claims in combination, as explained in more detail below. The disclosures of these references may also be combined with information known to persons skilled in the art at the time of the alleged inventions, and understood and supplemented in view of the common sense of persons skilled in the art at the time of the

alleged inventions, including any statements in the intrinsic records of the Asserted Patents and related applications.

A person of ordinary skill would have been motivated to combine the prior art cited in the Exhibits based on the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art. For example, the identified prior art references for the Asserted Patents, including portions cited in attached Exhibits A-00 through A-30 and B-00 through B-29, are analogous prior art to the subject matter of the Asserted Claims and each other, and are properly combinable. Because these prior art references and the Asserted Patents are from the same field of endeavor (*see, e.g.*, '109 Patent, 1:25-33; '110 Patent, 1:43-51), it would have been obvious for a POSITA to either ascertain any missing functionality claimed and/or look from one piece of prior art to another in order to find any missing functionality the POSITA desired to implement. Moreover, these references are reasonably pertinent to the problems purportedly addressed by the Asserted Patents. The identified prior art references for each of the Asserted Patents, including portions cited in attached Exhibits A-00 through A-30 and B-00 through B-29, address the same or similar technical issues and suggest the same or similar solutions to those issues as the Asserted Claims.

On such bases, on a limitation-by-limitation basis, Defendants expressly intend to combine one or more prior art items identified in the Exhibits with each other to address any further contention from Plaintiff that a particular prior art item supposedly lacks one or more limitations of an Asserted Claim. *See e.g.*, Exhibit A-00 and B-00. In other words, Defendants contend that each charted prior art item can be combined with other charted prior art items when a particular prior art item lacks or does not explicitly disclose a limitation or feature of an Asserted Claim. The suggested obviousness combinations described below are not to be construed to suggest that any

reference included in the combinations is not anticipatory. Further, if Plaintiff contends that any of the anticipatory prior art fails to disclose one or more limitations of the Asserted Claims, Defendants reserve the right to identify other prior art references that, when combined with the anticipatory prior art, would render the Asserted Claims obvious despite an allegedly missing limitation. Defendants will further specify the motivations to combine the prior art, including through reliance on expert testimony, at the appropriate later stage of this lawsuit.

A person of skill in the art would have been motivated to combine the identified prior art items. As the United States Supreme Court held in *KSR*, 550 U.S. at 416: "The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." The Supreme Court further held that, "[w]hen a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *Id.* at 417.

The Supreme Court has further held that "in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420. It is sufficient that a combination of limitations was "obvious to try" holding that, "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense." *Id.* at 421." In that instance the fact that a



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combination was obvious to try might show that it was obvious under § 103." *Id.* Finally, the Supreme Court recognized that "[g]ranting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may, in the case of patents combining previously known limitations, deprive prior inventions of their value or utility." *Id.* at 419. All of the following rationales recognized in *KSR* support a finding of obviousness with respect to each of the obviousness combinations disclosed herein:

(1) Combining prior art limitations according to known methods to yield predictable results;

(2) Simple substitution of one known limitation for another to obtain predictable results;

(3) Use of known technique to improve similar devices (methods, or products) in the same way;

(4) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;

(5) "Obvious to try"—choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;

(6) Known work in one field of endeavour may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; and

(7) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.



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Certain of these rationales are discussed with greater specificity below, but all apply, and the lack of a more specific discussion of some should not be taken to imply or admit that others do not also apply as the discussion below is intended to provide further explanation regarding certain of the specific rationales. As Plaintiff's positions regarding claim construction, specific prior art, specific combinations and/or the state of the art at the time of invention have not yet been disclosed, additional explanation regarding obviousness and/or motivation to combine specific references and knowledge may become relevant and appropriate. Accordingly, Defendants reserve the right to further identify and explain motivations to combine as the need arises based on positions taken by Plaintiff and/or rulings issued by the Court.

Defendants further contend that the prior art identified in these Invalidity Contentions is evidence of simultaneous or near-simultaneous independent invention by others of the alleged invention as recited in one or more of the Asserted Claims. Defendants reserve the right to rely on the simultaneous or near-simultaneous independent invention by others as further evidence of the obviousness of the Asserted Claims.

Each limitation of the Asserted Claims was well known to those of ordinary skill in the art before the priority date, as detailed below. The limitations recited in the Asserted Claims are mere combinations and modifications of these well-known limitations. A person of ordinary skill in the art would be able, and motivated, to improve the existing technology in the same or similar manner by combining or modifying the individual limitations that were already known in the art to yield predictable results.

Subject to the foregoing, Defendants identify the following exemplary reasons that skilled artisans would have combined limitations of the prior art to render obvious the Asserted Claims. The fact that others are not discussed more specifically should not be interpreted as an admission



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or concession that it does not apply. To the contrary, the discussion below simply provides more explanation of these specific rationales.

**a) Motivations Identified During Prosecution**

Defendants hereby expressly incorporate by reference any statements and reasons set forth by the Examiner during prosecution of the Asserted Patents and related patent applications, as to why it would have been obvious to modify or combine references to achieve the limitations of the Asserted Claims.

**b) Combinations of Related References**

In some instances, multiple prior art publications and/or physical references discuss or address the same or substantially similar underlying system or other project, such as multiple patents or publications discussing the same subject matter. Where multiple references discuss or relate to the same or related underlying projects, systems, or other subject matter, it would have been obvious to combine the discussions and disclosures of the references as they would be understood to describe features or potential features of the underlying project, system, or subject matter. Similarly, where one reference cites or discusses other references or their teachings, or references have one or more authors in common and a related area of subject matter, or have a common assignee, it would have been obvious to consider the teachings of the references in combination with each other due to the express relationships and commonalities between the references.

**c) Specific Motivations to Combine and Additional Obviousness Considerations**

**(1) U.S. Patent No. 8,982,109**

The ’109 Patent “relates generally to imaging and display systems and, more particularly, to monitors, and interactive displays” and discloses methods for causing a computerized flat panel

display system to behave similarly to a mirror. '109 Patent at 1:26-31. More particularly, the Asserted Claims of the '109 Patent relate to a method for operating a system comprising a monitor, camera, and processor, "so as to display a mirror-mimicking image on the monitor." *Id.* at Claim 1. According to the method disclosed in the Asserted Claims of the '109 Patent, a camera captures live images of a user, which undergo digital image processing by a processor and are subsequently displayed on a digital screen (i.e., a monitor), which replaces a conventional mirror.

The '109 Patent aims to mitigate differences between camera-generated and mirror-generated images by manipulating digital images captured by a camera such that these images convincingly resemble mirror images once projected onto a display monitor. *Id.* at 14:6-12. This manipulation is performed via a combination certain image processing techniques, performed by a processor on captured digital images. *Id.* at 14:13-16. All of the image processing techniques disclosed in the '109 Patent were well-known in the prior art at the time of the '109 Patent's filing.

(a) Francois II in view of Geisner and/or Haan and/or Iwabuchi and/or Kurtz and/or Lin and/or Lizee and/or Rosenberg and/or Rowles and/or Suggs

Francois II comprises six publications. When considered in combination, the publications of Francois II disclose a virtual mirror system comprising a flat LCD display, a camera, and a device used for tracking a user. *See, e.g., A Handheld Virtual Mirror* (2002), introductory paragraph. Further, Francois II discloses the virtual mirror system including a processing unit "specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time." *Id.*, Section 2.2. System integration. Francois II also discloses transforming input video stream of a user captured by a camera and performing a "mirror transform" step which uses "synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image



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display cell." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003), 13-15; *see also id.*, Figs. 12-13.

Geisner discloses a shopping application with "a tracking system [which] captures user motions" and which "allow[s] a user to manipulate an on-screen representation the user" having "a likeness of the user." Geisner at Abstract. Similar to Francois II, Geisner discloses "a computer implemented method wherein a scene including a human target user is captured using a capture device which is part of the tracking system" and that a "representation of the scene and the human target is rendered on a display device." *Id.*, [0003]. Geisner further discloses a "a model representing a human target" having "one or more joints n1-n18" that "may enable one or more body parts defined there between to move relative to one or more other body parts," *Id.*, [0123]. "Each of the joints represents a place in the skeleton where the skeleton can pivot in the x, y, z directions or a place of interest on the body" (*id.* at [0124]; *see also* Fig. 8), including flipping across a vertical axis, such that the left and right sides of the human target model are flipped (*see, e.g.,* Fig. 9). Moreover, Geisner discloses "interface elements" that "allow the user to change the appearance of the on-screen representation," including, for example, "lighting controls [that] may allow a user to change the type and position of lighting sources on a scene." *Id.*, [0160].

A POSITA would have recognized that Geisner's disclosure relating to manipulating the image of the "model representing a human target" via "pivoting" the joints n1-n-18 (*id.*, [0123]), could easily be incorporated into Francois II, as both Geisner and Francois II disclose systems and methods for tracking the motion of a human user and displaying these tracked motions to the user. Similarly, a POSITA would have recognized that the interface elements disclosed in Geisner allowing users to control the lighting of a displayed image could also have been incorporated into Francois II. A POSITA would have been motivated to incorporate these elements of Geisner into



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Francois II, as they would provide improved ability for a user to control a displayed self-image, better enabling viewing inverted mirror images, as well as images with customizable lighting and shading. Given that Francois II aims to provide users with "a handheld virtual mirror device" (*see, e.g., A Handheld Virtual Mirror* (2002), at the introductory paragraph), this incorporation by a POSITA would have constituted nothing more than "applying a known technique to a known device (method, or product) ready for improvement to yield predictable results." *See KSR*, 550 U.S. at 417.

Similar to Francois II, Haan is directed to a "mirror device" comprising a display device with a display screen, which displays images of a user recorded by a camera in real-time. *See* Haan, Abstract. Haan discloses that this mirror system may include a computer program that could enable "artificial light conditions…to judge the effect of the application of make-up." *See* Haan, [0113]. A POSITA would have been motivated to incorporate this feature of Haan into the virtual mirror device described in Francois II, as this would enhance a user's ability to "use of video analysis and graphics techniques [to] allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 15.

Similarly, both Francois II and Rosenberg disclose "a digital mirror system." *See* Rosenberg, [0006]. Rosenberg further discloses that the digital mirror system "employs electronic imaging hardware and software components to provide a diverse range of user-selectable mirroring capabilities to a person who stands before the wall mounted display." *See id.*, [0025]. For example, the digital mirror system of Rosenberg is capable of being inverted across the vertical axis: "[t]his left-right inverted representation is generally produced by flipping the pixels of the image around the vertical centerline such that right side of the user, from the user's perspective, appears upon the



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right side of the display, and the left side of the user, from the user's perspective, appears upon the left side of the display." *See id.*, [0026]. Rowles also discloses a "digital mirror" that allows users to see a virtual reflection. *See* Rowles at Abstract. Rowles discloses that the "arrangement of the pixel data in the rows and columns is read out of the memory locations in a reverse order (e.g., from right to left—Pm1 to P11) to transpose or horizontally flip the captured image into a horizontally mirrored image" and thus allows for users to view themselves in a mirrored view. *Id.*, 14:43-47. A POSITA would have recognized that these features described in Rosenberg and Rowles could be implemented into Francois II, as Rosenberg, Rowles, and Francois II relate to virtual mirror systems, and such an integration would enhance the ability for users to control the display of their virtual reflections.

Iwabuchi discloses a computer-augmented makeup mirror system, which includes a camera, a proximity sensor, and monitor which displays a "mirror image" of the user. *See* Iwabuchi, page 498; *see also* Fig. 1. Iwabuchi additionally discloses the computer-augmented makeup mirror system as capable of simulating various lighting conditions on the screen, including, "makeup mode, office mode, cloudy mode, clear weather mode, red sunset mode, and candle mode." *Id.*, 498; *see also* Fig. 2. Suggs discloses computing device that includes a display and a digital camera that can capture images of a user for display. *See* Suggs, [0017]; [0022]; [0042]. Suggs discloses adjusting the brightness of the display based on the detected position of a user. *Id.*, [0055]. Kurtz discloses a two-way video communications system, which includes an image capture camera device to capture real time video images of a user, as well as a display device to present the captured video images. *See* Kurtz, [0042]. Kurtz discloses that an "422 can be modified or obscured with other visual effects, such as distorting, blurring (lowering resolution), or shading (reducing brightness or contrast)." *Id.*, [0067]. Lizee discloses a "virtual representation

compris[ing] a mirrored silhouette transformation of the user image such that the virtual representation and the user share a substantially same orientation." Lizee, Abstract. To accommodate user movement during the gaming experience, Lizee also discloses that the image framing of the user can be resized as the user moves around the display screen. *See id.* at [0040]-[0041], [0043], [0056]-[0057], FIGS. 2A-C.

A POSITA would have recognized that the techniques disclosed in Iwabuchi, Suggs, and Kurtz relating to adjusting the illumination intensity of a displayed image, including the brightness and shading, could be incorporated into the image display functionality disclosed throughout Francois II. The ability to adjust the illumination intensity of a displayed image would improve the visibility of the image displayed to the user. Further, This would have constituted nothing more than "application of a known technique," *i.e.,* adjusting the brightness and/or shading of a displayed image, "to a piece of prior art ready for the improvement." *See KSR*, 550 U.S. at 417; *see also id.* at 415–19 (obvious to implement known techniques to improve similar devices and methods in known ways to yield predictable results, especially where some teaching, suggestion, or motivation exists to do so).

A POSITA would have recognized that Lizee's mirroring and movement tracking functionality could be readily incorporated into Francois II's mirror system because doing so merely constitutes "application of a known technique to a piece of prior art ready for the improvement." Francois II and Lizee are both directed presenting virtual, mirrored user representations. Thus, a POSITA would thus have recognized that Lizee's disclosures are equally applicable to the teachings of Francois II.

Lin discloses a mirror device with an embedded display unit that captures and displays an image of a user. *See* Lin, Abstract; [0021]-[0023]. Lin discloses detecting distance variation

between a user and the display system, and based on the distance, varying the sizing and display of the image on the device. *See id*., [0024]; [0030]; Claim 13; Claim 14.

A POSITA would have recognized that both Francois II and Lin concern mirror systems that display moving images of a user that were captured by a camera in real time. *See*, e.g., *A Handheld Virtual Mirror* (2002), introductory paragraph; Lin, Abstract, [0021]-[0023]. Accordingly, a POSITA would have recognized that the improvements in Lin could readily be implemented in Francois II to improve the user image display devices with a reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the system optimization techniques disclosed in Lin into the virtual mirror system disclosed in Francois II, such that the mirror device in Francois II is able to detect the user's distance to the device and adjust the size of displayed image based on the distance. Lin, [0024]; [0030]. A POSITA would recognize that implementing these system optimization measures in Francois II would result in a more efficient virtual mirror device, with improved image display. Additionally, a POSITA would have had a reasonable expectation of success because distance sensors were well known and the incorporation of adjusting the size of the displayed image based on distance would have been a simple software change that would have yielded predictable results.

As another example, to the extent that Francois II is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Francois II with any of the references identified in Exhibit A-00 for at least the reasons discussed above or in Exhibit A-00.

(b) Geisner and/or Francois II and/or Haan and/or Iwabuchi and/or Kurtz and/or Lin and/or Lizee and/or Rosenberg and/or Rowles



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Geisner discloses that "[a]n on-screen shopping application which reacts to a human target user's motions to provide a shopping experience to the user is provided." *See* Geisner, [0003]. Further, Geisner discloses a tracking system "used to track user motions and execute a shopping application." *Id.* Additionally, Geisner discloses "[a]n on-screen interface allows the user to interact with virtual articles that represent real-world articles available to the user," wherein "[u]ser movements which are recognized as article manipulation or transaction control gestures are translated into commands for the shopping application." *Id.*

Francois II comprises six publications. When considered in combination, the publications of Francois II disclose a virtual mirror system comprising a flat LCD display, a camera, and a device used for tracking a user. *See, e.g., A Handheld Virtual Mirror* (2002), introductory paragraph. Francois II additionally discloses the virtual mirror system including a processing unit "specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time." *Id.*, Section 2.2.System integration. Francois II also discloses transforming input video stream of a user captured by a camera and performing a "mirror transform" step which uses "synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003), 13-15; *see also id.*, Figs. 12-13.

Haan is directed to a "mirror device" comprising a display device with a display screen, which displays images of a user recorded by a camera in real-time. *See* Haan, Abstract. Haan discloses using a process called "synthesis" in which the mirror device system uses multiple cameras to capture various images, which can be used to "construct a virtual camera position and/or magnification." *See id.*, [0058]. Similarly, Rosenberg discloses a "digital mirror" that



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"enables the user to view a composite image upon the mirror display that includes a display of multiple images collected by the camera at different points in time. The feature, referred to herein as multi-view mirroring, allows a user to view himself or herself from multiple perspectives upon the same screen, thereby getting a more holistic impression of his or her appearance." *See* Rosenberg, [0048].

A POSITA would be motivated to incorporate the synthesis mechanism disclosed in Haan, Rosenberg, and Francois II into Geisner, as Haan, Rosenberg, and Francois II relate to providing a user a virtual mirror display system. Further, Geisner discloses providing a system in which "visual images can be obtained from multiple angles for that user." *See* Geisner, [0103]. A POSITA would recognize that the synthesis feature of Haan, Rosenberg, and Francois II would further enable users of the Geisner system to view themselves from multiple perspectives.

Iwabuchi discloses a smart mirror system for aiding in the application of makeup and cosmetics. Iwabuchi at Abstract. The smart mirror disclosed in Iwabuchi discloses transforming an image taken from above eye-level and displaying the image from an eye-level perspective. *Id.* Further, Iwabuchi discloses that to improve image quality, the system can switch between a high- and low-resolution camera depending on how close a user's face is to the smart mirror *Id.* at 497-98. A POSITA would have recognized that Iwabuchi's disclosure of adjusting the camera resolution depending on the distance between a user and the mirror device could readily be incorporated into Geisner because doing so merely constitutes "application of a known technique to a piece of prior art ready for the improvement" (*see KSR*, 550 U.S. at 417) and because both Iwabuchi and Geisner pertain to providing a user a virtual mirror and reflection.

Rowles also discloses a "digital mirror" that allows users to see a virtual reflection. *See* Rowles at Abstract. Rowles discloses that the "digital mirror may also be used to store or archive

pictures for future comparisons. The user may also select a number of stored images in the digital mirror to be shown in a continuous manner similar to a slide show." *See* Rowles, 5:7-10. Further, Rowles discloses that the "digital mirror may also send pictures back to the remote computer system for archival and or further editing or manipulation." *Id.*, 5:21-23. In other words, Rowles discloses that the digital mirror captures and registers a reference image, which may form the basis for further image processing and modification. A POSITA would recognize that this functionality could be readily incorporated into Geisner, as Geisner provides users a "tracking system is used to track user motions and execute a shopping application." *See* Geisner, [0003].

Lizee discloses a "virtual representation compris[ing] a mirrored silhouette transformation of the user image such that the virtual representation and the user share a substantially same orientation." Lizee, Abstract. To accommodate user movement during the gaming experience, Lizee also discloses that the image framing of the user can be resized as the user moves around the display screen. *See id.* at [0040]-[0041], [0043], [0056]-[0057], FIGS. 2A-C. Kurtz discloses a two-way video communications system, which includes an image capture camera device to capture real time video images of a user, as well as a display device to present the captured video images. *See* Kurtz, [0042]. Kurtz discloses that "the user interface 440 can include interface controls 190…[that] can provide or enable control of an image capture device 120, relative to zooming, panning, tilting, and other camera type functions." *See id.* [0048].

Given that Geisner, Lizee, and Kurtz each relate to providing a virtual mirror for display to a user, a POSITA would be motivated to incorporate the dynamic image framing features of Lizee and/or the panning and tilting functions of Kurtz into Geisner, as these features would enhance the "tracking system is used to track user motions and execute a shopping application" disclosed in Geisner. *See* Geisner, [0003].

Lin discloses a mirror device with an embedded display unit that captures and displays an image of a user. *See* Lin, Abstract; [0021]-[0023]. Lin discloses having distance sensors to detect the distance between a user and the display system, and based on the distance, varying the sizing and display of the image on the device. *See id.,* [0024]; [0030]; Claim 13; Claim 14.

A POSITA would have recognized that Geisner and Lin both disclose mirror systems capable of displaying moving images of a user that were captured by a camera in real time. *See* Geisner, [0003]; Lin, Abstract, [0021]-[0023]. Lin discloses certain system optimization techniques that involve detecting a user's distance to the device and adjusting the size of the displayed image based on this detected distance. Lin, [0024], [0030]. Given that both Geisner and Lin relate to virtual mirror systems, a POSITA would have recognized that these system optimization techniques could readily be implemented into Geisner. A POSITA would understand that such an implementation would result in predictable results, including an improved image display used for providing users an improved virtual shopping display interface. *See* Geisner, [0003].

As another example, to the extent that Geisner is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Geisner with any of the references identified in Exhibit A-00 for at least the reasons discussed above or in Exhibit A-00.

(c) Haan in view of Francois II and/or Geisner and/or Hatanaka and/or Iwabuchi and/or Kurtz and/or Lin and/or Lizee and/or Miyaoku and/or Ooi and/or Rosenberg and/or Rowles

Haan is directed to a "mirror device" comprising a display device with a display screen, which displays images of a user recorded by a camera in real-time. Additionally, the mirror device

comprises a means for determining and signaling the position of a body part of the user (e.g., face) with respect to the display screen, and adjusts the view point from which the displayed image is recorded based on the determined body part position. *See* Haan, Abstract. *See also, e.g., id.*, [0006]-[0011]; [0056]-[0058]; Fig. 2. Haan further discloses the recorded images being "fed to a position determination means" in which the recorded images are analyzed, a body part orientation (e.g., face orientation) is determined, a "synthesis of the various images" to "construct a virtual camera position and/or magnification" is performed, and the synthesized images are displayed. *See id.*, [0058].

Francois II comprises six publications. When considered in combination, the publications of Francois II disclose a virtual mirror system comprising a flat LCD display, a camera, and a device used for tracking a user. *See, e.g., A Handheld Virtual Mirror* (2002), introductory paragraph. Francois II additionally discloses the virtual mirror system including a processing unit "specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time." *Id.*, Section 2.2.System integration. Francois II also discloses transforming input video stream of a user captured by a camera and performing a "mirror transform" step which uses "synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003), 13-15; *see also id.*, Figs. 12-13.

Moreover, one of the Francois II references discloses a scalable software architecture framework based on a "distributed asynchronous parallel processing model [that] allow[s] natural and efficient manipulation of generic data streams, using existing libraries or native code alike" and enables "desirable software engineering qualities such as efficiency, scalability, extensibility,



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reusability and interoperability." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 3. A POSITA would have been motivated to incorporate the parallel processing and scalable software features of Francois II into Haan, as both Francois II and Haan (*see, e.g.,* Haan, [0058].) pertain to virtual mirror systems having processors, and the features of Francois II would improve the processing features of Haan.

Geisner discloses a shopping application with "a tracking system [which] captures user motions" and which "allow[s] a user to manipulate an on-screen representation the user" having "a likeness of the user." Geisner at Abstract. Geisner further discloses that when "multimedia console 100 is powered ON, a set amount of hardware resources are reserved for system use by the multimedia console operating system. These resources may include a reservation of memory (e.g., 16 MB), CPU and GPU cycles (e.g., 5%), networking bandwidth (e.g., 8 kbs), etc. Because these resources are reserved at system boot time, the reserved resources do not exist from the application's view." *See id.*, [0089]. Further, Geisner discloses that the "amount of memory required for an overlay depends on the overlay area size and the overlay preferably scales with screen resolution." *Id.*, [0091]. A POSITA have recognized that scaling the amount of system resource (e.g., memory) usage with resolution, as described in Geisner, could have easily been implemented in Haan, as both Haan and Geisner pertain to digitally displaying a user in real time. A POSITA would have been motivated to implement Geisner's features into Haan to improve the efficiency and image display quality of the Haan mirror device.

Iwabuchi discloses a smart mirror system for aiding in the application of makeup and cosmetics. Iwabuchi at Abstract. Iwabuchi discloses altering the resolution of an image depending on whether a user is close to or far from the mirror. *See, e.g.,* Iwabuchi, pages 497-498. Iwabuchi discloses developing an "automatic zoom function…for zooming at a particular part of the face"

during "the makeup application process, [when] we usually bring our face close to the mirror in order to ensure that our makeup is satisfactory and to check the makeup near certain face parts such as the eyes and the mouth." *Id.*, page 497. A POSITA would have recognized that auto zooming a user's reflected virtual image as a user comes closer to the display (and in turn increasing the image resolution) in the Haan mirror would have improved the image display quality of said mirror to the benefit of the users. A POSITA would be motivated to implement the features disclosed in Iwabuchi into Haan, as both Haan and Iwabuchi disclose a smart virtual mirror system.

Kurtz discloses systems and methods to "alter[] images of the [first] individual using a gaze adapting process that effects image capture or image processing to provide an eye contact image of the [first] individual to the [second] viewer wherein the eyes of the [first] individual appear to be looking at the eyes of the [second] individual in the remote environment[.]" *E.g.*, Kurtz, Cl. 11. Kurtz further discloses the capture and use of reference images to generate transformation mapping. *See e.g.*, *id.*, [0085], [0104], [0108], [0122]-[0123], and [0125]. For example, Kurtz discloses an "eye-gaze correction scene analysis algorithm" that "can use a set of eye-gaze context rules to associate the sensitivity (using triggers or threshold levels) or need for eye gaze correction with the video context for a current video scene, including event classification and capture field of view." *Id.*, [0144]. A POSITA would recognize that the eye-gaze correction scene analysis algorithm disclosed in Kurtz could be implemented into Haan, as both Kurtz and Haan disclose systems and methods to alter captured images. A POSITA would be motivated to incorporate these features into Haan, as this would result in a more realistic virtual mirror viewing experience for users.

Lizee discloses image capturing systems and methods which provide a virtual reality gaming experience to a user. *See* Lizee at Abstract. Lizee further discloses certain image

processing techniques, such as "invert[ing] [an image] from left to right about a vertical axis." *See* Lizee, [0034]. A POSITA would have recognized that Lizee's image processing inversion technique could readily be incorporated into Haan's virtual mirror system, because doing so merely constitutes "application of a known technique to a piece of prior art ready for the improvement." *See KSR*, 550 U.S. at 417.

Ooi, for example, discloses an "image display device" that captures a moving image of a user for display, as well as distance information of the user in relation to the image display device. *See* Ooi, [0041]; [0052]; [0059]-[0060]. Based on the distance information, Ooi discloses controlling and varying the power consumption of the image display device, as well as the frame rate and image quality of the real-time moving images, as part of a system optimization process. *See id.*, [0060]-[0063].

A POSITA would have recognized that both Haan and Ooi concern image display devices that display moving images of a user that were captured by a camera in real time. *See, e.g.,* Haan, Abstract; Ooi, [0041]. Accordingly, a POSITA would have recognized that the improvements in one could readily be implemented in the other to improve the user image display devices with a reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the system optimization techniques disclosed in Ooi into the mirror device disclosed in Haan, such that the mirror device in Haan is able to adaptively control its power consumption and vary the image frame rate and quality (i.e., resolution), depending on the distance of the user from the mirror device. Ooi, [0060]-[0063]. A POSITA would recognize that implementing these system optimization measures in Haan would result in a more efficient virtual mirror device, with improved image frame rates and resolutions.

Miyaoku discloses a "mirror-type environmental information-presentation device has both the original function of a mirror and the ability to present information." *See* Miyaoku, [0011]. Miyaoku discloses determining the distance of a user in relation to the presentation device by detecting the size of a user's facial region and determining that a user is nearer to the presentation device when the facial region increases and farther when the facial region decreases. *See id.*, [0016]. Similar to Ooi, Miyaoku discloses varying an animation rate (i.e., varying a frame rate) depending on the calculated distance between the user and the presentation device. *See id.*, [0060]-[0065]. *See also, id.*, Abstract: "The means for achieving the objective include presenting information in ways suitable for the user's visual recognition according to the distance between the user and the display, presenting animation that moves at a faster or slower speed or stops moving depending on whether the distance to the user is close or far, and altering the magnification ratio of the information according to the variation in the distance between the user and the display."

A POSITA would have recognized that both Haan and Miyaoku concern image display devices for providing virtual mirror functionality to a user. *See, e.g.,* Haan, Abstract; Miyaoku, [0011]. Accordingly, a POSITA would have recognized that the improvements in one could readily be implemented in the other to improve the user image display devices with a reasonable expectation of success and predictable results. Further, a POSITA would recognize that varying the frame rate depending on the user's distance would enhance the viewing experience of a user who is using the virtual mirror of Haan, such that the reflected user images are presented "in ways suitable for the user's visual recognition," as implemented in Miyaoku. *See* Miyaoku, Abstract.

Hatanaka discloses an image communication system and image-processing techniques for distributing real time video images. *See* Hatanaka, [0001]. Additionally, Hatanaka discloses methods to adjust the "frame rate, quantization step size, compression ratio, etc., according to



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viewing distance" of a user. *Id*., [0039]. Hatanaka also discloses adjusting the resolution of captured video image data based on the viewing distance, "enabling efficient processing of images." *Id*., [0049]-[0051].

Similar to Ooi and Miyaoku, a POSITA would be motivated to combine Hatanaka with Haan, as they both disclose image display devices and techniques for displaying images of a user captured in real time by a camera. Additionally, Hatanaka teaches that efficient image processing can result from adjusting the resolution of a video based on distance. A POSITA would recognize that dynamically adjusting the resolution, as well as the frame rate and other image processing variables, would result in a more efficient image processing and display system, and would thus be motivated to implement these functionalities in Haan.

Similar to Haan, Rosenberg discloses "a digital mirror system." *See* Rosenberg, [0006]. Further, Rosenberg discloses using a "proximity and/or motion sensor…configured to detect whether a person (or other moving option) comes within an area that extends six to eight feet in front of the screen area." *See* Rosenberg, [0056]. In other words Rosenberg discloses determining when a user is a certain distance from the digital mirror system. A POSITA would be motivated to incorporate this feature into Haan, as both Haan and Rosenberg pertain to virtual mirror systems, and this feature would allow Haan to adjust its functionality based on a user's distance, which would allow for an enhanced viewing experience for users.

Like Haan, Rowles also discloses a "digital mirror" that allows users to see a virtual reflection. *See* Rowles at Abstract. Rowles discloses that the "arrangement of the pixel data in the rows and columns is read out of the memory locations in a reverse order (e.g., from right to left—Pm1 to P11) to transpose or horizontally flip the captured image into a horizontally mirrored image" and thus allows for users to view themselves in a mirrored view. *Id.*, 14:43-47. A POSITA

would have recognized that these features could readily be implemented into Haan as part of providing users with a mirrored image.

Lin discloses a mirror device with an embedded display unit that captures and displays an image of a user. *See* Lin, Abstract; [0021]-[0023]. Lin discloses detecting distance variation between a user and the display system, and based on the distance, varying the sizing and display of the image on the device. *See id*., [0024]; [0030]; Claim 13; Claim 14.

A POSITA would have recognized that both Haan and Lin concern mirror devices that display moving images of a user that were captured by a camera in real time. *See*, e.g., Haan, Abstract, [0058]; Lin, Abstract, [0021]-[0023]. Accordingly, a POSITA would have recognized that the improvements in one could readily be implemented in the other to improve the user image display devices with a reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the system optimization techniques disclosed in Lin into the mirror device disclosed in Haan, such that the mirror device in Haan is able to detect the user's distance to the device and adjust the size of displayed image based on the distance. Lin, [0024]; [0030]. A POSITA would recognize that implementing these system optimization measures in Haan would result in a more efficient virtual mirror device, with improved image display. Additionally, a POSITA would have had a reasonable expectation of success because distance sensors were already well known and the incorporation of adjusting the size of the displayed image based on the distance would have been a simple software change that would have yielded predictable results.

As another example, to the extent that Haan is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art

at the time of the invention to combine Haan with any of the references identified in Exhibit A-00 for at least the reasons discussed above or in Exhibit A-00.

(d) Kurtz in view of Lizee and/or Iwabuchi and/or Lin

Kurtz discloses systems and methods for video communication between two users which is generally adapted to improve user residential privacy. Amongst other things, the published claims include a processor which is configured to "alter[] images of the [first] individual using a gaze adapting process that effects image capture or image processing to provide an eye contact image of the [first] individual to the [second] viewer wherein the eyes of the [first] individual appear to be looking at the eyes of the [second] individual in the remote environment[.]" *E.g.*, Kurtz at Cl. 11. Kurtz further discloses the capture and use of reference images to generate transformation mapping. *See e.g.*, *id.* at [0085], [0104], [0108], [0122]-[0123], and [0125].

Lizee discloses image capturing systems and methods which provide a virtual reality gaming experience to a user. *See* Lizee at Abstract. More specifically, Lizee discloses a "virtual representation compris[ing] a mirrored silhouette transformation of the user image such that the virtual representation and the user share a substantially same orientation. A position and motion of the user may also be calculated to position and move the virtual representation in a given virtual environment." *Id.* To accommodate user movement during the gaming experience, Lizee discloses that the image framing of the user can be resized as the user moves around the display screen. *See id.* at [0040]-[0041], [0043], [0056]-[0057], FIGS. 2A-C.

A POSITA would have recognized that Lizee's movement tracking functionality could be readily incorporated into Kurtz's video communication system because doing so merely constitutes "application of a known technique to a piece of prior art ready for the improvement." Although, in a narrow sense, Kurtz is directed to a video communication system and Lizee is

directed to a video game system, a POSITA would recognize that they are fundamentally solving the same problem — tracking a user with an image capture device, for display on a display device. As previously stated, Kurtz discloses a method for tracking and transforming a user's gaze, while Lizee discloses a method for tracking and transforming a user's movement. A POSITA would thus have recognized that Lizee's disclosure of user tracking is equally applicable to the teachings of Kurtz.

Iwabuchi discloses a smart mirror system for aiding in the application of makeup and cosmetics. Iwabuchi at Abstract. Specifically, the smart mirror, which has at least one camera mounted atop a display screen, transforms the downward-angled image to an eye-level-perspective image, and performs such functions as "Automatic zoom to a specific part of the face, Display the face from various angles, Simulation of lighting conditions, and Internet voting on better makeup results." *Id.* (internal citations omitted). Further, Iwabuchi discloses that "an infrared range sensor [can] measure the distance between the camera and the face," and that to improve image quality, the system can switch between a high- and low-resolution camera depending on how close a user's face is to the smart mirror *Id.* at 497-98.

A POSITA would have recognized that Iwabuchi's disclosure of resolution adjustment could also be equally incorporated into Kurtz's video communication system because doing so merely constitutes "application of a known technique to a piece of prior art ready for the improvement." Regardless of whether the application is a video communication system or a mirror, the disclosures of both Kurtz and Iwabuchi aim to maximize the image quality of the displayed video. Accordingly, a POSTIA would thus have recognized that Iwabuchi's disclosure of distance sensing is equally applicable to the teachings of Kurtz.

Lin discloses a mirror device with an embedded display unit that captures and displays an image of a user. *See* Lin, Abstract; [0021]-[0023]. Lin discloses detecting distance variation between a user and the display system, and based on the distance, varying the sizing and display of the image on the device. *See id*., [0024]; [0030]; Claim 13; Claim 14.

A POSITA would have recognized that both Kurtz and Lin concern systems that display moving images of a user that were captured by a camera in real time. *See*, e.g., A Handheld Virtual Mirror (2002), introductory paragraph; Lin, Abstract, [0021]-[0023]. Accordingly, a POSITA would have recognized that the improvements in Lin could readily be implemented in Kurtz to improve the user image display devices with a reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the system optimization techniques disclosed in Lin into the system disclosed in Kurtz, such that the device in Kurtz is able to detect the user's distance to the device and adjust the size of displayed image based on the distance. Lin, [0024]; [0030]. A POSITA would recognize that implementing these system optimization measures in Kurtz would result in a more efficient communication system, with improved image display. Additionally, a POSITA would have had a reasonable expectation of success because distance sensors were well known and the incorporation of adjusting the size of the displayed image based on distance would have been a simple software change that would have yielded predictable results.

As another example, to the extent that Kurtz is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Kurtz with any of the references identified in Exhibit A-00 for at least the reasons discussed above or in Exhibit A-00.

(e) Rosenberg in view of Geisner and/or Haan and/or Hatanaka and/or Iwabuchi and/or Kurtz and/or Lin



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In Rosenberg, "a digital mirror system is provided that has a digital mirror display to display at least one image." *See* Rosenberg, [0025]. This digital mirror system comprises a camera, that captures real-time video images of a user, a sensor that tracks and detects the movements of the user, an LCD display screen that displays the streaming real-time video images, and a processor, which controls the display screen and camera and performs various image processing on the captured video images. *See id.*, [0025]-[0029]; *see also* [0109]; Fig. 13. Rosenberg further discloses that the digital mirror system "employs electronic imaging hardware and software components to provide a diverse range of user-selectable mirroring capabilities to a person who stands before the wall mounted display." *See id.*, [0025]. For example, the digital mirror system of Rosenberg is capable of being inverted across the vertical axis: "[t]his left-right inverted representation is generally produced by flipping the pixels of the image around the vertical centerline such that right side of the user, from the user's perspective, appears upon the right side of the display, and the left side of the user, from the user's perspective, appears upon the left side of the display." *See id.*, [0026]. Rosenberg further discloses that this exemplary image processing "is generally performed by a processing electronics at a high rate of speed so that the left-right inverted video image of the user is presented substantially in real-time to the user (i.e., there is not a noticeable time lag for the user)." *Id.* Rosenberg also discloses these image processing features as enabling users to see their digital reflection in real time from any selected angle, allowing user's to view themselves from various points of view: "[i]n another set of inventive features, the integrated digital mirror enables users to quickly and easily view not only their frontal image, but also profile images and rear images. In fact, the user is enabled to view his or her image from any desired angle." *See id.*, [0037].

Ooi, Miyaoku, Geisner, Hatanaka, and Lin, for example, each disclose image display devices and systems capable of system optimization techniques such as controlling the system's power consumption, processing rate, and image display frame rate in relation to the distance of a user from the display. Ooi, for example, discloses an "image display device" that captures a moving image of a user for display, as well as distance information of the user in relation to the image display device. *See* Ooi, [0041]; [0052]; [0059]-[0060]. Based on the distance information, Ooi discloses controlling and varying the power consumption of the image display device, as well as the frame rate and image quality of the real-time moving images, as part of a system optimization process. *See id.*, [0060]-[0063]. *See also* Miyaoku, Abstract, [0011], [0016]; [0060]-[0065]; Geisner [0089]-[0091]; Hatanaka, [0019], [0029], [0049]-[0050]; Lin, Abstract, [0021]-[0023].

A POSITA would have recognized that the techniques disclosed in Ooi, Miyaoku, Geisner, and Hatanaka for varying the power consumption, processing rate, and image display frame rate could readily be integrated into Rosenberg, as Rosenberg, Ooi, Miyaoku, Geisner, and Hatanaka each relate to image display systems for displaying real time images of a user captured by a camera onto a screen. A POSITA would have been motivated to incorporate the techniques disclosed in Ooi, Miyaoku, Geisner, and Hatanaka into Rosenberg, because said techniques would result in more efficient image display systems based on a user's distance from the display system. Adjusting the frame rate based on distance would also result in enhanced image display quality.

Miyaoku, Ooi, Geisner, and Hatanaka, for example, each disclose image display devices and systems capable of controlling the displayed image resolution in relation to the distance of a user from the display. For example, Miyaoku discloses varying the detail and/or sizes of the images presented to a user, depending on the user's distance from the screen. *See* Miyaoku, [0035]-[0036].



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Ooi discloses controlling and varying the power consumption of the image display device, as well as the frame rate and image quality (i.e., image resolution) of the real-time moving images, as part of a system optimization process. *See id.*, [0060]-[0063]. *See also* Hatanaka, [0019], [0029], [0049]-[0050]. *See also*, Geisner, [0080]-[0081], [0088]-[0091], [0134].

A POSITA would be motivated to combine Miyaoku, Ooi, Geisner, and Hatanaka with Rosenberg, as they all disclose image display devices and techniques for displaying images of a user captured in real time by a camera. Additionally, Hatanaka teaches that efficient image processing can result from adjusting the resolution of a video based on distance. A POSITA would recognize that dynamically adjusting the resolution based on the distance of a user from the display device would result in efficiency savings for the system, as well as enhanced display functionalities.

Similar to Rosenberg, Haan is directed to a "mirror device" comprising a display device with a display screen, which displays images of a user recorded by a camera in real-time. *See* Haan, Abstract. Haan discloses that this mirror system may include a computer program that could enable "artificial light conditions…to judge the effect of the application of make-up." *See* Haan, [0113]. A POSITA would have been motivated to incorporate this feature of Haan into the virtual mirror device described in Rosenberg, as Rosenberg discloses a "lighting emulation feature" and teaches that said "lighting emulation feature" uses "well known image processing techniques are used upon the real-time video imagery to alter the natural lighting conditions of the imagery to that of a simulated lighting condition." *See* Rosenberg, [0116].

As another example, to the extent that Rosenberg is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in

the art at the time of the invention to combine Rosenberg with any of the references identified in Exhibit A-00 for at least the reasons discussed above or in Exhibit A-00.

(f) Rowles in view of Francois II and/or Geisner and/or Haan and/or Iwabuchi and/or Kurtz and/or Lin and/or Lizee and/or Rosenberg

Rowles discloses a "digital mirror is an apparatus that captures and displays an image to a user through the use of a digital electronic system. The digital mirror includes an image capture device and a display device on the same side to display the captured image to a user. A digital mirror further includes a user interface and an internal electronic control and image processing system to control the camera and the display device and process captured images for display on the display device." *See* Rowles, 5:33-40.

Francois II, Geisner, and Iwabuchi each disclose virtual mirror systems. For example, Francois II comprises six publications. When considered in combination, the publications of Francois II disclose a virtual mirror system comprising a flat LCD display, a camera, and a device used for tracking a user. *See, e.g., A Handheld Virtual Mirror* (2002), introductory paragraph. Geisner discloses that "[a]n on-screen shopping application which reacts to a human target user's motions to provide a shopping experience to the user is provided." *See* Geisner, [0003]. Iwabuchi discloses a computer-augmented makeup mirror system, which includes a camera, a proximity sensor, and monitor which displays a "mirror image" of the user. *See* Iwabuchi, page 498; *see also* Fig. 1. Each of Francois, Geisner, and Iwabuchi also contains disclosure pertaining to varying an image resolution based on a determined user distance. *See, e.g.,* the following Francois II publications: Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration; *Software Architecture for Computer*

*Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract), 5-6, 10-11, 13-17, 21-22, Figs. 15 and 19. *See also* Geisner, [0081]; [0088]-[0091]; Iwabuchi at 497-498.

A POSITA would recognize that the mechanisms disclosed in Francois II, Geisner, and Iwabuchi relating to adjusting an image resolution based on a determined user distance could readily be implemented into Rowles, as Francois II, Geisner, Iwabuchi, and Rowles all pertain to image display systems that provide users a virtual reflection of themselves. A POSITA would further recognize that these features would provide Rowles with improved image display and efficiency.

Kurtz and Rosenberg disclose determining a distance to a user from a virtual mirror display. *See, e.g.,* Kurtz, [0065]-[0066]; *see also* Rosenberg, [0056], [0062]. Haan and Lizee include disclosure related to varying a rate of performance on images based on a determined user distance. *See, e.g.,* Haan, [0080]-[0082], [0097]; *see also* Lizee, [0032], [0036]-[0037], [0084]. A POSITA would be motivated to teach the features described above in Kurtz, Rosenberg, Haan, and Lizee into Rowles, as these references each disclose virtual mirror systems. Further, a POSITA would recognize that incorporating these features into Rowles would enable Rowles to improve its system efficiency by varying a rate of image processing based on whether the user is near or far.

Lin discloses a mirror device with an embedded display unit that captures and displays an image of a user. *See* Lin, Abstract; [0021]-[0023]. Lin discloses having distance sensors to detect the distance between a user and the display system, and based on the distance, varying the sizing and display of the image on the device. *See id.,* [0024]; [0030]; Claim 13; Claim 14.

A POSITA would have recognized that both Rowles and Lin relate to mirror systems that display moving images of a user that were captured by a camera in real time. *See, e.g.,* Rowles,

5:33-40; Lin, Abstract, [0021]-[0023]. Accordingly, a POSITA would have recognized that the improvements in Lin could readily be implemented in the "user interface and an internal electronic control and image processing system to control the camera and the display device and process captured images for display on the display device" as disclosed in the "digital mirror" system of Rowles. *See* Rowles, 5:33-40. A POSITA would recognize that implementing the system optimization measures in Lin would improve upon the internal electronic control and image processing system introduced in Rowles and enable a more efficient virtual mirror system. Adjusting the size of the displayed image based on distance could readily be incorporated into Rowle's image processing system and lead to reasonably animated improvements in the functionality of the mirror system.

As another example, to the extent that Rowles is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Rowles with any of the references identified in Exhibit A-00 for at least the reasons discussed above or in Exhibit A-00.

(g) Straka II in view of Kurtz and/or Geisner and/or Iwabuchi and/or Hatanaka and/or Lin

Straka II discloses a method of operating a mirror system which is largely similar to that disclosed in the '109 Patent. *See generally*, Straka II. For example, Straka II discloses a "virtual mirror system which combines a multicamera capture system with real-time free-viewpoint video." *Id.* at 3. In other words, Straka II discloses at least one camera positioned at a height above each of the user's head and a display screen such that it captures an image of the user from a downward-looking angle, a display screen to act as a mirror surface, and means to transform the perspective of the image from one taken at a downward-looking angle to one that is taken at an

eye-level height. *Id.* at 1-3, 7. Furthermore, Straka II discloses tracking a user, on the display screen, as the user moves from a first point to a second point, much the way a mirror would. *Id.* at 7, FIG. 1(b).

Kurtz discloses systems and methods for video communication between two users including a processor configured to "alter[] images of the [first] individual using a gaze adapting process that effects image capture or image processing to provide an eye contact image of the [first] individual to the [second] viewer wherein the eyes of the [first] individual appear to be looking at the eyes of the [second] individual in the remote environment[.]" *E.g.*, Kurtz at Cl. 11. Kurtz further discloses the capture and use of reference images to generate transformation mapping. *See e.g.*, *id.* at [0085], [0104], [0108], [0122]-[0123], and [0125]. Kurtz also discloses "changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image." *See e.g.*, *id.* at [0048].

A POSITA would have recognized that Kurtz's reference image registration could be incorporated into the mirror system of Straka II. This would have constituted nothing more than "application of a known technique," *i.e.,* the addition or reference image registration "to a piece of prior art ready for the improvement." As previously stated, Straka II discloses at least one camera positioned at a height above each of the user's head and a display screen such that it captures an image of the user from a downward-looking angle. To use the image captured by the camera(s) as a mirror, which is the stated goal of Straka II, some form of image distortion correction must occur. Straka II at 4 ("In the first stage, we acquire a live stream of multiple synchronized camera images. Each image is then undistorted using radial distortion parameters determined during camera calibration."). A POSITA would thus have recognized that the Kurtz's disclosure of reference image registration is equally applicable to the teachings of Straka II.



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A POSITA would also have recognized that Kurtz's disclosure of brightness control could also be equally incorporated into the mirror system of Straka II. This would have constituted nothing more than "applying a known technique to a known device (method, or product) ready for improvement to yield predictable results." As previously stated, Kurtz discloses the use of brightness control which is "typical to televisions and computer monitors." Kurtz at [0048]. Furthermore, Straka II discloses that its system uses "a 47 inch Full-HD television mounted in portrait mode." Straka II at 3. Accordingly, a POSTIA would thus have recognized that Kurtz's disclosure of a brightness control is equally applicable to the teachings of Straka II.

Geisner discloses a shopping application with "a tracking system [which] captures user motions" and which "allow[s] a user to manipulate an on-screen representation the user" having "a likeness of the user." Geisner at Abstract. Like Straka II, Geisner also discloses "user movements which are recognized as . . . control gestures [which] are translated into commands. *Id.* Geisner further discloses that a "capture device captures data at interactive rates, increasing the fidelity of the data and allowing the disclosed techniques to process the raw depth data, digitize the objects in the scene, [and] extract the surface and texture of the object" to update the user's on-screen representation in real time. *Id.* at [0134].

A POSITA would have recognized that Geisner's disclosure of interactive rates for the improved image accuracy could also be equally incorporated into the mirror system of Straka II. This would have constituted nothing more than "applying a known technique to a known device (method, or product) ready for improvement to yield predictable results." As the stated goal of Straka II is to "simulate a physically correct full-body mirror on a monitor," the incorporation of any known technique to improve the quality of the monitor's display would be a logical

improvement. Straka II at Abstract. Accordingly, a POSTIA would thus have recognized that Geisner's disclosure of interactive rates is equally applicable to the teachings of Straka II.

Iwabuchi discloses a smart mirror system for aiding in the application of makeup and cosmetics. Iwabuchi at Abstract. Specifically, the smart mirror, which has at least one camera mounted atop a display screen, transforms the downward-angled image to an eye-level-perspective image, and performs such functions as "Automatic zoom to a specific part of the face, Display the face from various angles, Simulation of lighting conditions, and Internet voting on better makeup results." *Id.* (internal citations omitted). Further, Iwabuchi discloses that "an infrared range sensor [can] measure the distance between the camera and the face." *Id.* at 497-98.

A POSITA would have recognized that Iwabuchi's disclosure of distance measurements could also be equally incorporated into the mirror system of Straka II. This would have constituted nothing more than "applying a known technique to a known device (method, or product) ready for improvement to yield predictable results." Like Straka II, Iwabuchi is also directed to a virtual mirror; thus, the incorporation of any known technique — i.e., distance sensing — to improve the functionality of a virtual mirror would be a logical improvement. Accordingly, a POSTIA would thus have recognized that Iwabuchi's disclosure of distance sensing is equally applicable to the teachings of Straka II.

Lin discloses a mirror device with an embedded display unit that captures and displays an image of a user. *See* Lin, Abstract; [0021]-[0023]. Lin discloses having distance sensors to detect the distance between a user and the display system, and based on the distance, varying the sizing and display of the image on the device. *See id.,* [0024]; [0030]; Claim 13; Claim 14.

A POSITA would have recognized that both Straka II and Lin concern mirror systems that display moving images of a user that were captured by a camera in real time. *See,* Straka II at 1-2;

Lin, Abstract, [0021]-[0023]. Accordingly, a POSITA would have recognized that the improvements in Lin could readily be implemented in Straka II to improve the user image display devices with a reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the system optimization techniques disclosed in Lin into the mirror system disclosed in Straka II, such that the mirror device in Straka II is able to detect the user's distance to the device and adjust the size of displayed image based on the distance. Lin, [0024], [0030]. A POSITA would recognize that implementing these system optimization measures in Straka II would result in a more efficient mirror system, with the improved image display. A POSITA would have recognized that Lin's disclosure of distance measurements and varying the size of the image based on distance could also be equally incorporated into the mirror system of Straka II. This would have constituted nothing more than "applying a known technique to a known device (method, or product) ready for improvement to yield predictable results." Lin is directed to a mirror device with a display unit; thus, the incorporation of any known technique — i.e., distance sensing — to improve the functionality of the mirror system would have been a reasonably anticipated improvement. Lin, Abstract [0021]-[0023]. Further, adjusting the size of the displayed image based on distance would have been a simple software change that would have yielded predictable results.

Hatanaka discloses an image communication system and image-processing techniques for distributing real time video images. *See* Hatanaka, [0001]. More specifically, Hatanaka discloses the modification of images through transformation mapping. *Id.*, [0020], [0024]-[0028], [0037]-[0039], [0047]-[0051], and [0070]-[0077]. Hatanaka also discloses measuring a distance between a display and its audience. *E.g.*, *id.*, [0028]-[0029].

A POSITA would have recognized that Hatanaka's disclosure of transformation mapping and distance measurements could also be equally incorporated into the mirror system of Straka II. This would have constituted nothing more than "applying a known technique to a known device (method, or product) ready for improvement to yield predictable results." Like Straka II, Hatanaka is also directed to acquiring manipulating, and displaying images in real time. Accordingly, a POSTIA would thus have recognized that Hatanaka's disclosures are equally applicable to the teachings of Straka II.

As another example, to the extent that Straka II is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Straka II with any of the references identified in Exhibit A-00 for at least the reasons discussed above or in Exhibit A-00.

**(2) U.S. Patent No. 8,982,110**

The '110 Patent "relates generally to imaging and display systems and, more particularly, to monitors, and interactive displays." '110 Patent at 1:43-45. More particularly, the Asserted Claims of the '110 Patent relate to a computerized method for operating a virtual display system comprising a camera, a display monitor, and a processor. *Id.* at Claim 1. The method of the Asserted Claims of the '110 Patent includes detecting, via the processor, a user's presence in a stream of images captured by the camera, and "operating the processor to apply adaptive transformation mapping to the stream of images captured by the camera to generate modified images that appear to be captured from a different point of view of the camera's actual point of view." *Id.*

According to the '110 Patent, these "virtual mirror" images can be further manipulated to provide additional enhancement features. *Id.* at 5:1-4. A virtual mirror image can be manipulated,



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for example, to augment the displayed color, texture, and shape of a user's body or an image background. *Id.* at 5:9-12. These augmentations can enable body measurements, body monitoring, and multi-level user identification and authentication. *Id.* at 5:7-14.

(a) Francois II in view of Geisner and/or Haan and/or Iwabuchi and/or Kurtz and/or Lizee and/or Rosenberg and/or Rowles and/or Wolf

Francois II comprises six publications. When considered in combination, the publications of Francois II disclose a virtual mirror system comprising a flat LCD display, a camera, and a device used for tracking a user. *See, e.g., A Handheld Virtual Mirror* (2002), introductory paragraph. Further, Francois II discloses the virtual mirror system including a processing unit "specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time." *Id.*, Section 2.2.System integration. Francois II also discloses transforming input video stream of a user captured by a camera and performing a "mirror transform" step which uses "synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003), 13-15; *see also id.*, Figs. 12-13.

Geisner discloses that "[a]n on-screen shopping application which reacts to a human target user's motions to provide a shopping experience to the user is provided." *See* Geisner, [0003]. Further, Geisner discloses a tracking system "used to track user motions and execute a shopping application." *Id.* Geisner discloses "a computer implemented method wherein a scene including a human target user is captured using a capture device which is part of the tracking system" and that a "representation of the scene and the human target is rendered on a display device." *Id.*, [0003]. Geisner further discloses a "a model representing a human target" having "one or more joints n1-



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n18" that "may enable one or more body parts defined there between to move relative to one or more other body parts," *Id.*, [0123]. "Each of the joints represents a place in the skeleton where the skeleton can pivot in the x, y, z directions or a place of interest on the body" (*id.* at [0124]; *see also* Fig. 8), including flipping across a vertical axis, such that the left and right sides of the human target model are flipped (*see, e.g.,* Fig. 9). Moreover, Geisner discloses "interface elements" that "allow the user to change the appearance of the on-screen representation," including, for example, "lighting controls [that] may allow a user to change the type and position of lighting sources on a scene." *Id.*, [0160].

A POSITA would have recognized that Geisner's disclosure relating to manipulating the image of the "model representing a human target" via "pivoting" the joints n1-n-18 (*id.*, [0123]), could easily be incorporated into Francois II, as both Geisner and Francois II disclose systems and methods for tracking the motion of a human user and displaying these tracked motions to the user. Similarly, a POSITA would have recognized that the interface elements disclosed in Geisner allowing users to control the lighting of a displayed image could also have been incorporated into Francois II. A POSITA would have been motivated to incorporate these elements of Geisner into Francois II, as they would provide improved ability for a user to control a displayed self-image, better enabling viewing inverted mirror images, as well as images with customizable lighting and shading. Given that Francois II aims to provide users with "a handheld virtual mirror device" (*see, e.g., A Handheld Virtual Mirror* (2002), at the introductory paragraph), this incorporation by a POSITA would have constituted nothing more than "applying a known technique to a known device (method, or product) ready for improvement to yield predictable results." *See KSR*, 550 U.S. at 417.



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Haan is directed to a "mirror device" comprising a display device with a display screen, which displays images of a user recorded by a camera in real-time. *See* Haan, Abstract. Haan discloses that "wherein the distance is measured, the field of view of the cameras is, in embodiments, changed in dependence on the measured distance d. When the subject moves closer to the mirror, not only the magnification is changed, but also the cameras are rotated so that the cameras are pointed at the position of the viewer. This improves the image." *See* Haan, [0097]. A POSITA would have been motivated to incorporate this feature of Haan into the virtual mirror device described in Francois II, as this would enhance a user's ability to "use of video analysis and graphics techniques [to] allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 15.

Kurtz discloses a two-way video communications system, which includes an image capture camera device to capture real time video images of a user, as well as a display device to present the captured video images. *See* Kurtz, [0042]. Kurtz discloses that "the user interface 440 can include interface controls 190…[that] can provide or enable control of an image capture device 120, relative to zooming, panning, tilting, and other camera type functions." *See id.* [0048]. Lizee discloses image capturing systems and methods which provide a virtual reality gaming experience to a user. *See* Lizee at Abstract. Lizee states that "user motions may be detected and used to control various virtual camera perspective modifications, which may include moving, rotating, panning, zooming, orbiting and/or dollying the virtual camera relative to the silhouette model 24 and/or the virtual environment." *Id.* at [0063].

Iwabuchi discloses a smart mirror system for aiding in the application of makeup and cosmetics. Iwabuchi at Abstract. The smart mirror disclosed in Iwabuchi discloses transforming

an image taken from above eye-level and displaying the image from an eye-level perspective. *Id.* Further, Iwabuchi discloses that to improve image quality, the system can switch between a high- and low-resolution camera depending on how close a user's face is to the smart mirror *Id.* at 497-98. *See also,* Rosenberg, [0025], [0049]-[0052], [0077]-[0080], Fig. 5.

A POSITA would have recognized that the techniques disclosed in Kurtz, Lizee, Iwabuchi, and Rosenberg relating to adjusting the field of view or image magnitude according to a user input, could be incorporated into the image display functionality disclosed throughout Francois II. This would have constituted nothing more than "application of a known technique," *i.e.,* adjusting the field of view and magnitude of the image, "to a piece of prior art ready for the improvement." *See KSR*, 550 U.S. at 417; *see also id.* at 415–19 (obvious to implement known techniques to improve similar devices and methods in known ways to yield predictable results, especially where some teaching, suggestion, or motivation exists to do so).

Rowles also discloses a "digital mirror" that allows users to see a virtual reflection. *See* Rowles at Abstract. Rowles discloses that the "arrangement of the pixel data in the rows and columns is read out of the memory locations in a reverse order (e.g., from right to left—Pm1 to P11) to transpose or horizontally flip the captured image into a horizontally mirrored image" and thus allows for users to view themselves in a mirrored view. *Id.*, 14:43-47. A POSITA would have recognized that these features described Rowles could be implemented into Francois II, as Rowles, and Francois II relate to virtual mirror systems, and such an integration would enhance the ability for users to control the display of their virtual reflections and field-of-view manipulations.

Wolf discloses an image processing system used to capture an image, modify the image, such as to correct eye gaze, and display the modified image. Wolf, Abstract, Claim 13, [0067].



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Wolf discloses correcting an image and transmitting the corrected over a network to a remote display device which displays the corrected image. Wolf, [0080], [0087].

A POSITA would have recognized that both Francois II and Wolf are image processing devices that modify and display real time images. *See*, e.g., A Handheld Virtual Mirror (2002), introductory paragraph; Wolf, Abstract, [0080], [0087]. Accordingly, a POSITA would have recognized that the improvements in one could readily be implemented in the other to improve the user image display devices with a reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the transmission techniques of modified images disclosed in Wolf into the image processing device of Francois II such that the modified images can be transmitted through a network through remote display devices. Wolf, [0080], [0087]. A POSITA would recognize that implementing these transmission techniques to the modified images of Francois II would result in the transmission of modified images across a network and allow for a natural interpersonal communication with other users. Additionally, a POSITA would have had a reasonable expectation of success because transmissions of images were already well known and the incorporation of transmitting a modified image across a network would have been a change a POSITA could readily implement to yield predictable results.

As another example, to the extent that Francois II is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Francois II with any of the references identified in Exhibit B-00 for at least the reasons discussed above or in Exhibit B-00.

(b) Geisner and/or Francois II and/or Haan and/or Iwabuchi and/or Kurtz and/or Lizee and/or Rosenberg and/or Rowles



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Geisner discloses that "[a]n on-screen shopping application which reacts to a human target user's motions to provide a shopping experience to the user is provided." *See* Geisner, [0003]. Further, Geisner discloses a tracking system "used to track user motions and execute a shopping application." *Id.* Additionally, Geisner discloses "[a]n on-screen interface allows the user to interact with virtual articles that represent real-world articles available to the user," wherein "[u]ser movements which are recognized as article manipulation or transaction control gestures are translated into commands for the shopping application." *Id.*

Francois II comprises six publications. When considered in combination, the publications of Francois II disclose a virtual mirror system comprising a flat LCD display, a camera, and a device used for tracking a user. *See, e.g., A Handheld Virtual Mirror* (2002), introductory paragraph. Francois II additionally discloses the virtual mirror system including a processing unit "specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time." *Id.*, Section 2.2.System integration. Francois II also discloses transforming input video stream of a user captured by a camera and performing a "mirror transform" step which uses "synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003), 13-15; *see also id.*, Figs. 12-13.

Haan is directed to a "mirror device" comprising a display device with a display screen, which displays images of a user recorded by a camera in real-time. *See* Haan, Abstract. Haan discloses using a process called "synthesis" in which the mirror device system uses multiple cameras to capture various images, which can be used to "construct a virtual camera position and/or magnification." *See id.*, [0058]. Similarly, Rosenberg discloses a "digital mirror" that



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"enables the user to view a composite image upon the mirror display that includes a display of multiple images collected by the camera at different points in time. The feature, referred to herein as multi-view mirroring, allows a user to view himself or herself from multiple perspectives upon the same screen, thereby getting a more holistic impression of his or her appearance." *See* Rosenberg, [0048]. Similar to Haan and Rosenberg, Wolf discloses an image processing system used to capture an image, modify the image, such as to correct eye gaze, and display the modified image. Wolf, Abstract, Claim 13, [0067]. Wolf discloses correcting an image and transmitting the corrected over a network to a remote display device which displays the corrected image. Wolf, [0080], [0087].

A POSITA would be motivated to incorporate the image synthesis and modification mechanisms disclosed in Haan, Rosenberg, Francois II, and Wolf into Geisner, as Haan, Rosenberg, Francois II, and Wolf relate to providing a user a virtual mirror display system capable of displaying synthesized and modified images of a user. Further, Geisner discloses providing a system in which "visual images can be obtained from multiple angles for that user." *See* Geisner, [0103]. A POSITA would recognize that the image synthesis and modification mechanisms disclosed in Haan, Rosenberg, Francois II, and Wolf would further enable users of the Geisner system to view themselves from multiple perspectives and therefore would be motivated to implement these features into Geisner.

Kurtz discloses a two-way video communications system, which includes an image capture camera device to capture real time video images of a user, as well as a display device to present the captured video images. *See* Kurtz, [0042]. Kurtz discloses that "the user interface 440 can include interface controls 190…[that] can provide or enable control of an image capture device 120, relative to zooming, panning, tilting, and other camera type functions." *See id.* [0048]. Lizee

discloses image capturing systems and methods which provide a virtual reality gaming experience to a user. *See* Lizee at Abstract. Lizee states that "user motions may be detected and used to control various virtual camera perspective modifications, which may include moving, rotating, panning, zooming, orbiting and/or dollying the virtual camera relative to the silhouette model 24 and/or the virtual environment." *Id.* at [0063].

Iwabuchi discloses a smart mirror system for aiding in the application of makeup and cosmetics. Iwabuchi at Abstract. The smart mirror disclosed in Iwabuchi discloses transforming an image taken from above eye-level and displaying the image from an eye-level perspective. *Id.* Further, Iwabuchi discloses that to improve image quality, the system can switch between a high- and low-resolution camera depending on how close a user's face is to the smart mirror *Id.* at 497-98. *See also,* Rosenberg, [0025], [0049]-[0052], [0077]-[0080], Fig. 5. *See also,* Rowles 3:61-4:30; 5:19-5:29.

A POSITA would have recognized that the techniques disclosed in Kurtz, Lizee, Iwabuchi, Rosenberg, Rowles relating to adjusting the field of view or image magnitude according to a user input, could be incorporated into the on-screen shopping application disclosed in Geisner. This would have constituted nothing more than "application of a known technique," *i.e.,* adjusting the field of view and magnitude of the image, "to a piece of prior art ready for the improvement." *See KSR*, 550 U.S. at 417; *see also id.* at 415–19 (obvious to implement known techniques to improve similar devices and methods in known ways to yield predictable results, especially where some teaching, suggestion, or motivation exists to do so).

As another example, to the extent that Geisner is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in

the art at the time of the invention to combine Geisner with any of the references identified in Exhibit B-00 for at least the reasons discussed above or in Exhibit B-00.

(c) Haan in view of Francois II and/or Geisner and/or Lizee and/or Kurtz and/or Enstad and/or Miyaoku and/or Iwabuchi and/or Hatanaka and/or Rosenberg and/or Rowles and/or Wolf and/or Jeon

Haan is directed to a "mirror device" comprising a display device with a display screen, which displays images of a user recorded by a camera in real-time. Additionally, the mirror device comprises a means for determining and signaling the position of a body part of the user (e.g., face) with respect to the display screen, and adjusts the view point from which the displayed image is recorded based on the determined body part position. *See* Haan, Abstract. *See also, e.g., id.*, [0006]-[0011]; [0056]-[0058]; Fig. 2. Haan further discloses the recorded images being "fed to a position determination means" in which the recorded images are analyzed, a body part orientation (e.g., face orientation) is determined, a "synthesis of the various images" to "construct a virtual camera position and/or magnification" is performed, and the synthesized images are displayed. *See id.*, [0058].

Wolf discloses an image processing system used to capture an image, modify the image, such as to correct eye gaze, and display the modified image. Wolf, Abstract, Claim 13, [0067]. Wolf discloses correcting an image and transmitting the corrected image over a network to a remote display device which displays the corrected image. Wolf, [0080], [0087].

A POSITA would have recognized that both Haan and Wolf are image processing devices that modify and display real time images. *See*, e.g., Haan, Abstract, [0058]; Wolf, Abstract, [0080], [0087]. Accordingly, a POSITA would have recognized that the improvements in one could readily be implemented in the other to improve the user image display devices with a

reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the transmission techniques of modified images disclosed in Wolf into the image processing device of Haan such that the modified images can be transmitted through a network through remote display devices. Wolf, [0080], [0087]. A POSITA would recognize that implementing these transmission techniques to the modified images of Haan would result in transmission of modified images across a network and allow for a natural interpersonal communication with other users. Additionally, a POSITA would have had a reasonable expectation of success because transmissions of images were already well known and the incorporation of transmitting a modified image across a network would have been a change a POSITA could readily implement to yield predictable results.

Jeon discloses an image processing system which captures and edits images. Jeon, Abstract. In particular, Jeon discloses a method to change the point of view of the image which corrects the gaze of the user. Jeon Abstract, 3:6-20. The method includes editing pixels in an image and moving the position of the pixel within the image. Jeon 1:63-2:8.

A POSITA would have recognized that both Haan and Jeon are image processing devices that capture, modify, and output images. *See*, e.g., Haan, Abstract, [0058]; Jeon, Abstract, 2:9-24. Accordingly, a POSITA would have recognized that the improvements in one could readily be implemented in the other to improve the user image display devices with a reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the image processing techniques disclosed in Jeon into the image processing device of Haan such that the system would have a more robust set of image transformation techniques to modify the images. *See* Jeon 4:46-65. A POSITA would recognize that implementing these additional image transformation techniques would create a more comprehensive system for image

processing. Further, adding the image processing techniques of Jeon to Haan would have been a simple software change that would have yielded predictable results

Lizee, Kurtz, Enstad, Miyaoku, Iwabuchi, Hatanaka, Francois II, Geisner, Rowles, and Rosenberg all disclose image display devices in which live images captured by a camera and modified to be displayed on a display screen are transmitted over a network, including for enabling remote view of the modified images for telepresence. *See* Lizee, [0029]; *see also* Kurtz, [0042]; Enstad, [0026], Fig. 1; Miyaoku, [0028]-[0031], Fig. 1; Iwabuchi, page 496; Hatanaka, [0008]-[0013]; Geisner, [0099]-[0100]; Rowles, 5:19-23; Rosenberg, [0074]. For example, Lizee discloses capturing images of users for use in a virtual environment, wherein said virtual environment "could be shared between two or more networked systems." *See* Lizee, [0078]. Additionally, Kurtz discloses "transferring image and other data" over a wireless or wired network channel, wherein the transferred image data displays each user captured by cameras in separate locations. *See* Kurtz, [0042]; Fig. 1. *See also* Enstad, [0025]-[0026]; Miyaoku, [0028]-[0031]; Iwabuchi, pages 502-503; Hatanaka, [0064]-[0065]; Rosenberg, [0109]. *See also* one of the Francois II references: *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 15-16.

A POSITA would be motivated to combine Lizee, Kurtz, Enstad, Miyaoku, Iwabuchi, Hatanaka, Francois II, Geisner, Rowles, and Rosenberg, as all of these references pertain to image display devices that display mirrored images of a user. A POSITA would further have been motivated to implement the telepresence functionalities disclosed in Lizee, Kurtz, Enstad, Miyaoku, Iwabuchi, Hatanaka, and Rosenberg into Haan, which already discloses a mirror device that presents a reflected image of a user to the user. This would have constituted nothing more than "application of a known technique," *i.e.,* the addition of network connectivity and telepresence

functionality "to a piece of prior art ready for the improvement." *See KSR*, 550 U.S. at 417; *see also id.* at 415–19 (obvious to implement known techniques to improve similar devices and methods in known ways to yield predictable results, especially where some teaching, suggestion, or motivation exists to do so).

As another example, to the extent that Haan is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Haan with any of the references identified in Exhibit B-00 for at least the reasons discussed above or in Exhibit B-00.

(d) Kurtz in view of Lizee and/or Iwabuchi and/or Wolf

Kurtz discloses systems and methods for video communication between two users which is generally adapted to improve user residential privacy. Amongst other things, the published claims include a processor which is configured to "alter[] images of the [first] individual using a gaze adapting process that effects image capture or image processing to provide an eye contact image of the [first] individual to the [second] viewer wherein the eyes of the [first] individual appear to be looking at the eyes of the [second] individual in the remote environment[.]" *E.g.*, Kurtz at Cl. 11. Kurtz further discloses the capture and use of reference images to generate transformation mapping. *See e.g.*, *id.* at [0085], [0104], [0108], [0122]-[0123], and [0125].

Lizee discloses image capturing systems and methods which provide a virtual reality gaming experience to a user. *See* Lizee at Abstract. More specifically, Lizee discloses a "virtual representation compris[ing] a mirrored silhouette transformation of the user image such that the virtual representation and the user share a substantially same orientation. A position and motion of the user may also be calculated to position and move the virtual representation in a given virtual environment." *Id.* To accommodate user movement during the gaming experience, Lizee discloses

that the image framing of the user can be resized as the user moves around the display screen. *See id.* at [0040]-[0041], [0043], [0056]-[0057], FIGS. 2A-C. In some embodiments, however, Lizee discloses that in response to user commands and/or gestures, the viewing perspective displayed on the screen can be different from the perspective of the user actually captured by the camera; for example, Lizee states that "user motions may be detected and used to control various virtual camera perspective modifications, which may include moving, rotating, panning, zooming, orbiting and/or dollying the virtual camera relative to the silhouette model 24 and/or the virtual environment." *Id.* at [0063].

A POSITA would have recognized that Lizee's various virtual camera perspective modifications could be readily incorporated into Kurtz's video communication system because doing so merely constitutes "application of a known technique to a piece of prior art ready for the improvement." Although, in a narrow sense, Kurtz is directed to a video communication system and Lizee is directed to a video game system, a POSITA would recognize that they are fundamentally solving the same problem — transforming a user image for display on a display device. As previously stated, Kurtz discloses a method for tracking and transforming a user's gaze, which is simply one form of the multiple perspective modifications disclosed by Lizee. A POSITA would thus have recognized that Lizee's disclosure of user tracking is equally applicable to the teachings of Kurtz.

Iwabuchi discloses a smart mirror system for aiding in the application of makeup and cosmetics. Iwabuchi at Abstract. Specifically, the smart mirror, which has at least one camera mounted atop a display screen, transforms the downward-angled image to an eye-level-perspective image, and performs such functions as "Automatic zoom to a specific part of the face, Display the face from various angles, Simulation of lighting conditions, and Internet voting on better makeup

results." *Id.* (internal citations omitted). In other words, Iwabuchi discloses that numerous transformations can be performed on the user image to provide visual information to aid in makeup application, which is not possible with a conventional mirror. *See id.* at 497-98.

A POSITA would have recognized that Iwabuchi's image transformations could also be equally incorporated into Kurtz's video communication system because doing so merely constitutes "application of a known technique to a piece of prior art ready for the improvement." Regardless of whether the application is a video communication system or a mirror, a POSITA would recognize that they are fundamentally solving the same problem — transforming a user image for display on a display device. A POSITA would thus have recognized that Lizee's disclosure of user tracking is equally applicable to the teachings of Kurtz.

Wolf discloses an image processing system used to capture an image, modify the image, such as to correct eye gaze, and display the modified image. Wolf, Abstract, Claim 13, [0067]. Wolf discloses correcting an image and transmitting the corrected over a network to a remote display device which displays the corrected image. Wolf, [0080], [0087].

A POSITA would have recognized that both Kurtz and Wolf are image processing devices that modify and display real time images. *See*, e.g., A Handheld Virtual Mirror (2002), introductory paragraph; Wolf, Abstract, [0080], [0087]. Accordingly, a POSITA would have recognized that the improvements in one could readily be implemented in the other to improve the user image display devices with a reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the transmission techniques of modified images disclosed in Wolf into the communication system of Kurtz such that the modified images can be transmitted through a network through remote display devices. Wolf, [0080], [0087]. A POSITA would recognize that implementing these transmission techniques to the

modified images of Kurtz would result in the transmission of modified images across a network and allow for a natural interpersonal communication with other users. Additionally, a POSITA would have had a reasonable expectation of success because transmissions of images were already well known and the incorporation of transmitting a modified image across a network would have been a change a POSITA could readily implement to yield predictable results.

As another example, to the extent that Kurtz is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Kurtz with any of the references identified in Exhibit B-00 for at least the reasons discussed above or in Exhibit B-00.

(e) Rosenberg in view of Lizee and/or Kurtz and/or Enstad and/or Miyaoku and/or Iwabuchi and/or Hatanaka and/or Geisner and/or Francois II and/or Rowles and/or Wolf

Rosenberg is directed to "a digital mirror system…that has a digital mirror display to display at least one image." *See* Rosenberg, [0025]. This digital mirror system comprises a camera, that captures real-time video images of a user, a sensor that tracks and detects the movements of the user, an LCD display screen that displays the streaming real-time video images, and a processor, which controls the display screen and camera and performs various image processing on the captured video images. *See id.*, [0025]-[0029]; *see also* [0109]; Fig. 13. Rosenberg further discloses that the digital mirror system "employs electronic imaging hardware and software components to provide a diverse range of user-selectable mirroring capabilities to a person who stands before the wall mounted display." *See id.*, [0025]. For example, the digital mirror system of Rosenberg is capable of being inverted across the vertical axis: "[t]his left-right inverted representation is generally produced by flipping the pixels of the image around the vertical centerline such that right side of the user, from the user's perspective, appears upon the right side

of the display, and the left side of the user, from the user's perspective, appears upon the left side of the display." *See id.*, [0026]. Rosenberg further discloses that this exemplary image processing "is generally performed by a processing electronics at a high rate of speed so that the left-right inverted video image of the user is presented substantially in real-time to the user (i.e., there is not a noticeable time lag for the user)." *Id.* Rosenberg also discloses these image processing features as enabling users to see their digital reflection in real time from any selected angle, allowing user's to view themselves from various points of view: "[i]n another set of inventive features, the integrated digital mirror enables users to quickly and easily view not only their frontal image, but also profile images and rear images. In fact, the user is enabled to view his or her image from any desired angle." *See id.*, [0037].

Lizee, Kurtz, Enstad, Miyaoku, Iwabuchi, Hatanaka, and Wolf all disclose image display devices in which live images captured by a camera and modified to be displayed on a display screen are transmitted over a network, including for enabling remote view of the modified images for telepresence. *See* Lizee, [0029]; *see also* Kurtz, [0042]; Enstad, [0026], Fig. 1; Miyaoku, [0028]-[0031], Fig. 1; Iwabuchi, page 496; Hatanaka, [0008]-[0013]; Wolf, Abstract, [0080], [0087]. Lizee, for example, discloses capturing images of users for use in a virtual environment, wherein said virtual environment "could be shared between two or more networked systems." *See* Lizee, [0078]. Kurtz also discloses "transferring image and other data" over a wireless or wired network channel, wherein the transferred image data displays each user captured by cameras in separate locations. *See* Kurtz, [0042]; Fig. 1. *See also* Enstad, [0025]-[0026]; Miyaoku, [0028]-[0031]; Iwabuchi, pages 502-503; Hatanaka, [0064]-[0065]; Wolf, [0080], [0087].

A POSITA would be motivated to combine Rosenberg with Lizee, Kurtz, Enstad, Miyaoku, Iwabuchi, Hatanaka, and Wolf as all of these references pertain to image display devices



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that display mirrored images of a user. A POSITA would further have been motivated to implement the telepresence functionalities disclosed in Lizee, Kurtz, Enstad, Miyaoku, Iwabuchi, Hatanaka, and Wolf into Rosenberg, as Rosenberg is directed to a digital mirror system that displays images of a user. Such an implementation would represent an "application of a known technique," *i.e.,* the addition of network connectivity and telepresence functionality "to a piece of prior art ready for the improvement." *See KSR*, 550 U.S. at 417; *see also id.* at 415–19 (obvious to implement known techniques to improve similar devices and methods in known ways to yield predictable results, especially where some teaching, suggestion, or motivation exists to do so).

Lizee, Kurtz, Geisner, Francois II, and Rowles also disclose image display systems capable of processing functionality capable of generating background segmentation on images captured via the camera, and replacing said segments with replacement segments, wherein in some cases, these replacement segments represent a virtual background. For example, one of the Francois II references discloses a system comprising "capture, segmentation, tracking, visualization" and further discloses that "segmentation is performed by change detection using an adaptive statistical color background model." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003), page 10. Further, as part of the segmentation process, "[f]or each pixel, a decision is made whether it is an observation of the background or of an occluding element. The output is a foreground binary mask. This comparison is performed by the background comparison cell." *Id.*, pages 10-11. *See also* Lizee, [0073]-[0075]; Kurtz, [0123]; Geisner, [0153], [0156], [0158], [0159]; Rowles, 13:43-58.

A POSITA would be motivated to implement the background segmentation techniques disclosed in Lizee, Kurtz, Geisner, and Francois II into Rosenberg. First, all of the references pertain to image display devices or processing systems, wherein user images captured via a camera

can be displayed on a display screen to a user. A POSITA would recognize that a user who is using the digital mirror system of Rosenberg may desire to see a reflected image in another setting, and therefore, the POSITA would be motivated to incorporate these segmentation techniques into Rosenberg.

As another example, to the extent that Rosenberg is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Rosenberg with any of the references identified in Exhibit B-00 for at least the reasons discussed above or in Exhibit B-00.

(f) Rowles in view of Francois II and/or Geisner and/or Haan and/or Iwabuchi and/or Kurtz and/or Lizee and/or Rosenberg and/or Wolf

Rowles discloses a "digital mirror is an apparatus that captures and displays an image to a user through the use of a digital electronic system. The digital mirror includes an image capture device and a display device on the same side to display the captured image to a user. A digital mirror further includes a user interface and an internal electronic control and image processing system to control the camera and the display device and process captured images for display on the display device." *See* Rowles, 5:33-40.

Francois II, Geisner, Kurtz, Lizee, and Wolf all pertain to display systems that provide users virtual reflections of themselves. Further, Francois II, Geisner, Kurtz, Lizee, and Wolf all include disclosure relating to displaying a modified image on a remote screen for video telepresence. *See, e.g.,* the following Francois II publication: *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 15-17, Fig. 15. *See also* Geisner, [0099]-[0100]; Kurtz, [0042], Fig. 1; Lizee, [0078]; Wolf, [0080], [0087]. A POSITA would recognize that the



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telepresence functionality disclosed in Francois II, Geisner, Kurtz, Lizee, and Wolf could readily be implemented into Rowles, as Rowles also discloses a digital mirror system used to display mirrored images of a user to the user. Further, a POSITA would recognize that this incorporation would have constituted nothing more than "applying a known technique to a known device (method, or product) ready for improvement to yield predictable results." *See KSR*, 550 U.S. at 417.

Haan, Iwabuchi, and Rosenberg each include disclosure relating to detecting one or more body parts, via the processor. *See, e.g.,* Haan, [0036], [0058]; Iwabuchi, pages 496-497, 501-502; Rosenberg, [0025]. Haan, Iwabuchi, and Rosenberg also disclose a virtual mirror system. Given this, a POSITA would recognize that the body part detection features disclosed in Haan Iwabuchi, and Rosenberg could readily be integrated into Rowles. Further, a POSITA would recognize that adding these features to Rowles would improve Rowles image capture system, as the incorporation would allow the detection of a user.

As another example, to the extent that Rowles is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Rowles with any of the references identified in Exhibit B-00 for at least the reasons discussed above or in Exhibit B-00.

(g) Straka II in view of Kurtz and/or Geisner and/or Wolf

Straka II discloses a method of operating a mirror system which is largely similar to that disclosed in the '110 Patent. *See generally*, Straka II. For example, Straka II discloses a "virtual mirror system which combines a multicamera capture system with real-time free-viewpoint video." *Id.* at 3. In other words, Straka II discloses at least one camera positioned at a height above



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each of the user's head and a display screen such that it captures an image of the user from a downward-looking angle, a display screen to act as a mirror surface, and means to transform the perspective of the image from one taken at a downward-looking angle to one that is taken at an eye-level height. *Id.* at 1-3, 7. Furthermore, Straka II discloses tracking a user, on the display screen, as the user moves from a first point to a second point, much the way a mirror would. *Id.* at 7, FIG. 1(b).

Kurtz discloses systems and methods for video communication between two users including a processor configured to "alter[] images of the [first] individual using a gaze adapting process that effects image capture or image processing to provide an eye contact image of the [first] individual to the [second] viewer wherein the eyes of the [first] individual appear to be looking at the eyes of the [second] individual in the remote environment[.]" *E.g.*, Kurtz at Cl. 11. Kurtz further discloses (i) varying image magnitude or field-of-view between a wide and a narrow field-of-view (Kurtz at [0072], [0075]), (ii) segmenting images and/or overlaying objects in or on an image, such as hair, clothes, makeup, and/or a virtual environment (Kurtz at [0123]), and (iii) transmitting the image over a network and displaying the image on a remote screen (Kurtz at [0042] and FIG. 1).

A POSITA would have recognized that Kurtz's aforementioned features (i)-(iii) could be incorporated into the mirror system of Straka II. These would have constituted nothing more than "application of a known technique to a piece of prior art ready for the improvement," as each of these features are widely known in the field of digital and video imaging. First, as explained in Kurtz, "the field of view captured by a camera can be optimized, by both mechanical movement (pan, tilt, and zoom) and image cropping, to follow and frame an individual in their environment." Kurtz at [0010]. Accordingly, varying the image magnitude or field-of-view between a wide and



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a narrow field-of-view (as disclosed in Kurtz at [0072], [0075]) the display of a user's face or full body on a screen in a manner that simulates the reflection of a mirror. The virtual mirror disclosed in Straka II would therefore benefit from varying image magnitudes or field-of-view. Second, modifying images in a mirror to include segmentations or overlaid objects is a logical use for virtual mirrors, as it affords a user the opportunity to envision themselves with different appearances. Finally, the distortion correction technology of Straka II lends itself to live video feed transmission due to the downward-angled image that many systems suffer from which results from a camera positioned above the display screen. A POSITA would thus have recognized that the Kurtz's disclosures are equally applicable to the teachings of Straka II.

Geisner discloses a shopping application with "a tracking system [which] captures user motions" and which "allow[s] a user to manipulate an on-screen representation the user" having "a likeness of the user." Geisner at Abstract. Like Straka II, Geisner also discloses "user movements which are recognized as . . . control gestures [which] are translated into commands. *Id.* Geisner further discloses (i) varying image magnitude or field-of-view between a wide and a narrow field-of-view (Geisner at [0059]), (ii) segmenting images and/or overlaying objects in or on an image, such as hair, clothes, makeup, and/or a virtual environment (Geisner at [0156]-[0162]), and (iii) transmitting the image over a network and displaying the image on a remote screen (Geisner at [0153], [0156], and [0158]-[0159]).

A POSITA would have recognized that Geisner's aforementioned features (i)-(iii) could be incorporated into the mirror system of Straka II. These would have constituted nothing more than "application of a known technique to a piece of prior art ready for the improvement," as each of these features are widely known in the field of digital and video imaging. The system disclosed in Geisner is configured to "adjust the color, positioning, or scale of a selected feature based on



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the detected target features." Geisner at [0059]. Incorporating this adjustment of the positioning and scale of the detected target features, as disclosed in Geisner, into the virtual mirror system disclosed in Straka II would result in an improved ability to display a user's face or full body on a screen in a manner that simulates the reflection of a mirror. Second, modifying images in a mirror to include segmentations or overlaid objects is a logical use for virtual mirrors, as it affords a user the opportunity to envision themselves with different appearances. Finally, the distortion correction technology of Straka II lends itself to live video feed transmission due to the downward-angled image that many systems suffer from which results from a camera positioned above the display screen. A POSITA would thus have recognized that the Geisner's disclosures are equally applicable to the teachings of Straka II.

Wolf discloses an image processing system used to capture an image, modify the image, such as to correct eye gaze, and display the modified image. Wolf, Abstract, Claim 13, [0067]. Wolf discloses correcting an image and transmitting the corrected image over a network to a remote display device which displays the corrected image. Wolf, [0080], [0087].

A POSITA would have recognized that both Straka II and Wolf are image processing devices that modify and display real time images. *See*, e.g., Straka II, 1-2; Wolf, Abstract, [0080], [0087]. Accordingly, a POSITA would have recognized that the improvements in one could readily be implemented in the other to improve the user image display devices with a reasonable expectation of success and predictable results. For example, a POSITA would have been motivated to incorporate the transmission techniques of modified images disclosed in Wolf into the image processing device of Straka II such that the modified images can be transmitted through a network through remote display devices. Wolf, [0080], [0087]. A POSITA would recognize that implementing these transmission techniques to the modified images of Straka II would result in

the transmission of modified images across a network and allow for a natural interpersonal communication with other users. Additionally, a POSITA would have had a reasonable expectation of success because transmissions of images were already well known and the incorporation of transmitting a modified image across a network would have been a change a POSITA could readily implement to yield predictable results.

As another example, to the extent that Straka II is deemed not to anticipate an Asserted Claim for failing to teach a limitation, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine Straka II with any of the references identified in Exhibit B-00 for at least the reasons discussed above or in Exhibit B-00.

**d) Incorporation by Reference**

Defendants also incorporate by reference motivations to combine discussed in any IPR or reexamination proceedings concerning the Asserted Patents, including IPR2022-00489 and IPR2022-00490. Defendants also incorporate by reference the motivations to combine discussed in any invalidity expert reports served by *Facebook, Inc., Instagram, LLC, and WhatsApp LLC* in the previous lawsuit filed by EyesMatch against those defendants (C.A. No. 21-111-RGA-JLH), to the extent that any such reports were served.

**C. Claim Charts—P.R. 3-3(c)**

Pursuant to P.R. 3-3(c), and subject to Defendants' reservation of rights, claim charts providing a limitation-by-limitation analysis of where specifically, in each prior art item, each limitation of the Asserted Claims of the Asserted Patents are attached in A-00 through A-30 and B-00 through B-29.

### 1. Claim Charts for U.S. Patent No. 8,982,109

| Exhibit | Prior Art Reference |
|---|---|
| Exhibit A-00 | Claim Chart of Prior Art References against U.S. Patent No. 8,982,109 (the "'109 Patent References") |
| Exhibit A-01 | U.S. Patent Pub. No. 2009/0015658 ("Enstad") |
| Exhibit A-02 | *A Handheld Mirror Simulation*, Francois et al. (2003) ("Francois I") |
| Exhibit A-03 | (i) *A Handheld Mirror Simulation*, Francois et al. (2003);<br>(ii) Integrated Media Systems Center, Alexandre R.J. Francois et al., *A Handheld Virtual Mirror* (2002);<br>(iii) Image and Vision Computing 21, 137–143, Alexandre R.J. Francois et al., *Mirror symmetry -> 2-view stereo geometry* (2003);<br>(iv) Institute for Robotics and Intelligent Systems, Alexandre R.J. Francois, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003);<br>(v) Integrated Media Systems Center, Alexandre R.J. Francois, *Software Architecture for Immersipresence* (2003);<br>(vi) The Computer Journal, Vol. 54 No. 7, Alexandre R.J. Francois, *An Architectural Framework for the Design, Analysis and Implementation of Interactive Systems* (2010)<br>(collectively, "Francois II") |
| Exhibit A-04 | U.S. Patent Pub. No. 2011/0298910 ("Haan") |
| Exhibit A-05 | JP Patent Pub. No. 2010-177777 A ("Hatanaka") |
| Exhibit A-06 | *Smart Makeup Mirror: Computer-Augmented Mirror to Aid Makeup Application*, Iwabuchi et al. ("Iwabuchi") |
| Exhibit A-07 | U.S. Patent Pub. No. 2008/0297589 ("Kurtz") |
| Exhibit A-08 | WO Patent Pub. No. 2006/108279 ("Lizee") |
| Exhibit A-09 | JP Patent Pub. No. 2006-236013 A ("Miyaoku") |
| Exhibit A-10 | U.S. Patent No. 7,999,843 ("Ohba") |
| Exhibit A-11 | *High-Speed Gaze Controller for Millisecond-Order Pan/Tilt Camera*, |

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| | Okumura et al. (“Okumura I”) |
| Exhibit A-12 | U.S. Patent Pub. No. 2011/0254691 (“Ooi”) |
| Exhibit A-13 | U.S. Patent Pub. No. 2007/0040033 (“Rosenberg”) |
| Exhibit A-14 | *Virtual Mirror by Fusing Multiple RGB-D Cameras*, Shen et al. (“Shen”) |
| Exhibit A-15 | *A Free-Viewpoint Virtual Mirror with Marker-Less User Interaction*, Straka et al. (“Straka I”) |
| Exhibit A-16 | U.S. Patent Pub. No. 2014/0313230 (“Suggs”) |
| Exhibit A-17 | U.S. Patent No. 9,355,585 (“Tripathi”) |
| Exhibit A-18 | “Magic Mirror” System, by IconNicohls (“Magic Mirror”) |
| Exhibit A-19 | Saccade Mirror System (“Okumura II”), as described in:<br>(i) *High-Speed Gaze Controller for Millisecond-Order Pan/Tilt Camera System*, Okumura et al.<br>(ii) Ishikawa Group Laboratory. (2012, July 6). *1ms Auto Pan-Tilt for perfect recentering*. YouTube. https://www.youtube.com/watch?v=9Q_lcFZOgVo. |
| Exhibit A-20 | Virtual Mirror System (“Straka II”), as described in:<br>(i) *Free-Viewpoint Virtual Mirror with Marker-Less User Interaction System*, Straka et al.<br>(ii) rvlab. (2011, February 28). *A Free-Viewpoint Virtual Mirror with Marker-Less User Interaction*. YouTube. https://www.youtube.com/watch?v=b1Ryo3bcTDk. |
| Exhibit A-21 | U.S. Patent Pub. No. 2011/0246329 (“Geisner”) |
| Exhibit A-22 | JP Patent Pub. 2003153263 (“Ikui”) |
| Exhibit A-23 | U.S. Patent No. 9,122,320 (“Rowles”) |
| Exhibit A-24 | U.S. Patent Pub. No. 2010/0226531 (“Goto”) |
| Exhibit A-25 | Shiseido Augmented Reality Cosmetic Mirror System (“Shiseido”), as described in:<br>(i) Goto |

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|---|---|
| | (ii) *Shiseido Makeup Mirror Lets You Try on Cosmetics With Augmented Reality*, Trend Hunter, 6 February 2010, https://www.trendhunter.com/trends/shiseido-makeup-mirror.<br><br>(iii) *Try Out Dozens of Looks In Minutes And Wipe Them Off At The Push Of A Button With The Magic Make-Up Mirror*, Daily Mail, 28 March 2011, https://www.dailymail.co.uk/femail/article-1370892/Shiseidos-magic-make-mirror-try-dozens-looks.html.<br><br>(iv) *Shiseido: Augmented Reality Cosmetic Mirror*, uploaded by PSVParis, 6 December 2010, https://www.youtube.com/watch?v=n8Jp1LuQByg. |
| Exhibit A-26 | Human-Computer Interface System ("Francois III"), as described in<br>(i) *A Handheld Mirror Simulation*, Francois et al. (2003);<br>(ii) Integrated Media Systems Center, Alexandre R.J. Francois et al., *A Handheld Virtual Mirror* (2002) |
| Exhibit A-27 | JP Patent Pub. No. 2007-166529 ("Miyamoto") |
| Exhibit A-28 | JP Patent Pub. No. 2010-250452 ("Hamamoto") |
| Exhibit A-29 | U.S. Patent Pub. No. 2011/0102538 ("Tan") |
| Exhibit A-30 | U.S. Patent Pub. No. 2011/0134146 ("Lin") |

### 2. Claim Charts for U.S. Patent No. 8,982,110

| Exhibit | Prior Art Reference |
|---|---|
| Exhibit B-00 | Claim Chart of Prior Art References against U.S. Patent No. 8,982,110 (the "'110 Patent References") |
| Exhibit B-01 | Enstad |
| Exhibit B-02 | Francois I |
| Exhibit B-03 | Francois II |
| Exhibit B-04 | Haan |
| Exhibit B-05 | Hatanaka |
| Exhibit B-06 | Iwabuchi |

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|---|---|
| Exhibit B-07 | Kurtz |
| Exhibit B-08 | Lizee |
| Exhibit B-09 | Miyaoku |
| Exhibit B-10 | Ohba |
| Exhibit B-11 | Okumura I |
| Exhibit B-12 | Ooi |
| Exhibit B-13 | Rosenberg |
| Exhibit B-14 | Shen |
| Exhibit B-15 | Straka I |
| Exhibit B-16 | Suggs |
| Exhibit B-17 | Tripathi |
| Exhibit B-18 | Magic Mirror |
| Exhibit B-19 | Okumura II |
| Exhibit B-20 | Straka II |
| Exhibit B-21 | Geisner |
| Exhibit B-22 | Ikui |
| Exhibit B-23 | Rowles |
| Exhibit B-24 | Goto |
| Exhibit B-25 | Shiseido Augmented Reality Cosmetic Mirror System ("Shiseido"), as described in:<br>(i) Goto<br>(ii) *Shiseido Makeup Mirror Lets You Try on Cosmetics With Augmented Reality*, Trend Hunter, 6 February 2010, https://www.trendhunter.com/trends/shiseido-makeup-mirror.<br>(iii) *Try Out Dozens of Looks In Minutes And Wipe Them Off At The Push Of A Button With The Magic Make-Up Mirror*, Daily Mail, 28 March |



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|---|---|
| | 2011, https://www.dailymail.co.uk/femail/article-1370892/Shiseidos-magic-make-mirror-try-dozens-looks.html.<br><br>(iv) *Shiseido: Augmented Reality Cosmetic Mirror*, uploaded by PSVParis, 6 December 2010, https://www.youtube.com/watch?v=n8Jp1LuQByg. |
| Exhibit B-26 | Francois III |
| Exhibit B-27 | U.S. Patent Pub. No. 2010/0177159 ("Tojo") |
| Exhibit B-28 | U.S. Patent Pub. No. 2013/0070046 ("Wolf") |
| Exhibit B-29 | U.S. Patent No. 6,677,980 ("Jeon") |

### D. Invalidity Under 35 U.S.C. § 112—P.R. 3-3(d)

Pursuant to P.R. 3-3(d), and subject to Defendants' reservation of rights, Defendants identify below the grounds upon which Defendants currently contend the Asserted Claims are invalid for lack of written description and/or enablement under 35 U.S.C. § 112, ¶ 1, and/or for failing to comply with the definiteness requirements of 35 U.S.C. § 112, ¶ 2. The disclosures below do not attempt to identify all recitations of a given term or phrase in each claim. Where Defendants have identified an instance of a term or limitation in a particular claim that renders the claim invalid under Section 112, Defendants contend that every instance of the challenged term or limitation, or similar term or limitation, in the claim renders the claim invalid for the same reasons.

The following contentions are subject to revision and amendment under Federal Rule of Civil Procedure 26(e) and the Orders of record in this matter where appropriate in light of further investigation and discovery regarding the defenses below, the Court's construction of the claims at issue, or the review and analysis of expert witnesses.

#### 1. Lack of Enablement and Written Description

One or more Asserted Claims of the patents-in-suit are invalid under § 112, ¶ 1 for failing to particularly point out and distinctly claim the subject matter which the patentee regards as its



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alleged invention such that one skilled in the relevant art would be reasonably apprised of the bounds of the asserted claims when read in light of the specification. Section 112, paragraph 1 requires that the specification contain a written description of the invention."[T]he hallmark of written description is disclosure." *Boston Scientific Corp. v. Johnson & Johnson*, 647 F. 3d 1353, 1361-62 (Fed. Cir. 2011) (citation omitted). The test for whether a specification adequately describes an invention is "whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date . . . . [T]he test requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art . . . . [It] is a question of fact." *Ariad Pharms., Inc. v. Eli Lilly and Co.,* 598 F. 3d 1336, 1351 (Fed. Cir. 2010) (*en banc*); *Boston Scientific*, 647 F. 3d at 1362.

Section 112, paragraph 1 also requires that the patent specification enable "those skilled in the art how to make and use the full scope of the claimed invention without 'undue experimentation. '" *Genentech, Inc. v. Novo Nordisk A/S*, 108 F. 3d 1361, 1365 (Fed. Cir. 1997) (quoting *In re Wright*, 999 F. 2d 1557, 1561 (Fed. Cir. 1993))."[T]he scope of the claims must be less than or equal to the scope of the enablement." *Nat'l Recovery Tech., Inc. v. Magnetic Separation Sys., Inc.,* 166 F. 3d 1190, 1196 (Fed. Cir. 1999).

Subject to Defendants' reservation of rights, Defendants identify the following written description and enablement grounds with respect to the following asserted claims. The following does not purport to list every claim limitation to the foregoing disclosed grounds. Where a particular claim term or limitation is identified, Defendants contend that the identified term or limitation, as well as the surrounding claim language in context as recited in the applicable claim, suffer from the identified Section 112 defect. Furthermore, where a particular claim term or

limitation is identified with respect to one or more particular claims, Defendants contend that each other Asserted Claim that recites the same claim term or limitation, or similar claim term or limitation, is subject to the same Section 112 defect. Defendants also reserve the right to assert additional Section 112 defenses as discovery progresses.

The Asserted Claims fail to meet the requirements of 35 U.S.C. § 112, ¶ 1 because the specifications of the Asserted Patents do not contain a written description of the alleged invention and do not enable a person skilled in the art to make and use the alleged invention. In particular, at least the following limitations of the Asserted Claims are not enabled and/or lack written description support:

**'109 Patent**

- "…applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror;" Claim 1[c].
- "…resizing the image to reduce variations caused by changes in object's distance to the camera;" Claim 1[d].
- "…wherein the non-ordered steps are performed on a series of images of a live video feed from the camera;" Claim 1[f].
- "determining distance to a user appearing in the live video feed;" Claim 1[g].
- "…varying rate at which the non-ordered steps are performed on the series of images according to the distance." Claim 1[h].
- "…using data obtained from the registration to generate the transformation mapping." Claim 7[c].

**'110 Patent**

- "operating the processor to detect the presence of the user in the stream of images;" Claim 1[b].
- "operating the processor to apply adaptive transformation mapping to the stream of images captured by the camera to generate modified images that appear to be captured from a different point of view of the camera's actual point of view;" Claim 1[c].

- "wherein the different point of view corresponds to an image taken from a different angle and a different distance than the actual images captured by the camera" Claim 1[e].

- "wherein during mirror tracking mode the processor utilizes the angle of the images captured by the camera and applies parametric input for a mapping transformation that changes imaging perspective of the images captured by the camera." Claim 1[f].

- "The method of claim 1, wherein during idle mode the camera continuously sends captured images to the processor, and the user presence is identified by the processor detecting a body part in the images." Claim 3.

- "The method of claim 3, wherein the body part comprises one of legs, face, eyes, and hands." Claim 4.

**2. Indefiniteness**

As detailed below, the Asserted Claims are indefinite under 35 U.S.C. § 112, ¶ 2. Claims are indefinite under 35 U.S.C. § 112, ¶ 2 when they "fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.,* 134 S. Ct. 2120, 2124 (2014).

Defendants note that the Court's Docket Control Orders contemplate that all indefiniteness issues be brought to the Court's attention through the *Markman* briefing process (*see* Dkt. No. 27 at 5), which has not yet begun. Defendants' detailed arguments as to indefiniteness will be presented at that time, through the *Markman* meet and confer and briefing process.

Subject to Defendants' reservation of rights, and based on Defendants' present understanding of EyesMatch's Infringement Contentions, at least one or more of these claim terms/phrases/limitations are indefinite because they, read in light of the specifications and the prosecution histories, fail to inform with reasonable certainty those skilled in the art about the scope of the invention, and are therefore invalid for indefiniteness under 35 U.S.C. § 112 ¶ 2. *See Nautilus, Inc. v. Biosig Instruments, Inc.,* 134 S. Ct. 2120 (2012). Although the question of whether a given claim term is indefinite may turn on claim construction positions (including claim



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construction positions advocated by EyesMatch), Defendants allege that at least the following claims of the Asserted Patents are invalid because they include limitations and/or claim terms that fail to satisfy the definiteness requirement of 35 U.S.C. § 112 ¶ 2:

**'109 Patent**

- "…applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror;" Claim 1[c].
- "…resizing the image to reduce variations caused by changes in object's distance to the camera;" Claim 1[d].
- "…wherein the non-ordered steps are performed on a series of images of a live video feed from the camera;" Claim 1[f].
- "…varying rate at which the non-ordered steps are performed on the series of images according to the distance." Claim 1[h].
- "…using data obtained from the registration to generate the transformation mapping." Claim 7[c].

**'110 Patent**

- "operating the processor to apply adaptive transformation mapping to the stream of images captured by the camera to generate modified images that appear to be captured from a different point of view of the camera's actual point of view;" Claim 1[c].
- "wherein the non-ordered steps are performed on a series of images of a live video feed from the camera;" Claim 1[f].
- "wherein during mirror tracking mode the processor utilizes the angle of the images captured by the camera and applies parametric input for a mapping transformation that changes imaging perspective of the images captured by the camera." Claim 1[g].
- "The method of claim 1, wherein the mapping transformation comprises a combination of at least two of the following transformations: vertical flips about a vertical axis," Claim 2.
- "The method of claim 1, wherein the mapping transformation comprises a combination of at least two of the following transformations: vertical flips about a vertical axis," Claim 2.

- "The method of claim 1, wherein the mapping transformation comprises a combination of at least two of the following transformations: vertical flips about a vertical axis," Claim 2.

- "The method of claim 1, wherein during idle mode the camera continuously sends captured images to the processor, and the user presence is identified by the processor detecting a body part in the images." Claim 3.

- "The method of claim 3, wherein the body part comprises one of legs, face, eyes, and hands." Claim 4.

**E. Subject Matter Eligibility Contentions**

The Asserted Claims are directed to abstract ideas and lack an inventive concept, and they are therefore ineligible for patent protection under the subject matter requirements of Section 101 of the Patent Act. In accordance with the Standing Order Regarding Subject Matter Eligibility Contentions issued by this Court on July 25, 2019, Samsung submits separate subject matter eligibility contentions concurrently herewith.

**F. Other Grounds of Invalidity**

Defendants reserve the right to assert that the Asserted Claims are invalid under 35 U.S.C. §102(a), (b), (f) and/or (g) in the event Defendants obtain evidence (i) concerning prior art publications and systems through on-going discovery, including that which is subject to any third-party subpoenas; (ii) concerning any on-sale or public use bars, or any products or devices offered for sale or sold that render one or more of the Asserted Claims obvious; or (iii) that the named inventors of the patents-in-suit, did not invent (either alone or in conjunction with other parties) or first conceive of the subject matter claimed in the patents-in-suit. Should Defendants obtain such evidence of the latter, they will provide the name of the person(s) from whom and the circumstances under which the invention or any part of it was derived, and/or the circumstances surrounding the conception of the invention before the patent application.



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Defendants reserve the right to supplement these disclosures based on further investigation and discovery.

## III. DOCUMENT PRODUCTION ACCOMPANYING INVALIDITY CONTENTIONS—P.R. 3-4

Documents required to be produced under the Docket Control Order (Dkt. No. 27) and Patent Local Rule 3-4 are being produced to EyesMatch under a separate letter or will be made available for inspection. By way of example, Samsung has separately produced documents or produces concurrently with service of these Invalidity Contentions prior art references and materials at least at SAMS.EM.VOL001, and Samsung is investigating source code to make available for inspection. Defendants reserve the right to produce and rely on additional documents relating to their products in view of, for example, additional information revealed during discovery regarding the content of EyesMatch's allegations and/or amendments to EyesMatch's Infringement Contentions.

## IV. OTHER PRIOR ART

In addition to the prior art references that Defendants have specifically discussed in these Invalidity Contentions, Defendants identify each reference produced and cited in the accompanying document production of the same date. All of these references are relevant prior art, and Defendants reserve the right to rely on them based on its continuing research and analysis of the Asserted Claims, accused instrumentalities, and the prior art.

Further, Defendants contend that one or more claims of the patents-in-suit may be invalid due to derivation under 35 U.S.C. § 102(f). It is plain from the specifications and the prosecution histories that the named inventors "stood on the shoulders of others" at best and likely had access to numerous highly pertinent prior art references in connection with their work and related documentation and communications.



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Defendants further reserve the right to supplement these Invalidity Contentions once discovery into the original assignees, named inventors, and other third parties can take place, including as to the full scope of the named inventors.

In addition, until all prior art references available to the named inventors are identified or produced and they are deposed, it is impossible to know all aspects of what the named inventors learned from prior art sources (or from collaborations with others) and what they independently contributed to the claimed subject matter. Defendants will supplement these Invalidity Contentions if and when more information becomes available.

## V. PRIOR ART INDEX

### A. Patents & Published Patent Applications

| Patent or Patent Publication Number | Prior Art Provision | Country of Origin | Filing Date | Issuance or Publication Date |
|---|---|---|---|---|
| Chinese Patent No. 101751209 | 35 U.S.C. §§ 102(a) and (b) | CN | November 28, 2008 | June 23, 2010 |
| Chinese Patent No. 1056259 | 35 U.S.C. §§ 102(a) and (b) | CN | December 3, 1994 | September 6, 2000 |
| Chinese Patent No. 201557200 | 35 U.S.C. §§ 102(a) and (b) | CN | November 6, 2009 | August 18, 2010 |
| Chinese Patent No. 201867819 | 35 U.S.C. §§ 102(a) and (b) | CN | December 14, 2010 | June 15, 2011 |
| European Patent Pub. No. 1178460 | 35 U.S.C. §§ 102(a) and (b) | EP | July 31, 2001 | February 6, 2002 |
| European Patent Pub. No. 2053850 | 35 U.S.C. §§ 102(a) and (b) | EP | October 22, 2008 | April 29, 2009 |
| European Patent Pub. No. 2081144 | 35 U.S.C. §§ 102(a) and (b) | EP | January 9, 2009 | July 22, 2009 |
| German Patent Pub. No. 102006048143 | 35 U.S.C. §§ 102(a) and (b) | DE | October 10, 2006 | April 17, 2008 |
| Great British Patent Pub. No. 2467898 | 35 U.S.C. §§ 102(a) and (b) | GB | December 4, 2008 | August 18, 2010 |



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| Patent or Patent Publication Number | Prior Art Provision | Country of Origin | Filing Date | Issuance or Publication Date |
|---|---|---|---|---|
| Japanese Patent Pub. No. 2004297734 | 35 U.S.C. §§ 102(a) and (b) | JP | March 28, 2003 | October 21, 2004 |
| Japanese Patent Pub. No. 2006072611 | 35 U.S.C. §§ 102(a) and (b) | JP | September 1, 2004 | March 16, 2006 |
| Japanese Patent Pub. No. 2006140747 | 35 U.S.C. §§ 102(a) and (b) | JP | November 11, 2004 | June 1, 2006 |
| Japanese Patent Pub. No. 2006236013 (Miyaoku) | 35 U.S.C. §§ 102(a) and (b) | JP | February 25, 2005 | September 7, 2006 |
| Japanese Patent Pub. No. 2006330011 | 35 U.S.C. §§ 102(a) and (b) | JP | May 23, 2005 | December 7, 2006 |
| Japanese Patent Pub. No. 2007002355 | 35 U.S.C. §§ 102(a) and (b) | JP | June 23, 2005 | January 11, 2007 |
| Japanese Patent Pub. No. 2007166529 (Miyamoto) | 35 U.S.C. §§ 102(a) and (b) | JP | December 16, 2005 | June 28, 2007 |
| Japanese Patent Pub. No. 2008277983 | 35 U.S.C. §§ 102(a) and (b) | JP | April 26, 2007 | November 13, 2008 |
| Japanese Patent Pub. No. 2009204817 | 35 U.S.C. §§ 102(a) and (b) | JP | February 27, 2008 | September 10, 2009 |
| Japanese Patent Pub. No. 2010070889 | 35 U.S.C. §§ 102(a) and (b) | JP | September 22, 2008 | April 2, 2010 |
| Japanese Patent Pub. No. 2010177777 (Hatanaka) | 35 U.S.C. §§ 102(a) and (b) | JP | January 27, 2009 | August 12, 2010 |
| Japanese Patent | 35 U.S.C. §§ | JP | April 14, 2009 | November 4, 2010 |

| Patent or Patent Publication Number | Prior Art Provision | Country of Origin | Filing Date | Issuance or Publication Date |
|---|---|---|---|---|
| Pub. No. 2010250452 (Hamamoto) | 102(a) and (b) | | | |
| Japanese Patent Pub. No. 2010273057 | 35 U.S.C. §§ 102(a) and (b) | JP | May 21, 2009 | December 2, 2010 |
| Japanese Patent Pub. No. 2011029949 | 35 U.S.C. §§ 102(a) and (b) | JP | July 27, 2009 | February 10, 2011 |
| Japanese Patent Pub. No. 2011077710 | 35 U.S.C. §§ 102(a) and (b) | JP | September 29, 2009 | April 14, 2011 |
| Japanese Patent Pub. No. 2011205585 | 35 U.S.C. §§ 102(a) and (b) | JP | March 26, 2010 | October 13, 2011 |
| Japanese Patent Pub. No. 2012060547 | 35 U.S.C. § 102 (a) | JP | September 13, 2010 | March 22, 2012 |
| Korean Patent No. 100870274 | 35 U.S.C. §§ 102(a) and (b) | KR | November 17, 2006 | November 25, 2008 |
| Korean Patent Pub. No. 1019990082285 | 35 U.S.C. §§ 102(a) and (b) | KR | February 7, 1997 | November 25, 1999 |
| Korean Patent Pub. No. 20080102789 | 35 U.S.C. §§ 102(a) and (b) | KR | May 22, 2007 | November 26, 2008 |
| Korean Patent Pub. No. 20100135001 | 35 U.S.C. §§ 102(a) and (b) | KR | June 16, 2009 | December 24, 2010 |
| Korean Patent Pub. No. 20110013810 | 35 U.S.C. §§ 102(a) and (b) | KR | August 3, 2009 | February 10, 2011 |
| U.S. Patent No. 6677980 (Jeon) | 35 U.S.C. §§ 102(a), (b), and (e) | US | November 10, 2000 | January 14, 2004 |
| U.S. Patent No. 6727935 | 35 U.S.C. §§ 102(a), (b), and (e) | US | June 28, 2002 | April 27, 2004 |
| U.S. Patent No. 6806898 | 35 U.S.C. §§ 102(a), (b), | US | March 20, 2000 | October 19, 2004 |

| Patent or Patent Publication Number | Prior Art Provision | Country of Origin | Filing Date | Issuance or Publication Date |
|---|---|---|---|---|
| | and (e) | | | |
| U.S. Patent No. 7062454 | 35 U.S.C. §§ 102(a), (b), and (e) | US | May 6, 1999 | June 13, 2006 |
| U.S. Patent No. 7693584 | 35 U.S.C. §§ 102(a), (b), and (e) | US | October 31, 2007 | April 6, 2010 |
| U.S. Patent No. 7714912 | 35 U.S.C. §§ 102(a), (b), and (e) | US | January 24, 2007 | May 11, 2010 |
| U.S. Patent No. 7839444 | 35 U.S.C. §§ 102(a), (b), and (e) | US | November 9, 2006 | November 23, 2010 |
| U.S. Patent No. 7916129 | 35 U.S.C. §§ 102(a), (b), and (e) | US | August 29, 2006 | March 29, 2011 |
| U.S. Patent No. 7999843 (Ohba) | 35 U.S.C. §§ 102(a), (b), and (e) | US | January 28, 2005 | August 16, 2011 |
| U.S. Patent No. 8937638 | 35 U.S.C. §§ 102(a) and (e) | US | August 10, 2012 | January 20, 2015 |
| U.S. Patent No. 8976224 | 35 U.S.C. § 102 (e) | US | October 10, 2012 | March 10, 2015 |
| U.S. Patent No. 9355585 (Tripathi) | 35 U.S.C. § 102(e) | US | April 3, 2012 | May 31, 2016 |
| U.S. Patent No. 9684953 | 35 U.S.C. § 102 (e) | US | November 13, 2012 | June 20, 2017 |
| U.S. Patent Pub. No. 20030025800 | 35 U.S.C. §§ 102(a), (b), and (e) | US | July 15, 2002 | February 6, 2003 |
| U.S. Patent Pub. No. 20030101105 | 35 U.S.C. §§ 102(a), (b), and (e) | US | November 26, 2002 | May 29, 2003 |
| U.S. Patent Pub. No. 20030234866 | 35 U.S.C. §§ 102(a), (b), and (e) | US | June 21, 2002 | December 25, 2003 |

| Patent or Patent Publication Number | Prior Art Provision | Country of Origin | Filing Date | Issuance or Publication Date |
|---|---|---|---|---|
| U.S. Patent Pub. No. 20050289363 | 35 U.S.C. §§ 102(a), (b), and (e) | US | June 28, 2004 | December 29, 2005 |
| U.S. Patent Pub. No. 20060203101 | 35 U.S.C. §§ 102(a), (b), and (e) | US | March 14, 2005 | September 14, 2006 |
| U.S. Patent Pub. No. 2007/0040033 (Rosenberg) | 35 U.S.C. §§ 102(a), (b), and (e) | US | September 26, 2006 | February 22, 2007 |
| U.S. Patent Pub. No. 20070038944 | 35 U.S.C. §§ 102(a), (b), and (e) | US | May 3, 2006 | February 15, 2007 |
| U.S. Patent Pub. No. 20070126884 | 35 U.S.C. §§ 102(a), (b), and (e) | US | June 6, 2006 | June 7, 2007 |
| U.S. Patent Pub. No. 20070140527 | 35 U.S.C. §§ 102(a), (b), and (e) | US | November 14, 2006 | June 21, 2007 |
| U.S. Patent Pub. No. 20080252596 | 35 U.S.C. §§ 102(a), (b), and (e) | US | April 10, 2008 | October 16, 2008 |
| U.S. Patent Pub. No. 20080297589 (Kurtz) | 35 U.S.C. §§ 102(a), (b), and (e) | US | May 31, 2006 | December 4, 2008 |
| U.S. Patent Pub. No. 20090015658 (Enstad) | 35 U.S.C. §§ 102(a), (b), and (e) | US | July 11, 2008 | January 15, 2009 |
| U.S. Patent Pub. No. 20090051699 | 35 U.S.C. §§ 102(a), (b), and (e) | US | August 25, 2008 | February 26, 2009 |
| U.S. Patent Pub. No. 20090052859 | 35 U.S.C. §§ 102(a), (b), and (e) | US | August 20, 2007 | February 26, 2009 |
| U.S. Patent Pub. No. 20090263021 | 35 U.S.C. §§ 102(a), (b), and (e) | US | June 17, 2009 | October 22, 2009 |

| Patent or Patent Publication Number | Prior Art Provision | Country of Origin | Filing Date | Issuance or Publication Date |
|---|---|---|---|---|
| U.S. Patent Pub. No. 20090315869 | 35 U.S.C. §§ 102(a), (b), and (e) | US | June 17, 2009 | December 24, 2009 |
| U.S. Patent Pub. No. 20090315924 | 35 U.S.C. §§ 102(a), (b), and (e) | US | December 5, 2008 | December 24, 2009 |
| U.S. Patent Pub. No. 20100177159 (Tojo) | 35 U.S.C. §§ 102(a), (b), and (e) | US | January 7, 2010 | July 5, 2010 |
| U.S. Patent Pub. No. 20100225735 | 35 U.S.C. §§ 102(a), (b), and (e) | US | March 9, 2009 | September 9, 2010 |
| U.S. Patent Pub. No. 20100226531 (Goto) | 35 U.S.C. §§ 102(a), (b), and (e) | US | January 15, 2007 | September 9, 2010 |
| U.S. Patent Pub. No. 20100315415 | 35 U.S.C. §§ 102(a), (b), and (e) | US | October 29, 2008 | December 16, 2010 |
| U.S. Patent Pub. No. 20110001793 | 35 U.S.C. §§ 102(a), (b), and (e) | US | July 10, 2009 | January 6, 2011 |
| U.S. Patent Pub. No. 20110102538 (Tan) | 35 U.S.C. §§ 102(a), (b), and (e) | US | October 29, 2009 | May 5, 2011 |
| U.S. Patent Pub. No. 20110107216 | 35 U.S.C. §§ 102(a), (b), and (e) | US | May 24, 2010 | May 5, 2011 |
| U.S. Patent Pub. No. 20110134146 (Lin) | 35 U.S.C. §§ 102(a), (b), and (e) | US | February 15, 2011 | June 9, 2011 |
| U.S. Patent Pub. No. 20110135114 | 35 U.S.C. §§ 102(a), (b), and (e) | US | August 21, 2009 | June 9, 2011 |
| U.S. Patent Pub. No. 20110135114 | 35 U.S.C. §§ 102(a), (b), and (e) | US | August 21, 2009 | June 9, 2011 |

| Patent or Patent Publication Number | Prior Art Provision | Country of Origin | Filing Date | Issuance or Publication Date |
|---|---|---|---|---|
| U.S. Patent Pub. No. 20110254691 (Ooi) | 35 U.S.C. §§ 102(a), (b), and (e) | US | August 25, 2010 | October 20, 2011 |
| U.S. Patent Pub. No. 20110254940 | 35 U.S.C. §§ 102(a), (b), and (e) | US | April 13, 2011 | October 20, 2011 |
| U.S. Patent Pub. No. 20110285669 | 35 U.S.C. §§ 102(a), (b), and (e) | US | June 29, 2010 | November 24, 2011 |
| U.S. Patent Pub. No. 20110298910 (Haan) | 35 U.S.C. §§ 102(a), (b), and (e) | US | February 15, 2011 | December 8, 2011 |
| U.S. Patent Pub. No. 20110298967 | 35 U.S.C. §§ 102(a), (b), and (e) | US | June 4, 2010 | December 8, 2011 |
| U.S. Patent Pub. No. 20120147131 | 35 U.S.C. §§ 102(a) and (e) | US | December 8, 2011 | June 14, 2012 |
| U.S. Patent Pub. No. 20120257000 | 35 U.S.C. §§ 102(a) and (e) | US | April 7, 2011 | October 11, 2012 |
| U.S. Patent Pub. No. 20120287153 | 35 U.S.C. §§ 102(a) and (e) | US | April 26, 2012 | November 15, 2012 |
| U.S. Patent Pub. No. 20120327179 | 35 U.S.C. §§ 102(a) and (e) | US | June 24, 2011 | December 27, 2012 |
| U.S. Patent Pub. No. 20130057573 | 35 U.S.C. §§ 102(a) and (e) | US | November 11, 2011 | March 7, 2013 |
| U.S. Patent Pub. No. 20130070046 (Wolf) | 35 U.S.C. § 102(e) | US | April 26, 2011 | March 21, 2013 |
| U.S. Patent Pub. No. 20130113830 | 35 U.S.C. §§ 102(a) and (e) | US | November 2, 2012 | May 9, 2013 |
| U.S. Patent Pub. No. 20130242187 | 35 U.S.C. §§ 102(a) and (e) | US | July 27, 2011 | September 19, 2013 |
| U.S. Patent Pub. No. 20140063056 | 35 U.S.C. §§ 102(a) and (e) | US | August 29, 2012 | March 6, 2014 |
| U.S. Patent Pub. No. | 35 U.S.C. §§ | US | May 10, 2012 | June 19, 2014 |

| Patent or Patent Publication Number | Prior Art Provision | Country of Origin | Filing Date | Issuance or Publication Date |
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| 20140168277 | 102(a) and (e) | | | |
| U.S. Patent Pub. No. 20140313230 (Suggs) | 35 U.S.C. §§ 102(a) and (e) | US | December 20, 2011 | October 23, 2014 |
| WO Patent Pub. No. 2006108279 (Lizee) | 35 U.S.C. §§ 102(a) and (b) | WO | April 4, 2006 | October 19, 2006 |

**B. Publications**

| Title | Prior Art Provision | Author and Publisher | Date of Publication |
|---|---|---|---|
| *The Personal Presence System - A Wide Area Network Resource for the Real Time Composition of Multipoint Multimedia Communications* | 35 U.S.C. §§ 102(a) and (b) | Boyer and Lukacs; Multimedia Systems | 1994 |
| *3-D Tracking of Shoes for Virtual Mirror Applications* | 35 U.S.C. §§ 102(a) and (b) | Eisert et al.; IEEE | June 23-28, 2008 |
| *Large Scale Video Conferencing: A Digital Amphitheater* | 35 U.S.C. §§ 102(a) and (b) | Gharai et al.; USC Information Sciences Institute | March 1, 2002 |
| *Smart Makeup Mirror: Computer-Augmented Mirror to Aid Makeup Application* (Iwabuchi) | 35 U.S.C. §§ 102(a) and (b) | Iwabuchi et al.; Springer, Berlin, Heidelberg | 2009 |
| *Virtual Mirror By Fusing Multiple RGB-D Cameras* (Shen) | 35 U.S.C. § 102(a) | Shen et al.; IEEE | December 3-6, 2012 |
| *People Objects: 3-D Modeling of Heads in Real-Time* | 35 U.S.C. §§ 102(a) and (b) | Slowe | September 1998 |
| *A Free-Viewpoint Virtual Mirror with Marker-Less User* | 35 U.S.C. §§ 102(a) and (b) | Straka et al.; Springer, Berlin, Heidelberg | 2011 |

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| *Interaction* (Straka I) | | | |
| *SIMULACRUM: Situated Memory for Architectural Space* | 35 U.S.C. §§ 102(a) and (b) | Vora; Massachusetts Institute of Technology | September 29, 2003 |
| *Designing Displays for Human Connectedness* | 35 U.S.C. §§ 102(a) and (b) | Agamanolis; Springer, Dordrecht | 2003 |
| *Reflexion: a responsive virtual mirror* | 35 U.S.C. §§ 102(a) and (b) | Agamanolis and Cullinan | 2002 |
| *Object-Based Media and Stream-Based Computing* | 35 U.S.C. §§ 102(a) and (b) | Bove; Proceedings of the SPIE | January 24-30, 1998 |
| *The Abstraction, Transmission, and Reconstruction of Presence: A Proposed Model for Computer Based Interactive Art* | 35 U.S.C. §§ 102(a) and (b) | Dodge; Massachusetts Institute of Technology | September 1997 |
| *People in Books: Using a FlashCam to Become Part of an Interactive Book for Connected Reading* | 35 U.S.C. § 102(a) | Follmer et al.; Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work | February 11-15, 2012 |
| *Augmented Reality Mirror For Virtual Facial Alterations* | 35 U.S.C. § 102(a) | Kitanovski and Izquierdo; IEEE | 2011 |
| *HyperMirror: Toward Pleasant-to-use Video Mediated Communication System* | 35 U.S.C. §§ 102(a) and (b) | Morikawa and Maesako; Proceedings of the 1998 ACM conference on Computer Supported Cooperative Work | 1998 |
| *Asynchronous reflections: theory and practice in the design of multimedia mirror systems* | 35 U.S.C. §§ 102(a) and (b) | Zhang et al; Multimedia Systems | May 18, 2010 |
| *A Handheld Virtual Mirror* (Francois II) | 35 U.S.C. §§ 102(a) and (b) | Francois et al; ACM SIGGRAPH 2002 Conference Abstracts and Applications | November 2002 |
| *An Architectural Framework for the* | 35 U.S.C. §§ | Francois; The Computer | November 10, 2010 |

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| *Design, Analysis and Implementation of Interactive Systems* (Francois II) | 102(a) and (b) | Journal | |
| *Mirror symmetry ⇒ 2-view stereo geometry* (Francois II) | 35 U.S.C. §§ 102(a) and (b) | Francois et al.; Image and Vision Computing | 2003 |
| *Software Architecture for Computer Vision: Beyond Pipes and Filters* (Francois II) | 35 U.S.C. §§ 102(a) and (b) | Francois; University of Southern California | July 2003 |
| *Software Architecture for Immersipresence* (Francois II) | 35 U.S.C. §§ 102(a) and (b) | Francois et al.; University of Southern California | December 2003 |
| *Magic Mirror System with Hand-held and Wearable Augmentations* | 35 U.S.C. §§ 102(a) and (b) | Fiala; IEEE | 2007 |
| *Wireless, Full-body Interaction with Autonomous Agents* | 35 U.S.C. §§ 102(a) and (b) | Maes et al.; IEEE | November 1995 |
| *An Intelligent Fitting Room Using Multi-Camera Perception* | 35 U.S.C. §§ 102(a) and (b) | Zhang et al.; Proceedings of the 2008 International Conference on Intelligent User Interfaces | January 13-16, 2008 |
| *A Virtual Mirror Interface using Real-time Robust Face Tracking* | 35 U.S.C. §§ 102(a) and (b) | Darrell et al.; IEEE | 1998 |
| *Digital Reflection: Simulating The Mirroring Effect* | 35 U.S.C. §§ 102(a) and (b) | del Valle et al.; IEEE | 2006 |
| *C-Slate: A Multi-Touch and Object Recognition System for Remote Collaboration using Horizontal Surfaces* | 35 U.S.C. §§ 102(a) and (b) | Izadi et al.; IEEE | 2007 |
| *Steerable Augmented Reality with the Beamatron* | 35 U.S.C. § 102(a) | Wilson et al.; Proceedings of the 25th Annual ACM Symposium on User | October 7-10, 2012 |

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| | | Interface Software and Technology | |
| *High-Speed Gaze Controller for Millisecond-Order Pan/Tilt Camera* (Okumura I) | 35 U.S.C. §§ 102(a) and (b) | Okumura et al.; IEEE | May 9-13, 2011 |

### C. Products and Systems

Defendants' investigation and discovery for prior art systems remains ongoing, and Defendants' reserve the right to identify and rely upon additional prior art system references. In particular, Defendants reserve the right to rely on any prior art systems that are described in the patent and publication prior art listed above or that was developed, sold, or manufactured by the original assignees or authors of the patent and publication references above. Defendants are diligently seeking and will continue to diligently seek documents from third parties in discovery to demonstrate such third parties' earlier dates of invention under 35 U.S.C. § 102(g) and/or prior art offers for sale and public uses of products embodying the claimed invention under 35 U.S.C. § 102(b) or under 35 U.S.C. § 102(a).

In addition, Defendants reserve the right to rely on the following systems that are prior art to the Asserted Patents under at least 35 U.S.C. §§ 102(a), (b) and/or (g). Invalidity claim charts for these references are attached as A-00 through A-30 and B-00 through B-29 .

Defendants reserve the right to supplement these Invalidity Contentions with further information and documentation, if and when it becomes available.

The products, components, systems, and methods listed below constitute prior art under 35 U.S.C. § 102 because they were invented, designed, developed, reduced to practice and/or in public use, or on sale, and/or in the public's knowledge prior to the priority date of the Asserted Patents. Furthermore, none of the products, components, systems, and methods listed below were



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abandoned, suppressed, or concealed. To support Defendants' position that following systems are prior art, Defendants reserve the right to rely on the following sources of evidence.

| Prior Art Reference | Sources | Prior Art Provision |
|---|---|---|
| Magic Mirror/ Icon Nicholson | Products, components, systems, and methods invented, designed, developed, reduced to practice, and/or in public use or on sale related to Icon Nicholson's Magic Mirror. Magic Mirror qualifies as prior art under § 102 because it was either (1) known or used by others in the U.S at least by January 22, 2027; (2) in public use or on sale in the United States no later than January 22, 2007 or (3) reduced to practice in the United States no later than January 22, 2007 without being abandoned, suppressed, or concealed. Magic Mirror was likely in public use or on sale in the U.S. and/or reduced to practice in the United States by or before January 22, 2007. To support Magic Mirror's substantive disclosures and status as prior art under § 102, Defendants' reserve the right to rely on the following sources of evidence:<br><br>• *Dressing Rooms of the Future*, Forbes, 22 July 2008, https://www.forbes.com/2008/07/22/style-shopping-retailer-forbeslife-cx_jp_0722style.html?sh=73a0c3a56ced.<br><br>• *The Web, Camera, and Texting in the Fitting Room*, CNN Money, 22 January 2007, https://money.cnn.com/2007/01/22/news/companies/retail_innovation/index.htm?postversion=2007012218.<br><br>Defendants reserve the right to rely on other sources of evidence identified as discovery and Defendants' investigation progresses. At the time of these contentions, Icon Nicholson has not yet produced any discovery, and we reserve the right to supplement the contentions based on review of Icon Nicholson's production, if any. The substantive disclosures of Magic Mirror's, as compared to the limitations of the Asserted Claims is provided in the claim charts attached hereto. | 35 U.S.C. §§ 102(a); (b); (g) |
| Straka II | Products, components, systems, and methods invented, designed, developed, reduced to practice, and/or in public use or on sale related to Straka's Virtual Mirror System ("Straka II"). Straka II qualifies as prior art under § 102 because it was at least known or used by others in the U.S at least by February 28, 2011. To support Straka II's substantive disclosures and status as prior art under § 102, Defendants' reserve the right to rely on the following sources of evidence: | 35 U.S.C. § 102(a) |



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| | • Proceedings of the 17th Scandinavian Conference on Image Analysis, Matthias Straka et al., *A Free-Viewpoint Virtual Mirror with Marker-Less User Interaction* (2011).<br><br>• *A Free-Viewpoint Virtual Mirror with Marker-Less User Interaction*, uploaded by rvlab, 28 February 2011, https://www.youtube.com/watch?v=b1Ryo3bcTDk.<br><br>Defendants reserve the right to rely on other sources of evidence identified as discovery and Defendants' investigation progresses. At the time of these contentions, Straka has not yet produced any discovery, and we reserve the right to supplement the contentions based on review of Straka's production, if any, including asserting that Straka II was in public use or on sale in the United States no later than the priority date of the Asserted Patents or reduced to practice in the United States no later than to the priority date of the Asserted Patents without being abandoned, suppressed, or concealed. The substantive disclosures of Straka II, as compared to the limitations of the Asserted Claims is provided in the claim charts attached hereto. | |
| Okumura II | Products, components, systems, and methods invented, designed, developed, reduced to practice, and/or in public use or on sale related to the Saccade Mirror System ("Okumura II"). Okumura II qualifies as prior art under § 102 because it was at least known or used by others in the U.S at least by 2011. To support Okumura II's substantive disclosures and status as prior art under § 102, Defendants' reserve the right to rely on the following sources of evidence:<br><br>• 2011 IEEE International Conference on Robotics and Automation, Kohei Okumura et al., *High-speed Gaze Controller for Millisecond-order Pan/tilt Camera System* (2011).<br><br>• *1ms Auto Pan-Tilt for Perfect Recentering*, uploaded by Ishikawa Group Laboratory, 6 July 2012, https://www.youtube.com/watch?v=9Q_lcFZOgVo.<br><br>Defendants reserve the right to rely on other sources of evidence identified as discovery and Defendants' investigation progresses. At the time of these contentions, Okumura has not yet produced any discovery, and we reserve the right to supplement the contentions based on review of Okumura's production, if any including asserting that Okumura II was in public use or on sale in the United States no later than the priority date of the Asserted | 35 U.S.C. § 102(a) |

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| | Patents or reduced to practice in the United States no later than to the priority date of the Asserted Patents without being abandoned, suppressed, or concealed. The substantive disclosures of Okumura II, as compared to the limitations of the Asserted Claims is provided in the claim charts attached hereto. | |
| Shiseido Augmented Reality Cosmetic Mirror | Products, components, systems, and methods invented, designed, developed, reduced to practice, and/or in public use or on sale related to Shiseido's Augmented Reality Cosmetic Mirror ("Shiseido"). Based on information and belief, Shiseido qualifies as prior art under § 102 because it was at least known or used by others in the U.S at least by September 9, 2010. To support Shiseido's substantive disclosures and status as prior art under § 102, Defendants' reserve the right to rely on the following sources of evidence:<br><br>• Goto<br><br>• *Shiseido Makeup Mirror Lets You Try on Cosmetics With Augmented Reality*, Trend Hunter, 6 February 2010, https://www.trendhunter.com/trends/shiseido-makeup-mirror.<br><br>• *Try Out Dozens of Looks In Minutes And Wipe Them Off At The Push Of A Button With The Magic Make-Up Mirror*, Daily Mail, 28 March 2011, https://www.dailymail.co.uk/femail/article-1370892/Shiseidos-magic-make-mirror-try-dozens-looks.html.<br><br>• *Shiseido: Augmented Reality Cosmetic Mirror*, uploaded by PSVParis, 6 December 2010, https://www.youtube.com/watch?v=n8Jp1LuQByg.<br><br>Defendants reserve the right to rely on other sources of evidence identified as discovery and Defendants' investigation progresses. At the time of these contentions, Shiseido has not yet produced any discovery, and we reserve the right to supplement the contentions based on review of Shiseido's production, if any including asserting that Shiseido was in public use or on sale in the United States no later than the priority date of the Asserted Patents or reduced to practice in the United States no later than to the priority date of the Asserted Patents without being abandoned, suppressed, or concealed. The substantive disclosures of Shiseido, as compared to the limitations of the Asserted Claims is provided in the claim charts attached hereto. | 35 U.S.C. § 102(a) |

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| Philips Mirror TV | Products, components, systems, and methods invented, designed, developed, reduced to practice, and/or in public use or on sale related to Phillip's Mirror TV. Phillip's Mirror TV qualifies as prior art under § 102 because it was either (1) known or used by others in the U.S at least by October 31, 2007; (2) in public use or on sale in the United States no later than October 31, 2007or (3) reduced to practice in the United States no later than October 31, 2007 without being abandoned, suppressed, or concealed. Phillip's Mirror TV was likely in public use or on sale in the U.S. and/or reduced to practice in the United States by or before October 31, 2007. To support Magic Mirror's substantive disclosures and status as prior art under § 102, Defendants' reserve the right to rely on the following sources of evidence:<br><br>• *Philips MiraVision 23" LCD TV is mirror clear*, Luxrylaunches, 31 October 2007, https://luxurylaunches.com/gadgets/philips_miravision_23_lcd_tv_is_mirror_clear.php.<br><br>• *mirrorTV*, Philips, https://www.philips.co.uk/c-p/BDL3221M_00/32-inch.<br><br>• *Modea mirrorTV*, Philips, https://www.philips.co.uk/c-p/30HM9202_12/modea-30-inch-lcd.<br><br>• *mirrorTV User Guide*, Philips, https://www.p4c.philips.com/files/b/bdl3221m_00/bdl3221m_00_pss_.pdf.<br><br>• *mirrorTV Manual*, Philips, https://www.p4c.philips.com/files/b/bdl3221m_00/bdl3221m_00_dfu_eng.pdf<br><br>Defendants reserve the right to rely on other sources of evidence identified as discovery and Defendants' investigation progresses. At the time of these contentions, Phillip's has not yet produced any discovery, and we reserve the right to supplement the contentions based on review of Phillip's production, if any. | 35 U.S.C. §§ 102(a); (b); (g) |
| Francois III | Products, components, systems, and methods invented, designed, developed, reduced to practice, and/or in public use or on sale related to Human-Computer Interface system ("Francois III"). Francois III qualifies as prior art under § 102 because it was either (1) known or used by others in the U.S at least by 2003; (2) in public use or on sale in the United States no later than 2003 or (3) reduced to practice in the United States no later than 2003 without being abandoned, suppressed, or concealed. | 35 U.S.C. §§ 102(a); (b); (g) |

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| | Francois III was likely in public use or on sale in the U.S. and/or reduced to practice in the United States by or before 2003. To support Francois III substantive disclosures and status as prior art under § 102, Defendants' reserve the right to rely on the following sources of evidence:<br>(i) *A Handheld Mirror Simulation*, Francois et al. (2003);<br>(ii) Integrated Media Systems Center, Alexandre R.J. Francois et al., *A Handheld Virtual Mirror* (2002)<br>Defendants reserve the right to rely on other sources of evidence identified as discovery and Defendants' investigation progresses. At the time of these contentions, Francois has not yet produced any discovery, and we reserve the right to supplement the contentions based on review of Francois' production, if any. | |

Defendants reserves the right to rely on other sources of evidence identified as discovery and Defendants' investigation progresses.



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Dated: February 2, 2024

Respectfully submitted,

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**CERTIFICATE OF SERVICE**

The undersigned hereby certifies that counsel of record who are deemed to have consented to electronic service are being served today, February 2, 2024, with a copy of this document via electronic mail.

*/s/ Jose Villarreal*
Jose Villarreal

# Exhibit A-00: Invalidity of U.S. Patent No. 8,982,109 in view of Prior Art References (the "'109 Patent References")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

This chart identifies disclosures from the following references which disclose, alone or in combination, each of the limitations of U.S. Patent No. 8,982,109 (the "'109 Patent"), at least under Plaintiff's apparent interpretation as showing in Plaintiff's infringement contentions.

- **U.S. Patent Pub. No. 2009/0015658 ("Enstad")** was originally filed July 11, 2008 and published on January 15, 2009, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a), (b) and (e).
- ***A Handheld Mirror Simulation*, Francois et al., ("Francois I")** became public on July 6-9, 2003, at the 2003 International Conference on Multimedia and Expo, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b).
- ***A Handheld Virtual Mirror*, Francois et al.; *A Handheld Mirror Simulation*, Francois et al.; *Mirror symmetry -> 2-view stereo geometry*, Francois et al.; *Software Architecture for Computer Vision: Beyond Pipes and Filters*, Francois; *Software Architecture for Immersipresence*, Francois; *An Architectural Framework for the Design, Analysis and Implementation of Interactive Systems*, Francois (collectively "Francois II")** comprise the technical publications listed below, each of which are available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b):
  - *A Handheld Mirror Simulation*, Francois et al., ("Francois I") (2003);
  - Integrated Media Systems Center, Alexandre R.J. Francois et al., *A Handheld Virtual Mirror* (2002);
  - Image and Vision Computing 21, 137–143, Alexandre R.J. Francois et al., *Mirror symmetry -> 2-view stereo geometry (2003)*;
  - Institute for Robotics and Intelligent Systems, Alexandre R.J. Francois, *Software Architecture for Computer Vision: Beyond Pipes and Filters (2003);*
  - Integrated Media Systems Center, Alexandre R.J. Francois, *Software Architecture for Immersipresence* (2003);
  - The Computer Journal, Vol. 54 No. 7, Alexandre R.J. Francois, *An Architectural Framework for the Design, Analysis and Implementation of Interactive Systems* (2010).
- **U.S. Patent Pub. No. 2011/0298910 ("Haan")** was originally filed February 15, 2010 and was published December 8, 2011, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a), (b) and (e).
- **Japanese Patent Pub. No. JP 2010-177777 A ("Hatanaka")** was originally filed January 27, 2009 and published on August 12, 2010, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b).

- ***Smart Makeup Mirror: Computer-Augmented Mirror to Aid Makeup Application*, Iwabuchi et al. ("Iwabuchi")** was published on July 24, 2009 and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b).
- **U.S. Patent Pub. No. 2008/0297589 ("Kurtz")** was originally filed May 31, 2007 and published on December 4, 2008, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a), (b), and (e).
- **WO Patent Pub. No. 2006/108279 ("Lizee")** was originally filed April 11, 2006 and published October 19, 2006, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b).
- **Japanese Patent Pub. No. JP 2006-236013 A ("Miyaoku")** was originally filed on February 25, 2005 and published on September 7, 2006, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b).
- **U.S. Patent No. 7,999,843 ("Ohba")** was originally filed January 28, 2005 and issued on August 16, 2011, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a), (b), and (e).
- **High-speed Gaze Controller for Millisecond-order Pan/tilt Camera, Okumura et al. ("Okumura I")** was originally published May 9-13, 2011, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b).
- **U.S. Patent Pub. No. 2011/0254691 ("Ooi")** was originally filed August 25, 2010 and published on October 20, 2011, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a), (b) and (e).
- **U.S. Patent Pub. No. 2007/0040033 ("Rosenberg")** was originally filed September 26, 2006 and was published on February 22, 2007, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a), (b) and (e).
- ***Virtual Mirror by Fusing Multiple RGB-D* Cameras, Shen et al. ("Shen")** was originally published at least as of December 3, 2012 in the IEEE *Proceedings of The 2012 Asia Pacific Signal and Information Processing Association Annual Summit and Conference*, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b).
- ***A Free-Viewpoint Virtual Mirror with Marker-Less User Interaction*, Straka et al. ("Straka I")** was originally published in May 2011, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b).
- **U.S. Patent Pub. No. 2014/0313230 ("Suggs")** was originally filed December 20, 2011 and published on October 23, 2014, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. § 102(e).
- **U.S. Patent No. 9,355,585 ("Tripathi")** was originally filed April 3, 2012 and issued on May 31, 2016, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102 (e).
- **The Saccade Mirror System ("Okumura II")** expressly and/or inherently discloses and/or renders obvious the asserted claims of the '109 Patent. On information and belief, Okumura II is described at least in the following documents:
    - 2011 IEEE International Conference on Robotics and Automation, Kohei Okumura et al., *High-speed Gaze Controller for Millisecond-order Pan/tilt Camera System* (2011).
    - 1ms Auto Pan-Tilt for Perfect Recentering, uploaded by Ishikawa Group Laboratory, 6 July 2012, https://www.youtube.com/watch?v=9Q_lcFZOgVo.
- **The Virtual Mirror System ("Straka II")** expressly and/or inherently discloses and/or renders obvious the asserted claims of the '109 Patent. On information and belief, Straka II is described at least in the following documents:

  - Proceedings of the 17th Scandinavian Conference on Image Analysis, Matthias Straka et al., *A Free-Viewpoint Virtual Mirror with Marker-Less User Interaction* (2011).
  - *A Free-Viewpoint Virtual Mirror with Marker-Less User Interaction*, uploaded by rvlab, 28 February 2011, https://www.youtube.com/watch?v=b1Ryo3bcTDk.
- **U.S. Patent Pub. No. 2011/0246329 ("Geisner")** was originally filed April 1, 2010 and issued on October 6, 2011, and thus is available as prior art to '109 Patent under at least 35 U.S.C. §§ 102(a), (b) and (e).
- **JP Patent Pub. No. 2003153263 ("Ikui")** was originally filed November 19, 2001 and published on May 23, 2003, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a) and (b).
- **U.S. Patent No. 9,122,320 ("Rowles")** was originally filed February 16, 2011 and issued on September 1, 2015, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. § 102(e).
- **U.S. Patent Pub. No. 2010/0226531 ("Goto")** was originally filed January 15, 2007 and published on September 9, 2010, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a), (b), and (e).
- **Shiseido Augmented Reality Cosmetic Mirror System Art ("Shiseido")** expressly and/or inherently discloses and/or renders obvious the Asserted Claims of the '109 Patent. On information and belief, Shiseido is described at least in the following documents:
  - Goto, published on September 9, 2010.
  - *Shiseido Makeup Mirror Lets You Try on Cosmetics With Augmented Reality*, Trend Hunter, 6 February 2010, https://www.trendhunter.com/trends/shiseido-makeup-mirror ("Trend Hunter").
  - *Try Out Dozens of Looks In Minutes And Wipe Them Off At The Push Of A Button With The Magic Make-Up Mirror*, Daily Mail, 28 March 2011, https://www.dailymail.co.uk/femail/article-1370892/Shiseidos-magic-make-mirror-try-dozens-looks.html ("Daily Mail").
  - *Shiseido: Augmented Reality Cosmetic Mirror*, uploaded by PSVParis, 6 December 2010, https://www.youtube.com/watch?v=n8Jp1LuQByg ("YouTube").
- **Human-Computer Interface System ("Francois III")** expressly and/or inherently discloses and/or renders obvious the Asserted Claims of the '109 Patent. On information and belief, Francois III is described at least in the following documents:
  - A Handheld Mirror Simulation, Francois et al. (2003);
  - Integrated Media Systems Center, Alexandre R.J. Francois et al., A Handheld Virtual Mirror (2002)
- **Japanese Patent Pub. No. JP2007166529A ("Miyamoto")** was originally filed September 16, 2005 and was published on June 28, 2007, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(b).
- **Japanese Patent Pub. No. JP2010250452A ("Hamamoto")** was originally filed April 14, 2009, and was published on November 4, 2010, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(b).
- **U.S. Patent Pub. No. 2010/0102538 ("Tan")** was originally filed October 29, 2009 and was published on May 5, 2011, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. §§ 102(a), (b) and (e).

- **U.S. Patent Pub. No. 2011/0134146 ("Lin")** was originally filed February 15, 2011 and was published on June 9, 2011, and thus is available as prior art to the '109 Patent under at least 35 U.S.C. § 102(e).

The '109 Patent References anticipate the Asserted Claims of the '109 Patent. To the extent it is found the '109 Patent References do not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that '109 Patent References do not anticipate the Asserted Claims, the '109 Patent References render obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0002], [008-009], [0026], [0029]-[0032], Figs. 1-2<br><br>**Francois I.** *See* Abstract, p. 745, 1.INTRODUCTION, p. 745, Fig. 1<br><br>**Francois II.** *See A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract), *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15<br><br>**Haan.** *See* Abstract, paras. [001], [0006-0011], [0056]-[0058], Fig. 2, Claim 1<br><br>**Hatanaka.** *See* paras. [0001], [0008]-[0013], [0015]-[0020], [0021]-[0024], [0027]<br><br>**Iwabuchi.** *See* "Smart Makeup Mirror" at p. 496<br><br>**Kurtz.** *See* para. [0042], Fig. 1<br><br>**Lizee.** *See* para. [0029], Fig. 1<br><br>**Miyaoku.** *See* Abstract, paras. [0002]-[0008], [0011], [0015], [0022]-[0025], [0028]-[0031], [0073]-[0080], [0081]-[0084]<br><br>**Ohba.** *See* 5:14-29, 5:52-53, 5:60-66, Figs. 1, 2<br><br>**Okumura I.** *See* pp. 6186, 6187, 6189, 6190-6191 |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Ooi.** *See* paras. [0001], [0005]-[0007], [0008], [0039]-[0044], [0047]-[0055], [0066]-[0067]<br><br>**Rosenberg.** *See* paras. [0006]-[0008], [0025]-[0029], [0109]<br><br>**Shen.** *See* p. 4<br><br>**Straka I** *See* Straka I at p. 3<br><br>**Suggs.** *See* paras. [0017]-[0018], [0022]-[0023], [0042]<br><br>**Tripathi.** *See* 1:6-31, 1:35-2:12, 3:35-4:35, 4:36-51, 5:28-41, 6:6-28, 7:45-50, 10:17-24, 11:54-12:24<br><br>**Magic Mirror.** *See* Forbes at 2-3, Forbes at 3, CNN Money at 1, Digital Commerce 360 at 2, CBC at 1-2<br><br>**Okumura II.** *See* pp. 6186, 6187, 6189, 6190, 6190-6191, 6191<br><br>**Straka II.** *See* Straka II at p. 3<br><br>**Geisner.** *See* paras. [0003]-[0004]; [0024]-[0025]; [0026]-[0031]; [0034]-[0040]; [0042]-[0048]; [0054]-[0056]; [0072]-[0073]; [0102]-[0105]; [0109]-[0111]; [0114]; [0121]-[0125]; [0129]-[0132]; Figs. 1, 1B, 2, 5, 7-10<br><br>**Rowles.** *See* Abstract; 1:24-25; 3:61-4:30; 4:15-5:29; 7:4-14; 7:20-45; 7:65-8:43; 8:53-9:3; 9:43-10:12; 10:53-11:6; 11:44-57; 12:56-13:10; 14:6-17; 14:61-15:8; Figs. 1A, 1C, 2A, 3A, 3B, 3C, 4A, 4B, 6A<br><br>**Goto.** *See* paras. [0007]; [0085]; [0088]; [0104]; [0129] |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Shiseido.** *See* Goto, paras. [0007]; [0085]; [0088]; [0104]; [0129]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), Abstract, p. 745; 1.INTRODUCTION, p. 745; Figs. 1, 4. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* para. [0007]<br><br>**Hamamoto.** *See* pp. 1, 3<br><br>**Tan.** *See* paras. [0015]; [0038]<br><br>**Lin.** *See* Abstract; paras. [0021]; [0028]; Fig. 3A<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 1[a]. obtaining a digital image from a camera; | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0002], [0008]-[0009], [0026], [0029]-[0032], Figs. 1-2<br><br>**Francois I.** *See* Abstract, p. 745, 1.INTRODUCTION, p. 745, Fig.1<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, *Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract), *Mirror symmetry -> 2-view stereo geometry* (2003) at 138, *Mirror symmetry -> 2-view stereo geometry* (2003) at 139, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15.<br><br>**Haan.** *See* Claim 1, paras. [0006]-[0011], [0024]-[0027], [0058].<br><br>**Hatanaka.** *See* paras. [0001]-[0003], [0015]-[0020], [0021]-[0024], [0037]-[0038], [0041]-[0045], [0049]-[0051], [0055]-[0057], [0071]-[0075], [0086].<br><br>**Iwabuchi.** *See* Abstract" at p. 495, "Smart Makeup Mirror" at p. 496, "3. Makeup Support Function" at pp. 496-497<br><br>**Kurtz.** *See* Abstract, paras. [0042]-[0043], Fig. 1<br><br>**Lizee.** *See* paras. [0029]-[0030]<br><br>**Miyaoku.** *See* Abstract, paras. [0007]-[0008], [0014]-[0015], [0024], [0027], [0028]-[0031], [0033], [0074]-[0075], [0083]<br><br>**Ohba.** *See* 5:14-29<br><br>**Okumura I.** *See* pp. 6186, 6187, 6189, 6190-6191<br><br>**Ooi.** *See* paras. [0008], [0039]-[0041], [0051]-[0055]<br><br>**Rosenberg.** *See* paras. [0025]-[0029], [0038]-[0039] |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Shen.** *See* pp.3, 4<br><br>**Straka I.** *See* Straka I at p. 2, 3, 4<br><br>**Suggs.** *See* Abstract, paras. [0019], [0023]-[0024], [0043]<br><br>**Tripathi.** *See* 6:10-20, 7:45-50, 10:17-24, 11:44-12:24<br><br>**Magic Mirror.** *See* Forbes at 2-3, CNN Money at 1, Digital Commerce 360 at 2<br><br>**Okumura II.** *See* pp. 6186, 6187, 6189, 6190-6191<br><br>**Straka II.** *See* Sect. 3, Straka II at pp. 2, 3, 4<br><br>**Geisner.** *See* paras. [0004]; [0028]-[0031]; [0042]-[0047]; [0053]-[0057]; [0072]; [0103]; [0114]-[0116]; [0124]-[0127]; [0129]-[0132]; [0139]; Figs. 1, 1B, 2, 7, 9, 10<br><br>**Rowles.** *See* Abstract; 1:24-25; 3:37-46; 3:54-60; 4:1-14; 4:37-46; 4:60-5:18; 5:33-40; 5:61-6:6; 6:33-44; 6:50-63; 7:4-8:13; 8:66-9:3; 9:30-38; 9:51-10:3; 10:60-11:6; 11:44-12:55; 12:56-13:10; 13:11-14:5; 14:61-15:8; 15:43-58; 16:24-57; Figs. 1A, 3A, 3B, 3C, 3D, 3E, 6A, 6B<br><br>**Goto.** *See* paras. [0007]; [0085]; [0088]; [0104]; [0129]<br><br>**Shiseido.** *See* Goto, paras. [0007]; [0085]; [0088]; [0104]; [0129]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), Abstract, p. 745; 1.INTRODUCTION, p. 745; Figs. 1, 4. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2 |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Miyamoto.** *See* paras. [0007]; [0011]; [0030]<br><br>**Hamamoto.** *See* p. 3<br><br>**Tan.** *See* para. [0018]<br><br>**Lin.** *See* para. [0023]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0005]. [0028], [0053]<br><br>**Francois I.** *See* 1.INTRODUCTION, p. 745<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract), *Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138, *Mirror symmetry -> 2-view stereo geometry* (2003) at 139-140, *Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143, *Mirror symmetry -> 2-view stereo geometry* (2003) at 143, *Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a), *Software* |

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| | *Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15<br><br>**Haan.** *See* paras. [0001], [0028], [0072], [0101]<br><br>**Iwabuchi.** *See* "3.3 Left and Right Reversing Mirror" at p. 498<br><br>**Kurtz.** *See* paras. [0046], [0062], [0087], [0160], [0161]<br><br>**Lizee.** *See* para. [0034]<br><br>**Miyaoku.** *See* paras. [0073]-[0074]<br><br>**Ohba.** *See* 5:34-37, 7:25-28<br><br>**Okumura I.** *See* pp. 6187-6188<br><br>**Rosenberg.** *See* paras. [0025]-[0027], [0061], [0077]<br><br>**Shen.** *See* p.4<br><br>**Straka I.** *See* Abstract, pp. 1, 2, 7<br><br>**Suggs**. *See* paras. [0034]-[0037], [0053]<br><br>**Okumura II.** *See* pp. 6187-6188<br><br>**Straka II.** *See* Sect. 3, Straka II at Abstract, pp. 1, 2, 7<br><br>**Geisner.** *See* paras. [0124]-[0127]; Figs. 8, 9 |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Rowles.** *See* 1:29-38; 3:61-4:14; 4:47-59; 11:44-12:55; 14:18-56; Figs. 3B, 4A, 4B, 5A, 5B<br><br>**Goto.** *See* paras. [0103]-[0104]; [0108]-[0109]<br><br>**Shiseido.** *See* Goto, paras. [0103]-[0104]; [0108]-[0109]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), 1.INTRODUCTION, p. 745. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Hamamoto.** *See* p. 3<br><br>**Tan.** *See* paras. [0019]; [0053]<br><br>**Lin.** *See* paras. [0022]; [0023]; Fig. 4<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0030], [0031]<br><br>**Francois I.** *See* 1.INTRODUCTION, p. 745, Figs. 4-6, User view synthesis, pp. 746-47<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, *Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract), *Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138, *Mirror symmetry -> 2-view stereo geometry* (2003) at 139-140, *Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143, *Mirror symmetry -> 2-view stereo geometry* (2003) at 143, *Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a), *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract), *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17., *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15<br><br>**Haan.** *See* paras. [0018]-[0019], [0025]-[0027], [0033], [0056]-[0059], [0060]-[0064], [0071]-[0074], [0075]-[0076], [0095]<br><br>**Hatanaka.** *See* paras. [0020], [0024]-[0028], [0037]-[0039], [0040]-[0047], [0048]-[0051], [0067]-[0069], [0070]-[0077], [0078]-[0079]<br><br>**Iwabuchi.** *See* "Smart Makeup Mirror" at p. 496, "3 Makeup Support Function" at p. 496-97, "3.1 Automatic Zoom and Pan" at p. 497, "3.2 Intuitive Magnification Rate Control" at pp. 497-498, "3.3 Left and Right Reversing Mirror" at p. 498, "3.4 Profile Check" at p. 498, "3.5 Lighting Mode" at p. 498, "4.1 Test by the Author" at p. 500<br><br>**Kurtz.** *See* paras. [0046], [0062], [0066], [0087], [0160], [0161]<br><br>**Lizee.** *See* paras. [0048], [0057], [0061]-[0063] |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Miyaoku.** *See* paras. [0014]-[0016], [0021]-[0025], [0034]-[0037], [0073]-[0074], claim 1<br><br>**Ohba.** *See* 5:34-46, 7:25-34<br><br>**Okumura I.** *See* pp. 6187-6188<br><br>**Ooi.** *See* paras. [0062]-[0063]<br><br>**Rosenberg.** *See* paras. [0006]-[0008], [0025]-[0029], [0035], [0074]<br><br>**Shen.** *See* p.4, Fig. 2<br><br>**Straka I.** *See* Straka I at p. 7<br><br>**Suggs.** *See* paras. [0034]-[0037], [0053]<br><br>**Tripathi.** *See* 3:53-61, 6:6-28, 9:62-67, 9:62-67, 10:40-50, 10:17-24, 11:54-12:24<br><br>**Magic Mirror.** *See* CNN Money at 1<br><br>**Okumura II.** *See* pp. 6187-6188<br><br>**Straka II.** *See* Straka II at p. 7<br><br>**Geisner.** *See* paras. [0039]; [0047]-[0049]; [0051]-[0054]; [0062]; [0103]; [0111]; [0124]-[0127]; [0129]-[0132]; [0133]-[0134]; [0153]-[0154]; Figs. 2, 9, 10<br><br>**Rowles.** *See* Abstract; 3:37-4:30; 4:31-5:29; 5:31-7:3; 7:20-45; 7:46-64; 7:65-8:43; 8:53-9:17; 10:4-12; 10:21-52; 10:53-11:6; 11:44-12:55; 13:43-58; 14:6-17; 14:18-56; 16:12-23; 16:24-38; 17:20-33; Figs. 1A, 1B, 2D, 3A, 3B, 4A, 4B, 5A, 5B |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Goto.** *See* paras. [0103]-[0104]; [0108]-[0109]<br><br>**Shiseido.** *See* Goto, paras. [0103]-[0104]; [0108]-[0109]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), 1.INTRODUCTION, p. 745; 2.3 User view synthesis, pp. 746-47; Figs. 4, 6. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* paras. [0011]; [0025]; [0026]; [0030]; [0031]; [0035]; [0036]<br><br>**Hamamoto.** *See* pp. 3, 5<br><br>**Tan.** *See* paras. [0027]; [0029]; [0031]<br><br>**Lin.** *See* Abstract; paras. [0022]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0027]-[0028], [0031], [0043]-[0047]<br><br>**Francois I.** *See* RELATED WORK AND APPLICATIONS, p. 748, 1.INTRODUCTION, p. 745, Figs. 4-6, User view synthesis, pp. 746-47.<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15<br><br>**Haan.** *See* paras. [0012], [0022]-[0023], [0058], [0072]-[0073], [0074]-[0076]<br><br>**Hatanaka.** *See* paras. [0027], [0038]-[0039]<br><br>**Iwabuchi.** *See* "3 Makeup Support Function" at p. 497, "3.1 Automatic Zoom and Pan" at p. 497, "3.2 Intuitive Magnification Rate Control" at pp. 497-498<br><br>**Kurtz.** *See* paras. [0072], [0075]<br><br>**Lizee.** *See* paras. [0040]-[0041], [0043], [0056], Figs. 2A-C<br><br>**Miyaoku.** *See* paras. [0020], [0033]-[0034], [0035]-[0036], [0052]-[0062], [0063]-[0066], [0067]-[0072], [0073]-[0080]<br><br>**Ohba.** *See* 5:43-51, 8:34-43, 9:43-54, Claims 8-10<br><br>**Rosenberg.** *See* paras. [0050]-[0052], [0077]<br><br>**Shen.** *See* pp.1, 2, 3, 4, Fig. 2<br><br>**Straka I.** *See* Straka I at p.3, Fig. 1(b) |

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| | **Suggs.** *See* paras. [0015], [0029], [0032], [0057]<br><br>**Tripathi.** *See* 3:53-61, 9:62-67, 10:40-50<br><br>**Straka II.** *See* Straka II at p. 3, Fig. 1(b)<br><br>**Geisner.** *See* paras. [0062]; [0161]; [0121]-[0125]; Figs. 8, 12, 13<br><br>**Rowles.** *See* 3:47-60; 5:2-6; 6:7-15; 6:33-63; 7:20-31; 8:14-8:43; 9:4-9:17; Figs. 1A, 1B, 3B<br><br>**Goto.** *See* paras. [0103]-[0104]; [0108]-[0109]<br><br>**Shiseido.** *See* Goto, paras. [0103]-[0104]; [0108]-[0109]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), 4.RELATED WORK AND APPLICATIONS, p. 748; 1.INTRODUCTION, p. 745; 2.3 User view synthesis, pages 746-47; Figs. 4, 6. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* paras. [0026]; [0035]; [0036]<br><br>**Hamamoto.** *See* p. 5<br><br>**Tan.** *See* paras. [0027]; [0029]<br><br>**Lin.** *See* Abstract; paras. [0030]; [0034]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, |

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| | and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* para. [0057], Fig. 1, Fig. 12<br><br>**Francois I.** *See* Abstract, p. 745, 1.INTRODUCTION, p. 745, Fig. 1, Fig. 6, 3.SYSTEM INTEGRATION, p. 747,<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17., *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15<br><br>**Haan.** *See* paras. [0006]-[0011], [0056]-[0058], [0072], [0076], Fig. 2, Claim 1<br><br>**Hatanaka.** *See* paras. [0020], [0024]-[0028], [0037]-[0039], [0040]-[0047], [0048]-[0051], [0067]-[0069], [0070]-[0077], [0078]-[0079]<br><br>**Iwabuchi.** *See* Abstract" at p. 495, "Smart Makeup Mirror" at p. 496, "3 Makeup Support Function" at pp. 496-497, "3.6 Makeup Log" at 498, "3.6 Makeup Log" at 499 |

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| | **Kurtz.** *See* paras. [0019], [0139], [0143]-[0144]<br><br>**Lizee.** *See* para. [0034]<br><br>**Miyaoku.** *See* Abstract, paras. [0002]-[0008], [0011], [0015], [0022]-[0025], [0028]-[0031], [0073]-[0080], [0081]-[0084]<br><br>**Ohba.** *See* 8:34-43<br><br>**Okumura I.** *See* p. 6190-6191<br><br>**Ooi.** *See* paras. [0001], [0005]-[0007], [0008], [0039]-[0044], [0047]-[0055], [0066]-[0067]<br><br>**Rosenberg.** *See* paras. [0038], [0048], [0062]-[0063], [0074], [0077]<br><br>**Shen.** *See* p.4, Fig. 2<br><br>**Straka I.** *See* Straka I at pp. 3-4, 5-6, Figs. 5(a)-(c)<br><br>**Suggs.** *See* paras. [0019], [0021], [0034], [0035]-[0037], [0057]<br><br>**Tripathi.** *See* 3:53-61, 6:6-28, 9:62-67, 10:40-50, 10:17-24, 11:54-12:24<br><br>**Magic Mirror.** *See* Forbes at 3, CNN Money at 1, CBC at 1-2<br><br>**Okumura II.** *See* pp. 6190, 6190-6191, 6191<br><br>**Straka II.** *See* Straka II at pp. 3-4, 5-6, Figs. 5(a)-(c)<br><br>**Geisner.** *See* paras. [0024]; [0061]-[0063]; [0072]-[0075]; [0079]-[0081]; [0121]-[0125]; [0129]-[0132]; Figs. 8, 9, 12, 13 |

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| | **Ikui.** *See* paras. [0005]-[0006]; [0016], [0020]; [0038]; [0043]; [0045]<br><br>**Rowles.** *See* Abstract; 3:37-4:30; 4:31-5:29; 5:31-7:3; 7:20-45; 7:46-64; 7:65-8:43; 8:53-9:17; 10:4-12; 10:21-52; 10:53-11:6; 11:44-12:55; 13:43-58; 14:6-17; 14:18-56; 17:20-33; Figs. 1A, 1B, 2D, 3A, 3B, 4A, 4B<br><br>**Goto.** *See* paras. [0007]; [0085]; [0088]; [0104]; [0129]<br><br>**Shiseido.** *See* Goto, paras. [0007]; [0085]; [0088]; [0104]; [0129]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), Abstract, p. 745; 1.INTRODUCTION, p. 745; 3.SYSTEM INTEGRATION, page 747; Figs. 1, 4, 6. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** [0026]; [0035]-[0038]<br><br>**Hamamoto.** *See* pp. 12, 21<br><br>**Tan.** *See* paras. [0037]; [0038]; [0042]<br><br>**Lin.** *See* Abstract; paras. [0022]; [0029]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |

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| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0033], [0035-0036], claim 1, claim 4, Fig. 2<br><br>**Francois I.** *See* Abstract, p. 745, 1.INTRODUCTION, p. 745, 2.2Pinhole camera geometry, p. 746, 3.SYSTEM INTEGRATION, p. 747, Fig. 1<br><br>**Francois II U.S.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15<br><br>**Haan.** *See* paras. [0099]-[0106], [0058], [0076], 0084]-[0085], [0097]-[0099], [0118]<br><br>**Hatanaka.** *See* paras. [0001]-[0003], [0018]-[0026], [0037]-[0038], [0041]-[0045], [0049]-[0051], [0071]-[0075], [0086]<br><br>**Iwabuchi.** *See* "Smart Makeup Mirror" at p. 496, "3 Makeup Support Function" at p. 496, "3.1 Automatic Zoom and Pan" at p. 497, "3.4 Profile Check" at p. 498<br><br>**Kurtz.** *See* para. [0061]<br><br>**Lizee.** *See* paras. [0030], [0045] |

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| | **Miyaoku.** *See* [0028]-[0031], [0033]-[0034], [0035]-[0036], [0073]-[0075]<br><br>**Ohba.** *See* 5:14-29, 5:34-46<br><br>**Okumura I.** *See* p. 6190-6191<br><br>**Ooi.** *See* para. [0008], [0039]-[0041], [0051]-[0055]<br><br>**Rosenberg.** *See* para. [0077]<br><br>**Shen.** *See* pp.2, 4, 6<br><br>**Straka I.** *See* Straka I at Abstract, pp.2, 9<br><br>**Suggs.** *See* paras. [0035]-[0036], [0053]<br><br>**Tripathi.** *See* 6:6-28, 7:45-50, 10:17-24, 11:54-12:24<br><br>**Magic Mirror.** *See* Digital Commerce 260 at 2<br><br>**Okumura II.** *See* pp. 6190, 6190-6191, 6191<br><br>**Straka II.** *See* Straka II at Abstract, pp. 2, 9<br><br>**Geisner.** *See* paras. [0034]; [0043]-[0045]; [0081]; [0116]; [0131]; [0134]; Figs. 1, 1B, 3, 4, 9.<br><br>**Goto.** *See* paras. [0125]; [0123]-[0124]<br><br>**Shiseido.** *See* Goto, paras. [0125]; [0123]-[0124]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), Abstract, p. 745; 1.INTRODUCTION, p. 745; Figs. 1, 4. *A Handheld Virtual Mirror* (2002), at the |

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| | introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* para. [0030]<br><br>**Hamamoto.** *See* p. 21<br><br>**Tan.** *See* paras. [0030]; [0031]<br><br>**Lin.** *See* paras. [0022]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad** *See* paras. [0031], [0027]-[0028], [0043]-[0047]<br><br>**Francois I.** *See* 1.INTRODUCTION, p. 745, Figs. 4-6, 2.3 User view synthesis, pp. 746-47<br><br>**Francois II** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, *Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract), *Mirror symmetry -> 2-* |

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| | *view stereo geometry* (2003) at 137-138, *Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143, *Mirror symmetry -> 2-view stereo geometry* (2003) at 143, *Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a), Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13<br><br>**Haan** *See* paras. [0014], [0058], [0072], [0073], [0074]-[0076], [0095]-[0097], [0099]-[0106]<br><br>**Hatanaka** *See* paras. [0004], [0006]-[0007], [0013], [0018-0019], [0028]-[0029], [0030]-[0039], [0041]-[0045], [0049]-[0051], [0053], [0057]-[0062], [0064], [0067]-[0069], [0073]-[0074], [0078]-[0079]<br><br>**Iwabuchi** *See* "3.1 Automatic Zoom and Pan" at p. 497, "3.2 Intuitive Magnification Rate Control" at pp. 497-498<br><br>**Kurtz** *See* paras. [0065], [0066]<br><br>**Lizee** *See* paras. [0043], [0046], [0047]<br><br>**Miyaoku** *See* Abstract, paras. [0010], [0016]-[0018], [0034]-[0037], [0045]-[0049], [0054]<br><br>**Ohba** *See* 2:26-38, 2:64-3:6, 8:22-26, 9:4-8<br><br>**Okumura I** *See* p. 6187-6188<br><br>**Ooi** *See* paras. [0052], [0059]-[0060]<br><br>**Rosenberg** *See* para. [0056], [0062]<br><br>**Shen** *See* pp.1, 3, 4 |

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| | **Straka I** *See* Straka I at pp.3, 7, Fig. 1(b)<br><br>**Suggs** *See* paras. [0015], [0024], [0029], [0032]<br><br>**Magic Mirror** *See* Sydney Morning Herald<br><br>**Okumura II** *See* pp. 6187, 6187-6188<br><br>**Straka II** *See* Straka II at pp. 3, 7, Fig. 1(b)<br><br>**Geisner.** *See* paras. [0035]-[0038]; [0115]<br><br>**Ikui.** *See* para. [0014]<br><br>**Rowles.** *See* 5:2-6; 6:7-24; 6:33-63; 7:20-31; 8:14-8:43; 9:4-9:17; Fig. 1A, 3B<br><br>**Goto.** *See* paras. [0156]-[0157]<br><br>**Shiseido.** *See* Goto, paras. [0156]-[0157]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), 1.INTRODUCTION, p. 745; 2.3 User view synthesis, pages 746-47; Figs. 4, 6; . *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* paras. [0024]; [0026]; [0035]-[0037]<br><br>**Hamamoto.** *See* pp. 5, 6, 21<br><br>**Tan.** *See* paras. [0030]; [0031] |

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| | **Lin.** *See* Abstract; paras. [0022]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0031], [0034], [0045]-[0047]<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract), *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 3, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 5-6, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 10-11, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 21-22, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 19, *Software Architecture for Immersipresence* (2003) at 1 (Abstract), *Software Architecture for Immersipresence* (2003) at 8, *Software Architecture for Immersipresence* (2003) at 9, *Software Architecture for Immersipresence* (2003) at 10,<br><br>**Haan.** *See* paras. [0080]-[0081], [0082], [0097]<br><br>**Hatanaka.** *See* paras. [0039] |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Iwabuchi.** *See* "3.1 Automatic Zoom and Pan" at p. 497, "3.2 Intuitive Magnification Rate Control" at pp. 497-498<br><br>**Lizee.** *See* paras. [0032], [0036]-[0037], [0084]<br><br>**Miyaoku.** *See* paras. [0029], [0051]-[0056], [0060]-[0066], [0067]-[0072]<br><br>**Okumura I.** *See* p. 6186-6187<br><br>**Ooi.** *See* paras. [0005]-[0007], [0041]-[0042], [0060]-[0069], [0071]-[0077], [0079]<br><br>**Shen.** *See* p. 2<br><br>**Tripathi.** *See* 1:6-31, 1:35-2:12, 3:35-4:35, 5:1-16, 5:37-6:20, 6:21-42, 6:43-7:35, 7:36-63, 9:12-67, 10:1-24, 10:25-39, 10:40-60, 10:61-11:24, 11:25-44, 11:45-53, 11:54-12:10, 12:11-35, 12:36-53, 12:54-67<br><br>**Okumura II.** *See* pp. 6186, 6186-6187, 6187<br><br>**Geisner.** *See* paras. [0080]-[0081]; [0134]<br><br>**Ikui.** *See* paras. [0005]-[0006]; [0001]; [0026]; [0038]; [0043]-[0047]<br><br>**Rowles.** *See* 15:9-19; 8:27-32<br><br>**Goto.** *See* paras. [0156]-[0157]<br><br>**Shiseido.** *See* Goto, paras. [0156]-[0157]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), Section 2.2.System integration |

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| | **Miyamoto.** *See* paras. [0021]; [0026]; [0035]; [0036]<br><br>**Hamamoto.** *See* pp. 5, 6, 21<br><br>**Tan.** *See* paras. [0030]; [0031]<br><br>**Lin.** *See* paras. [0022]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |

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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0030]-[0033], [0038], [0041]<br><br>**Francois I.** *See* 2.GEOMETRIC ANALYSIS, pp. 745-46, Abstract, p. 745, 1.INTRODUCTION, p. 745, 5.CONCLUSION, p. 748, Fig. 1<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et |

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| | al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 2, *Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract), *Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138, *Mirror symmetry -> 2-view stereo geometry* (2003) at 139-140, *Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143, *Mirror symmetry -> 2-view stereo geometry* (2003) at 143, *Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a), *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract), *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15<br><br>**Haan.** *See* paras. [0028], [0058]<br><br>**Hatanaka.** *See* paras. [0020], [0024]-[0028], [0037]-[0039], [0040]-[0047], [0048]-[0051], [0067]-[0069], [0070]-[0077], [0078]-[0079]<br><br>**Iwabuchi.** *See* "3 Makeup Support Function" at p. 496-97, "3.4 Profile Check" at p. 498, "5 Adjusting Position of Display" at pp. 501-502<br><br>**Kurtz.** *See* para. [0144]<br><br>**Miyaoku.** *See* paras. [0014]-[0015], [0027], [0028]-[0031], [0033], [0073]-[0074]<br><br>**Okumura I.** *See* p. 6187, 6189<br><br>**Ooi.** *See* para. [0052]-[0060], [0062]-[0063]<br><br>**Rosenberg.** *See* paras. [0027]-[0028], [0037], [0042]-[0043], [0061], [0075]<br><br>**Shen.** *See* p. 4, Fig. 2 |

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| | **Straka I.** *See* Straka I at pp.1, 2, 3, Fig. 5(a)<br><br>**Suggs.** *See* paras. [0043]-[0045], [0048]-[0049], Fig. 3(c)<br><br>**Magic Mirror.** *See* CNN Money at 1<br><br>**Okumura II.** *See* pp. 6187, 6189<br><br>**Straka II.** *See* Straka II at pp. 1, 2, 3, Fig. 5(a)<br><br>**Geisner.** *See* paras. [0124]-[0127]; [0129]-[0132]; Figs. 8, 9, 10<br><br>**Rowles.** *See* Abstract; 3:61-4:30; 4:47-59; 5:41-52; 5:61-6:15; 6:33-63; 7:20-31; 7:65-8:43; 8:53-9:17; 10:4-12; 10:21-52; 10:53-11:6; 11:44-12:55; 14:6-17; 14:18-56; 17:20-33; Figs. 1A, 2D, 3A, 3B, 4A, 4B<br><br>**Goto.** *See* paras. [0103]-[0104]; [0108]-[0109]<br><br>**Shiseido.** *See* Goto, paras. [0103]-[0104]; [0108]-[0109]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), 2.GEOMETRIC ANALYSIS, pp. 745-46; Abstract, p. 745; 1.INTRODUCTION, p. 745; 5.CONCLUSION, p. 748; Fig. 1. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* paras. [0011]; [0026]; [0035]; [0036]<br><br>**Hamamoto.** *See* pp. 5, 6, 21<br><br>**Tan.** *See* paras. [0027]; [0029]; [0031] |

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| | **Lin.** *See* Abstract; paras. [0022]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |

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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Francois I.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Francois II.** *See* Claim Limitations 1[pre]-[1[h<br><br>**Haan.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Hatanaka.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Iwabuchi.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Kurtz.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Lizee.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Miyaoku.** *See* Claim Limitations 1[pre]-[1[h] |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Ohba.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Okumura I.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Ooi.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Rosenberg.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Shen.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Straka I.** *See* Claims 1[pre]-1[h]<br><br>**Suggs.** *See* paras. Claim Limitations 1[pre]-1[h]<br><br>**Tripathi.** *See* Claim Limitations 1[pre]-[h]<br><br>**Magic Mirror.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Okumura II.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Straka II.** *See* Claims 1[pre]-1[h]<br><br>**Geisner.** *See* Claims 1[pre]-1[h]<br><br>**Ikui.** *See* Claims 1[pre]-1[h]<br><br>**Rowles.** *See* Claims 1[pre]-1[h]<br><br>**Goto.** *See* Claims 1[pre]-1[h]<br><br>**Shiseido.** *See* Claims 1[pre]-1[h]<br><br>**Francois III.** *See* Claims 1[pre]-1[h] |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Miyamoto.** *See* Claims 1[pre]-1[h]<br><br>**Hamamoto.** *See* Claims 1[pre]-1[h]<br><br>**Tan.** *See* Claims 1[pre]-1[h]<br><br>**Lin.** *See* Claims 1[pre]-1[h]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 7[a]. obtaining a reference image; | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad** *See* paras. [0009], [0030]-[0031]<br><br>**Francois I.** *See* Abstract, p. 745, 1.INTRODUCTION, p. 745, Fig. 1<br><br>**Francois II U.S.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, *Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract), *Mirror symmetry -> 2-view stereo geometry* (2003) at 138, *Mirror symmetry -> 2-view stereo geometry* (2003) at 139 |

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| | **Haan** *See* paras. [0027], [0057]-[0058], [0059]<br><br>**Hatanaka** *See* paras. [0001]-[0003], [0015]-[0020], [0021]-[0024], [0037]-[0038], [0041]-[0045], [0049]-[0051], [0055]-[0057], [0071]-[0075], [0086]<br><br>**Iwabuchi** *See* "2 Smart Makeup Mirror" at p. 496, "3.5 Lighting Mode" at p. 498, "4.1 Test by the Author" at p. 500, "3.6 Makeup Log" at 498, "3.6 Makeup Log" at 499<br><br>**Kurtz** *See* paras. [0085], [0108], [0122], [0123], [0125]<br><br>**Lizee** *See* para. [0081], claim 19<br><br>**Miyaoku** *See* Abstract, paras. [0007]-[0008], [0014]-[0015], [0024], [0027], [0028]-[0031], [0033], [0074]-[0075], [0083]<br><br>**Ohba** *See* 6:62-7:17, 7:57-64, 9:55-67<br><br>**Okumura I** *See* pp. 6187-6188<br><br>**Ooi** *See* paras. [008], [0039]-[0041], [0051]-[0055]<br><br>**Rosenberg** *See* paras. [0035], [0039], [0044]-[0046], [0050]-[0052], [0053]-[0055]<br><br>**Shen** *See* p. 4, Fig. 2<br><br>**Straka I** *See* Straka I at p. 4<br><br>**Tripathi** *See* 6:10-20, 7:45-50, 10:17-24, 11:44-12:24<br><br>**Magic Mirror** *See* Forbes at 2-3, CNN Money at 1, Digital Commerce 360 at 2<br><br>**Okumura II** *See* pp. 6187-6188 |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Straka II** *See* Straka II at p. 4<br><br>**Geisner.** *See* paras. [0042]-[0043]; [0045]; [0049]-[0050]; [0056]-[0057]; [0103]; [0121]-[0125]; [0129]-[0132]; Figs. 8, 9, 12, 13<br><br>**Rowles.** *See* Abstract; 1:24-25; 3:37-46; 3:54-60; 4:1-14; 4:37-46; 4:60-5:18; 5:33-40; 5:61-6:6; 6:33-44; 6:50-63; 7:4-8:13; 8:66-9:3; 9:30-38; 9:51-10:3; 10:60-11:6; 11:44-12:55; 12:56-13:10; 13:11-14:5; 14:61-15:8; 15:43-58; 16:24-57; Figs. 1A, 3A, 3B, 3C, 3D, 3E, 6A, 6B<br><br>**Goto.** *See* paras. [0162]-[0163]<br><br>**Shiseido.** *See* Goto, paras. [0162]-[0163]; Daily Mail, pp. 2, 3; YouTube at 0:015<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), Abstract, p. 745; 1.INTRODUCTION, p. 745; Figs. 1, 4. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* paras. [0015]; [0030]<br><br>**Hamamoto.** *See* p. 3<br><br>**Tan.** *See* para. [0018]<br><br>**Lin.** *See* paras. [0023]; [0029]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| 7[b]. performing registration of the digital image with the reference image; | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad** *See* paras. [0038]-[0039], [0009]<br><br>**Francois I.** *See* User view synthesis, p. 747<br><br>**Francois II U.S.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, *Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract), *Mirror symmetry -> 2-view stereo geometry* (2003) at 138, *Mirror symmetry -> 2-view stereo geometry* (2003) at 139, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15.<br><br>**Haan** *See* paras. [0027], [0058]-[0063], [0065]-[0066], [0069], [0072]-[0074], [0118]<br><br>**Hatanaka** *See* paras. [0020], [0024]-[0028], [0037]-[0039], [0040]-[0047], [0048]-[0051], [0067]-[0069], [0070]-[0077], [0078]-[0079]<br><br>**Iwabuchi** *See* "2 Smart Makeup Mirror" at p. 496, "3.5 Lighting Mode" at p. 498, "4.1 Test by the Author" at p. 500, "3.6 Makeup Log" at 498, "3.6 Makeup Log" at 499<br><br>**Kurtz** *See* paras. [0085], [0108], [0122], [0123], [0125]<br><br>**Lizee** *See* para. [0081], claim 19 |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Miyaoku** *See* paras. [0028]-[0031], [0059]-[0061], [0068]-[0069]<br><br>**Ohba** *See* 6:62-7:17, 7:57-64, 9:55-67<br><br>**Okumura I** *See* pp. 6187-6188<br><br>**Ooi** *See* paras. [0052]-[0060]<br><br>**Rosenberg** *See* paras. [0039], [0050]-[0052], [0074]<br><br>**Shen** *See* p. 4, Fig. 2<br><br>**Straka I** *See* Straka I at pp. 4-5, 5-6<br><br>**Tripathi** *See* 4:16-5:15, 5:28-6:3, 6:6-28, 7:51-67, 8:44-9:11, 10:40-60<br><br>**Okumura II** *See* pp. 6187-6188<br><br>**Straka II** *See* Straka II at pp. 4-5, 5-6<br><br>**Geisner.** *See* paras. [0042]-[0043]; [0045]; [0049]-[0050]; [0056]-[0057]; [0103]; [0121]-[0125]; [0129]-[0132]; Figs. 8, 9, 12, 13<br><br>**Rowles.** *See* 5:7-23; 7:32-45; 10:4-12; 14:18-56; 15:19-42; 16:24-17:33; Figs. 5A, 5B, 3A<br><br>**Goto.** *See* paras. [0162]-[0163]<br><br>**Shiseido.** *See* Goto, paras. [0162]-[0163]<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), 2.3 User view synthesis, page 747. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* para. [0015]<br><br>**Hamamoto.** *See* pp. 3, 15<br><br>**Tan.** *See* para. [0018]<br><br>**Lin.** *See* para. [0029];<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0039], [0009]<br><br>**Francois I.** *See* User view synthesis, p. 747<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, *Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract), *Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138, *Mirror symmetry -> 2-view stereo geometry* |

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| | (2003) at 139-140, *Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143, *Mirror symmetry -> 2-view stereo geometry* (2003) at 143, *Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a), Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15<br><br>**Haan.** *See* paras. [0072], [0058]-[0063], [0065]-[0066], [0069], [0072]-[0074], [0118]<br><br>**Hatanaka.** *See* paras. [0020], [0024]-[0028], [0037]-[0039], [0040]-[0047], [0048]-[0051], [0067]-[0069], [0070]-[0077], [0078]-[0079]<br><br>**Iwabuchi.** *See* "3.5 Lighting Mode" at p. 498, "4.1 Test by the Author" at p. 500, "3.6 Makeup Log" at 498, "3.6 Makeup Log" at 499<br><br>**Kurtz.** *See* paras. [0085], [104], [108], [0122], [0123], [0125], Table 3<br><br>**Lizee.** *See* para. [0081], claim 19<br><br>**Miyaoku.** *See* paras. [0028]-[0031], [0059]-[0061], [0068]-[0069]<br><br>**Ohba.** *See* 6:62-7:17, 7:57-64, 9:55-67<br><br>**Okumura I.** *See* pp. 6187-6188<br><br>**Ooi.** *See* paras. [0062]-[0063]<br><br>**Rosenberg.** *See* paras. [0039], [0050]-[0052], [0077], [0086], [0087]-[0088]<br><br>**Shen.** *See* p. 4, Fig. 2 |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Straka I.** *See* Straka I at pp. 4-5, 5-6<br><br>**Tripathi.** *See* 3:53-61, 6:6-28, 9:62-67, 10:40-50, 10:17-24, 11:54-12:24<br><br>**Okumura II.** *See* pp. 6187-6188<br><br>**Straka II.** *See* Straka II at pp. 4-5, 5-6<br><br>**Geisner.** *See* paras. [0047]-[0049]; [0051]-[0054]; [0062]; [0066]-[0068]; [0103]; [0111]; [0124]-[0127]; [0129]-[0132]; [0133]-[0134]; [0153]-[0154]; Figs. 2, 9, 10, 12, 13<br><br>**Rowles.** *See* Abstract; 3:37-4:30; 4:31-5:29; 5:31-7:3; 7:20-45; 7:46-64; 7:65-8:43; 8:53-9:17; 10:4-12; 10:21-52; 10:53-11:6; 11:44-12:55; 13:43-58; 14:6-17; 14:18-56; 16:12-23; 16:24-38; 17:20-33; Figs. 1A, 1B, 2D, 3A, 3B, 4A, 4B, 5A, 5B<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), 2.3 User view synthesis, p. 747. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* paras. [0015]; [0026]; [0035]; [0036]<br><br>**Hamamoto.** *See* pp. 3, 5<br><br>**Tan.** *See* paras. [0027]; [0029]; [0031]<br><br>**Lin.** *See* Abstract; paras. [0022]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, |

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| | and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| **Claim 8** | |
| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0051]-[0052], Fig. 11<br><br>**Francois I.** *See* Figs. 4-6, 2.3 User view synthesis, pp. 746-47, 5.CONCLUSION, p. 748<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2, *Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract), *Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138, *Mirror symmetry -> 2-view stereo geometry* (2003) at 139-140, *Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143, *Mirror symmetry -> 2-view stereo geometry* (2003) at 143, *Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a), Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15 |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Haan.** *See* paras. [0009]-[0011], [0015]-[0016], [0018], [0036]<br><br>**Hatanaka.** *See* paras. [0020], [0024]-[0028], [0037]-[0039], [0040]-[0047], [0048]-[0051], [0067]-[0069], [0070]-[0077], [0078]-[0079]<br><br>**Iwabuchi.** *See* "5 Adjusting Position of Display" at pp. 501-502, "Smart Makeup Mirror" at p. 496, "3.1 Automatic Zoom and Pan" at p. 497, "3.2 Intuitive Magnification Rate Control" at pp. 497-498, "3.3 Left and Right Reversing Mirror" at p. 498, "3.4 Profile Check" at p. 498, "3.5 Lighting Mode" at p. 498, "4.1 Test by the Author" at p. 500<br><br>**Kurtz.** *See* paras. [0048], [0049], [0090], [0099], [0138]<br><br>**Lizee.** *See* para. [0057]<br><br>**Miyaoku.** *See* [0051]-[0056], [0059]-[0061], [0068]-[0069], [0075]-[0076], [0080]<br><br>**Ohba.** *See* 3:40-47, 5:47-51, 8:34-43, Claims 8-10<br><br>**Okumura I.** *See* pp. 6187-6188<br><br>**Ooi.** *See* para. [0041]<br><br>**Rosenberg.** *See* paras. [0048]-[0049], [0093]-[0095], [0096]-[0098]<br><br>**Shen.** *See* pp. 1, 3<br><br>**Straka I.** *See* Straka I at p. 7<br><br>**Tripathi.** *See* 3:53-61, 6:6-28, 9:62-67, 10:40-50, 10:17-24, 11:54-12:24<br><br>**Magic Mirror.** *See* CNN Money at 1 |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Okumura II.** *See* pp. 6187-6188<br><br>**Straka II.** *See* Straka II at p. 7<br><br>**Geisner.** *See* paras. [0039]; [0047]-[0049]; [0051]-[0054]; [0062]; [0066]-[0068]; [0103]; [0111]; [0124]-[0127]; [0129]-[0132]; [0133]-[0134]; [0153]-[0154]; Figs. 2, 9, 10, 12, 13<br><br>**Rowles.** *See* 4:1-14; 6:50-63; 11:58-12:21; Figs. 1A, 3B<br><br>**Francois III.** *See A Handheld Mirror Simulation*, Francois et al. (2003), 2.3 User view synthesis, pp. 746-47; 5.CONCLUSION, p. 748; Figs. 6. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* paras. [0026]; [0035]; [0036]<br><br>**Hamamoto.** *See* pp. 3, 5<br><br>**Tan.** *See* paras. [0027]; [0029]; [0031]<br><br>**Lin.** *See* Abstract; paras. [0022]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, *A Handheld Virtual Mirror* (2002), at Figure 2,<br><br>**Haan.** *See* paras. [0113]<br><br>**Iwabuchi.** *See* "3.5 Lighting Mode" at p. 498, "3.6 Makeup Log" at 498, "3.6 Makeup Log" at 499<br><br>**Kurtz.** *See* paras. [0048], [0067], [0112]<br><br>**Ooi.** *See* paras. [0012], [0043], [0059], [0066], [0077], [0095]-[0097], [0105]-[0112]<br><br>**Rosenberg.** *See* para. [0116]<br><br>**Suggs.** *See* para. [0055]<br><br>**Tripathi.** *See* 1:8-15, 1:35-1:51, 3:35-3:52, 3:62-4:51, 5:1-12, 9:30-10:24<br><br>**Geisner.** *See* paras. [0159]-[0160]<br><br>**Rowles.** *See* 4:15-30; 4:37-46; 4:60-5:6; 6:10-6:15; 6:64-7:3; 7:32-8:45; 8:14-8:43; 10:4-12; 16:12-23; Fig. 1A<br><br>**Francois III.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Fig. 2 |

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| | **Hamamoto.** *See* Abstract, pp. 3, 6<br><br>**Lin.** *See* paras. [0021]; [0028]; Fig. 3A<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Francois I.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Francois II.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Haan.** *See* paras. Claim Limitations 1[pre]-[1[h]<br><br>**Hatanaka.** *See* paras. Claim Limitations 1[pre]-1[h]<br><br>**Iwabuchi.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Kurtz.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Lizee.** *See* Claim Limitations 1[pre]-[1[h] |

| Asserted Claim of the ’109 Patent | Exemplary Citations to the ’109 Patent References |
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| | **Miyaoku.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Ohba.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Okumura I.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Ooi.** *See* Claim Limitations 1[pre]-1[h]<br><br>**Rosenberg.** *See* 1[pre]-[1[h]<br><br>**Shen.** *See* Claim Limitations 1[pre]-[h]<br><br>**Straka I.** *See* Claims 1[pre]-1[h]<br><br>**Suggs.** *See* paras. Claim Limitations 1[pre]-1[h]<br><br>**Tripathi.** *See* Claim Limitation 1[pre]-1[h]<br><br>**Magic Mirror.** *See* Claim Limitations1[pre]-1[h]<br><br>**Okumura II.** *See* Claim Limitations 1[pre]-[1[h]<br><br>**Straka II.** *See* Claims 1[pre]-1[h]<br><br>**Geisner.** *See* Claims 1[pre]-1[h]<br><br>**Ikui.** *See* Claims 1[pre]-1[h]<br><br>**Rowles.** *See* Claims 1[pre]-1[h]<br><br>**Goto.** *See* Claims 1[pre]-1[h]<br><br>**Shiseido.** *See* Claims 1[pre]-1[h] |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Francois III.** *See* Claims 1[pre]-1[h]<br><br>**Miyamoto.** *See* Claims 1[pre]-1[h]<br><br>**Hamamoto.** *See* Claims 1[pre]-1[h]<br><br>**Tan.** *See* Claims 1[pre]-1[h]<br><br>**Lin.** *See* Claims 1[pre]-1[h]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 11[a]. determining distance to a user appearing in the image; and, | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation.<br><br>**Enstad.** *See* paras. [0031], [0027]-[0028], [0043]-[0047]<br><br>**Francois I.** *See* Claim Limitation 1[g], 1.INTRODUCTION, p. 745, Figs. 4-6, 2.3 User view synthesis, pp. 746-47<br><br>**Francois II.** *See* Claim Limitation 1[g], Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph, Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis, *A Handheld Virtual Mirror* (2002), at Figure 1, *A Handheld Virtual Mirror* (2002), at Figure 2<br><br>**Haan.** *See* Claim Limitation 1[g], paras. [0058], [0073]-[0074], [0074]-[0076] |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Hatanaka.** *See* Claim Limitation 1[g], paras. [0004], [0006]-[0007], [0013], [0018]-[0019], [0028]-[0029], [0030]-[0039], [0041]-[0045], [0049]-[0051], [0053], [0057]-[0062], [0064], [0067]-[0069], [0073]-[0074], [0078]-[0079]<br><br>**Iwabuchi.** *See* Claim Limitation 1[g], "3.4 Profile Check" at p. 498, "3.1 Automatic Zoom and Pan" at p. 497, "3.2 Intuitive Magnification Rate Control" at pp. 497-498<br><br>**Kurtz.** *See* Claim Limitation 1[g], paras. [0065], [0066]<br><br>**Lizee.** *See* Claim Limitation 1[g], paras. [0043], [0046]<br><br>**Miyaoku.** *See* Claim Limitation 1[g], paras. [0010], [0016], [0045]<br><br>**Ohba.** *See* Claim Limitation 1[g], 2:26-38, 2:64-3:6, 8:22-26, 9:4-8<br><br>**Okumura I.** *See* Claim Limitation 1[g], p. 6187-6188<br><br>**Ooi.** *See* Claim Limitation 1[g], paras. [0052], [0059]-[0060]<br><br>**Rosenberg.** *See* Claim Limitation 1[g], paras. [0056], [0062]<br><br>**Shen.** *See* Claim Limitation 1[g], pp.1, 3, 4<br><br>**Straka I.** *See* Claim Limitation 1[g], pp. 3, 7, Fig. 1(b)<br><br>**Suggs.** *See* Claim Limitation 1[g], paras. [0029], [0034], [0044]<br><br>**Magic Mirror.** *See* Claim Limitation 1[g]<br><br>**Okumura II.** *See* Claim Limitation 1[g], pp. 6187, 61187-6188<br><br>**Straka II.** *See* Claim Limitation 1[g], Straka II at pp. 3, 7, Fig. 1(b) |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Geisner.** *See* Claim Limitation 1[g]<br><br>**Ikui.** *See* Claim Limitation 1[g]<br><br>**Rowles.** *See* Claim Limitation 1[g]<br><br>**Goto.** *See* Claim Limitation 1[g]<br><br>**Shiseido.** *See* Claim Limitation 1[g]<br><br>**Francois III.** *See* Claim Limitation 1[g]; *see also A Handheld Mirror Simulation*, Francois et al. (2003), 1.INTRODUCTION, p. 745; 2.3 User view synthesis, pp. 746-47; Fig. 6. *A Handheld Virtual Mirror* (2002), at the introductory paragraph; Section 1.Problem formulation and geometric analysis; Section 2.2.System integration; Section 3.Perspectives; Figs. 1, 2<br><br>**Miyamoto.** *See* Claim Limitation 1[g]; *see also* [0024]; [0026]; [0035]; [0036]<br><br>**Hamamoto.** *See* Claim Limitation 1[g]; *see also* pp. 5, 6, 21<br><br>**Tan.** *See* Claim Limitation 1[g]; *see also* paras. [0030]; [0031]<br><br>**Lin.** *See* Claim Limitation 1[g]; *see also* Abstract; paras. [0022]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |
| 11[b]. varying resolution of the image according to the distance. | Each reference below discloses or suggests this feature, alone or in combination with the other references shown for this limitation. |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Enstad.** *See* paras. [0031], [0034], [0045]-[0047]<br><br>**Francois II.** *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract), *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 3, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 5-6, Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15., *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 10-11, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 21-22, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 19,<br><br>**Haan.** *See* paras. [0074], [0080]-[0081], [0082], [0097]<br><br>**Hatanaka.** *See* paras. [0006]-[0007], [0027], [0037]-[0039], [0040]-[0047], [0048]-[0051], [0067]-[0069], [0070]-[0077]<br><br>**Iwabuchi.** *See* "3.4 Profile Check" at p. 498, "3.1 Automatic Zoom and Pan" at p. 497, "3.2 Intuitive Magnification Rate Control" at pp. 497-498<br><br>**Kurtz.** *See* para. [0073]<br><br>**Miyaoku.** *See* paras. [0020], [0033]-[0034], [0035]-[0036], [0052]-[0062], [0063]-[0066], [0067]-[0072], [0073]-[0080]<br><br>**Okumura I.** *See* pp. 6190-6191<br><br>**Ooi.** *See* paras. [0005]-[0007], [0041]-[0042], [0060]-[0069], [0071]-[0077], [0079]<br><br>**Shen.** *See* p. 7 |

| Asserted Claim of the '109 Patent | Exemplary Citations to the '109 Patent References |
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| | **Straka I.** *See* Straka I at p. 7<br><br>**Tripathi.** *See* 1:35-2:12, 5:58-6:3, 6:47-52, 7:9-7:28, 9:12-67<br><br>**Okumura II.** *See* pp. 6190-6191<br><br>**Straka II.** *See* Straka II at p. 7<br><br>**Geisner.** *See* paras. [0081]; [0088]-[0091]<br><br>**Ikui.** *See* paras. [0005]-[0006]; [0001]; [0026]; [0038]; [0043]-[0047]<br><br>**Rowles.** *See* 3:54-60<br><br>**Goto.** *See* paras. [0156]-[0157]<br><br>**Shiseido.** *See* Goto, paras. [0156]-[0157]<br><br>**Francois III.** *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration<br><br>**Miyamoto.** *See* paras. [0021]; [0026]; [0035]; [0036]<br><br>**Hamamoto.** *See* pp. 5, 6<br><br>**Tan.** *See* paras. [0030]; [0031]<br><br>**Lin.** *See* Abstract; paras. [0022]; [0030]<br><br>Further, this limitation would have been obvious to a person of ordinary skill in the art based on (1) the above citations; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. |

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# Exhibit A-01: Invalidity of U.S. Patent No. 8,982,109 in view of U.S. Patent Pub. No. 2009/0015658 ("Enstad")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

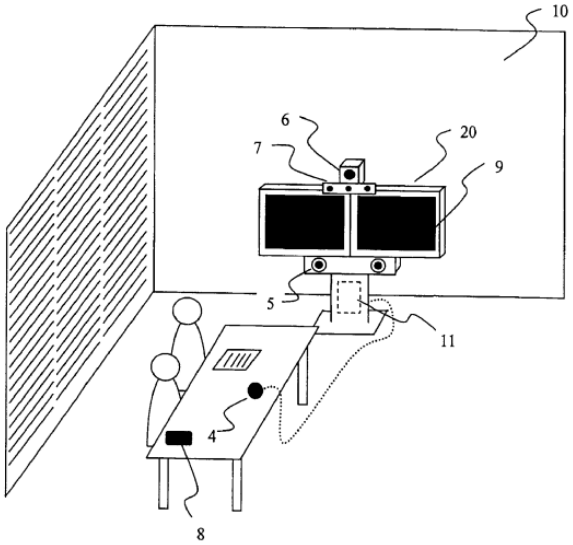
Enstad was originally filed July 11, 2008 and published on January 15, 2009, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a), (b) and (e).

Enstad anticipates the Asserted Claims of the '109 Patent. To the extent it is found Enstad does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Enstad does not anticipate the Asserted Claims, Enstad renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

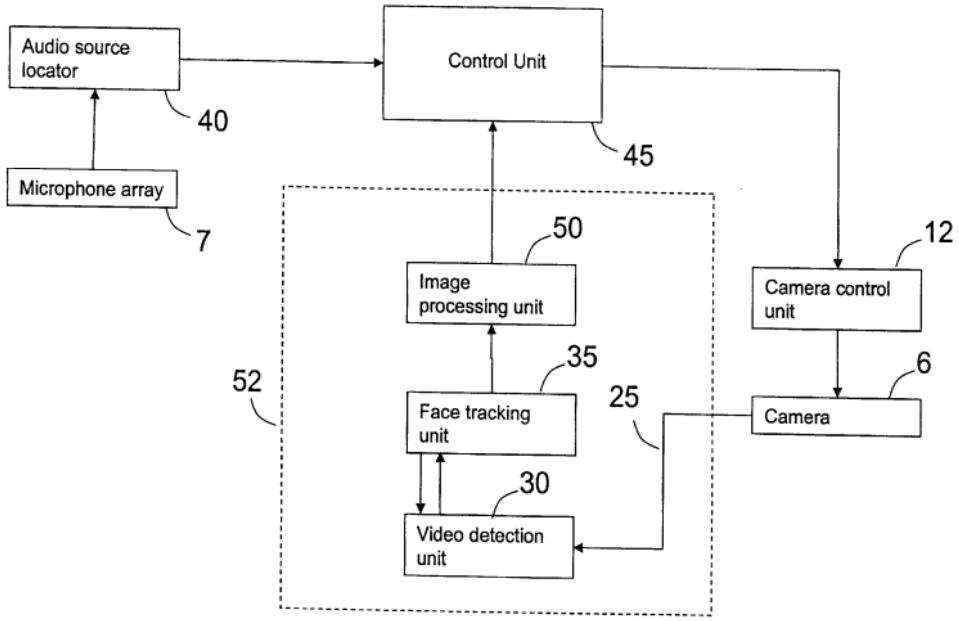
Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Enstad expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"The present invention relates to automatic adjustment of camera orientation and zoom in situations, such as but not limited to, video conferencing." *See* para. [0002].<br><br>"It is an object of the present invention to provide a method and a system solving at least one of the above-mentioned problems in conventional systems. A non-limiting embodiment includes an automatic field adjustment system that ensures a good camera orientation for multiple situations (i.e., multiple configurations of people and/or equipment) in a video conferencing room.<br><br>A non-limiting embodiment includes a method for automatically determining an orientation and zoom of an image pickup device associated with a video conferencing system, wherein the method includes the steps of: generating, at the image pickup device, an image signal representative of an image framed by the image pickup device; processing the image signal to identify objects plural users of the video conferencing system in the image; steering the image pickup device to an initial orientation; determining a location of all the identified objects relative to a reference point and determining respective sizes of the identified objects; defining an area of interest in the image, wherein the area of interest includes all the identified objects; and steering the image pickup device to frame the defined area of interest including all the identified objects where a center of the frame substantially coincides with a center of all the identified objects." *See* paras. [0008]-[0009].<br><br>"FIG. 1 illustrates a typical video conferencing room 10, with an exemplary video conferencing system 20. Video conferencing systems 20 may, for example, consist of the following components: a codec 11 (for coding and decoding audio and video information), a user input device 8 (i.e. remote control or keyboard), a image capture device 6 (a camera, which can be a high-definition camera), an audio capture device 4 |

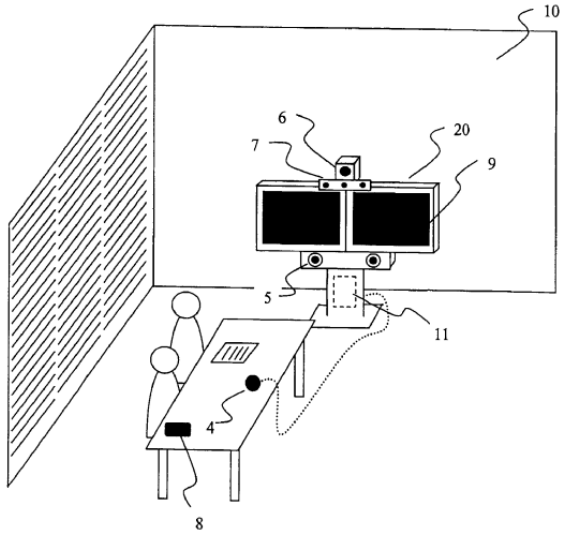
| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| | and/or 7 (microphone), a video display 9 (a screen which can be a high-definition display) and an audio reproduction device 5 (loudspeakers). Often, high end video conferencing systems (VCS) use high quality cameras 6 with motorized pan-, tilt-, and zoom capabilities." *See* para. [0026].<br><br>  <br><br>**Figure 1**<br><br>"FIG. 2 schematically shows the components in the "best view" locator 52 according to a non-limiting embodiment of the present invention. While FIG. 2 shows examples of hardware, it should be understood that the present invention can be implement in hardware, software, firmware, or a combination of these. |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Enstad |
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| | A video detection unit 30 is configured to continuously (or with very short intervals on an order of a second or millisecond) detect objects, e.g. faces and/or heads, in the frames of a captured video signal. At predefined events (e.g. when the VCS is switched on, when initiated through the user input device 8, etc.) the camera zooms out to its maximum field of view (or near maximum field of view) and moves to a predefined pan- and tilt-orientation (azimuth- and elevation-angle), capturing as much as possible of the room 10 where the system is situated. The video detection unit 30 analyses the frames in the video signal and detects all the faces/heads and their location in the video frame relative to a predetermined and static reference point (e.g. the center of the frame). The face/head location and size (or area) in the video image is transformed into camera coordinates (azimuth- and elevation angles and zoom factors) Information about each detected face/head (e.g. position, size, etc.) is sent to an image processing unit 50 via face tracking unit 35. Based on said face/head information the image processing unit defines a rectangular area that at least comprises all the detected faces/heads. A predefined set of rules dictates how the area should be defined, and the area represents the best view of the people in the frame (or video conferencing room 10). The camera coordinates (azimuth- and elevation angles and zoom factors) for the defined area and its location are sent to a control unit 45. The control unit instructs a camera control unit 12 to move the camera to said camera coordinates, and the camera's 6 pan, tilt and zoom is adjusted to frame an image corresponding to the defined area.<br><br>The image pickup device (or camera) 6 includes a camera control unit 12 for positioning the image pickup device. The camera control unit 12 is the steering mechanism. In one embodiment, the steering mechanism includes motors, controlling the pan- and tilt-orientation and the degree of zoom of the image pickup device 6. In another embodiment, the steering mechanism (or control unit 12) is configured to implement digital tilt, digital pan and digital zoom (i.e., digital pan/tilt/zoom). Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known |

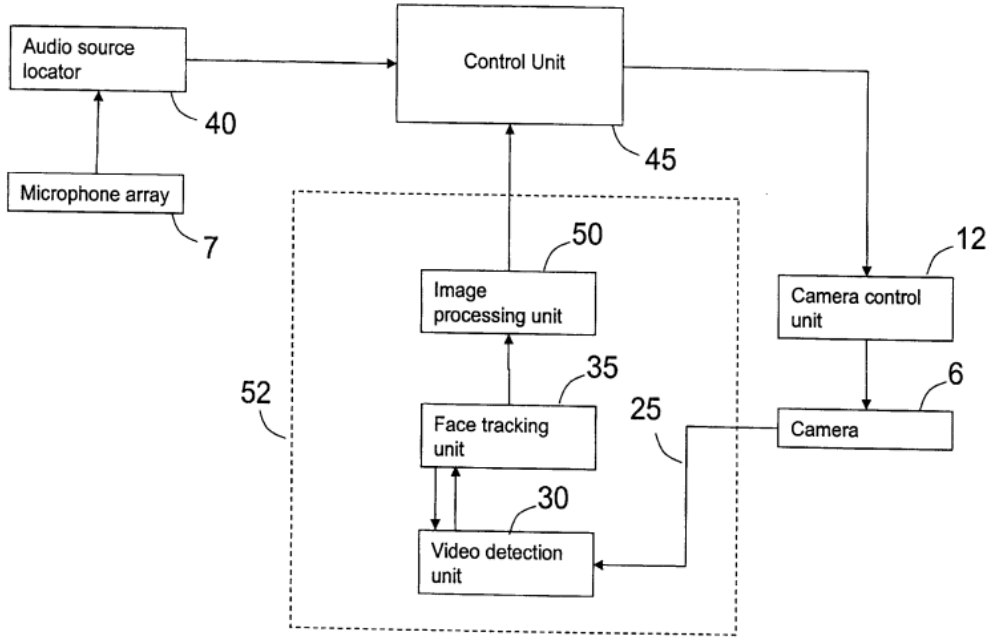
| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| | to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera.<br><br>The camera control unit 12 can also report back its current azimuth- and elevation angles and zoom factors on demand. The image processing unit 50 and the control unit 45 may supply control signals to the camera control unit 12. Camera control unit 12 uses a camera coordinate system which indicates a location based on azimuth- and elevation angles and zoom factors which describe the direction of the captured frame relative to camera 6 and the degree of zoom. Video detection unit 30 is configured to convert coordinate measurements expressed in a video (or image) coordinate system to coordinate measurements expressed in the camera coordinate system using the azimuth- and elevation angles and zoom factors of camera 6 when the frame was captured by camera 6." *See* paras. [0029]-[0032]. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| |  <br>**Figure 2**<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | Enstad expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| | "The present invention relates to automatic adjustment of camera orientation and zoom in situations, such as but not limited to, video conferencing." *See* para. [0002].<br><br>"It is an object of the present invention to provide a method and a system solving at least one of the above-mentioned problems in conventional systems. A non-limiting embodiment includes an automatic field adjustment system that ensures a good camera orientation for multiple situations (i.e., multiple configurations of people and/or equipment) in a video conferencing room.<br><br>A non-limiting embodiment includes a method for automatically determining an orientation and zoom of an image pickup device associated with a video conferencing system, wherein the method includes the steps of: generating, at the image pickup device, an image signal representative of an image framed by the image pickup device; processing the image signal to identify objects plural users of the video conferencing system in the image; steering the image pickup device to an initial orientation; determining a location of all the identified objects relative to a reference point and determining respective sizes of the identified objects; defining an area of interest in the image, wherein the area of interest includes all the identified objects; and steering the image pickup device to frame the defined area of interest including all the identified objects where a center of the frame substantially coincides with a center of all the identified objects." *See* paras. [0008]-[0009].<br><br>"FIG. 1 illustrates a typical video conferencing room 10, with an exemplary video conferencing system 20. Video conferencing systems 20 may, for example, consist of the following components: a codec 11 (for coding and decoding audio and video information), a user input device 8 (i.e. remote control or keyboard), a image capture device 6 (a camera, which can be a high-definition camera), an audio capture device 4 and/or 7 (microphone), a video display 9 (a screen which can be a high-definition display) and an audio reproduction device 5 (loudspeakers). Often, high end video conferencing systems (VCS) use high quality cameras 6 with motorized pan-, tilt-, and zoom capabilities." *See* para. [0026]. |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Enstad |
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| |  <br>**Figure 1**<br><br>“FIG. 2 schematically shows the components in the “best view” locator 52 according to a non-limiting embodiment of the present invention. While FIG. 2 shows examples of hardware, it should be understood that the present invention can be implement in hardware, software, firmware, or a combination of these.<br><br>A video detection unit 30 is configured to continuously (or with very short intervals on an order of a second or millisecond) detect objects, e.g. faces and/or heads, in the frames of a captured video signal. At predefined events (e.g. when the VCS is switched on, when initiated through the user input device 8, etc.) the camera zooms out to its maximum field of view (or near maximum field of view) and moves to a predefined pan- and tilt-orientation (azimuth- and elevation-angle), capturing as much as possible of the room 10 where the system is situated. The video detection unit 30 analyses the frames in the video signal and detects all the faces/heads and their location in the video frame |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Enstad |
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| | relative to a predetermined and static reference point (e.g. the center of the frame). The face/head location and size (or area) in the video image is transformed into camera coordinates (azimuth- and elevation angles and zoom factors) Information about each detected face/head (e.g. position, size, etc.) is sent to an image processing unit 50 via face tracking unit 35. Based on said face/head information the image processing unit defines a rectangular area that at least comprises all the detected faces/heads. A predefined set of rules dictates how the area should be defined, and the area represents the best view of the people in the frame (or video conferencing room 10). The camera coordinates (azimuth- and elevation angles and zoom factors) for the defined area and its location are sent to a control unit 45. The control unit instructs a camera control unit 12 to move the camera to said camera coordinates, and the camera's 6 pan, tilt and zoom is adjusted to frame an image corresponding to the defined area.<br><br>The image pickup device (or camera) 6 includes a camera control unit 12 for positioning the image pickup device. The camera control unit 12 is the steering mechanism. In one embodiment, the steering mechanism includes motors, controlling the pan- and tilt-orientation and the degree of zoom of the image pickup device 6. In another embodiment, the steering mechanism (or control unit 12) is configured to implement digital tilt, digital pan and digital zoom (i.e., digital pan/tilt/zoom). Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera.<br><br>The camera control unit 12 can also report back its current azimuth- and elevation angles and zoom factors on demand. The image processing unit 50 and the control unit 45 may supply control signals to the camera control unit 12. Camera control unit 12 uses a camera coordinate system which indicates a location based on azimuth- and elevation |

| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| | angles and zoom factors which describe the direction of the captured frame relative to camera 6 and the degree of zoom. Video detection unit 30 is configured to convert coordinate measurements expressed in a video (or image) coordinate system to coordinate measurements expressed in the camera coordinate system using the azimuth- and elevation angles and zoom factors of camera 6 when the frame was captured by camera 6." *See* paras. [0029]-[0032].<br>  <br><br>**Figure 2**<br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other |

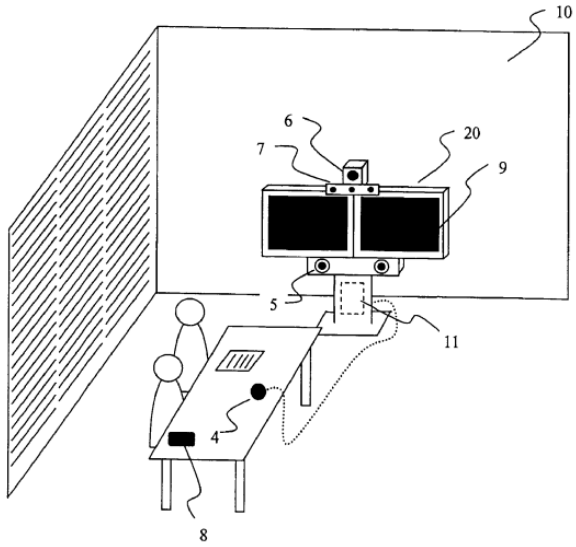
| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| | invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Enstad expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. *See*, *e.g.*, disclosures below.<br><br>"Adjustments to the camera are typically done via a remote control, either by manually controlling the camera pan, tilt and zoom, or by choosing between a set of pre-defined camera positions. These pre-defined positions are manually programmed. Often, before or during a video conference, the users do not want to be preoccupied with the manual control of the camera, or the less experienced user may not even be aware of the possibility (or how) to change the cameras field of view. Hence, the camera is often left sub-optimally adjusted in a video conference, resulting in a degraded video experience." *See* para. [0005].<br><br>"There may be many opinions on what the "best view" of a set of participants in a video conference is. However, as used herein, a "best view" is referred to as a close-up of a group of participants, where the video frame center substantially coincides with the center of the group, and where the degree of zoom gives a tightly fitted image around the group. However, the image must not be too tight, showing at least a portion of the participant's upper body, and providing room for the participants to move slightly without exiting the video frame." *See* para. [0028].<br><br>"The systems according to the non-limiting embodiments discussed herein provide a novel way of automatically obtaining the best visual representation of all the participants in a video conferencing room. Further, the system is automatically adapting to new situations, such as participants leaving or entering the meeting room, and changing the visual representation accordingly. These exemplary embodiments of the present invention provide a more user friendly approach to a superior visual experience." *See* para. [0053]. |

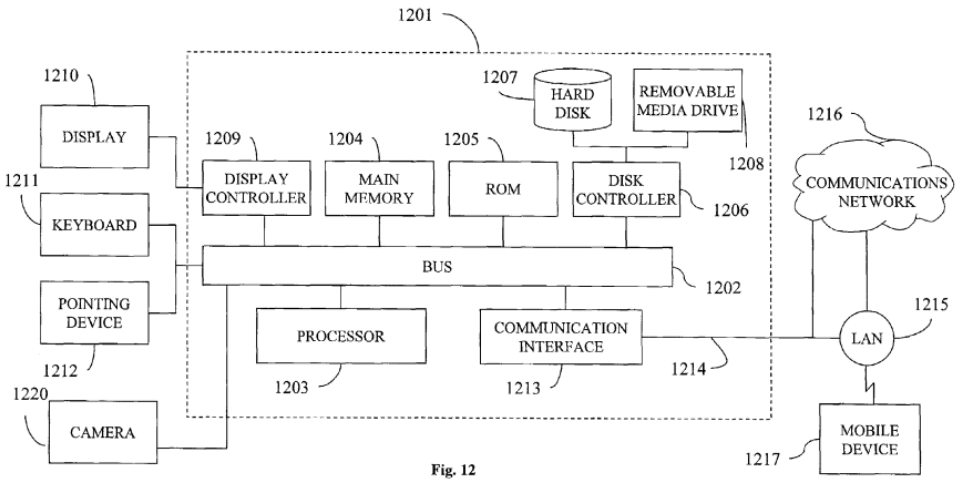
| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Enstad expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"The video detection unit 30 analyses the frames in the video signal and detects all the faces/heads and their location in the video frame relative to a predetermined and static reference point (e.g. the center of the frame). The face/head location and size (or area) in the video image is transformed into camera coordinates (azimuth- and elevation angles and zoom factors) Information about each detected face/head (e.g. position, size, etc.) is sent to an image processing unit 50 via face tracking unit 35. Based on said face/head information the image processing unit defines a rectangular area that at least comprises all the detected faces/heads. A predefined set of rules dictates how the area should be defined, and the area represents the best view of the people in the frame (or video conferencing room 10). The camera coordinates (azimuth- and elevation angles and zoom factors) for the defined area and its location are sent to a control unit 45. The control unit instructs a camera control unit 12 to move the camera to said camera coordinates, and the camera's 6 pan, tilt and zoom is adjusted to frame an image corresponding to the defined area." *See* para. [0030].<br><br>"Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may |

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| | be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera." *See* para. [0031].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Enstad expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera. *See*, *e.g.*, disclosures below.<br><br>"Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera." *See* para. [0031].<br><br>"Non-limiting embodiments of the present invention use video detection techniques to detect participants and their respective locations in video frames captured by the camera 6, and based on the location and sizes of the detected participants automatically determine and use the optimal camera orientation and zoom for capturing the best view of all the participants.<br><br>There may be many opinions on what the "best view" of a set of participants in a video conference is. However, as used herein, a "best view" is referred to as a close-up of a group of participants, where the video frame center substantially coincides with the |

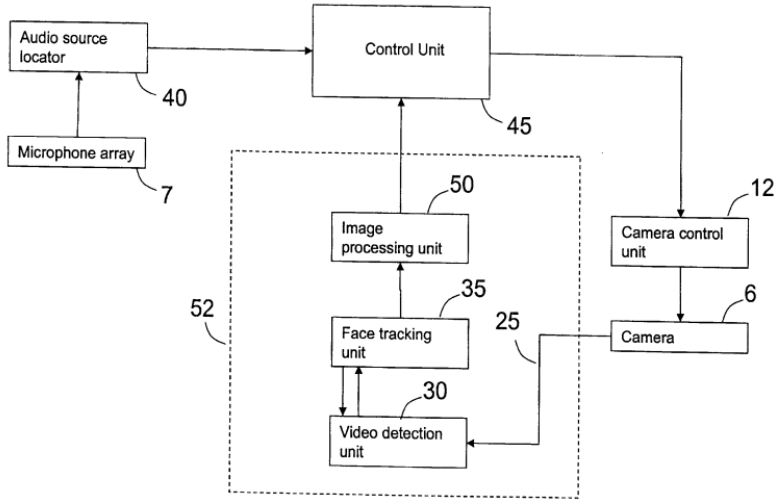
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| | center of the group, and where the degree of zoom gives a tightly fitted image around the group. However, the image must not be too tight, showing at least a portion of the participant's upper body, and providing room for the participants to move slightly without exiting the video frame." *See* paras. [0027]-[0028].<br><br>"According to another exemplary embodiment, the best view frame 34 is defined by just subtracting a compensation value Zc from the calculated zoom factor Zfa, making the camera zoom out an additional distance. The compensation value Zc may be static, or vary linearly depending on the size of the first area zoom factor Zfa.<br><br>FIG. 7 schematically shows an exemplary video frame taken from an initial camera orientation. 3 faces have been detected in the video frame, and the image processing unit 50 has defined a best view frame 34, and calculated the location (αfa,φfa) of the best view frame.<br><br>Most image pickup devices 6 for video conferencing systems operate with standard television image aspect ratios, e.g. 4:3 (1.33:1) or 16:9 (1.78:1). Since most calculated best view frames 34 as described above have aspect ratios that deviate from the standards, e.g. 4:3 or 16:9, some considerations must be made when deciding the zoom coordinate. Since Aφ is the shortest edge of area 34, if the camera zooms in to capture the exact height Aφ, large parts of the area will miss the light sensitive area (e.g. image sensor) in the camera because its aspect ratio is different than the defined area. If the camera zooms in to capture the exact width Aα of the defined area 34, no information is lost.<br><br>Therefore, according to one exemplary embodiment of the present invention, the two sides Aφ and Aα of the best view frame 34 are compared. Each of the two sides defines a zoom factor needed to fit the area of interest in the image frame, in the horizontal and vertical direction respectively. Thus, the degree of zoom is defined by the smallest of the two calculated zoom factors, ensuring that the area of interest is not cropped when zooming to the area of interest. |

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| | In step 100, the image processing unit 50 supplies the camera control unit 12 with the camera positioning directives (αfa,φfa,Z) (azimuth, elevation, zoom) derived in step 90, via control unit 45. Once the camera positioning directives are received, the camera moves and zooms to the instructed coordinates, to get the best view of the participants in the video conference. FIG. 8 shows the best view of participant 1 and 2 from meeting room 10a in FIG. 6." *See* paras. [0043]-[0047].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | Enstad expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below. |

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| |  <br>**Figure 1**<br><br>“The computer system 1201 may also include a display controller 1209 coupled to the bus 1202 to control a display 1210, such as a cathode ray tube (CRT) or LCD display, for displaying information to a computer user. The computer system includes input devices, such as a keyboard 1211 and a pointing device 1212, for interacting with a computer user and providing information to the processor 1203. The pointing device 1212, for example, may be a mouse, a trackball, or a pointing stick for communicating direction information and command selections to the processor 1203 and for controlling cursor movement on the display 1210. In addition, a printer may provide printed listings of data stored and/or generated by the computer system 1201.” *See* para. [0057]. |

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| |  <br>Fig. 12<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Enstad expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"1. A method for automatically determining an orientation and zoom of an image pickup device associated with a video conferencing system, wherein said method comprises the steps of:<br><br>generating, at said image pickup device, an image signal representative of an image framed by said image pickup device; |

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| | processing the image signal to identify objects in said image;<br><br>steering the image pickup device to an initial orientation;<br><br>determining a location of all the identified objects relative to a reference point and determining respective sizes of the identified objects;<br><br>defining an area of interest in said image, wherein said area of interest includes all the identified objects; and<br><br>steering the image pickup device to frame said defined area of interest including all the identified objects where a center of the frame substantially coincides with a center formed by a group of all the identified objects." *See* claim 1.<br><br>"4. The method according to claim 1, wherein the image signal represents a frame of a video, and the step of processing the image signal to identify objects further comprises:<br><br>detecting images of faces or heads that appear in a series of frames of the video;<br><br>tracking the detected faces or heads through the series of frames of the video;<br><br>registering a detection of the face or head if said detection occurs in a predefined number of frames in the series of frames." *See* claim 4. |

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| |  <br>**Figure 2**<br><br>"FIG. 3 is a flow chart of the operation of the "best view" locator 52. Camera 6 outputs a video signal comprising a series of frames (images). The frames are analyzed by the video detection unit 30. At predefined events, the camera control unit 12 is instructed to move the camera to an initial orientation (step 60). The object of the initial orientation is to make sure that the camera can "see" all the persons in the meeting room. There are several ways of deciding such an initial orientation." *See* para. [0033].<br><br>"According to another exemplary embodiment of the invention, the camera is configured to capture the entire room by examining a set of initial orientations (14, 15) with a maximum field of view, and where the set's fields of view overlaps. In most cases, a set of 2 orientations will suffice. However, the number of orientations will depend on the cameras maximum field of view, and may be 3, 4, 5, 6, etc. For each orientation (14, 15) the one or more video frames are analyzed by video detection unit 30 to detect faces and/or heads and their respective locations. After analyzing all the orientations, the |

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| | image processing unit 50 calculates the pan- and tilt orientation that includes all or a maximum amount possible of the detected participants, and defines said calculated orientation as the initial orientation.<br><br>A video detection unit 30 analyzes the video signals 25 from the camera 6 to detect and localize faces and/or heads (step 70) in a video frame. The video detection unit 30 measures the offset of the location of the detected faces/heads from some pre-determined and static reference point (for example, the center of the video image)." *See* paras. [0035]-[0036].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Enstad expressly and/or inherently discloses and/or renders obvious t determining distance to a user appearing in the live video feed. *See*, *e.g.*, disclosures below.<br><br>"Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera." *See* para. [0031].<br><br>"Non-limiting embodiments of the present invention use video detection techniques to detect participants and their respective locations in video frames captured by the camera 6, and based on the location and sizes of the detected participants automatically |

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| | determine and use the optimal camera orientation and zoom for capturing the best view of all the participants.<br><br>There may be many opinions on what the "best view" of a set of participants in a video conference is. However, as used herein, a "best view" is referred to as a close-up of a group of participants, where the video frame center substantially coincides with the center of the group, and where the degree of zoom gives a tightly fitted image around the group. However, the image must not be too tight, showing at least a portion of the participant's upper body, and providing room for the participants to move slightly without exiting the video frame." *See* paras. [0027]-[0028].<br><br>"According to another exemplary embodiment, the best view frame 34 is defined by just subtracting a compensation value Zc from the calculated zoom factor Zfa, making the camera zoom out an additional distance. The compensation value Zc may be static, or vary linearly depending on the size of the first area zoom factor Zfa.<br><br>FIG. 7 schematically shows an exemplary video frame taken from an initial camera orientation. 3 faces have been detected in the video frame, and the image processing unit 50 has defined a best view frame 34, and calculated the location (αfa,φfa) of the best view frame.<br><br>Most image pickup devices 6 for video conferencing systems operate with standard television image aspect ratios, e.g. 4:3 (1.33:1) or 16:9 (1.78:1). Since most calculated best view frames 34 as described above have aspect ratios that deviate from the standards, e.g. 4:3 or 16:9, some considerations must be made when deciding the zoom coordinate. Since Aφ is the shortest edge of area 34, if the camera zooms in to capture the exact height Aφ, large parts of the area will miss the light sensitive area (e.g. image sensor) in the camera because its aspect ratio is different than the defined area. If the camera zooms in to capture the exact width Aα of the defined area 34, no information is lost. |

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| | Therefore, according to one exemplary embodiment of the present invention, the two sides Aφ and Aα of the best view frame 34 are compared. Each of the two sides defines a zoom factor needed to fit the area of interest in the image frame, in the horizontal and vertical direction respectively. Thus, the degree of zoom is defined by the smallest of the two calculated zoom factors, ensuring that the area of interest is not cropped when zooming to the area of interest.<br><br>In step 100, the image processing unit 50 supplies the camera control unit 12 with the camera positioning directives (αfa,φfa,Z) (azimuth, elevation, zoom) derived in step 90, via control unit 45. Once the camera positioning directives are received, the camera moves and zooms to the instructed coordinates, to get the best view of the participants in the video conference. FIG. 8 shows the best view of participant 1 and 2 from meeting room 10a in FIG. 6." *See* paras. [0043]-[0047].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Enstad expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. *See*, *e.g.*, disclosures below.<br><br>"The image pickup device (or camera) 6 includes a camera control unit 12 for positioning the image pickup device. The camera control unit 12 is the steering mechanism. In one embodiment, the steering mechanism includes motors, controlling the pan- and tilt-orientation and the degree of zoom of the image pickup device 6. In another embodiment, the steering mechanism (or control unit 12) is configured to implement digital tilt, digital pan and digital zoom (i.e., digital pan/tilt/zoom). Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is |

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| | accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera." *See* para. [0031].<br><br>"Referring to FIG. 4, according to one exemplary embodiment of the invention, the camera zooms out to its maximum field of view and moves to a predefined pan- and tilt-orientation 13, capturing as much as possible of the room 10 a and/or capturing the part of the room with the highest probability of finding meeting participants. The predefined pan- and tilt-orientation (or initial orientation) is typically manually entered into the system through a set-up function (e.g. move camera manually to an optimal initial position and then save position) or it is a default factory value." *See* para. [0034].<br><br>"Most image pickup devices 6 for video conferencing systems operate with standard television image aspect ratios, e.g. 4:3 (1.33:1) or 16:9 (1.78:1). Since most calculated best view frames 34 as described above have aspect ratios that deviate from the standards, e.g. 4:3 or 16:9, some considerations must be made when deciding the zoom coordinate. Since Aφ is the shortest edge of area 34, if the camera zooms in to capture the exact height Aφ, large parts of the area will miss the light sensitive area (e.g. image sensor) in the camera because its aspect ratio is different than the defined area. If the camera zooms in to capture the exact width Aα of the defined area 34, no information is lost.<br><br>Therefore, according to one exemplary embodiment of the present invention, the two sides Aφ and Aα of the best view frame 34 are compared. Each of the two sides defines a zoom factor needed to fit the area of interest in the image frame, in the horizontal and vertical direction respectively. Thus, the degree of zoom is defined by the smallest of the |

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| | two calculated zoom factors, ensuring that the area of interest is not cropped when zooming to the area of interest.<br><br>In step 100, the image processing unit 50 supplies the camera control unit 12 with the camera positioning directives (αfa,φfa,Z) (azimuth, elevation, zoom) derived in step 90, via control unit 45. Once the camera positioning directives are received, the camera moves and zooms to the instructed coordinates, to get the best view of the participants in the video conference. FIG. 8 shows the best view of participant 1 and 2 from meeting room 10 a in FIG. 6." *See* paras. [0045]-[0047].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | Enstad expressly and/or inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. *See*, *e.g.*, disclosures below.<br><br>"The video detection unit 30 analyses the frames in the video signal and detects all the faces/heads and their location in the video frame relative to a predetermined and static reference point (e.g. the center of the frame). The face/head location and size (or area) in the video image is transformed into camera coordinates (azimuth- and elevation angles and zoom factors) Information about each detected face/head (e.g. position, size, etc.) is sent to an image processing unit 50 via face tracking unit 35. Based on said face/head information the image processing unit defines a rectangular area that at least comprises |

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| | all the detected faces/heads. A predefined set of rules dictates how the area should be defined, and the area represents the best view of the people in the frame (or video conferencing room 10). The camera coordinates (azimuth- and elevation angles and zoom factors) for the defined area and its location are sent to a control unit 45. The control unit instructs a camera control unit 12 to move the camera to said camera coordinates, and the camera's 6 pan, tilt and zoom is adjusted to frame an image corresponding to the defined area.<br><br>Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera.<br><br>The camera control unit 12 can also report back its current azimuth- and elevation angles and zoom factors on demand. The image processing unit 50 and the control unit 45 may supply control signals to the camera control unit 12. Camera control unit 12 uses a camera coordinate system which indicates a location based on azimuth- and elevation angles and zoom factors which describe the direction of the captured frame relative to camera 6 and the degree of zoom. Video detection unit 30 is configured to convert coordinate measurements expressed in a video (or image) coordinate system to coordinate measurements expressed in the camera coordinate system using the azimuth- and elevation angles and zoom factors of camera 6 when the frame was captured by camera 6.<br><br>FIG. 3 is a flow chart of the operation of the “best view” locator 52. Camera 6 outputs a video signal comprising a series of frames (images). The frames are analyzed by the video detection unit 30. At predefined events, the camera control unit 12 is instructed to |

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| | move the camera to an initial orientation (step 60). The object of the initial orientation is to make sure that the camera can "see" all the persons in the meeting room. There are several ways of deciding such an initial orientation." *See* paras. [0030]-[0033].<br><br>"When an image of a face/head is detected, the video detection unit 30 defines a rectangular segment (or box) surrounding said image of a face/head. According to one embodiment of the invention, said rectangular segment is the analysis window 33. The location of said segment containing an image of a face/head is measured relative to a video coordinate system which is based on the video frame. The video coordinate system applies to each frame captured by camera 6. The video coordinate system has a horizontal or x-axis and a vertical or y-axis. When determining a position of a pixel or an image, video detection unit 30 determine that position relative the x-axis and the y-axis of that pixel's or image's video frame. In one exemplary embodiment of the invention, the analysis window 33 center point 31 (pixel in the middle of the window) is the location reference point, and its location is defined by the coordinates x and y in said video coordinate system. When the video detection unit 30 has calculated the location (x,y) and size (e.g. dx=20 dy=24 pixels) of all the faces/heads in a frame, the video detection unit 30 uses knowledge of the video frame, optics and mechanics to calculate (step 80) the corresponding location (α,φ) and size (Δα,Δφ) in azimuth and elevation angles in the camera coordinate system for each image of a face/head. The camera coordinates for each face/head are then sent to a face tracking unit 35." *See* para. [0038].<br><br>"According to one embodiment of the invention, based on the location (α,φ) of each face and their corresponding sizes (Δα,Δφ), the image processing unit 50 may calculate a first area restricted by a set of margins (M1, M2, M3 and M4), where the margins are derived from the left side of the leftmost face segment (M1), upper side of the uppermost face segment (M3), right side of the rightmost face segment (M2) and the bottom side of the bottommost face segment (M4). The location of the center (αfa,φfa) of the first area can now be calculated in camera coordinates based on the margins. The location of the first area is relative to a reference point (α0,φ0), typically the direction of the camera when |

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| | azimuth and elevation angle is zero. Further, the width and height of the first area is transformed into a zoom factor (Zfa)." *See* para. [0041].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Enstad expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[a]. obtaining a reference image; | Enstad expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below.<br><br>"A non-limiting embodiment includes a method for automatically determining an orientation and zoom of an image pickup device associated with a video conferencing system, wherein the method includes the steps of: generating, at the image pickup device, an image signal representative of an image framed by the image pickup device; |

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| | processing the image signal to identify objects plural users of the video conferencing system in the image; steering the image pickup device to an initial orientation; determining a location of all the identified objects relative to a reference point and determining respective sizes of the identified objects; defining an area of interest in the image, wherein the area of interest includes all the identified objects; and steering the image pickup device to frame the defined area of interest including all the identified objects where a center of the frame substantially coincides with a center of all the identified objects." *See* para. [0009].<br><br>"A video detection unit 30 is configured to continuously (or with very short intervals on an order of a second or millisecond) detect objects, e.g. faces and/or heads, in the frames of a captured video signal. At predefined events (e.g. when the VCS is switched on, when initiated through the user input device 8, etc.) the camera zooms out to its maximum field of view (or near maximum field of view) and moves to a predefined pan- and tilt-orientation (azimuth- and elevation-angle), capturing as much as possible of the room 10 where the system is situated. The video detection unit 30 analyses the frames in the video signal and detects all the faces/heads and their location in the video frame relative to a predetermined and static reference point (e.g. the center of the frame). The face/head location and size (or area) in the video image is transformed into camera coordinates (azimuth- and elevation angles and zoom factors) Information about each detected face/head (e.g. position, size, etc.) is sent to an image processing unit 50 via face tracking unit 35. Based on said face/head information the image processing unit defines a rectangular area that at least comprises all the detected faces/heads. A predefined set of rules dictates how the area should be defined, and the area represents the best view of the people in the frame (or video conferencing room 10). The camera coordinates (azimuth- and elevation angles and zoom factors) for the defined area and its location are sent to a control unit 45. The control unit instructs a camera control unit 12 to move the camera to said camera coordinates, and the camera's 6 pan, tilt and zoom is adjusted to frame an image corresponding to the defined area.<br><br>The image pickup device (or camera) 6 includes a camera control unit 12 for positioning the image pickup device. The camera control unit 12 is the steering mechanism. In one |

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| | embodiment, the steering mechanism includes motors, controlling the pan- and tilt-orientation and the degree of zoom of the image pickup device 6. In another embodiment, the steering mechanism (or control unit 12) is configured to implement digital tilt, digital pan and digital zoom (i.e., digital pan/tilt/zoom). Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera." *See* paras. [0030]-[0031].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Enstad expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"When an image of a face/head is detected, the video detection unit 30 defines a rectangular segment (or box) surrounding said image of a face/head. According to one embodiment of the invention, said rectangular segment is the analysis window 33. The location of said segment containing an image of a face/head is measured relative to a video coordinate system which is based on the video frame. The video coordinate system applies to each frame captured by camera 6. The video coordinate system has a horizontal or x-axis and a vertical or y-axis. When determining a position of a pixel or an image, video detection unit 30 determine that position relative the x-axis and the y-axis of that pixel's or image's video frame. In one exemplary embodiment of the |

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| | invention, the analysis window 33 center point 31 (pixel in the middle of the window) is the location reference point, and its location is defined by the coordinates x and y in said video coordinate system. When the video detection unit 30 has calculated the location (x,y) and size (e.g. dx=20 dy=24 pixels) of all the faces/heads in a frame, the video detection unit 30 uses knowledge of the video frame, optics and mechanics to calculate (step 80) the corresponding location (α,φ) and size (Δα,Δφ) in azimuth and elevation angles in the camera coordinate system for each image of a face/head. The camera coordinates for each face/head are then sent to a face tracking unit 35.<br><br>Face tracking unit 35 correlates the detected faces from the current video frame to the detected faces in the previous video frames and hence tracks the detected faces through a series of frames. Only if a face/head is detected at substantially the same location throughout a series of frames, the detection is validated or registered as a positive detection. First of all this prevents false face detections, unless the same detection occurs in several consecutive video frames. Also, if the face detection unit fails to detect a face in the substantially same coordinates as a face has been detected before, the image tracking unit does not consider the face as absent from the image unless the detection has failed in several consecutive frames. This is to prevent false negative detections. Further, the tracking allows for obtaining a proper position of a participant who may be moving in a video frame. To perform this tracking, face tracking unit 35 creates and maintains a track file for each detected face. The track file can, for example, be stored in a memory device such as random access memory or a hard drive." *See* paras. [0038]-[0039].<br><br>"A non-limiting embodiment includes a method for automatically determining an orientation and zoom of an image pickup device associated with a video conferencing system, wherein the method includes the steps of: generating, at the image pickup device, an image signal representative of an image framed by the image pickup device; processing the image signal to identify objects plural users of the video conferencing system in the image; steering the image pickup device to an initial orientation; determining a location of all the identified objects relative to a reference point and determining respective sizes of the identified objects; defining an area of interest in the |

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| | image, wherein the area of interest includes all the identified objects; and steering the image pickup device to frame the defined area of interest including all the identified objects where a center of the frame substantially coincides with a center of all the identified objects." *See* para. [0009].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Enstad expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping. *See*, *e.g.*, disclosures below.<br><br>"When an image of a face/head is detected, the video detection unit 30 defines a rectangular segment (or box) surrounding said image of a face/head. According to one embodiment of the invention, said rectangular segment is the analysis window 33. The location of said segment containing an image of a face/head is measured relative to a video coordinate system which is based on the video frame. The video coordinate system applies to each frame captured by camera 6. The video coordinate system has a horizontal or x-axis and a vertical or y-axis. When determining a position of a pixel or an image, video detection unit 30 determine that position relative the x-axis and the y-axis of that pixel's or image's video frame. In one exemplary embodiment of the invention, the analysis window 33 center point 31 (pixel in the middle of the window) is the location reference point, and its location is defined by the coordinates x and y in said video coordinate system. When the video detection unit 30 has calculated the location (x,y) and size (e.g. dx=20 dy=24 pixels) of all the faces/heads in a frame, the video detection unit 30 uses knowledge of the video frame, optics and mechanics to calculate (step 80) the corresponding location (α,φ) and size (Δα,Δφ) in azimuth and elevation |

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| | angles in the camera coordinate system for each image of a face/head. The camera coordinates for each face/head are then sent to a face tracking unit 35.<br><br>Face tracking unit 35 correlates the detected faces from the current video frame to the detected faces in the previous video frames and hence tracks the detected faces through a series of frames. Only if a face/head is detected at substantially the same location throughout a series of frames, the detection is validated or registered as a positive detection. First of all this prevents false face detections, unless the same detection occurs in several consecutive video frames. Also, if the face detection unit fails to detect a face in the substantially same coordinates as a face has been detected before, the image tracking unit does not consider the face as absent from the image unless the detection has failed in several consecutive frames. This is to prevent false negative detections. Further, the tracking allows for obtaining a proper position of a participant who may be moving in a video frame. To perform this tracking, face tracking unit 35 creates and maintains a track file for each detected face. The track file can, for example, be stored in a memory device such as random access memory or a hard drive." *See* paras. [0038]-[0039].<br><br>"A non-limiting embodiment includes a method for automatically determining an orientation and zoom of an image pickup device associated with a video conferencing system, wherein the method includes the steps of: generating, at the image pickup device, an image signal representative of an image framed by the image pickup device; processing the image signal to identify objects plural users of the video conferencing system in the image; steering the image pickup device to an initial orientation; determining a location of all the identified objects relative to a reference point and determining respective sizes of the identified objects; defining an area of interest in the image, wherein the area of interest includes all the identified objects; and steering the image pickup device to frame the defined area of interest including all the identified objects where a center of the frame substantially coincides with a center of all the identified objects." *See* para. [0009]. |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Enstad |
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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants’ Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 8** | |



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| | |
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| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Enstad expressly and/or inherently discloses and/or renders obvious applying a translation transformation to move the image within display area of the monitor. *See*, *e.g.*, disclosures below.<br><br>"According to another embodiment of the present invention another predefined event is when a participant is detected leaving the room (or field of view). Such detection depends on the tracking function mentioned earlier. As shown in FIG. 11a, when a participant leaves the room, the track file or track history will show that the position/location (α,φ) of a detected face changes from a position (α3, φ3) to a position (α4,φ4) close to the edge of the frame, over a sequence of frames (FIG. 11a-11b). If the same face detection suddenly disappears (no longer detecting a face) and do not return within a certain time frame (FIG. 11c), the face detection is considered as a participant leaving the conference. Upon detection of such an event, step 60-100 is repeated to adjust the field of view of the camera to a new optimal view as shown in FIG. 11d.<br><br>According to yet another embodiment of the present invention, another predefined event is when movement is detected near the edge of the video frame. Not everybody entering a video conferencing room will start speaking at once. This will depend on the situation, seniority of the participant, etc. Therefore, it may take some time before the system detects the new arrival and acts accordingly. Referring back to FIG. 9, parts 38 of a participant may be captured in the video frame, even though most of the person is outside the camera's field of view. Since people rarely sit completely still, relative to the static furniture, the parts 38 can easily be detected as movement in the image by video detection unit 35. Upon detection of such an event (movement is detected near the image/frame edge), steps 60-100 are repeated to adjust the field of view of the camera to a new optimal view." *See* paras. [0051]-[0052]. |

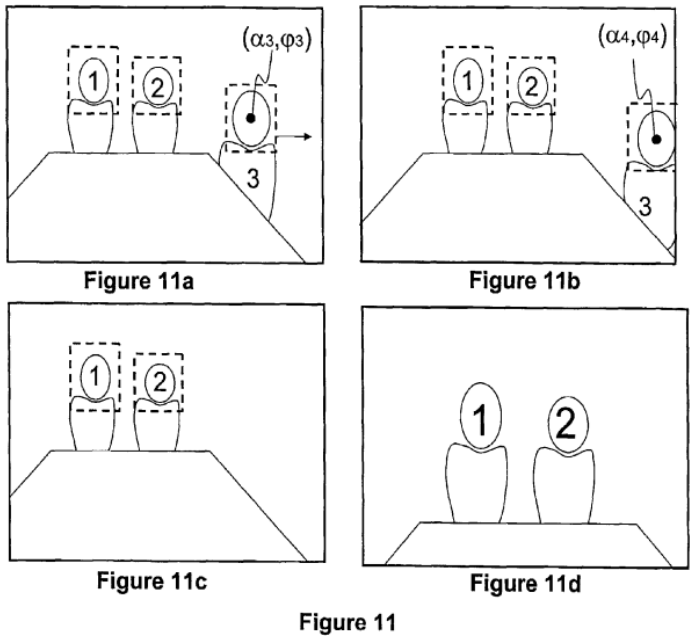



Figure 11

This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document.

| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Enstad inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Enstad expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | Enstad expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*: |

| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| | "Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera." *See* para. [0031].<br><br>"Non-limiting embodiments of the present invention use video detection techniques to detect participants and their respective locations in video frames captured by the camera 6, and based on the location and sizes of the detected participants automatically determine and use the optimal camera orientation and zoom for capturing the best view of all the participants.<br><br>There may be many opinions on what the "best view" of a set of participants in a video conference is. However, as used herein, a "best view" is referred to as a close-up of a group of participants, where the video frame center substantially coincides with the center of the group, and where the degree of zoom gives a tightly fitted image around the group. However, the image must not be too tight, showing at least a portion of the participant's upper body, and providing room for the participants to move slightly without exiting the video frame." *See* paras. [0027]-[0028].<br><br>"According to another exemplary embodiment, the best view frame 34 is defined by just subtracting a compensation value Zc from the calculated zoom factor Zfa, making the camera zoom out an additional distance. The compensation value Zc may be static, or vary linearly depending on the size of the first area zoom factor Zfa.<br><br>FIG. 7 schematically shows an exemplary video frame taken from an initial camera orientation. 3 faces have been detected in the video frame, and the image processing unit |

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| | 50 has defined a best view frame 34, and calculated the location (αfa,φfa) of the best view frame.<br><br>Most image pickup devices 6 for video conferencing systems operate with standard television image aspect ratios, e.g. 4:3 (1.33:1) or 16:9 (1.78:1). Since most calculated best view frames 34 as described above have aspect ratios that deviate from the standards, e.g. 4:3 or 16:9, some considerations must be made when deciding the zoom coordinate. Since Aφ is the shortest edge of area 34, if the camera zooms in to capture the exact height Aφ, large parts of the area will miss the light sensitive area (e.g. image sensor) in the camera because its aspect ratio is different than the defined area. If the camera zooms in to capture the exact width Aα of the defined area 34, no information is lost.<br><br>Therefore, according to one exemplary embodiment of the present invention, the two sides Aφ and Aα of the best view frame 34 are compared. Each of the two sides defines a zoom factor needed to fit the area of interest in the image frame, in the horizontal and vertical direction respectively. Thus, the degree of zoom is defined by the smallest of the two calculated zoom factors, ensuring that the area of interest is not cropped when zooming to the area of interest.<br><br>In step 100, the image processing unit 50 supplies the camera control unit 12 with the camera positioning directives (αfa,φfa,Z) (azimuth, elevation, zoom) derived in step 90, via control unit 45. Once the camera positioning directives are received, the camera moves and zooms to the instructed coordinates, to get the best view of the participants in the video conference. FIG. 8 shows the best view of participant 1 and 2 from meeting room 10a in FIG. 6." *See* paras. [0043]-[0047].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other |

| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| | invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | Enstad expressly and/or inherently discloses and/or renders obvious varying resolution of the image according to the distance. *See*, *e.g.*, disclosures below.<br><br>"The image pickup device (or camera) 6 includes a camera control unit 12 for positioning the image pickup device. The camera control unit 12 is the steering mechanism. In one embodiment, the steering mechanism includes motors, controlling the pan- and tilt-orientation and the degree of zoom of the image pickup device 6. In another embodiment, the steering mechanism (or control unit 12) is configured to implement digital tilt, digital pan and digital zoom (i.e., digital pan/tilt/zoom). Digital zoom may be accomplished by cropping an image down to a centered area with the same aspect ratio as the original, and interpolating the result back up to the pixel dimensions of the original. It is accomplished electronically, without any adjustment of the camera's optics. Digital pan and tilt may be accomplished by using the cropped image and adjusting a viewing area within the larger original image. Also, other techniques of digital pan/tilt/zoom known to those of ordinary skill in the art may be used. It is possible that a combination of digital steering (digital pan/tilt/zoom) and mechanical steering may be used. An example of a camera with digital pan/tilt/zoom capability is the Tandberg 1000 camera." *See* para. [0031].<br><br>"Referring to FIG. 4, according to one exemplary embodiment of the invention, the camera zooms out to its maximum field of view and moves to a predefined pan- and tilt-orientation 13, capturing as much as possible of the room 10 a and/or capturing the part of the room with the highest probability of finding meeting participants. The predefined pan- and tilt-orientation (or initial orientation) is typically manually entered into the system through a set-up function (e.g. move camera manually to an optimal initial position and then save position) or it is a default factory value." *See* para. [0034].<br><br>"Most image pickup devices 6 for video conferencing systems operate with standard television image aspect ratios, e.g. 4:3 (1.33:1) or 16:9 (1.78:1). Since most calculated |

| Asserted Claim of the '109 Patent | Exemplary Citations to Enstad |
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| | best view frames 34 as described above have aspect ratios that deviate from the standards, e.g. 4:3 or 16:9, some considerations must be made when deciding the zoom coordinate. Since Aφ is the shortest edge of area 34, if the camera zooms in to capture the exact height Aφ, large parts of the area will miss the light sensitive area (e.g. image sensor) in the camera because its aspect ratio is different than the defined area. If the camera zooms in to capture the exact width Aα of the defined area 34, no information is lost.<br><br>Therefore, according to one exemplary embodiment of the present invention, the two sides Aφ and Aα of the best view frame 34 are compared. Each of the two sides defines a zoom factor needed to fit the area of interest in the image frame, in the horizontal and vertical direction respectively. Thus, the degree of zoom is defined by the smallest of the two calculated zoom factors, ensuring that the area of interest is not cropped when zooming to the area of interest.<br><br>In step 100, the image processing unit 50 supplies the camera control unit 12 with the camera positioning directives (αfa,φfa,Z) (azimuth, elevation, zoom) derived in step 90, via control unit 45. Once the camera positioning directives are received, the camera moves and zooms to the instructed coordinates, to get the best view of the participants in the video conference. FIG. 8 shows the best view of participant 1 and 2 from meeting room 10 a in FIG. 6." *See* paras. [0045]-[0047].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Enstad alone; and/or (2) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

# Exhibit A-02: Invalidity of U.S. Patent No. 8,982,109 in view of *A Handheld Mirror Simulation*, Francois et al., ("Francois I")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

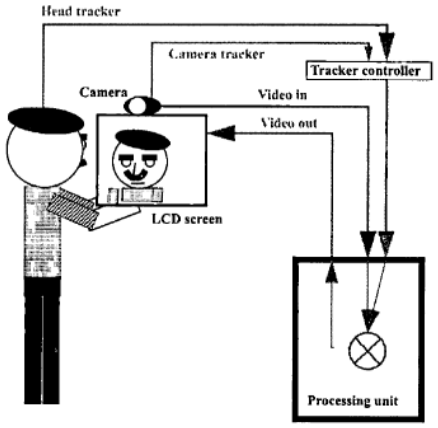
Francois I was at least published by 2003, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a) and (b).

Francois I anticipates the Asserted Claims of the '109 Patent. To the extent it is found Francois I does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Francois I does not anticipate the Asserted Claims, Francois I renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

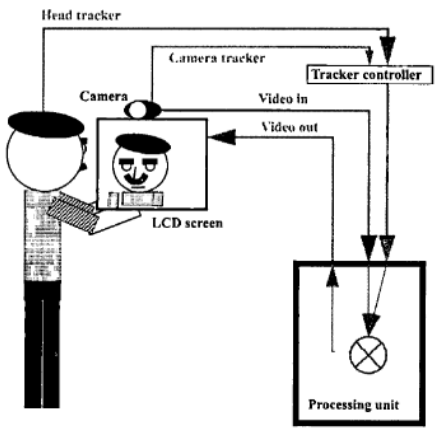
Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Francois I expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"We present the design and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in realtime. Our system is build [*sic*] around a LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Our system provides a generic interface for applications involving rich, first-person interaction, such as the Virtual Daguerreotype." *See* Abstract, page 745.<br><br>"We present the design and construction of a handheld mirror simulation device. Rather than attempting to solve the difficult vision problem of a general, exact mirror simution [*sic*], our focus is on the design and construction of a first person Human-Computer Interface (HCI) to be used in new interactive experiments and applications. While remaining simple, our first prototype must provide a better experience to the user than the traditional fixed camera / fixed display / horizontal image flip mirror setting. A major novelty in our approach is the hands-on aspect, which requires a more elaborate model to convincingly reproduce the interaction between the user and the mirror as an object. One important clue is the evolution of the user's field of view in the mirror as her position with respect to the mirror changes. Furthermore, our goal is to produce a working but extensible system, to serve as a platform for future enhancements to the HCI device subsystem itself, as well as to allow easy integration in applications |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| | Our system is composed of a handheld LCD screen manipulated by the user, a single camera fixed on the screen, and two 6 degrees of freedom trackers giving in real time the positions and orientations of the camera and the user's head. The major system components and their relations are illustrated in figure 1. The user sees on the screen what they would see on a real mirror.<br><br>The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* 1.INTRODUCTION, page 745.<br><br>  <br>**Figure 1. Handheld mirror simulation system.**<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| | the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | To the extent the preamble is limiting, Francois I expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below.<br><br>"We present the design and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in realtime. Our system is build [*sic*] around a LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Our system provides a generic interface for applications involving rich, first-person interaction, such as the Virtual Daguerreotype." *See* Abstract, page 745.<br><br>"We present the design and construction of a handheld mirror simulation device. Rather than attempting to solve the difficult vision problem of a general, exact mirror simution [*sic*], our focus is on the design and construction of a first person Human-Computer Interface (HCI) to be used in new interactive experiments and applications. While remaining simple, our first prototype must provide a better experience to the user than the traditional fixed camera / fixed display / horizontal image flip mirror setting. A major novelty in our approach is the hands-on aspect, which requires a more elaborate model to convincingly reproduce the interaction between the user and the mirror as an object. One important clue is the evolution of the user's field of view in the mirror as her position with respect to the mirror changes. Furthermore, our goal is to produce a working but |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| | extensible system, to serve as a platform for future enhancements to the HCI device subsystem itself, as well as to allow easy integration in applications<br><br>Our system is composed of a handheld LCD screen manipulated by the user, a single camera fixed on the screen, and two 6 degrees of freedom trackers giving in real time the positions and orientations of the camera and the user's head. The major system components and their relations are illustrated in figure 1. The user sees on the screen what they would see on a real mirror.<br><br>The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* 1.INTRODUCTION, page 745. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| |  <br>**Figure 1. Handheld mirror simulation system.**<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Francois I expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. *See*, *e.g.*, disclosures below.<br><br>"We present the design and construction of a handheld mirror simulation device. Rather than attempting to solve the difficult vision problem of a general, exact mirror simution [*sic*], our focus is on the design and construction of a first person Human-Computer Interface (HCI) to be used in new interactive experiments and applications. While remaining simple, our first prototype must provide a better experience to the user than the traditional fixed camera / fixed display / horizontal image flip mirror setting. A major novelty in our approach is the hands-on aspect, which requires a more elaborate model |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
|---|---|
| | to convincingly reproduce the interaction between the user and the mirror as an object. One important clue is the evolution of the user's field of view in the mirror as her position with respect to the mirror changes. Furthermore, our goal is to produce a working but extensible system, to serve as a platform for future enhancements to the HCI device subsystem itself, as well as to allow easy integration in applications" *See* 1.INTRODUCTION, page 745.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Francois I expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror . *See*, *e.g.*, disclosures below.<br><br>"This paper is organized as follows. In section 2, we outline the geometric analysis of mirror and camera imaging, leading to the image transform for mirror simulation, based on the flat world assumption. In section 3, we briefly explain the software and hardware design of our prototype. In section 4, we relate our work to other mirror experiments, and to upcoming applications. Finally, we conclude the paper in section 5." *See* 1.INTRODUCTION, page 745.<br><br>"In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically, i.e. express $x_p$ and $y_p$ in terms of $x'_p$ and $y'_p$. |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Francois I |
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$$\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix}$$

The mirror projection equations become:

$$\begin{bmatrix} U_p \\ V_p \\ W_p \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1/d & t_z/d \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} \qquad \begin{aligned} x_p &= d(x' + t_x)/(z' + t_z) \\ y_p &= d(y' + t_y)/(z' + t_z) \end{aligned}$$

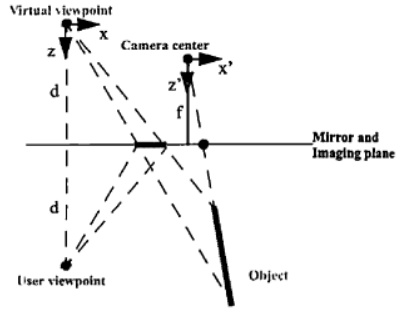
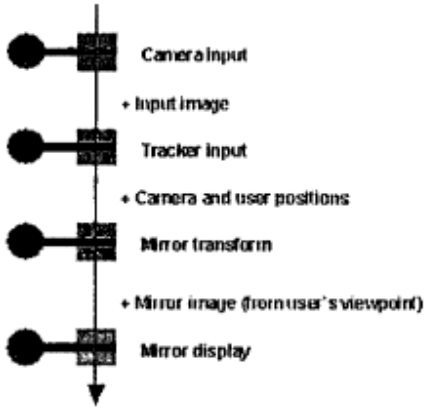



**Figure 4. An underconstrained problem.**

Express xp and yp in terms of x’p and /p thus requires to recover the actual 3-D position of each point from its image projection. This is obviously an underconstrained problem, as an image pixel might potentially be the projection of any world point on a ray passing through the camera center and the pixel, as illustrated in figure 4. Various computer vision techniques could be used to attempt to recover the 3-13 geometry of the world from images in some cases. Another solution would be to use a 3-D model of the environment, if available. For our first prototype, we followed a simpler approximate approach. Since we are designing our mirror as a first person interaction tool, we assume that the center of interest is the user himself, and that the background is of lesser

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| | importance. We thus model the world as a plane parallel to the mirror/imaging plane, at the same distance as the user's viewpoint (see figure 5).<br><br>The $z'$ component of each world point is thus fixed to $z' = f + d$ in the camera centered coordinate system. We can now inverse the camera projection equations:<br><br>$x'_p = fx'/(f+d) \Leftrightarrow x' = (f+d)x'_p/f$<br>$y'_p = fy'/(f+d) \Leftrightarrow y' = (f+d)y'_p/f$<br><br>The transformation equations that relate the user's view to the camera image are thus:<br><br>$x_p = d((f+d)x'_p/f + t_x)/((f+d) + t_z)$<br>$y_p = d((f+d)y'_p/f + t_y)/((f+d) + t_z)$<br><br>The only parameters are f, d and [txtytz]. The theoretical focal length of the camera can be obtained by various calibration methods. The positions and orientations of the user's viewpoint and the camera center provided by the tracking devices, allow to compute both the distance d and the change of referential translation parameters. Note that under our assumptions, the transform relating the user's view to the camera view is reduced to a scaling and a translation. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, while remaining a reasonable approximation for a large class of applications. The major field-of-view variations occuring when varying the angle of view and the distance to the mirror, are convincingly simulated. |

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| |  <br>**Figure 6. Mirror simulation application graph.**<br><br>*See* 2.3 User view synthesis, pages 746-47.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Francois I expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera. *See*, *e.g.*, disclosures below.<br><br>"Our system provides a fundamental platform for other realtime interactive applications. Digital image processing modules can easily be added to the system in order to simulate various mirror deformations, such as magnifying, concave and convex mirrors (see |

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| | figure 8). Note that the deformation parameters can also be dynamic." *See* 4.RELATED WORK AND APPLICATIONS, page 748.<br><br>"This paper is organized as follows. In section 2, we outline the geometric analysis of mirror and camera imaging, leading to the image transform for mirror simulation, based on the flat world assumption. In section 3, we briefly explain the software and hard1ware design of our prototype. In section 4, we relate our work to other mirror experiments, and to upcoming applications. Finally, we conclude the paper in section 5." *See* 1.INTRODUCTION, page 745.<br><br>"In order to synthesize the images corresponding to the user's view1point from the images captured by the camera, we must relate them geometrically, i.e. express $x_p$ and $y_p$ in terms of $x'_p$ and $y'_p$. |

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$$\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix}$$

The mirror projection equations become:

$$\begin{bmatrix} U_p \\ V_p \\ W_p \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1/d & t_z/d \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} \qquad \begin{aligned} x_p &= d(x' + t_x)/(z' + t_z) \\ y_p &= d(y' + t_y)/(z' + t_z) \end{aligned}$$

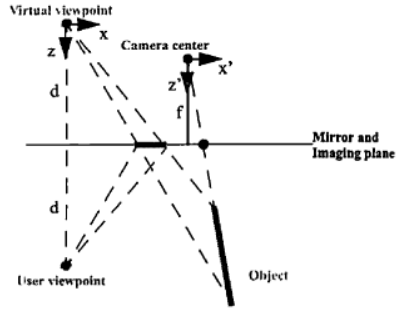
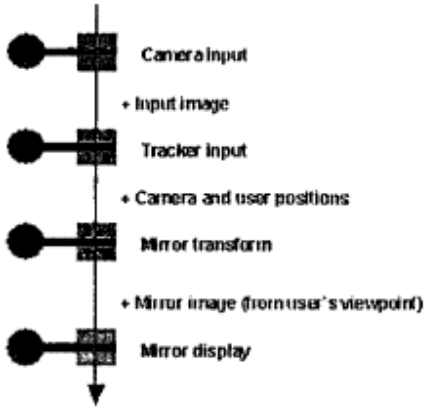


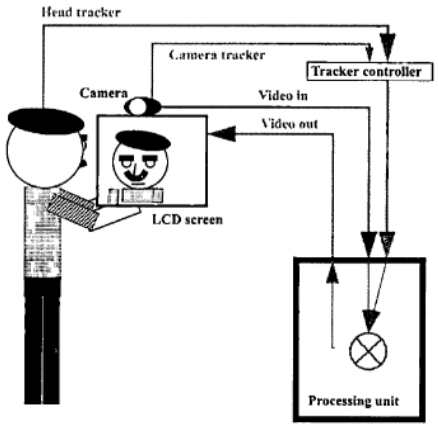

**Figure 4. An underconstrained problem.**

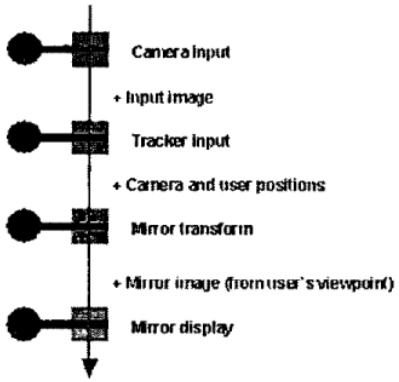
Express xp and yp in terms of x’p and /p thus requires to recover the actual 3-D position of each point from its image projection. This is obviously an underconstrained problem, as an image pixel might potentially be the projection of any world point on a ray passing through the camera center and the pixel, as illustrated in figure 4. Various computer vision techniques could be used to attempt to recover the 3-13 geometry of the world from images in some cases. Another solution would be to use a 3-D model of the environment, if available. For our first prototype, we followed a simpler approximate approach. Since we are designing our mirror as a first person interaction tool, we assume that the center of interest is the user himself, and that the background is of lesser

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| | importance. We thus model the world as a plane parallel to the mirror/imaging plane, at the same distance as the user's viewpoint (see figure 5).<br><br>The $z'$ component of each world point is thus fixed to $z' = f + d$ in the camera centered coordinate system. We can now inverse the camera projection equations:<br><br>$x'_p = fx'/(f+d) \Leftrightarrow x' = (f+d)x'_p/f$<br>$y'_p = fy'/(f+d) \Leftrightarrow y' = (f+d)y'_p/f$<br><br>The transformation equations that relate the user's view to the camera image are thus:<br><br>$x_p = d((f+d)x'_p/f + t_x)/((f+d) + t_z)$<br>$y_p = d((f+d)y'_p/f + t_y)/((f+d) + t_z)$<br><br>The only parameters are f, d and [txtytz]. The theoretical focal length of the camera can be obtained by various calibration methods. The positions and orientations of the user's viewpoint and the camera center provided by the tracking devices, allow to compute both the distance d and the change of referential translation parameters. Note that under our assumptions, the transform relating the user's view to the camera view is reduced to a scaling and a translation. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, while remaining a reasonable approximation for a large class of applications. The major field-of-view variations occuring when varying the angle of view and the distance to the mirror, are convincingly simulated. |

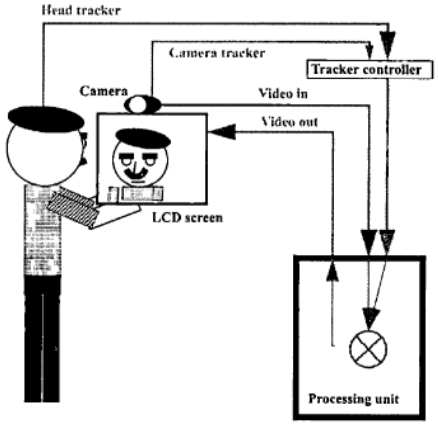
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| |  <br>**Figure 6. Mirror simulation application graph.**<br><br>*See* 2.3 User view synthesis, pages 746-47.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | To the extent the preamble is limiting, Francois I expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below.<br><br>"We present the design and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's |

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| | position, must be synthesized and displayed in realtime. Our system is build [*sic*] around a LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Our system provides a generic interface for applications involving rich, first-person interaction, such as the Virtual Daguerreotype." *See* Abstract, page 745.<br><br>"We present the design and construction of a handheld mirror simulation device. Rather than attempting to solve the difficult vision problem of a general, exact mirror simution [*sic*], our focus is on the design and construction of a first person Human-Computer Interface (HCI) to be used in new interactive experiments and applications. While remaining simple, our first prototype must provide a better experience to the user than the traditional fixed camera / fixed display / horizontal image flip mirror setting. A major novelty in our approach is the hands-on aspect, which requires a more elaborate model to convincingly reproduce the interaction between the user and the mirror as an object. One important clue is the evolution of the user's field of view in the mirror as her position with respect to the mirror changes. Furthermore, our goal is to produce a working but extensible system, to serve as a platform for future enhancements to the HCI device subsystem itself, as well as to allow easy integration in applications<br><br>Our system is composed of a handheld LCD screen manipulated by the user, a single camera fixed on the screen, and two 6 degrees of freedom trackers giving in real time the positions and orientations of the camera and the user's head. The major system components and their relations are illustrated in figure 1. The user sees on the screen what they would see on a real mirror.<br><br>The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream |

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| | displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* 1.INTRODUCTION, page 745.<br>  <br><br>**Figure 1. Handheld mirror simulation system.**<br><br>"The application graph for the mirror simulation is presented in figure 6. Generic modules such as video capture and display were already available. Note that thanks to the modularity of the framework, any processing can be carried on the images before or after the mirror transform.<br><br>The prototype system is composed of a handheld 10" LCD screen fitted with a camera and a magnetic tracker sensor (see figure 7), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the mirror image stream and display it in real-time on the LCD screen. The result is a convincing handheld mirror simulation, in spite of the inherent limitations of our mirror transform model." *See* 3.SYSTEM INTEGRATION, page 747. |

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| |  <br>**Figure 6. Mirror simulation application graph.**<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | To the extent the preamble is limiting, Francois I expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"We present the design and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in realtime. Our system is build [*sic*] around a LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real- |

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| | time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Our system provides a generic interface for applications involving rich, first-person interaction, such as the Virtual Daguerreotype." *See* Abstract, page 745.<br><br>"We present the design and construction of a handheld mirror simulation device. Rather than attempting to solve the difficult vision problem of a general, exact mirror simution [*sic*], our focus is on the design and construction of a first person Human-Computer Interface (HCI) to be used in new interactive experiments and applications. While remaining simple, our first prototype must provide a better experience to the user than the traditional fixed camera / fixed display / horizontal image flip mirror setting. A major novelty in our approach is the hands-on aspect, which requires a more elaborate model to convincingly reproduce the interaction between the user and the mirror as an object. One important clue is the evolution of the user's field of view in the mirror as her position with respect to the mirror changes. Furthermore, our goal is to produce a working but extensible system, to serve as a platform for future enhancements to the HCI device subsystem itself, as well as to allow easy integration in applications<br><br>Our system is composed of a handheld LCD screen manipulated by the user, a single camera fixed on the screen, and two 6 degrees of freedom trackers giving in real time the positions and orientations of the camera and the user's head. The major system components and their relations are illustrated in figure 1. The user sees on the screen what they would see on a real mirror.<br><br>The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of |

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| | what the user would see on the screen surface if it were a real mirror." *See* 1.INTRODUCTION, page 745.<br>  <br><br>**Figure 1. Handheld mirror simulation system.**<br><br>"A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint." *See* 2.2 Pinhole camera geometry, page 746.<br><br>"The application graph for the mirror simulation is presented in figure 6. Generic modules such as video capture and display were already available. Note that thanks to the modularity of the framework, any processing can be carried on the images before or after the mirror transform." *See* 3.SYSTEM INTEGRATION, page 747.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| 1[g]. determining distance to a user appearing in the live video feed; and | Francois I expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video feed. *See*, *e.g.*, disclosures below.<br><br>"This paper is organized as follows. In section 2, we outline the geometric analysis of mirror and camera imaging, leading to the image transform for mirror simulation, based on the flat world assumption. In section 3, we briefly explain the software and hard1ware design of our prototype. In section 4, we relate our work to other mirror experiments, and to upcoming applications. Finally, we conclude the paper in section 5." *See* 1.INTRODUCTION, page 745.<br><br>"In order to synthesize the images corresponding to the user's view1point from the images captured by the camera, we must relate them geometrically, i.e. express $x_p$ and $y_p$ in terms of $x'_p$ and $y'_p$. |

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$$\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix}$$

The mirror projection equations become:

$$\begin{bmatrix} U_p \\ V_p \\ W_p \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1/d & t_z/d \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} \qquad \begin{aligned} x_p &= d(x' + t_x)/(z' + t_z) \\ y_p &= d(y' + t_y)/(z' + t_z) \end{aligned}$$

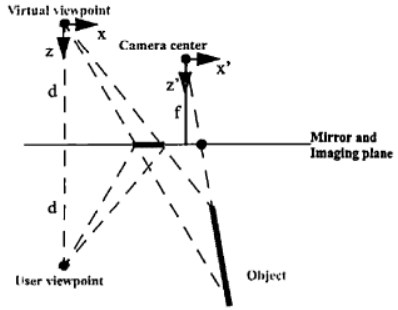
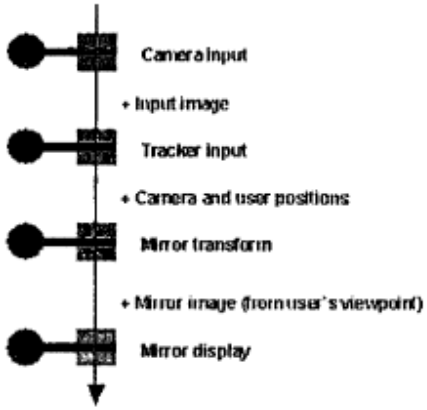



**Figure 4. An underconstrained problem.**

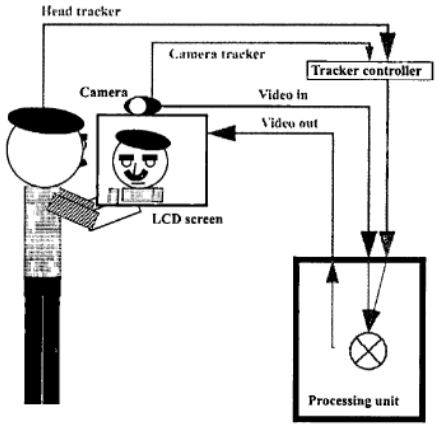
Express xp and yp in terms of x’p and /p thus requires to recover the actual 3-D position of each point from its image projection. This is obviously an underconstrained problem, as an image pixel might potentially be the projection of any world point on a ray passing through the camera center and the pixel, as illustrated in figure 4. Various computer vision techniques could be used to attempt to recover the 3-13 geometry of the world from images in some cases. Another solution would be to use a 3-D model of the environment, if available. For our first prototype, we followed a simpler approximate approach. Since we are designing our mirror as a first person interaction tool, we assume that the center of interest is the user himself, and that the background is of lesser

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| | importance. We thus model the world as a plane parallel to the mirror/imaging plane, at the same distance as the user's viewpoint (see figure 5).<br><br>The $z'$ component of each world point is thus fixed to $z' = f + d$ in the camera centered coordinate system. We can now inverse the camera projection equations:<br><br>$x'_p = fx'/(f+d) \Leftrightarrow x' = (f+d)x'_p/f$<br>$y'_p = fy'/(f+d) \Leftrightarrow y' = (f+d)y'_p/f$<br><br>The transformation equations that relate the user's view to the camera image are thus:<br><br>$x_p = d((f+d)x'_p/f + t_x)/((f+d) + t_z)$<br>$y_p = d((f+d)y'_p/f + t_y)/((f+d) + t_z)$<br><br>The only parameters are f, d and [txtytz]. The theoretical focal length of the camera can be obtained by various calibration methods. The positions and orientations of the user's viewpoint and the camera center provided by the tracking devices, allow to compute both the distance d and the change of referential translation parameters. Note that under our assumptions, the transform relating the user's view to the camera view is reduced to a scaling and a translation. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, while remaining a reasonable approximation for a large class of applications. The major field-of-view variations occuring when varying the angle of view and the distance to the mirror, are convincingly simulated. |

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| |  <br>**Figure 6. Mirror simulation application graph.**<br><br>*See* 2.3 User view synthesis, pages 746-47.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Francois I inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | To the extent the preamble is limiting, Francois I expressly and/or inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. *See*, *e.g.*, disclosures below.<br><br>“When a person looks into a planar mirror, they see what they would see from the symmetrical (virtual) point of view (see figure 2). Assimilating image formation by the eye to a perspective projection, the image perceived by the viewer on the mirror surface is a perspective projection on the mirror plane with respect to the virtual viewpoint. A point of homogenous coordinates [xyz1] m an orthonormal coordinate system centered on the virtual viewpoint (symmetrical of the user viewpoint with respect to the mirror plane) with the z direction normal to the mirror, is seen on the mirror surface at its projected location [xpypd], where d is the orthogonal distance of the viewpoint to the mirror plane, and<br><br>$\begin{bmatrix} U_p \\ V_p \\ W_p \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1/d & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$ $x_p = U_p / W_p = dx/z$ $y_p = V_p / W_p = dy/z$<br><br>The image perceived on the mirror depends only on the position of the user with respect to the mirror, and the field of view covered by the mirror depends only on the position of the user with respect to the mirror edges. In particular, the image perceived on the mirror remains "fixed" when the viewing direction changes while the viewpoint remains fixed.” *See* 2.GEOMETRIC ANALYSIS, pages 745-46.<br><br>“We present the design and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer’s position with |

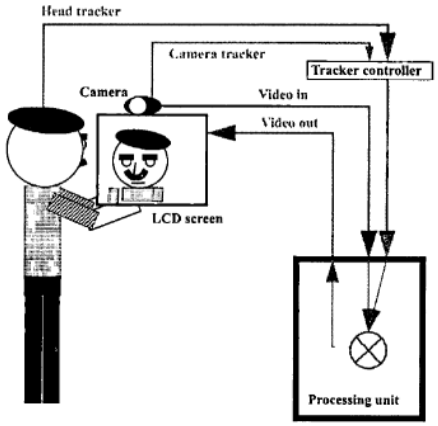
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| | respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in realtime. Our system is build [*sic*] around a LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Our system provides a generic interface for applications involving rich, first-person interaction, such as the Virtual Daguerreotype." *See* Abstract, page 745.<br><br>"We present the design and construction of a handheld mirror simulation device. Rather than attempting to solve the difficult vision problem of a general, exact mirror simution [*sic*], our focus is on the design and construction of a first person Human-Computer Interface (HCI) to be used in new interactive experiments and applications. While remaining simple, our first prototype must provide a better experience to the user than the traditional fixed camera / fixed display / horizontal image flip mirror setting. A major novelty in our approach is the hands-on aspect, which requires a more elaborate model to convincingly reproduce the interaction between the user and the mirror as an object. One important clue is the evolution of the user's field of view in the mirror as her position with respect to the mirror changes. Furthermore, our goal is to produce a working but extensible system, to serve as a platform for future enhancements to the HCI device subsystem itself, as well as to allow easy integration in applications<br><br>Our system is composed of a handheld LCD screen manipulated by the user, a single camera fixed on the screen, and two 6 degrees of freedom trackers giving in real time the positions and orientations of the camera and the user's head. The major system components and their relations are illustrated in figure 1. The user sees on the screen what they would see on a real mirror.<br><br>The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's |

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| | position, must be synthesized and displayed in real-time. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* 1.INTRODUCTION, page 745.<br><br>  <br><br>**Figure 1. Handheld mirror simulation system.**<br><br>"We have presented a handheld mirror interface system. The system is designed to be a platform that will be used in many interactive applications. In particular, the use of the Modular Flow Scheduling Middleware as the software architecture ensures efficiency and extensibility through multithreading and modularity.<br><br>Adopting the simplifying pinhole camera and flat world models, we have shown that the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a reasonable approximation in a large class of applications. Beyond the inherent inability of the model to account for |

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| | depth in the scene, a major limitation is the impossibility to simulate eye contact. This is due to the physical separation between the capture device (camera) and the visualization device (screen). More elaborate modeling and processing is required to achieve this effect, e.g. with head modeling, tracking and synthesis" *See* 5.CONCLUSION, page 748.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

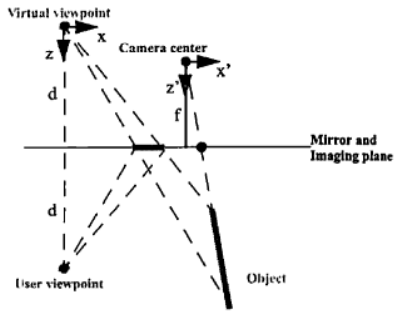
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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Francois I expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[a]. obtaining a reference image; | To the extent the preamble is limiting, Francois I expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below.<br><br>"We present the design and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with |

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| | respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in realtime. Our system is build [*sic*] around a LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Our system provides a generic interface for applications involving rich, first-person interaction, such as the Virtual Daguerreotype." *See* Abstract, page 745.<br><br>"We present the design and construction of a handheld mirror simulation device. Rather than attempting to solve the difficult vision problem of a general, exact mirror simution [*sic*], our focus is on the design and construction of a first person Human-Computer Interface (HCI) to be used in new interactive experiments and applications. While remaining simple, our first prototype must provide a better experience to the user than the traditional fixed camera / fixed display / horizontal image flip mirror setting. A major novelty in our approach is the hands-on aspect, which requires a more elaborate model to convincingly reproduce the interaction between the user and the mirror as an object. One important clue is the evolution of the user's field of view in the mirror as her position with respect to the mirror changes. Furthermore, our goal is to produce a working but extensible system, to serve as a platform for future enhancements to the HCI device subsystem itself, as well as to allow easy integration in applications<br><br>Our system is composed of a handheld LCD screen manipulated by the user, a single camera fixed on the screen, and two 6 degrees of freedom trackers giving in real time the positions and orientations of the camera and the user's head. The major system components and their relations are illustrated in figure 1. The user sees on the screen what they would see on a real mirror.<br><br>The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's |

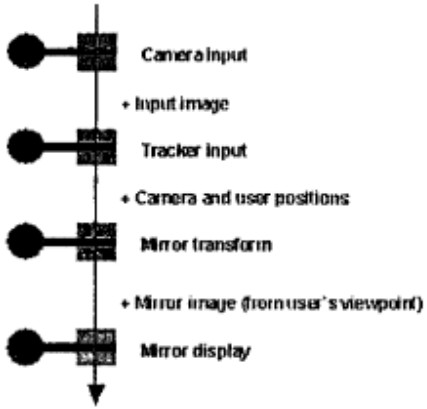
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| | position, must be synthesized and displayed in real-time. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* 1.INTRODUCTION, page 745.<br><br>  <br><br>**Figure 1. Handheld mirror simulation system.**<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Francois I expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"Various computer vision techniques could be used to attempt to recover the 3-13 geometry of the world from images in some cases. Another solution would be to use a |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| | 3-D model of the environment, if available. For our first prototype, we followed a simpler approximate approach." *See* 2.3 User view synthesis, page 747.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Francois I expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping . *See*, *e.g.*, disclosures below.<br><br>"Various computer vision techniques could be used to attempt to recover the 3-13 geometry of the world from images in some cases. Another solution would be to use a 3-D model of the environment, if available. For our first prototype, we followed a simpler approximate approach." *See* 2.3 User view synthesis, page 747.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 8** | |

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| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Francois I expressly and/or inherently discloses and/or renders obvious applying a translation transformation to move the image within display area of the monitor. *See*, *e.g.*, disclosures below.<br><br>"In order to synthesize the images corresponding to the user's view1point from the images captured by the camera, we must relate them geometrically, i.e. express $x_p$ and $y_p$ in terms of $x'_p$ and $y'_p$.<br><br>$$\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix}$$<br>The mirror projection equations become:<br>$$\begin{bmatrix} U_p \\ V_p \\ W_p \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1/d & t_z/d \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} \quad x_p = d(x' + t_x)/(z' + t_z) \quad y_p = d(y' + t_y)/(z' + t_z)$$<br>  <br><br>**Figure 4. An underconstrained problem.**<br><br>Express xp and yp in terms of x'p and /p thus requires to recover the actual 3-D position of each point from its image projection. This is obviously an underconstrained problem, |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| | as an image pixel might potentially be the projection of any world point on a ray passing through the camera center and the pixel, as illustrated in figure 4. Various computer vision techniques could be used to attempt to recover the 3-13 geometry of the world from images in some cases. Another solution would be to use a 3-D model of the environment, if available. For our first prototype, we followed a simpler approximate approach. Since we are designing our mirror as a first person interaction tool, we assume that the center of interest is the user himself, and that the background is of lesser importance. We thus model the world as a plane parallel to the mirror/imaging plane, at the same distance as the user's viewpoint (see figure 5).<br><br>The $z'$ component of each world point is thus fixed to $z' = f + d$ in the camera centered coordinate system. We can now inverse the camera projection equations:<br><br>$$x'_p = fx'/(f+d) \Leftrightarrow x' = (f+d)x'_p/f$$<br>$$y'_p = fy'/(f+d) \Leftrightarrow y' = (f+d)y'_p/f$$<br><br>The transformation equations that relate the user's view to the camera image are thus:<br><br>$$x_p = d((f+d)x'_p/f + t_x)/((f+d) + t_z)$$<br>$$y_p = d((f+d)y'_p/f + t_y)/((f+d) + t_z)$$<br><br>The only parameters are f, d and [txtytz]. The theoretical focal length of the camera can be obtained by various calibration methods. The positions and orientations of the user's viewpoint and the camera center provided by the tracking devices, allow to compute both the distance d and the change of referential translation parameters. Note that under our assumptions, the transform relating the user's view to the camera view is reduced to a scaling and a translation. This model provides a straightforward and efficient way of |

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| | synthesizing the viewer's image stream from the camera stream, while remaining a reasonable approximation for a large class of applications. The major field-of-view variations occuring when varying the angle of view and the distance to the mirror, are convincingly simulated.<br><br>  <br><br>**Figure 6. Mirror simulation application graph.**<br><br>*See* 2.3 User view synthesis, pages 746-47.<br><br>"Adopting the simplifying pinhole camera and flat world models, we have shown that the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a reasonable approximation in a large class of applications. Beyond the inherent inability of the model to account for depth in the scene, a major limitation is the impossibility to simulate eye contact. This is due to the physical separation between the capture device (camera) and the visualization device (screen). More elaborate modeling and processing is required to achieve this |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| | effect, e.g. with head modeling, tracking and synthesis." *See* 5.CONCLUSION, page 748.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Francois I expressly and/or inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Francois I expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below. |

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| | *See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | Francois I expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*:<br><br>"This paper is organized as follows. In section 2, we outline the geometric analysis of mirror and camera imaging, leading to the image transform for mirror simulation, based on the flat world assumption. In section 3, we briefly explain the software and hard1ware design of our prototype. In section 4, we relate our work to other mirror experiments, and to upcoming applications. Finally, we conclude the paper in section 5." *See* 1.INTRODUCTION, page 745.<br><br>"In order to synthesize the images corresponding to the user's view1point from the images captured by the camera, we must relate them geometrically, i.e. express $x_p$ and $y_p$ in terms of $x'_p$ and $y'_p$. |

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$$\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix}$$

The mirror projection equations become:

$$\begin{bmatrix} U_p \\ V_p \\ W_p \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1/d & t_z/d \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} \qquad \begin{aligned} x_p &= d(x' + t_x)/(z' + t_z) \\ y_p &= d(y' + t_y)/(z' + t_z) \end{aligned}$$

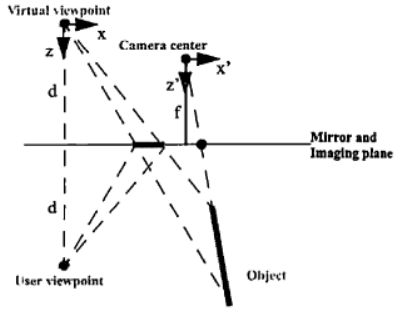
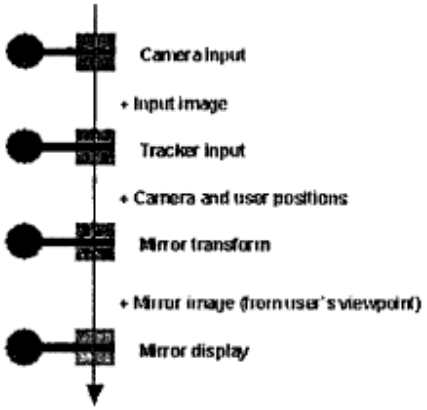



**Figure 4. An underconstrained problem.**

Express xp and yp in terms of x’p and /p thus requires to recover the actual 3-D position of each point from its image projection. This is obviously an underconstrained problem, as an image pixel might potentially be the projection of any world point on a ray passing through the camera center and the pixel, as illustrated in figure 4. Various computer vision techniques could be used to attempt to recover the 3-13 geometry of the world from images in some cases. Another solution would be to use a 3-D model of the environment, if available. For our first prototype, we followed a simpler approximate approach. Since we are designing our mirror as a first person interaction tool, we assume that the center of interest is the user himself, and that the background is of lesser

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| | importance. We thus model the world as a plane parallel to the mirror/imaging plane, at the same distance as the user's viewpoint (see figure 5).<br><br>The $z'$ component of each world point is thus fixed to $z' = f + d$ in the camera centered coordinate system. We can now inverse the camera projection equations:<br><br>$x'_p = fx'/(f+d) \Leftrightarrow x' = (f+d)x'_p/f$<br>$y'_p = fy'/(f+d) \Leftrightarrow y' = (f+d)y'_p/f$<br><br>The transformation equations that relate the user's view to the camera image are thus:<br><br>$x_p = d((f+d)x'_p/f + t_x)/((f+d) + t_z)$<br>$y_p = d((f+d)y'_p/f + t_y)/((f+d) + t_z)$<br><br>The only parameters are f, d and [txtytz]. The theoretical focal length of the camera can be obtained by various calibration methods. The positions and orientations of the user's viewpoint and the camera center provided by the tracking devices, allow to compute both the distance d and the change of referential translation parameters. Note that under our assumptions, the transform relating the user's view to the camera view is reduced to a scaling and a translation. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, while remaining a reasonable approximation for a large class of applications. The major field-of-view variations occuring when varying the angle of view and the distance to the mirror, are convincingly simulated. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois I |
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| |  <br>**Figure 6. Mirror simulation application graph.**<br><br>*See* 2.3 User view synthesis, pages 746-47.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | Francois I inherently discloses and/or renders obvious this limitation. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

# Exhibit A-03: Invalidity of U.S. Patent No. 8,982,109 in view of *A Handheld Virtual Mirror*, Francois et al.; *A Handheld Mirror Simulation*, Francois et al.; *Mirror symmetry -> 2-view stereo geometry*, Francois et al.; *Software Architecture for Computer Vision: Beyond Pipes and Filters*, Francois; *Software Architecture for Immersipresence*, Francois; *An Architectural Framework for the Design, Analysis and Implementation of Interactive Systems*, Francois (collectively "Francois II")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. The technical publications listed below (collectively "Francois II") are each available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a) and (b) as indicated by the publication dates below.

- *A Handheld Mirror Simulation*, Francois et al., ("Francois I")(2003);
- Integrated Media Systems Center, Alexandre R.J. Francois et al., *A Handheld Virtual Mirror* (2002);
- Image and Vision Computing 21, 137–143, Alexandre R.J. Francois et al., *Mirror symmetry -> 2-view stereo geometry* (2003);
- Institute for Robotics and Intelligent Systems, Alexandre R.J. Francois, *Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003);
- Integrated Media Systems Center, Alexandre R.J. Francois, *Software Architecture for Immersipresence* (2003);
- The Computer Journal, Vol. 54 No. 7, Alexandre R.J. Francois, *An Architectural Framework for the Design, Analysis and Implementation of Interactive Systems* (2010).

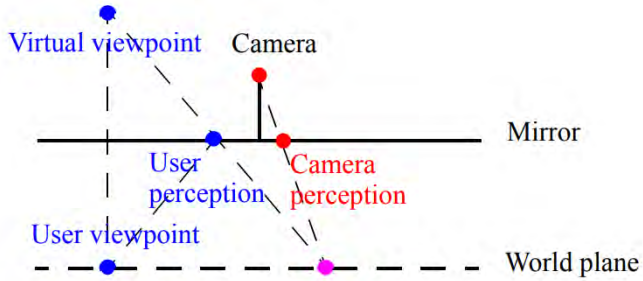
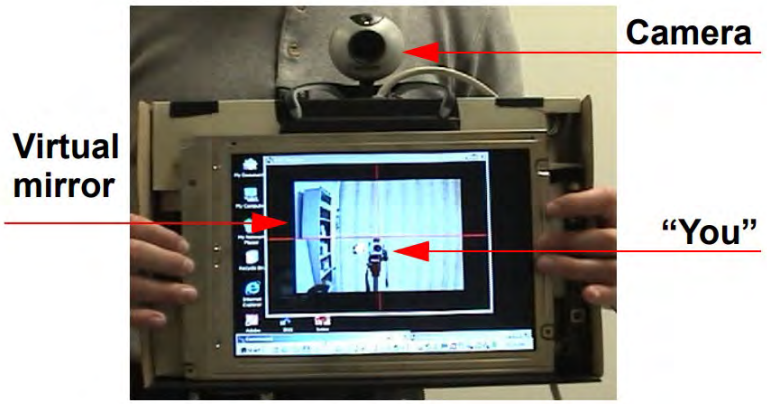
Francois II, alone or with other references, renders the Asserted Claims of the '109 Patent obvious. To the extent it is found Francois II does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Francois II does not disclose a limitation in the Asserted Claims, Francois II renders obvious the limitation, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art. Further, this chart herein incorporates by reference and in its entirety the chart for *A Handheld Mirror Simulation*, Francois et al., ("Francois I") (Exhibit A-02) for the '109 Patent.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

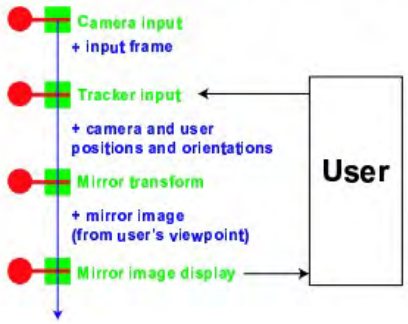
| **Asserted Claim of the '109 Patent** | **Exemplary Citations to Francois II** |
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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Francois II |
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| | by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the camera axis.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>“We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>“The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person looking in a mirror.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives. |

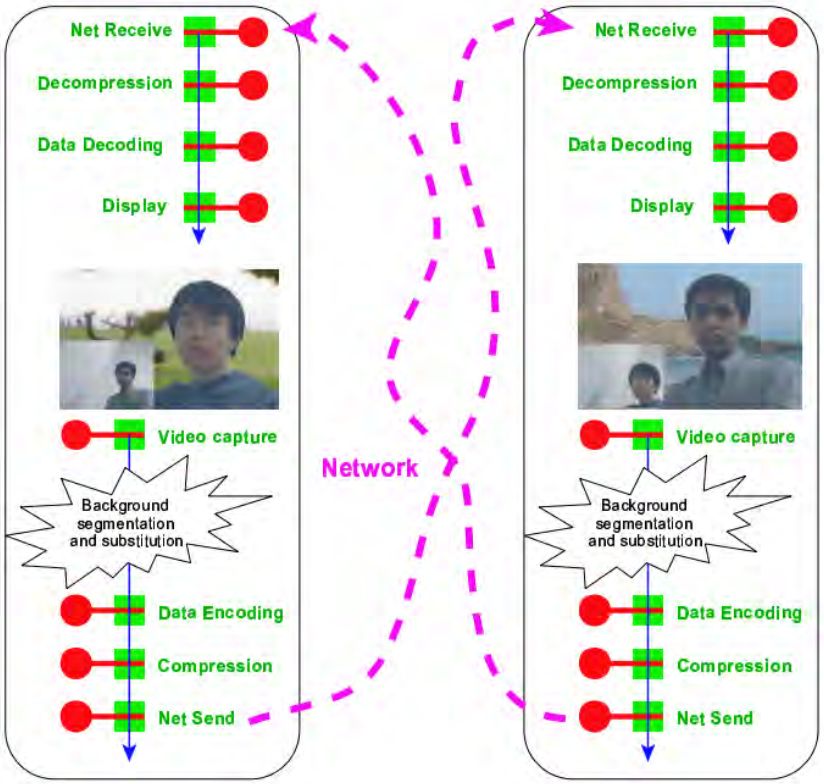
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| | *See A Handheld Virtual Mirror* (2002), at Figure 1:<br>  <br><br>Figure 1. Basic mirror geometry.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 2:<br>  <br><br>Figure 2. Handheld virtual mirror device. |

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| | "This document highlights and addresses architecture level software development issues facing researchers and practitioners in the field of Computer Vision. A new framework, or architectural style, called SAI, is introduced. It provides a formalism for the design, implementation and analysis of software systems that perform distributed parallel processing of generic data streams. Architectural patterns are illustrated with a number of demonstration projects ranging from single stream automatic real-time video processing to fully integrated distributed interactive systems mixing live video, graphics and sound. SAI is supported by an open source architectural middleware called MFSM." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract).<br><br>"4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model |

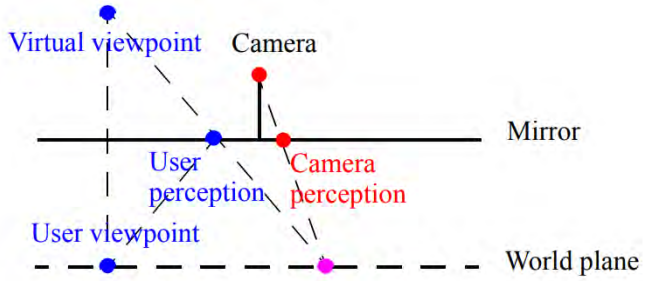
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| | makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications of such a device, the use of video analysis and graphics techniques will allow artists to explore |

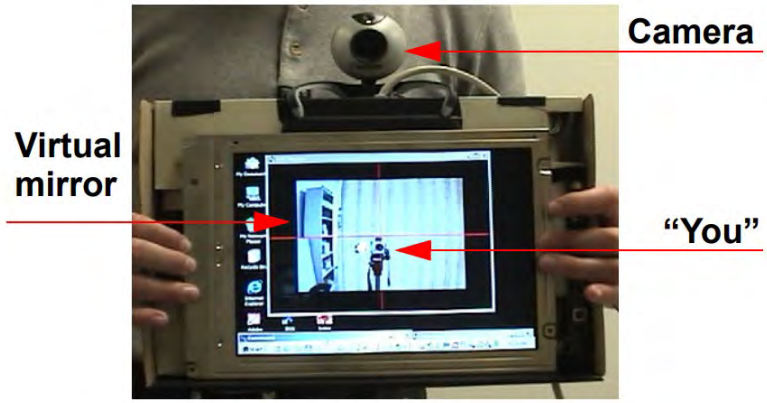
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| | and interfere with what has always been a private, solitary act, a person looking into a mirror." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13:<br><br>  <br><br>Figure 12: The handheld mirror simulation system ("Virtual Mirror").<br><br>  <br><br>Figure 13: The Virtual Mirror application graph. |

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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of heterogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois II |
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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below.<br><br>"In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>"The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>"The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person |

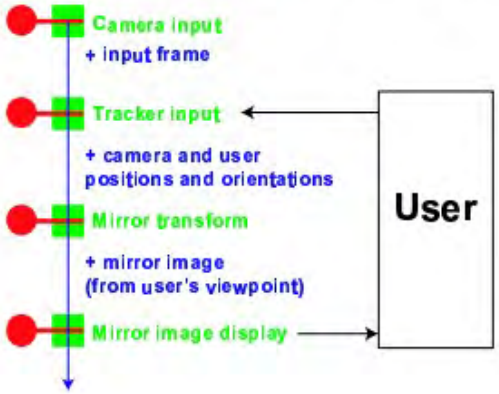
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| | looking in a mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1:<br><br>  <br><br>Figure 1. Basic mirror geometry.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 2: |

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| |  <br>Figure 2. Handheld virtual mirror device.<br><br>"We address the problem of 3D reconstruction from a single perspective view of a mirror symmetric scene. We establish the fundamental result that it is geometrically equivalent to observing the scene with two cameras, the cameras being symmetrical with respect to the unknown 3D symmetry plane. All traditional tools of classical 2-view stereo can then be applied, and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. However, the problems are greatly simplified here, as the rectification process and the computation of epipolar geometry can be easily performed from the original view only. If the camera is calibrated, we show how to synthesize the symmetric image generated by the same physical camera. A Euclidean reconstruction of the scene can then be computed from the resulting stereo pair. To validate this novel formulation, we have processed many real images, and show examples of 3D reconstruction. q 2003 Elsevier Science B.V. All rights reserved." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract). |

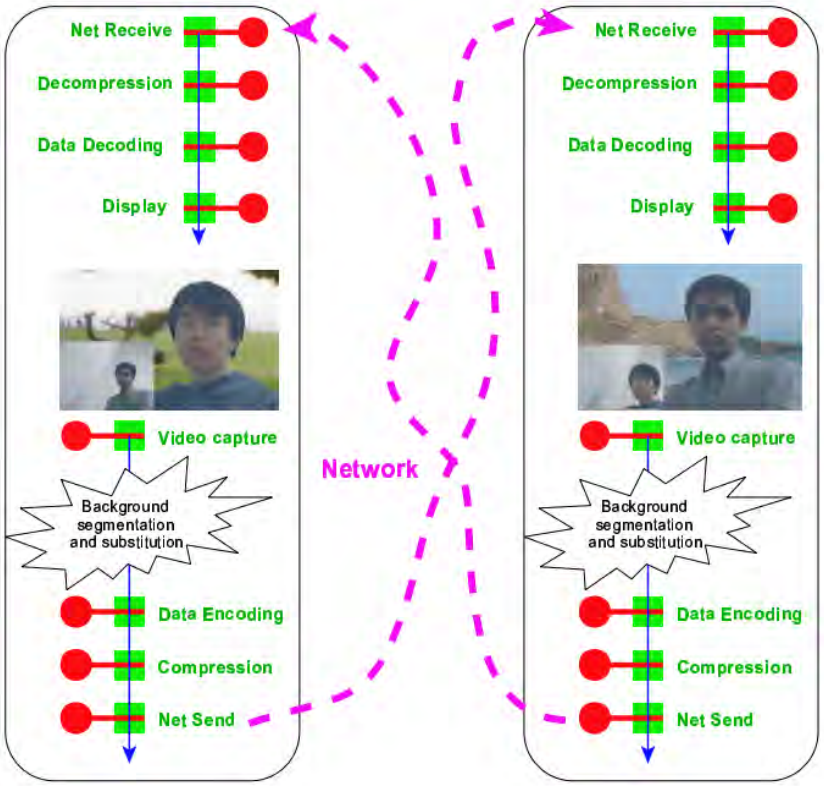
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| | "Theorem. One perspective view of a mirror symmetric scene, taken with an arbitrary projective camera, is geometrically equivalent to two perspective views of the scene from two projective cameras symmetrical with respect to the unknown 3D symmetry plane.<br><br>We show how to extract the epipolar geometry relating the two views from the single input image. Classical 2-view stereo results can then be applied (see e.g. Refs. [1,4]), and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. If the camera is calibrated, we show how to synthesize the image generated by the original camera placed symmetrically, in order to be able to use traditional 2-view stereo tools to obtain an Euclidean reconstruction of the scene.<br><br>This paper is organized as follows. In Section 2, we establish a lemma introducing a virtual camera, symmetric to the camera that produced the input image with respect to the object's symmetry plane. In Section 3, we establish a lemma linking the symmetry lines and epipolar lines in images of a symmetric scene taken by cameras in symmetrical locations. The proof for the mirror-stereo theorem is given in Section 4.<br><br>In Section 5, we show, in the case of a calibrated pinhole camera, how to build a virtual view taken by the same camera placed symmetrically in location and orientation. Examples of Euclidean 3D reconstructions obtained from such pairs with an off-the-shelf stereo package are presented. A summary of the contribution concludes the paper in Section 6. Throughout the paper, the approach and notation used are consistent with that of Ref. [4]." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 138.<br><br>"We developed our novel formulation to use existing 2- view stereo tools to perform 3D reconstruction of mirror symmetric objects from a single, real perspective image. Such systems take as input two images, taken by the same physical camera from different positions, and sometimes require the images to be rectified. If the rectification poses no theoretical problem given the availability of epipolar pencils, the synthesis of a virtual symmetric view taken by a physical camera requires more work. We show how to build such an image in the case of a calibrated pinhole camera, in order to allow Euclidean reconstruction of the scene. We then present the reconstruction results obtained by processing image pairs made of one real |

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| | perspective image of a mirror symmetric object, and one synthetic symmetric view, in an off-the-shelf commercial package, Eos System's PhotoModeler Pro 4.0." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 139.<br><br>"4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), |

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| | collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror.” *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13: |

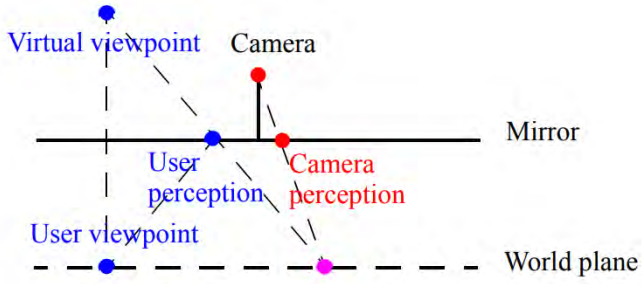
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| |  <br>Figure 12: The handheld mirror simulation system ("Virtual Mirror").<br>  <br>Figure 13: The Virtual Mirror application graph. |

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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois II |
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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois II |
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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image n. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the |

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| | camera axis." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>"We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>"The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person looking in a mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1: |

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| |  <br>Figure 1. Basic mirror geometry.<br><br>"We address the problem of 3D reconstruction from a single perspective view of a mirror symmetric scene. We establish the fundamental result that it is geometrically equivalent to observing the scene with two cameras, the cameras being symmetrical with respect to the unknown 3D symmetry plane. All traditional tools of classical 2-view stereo can then be applied, and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. However, the problems are greatly simplified here, as the rectification process and the computation of epipolar geometry can be easily performed from the original view only. If the camera is calibrated, we show how to synthesize the symmetric image generated by the same physical camera. A Euclidean reconstruction of the scene can then be computed from the resulting stereo pair. To validate this novel formulation, we have processed many real images, and show examples of 3D reconstruction. q 2003 Elsevier Science B.V. All rights reserved." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract).<br><br>"We establish more general epipolar projective properties of single views of mirror symmetric scenes, and apply them in a different context: we perform Euclidean 3D reconstruction of mirror symmetric objects from a single perspective view using traditional 2-view stereo geometry." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138.<br><br>"We developed our novel formulation to use existing 2- view stereo tools to perform 3D reconstruction of mirror symmetric objects from a single, real perspective image. Such systems |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Francois II |
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| | take as input two images, taken by the same physical camera from different positions, and sometimes require the images to be rectified. If the rectification poses no theoretical problem given the availability of epipolar pencils, the synthesis of a virtual symmetric view taken by a physical camera requires more work. We show how to build such an image in the case of a calibrated pinhole camera, in order to allow Euclidean reconstruction of the scene. We then present the reconstruction results obtained by processing image pairs made of one real perspective image of a mirror symmetric object, and one synthetic symmetric view, in an off-the-shelf commercial package, Eos System’s PhotoModeler Pro 4.0.<br><br>5.1. Calibrated pinhole camera case<br><br>Suppose the camera used to take the available picture is a pinhole camera. It projects the world point X into the image point x according to the formula: |

$x = KR[I|(-C)]X$

The $3 \times 3$ matrix $K$ is the camera calibration matrix. If $C$ is a pinhole camera, its calibration matrix is of the form:

$$k = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix}$$

where $\alpha_x$ $\alpha_y$ and represent the focal length of the camera in the $x$ and $y$ directions, respectively, and $(x_0, y_0)$ is the principal point, all expressed in terms of pixel dimensions.

$R$ is the $3 \times 3$ transform matrix from the world coordinate system to the camera coordinate system, in this case a rotation, defined by:

$$R = [\, e_1^{\mathrm{T}} \quad e_2^{\mathrm{T}} \quad e_3^{\mathrm{T}} \,]^{\mathrm{T}}$$

where $(e_1, e_2, e_3)$ is the orthonormal basis of the Euclidean coordinate system associated with the camera.

Let $(e_1', e_2', e_3')$ be the orthonormal basis of the Euclidean coordinate system associated with the virtual symmetrical camera. By construction, $e_j' = \overline{e_j} = \bar{Z}e_j$. Because of the symmetry, this coordinate system's orientation is reversed compared to that of $(e_1, e_2, e_3)$ (if one is right-handed, the other is left-handed).

The virtual camera projects the world point $X$ into the image point $x'$ according to:

$$x' = KR\bar{Z}[I| - \bar{\bar{C}}]X = K\bar{R}[I| - \bar{\bar{C}}]X$$

where:

$$\bar{R} = R\bar{Z} = [\, \overline{e_1}^{\mathrm{T}} \quad \overline{e_2}^{\mathrm{T}} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

The image point of the same world point seen by the physical camera placed in $\bar{C}$ and with principal axis direction $\overline{e_3}^{\mathrm{T}}$ is:

$$x'' = KR''[I| - \bar{C}]X$$

where

$$R'' = [\, e_1''\mathrm{T} \quad e_2''\mathrm{T} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

and $(e_1'', e_2'')$ is an orthonormal basis of the principal plane such that $(e_1'', e_2'', \overline{e_3})$ has the same orientation as $(e_1, e_2, e_3)$ (both are either right or left-handed). Such a basis is obtained by applying a rotation of an arbitrary angle $\theta$ to the basis $(\overline{e_1}, \overline{e_2})$ in the plane it defines, and inverting the direction of one of the axes. The rotation of the coordinate system corresponds to a rotation of the physical camera around its optical axis.

Using the notation

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \bar{R}[I| - \bar{\bar{C}}]X$$

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| | $x''$ can be written:<br>$x'' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>Since we are looking to relate $x''$ and<br>$x' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>the simplest analytic form naturally corresponds to no rotation, i.e. to the cases where the real camera coordinate system axes are aligned with that of the virtual (symmetric) ones, the direction of one of the axes being reversed to preserve the coordinate system's orientation. The two corresponding cases are shown in Fig. 2. For sake of clarity and simplicity, without loss of generality, we only consider an inversion of the x-axis.<br>Under these conditions, $x'$ and $x''$ differ only by their first component $U'$ and $U''$, respectively, and thus only the image points abscissas differ:<br>$u' = \frac{a}{c}\alpha_x + x_0, \qquad u'' = -\frac{a}{c}\alpha_x + x_0$<br>It follows that if the camera is calibrated, then the symmetric view of the virtual stereo pair can be obtained by simply performing a horizontal mirror of the original image with respect to a vertical axis going through the principal point. |

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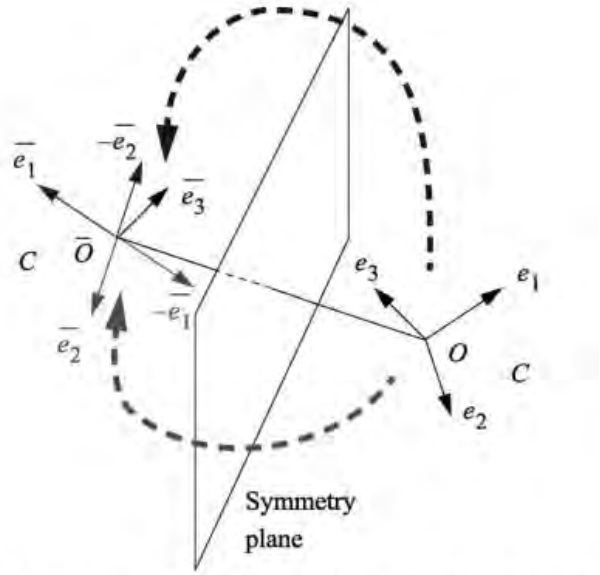



Fig. 2. How to relate the virtual view and the real camera's view from the virtual viewpoint.

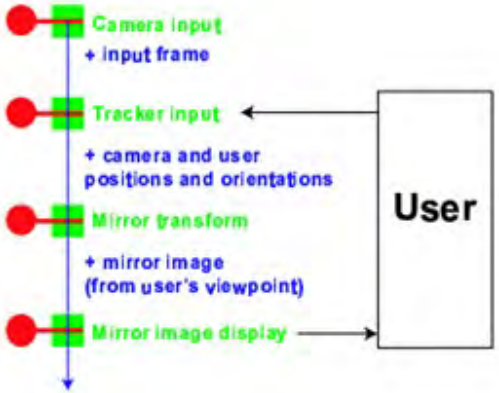
" *See Mirror symmetry -> 2-view stereo geometry* (2003) at 139-140.

"5.2. Stealth fighter model Our first example is a toy F-117 Stealth fighter. The input image and synthesized symmetric view are presented in Fig. 3a with their epipolar pencils. The internal parameters of the digital camera used were determined using Photo-modeler's calibration tool. After specifying a minimum number of point correspondences between the two images, the software was able to perform a full calibration of both camera positions and to infer the 3D position of the object points. Adding more point and line correspondences allowed to obtain a 3D wireframe model of the object presented in Fig. 3b. Note that the recovered object is mirror symmetric, and that the recovered cameras are actually symmetrical in location and orientation with respect to the object's symmetry plane, properties that are not used at any point in Photomodeler's reconstruction algorithms (the symmetry property is only used to

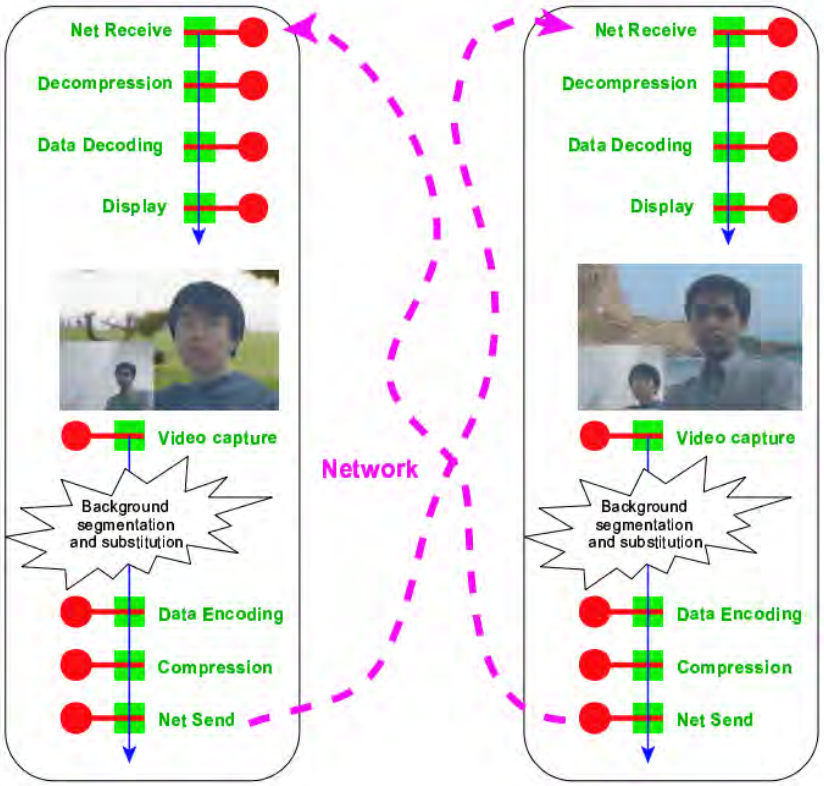
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| | synthesize the symmetric view). Once the 3D inference is performed, the 3D surface model shown in Fig. 3c is built and the texture can be extracted from the images. The final 3D model with texture map is shown in Fig. 3d. The construction of this 3D textured model took only a few minutes to a novice Photomodeler user. Incorporating symmetry derived constraints in the workflow and in the interface would greatly facilitate the process and reduce the time needed to build a model, while also helping in improving the accuracy of the manual input and helping deal with self occlusions across the symmetry plane." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143.<br><br>"5.3. Face model<br><br>The technique clearly applies beautifully to perfectly symmetric objects. We also wanted to try the more challenging problem posed by (quasi-)human faces. We used a bust of Darth Maul, which is fairly symmetric. The input and synthetic symmetric views are presented in Fig. 4a. The wireframe model and camera positions and orientations as recovered by Photomodeler are presented in Fig. 4b. Finally, the resulting textured model is shown in Fig. 4c. The polygonal model, although coarse, captures the geometry of the face fairly well, so that the resulting textured model is easily recognized as a face under various viewpoints." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 143.<br><br>*See Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a):<br><br>  <br>(a) Input image (left) of a Darth Maul bust and inverted image (right), used as a stereo pair |

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| | "4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, |

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| | implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror.” *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13: |

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| |  <br>Figure 12: The handheld mirror simulation system ("Virtual Mirror").<br>  <br>Figure 13: The Virtual Mirror application graph. |

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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the |

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| | camera axis.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>“We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>“The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person looking in a mirror.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1: |

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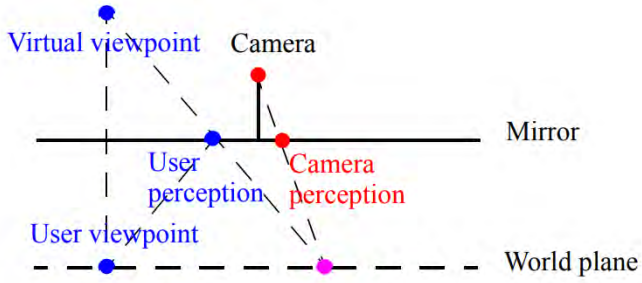



Figure 1. Basic mirror geometry.

*See A Handheld Virtual Mirror* (2002), at Figure 2:

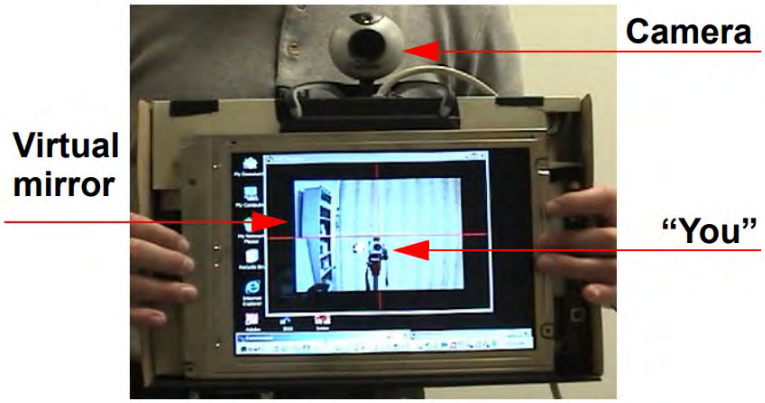



Figure 2. Handheld virtual mirror device.

"We address the problem of 3D reconstruction from a single perspective view of a mirror symmetric scene. We establish the fundamental result that it is geometrically equivalent to observing the scene with two cameras, the cameras being symmetrical with respect to the

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| | unknown 3D symmetry plane. All traditional tools of classical 2-view stereo can then be applied, and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. However, the problems are greatly simplified here, as the rectification process and the computation of epipolar geometry can be easily performed from the original view only. If the camera is calibrated, we show how to synthesize the symmetric image generated by the same physical camera. A Euclidean reconstruction of the scene can then be computed from the resulting stereo pair. To validate this novel formulation, we have processed many real images, and show examples of 3D reconstruction. q 2003 Elsevier Science B.V. All rights reserved." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract).<br><br>"We establish more general epipolar projective properties of single views of mirror symmetric scenes, and apply them in a different context: we perform Euclidean 3D reconstruction of mirror symmetric objects from a single perspective view using traditional 2-view stereo geometry." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138.<br><br>"We developed our novel formulation to use existing 2- view stereo tools to perform 3D reconstruction of mirror symmetric objects from a single, real perspective image. Such systems take as input two images, taken by the same physical camera from different positions, and sometimes require the images to be rectified. If the rectification poses no theoretical problem given the availability of epipolar pencils, the synthesis of a virtual symmetric view taken by a physical camera requires more work. We show how to build such an image in the case of a calibrated pinhole camera, in order to allow Euclidean reconstruction of the scene. We then present the reconstruction results obtained by processing image pairs made of one real perspective image of a mirror symmetric object, and one synthetic symmetric view, in an off-the-shelf commercial package, Eos System's PhotoModeler Pro 4.0.<br><br>5.1. Calibrated pinhole camera case<br><br>Suppose the camera used to take the available picture is a pinhole camera. It projects the world point X into the image point x according to the formula: |

$x = KR[I|(-\tilde{C})]X$

The $3 \times 3$ matrix $K$ is the camera calibration matrix. If $C$ is a pinhole camera, its calibration matrix is of the form:

$$k = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix}$$

where $\alpha_x$ $\alpha_y$ and represent the focal length of the camera in the $x$ and $y$ directions, respectively, and $(x_0, y_0)$ is the principal point, all expressed in terms of pixel dimensions.

$R$ is the $3 \times 3$ transform matrix from the world coordinate system to the camera coordinate system, in this case a rotation, defined by:

$$R = [\, e_1^{\mathrm{T}} \quad e_2^{\mathrm{T}} \quad e_3^{\mathrm{T}} \,]^{\mathrm{T}}$$

where $(e_1, e_2, e_3)$ is the orthonormal basis of the Euclidean coordinate system associated with the camera.

Let $(e'_1, e'_2, e'_3)$ be the orthonormal basis of the Euclidean coordinate system associated with the virtual symmetrical camera. By construction, $e'_j = \overline{e_j} = \tilde{Z}e_j$. Because of the symmetry, this coordinate system's orientation is reversed compared to that of $(e_1, e_2, e_3)$ (if one is right-handed, the other is left-handed).

The virtual camera projects the world point $X$ into the image point $x'$ according to:

$$x' = KR\tilde{Z}[I| - \tilde{C}]X = K\tilde{R}[I| - \tilde{C}]X$$

where:

$$\tilde{R} = R\tilde{Z} = [\, \overline{e_1}^{\mathrm{T}} \quad \overline{e_2}^{\mathrm{T}} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

The image point of the same world point seen by the physical camera placed in $\tilde{C}$ and with principal axis direction $\overline{e_3}^{\mathrm{T}}$ is:

$$x'' = KR''[I| - \tilde{C}]X$$

where

$$R'' = [\, e''_1\mathrm{T} \quad e''_2\mathrm{T} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

and $(e''_1, e''_2)$ is an orthonormal basis of the principal plane such that $(e''_1, e''_2, \overline{e_3})$ has the same orientation as $(e_1, e_2, e_3)$ (both are either right or left-handed). Such a basis is obtained by applying a rotation of an arbitrary angle $\theta$ to the basis $(\overline{e_1}, \overline{e_2})$ in the plane it defines, and inverting the direction of one of the axes. The rotation of the coordinate system corresponds to a rotation of the physical camera around its optical axis.

Using the notation

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = R[I| - \tilde{C}]X$$

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| | $x''$ can be written:<br>$x'' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>Since we are looking to relate $x''$ and<br>$x' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>the simplest analytic form naturally corresponds to no rotation, i.e. to the cases where the real camera coordinate system axes are aligned with that of the virtual (symmetric) ones, the direction of one of the axes being reversed to preserve the coordinate system's orientation. The two corresponding cases are shown in Fig. 2. For sake of clarity and simplicity, without loss of generality, we only consider an inversion of the x-axis.<br>Under these conditions, $x'$ and $x''$ differ only by their first component $U'$ and $U''$, respectively, and thus only the image points abscissas differ:<br>$u' = \frac{a}{c}\alpha_x + x_0, \qquad u'' = -\frac{a}{c}\alpha_x + x_0$<br>It follows that if the camera is calibrated, then the symmetric view of the virtual stereo pair can be obtained by simply performing a horizontal mirror of the original image with respect to a vertical axis going through the principal point. |

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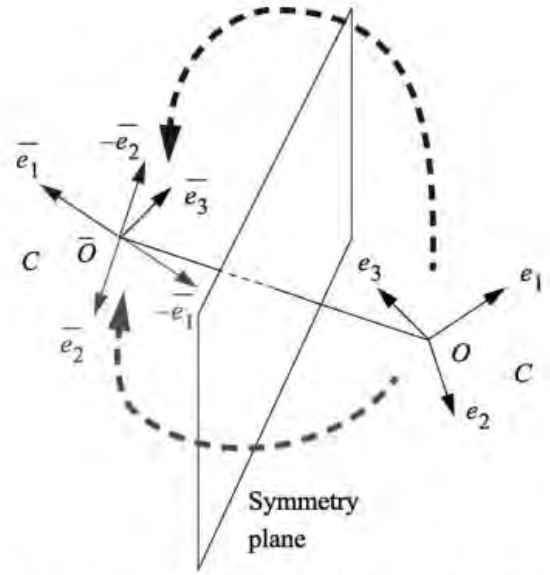



Fig. 2. How to relate the virtual view and the real camera's view from the virtual viewpoint.

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"5.2. Stealth fighter model Our first example is a toy F-117 Stealth fighter. The input image and synthesized symmetric view are presented in Fig. 3a with their epipolar pencils. The internal parameters of the digital camera used were determined using Photo-modeler's calibration tool. After specifying a minimum number of point correspondences between the two images, the software was able to perform a full calibration of both camera positions and to infer the 3D position of the object points. Adding more point and line correspondences allowed to obtain a 3D wireframe model of the object presented in Fig. 3b. Note that the recovered object is mirror symmetric, and that the recovered cameras are actually symmetrical in location and orientation with respect to the object's symmetry plane, properties that are not used at any point in Photomodeler's reconstruction algorithms (the symmetry property is only used to

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| | "This document highlights and addresses architecture level software development issues facing researchers and practitioners in the field of Computer Vision. A new framework, or architectural style, called SAI, is introduced. It provides a formalism for the design, implementation and analysis of software systems that perform distributed parallel processing of generic data streams. Architectural patterns are illustrated with a number of demonstration projects ranging from single stream automatic real-time video processing to fully integrated distributed interactive systems mixing live video, graphics and sound. SAI is supported by an open source architectural middleware called MFSM." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract).<br><br>"4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to |

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| | compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications |

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| | of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13: |

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Figure 12: The handheld mirror simulation system ("Virtual Mirror").

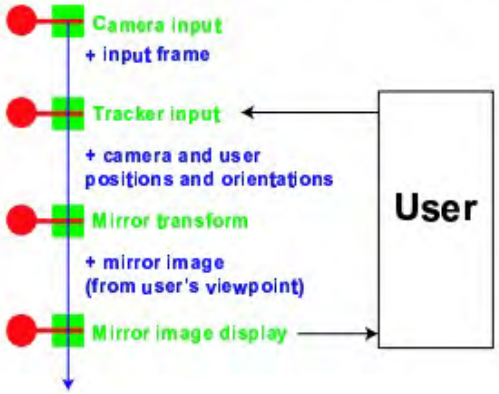
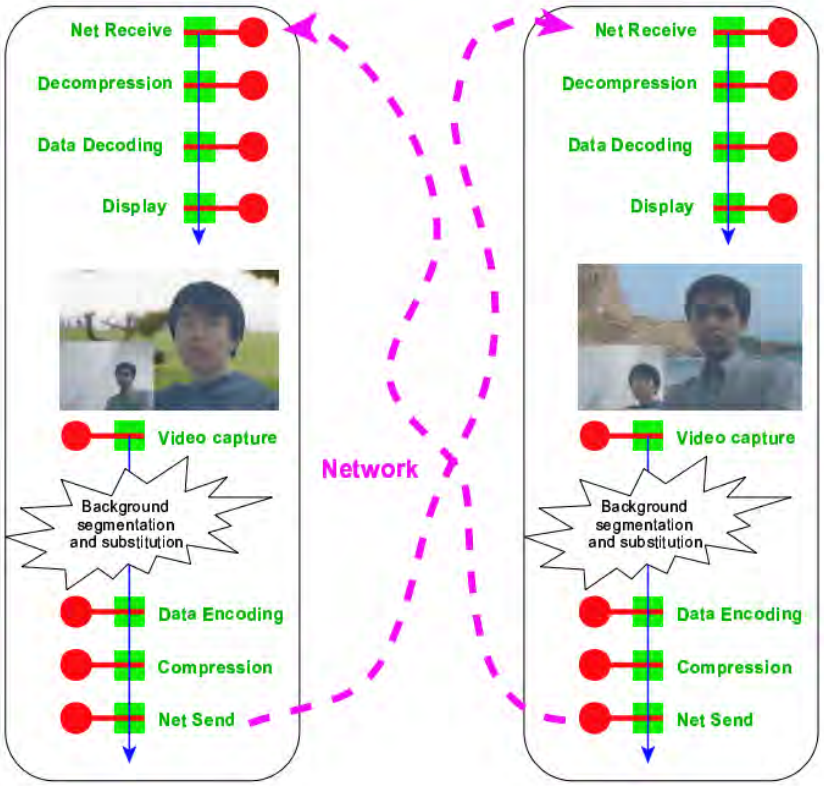


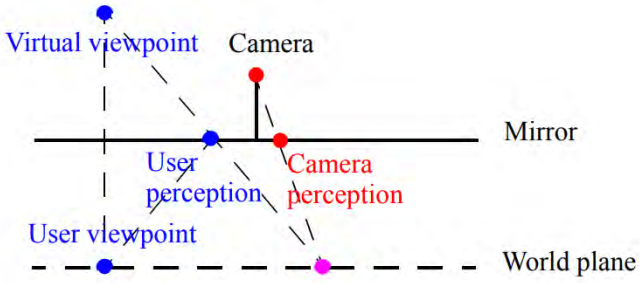
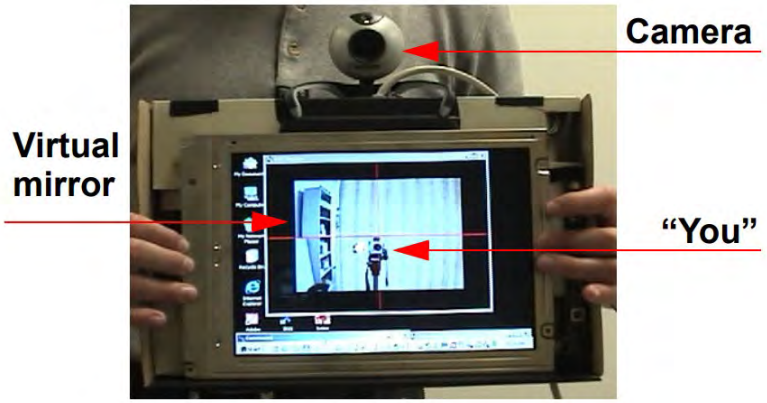

Figure 13: The Virtual Mirror application graph.

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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the |

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| |  <br>Figure 1. Basic mirror geometry.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 2:<br><br>  <br>Figure 2. Handheld virtual mirror device.<br><br>“4.3 Handheld mirror simulation |

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| | The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are |

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Figure 12: The handheld mirror simulation system ("Virtual Mirror").

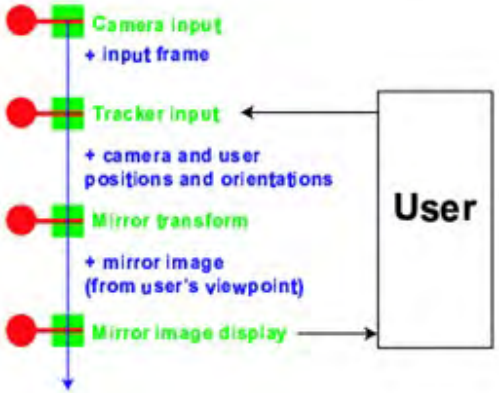
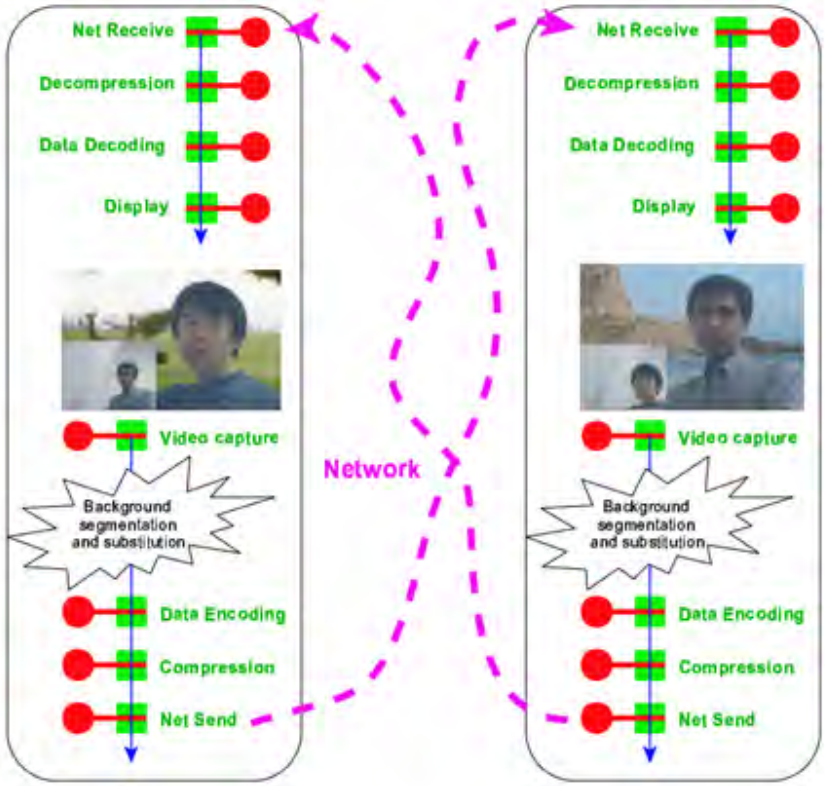



Figure 13: The Virtual Mirror application graph.

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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the |

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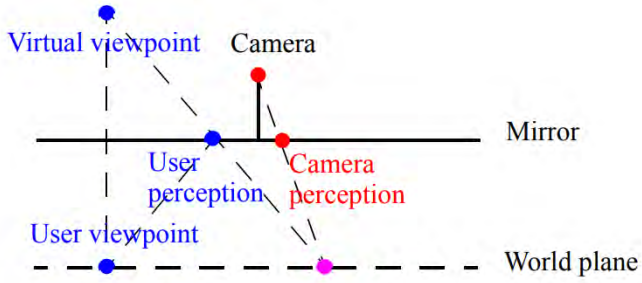



Figure 1. Basic mirror geometry.

*See A Handheld Virtual Mirror* (2002), at Figure 2:

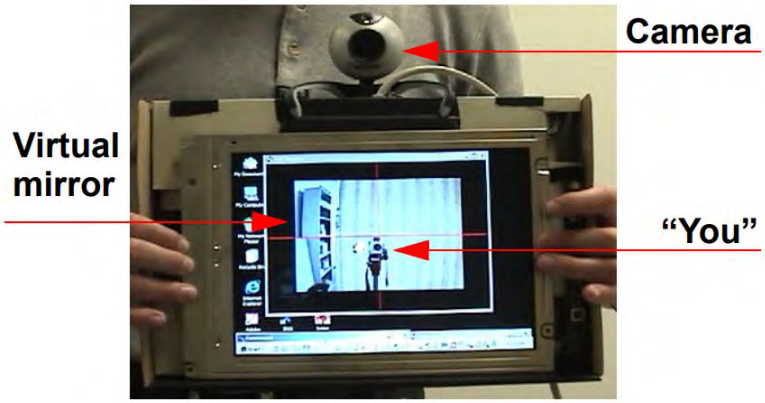



Figure 2. Handheld virtual mirror device.

"This document highlights and addresses architecture level software development issues facing researchers and practitioners in the field of Computer Vision. A new framework, or

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| | architectural style, called SAI, is introduced. It provides a formalism for the design, implementation and analysis of software systems that perform distributed parallel processing of generic data streams. Architectural patterns are illustrated with a number of demonstration projects ranging from single stream automatic real-time video processing to fully integrated distributed interactive systems mixing live video, graphics and sound. SAI is supported by an open source architectural middleware called MFSM." See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 1 (Abstract).<br><br>"4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The |

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Figure 12: The handheld mirror simulation system ("Virtual Mirror").

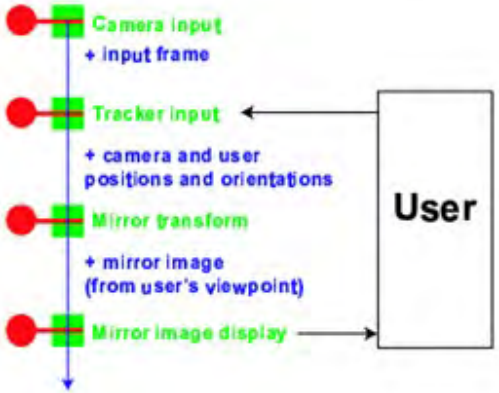
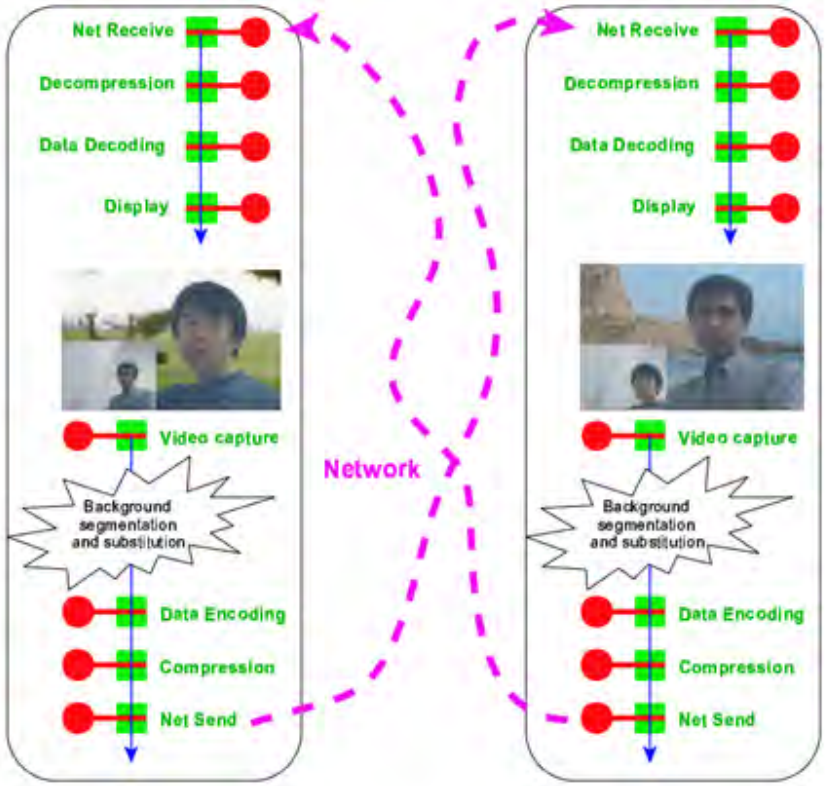


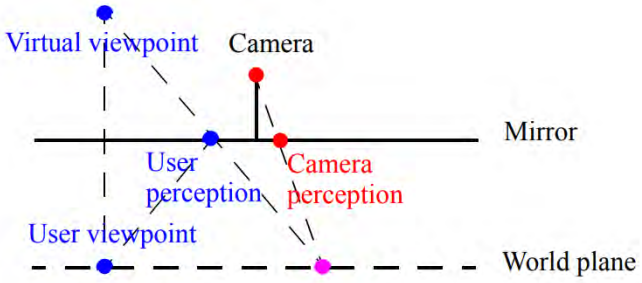
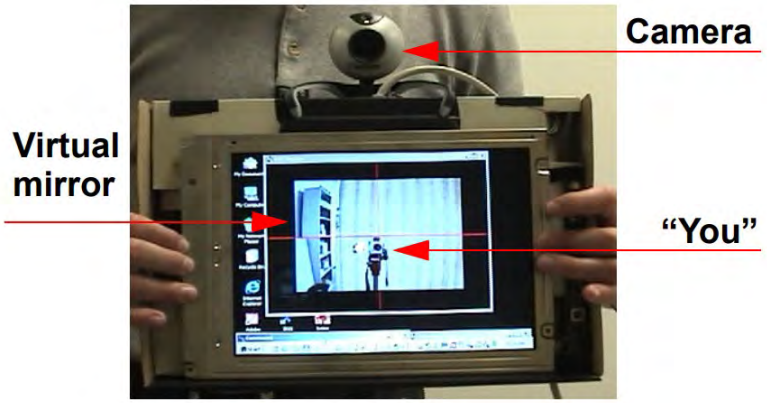

Figure 13: The Virtual Mirror application graph.

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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the |

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| | camera axis.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>“We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>“The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person looking in a mirror.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1: |

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| |  <br>Figure 1. Basic mirror geometry.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 2:<br><br>  <br>Figure 2. Handheld virtual mirror device.<br><br>"4.3 Handheld mirror simulation |

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| | The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are |

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| | synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror.” See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15.<br><br>See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13: |

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Figure 12: The handheld mirror simulation system ("Virtual Mirror").

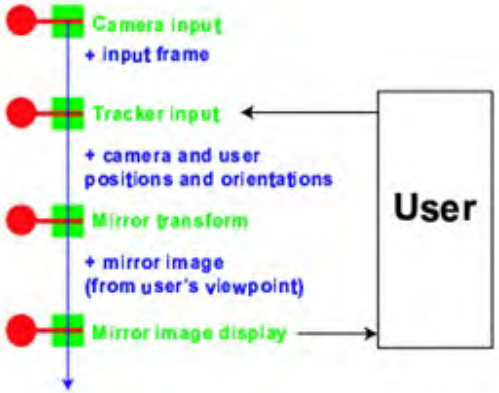
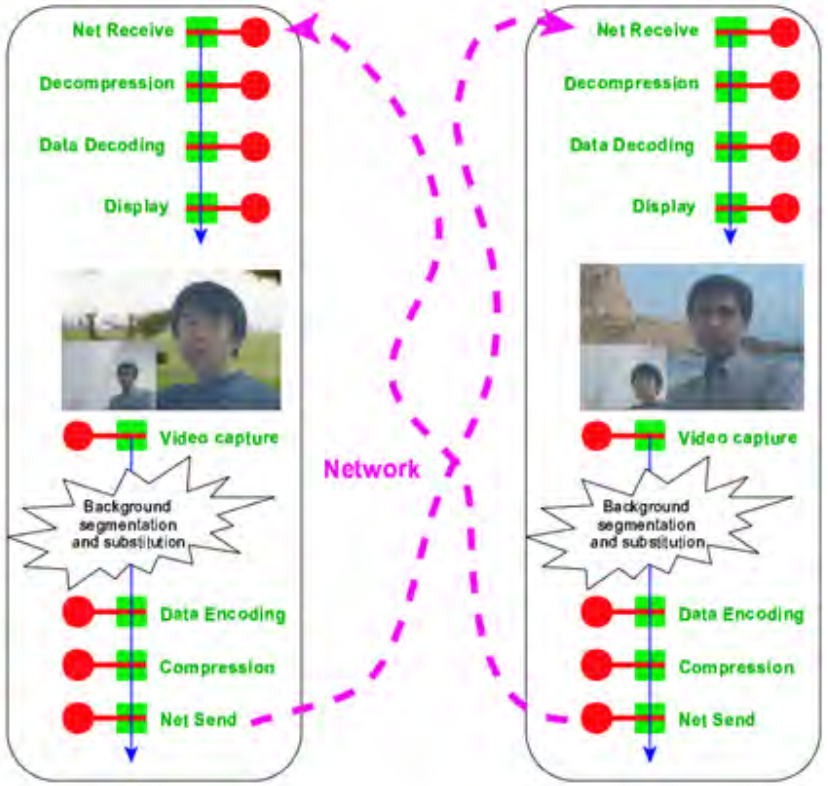



Figure 13: The Virtual Mirror application graph.

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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video feed;. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the |

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| | camera axis.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>“We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>“The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person looking in a mirror.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1: |

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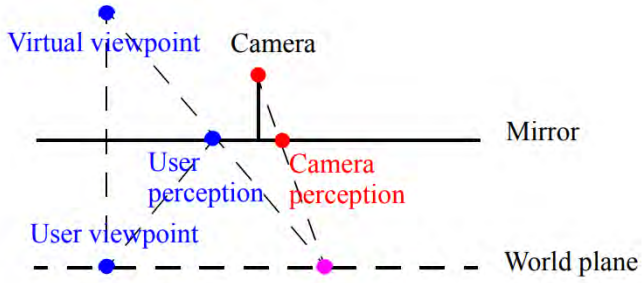



Figure 1. Basic mirror geometry.

*See A Handheld Virtual Mirror* (2002), at Figure 2:

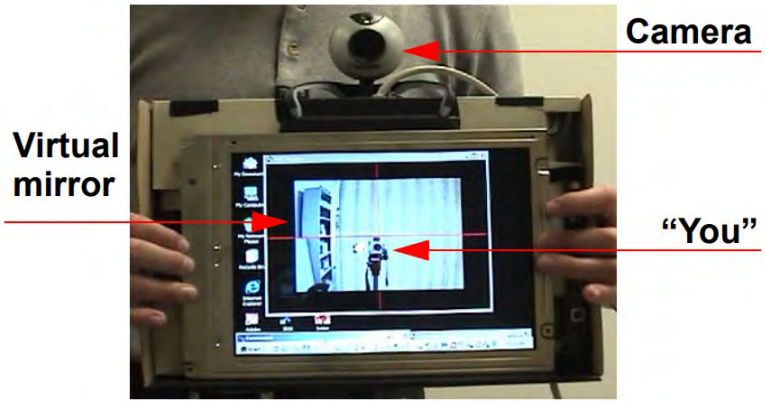



Figure 2. Handheld virtual mirror device.

"We address the problem of 3D reconstruction from a single perspective view of a mirror symmetric scene. We establish the fundamental result that it is geometrically equivalent to observing the scene with two cameras, the cameras being symmetrical with respect to the

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| | unknown 3D symmetry plane. All traditional tools of classical 2-view stereo can then be applied, and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. However, the problems are greatly simplified here, as the rectification process and the computation of epipolar geometry can be easily performed from the original view only. If the camera is calibrated, we show how to synthesize the symmetric image generated by the same physical camera. A Euclidean reconstruction of the scene can then be computed from the resulting stereo pair. To validate this novel formulation, we have processed many real images, and show examples of 3D reconstruction. q 2003 Elsevier Science B.V. All rights reserved.” *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract).<br><br>“We establish more general epipolar projective properties of single views of mirror symmetric scenes, and apply them in a different context: we perform Euclidean 3D reconstruction of mirror symmetric objects from a single perspective view using traditional 2-view stereo geometry.” *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138.<br><br>“We developed our novel formulation to use existing 2- view stereo tools to perform 3D reconstruction of mirror symmetric objects from a single, real perspective image. Such systems take as input two images, taken by the same physical camera from different positions, and sometimes require the images to be rectified. If the rectification poses no theoretical problem given the availability of epipolar pencils, the synthesis of a virtual symmetric view taken by a physical camera requires more work. We show how to build such an image in the case of a calibrated pinhole camera, in order to allow Euclidean reconstruction of the scene. We then present the reconstruction results obtained by processing image pairs made of one real perspective image of a mirror symmetric object, and one synthetic symmetric view, in an off-the-shelf commercial package, Eos System’s PhotoModeler Pro 4.0.<br><br>5.1. Calibrated pinhole camera case<br><br>Suppose the camera used to take the available picture is a pinhole camera. It projects the world point X into the image point x according to the formula: |

$x = KR[I|(-\tilde{C})]X$

The $3 \times 3$ matrix $K$ is the camera calibration matrix. If $C$ is a pinhole camera, its calibration matrix is of the form:

$$k = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix}$$

where $\alpha_x$ $\alpha_y$ and represent the focal length of the camera in the $x$ and $y$ directions, respectively, and $(x_0, y_0)$ is the principal point, all expressed in terms of pixel dimensions.

$R$ is the $3 \times 3$ transform matrix from the world coordinate system to the camera coordinate system, in this case a rotation, defined by:

$$R = [\, e_1^{\mathrm{T}} \quad e_2^{\mathrm{T}} \quad e_3^{\mathrm{T}} \,]^{\mathrm{T}}$$

where $(e_1, e_2, e_3)$ is the orthonormal basis of the Euclidean coordinate system associated with the camera.

Let $(e'_1, e'_2, e'_3)$ be the orthonormal basis of the Euclidean coordinate system associated with the virtual symmetrical camera. By construction, $e'_j = \overline{e_j} = \tilde{Z}e_j$. Because of the symmetry, this coordinate system's orientation is reversed compared to that of $(e_1, e_2, e_3)$ (if one is right-handed, the other is left-handed).

The virtual camera projects the world point $X$ into the image point $x'$ according to:

$$x' = KR\tilde{Z}[I| - \tilde{C}]X = K\tilde{R}[I| - \tilde{C}]X$$

where:

$$\tilde{R} = R\tilde{Z} = [\, \overline{e_1}^{\mathrm{T}} \quad \overline{e_2}^{\mathrm{T}} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

The image point of the same world point seen by the physical camera placed in $\tilde{C}$ and with principal axis direction $\overline{e_3}^{\mathrm{T}}$ is:

$$x'' = KR''[I| - \tilde{C}]X$$

where

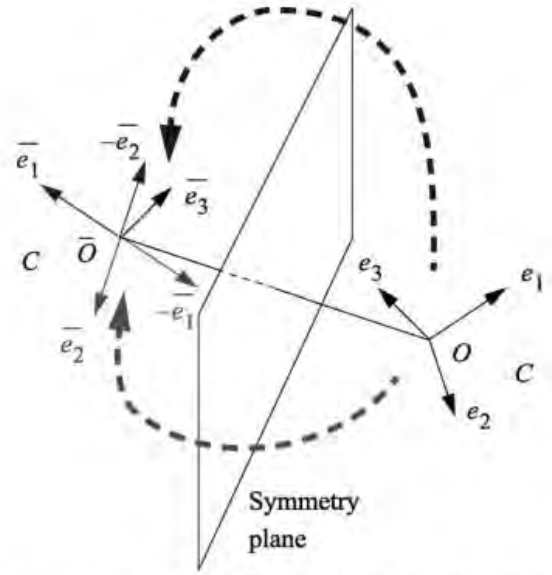
$$R'' = [\, e''_1\mathrm{T} \quad e''_2\mathrm{T} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

and $(e''_1, e''_2)$ is an orthonormal basis of the principal plane such that $(e''_1, e''_2, \overline{e_3})$ has the same orientation as $(e_1, e_2, e_3)$ (both are either right or left-handed). Such a basis is obtained by applying a rotation of an arbitrary angle $\theta$ to the basis $(\overline{e_1}, \overline{e_2})$ in the plane it defines, and inverting the direction of one of the axes. The rotation of the coordinate system corresponds to a rotation of the physical camera around its optical axis.

Using the notation

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = R[I| - \tilde{C}]X$$

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| | $x''$ can be written:<br>$x'' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>Since we are looking to relate $x''$ and<br>$x' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>the simplest analytic form naturally corresponds to no rotation, i.e. to the cases where the real camera coordinate system axes are aligned with that of the virtual (symmetric) ones, the direction of one of the axes being reversed to preserve the coordinate system's orientation. The two corresponding cases are shown in Fig. 2. For sake of clarity and simplicity, without loss of generality, we only consider an inversion of the x-axis.<br>Under these conditions, $x'$ and $x''$ differ only by their first component $U'$ and $U''$, respectively, and thus only the image points abscissas differ:<br>$u' = \frac{a}{c}\alpha_x + x_0, \qquad u'' = -\frac{a}{c}\alpha_x + x_0$<br>It follows that if the camera is calibrated, then the symmetric view of the virtual stereo pair can be obtained by simply performing a horizontal mirror of the original image with respect to a vertical axis going through the principal point. |

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| |  <br>Fig. 2. How to relate the virtual view and the real camera's view from the virtual viewpoint.<br><br>" *See Mirror symmetry -> 2-view stereo geometry* (2003) at 139-140.<br><br>"5.2. Stealth fighter model Our first example is a toy F-117 Stealth fighter. The input image and synthesized symmetric view are presented in Fig. 3a with their epipolar pencils. The internal parameters of the digital camera used were determined using Photo-modeler's calibration tool. After specifying a minimum number of point correspondences between the two images, the software was able to perform a full calibration of both camera positions and to infer the 3D position of the object points. Adding more point and line correspondences allowed to obtain a 3D wireframe model of the object presented in Fig. 3b. Note that the recovered object is mirror symmetric, and that the recovered cameras are actually symmetrical in location and orientation with respect to the object's symmetry plane, properties that are not used at any point in Photomodeler's reconstruction algorithms (the symmetry property is only used to |

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| | synthesize the symmetric view). Once the 3D inference is performed, the 3D surface model shown in Fig. 3c is built and the texture can be extracted from the images. The final 3D model with texture map is shown in Fig. 3d. The construction of this 3D textured model took only a few minutes to a novice Photomodeler user. Incorporating symmetry derived constraints in the workflow and in the interface would greatly facilitate the process and reduce the time needed to build a model, while also helping in improving the accuracy of the manual input and helping deal with self occlusions across the symmetry plane." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143.<br><br>"5.3. Face model<br><br>The technique clearly applies beautifully to perfectly symmetric objects. We also wanted to try the more challenging problem posed by (quasi-)human faces. We used a bust of Darth Maul, which is fairly symmetric. The input and synthetic symmetric views are presented in Fig. 4a. The wireframe model and camera positions and orientations as recovered by Photomodeler are presented in Fig. 4b. Finally, the resulting textured model is shown in Fig. 4c. The polygonal model, although coarse, captures the geometry of the face fairly well, so that the resulting textured model is easily recognized as a face under various viewpoints." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 143.<br><br>*See Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a):<br><br>  <br>(a) Input image (left) of a Darth Maul bust and inverted image (right), used as a stereo pair |

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| | "4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, |

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| | implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror.” See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15.<br><br>See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13: |

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Figure 12: The handheld mirror simulation system ("Virtual Mirror").

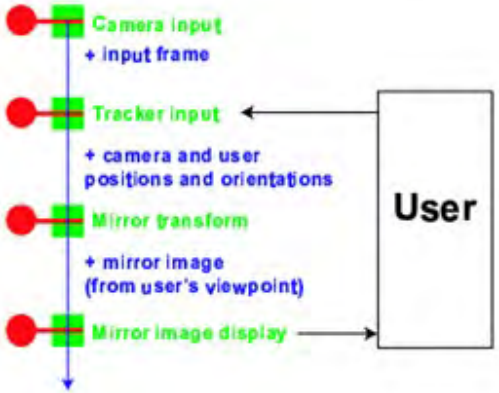



Figure 13: The Virtual Mirror application graph.

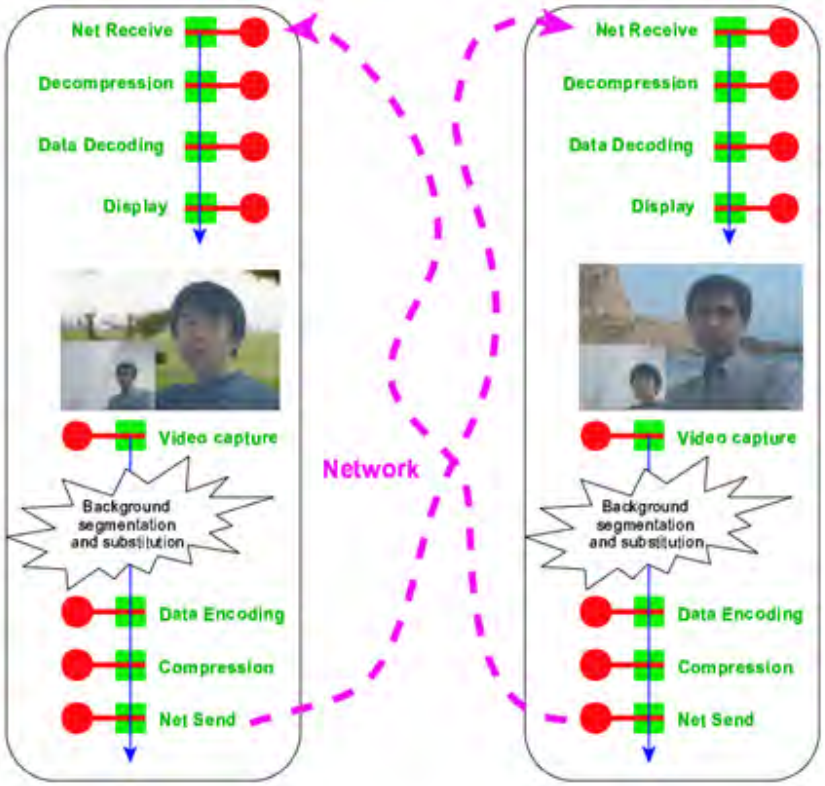
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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. *See*, *e.g.*, disclosures below.<br><br>"We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>"This document highlights and addresses architecture level software development issues facing researchers and practitioners in the field of Computer Vision. A new framework, or architectural style, called SAI, is introduced. It provides a formalism for the design, implementation and analysis of software systems that perform distributed parallel processing of generic data streams. Architectural patterns are illustrated with a number of demonstration projects ranging from single stream automatic real-time video processing to fully integrated distributed interactive systems mixing live video, graphics and sound. SAI is supported by an open source architectural middleware called MFSM." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract). |

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| | "SAI (Software Architecture for Immersipresence) is a new software architecture model for designing, analyzing and implementing applications performing distributed, asynchronous parallel processing of generic data streams. The goal of SAI is to provide a universal framework for the distributed implementation of algorithms and their easy integration into complex systems that exhibit desirable software engineering qualities such as efficiency, scalability, extensibility, reusability and interoperability. SAI specifies a new architectural style (components, connectors and constraints). The underlying extensible data model and hybrid (shared repository and message-passing) distributed asynchronous parallel processing model allow natural and efficient manipulation of generic data streams, using existing libraries or native code alike." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 3.<br><br>"2.2.1 Time A critical underlying concept in all user-related application domains (but by no means limited to these domain) is that of time. Whether implicitly or explicitly modeled, time relations and ordering are inherent properties of any sensory-related data stream (e.g. image streams, sound, haptics, etc.), absolutely necessary when users are involved in the system, even if not on-line or in real-time. Users perceive data as streams of dynamic information, i.e. evolving in time. This information only makes sense if synchronization constraints are respected within each stream (temporal precedence) and across streams (precedence and simultaneity). It follows that time information is a fundamental attribute of all process data, and should therefore be explicitly modeled both in data structures and in processes. Synchronization is a fundamental operation in temporal data stream manipulation systems. It should therefore also be an explicit element of the architectural model. A structure called pulse is introduced to regroup synchronous data. Data streams are thus quantized temporally (not necessarily uniformly). As opposed to the Pipes and Filters case, where data remains localized in the filters where it is created or used, it is grouped in pulses, which flow from processing center to processing center along streams. The processing centers do not consume their input, but merely use it to produce some output that is added to the pulse. This also reduces the amount of costly data copy: in a subgraph implemented on a platform with shared memory space, only a pointer to the evolving pulse structure will be transmitted from processing center |

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| | to processing center. Note that such processing centers can no longer be called filters." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 5-6.<br><br>"4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature |

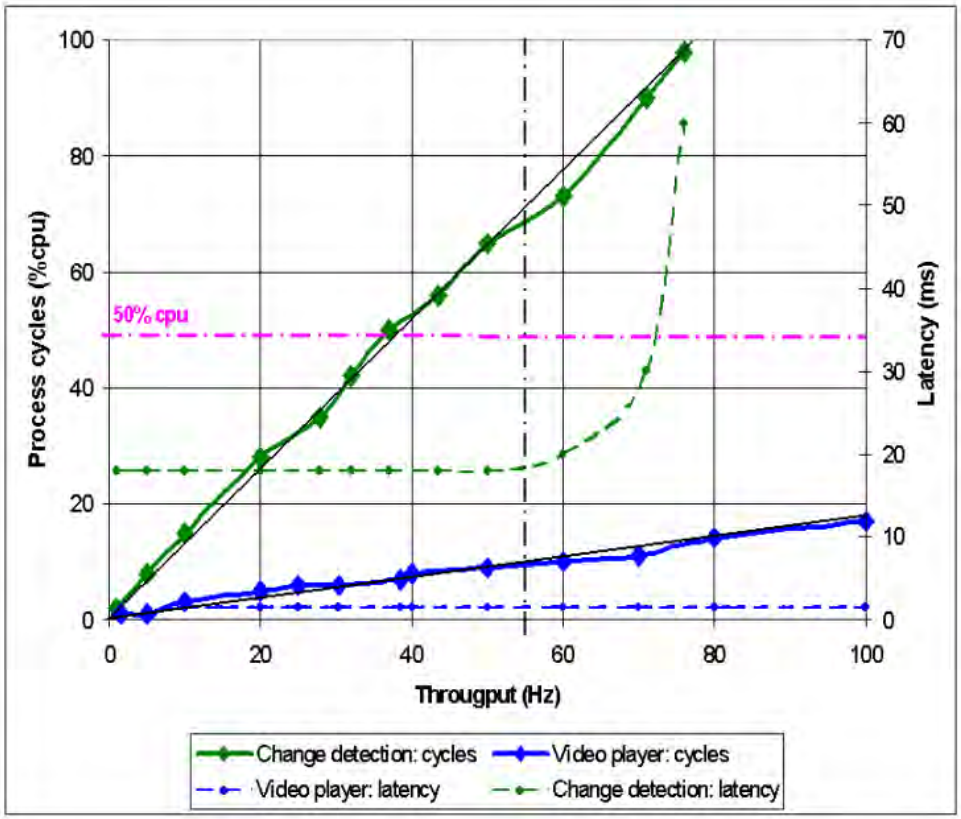
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| | as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror.” See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15.<br><br>“4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a |

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| | head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>"4.1 Real-time video segmentation and tracking |

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| | The development of real-time video analysis applications was actually a steering concern during the development of the SAI style. The system presented here was used as a testbed for the implementation, testing and refinement of some SAI concepts [18]. The video analysis tasks performed are low level segmentation and blob tracking. The segmentation is performed by change detection using an adaptive statistical color background model (the camera is assumed stationary). A review of background maintenance algorithms can be found in [28]. Blob tracking is performed using a new multiresolution algorithm whose description is out of the scope of this document. Figure 7 shows the conceptual level architecture of the software system. It is build around a single stream going through a number of cells. The graph can be decomposed into four functional subgraphs: capture, segmentation, tracking, visualization. The stream originates in the video input cell, which produces, at a given rate, pulses containing an image coming either from a live capture device or a video file. This cell and its source constitute the capture unit of the application. The stream then goes through the segmentation unit, which is analyzed below. Coming out of the segmentation, the stream goes through a tracking cell. The result visualization unit is composed of a rendering and a display subunits. Rendering of a persistent structure (here, the tracking graph) will be illustrated in a more general context in another example below ("Live Video in Animated 3-D Graphics"). The display cell simply puts on the screen its input images, in this case the composite frames produced by the renderer. A very interesting aspect of this system, and certainly the most innovative when it was introduced, is the asynchronous parallel implementation of the segmentation algorithm, which contains a feed-back loop. The corresponding conceptual graph is also a flow graph of the algorithm. Each input frame is compared with a statistical background model. For each pixel, a decision is made whether it is an observation of the background or of an occluding element. The output is a foreground binary mask. This comparison is performed by the background comparison cell. Each pulse, after going through this cell, contains the input image and a binary foreground image, which is used by the connected components cell to produce a labeled components image, added to the pulse. The input image and the labeled components image are used by the background update cell to update the distributions in the background model. Since the comparison and the update cells both use the persistent background model, they are both connected to a common source that holds the background model structure. This path forms a feed back loop in which the result of the processing of each frame is used to update the adaptive |

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| | background model. Because of the asynchrony of the processing, by the time the background model is updated with the result of the processing of a given frame, many other frames might have been compared to the model. In this particular context, the quality of the result is not affected–in fact, it is common practice in background model maintenance to perform only partial updates at each frame, in order to reduce computational load–and the overall system throughput permitted by this design is always significantly larger than that achievable in a sequential design.” *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 10-11.<br><br>“Figure 19 shows new experimental scalability tests performed on applications designed in the SAI style. The results are in accordance with those reported in [18]. The figure plots processing load, in percent, against processing rate, in frames per seconds, for an application performing video capture, segmentation by change detection, and result visualization, and the same plot for the same application with the segmentation turned off (the image displayed is the input). Both applications scale linearly with respect to throughput. All conditions being equal, the difference in slope between the two curves characterizes the processing load imposed by the segmentation part. Note that these tests were performed on a dual processor machine, so that the processor load is an average of the load of both processors. Because of the parallelism (multithreading in this case), the overall load is balanced between the two processors (by the operating system in this case). As a result, the system is completely oblivious to the 50% cpu load barrier. The figure also plots system latency, in ms, against processing rate, for both applications. The latency remains constant as long as system resources are available. In a sequential system, the latency would be directly proportional to the throughput, and in fact dictate the maximum achievable throughput. When a bottleneck is encountered (or some resources are exhausted), latency increases and system performance degrades. The segmentation application performance (in terms of latency) starts degrading around 55 frames per seconds, although the system can still achieve rates above 70 frames per second in these conditions. These plots suggest that: (1) as long as computing resources are available, the overhead introduced by the SAI processing model remains constant, and (2) the contribution of the different processes are combined linearly. In particular, the model does not introduce any non-linear complexity in the system. These properties are corroborated by empirical results and experience in developing and operating other systems designed in the SAI style. |

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| | Theoretical complexity analysis and overhead bounding are out of the scope of this document." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 21-22.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 19:<br><br>  <br><br><br>Figure 19: Scalability with respect to throughput. |

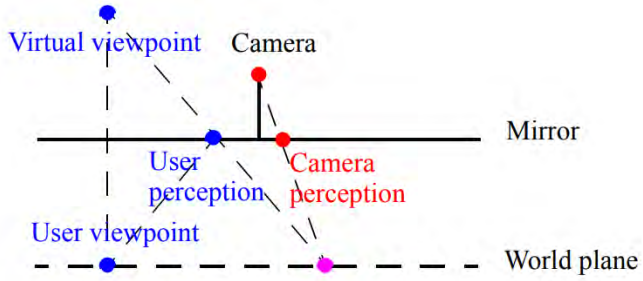
| Asserted Claim of the '109 Patent | Exemplary Citations to Francois II |
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| | "This document describes SAI, a new software architecture model for designing, analyzing and implementing applications performing distributed, asynchronous parallel processing of generic data streams. SAI provides a universal framework for the distributed implementation of algorithms and their easy integration into complex systems that exhibit desirable software engineering qualities such as efficiency, scalability, extensibility, reusability and interoperability. The SAI architectural style and its properties are described." *See Software Architecture for Immersipresence* (2003) at 1 (Abstract).<br><br>"The SAI style defines two types of components: cells and sources. Cells are processing centers. They do not store any state data related to their computations. The cells constitute an extensible set of specialized components that implement specific algorithms. Each specialized cell type is identified by a type name (string), and is logically defined by its input data, its parameters and its output. Cell instances are represented graphically as green squares. A cell can be active or inactive, in which case it is transparent to the system. Sources are shared repository of persistent data. Source instances are represented as red disks or circles. Two types of connectors link cells to cells and cells to sources. Cell to source connectors give the cell access to the source data. Cell to cell connectors define data conduits for the streams. The semantics of these connectors are relaxed compared to that of pipes (which are FIFO queues): they do not convey any constraint on the time ordering of the data flowing through them. Cell and source instances interact according to the following rules. A cell must be connected to exactly one source, which holds its persistent state data. A source can be connected to an arbitrary number of cell, all of which have concurrent shared memory access to the data held by the source. A source may hold data relevant to one or more of its connected cells, and should hold all the relevant data for each of its connected cells (possibly with some overlap). Cell-source connectors are drawn as either double or fat red lines. They may be drawn across cells (as if cells were connected together by these links) for layout convenience. Volatile data flows in streams, which are defined by cell-to-cell connections. A cell can be connected to exactly one upstream cell, and to an arbitrary number of downstream cells. Streams (and thus cell-cell connections) are drawn as thin blue arrows crossing over the cells." *See Software Architecture for Immersipresence* (2003) at 8. |

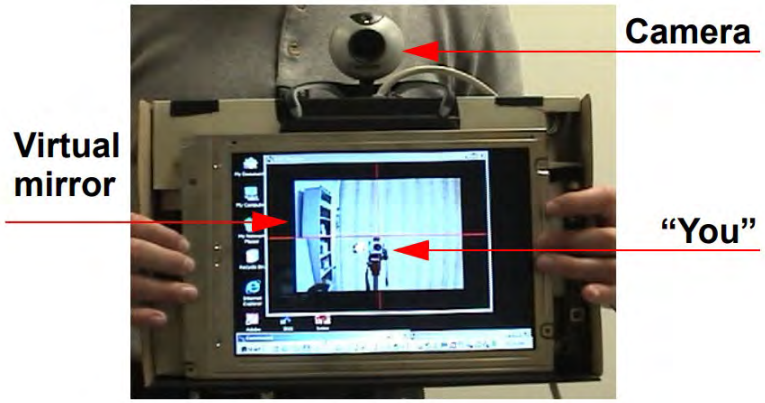
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| | "Data, whether persistent or volatile, is held in pulses. A pulse is a carrier for all the synchronous data corresponding to a given time stamp in a stream. Information in a pulse is organized as a mono-rooted composition hierarchy of node objects…. Each source contains a passive pulse, which encodes the instantaneous state of the data structures held by the source. Volatile data flows in streams, that are temporally quantized into active pulses." *See Software Architecture for Immersipresence* (2003) at 9.<br><br>"Finally, a critical architectural property that must be considered is performance overhead. Some aspects of the SAI data and processing models, such as filtering, involve non trivial computations, and could make the theory impractical. The existence of fairly complex systems designed in the SAI style and implemented with MFSM show that, at least for these examples, it is not the case. Experimental scalability tests performed on applications designed in the SAI style, reported in [20] and [16], suggest that: (1) as long as computing resources are available, the overhead introduced by the SAI processing model remains constant, and (2) the contribution of the different processes are combined linearly." *See Software Architecture for Immersipresence* (2003) at 10.<br><br>"2.1. Concurrent asynchronous processing SAI adopts a concurrent asynchronous processing model, to ensure that architectural designs specify costly synchronization structures explicitly, only when needed. In particular, such designs can be optimal with respect to latency and throughput simultaneously, where sequential models sacrifice latency for throughput (and vice -versa), and buffering in pipelined concurrent models may force suboptimal latency [2, 4]. Figure 1 illustrates system latency, which is the overall computation time for an input sample, and throughput or output rate, inverse of the time elapsed between two consecutive output samples. The goal for high-quality interaction is to minimize system latency and maximize system throughput…. The asynchronous concurrent model relaxes this constraint: instead of being held in a buffer to be processed by order of arrival, each incoming sample is processed on arrival in the processing center, in a separate thread. Achievable throughput is now optimal. It will actually be achieved if no hardware or software resources become exhausted (e.g. computing power, memory, bus bandwidth, etc.). Of course, an asynchronous model requires to explicitly implement synchronization when necessary, but only then." *An Architectural* |

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| | *Framework for the Design, Analysis and Implementation of Interactive Systems* (2010) at 1188-1189.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph. |

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| | “When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the camera axis.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>“We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>“The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person |

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| | looking in a mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1:<br><br>  <br><br>Figure 1. Basic mirror geometry.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 2: |

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| |  <br>Figure 2. Handheld virtual mirror device.<br><br>"We address the problem of 3D reconstruction from a single perspective view of a mirror symmetric scene. We establish the fundamental result that it is geometrically equivalent to observing the scene with two cameras, the cameras being symmetrical with respect to the unknown 3D symmetry plane. All traditional tools of classical 2-view stereo can then be applied, and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. However, the problems are greatly simplified here, as the rectification process and the computation of epipolar geometry can be easily performed from the original view only. If the camera is calibrated, we show how to synthesize the symmetric image generated by the same physical camera. A Euclidean reconstruction of the scene can then be computed from the resulting stereo pair. To validate this novel formulation, we have processed many real images, and show examples of 3D reconstruction. q 2003 Elsevier Science B.V. All rights reserved." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract).<br><br>"We establish more general epipolar projective properties of single views of mirror symmetric scenes, and apply them in a different context: we perform Euclidean 3D reconstruction of mirror symmetric objects from a single perspective view using traditional 2-view stereo geometry." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138. |

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| | “We developed our novel formulation to use existing 2- view stereo tools to perform 3D reconstruction of mirror symmetric objects from a single, real perspective image. Such systems take as input two images, taken by the same physical camera from different positions, and sometimes require the images to be rectified. If the rectification poses no theoretical problem given the availability of epipolar pencils, the synthesis of a virtual symmetric view taken by a physical camera requires more work. We show how to build such an image in the case of a calibrated pinhole camera, in order to allow Euclidean reconstruction of the scene. We then present the reconstruction results obtained by processing image pairs made of one real perspective image of a mirror symmetric object, and one synthetic symmetric view, in an off-the-shelf commercial package, Eos System’s PhotoModeler Pro 4.0.<br><br>5.1. Calibrated pinhole camera case<br><br>Suppose the camera used to take the available picture is a pinhole camera. It projects the world point X into the image point x according to the formula: |

$x = KR[I|(-\tilde{C})]X$

The $3 \times 3$ matrix $K$ is the camera calibration matrix. If $C$ is a pinhole camera, its calibration matrix is of the form:

$$k = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix}$$

where $\alpha_x$ $\alpha_y$ and represent the focal length of the camera in the $x$ and $y$ directions, respectively, and $(x_0, y_0)$ is the principal point, all expressed in terms of pixel dimensions.

$R$ is the $3 \times 3$ transform matrix from the world coordinate system to the camera coordinate system, in this case a rotation, defined by:

$$R = [\, e_1^{\mathrm{T}} \quad e_2^{\mathrm{T}} \quad e_3^{\mathrm{T}} \,]^{\mathrm{T}}$$

where $(e_1, e_2, e_3)$ is the orthonormal basis of the Euclidean coordinate system associated with the camera.

Let $(e'_1, e'_2, e'_3)$ be the orthonormal basis of the Euclidean coordinate system associated with the virtual symmetrical camera. By construction, $e'_j = \overline{e_j} = \bar{Z}e_j$. Because of the symmetry, this coordinate system's orientation is reversed compared to that of $(e_1, e_2, e_3)$ (if one is right-handed, the other is left-handed).

The virtual camera projects the world point $X$ into the image point $x'$ according to:

$$x' = KR\bar{Z}[I| - \tilde{\bar{C}}]X = K\bar{R}[I| - \tilde{\bar{C}}]X$$

where:

$$\bar{R} = R\bar{Z} = [\, \overline{e_1}^{\mathrm{T}} \quad \overline{e_2}^{\mathrm{T}} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

The image point of the same world point seen by the physical camera placed in $\tilde{C}$ and with principal axis direction $\overline{e_3}^{\mathrm{T}}$ is:

$$x'' = KR''[I| - \tilde{C}]X$$

where

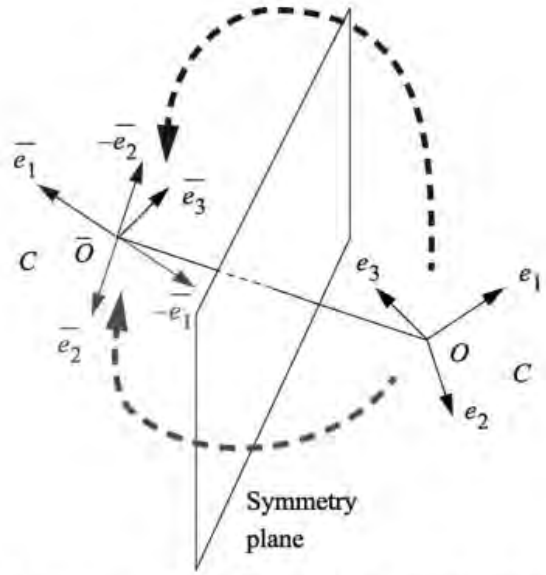
$$R'' = [\, e''_1\mathrm{T} \quad e''_2\mathrm{T} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

and $(e''_1, e''_2)$ is an orthonormal basis of the principal plane such that $(e''_1, e''_2, \overline{e_3})$ has the same orientation as $(e_1, e_2, e_3)$ (both are either right or left-handed). Such a basis is obtained by applying a rotation of an arbitrary angle $\theta$ to the basis $(\overline{e_1}, \overline{e_2})$ in the plane it defines, and inverting the direction of one of the axes. The rotation of the coordinate system corresponds to a rotation of the physical camera around its optical axis.

Using the notation

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \bar{R}[I| - \tilde{\bar{C}}]X$$

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| | $x''$ can be written:<br>$x'' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>Since we are looking to relate $x''$ and<br>$x' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>the simplest analytic form naturally corresponds to no rotation, i.e. to the cases where the real camera coordinate system axes are aligned with that of the virtual (symmetric) ones, the direction of one of the axes being reversed to preserve the coordinate system's orientation. The two corresponding cases are shown in Fig. 2. For sake of clarity and simplicity, without loss of generality, we only consider an inversion of the x-axis.<br>Under these conditions, $x'$ and $x''$ differ only by their first component $U'$ and $U''$, respectively, and thus only the image points abscissas differ:<br>$u' = \frac{a}{c}\alpha_x + x_0, \qquad u'' = -\frac{a}{c}\alpha_x + x_0$<br>It follows that if the camera is calibrated, then the symmetric view of the virtual stereo pair can be obtained by simply performing a horizontal mirror of the original image with respect to a vertical axis going through the principal point. |

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| |  <br>Fig. 2. How to relate the virtual view and the real camera's view from the virtual viewpoint.<br><br>" *See Mirror symmetry -> 2-view stereo geometry* (2003) at 139-140.<br><br>"5.2. Stealth fighter model Our first example is a toy F-117 Stealth fighter. The input image and synthesized symmetric view are presented in Fig. 3a with their epipolar pencils. The internal parameters of the digital camera used were determined using Photo-modeler's calibration tool. After specifying a minimum number of point correspondences between the two images, the software was able to perform a full calibration of both camera positions and to infer the 3D position of the object points. Adding more point and line correspondences allowed to obtain a 3D wireframe model of the object presented in Fig. 3b. Note that the recovered object is mirror symmetric, and that the recovered cameras are actually symmetrical in location and orientation with respect to the object's symmetry plane, properties that are not used at any point in Photomodeler's reconstruction algorithms (the symmetry property is only used to |

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| | synthesize the symmetric view). Once the 3D inference is performed, the 3D surface model shown in Fig. 3c is built and the texture can be extracted from the images. The final 3D model with texture map is shown in Fig. 3d. The construction of this 3D textured model took only a few minutes to a novice Photomodeler user. Incorporating symmetry derived constraints in the workflow and in the interface would greatly facilitate the process and reduce the time needed to build a model, while also helping in improving the accuracy of the manual input and helping deal with self occlusions across the symmetry plane." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143.<br><br>"5.3. Face model<br><br>The technique clearly applies beautifully to perfectly symmetric objects. We also wanted to try the more challenging problem posed by (quasi-)human faces. We used a bust of Darth Maul, which is fairly symmetric. The input and synthetic symmetric views are presented in Fig. 4a. The wireframe model and camera positions and orientations as recovered by Photomodeler are presented in Fig. 4b. Finally, the resulting textured model is shown in Fig. 4c. The polygonal model, although coarse, captures the geometry of the face fairly well, so that the resulting textured model is easily recognized as a face under various viewpoints." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 143.<br><br>*See Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a):<br><br>  <br>(a) Input image (left) of a Darth Maul bust and inverted image (right), used as a stereo pair |

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| | "This document highlights and addresses architecture level software development issues facing researchers and practitioners in the field of Computer Vision. A new framework, or architectural style, called SAI, is introduced. It provides a formalism for the design, implementation and analysis of software systems that perform distributed parallel processing of generic data streams. Architectural patterns are illustrated with a number of demonstration projects ranging from single stream automatic real-time video processing to fully integrated distributed interactive systems mixing live video, graphics and sound. SAI is supported by an open source architectural middleware called MFSM." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract).<br><br>"4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a |

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| | consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications |

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| | of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13: |

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Figure 12: The handheld mirror simulation system ("Virtual Mirror").

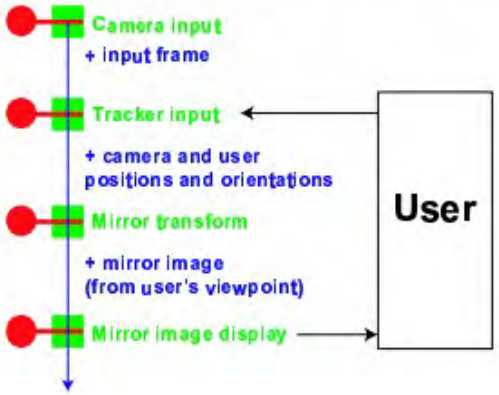
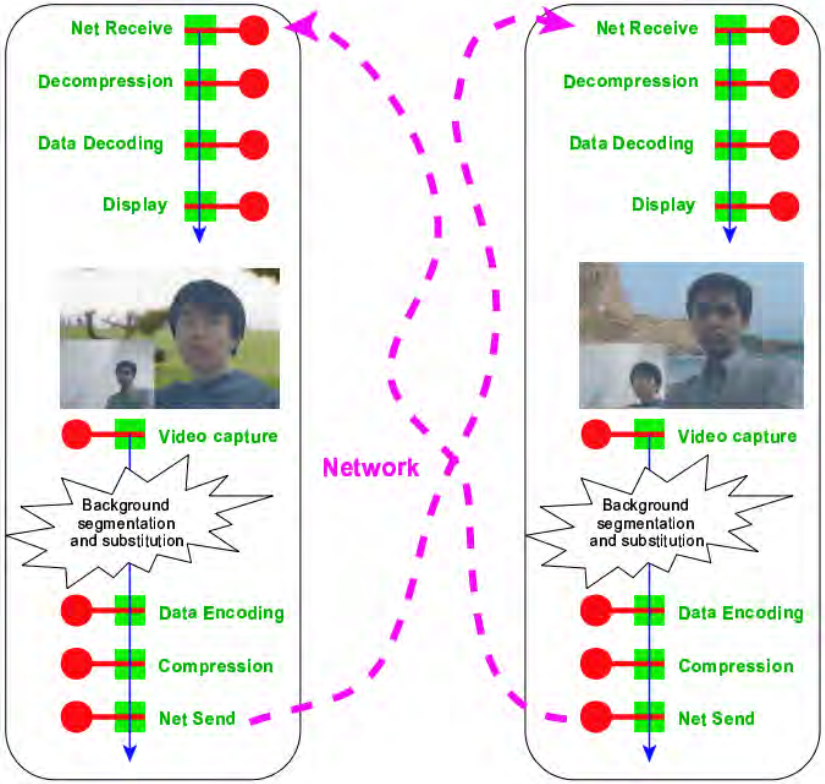


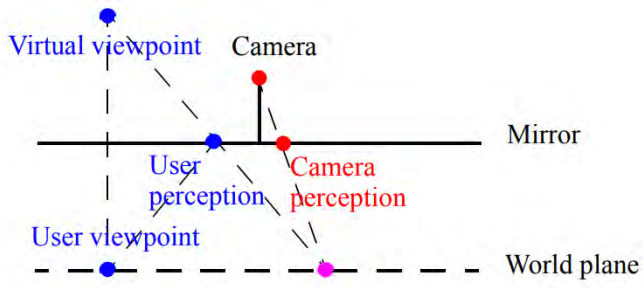

Figure 13: The Virtual Mirror application graph.

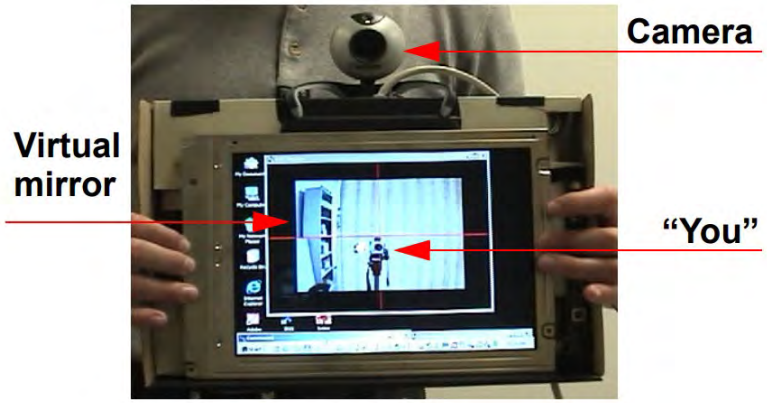
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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

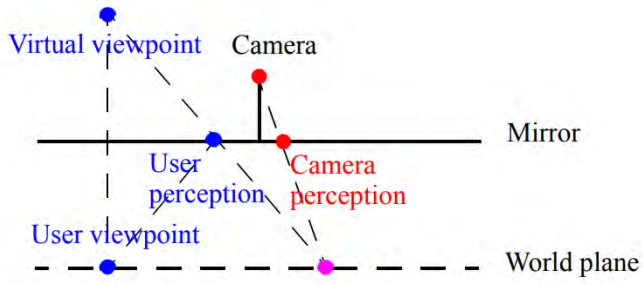
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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[a]. obtaining a reference image; | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below.<br><br>"In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate |

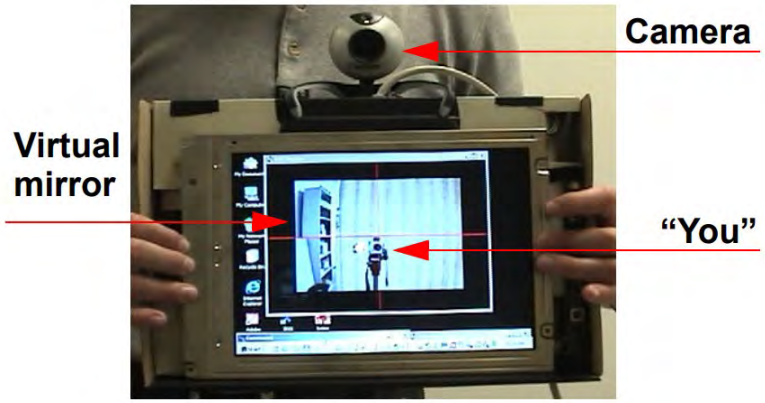
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| | them geometrically." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>"The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>"The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person looking in a mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1:<br><br>  <br><br>Figure 1. Basic mirror geometry. |

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| | *See A Handheld Virtual Mirror* (2002), at Figure 2:<br>  <br><br>Figure 2. Handheld virtual mirror device.<br><br>"We address the problem of 3D reconstruction from a single perspective view of a mirror symmetric scene. We establish the fundamental result that it is geometrically equivalent to observing the scene with two cameras, the cameras being symmetrical with respect to the unknown 3D symmetry plane. All traditional tools of classical 2-view stereo can then be applied, and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. However, the problems are greatly simplified here, as the rectification process and the computation of epipolar geometry can be easily performed from the original view only. If the camera is calibrated, we show how to synthesize the symmetric image generated by the same physical camera. A Euclidean reconstruction of the scene can then be computed from the resulting stereo pair. To validate this novel formulation, we have processed many real images, and show examples of 3D reconstruction. q 2003 Elsevier Science B.V. All rights reserved." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract). |

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| | "Theorem. One perspective view of a mirror symmetric scene, taken with an arbitrary projective camera, is geometrically equivalent to two perspective views of the scene from two projective cameras symmetrical with respect to the unknown 3D symmetry plane.<br><br>We show how to extract the epipolar geometry relating the two views from the single input image. Classical 2-view stereo results can then be applied (see e.g. Refs. [1,4]), and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. If the camera is calibrated, we show how to synthesize the image generated by the original camera placed symmetrically, in order to be able to use traditional 2-view stereo tools to obtain an Euclidean reconstruction of the scene.<br><br>This paper is organized as follows. In Section 2, we establish a lemma introducing a virtual camera, symmetric to the camera that produced the input image with respect to the object's symmetry plane. In Section 3, we establish a lemma linking the symmetry lines and epipolar lines in images of a symmetric scene taken by cameras in symmetrical locations. The proof for the mirror-stereo theorem is given in Section 4.<br><br>In Section 5, we show, in the case of a calibrated pinhole camera, how to build a virtual view taken by the same camera placed symmetrically in location and orientation. Examples of Euclidean 3D reconstructions obtained from such pairs with an off-the-shelf stereo package are presented. A summary of the contribution concludes the paper in Section 6. Throughout the paper, the approach and notation used are consistent with that of Ref. [4]." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 138.<br><br>"We developed our novel formulation to use existing 2- view stereo tools to perform 3D reconstruction of mirror symmetric objects from a single, real perspective image. Such systems take as input two images, taken by the same physical camera from different positions, and sometimes require the images to be rectified. If the rectification poses no theoretical problem given the availability of epipolar pencils, the synthesis of a virtual symmetric view taken by a physical camera requires more work. We show how to build such an image in the case of a calibrated pinhole camera, in order to allow Euclidean reconstruction of the scene. We then present the reconstruction results obtained by processing image pairs made of one real |

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| | perspective image of a mirror symmetric object, and one synthetic symmetric view, in an off-the-shelf commercial package, Eos System's PhotoModeler Pro 4.0." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 139.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>"The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation." |

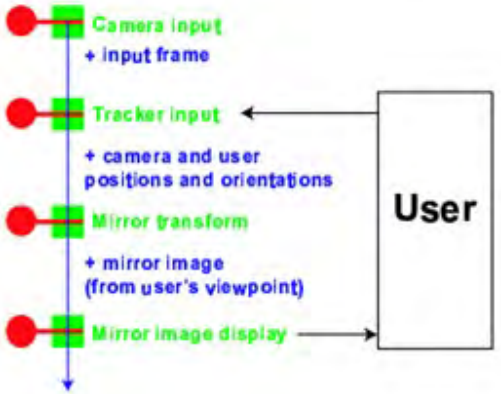
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| | *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>"The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person looking in a mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1:<br><br>  <br><br>Figure 1. Basic mirror geometry.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 2: |

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| |  <br>Figure 2. Handheld virtual mirror device.<br><br>"We address the problem of 3D reconstruction from a single perspective view of a mirror symmetric scene. We establish the fundamental result that it is geometrically equivalent to observing the scene with two cameras, the cameras being symmetrical with respect to the unknown 3D symmetry plane. All traditional tools of classical 2-view stereo can then be applied, and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. However, the problems are greatly simplified here, as the rectification process and the computation of epipolar geometry can be easily performed from the original view only. If the camera is calibrated, we show how to synthesize the symmetric image generated by the same physical camera. A Euclidean reconstruction of the scene can then be computed from the resulting stereo pair. To validate this novel formulation, we have processed many real images, and show examples of 3D reconstruction. q 2003 Elsevier Science B.V. All rights reserved." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract).<br><br>"Theorem. One perspective view of a mirror symmetric scene, taken with an arbitrary projective camera, is geometrically equivalent to two perspective views of the scene from two projective cameras symmetrical with respect to the unknown 3D symmetry plane. |

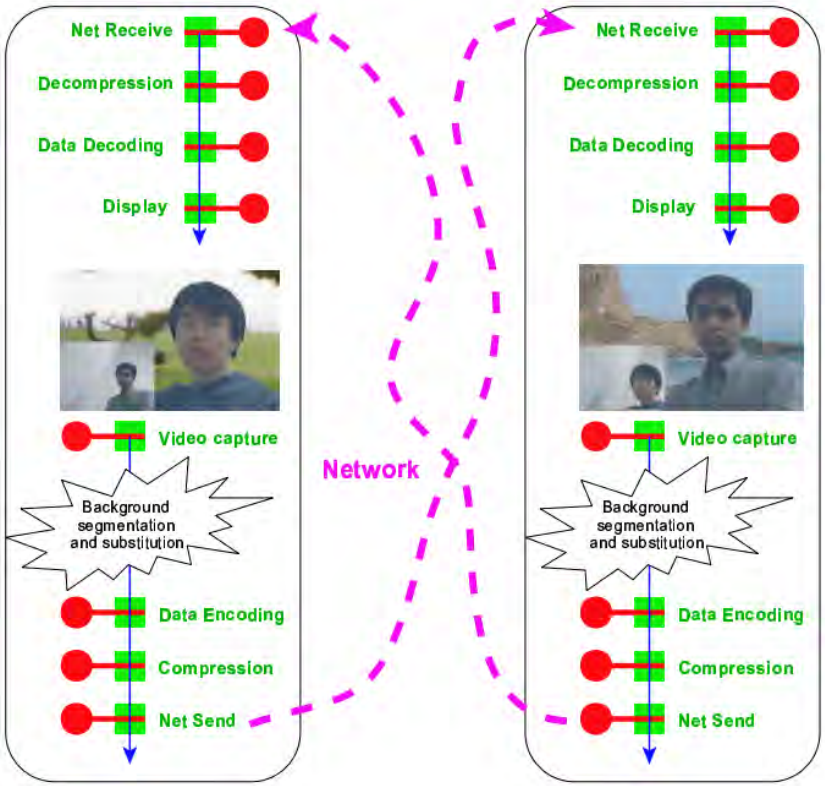
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| | We show how to extract the epipolar geometry relating the two views from the single input image. Classical 2-view stereo results can then be applied (see e.g. Refs. [1,4]), and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. If the camera is calibrated, we show how to synthesize the image generated by the original camera placed symmetrically, in order to be able to use traditional 2-view stereo tools to obtain an Euclidean reconstruction of the scene.<br><br>This paper is organized as follows. In Section 2, we establish a lemma introducing a virtual camera, symmetric to the camera that produced the input image with respect to the object's symmetry plane. In Section 3, we establish a lemma linking the symmetry lines and epipolar lines in images of a symmetric scene taken by cameras in symmetrical locations. The proof for the mirror-stereo theorem is given in Section 4.<br><br>In Section 5, we show, in the case of a calibrated pinhole camera, how to build a virtual view taken by the same camera placed symmetrically in location and orientation. Examples of Euclidean 3D reconstructions obtained from such pairs with an off-the-shelf stereo package are presented. A summary of the contribution concludes the paper in Section 6. Throughout the paper, the approach and notation used are consistent with that of Ref. [4]." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 138.<br><br>"We developed our novel formulation to use existing 2- view stereo tools to perform 3D reconstruction of mirror symmetric objects from a single, real perspective image. Such systems take as input two images, taken by the same physical camera from different positions, and sometimes require the images to be rectified. If the rectification poses no theoretical problem given the availability of epipolar pencils, the synthesis of a virtual symmetric view taken by a physical camera requires more work. We show how to build such an image in the case of a calibrated pinhole camera, in order to allow Euclidean reconstruction of the scene. We then present the reconstruction results obtained by processing image pairs made of one real perspective image of a mirror symmetric object, and one synthetic symmetric view, in an off-the-shelf commercial package, Eos System's PhotoModeler Pro 4.0." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 139. |

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| | “4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer’s position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer’s position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. |

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| | Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror.” *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Figs. 12 and 13: |

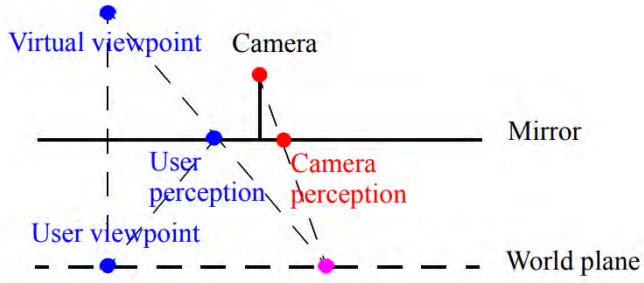
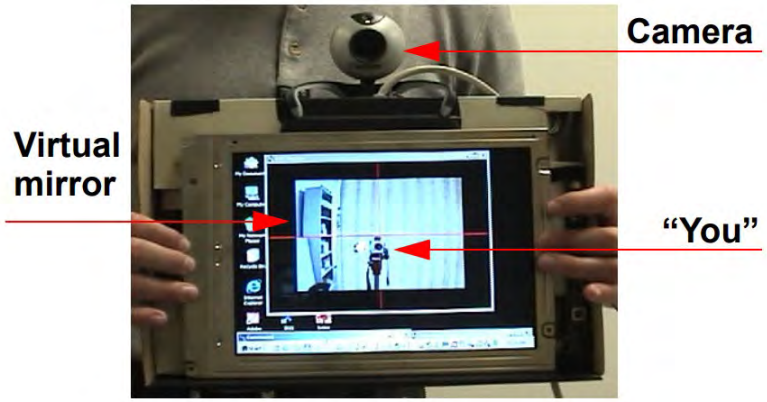
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| |  <br>Figure 12: The handheld mirror simulation system ("Virtual Mirror").<br>  <br>Figure 13: The Virtual Mirror application graph. |

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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois II |
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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the |

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| | camera axis.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>“We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>“The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person looking in a mirror.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1: |

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| |  <br>Figure 1. Basic mirror geometry.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 2:<br><br>  <br>Figure 2. Handheld virtual mirror device.<br><br>"We address the problem of 3D reconstruction from a single perspective view of a mirror symmetric scene. We establish the fundamental result that it is geometrically equivalent to observing the scene with two cameras, the cameras being symmetrical with respect to the |

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| | unknown 3D symmetry plane. All traditional tools of classical 2-view stereo can then be applied, and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. However, the problems are greatly simplified here, as the rectification process and the computation of epipolar geometry can be easily performed from the original view only. If the camera is calibrated, we show how to synthesize the symmetric image generated by the same physical camera. A Euclidean reconstruction of the scene can then be computed from the resulting stereo pair. To validate this novel formulation, we have processed many real images, and show examples of 3D reconstruction. q 2003 Elsevier Science B.V. All rights reserved." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract).<br><br>"We establish more general epipolar projective properties of single views of mirror symmetric scenes, and apply them in a different context: we perform Euclidean 3D reconstruction of mirror symmetric objects from a single perspective view using traditional 2-view stereo geometry." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138.<br><br>"We developed our novel formulation to use existing 2- view stereo tools to perform 3D reconstruction of mirror symmetric objects from a single, real perspective image. Such systems take as input two images, taken by the same physical camera from different positions, and sometimes require the images to be rectified. If the rectification poses no theoretical problem given the availability of epipolar pencils, the synthesis of a virtual symmetric view taken by a physical camera requires more work. We show how to build such an image in the case of a calibrated pinhole camera, in order to allow Euclidean reconstruction of the scene. We then present the reconstruction results obtained by processing image pairs made of one real perspective image of a mirror symmetric object, and one synthetic symmetric view, in an off-the-shelf commercial package, Eos System's PhotoModeler Pro 4.0.<br><br>5.1. Calibrated pinhole camera case<br><br>Suppose the camera used to take the available picture is a pinhole camera. It projects the world point X into the image point x according to the formula: |

$x = KR[I|(-\tilde{C})]X$

The $3 \times 3$ matrix $K$ is the camera calibration matrix. If $C$ is a pinhole camera, its calibration matrix is of the form:

$$k = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix}$$

where $\alpha_x$ $\alpha_y$ and represent the focal length of the camera in the $x$ and $y$ directions, respectively, and $(x_0, y_0)$ is the principal point, all expressed in terms of pixel dimensions.

$R$ is the $3 \times 3$ transform matrix from the world coordinate system to the camera coordinate system, in this case a rotation, defined by:

$$R = [\, e_1^{\mathrm{T}} \quad e_2^{\mathrm{T}} \quad e_3^{\mathrm{T}} \,]^{\mathrm{T}}$$

where $(e_1, e_2, e_3)$ is the orthonormal basis of the Euclidean coordinate system associated with the camera.

Let $(e'_1, e'_2, e'_3)$ be the orthonormal basis of the Euclidean coordinate system associated with the virtual symmetrical camera. By construction, $e'_j = \overline{e_j} = \bar{Z}e_j$. Because of the symmetry, this coordinate system's orientation is reversed compared to that of $(e_1, e_2, e_3)$ (if one is right-handed, the other is left-handed).

The virtual camera projects the world point $X$ into the image point $x'$ according to:

$$x' = KR\bar{Z}[I| - \tilde{C}]X = K\bar{R}[I| - \tilde{C}]X$$

where:

$$\bar{R} = R\bar{Z} = [\, \overline{e_1}^{\mathrm{T}} \quad \overline{e_2}^{\mathrm{T}} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

The image point of the same world point seen by the physical camera placed in $\tilde{C}$ and with principal axis direction $\overline{e_3}^{\mathrm{T}}$ is:

$$x'' = KR''[I| - \tilde{C}]X$$

where

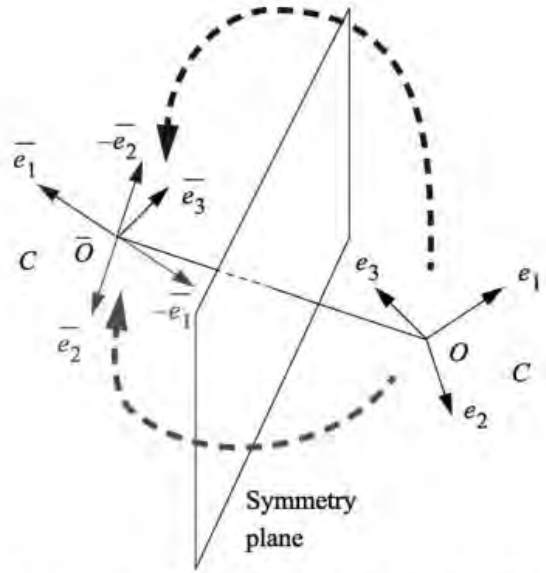
$$R'' = [\, e_1''\mathrm{T} \quad e_2''\mathrm{T} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

and $(e''_1, e''_2)$ is an orthonormal basis of the principal plane such that $(e''_1, e''_2, \overline{e_3})$ has the same orientation as $(e_1, e_2, e_3)$ (both are either right or left-handed). Such a basis is obtained by applying a rotation of an arbitrary angle $\theta$ to the basis $(\overline{e_1}, \overline{e_2})$ in the plane it defines, and inverting the direction of one of the axes. The rotation of the coordinate system corresponds to a rotation of the physical camera around its optical axis.

Using the notation

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \bar{R}[I| - \tilde{C}]X$$

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| | $x''$ can be written:<br>$x'' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>Since we are looking to relate $x''$ and<br>$x' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>the simplest analytic form naturally corresponds to no rotation, i.e. to the cases where the real camera coordinate system axes are aligned with that of the virtual (symmetric) ones, the direction of one of the axes being reversed to preserve the coordinate system's orientation. The two corresponding cases are shown in Fig. 2. For sake of clarity and simplicity, without loss of generality, we only consider an inversion of the x-axis.<br>Under these conditions, $x'$ and $x''$ differ only by their first component $U'$ and $U''$, respectively, and thus only the image points abscissas differ:<br>$u' = \frac{a}{c}\alpha_x + x_0, \qquad u'' = -\frac{a}{c}\alpha_x + x_0$<br>It follows that if the camera is calibrated, then the symmetric view of the virtual stereo pair can be obtained by simply performing a horizontal mirror of the original image with respect to a vertical axis going through the principal point. |

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| |  <br>Fig. 2. How to relate the virtual view and the real camera's view from the virtual viewpoint.<br><br>" *See Mirror symmetry -> 2-view stereo geometry* (2003) at 139-140.<br><br>"5.2. Stealth fighter model Our first example is a toy F-117 Stealth fighter. The input image and synthesized symmetric view are presented in Fig. 3a with their epipolar pencils. The internal parameters of the digital camera used were determined using Photo-modeler's calibration tool. After specifying a minimum number of point correspondences between the two images, the software was able to perform a full calibration of both camera positions and to infer the 3D position of the object points. Adding more point and line correspondences allowed to obtain a 3D wireframe model of the object presented in Fig. 3b. Note that the recovered object is mirror symmetric, and that the recovered cameras are actually symmetrical in location and orientation with respect to the object's symmetry plane, properties that are not used at any point in Photomodeler's reconstruction algorithms (the symmetry property is only used to |

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| | synthesize the symmetric view). Once the 3D inference is performed, the 3D surface model shown in Fig. 3c is built and the texture can be extracted from the images. The final 3D model with texture map is shown in Fig. 3d. The construction of this 3D textured model took only a few minutes to a novice Photomodeler user. Incorporating symmetry derived constraints in the workflow and in the interface would greatly facilitate the process and reduce the time needed to build a model, while also helping in improving the accuracy of the manual input and helping deal with self occlusions across the symmetry plane.” *See Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143.<br><br>“5.3. Face model<br><br>The technique clearly applies beautifully to perfectly symmetric objects. We also wanted to try the more challenging problem posed by (quasi-)human faces. We used a bust of Darth Maul, which is fairly symmetric. The input and synthetic symmetric views are presented in Fig. 4a. The wireframe model and camera positions and orientations as recovered by Photomodeler are presented in Fig. 4b. Finally, the resulting textured model is shown in Fig. 4c. The polygonal model, although coarse, captures the geometry of the face fairly well, so that the resulting textured model is easily recognized as a face under various viewpoints.” *See Mirror symmetry -> 2-view stereo geometry* (2003) at 143.<br><br>*See Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a):<br><br>  <br>(a) Input image (left) of a Darth Maul bust and inverted image (right), used as a stereo pair |

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| | “This document highlights and addresses architecture level software development issues facing researchers and practitioners in the field of Computer Vision. A new framework, or architectural style, called SAI, is introduced. It provides a formalism for the design, implementation and analysis of software systems that perform distributed parallel processing of generic data streams. Architectural patterns are illustrated with a number of demonstration projects ranging from single stream automatic real-time video processing to fully integrated distributed interactive systems mixing live video, graphics and sound. SAI is supported by an open source architectural middleware called MFSM.” See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 1 (Abstract).<br><br>“4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer’s position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer’s position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a |

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| | consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications |

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| | of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror.” See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15.<br><br>See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13: |

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Figure 12: The handheld mirror simulation system ("Virtual Mirror").

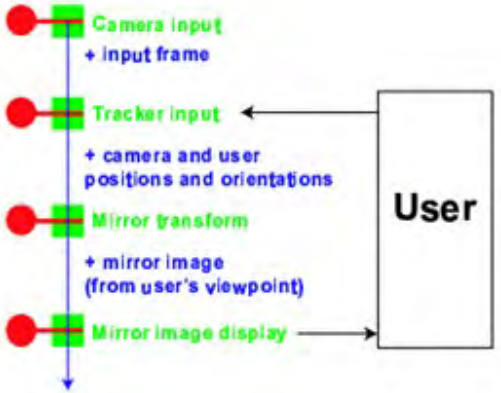
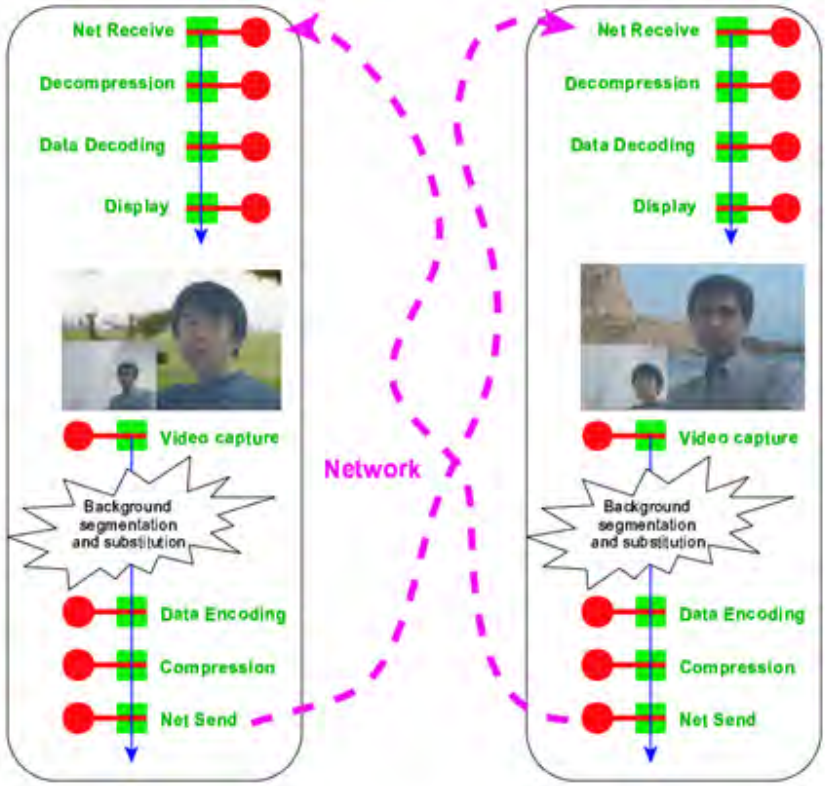



Figure 13: The Virtual Mirror application graph.

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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

| Asserted Claim of the '109 Patent | Exemplary Citations to Francois II |
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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

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| | Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Francois II |
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| **Claim 8** | |
| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious applying a translation transformation to move the image within display area of the monitor. *See*, *e.g.*, disclosures below.<br><br>“This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>“When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, |

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| | the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the camera axis.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>“We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>“The design and construction of realistic virtual mirrors represents an original experiment in Human-Computer Interface, that opens the door to various interactive experiments in entertainment, arts and communication. Use of video analysis and graphics techniques will allow to explore and interfere with what has always been a private, solitary act of a person looking in a mirror.” *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 3.Perspectives.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1: |

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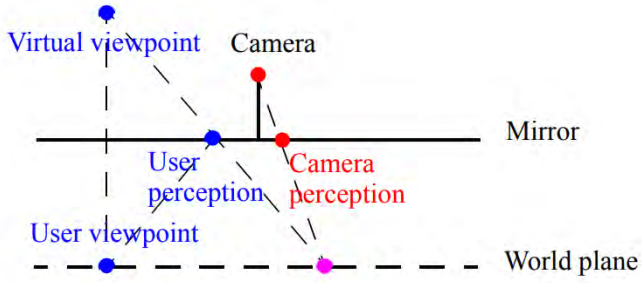



Figure 1. Basic mirror geometry.

*See A Handheld Virtual Mirror* (2002), at Figure 2:

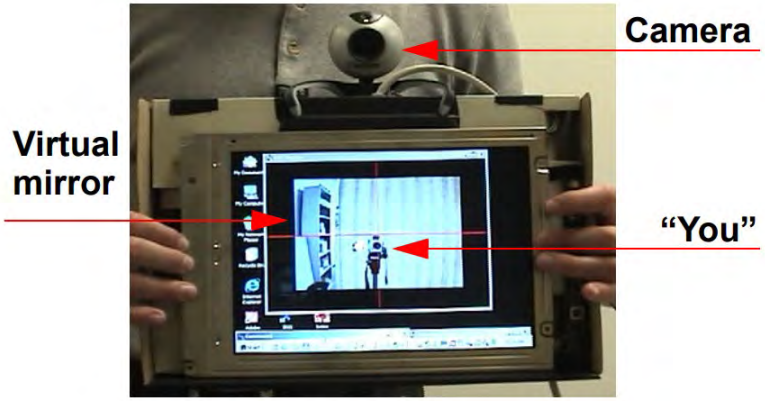



Figure 2. Handheld virtual mirror device.

"We address the problem of 3D reconstruction from a single perspective view of a mirror symmetric scene. We establish the fundamental result that it is geometrically equivalent to observing the scene with two cameras, the cameras being symmetrical with respect to the

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| | unknown 3D symmetry plane. All traditional tools of classical 2-view stereo can then be applied, and the concepts of fundamental/essential matrix, epipolar geometry, rectification and disparity hold. However, the problems are greatly simplified here, as the rectification process and the computation of epipolar geometry can be easily performed from the original view only. If the camera is calibrated, we show how to synthesize the symmetric image generated by the same physical camera. A Euclidean reconstruction of the scene can then be computed from the resulting stereo pair. To validate this novel formulation, we have processed many real images, and show examples of 3D reconstruction. q 2003 Elsevier Science B.V. All rights reserved." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137 (Abstract).<br><br>"We establish more general epipolar projective properties of single views of mirror symmetric scenes, and apply them in a different context: we perform Euclidean 3D reconstruction of mirror symmetric objects from a single perspective view using traditional 2-view stereo geometry." *See Mirror symmetry -> 2-view stereo geometry* (2003) at 137-138.<br><br>"We developed our novel formulation to use existing 2- view stereo tools to perform 3D reconstruction of mirror symmetric objects from a single, real perspective image. Such systems take as input two images, taken by the same physical camera from different positions, and sometimes require the images to be rectified. If the rectification poses no theoretical problem given the availability of epipolar pencils, the synthesis of a virtual symmetric view taken by a physical camera requires more work. We show how to build such an image in the case of a calibrated pinhole camera, in order to allow Euclidean reconstruction of the scene. We then present the reconstruction results obtained by processing image pairs made of one real perspective image of a mirror symmetric object, and one synthetic symmetric view, in an off-the-shelf commercial package, Eos System's PhotoModeler Pro 4.0.<br><br>5.1. Calibrated pinhole camera case<br><br>Suppose the camera used to take the available picture is a pinhole camera. It projects the world point X into the image point x according to the formula: |

$x = KR[I|(-\tilde{C})]X$

The $3 \times 3$ matrix $K$ is the camera calibration matrix. If $C$ is a pinhole camera, its calibration matrix is of the form:

$$k = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix}$$

where $\alpha_x$ $\alpha_y$ and represent the focal length of the camera in the $x$ and $y$ directions, respectively, and $(x_0, y_0)$ is the principal point, all expressed in terms of pixel dimensions.

$R$ is the $3 \times 3$ transform matrix from the world coordinate system to the camera coordinate system, in this case a rotation, defined by:

$$R = [\, e_1^{\mathrm{T}} \quad e_2^{\mathrm{T}} \quad e_3^{\mathrm{T}} \,]^{\mathrm{T}}$$

where $(e_1, e_2, e_3)$ is the orthonormal basis of the Euclidean coordinate system associated with the camera.

Let $(e'_1, e'_2, e'_3)$ be the orthonormal basis of the Euclidean coordinate system associated with the virtual symmetrical camera. By construction, $e'_j = \overline{e_j} = \tilde{Z}e_j$. Because of the symmetry, this coordinate system's orientation is reversed compared to that of $(e_1, e_2, e_3)$ (if one is right-handed, the other is left-handed).

The virtual camera projects the world point $X$ into the image point $x'$ according to:

$$x' = KR\tilde{Z}[I| - \tilde{C}]X = K\tilde{R}[I| - \tilde{C}]X$$

where:

$$\tilde{R} = R\tilde{Z} = [\, \overline{e_1}^{\mathrm{T}} \quad \overline{e_2}^{\mathrm{T}} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

The image point of the same world point seen by the physical camera placed in $\tilde{C}$ and with principal axis direction $\overline{e_3}^{\mathrm{T}}$ is:

$$x'' = KR''[I| - \tilde{C}]X$$

where

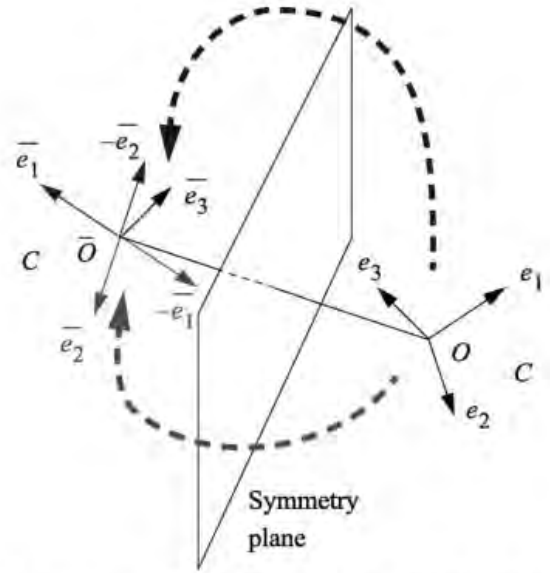
$$R'' = [\, e''_1\mathrm{T} \quad e''_2\mathrm{T} \quad \overline{e_3}^{\mathrm{T}} \,]^{\mathrm{T}}$$

and $(e''_1, e''_2)$ is an orthonormal basis of the principal plane such that $(e''_1, e''_2, \overline{e_3})$ has the same orientation as $(e_1, e_2, e_3)$ (both are either right or left-handed). Such a basis is obtained by applying a rotation of an arbitrary angle $\theta$ to the basis $(\overline{e_1}, \overline{e_2})$ in the plane it defines, and inverting the direction of one of the axes. The rotation of the coordinate system corresponds to a rotation of the physical camera around its optical axis.

Using the notation

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \tilde{R}[I| - \tilde{C}]X$$

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| | $x''$ can be written:<br>$x'' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>Since we are looking to relate $x''$ and<br>$x' = \begin{bmatrix} \alpha_x & 0 & x_0 \\ & \alpha_y & y_0 \\ & & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$<br>the simplest analytic form naturally corresponds to no rotation, i.e. to the cases where the real camera coordinate system axes are aligned with that of the virtual (symmetric) ones, the direction of one of the axes being reversed to preserve the coordinate system's orientation. The two corresponding cases are shown in Fig. 2. For sake of clarity and simplicity, without loss of generality, we only consider an inversion of the x-axis.<br>Under these conditions, $x'$ and $x''$ differ only by their first component $U'$ and $U''$, respectively, and thus only the image points abscissas differ:<br>$u' = \frac{a}{c}\alpha_x + x_0, \qquad u'' = -\frac{a}{c}\alpha_x + x_0$<br>It follows that if the camera is calibrated, then the symmetric view of the virtual stereo pair can be obtained by simply performing a horizontal mirror of the original image with respect to a vertical axis going through the principal point. |

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| |  <br>Fig. 2. How to relate the virtual view and the real camera's view from the virtual viewpoint.<br><br>" *See Mirror symmetry -> 2-view stereo geometry* (2003) at 139-140.<br><br>"5.2. Stealth fighter model Our first example is a toy F-117 Stealth fighter. The input image and synthesized symmetric view are presented in Fig. 3a with their epipolar pencils. The internal parameters of the digital camera used were determined using Photo-modeler's calibration tool. After specifying a minimum number of point correspondences between the two images, the software was able to perform a full calibration of both camera positions and to infer the 3D position of the object points. Adding more point and line correspondences allowed to obtain a 3D wireframe model of the object presented in Fig. 3b. Note that the recovered object is mirror symmetric, and that the recovered cameras are actually symmetrical in location and orientation with respect to the object's symmetry plane, properties that are not used at any point in Photomodeler's reconstruction algorithms (the symmetry property is only used to |

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| | synthesize the symmetric view). Once the 3D inference is performed, the 3D surface model shown in Fig. 3c is built and the texture can be extracted from the images. The final 3D model with texture map is shown in Fig. 3d. The construction of this 3D textured model took only a few minutes to a novice Photomodeler user. Incorporating symmetry derived constraints in the workflow and in the interface would greatly facilitate the process and reduce the time needed to build a model, while also helping in improving the accuracy of the manual input and helping deal with self occlusions across the symmetry plane.” *See Mirror symmetry -> 2-view stereo geometry* (2003) at 142-143.<br><br>“5.3. Face model<br><br>The technique clearly applies beautifully to perfectly symmetric objects. We also wanted to try the more challenging problem posed by (quasi-)human faces. We used a bust of Darth Maul, which is fairly symmetric. The input and synthetic symmetric views are presented in Fig. 4a. The wireframe model and camera positions and orientations as recovered by Photomodeler are presented in Fig. 4b. Finally, the resulting textured model is shown in Fig. 4c. The polygonal model, although coarse, captures the geometry of the face fairly well, so that the resulting textured model is easily recognized as a face under various viewpoints.” *See Mirror symmetry -> 2-view stereo geometry* (2003) at 143.<br><br>*See Mirror symmetry -> 2-view stereo geometry* (2003) at Fig. 4(a):<br><br>  <br>(a) Input image (left) of a Darth Maul bust and inverted image (right), used as a stereo pair |

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| | “This document highlights and addresses architecture level software development issues facing researchers and practitioners in the field of Computer Vision. A new framework, or architectural style, called SAI, is introduced. It provides a formalism for the design, implementation and analysis of software systems that perform distributed parallel processing of generic data streams. Architectural patterns are illustrated with a number of demonstration projects ranging from single stream automatic real-time video processing to fully integrated distributed interactive systems mixing live video, graphics and sound. SAI is supported by an open source architectural middleware called MFSM.” See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 1 (Abstract).<br><br>“4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer’s position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer’s position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to |

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| | compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications |

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| | of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror.” See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at 13-15.<br><br>See Software Architecture for Computer Vision: Beyond Pipes and Filters (2003) at Figs. 12 and 13: |

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Figure 12: The handheld mirror simulation system ("Virtual Mirror").

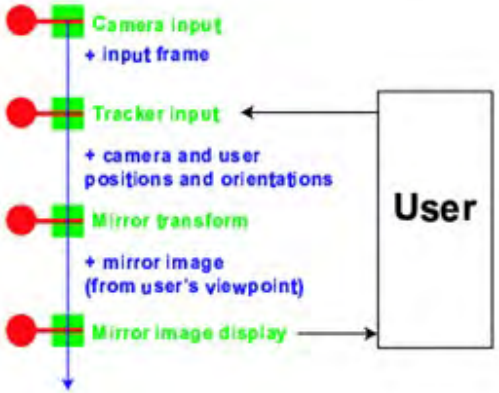
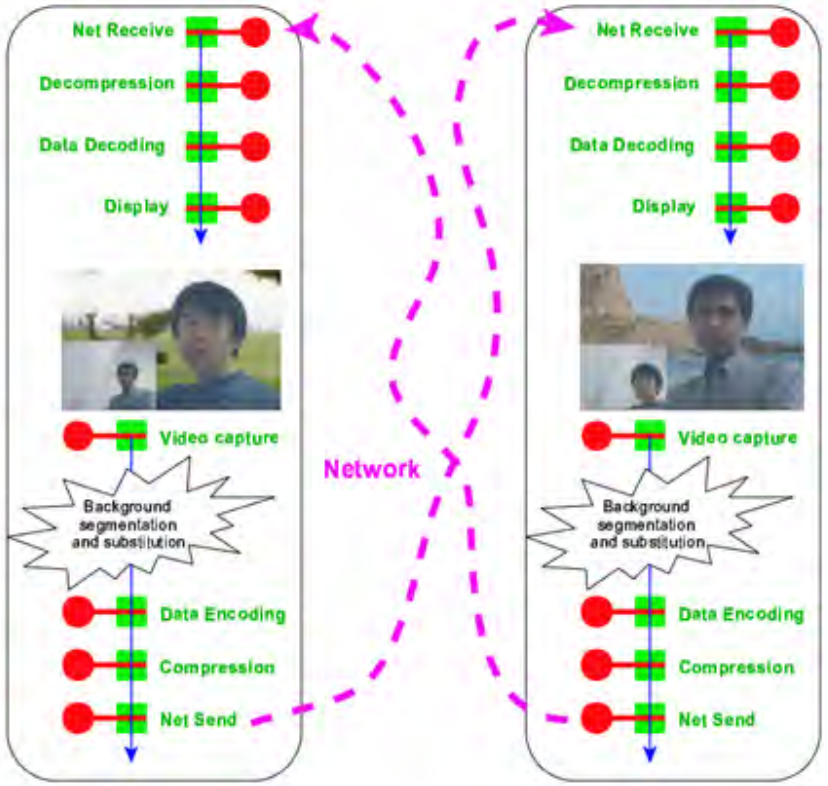


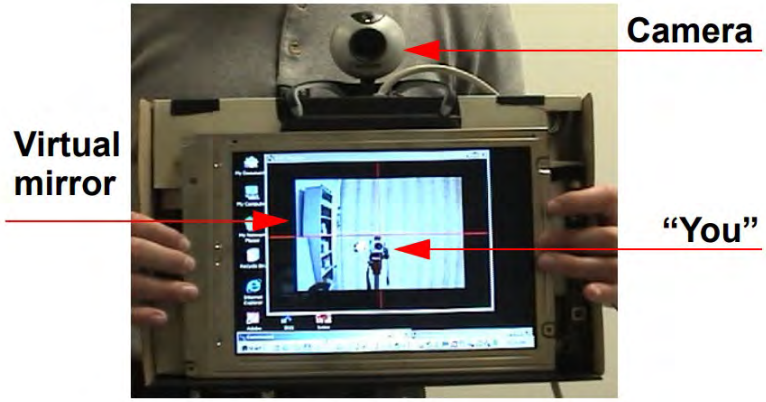

Figure 13: The Virtual Mirror application graph.

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| | "4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

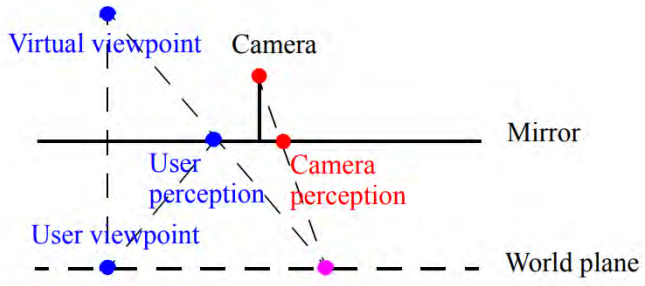
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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' |

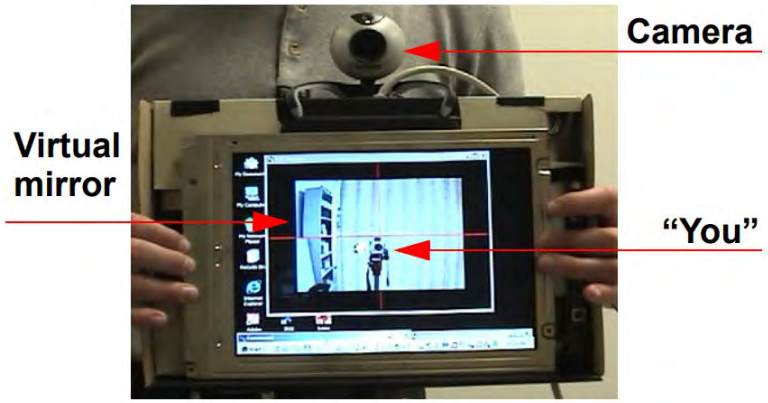
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| | Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. *See*, *e.g.*, disclosures below.<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker |

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| | transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 2:<br><br>  <br><br>Figure 2. Handheld virtual mirror device.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*:<br><br>"This sketch presents the design and construction of a handheld virtual mirror device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. Our system is build around a flat LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at the introductory paragraph.<br><br>"When a person looks into a mirror, they see what they would see from the symmetrical (virtual) point of view (figure 1). A camera whose position and orientation are fixed with |

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| | respect to the mirror produces a video stream that corresponds to this particular viewpoint. In order to synthesize the images corresponding to the user's viewpoint from the images captured by the camera, we must relate them geometrically. Such a transform cannot be formulated without assumptions or knowledge about the world geometry. In our case, the focus of attention is the user's own reflection in the mirror. We thus model the world as a plane parallel to the mirror, at the user's distance from the mirror. We have shown that under these assumptions, the transform relating the camera view and the user view depends only on the relative positions of the user viewpoint and the camera center, and is reduced to a scaling and a translation. The transform is exact when the user viewpoint lies on the camera axis. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, and provides a good approximation when the viewer's position remains close to the camera axis." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 1.Problem formulation and geometric analysis.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 1:<br><br>  <br>Figure 1. Basic mirror geometry.<br><br>*See A Handheld Virtual Mirror* (2002), at Figure 2: |

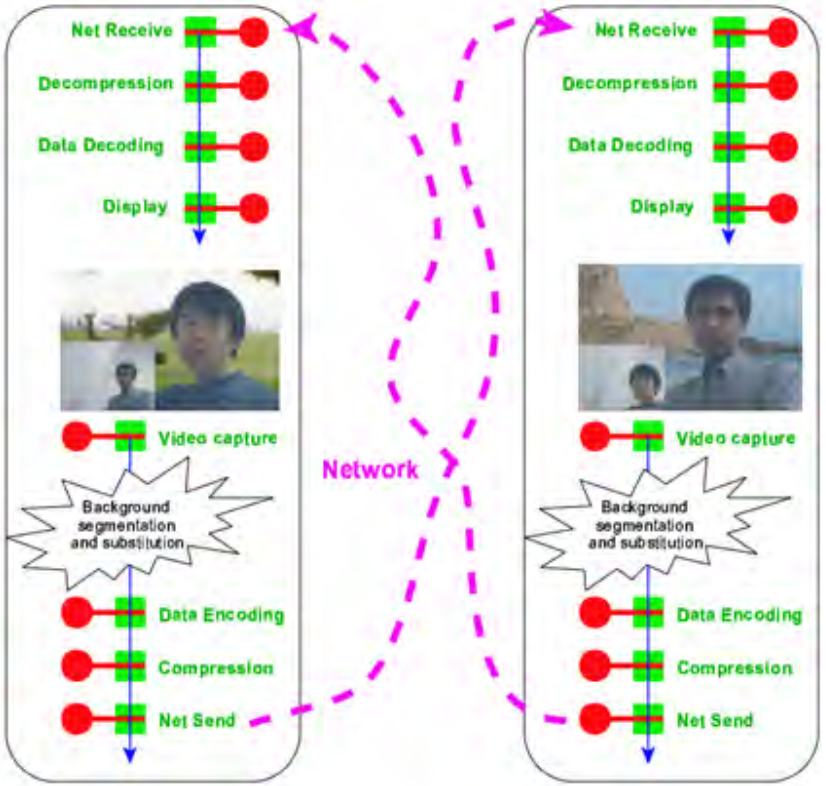
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| |  <br>Figure 2. Handheld virtual mirror device.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants’ Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | To the extent the preamble is limiting, Francois II expressly and/or inherently discloses and/or renders obvious varying resolution of the image according to the distance. *See*, *e.g.*, disclosures below.<br><br>“We have implemented the mirror image transform as a module in the Modular Flow Scheduling Middleware [François 2001], the open source implementation of IMSC's software architecture for Integrated Media Systems. It is specifically designed for parallel processing of concurrent data streams in real-time, and its modularity dramatically reduces development and integration time. The actual handheld virtual mirror system is composed of a handheld 10" LCD flat screen fitted with a camera and a magnetic tracker sensor (figure 2), a fixed processing unit, a fixed magnetic tracker transmitter, and a second magnetic tracker sensor placed on the user. Real-time camera and tracker inputs are used to synthesize the virtual mirror |

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| | stream and display it in real-time on the LCD screen. The result is a very convincing handheld mirror simulation." *See* Integrated Media Systems Center, Alexandre R.J. Francois II et al., *A Handheld Virtual Mirror* (2002), at Section 2.2.System integration.<br><br>"This document highlights and addresses architecture level software development issues facing researchers and practitioners in the field of Computer Vision. A new framework, or architectural style, called SAI, is introduced. It provides a formalism for the design, implementation and analysis of software systems that perform distributed parallel processing of generic data streams. Architectural patterns are illustrated with a number of demonstration projects ranging from single stream automatic real-time video processing to fully integrated distributed interactive systems mixing live video, graphics and sound. SAI is supported by an open source architectural middleware called MFSM." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 1 (Abstract).<br><br>"SAI (Software Architecture for Immersipresence) is a new software architecture model for designing, analyzing and implementing applications performing distributed, asynchronous parallel processing of generic data streams. The goal of SAI is to provide a universal framework for the distributed implementation of algorithms and their easy integration into complex systems that exhibit desirable software engineering qualities such as efficiency, scalability, extensibility, reusability and interoperability. SAI specifies a new architectural style (components, connectors and constraints). The underlying extensible data model and hybrid (shared repository and message-passing) distributed asynchronous parallel processing model allow natural and efficient manipulation of generic data streams, using existing libraries or native code alike." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 3.<br><br>"2.2.1 Time A critical underlying concept in all user-related application domains (but by no means limited to these domain) is that of time. Whether implicitly or explicitly modeled, time relations and ordering are inherent properties of any sensory-related data stream (e.g. image streams, sound, haptics, etc.), absolutely necessary when users are involved in the system, even if not on-line or in real-time. Users perceive data as streams of dynamic information, i.e. evolving in time. This information only makes sense if synchronization constraints are |

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| | respected within each stream (temporal precedence) and across streams (precedence and simultaneity). It follows that time information is a fundamental attribute of all process data, and should therefore be explicitly modeled both in data structures and in processes. Synchronization is a fundamental operation in temporal data stream manipulation systems. It should therefore also be an explicit element of the architectural model. A structure called pulse is introduced to regroup synchronous data. Data streams are thus quantized temporally (not necessarily uniformly). As opposed to the Pipes and Filters case, where data remains localized in the filters where it is created or used, it is grouped in pulses, which flow from processing center to processing center along streams. The processing centers do not consume their input, but merely use it to produce some output that is added to the pulse. This also reduces the amount of costly data copy: in a subgraph implemented on a platform with shared memory space, only a pointer to the evolving pulse structure will be transmitted from processing center to processing center. Note that such processing centers can no longer be called filters." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 5-6.<br><br>"4.3 Handheld mirror simulation<br><br>The Virtual Mirror project [16, 15] started as a feasibility study for the development and construction of a handheld mirror simulation device. The perception of the world reflected through a mirror depends on the viewer's position with respect to the mirror and the 3-D geometry of the world. In order to simulate a real mirror on a computer screen, images of the observed world, consistent with the viewer's position, must be synthesized and displayed in real-time. This is of course geometrically impossible, but with a few simplifying assumptions (e.g. planar world), the image transform required was made simple yet convincing enough to consider building an actual device. The current prototype system (see Figure 12) is comprised of an LCD screen manipulated by the user, a single camera fixed on the screen, and a tracking device. The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen. The synthesized video stream is a close approximation of what the user would see on the screen surface if it were a real mirror. Figure 13 shows the corresponding conceptual application graph. The single stream application does not involve any complicated structure. The stream originates in a live video input cell. A tracker input cell adds position and orientation data to the stream. A mirror transform cell uses |

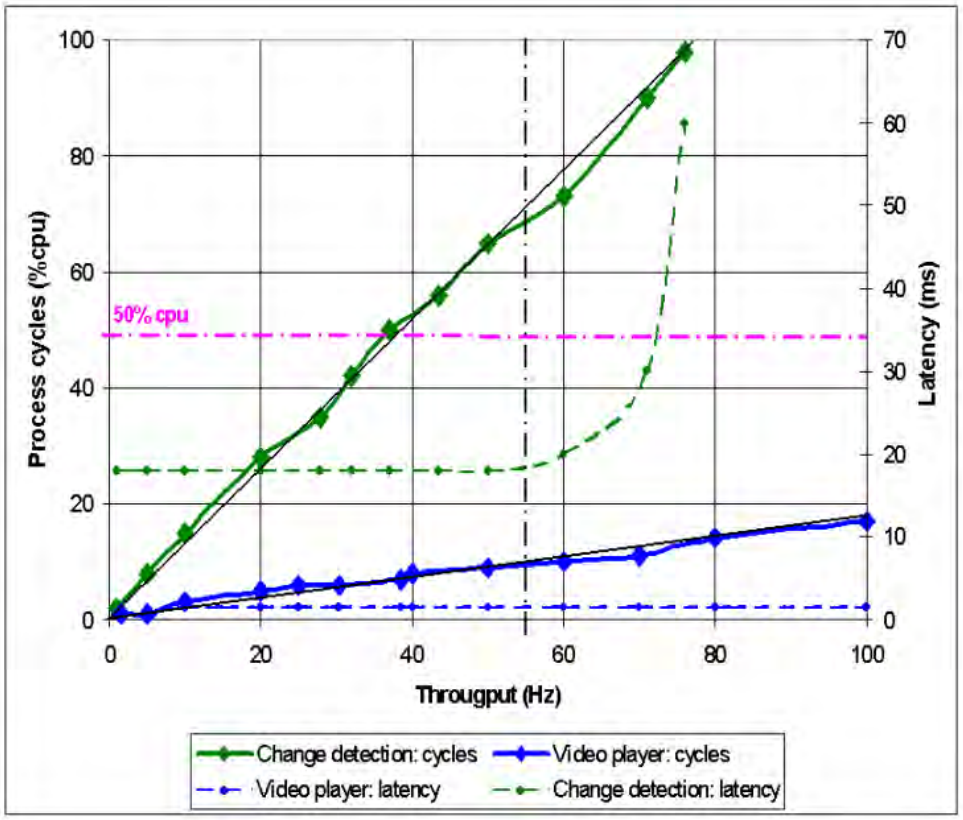
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| | the synchronous image and tracking data to synthesize the mirror simulation image, which is then presented to the user by an image display cell. The two major difficulties in this application are (1) synchronizing the various input streams (video and tracking data) to compute a consistent result; and (2) displaying the result with a low enough latency and a high enough throughput to produce a convincing simulation. The use of pulses in the SAI model makes synchronization a natural operation, involving no superfluous delays or computations. The asynchronous parallel processing model allow high frame rates and low latency. The essential purpose of this system is interaction. Interaction can be seen as a particular data stream loop feeding the user with a perceptual representation of the internal model (experience), collecting the users reaction through various sensory devices and modifying the state of the internal model accordingly (influence). From the systems point of view, these data streams are volatile, and the processes involved in producing and processing them are of the same nature as those carrying procedural internal evolution tasks. Here, the internal model is the mirror, implicit in the computations carried by the mirror transform cell. The user experiences the system through the image displayed on the handheld screen, and influences it by moving her head or the screen. Note that the way live video (frames) and corresponding tracker data are synchronized in the application as described in the conceptual graph is based on the assumption that the delay between the frame capture in the live input cell (push mechanism acting as pulse trigger), and the capture of tracker data in the tracker input cell (pull mechanism), is small enough that no inconsistency can be perceived. This approach happens to work in this case, even when the system is running on a modest platform, but certainly does not generalize to synchronization in more sophisticated settings. This illustrates the flexibility of the SAI style, that allows to devise general structures, as well as simplified or ad hoc design when allowed by the application. This project also illustrates the power of SAI for system integration. The modularity of the model ensures that components developed independently (but consistently with style rules) will function together seamlessly. This allows code re-use (e.g. the image node, and the live video capture and image display cells already existed), and distributed development and testing of new node and cell types. The whole project was completed in only a few months with very limited resources. The mirror simulation system can be used as a research platform. For example, it is a testbed for developing and testing video analysis techniques that could be used to replace the magnetic trackers, including face detection |

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| | and tracking, and gaze tracking. The device itself constitutes a new generic interface for applications involving rich, first-person interaction. A straightforward application is the Daguerr´eotype simulation described in [22]. Beyond technical and commercial applications of such a device, the use of video analysis and graphics techniques will allow artists to explore and interfere with what has always been a private, solitary act, a person looking into a mirror." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 13-15.<br><br>"4.5 Live video in animated 3-D graphics<br><br>The example presented in this section is a real-time, interactive application requiring manipulation of het1erogenous data streams [14]. A video stream (captured live or read from a file) is used as surface texture on an animated 3-D model, rendered in real-time. The (virtual) camera used for rendering can be manipulated n real-time (e.g. with a gamepad or through a head tracking device), making the system interactive. This system was developed to illustrate the design of a scene graph-based graphics toolkit, and the advantages provided by the SAI style for manipulating independently and synchronizing different data streams in a complex interactive (possibly immersive) setting. From a Computer Vision point of view, this example illustrates how the SAI style allows to manipulate video streams and geometric models in a consistent framework. The same architectural patterns generalize to manipulating generic data streams and persistent models. Figure 16 shows the system's conceptual graph. The graph is composed of four functional subgraphs, corresponding to four independent streams, organized around a central source that holds the 3-D model representation in the form of a scene graph, and various process parameters for the different connected cells. The rendering stream generates images of the model. The control stream updates the (virtual) camera position based on user input. Together, the rendering and control units (including the shared source) form an interaction loop with the user. The animation stream drives the dynamic evolution of the 3-D model. The texturing stream places images captured from a video source (camera or file) in the texture node in the scene graph. Interaction and modeling are now analyzed in more detail." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 16-17.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 15: |

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| |  <br>Figure 15: Conceptual graph for an early version of the IMSC Communicator, with support for video (synchronized image and sound).<br><br>"4.1 Real-time video segmentation and tracking |

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| | The development of real-time video analysis applications was actually a steering concern during the development of the SAI style. The system presented here was used as a testbed for the implementation, testing and refinement of some SAI concepts [18]. The video analysis tasks performed are low level segmentation and blob tracking. The segmentation is performed by change detection using an adaptive statistical color background model (the camera is assumed stationary). A review of background maintenance algorithms can be found in [28]. Blob tracking is performed using a new multiresolution algorithm whose description is out of the scope of this document. Figure 7 shows the conceptual level architecture of the software system. It is build around a single stream going through a number of cells. The graph can be decomposed into four functional subgraphs: capture, segmentation, tracking, visualization. The stream originates in the video input cell, which produces, at a given rate, pulses containing an image coming either from a live capture device or a video file. This cell and its source constitute the capture unit of the application. The stream then goes through the segmentation unit, which is analyzed below. Coming out of the segmentation, the stream goes through a tracking cell. The result visualization unit is composed of a rendering and a display subunits. Rendering of a persistent structure (here, the tracking graph) will be illustrated in a more general context in another example below (“Live Video in Animated 3-D Graphics”). The display cell simply puts on the screen its input images, in this case the composite frames produced by the renderer. A very interesting aspect of this system, and certainly the most innovative when it was introduced, is the asynchronous parallel implementation of the segmentation algorithm, which contains a feed-back loop. The corresponding conceptual graph is also a flow graph of the algorithm. Each input frame is compared with a statistical background model. For each pixel, a decision is made whether it is an observation of the background or of an occluding element. The output is a foreground binary mask. This comparison is performed by the background comparison cell. Each pulse, after going through this cell, contains the input image and a binary foreground image, which is used by the connected components cell to produce a labeled components image, added to the pulse. The input image and the labeled components image are used by the background update cell to update the distributions in the background model. Since the comparison and the update cells both use the persistent background model, they are both connected to a common source that holds the background model structure. This path forms a feed back loop in which the result of |

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| | the processing of each frame is used to update the adaptive background model. Because of the asynchrony of the processing, by the time the background model is updated with the result of the processing of a given frame, many other frames might have been compared to the model. In this particular context, the quality of the result is not affected–in fact, it is common practice in background model maintenance to perform only partial updates at each frame, in order to reduce computational load–and the overall system throughput permitted by this design is always significantly larger than that achievable in a sequential design." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 10-11.<br><br>"Figure 19 shows new experimental scalability tests performed on applications designed in the SAI style. The results are in accordance with those reported in [18]. The figure plots processing load, in percent, against processing rate, in frames per seconds, for an application performing video capture, segmentation by change detection, and result visualization, and the same plot for the same application with the segmentation turned off (the image displayed is the input). Both applications scale linearly with respect to throughput. All conditions being equal, the difference in slope between the two curves characterizes the processing load imposed by the segmentation part. Note that these tests were performed on a dual processor machine, so that the processor load is an average of the load of both processors. Because of the parallelism (multithreading in this case), the overall load is balanced between the two processors (by the operating system in this case). As a result, the system is completely oblivious to the 50% cpu load barrier. The figure also plots system latency, in ms, against processing rate, for both applications. The latency remains constant as long as system resources are available. In a sequential system, the latency would be directly proportional to the throughput, and in fact dictate the maximum achievable throughput. When a bottleneck is encountered (or some resources are exhausted), latency increases and system performance degrades. The segmentation application performance (in terms of latency) starts degrading around 55 frames per seconds, although the system can still achieve rates above 70 frames per second in these conditions. These plots suggest that: (1) as long as computing resources are available, the overhead introduced by the SAI processing model remains constant, and (2) the contribution of the different processes are combined linearly. In particular, the model does not introduce any non-linear complexity in the system. These properties are corroborated by empirical results and experience in developing and operating other systems designed in the SAI style. |

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| | Theoretical complexity analysis and overhead bounding are out of the scope of this document." *See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at 21-22.<br><br>*See Software Architecture for Computer Vision: Beyond Pipes and Filters* (2003) at Fig. 19:<br><br>  <br><br><br>Figure 19: Scalability with respect to throughput. |

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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Francois II alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants’ Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

# Exhibit A-04: Invalidity of U.S. Patent No. 8,982,109 in view of U.S. Patent Pub. No. 2011/0298910 ("Haan")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

Haan was originally filed February 15, 2010 and was published December 8, 2011, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a), (b) and (e).

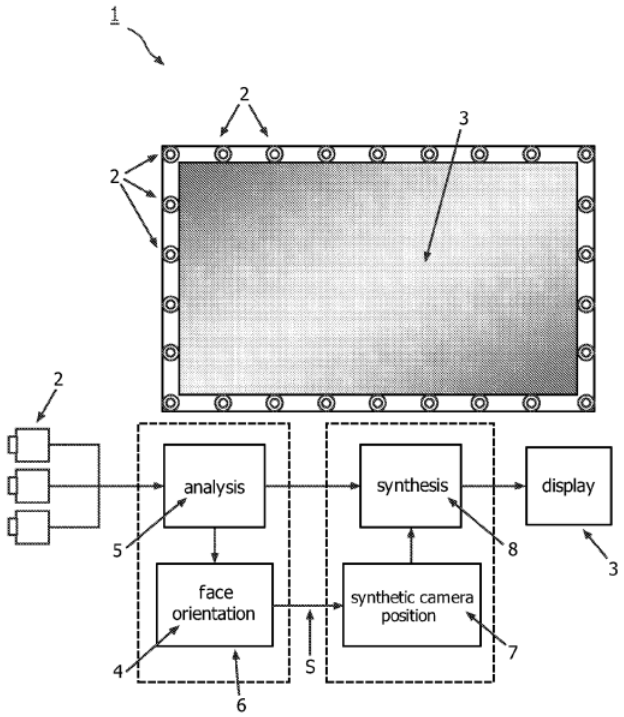
Haan anticipates the Asserted Claims of the '109 Patent. To the extent it is found Haan does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Haan does not anticipate the Asserted Claims Haan renders obvious the Asserted Claims either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Haan expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"Mirror device (1) comprises a display device (3) and a camera (2) to record an image. The device comprises means for determining (4, 41) the position of a body part. Said means put out a signal (S) indicative of the position of the body part with respect to the a [*sic*] display screen of a display device (3) for a viewer in front of the mirror device. In dependence of this signal (S) the view point from which the to be displayed image is recorded is changed." *See* Abstract.<br><br>"The invention relates to a mirror device and to a device having a frame for a display device." *See* para. [0001].<br><br>"To this end the mirror device in accordance with a first aspect of the invention comprises:<br><br>a display device with a display screen<br><br>at least one image recording device to record an image<br><br>a means to determine a position of a body part with respect to the display screen of the display device, said means outputting a [*sic*] indication signal to indicate the position of the body part of a viewer in front of the display screen<br><br>a means to change the view point from which the image is recorded in dependence on said indication signal<br><br>a means to display the recorded image on the display device." *See* paras. [0006]-[0011].<br><br>"FIG. 2 illustrates a first embodiment of the invention. The mirror device 1 comprises a number of cameras 2 and a display 3. The recorded images by cameras 2 are fed to a |

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| | position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be taken as a measure for the angle. When two images are taken 3-D analysis can be used to determine the angle of rotation of the head in respect of the mirror device and to determine the distance to the display screen. The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image." *See* paras. [0056] – [0058].<br><br>*See* Fig. 2: |

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| |  <br>FIG. 2<br><br>“1. Mirror device (1) comprising a display device (3) with a display screen<br><br>at least one image recording device (2) to record an image<br><br>a means (4, 41) to determine a position of a body part with respect to the display screen of the display device (3), said means outputting a [*sic*] indication signal |

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| | (S) to indicate the position of the body part of a viewer in front of the display screen<br><br>a means to change (7) the view point from which the image is recorded in dependence on said indication signal (S)<br><br>a means to display the recorded image on the display screen of the display device (3)." *See* claim 1.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | Haan expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below.<br><br>"1. Mirror device (1) comprising a display device (3) with a display screen<br><br>at least one image recording device (2) to record an image<br><br>a means (4, 41) to determine a position of a body part with respect to the display screen of the display device (3), said means outputting a [*sic*] indication signal (S) to indicate the position of the body part of a viewer in front of the display screen<br><br>a means to change (7) the view point from which the image is recorded in dependence on said indication signal (S)<br><br>a means to display the recorded image on the display screen of the display device (3)." *See* Claim 1. |

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| | "To this end the mirror device in accordance with a first aspect of the invention comprises:<br><br>a display device with a display screen<br><br>at least one image recording device to record an image<br><br>a means to determine a position of a body part with respect to the display screen of the display device, said means outputting a [*sic*] indication signal to indicate the position of the body part of a viewer in front of the display screen<br><br>a means to change the view point from which the image is recorded in dependence on said indication signal<br><br>a means to display the recorded image on the display device." *See* paras. [0006]-[0011].<br><br>"In embodiments the mirror device comprises a movable camera and means to move the movable camera, wherein the position of the movable camera is determined by the position of e.g. the head or body. In embodiments the mirror devices comprises more than one camera, wherein the position or orientation of the image recording is determined by determining which camera or cameras are used to record the image. In a simple embodiment only a single camera is used, so that the position is determined by the position of the single camera. The device is provided with means to move the camera. This is a mechanical solution for changing the point of view, i.e. the position of the camera. In more sophisticated embodiments more freedom in the position of the camera can be obtained by combining electronically the images of more than one camera into a combined image. Such more sophisticated embodiments allow changing the position of the camera in a gradual manner and electronically by mixing signals of various cameras. A virtual camera position can be made and one is no longer bounded by the actual positions of the camera(s). All of the cameras can be fixed, or a mix of fixed and movable cameras can be used." *See* paras. [0024]-[0027]. |

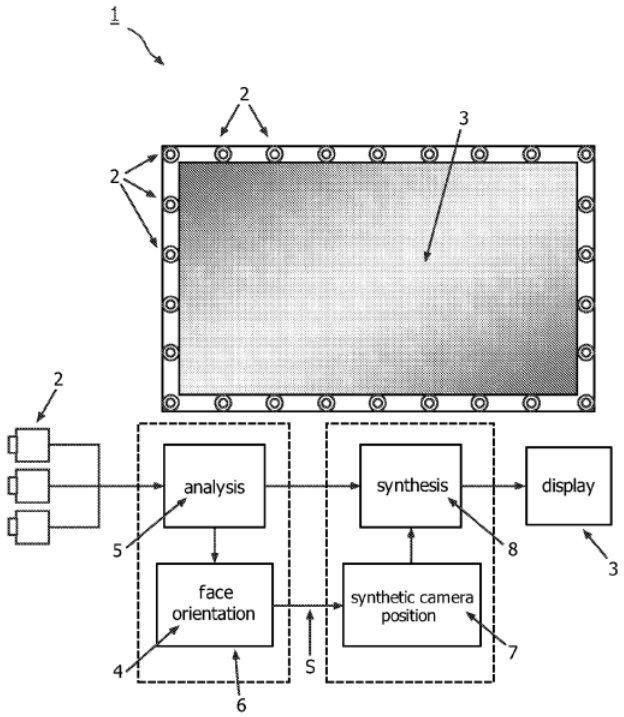
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| | "The recorded images by cameras 2 are fed to a position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be taken as a measure for the angle. When two images are taken 3-D analysis can be used to determine the angle of rotation of the head in respect of the mirror device and to determine the distance to the display screen. The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image." *See* para. [0058].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Haan expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. *See*, *e.g.*, disclosures below. |

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| | "MIRROR DEVICE" Title.<br><br>"The invention relates to a mirror device and to a device having a frame for a display device." *See* para. [0001].<br><br>"In embodiments the point of view is changeable in one direction, in more sophisticated embodiments in more than one direction. If one wants to look at the side of the head an enlargement of viewing possibilities in a left-right direction is useful; however, if one wants to look into one's own mouth an up-down increase in viewing angles is useful. In embodiments the position of recording can also be changed in a direction perpendicular to the display surface. In such embodiments an enlarged image can be provided." *See* para. [0028].<br><br>"FIG.7 illustrates a further embodiment of the invention. When one looks into a flat mirror the perceived distance at which the image is formed is the same as the distance between the object and the mirror. It is possible to use a convex mirror which allows magnification of the object. However this is a fixed magnification. Within embodiments of the invention the displayed image is magnified as a function of the distance to the mirror device. Typically, a viewer holds and maintains a certain distance to a mirror. When he/she wants to take a better look at a detail he/she reduces the distance to the mirror. FIG. 7 illustrates an embodiment of the invention." *See* para. [0072].<br><br>"This aspect of the invention provides a device or system to convert a regular TV or PC into a mirror device. The advantage is that any display device, or at least many, can be used to provide the advantages of the present invention." *See* para. [0101].<br><br>"The frame with hard and/or software would form a means for upgrading the TV or PC to provide the TV or PC with a mirror function, with extra possibilities, that it did not have before." *See* para. [0102]. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other |

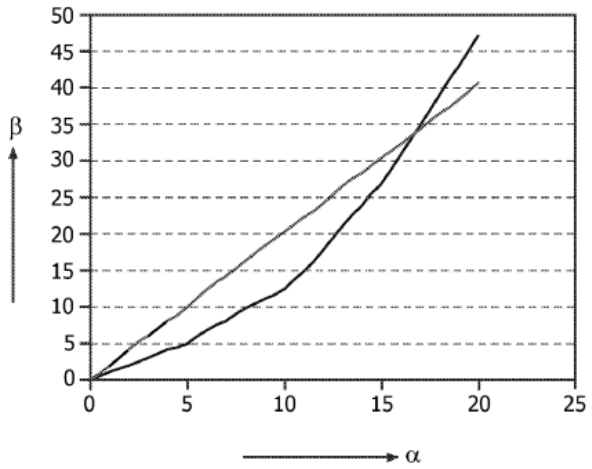
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| | invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Haan expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror. *See*, *e.g.*, disclosures below.<br><br>"In embodiments, the means to change the view point are arranged to increase the angle of turn of the display imaged in respect of a reflected image. The angle of turn is the angle at which a head of body is displayed in the mirror in comparison to displaying a face looking straight at the mirror. This angle is, for mirrors, determined by the simple rule that the angle of incidence equals the angle of reflection, i.e. the turn angle is the same as the angle at which the head is turned. If one turns the head 10 degrees to the right standing in front of a normal mirror the image of the face one sees in the normal mirror is also turned 10 degrees. In a device according to this preferred embodiment the image of the head would be turned more than 10 degrees, for instance 20 degrees.<br><br>When one looks in a mirror the image seems to be positioned behind the mirror, and the position of this image is determined by the reflection in the mirror. When one looks in a flat mirror the angle of view is geometrically restricted. By choosing the position of the view point such that the angle of view is increased compared to the geometrical angle of view when looking in a mirror, the viewer is able to see beyond the normal range of view, and those areas that are just out of view, have been moved into view. Increasing the angle of turn means that the head or body is rotated further than would be in a mirror image, and one would see those areas of the face that are normally just out of sight. Consequently one can apply make-up or shave areas carefully and keeping an eye on what one does, where in the past using a normal mirror, one would have to apply make-up or shave without actually seeing what one does." *See* paras. [0018]-[0019]. |

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| | "In embodiments the mirror devices comprises more than one camera, wherein the position or orientation of the image recording is determined by determining which camera or cameras are used to record the image.<br><br>In a simple embodiment only a single camera is used, so that the position is determined by the position of the single camera. The device is provided with means to move the camera. This is a mechanical solution for changing the point of view, i.e. the position of the camera.<br><br>In more sophisticated embodiments more freedom in the position of the camera can be obtained by combining electronically the images of more than one camera into a combined image. Such more sophisticated embodiments allow changing the position of the camera in a gradual manner and electronically by mixing signals of various cameras. A virtual camera position can be made and one is no longer bounded by the actual positions of the camera(s). All of the cameras can be fixed, or a mix of fixed and movable cameras can be used." *See* paras. [0025]-[0027].<br><br>"In simple embodiment, wherein the layer is switchable between a reflective and transmitting state, one could have the display displaying the recorded image all of the time, and switch the layer between a reflective and transmitting state." *See* para. [0033].<br><br>"FIG. 2 illustrates a first embodiment of the invention.<br><br>The mirror device 1 comprises a number of cameras 2 and a display 3.<br><br>The recorded images by cameras 2 are fed to a position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be taken as a measure for the angle. When |

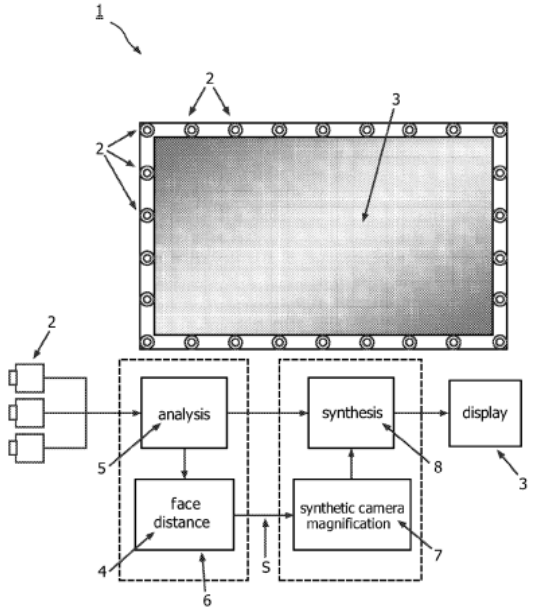
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| | two images are taken 3-D analysis can be used to determine the angle of rotation of the head in respect of the mirror device and to determine the distance to the display screen. The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image.<br><br>In simple embodiments, instead of a synthesized image, the image of a particular camera is used for a particular range of orientation of the head. Such a solution, although within the scope of the invention, however could lead to an image that jumps from one camera position to another. An embodiment intermediate to the two above described embodiments is that, dependent on the signal S, the number of camera [*sic*] used for synthesizing the image is limited to a small number, for instance two or three around the optimal virtual position, instead of using all of the data from all the cameras." *See* paras. [0056]-[0059]. |

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| |  <br>FIG. 2<br><br>“FIG. 3 illustrates the effect of the invention.<br><br>The orientation determining means establish for instance that the angle of turn of the head is 12 degrees. A normal mirror would then show the head being turned 12 degrees. This is shown for example in part 31. In the mirror device of the invention, the turning of the head can be exaggerated so that, instead of the head being displayed at a turning angle of 12 degrees, the turning angle (and thereby the camera position, i.e. the point of |

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| | view from the image is recorded) is increased for instance 7-fold, so that a 12 degree turn of the head causes the head, as displayed on the display screen, to be turned 84 degrees.<br><br>FIG. 3 is a somewhat exaggerated example. In most applications the ratio between the actual turning angle of the head and the turning angle of the displayed head will be closer to 1 for instance a factor of 1.2 to 3, preferably between 1.3 and 2.<br><br>The amplification of the rotation should be great enough to have an appreciable effect, yet not so great that the enlargement of view and amplified rotation would not be perceived by the user intuitively as using a normal mirror.<br><br>In FIG. 2 the cameras are shown mounted in a frame of the display device, around the display. This is an embodiment. The cameras can be mounted at some distance from the framework, to increase the possible view points. The cameras, or at least some or one of them, can also be positioned some distance in front of the display. In embodiments the camera can be positioned in side parts attached to the mirror device. The mirror device can have for instance two closing doors, which open when the mirror device is used, wherein cameras are mounted around the perimeter of the display device, as shown in FIG. 2, as well as on the doors, so that the range of possible view points is increased." *See* paras. [0060]-[0064]. |

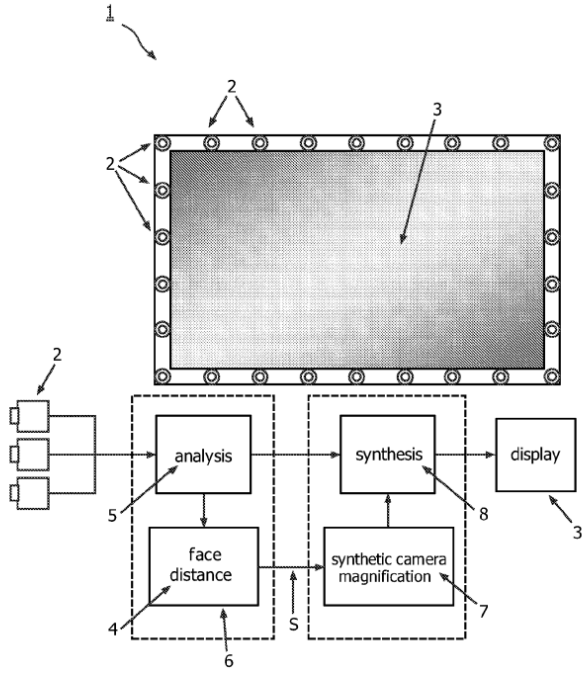
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| |  <br>FIG. 6<br><br>“The straight line depicts a situation in which the display device does not comprise a reflective semi-transparent layer, and the cameras are always used to record the image and show the head. In this example the relation between the angles α and β is β=2α, i.e. the rotation of a displayed head or torso is exaggerated by a factor of 2. This is a simple linear relation between the two rotation angles. The curved line depicts a situation wherein for small angle, smaller than 5 degrees no image is displayed and the device comprises a semi-transparent reflective layer. Between 0 and 5 degrees of turn both angles are equal to each other since the device works as a simple mirror, wherein the image is reflected in the semi-transparent reflective layer. When one turns the head over an angle larger than 5 degrees, an image is displayed with an exaggerated angle of turn. At first the exaggeration is only small, but it grows as the head is turned more. In this example a non-linear relation between the angles α and β is used. |

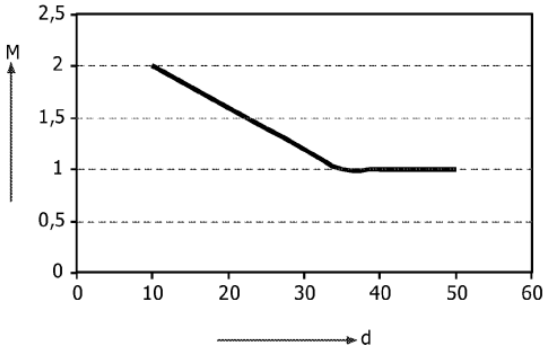
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| | FIG. 7 illustrates a further embodiment of the invention. When one looks into a flat mirror the perceived distance at which the image is formed is the same as the distance between the object and the mirror. It is possible to use a convex mirror which allows magnification of the object. However this is a fixed magnification. Within embodiments of the invention the displayed image is magnified as a function of the distance to the mirror device. Typically, a viewer holds and maintains a certain distance to a mirror. When he/she wants to take a better look at a detail he/she reduces the distance to the mirror. FIG. 7 illustrates an embodiment of the invention.<br><br>In FIG. 7 face distance determining means determine the distance of the face in respect of the mirror device. This determination determines the magnification of the displayed image. It is remarked that magnification is in fact equivalent to moving a camera with fixed magnification closer to the object, so all applications can be seen, in fact as changing the point of view, or in other words the position of the camera, be it a real camera or a virtual camera. Exaggerating the angle of rotation means in fact that one shifts the point of view from which the image is recorded further to the left or to the right then one would do for a mirror, amplification equals a shift of the point of view towards the object.<br><br>Distance can be determined in various ways, for instance, when using a single camera, the size of object provides a rough estimation of the distance; when two camera's [*sic*] are used, distance can be determined in much the same way as human eyes and brains determine distance namely by the parallax. Ultrasound means can also be used to measure distance, or such means as are regularly used for cameras to focus can be used." *See* paras. [0071]-[0074]. |

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| |  <br>FIG. 7<br><br>"FIG. 8 illustrates an exemplary relation between the magnification M of the image and the distance d in centimeter to the mirror.<br><br>For distances d larger than a threshold value, for instance in this example 35 cm distance, the magnification is kept at a fixed value of, in this example 1. This can be done for instance by using the device as a simple mirror, i.e. not displaying an image on the display device, but using the device in the reflective mode. For smaller distances, as the viewer moves his head or torso closer to the display screen, an enlarged image is displayed, i.e. with a magnification larger than 1. To avoid a sudden jump in the image there is a smooth transition between the two regions. In embodiment there can be a range of distances for which the magnification factor is less than 1. This can be for instance |

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| | useful when a hat is tried on, a normal mirror would show the face, but only part of the hat. By using a magnification smaller than 1, it does become possible to see the hat even at relatively small distances from the mirror. This would also be useful in small size changing cubicles." *See* paras. [0075]-[0076].<br><br>"For simplicity and ease of understanding FIGS. 3, 4 and 7 show set-ups in which the orientation (FIGS. 3, 4) respectively the distance (FIG. 7) is measured. Combinations of the two, in which both orientation and distance are measured, form preferred embodiments." *See* para. [0095].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Haan expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera n. *See*, *e.g.*, disclosures below.<br><br>"For instance, when a person sits in front of the mirror device and turns his or her head, the orientation of the face in respect of the mirror device is determined. In a device according to the invention the turning of the head causes the view point from which the image is recorded to be adjusted. This allows a greater freedom in the area of view, and allows the mirror device to display those areas that are normally just out of sight. It also allows, in embodiments, to bring the point of view closer to the object, i.e. to magnify the displayed image." *See* para. [0012].<br><br>"In embodiments the means to change the point of view are arranged to change the magnification (M) of the displayed image, with respect to a reflected image. |

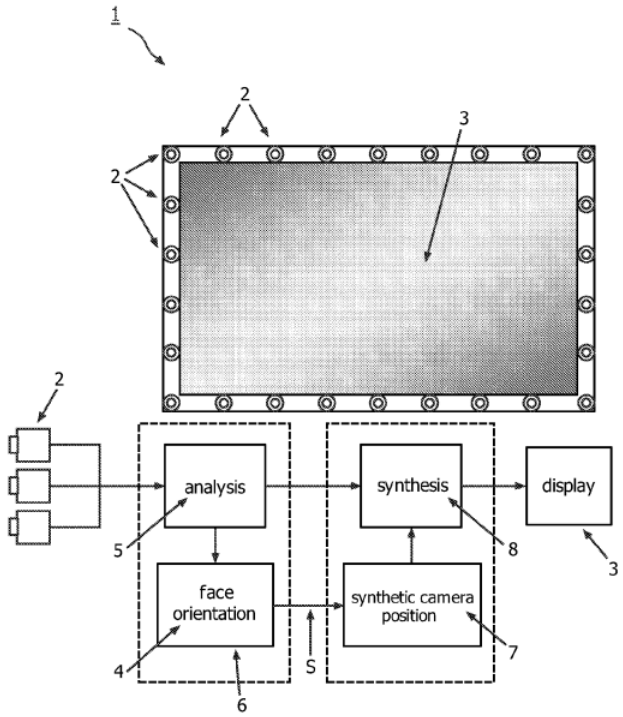
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| | This allows a viewer to change the magnification by for instance getting closer to the display screen. This is impossible with a normal flat mirror." *See* paras. [0022]-[0023].<br><br>"Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image." *See* para. [0058].<br><br>"FIG. 7 illustrates a further embodiment of the invention. When one looks into a flat mirror the perceived distance at which the image is formed is the same as the distance between the object and the mirror. It is possible to use a convex mirror which allows magnification of the object. However this is a fixed magnification. Within embodiments of the invention the displayed image is magnified as a function of the distance to the mirror device. Typically, a viewer holds and maintains a certain distance to a mirror. When he/she wants to take a better look at a detail he/she reduces the distance to the mirror. FIG. 7 illustrates an embodiment of the invention.<br><br>In FIG. 7 face distance determining means determine the distance of the face in respect of the mirror device. This determination determines the magnification of the displayed image. It is remarked that magnification is in fact equivalent to moving a camera with fixed magnification closer to the object, so all applications can be seen, in fact as changing the point of view, or in other words the position of the camera, be it a real camera or a virtual camera. Exaggerating the angle of rotation means in fact that one shifts the point of view from which the image is recorded further to the left or to the right |

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| | then one would do for a mirror, amplification equals a shift of the point of view towards the object." *See* paras. [0072]-[0073].<br>  <br><br>FIG. 7<br>"Distance can be determined in various ways, for instance, when using a single camera, the size of object provides a rough estimation of the distance; when two camera's [*sic*] are used, distance can be determined in much the same way as human eyes and brains determine distance namely by the parallax. Ultrasound means can also be used to measure distance, or such means as are regularly used for cameras to focus can be used. |

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| | FIG. 8 illustrates an exemplary relation between the magnification M of the image and the distance d in centimeter to the mirror.<br><br>For distances d larger than a threshold value, for instance in this example 35 cm distance, the magnification is kept at a fixed value of, in this example 1. This can be done for instance by using the device as a simple mirror, i.e. not displaying an image on the display device, but using the device in the reflective mode. For smaller distances, as the viewer moves his head or torso closer to the display screen, an enlarged image is displayed, i.e. with a magnification larger than 1. To avoid a sudden jump in the image there is a smooth transition between the two regions. In embodiment there can be a range of distances for which the magnification factor is less than 1. This can be for instance useful when a hat is tried on, a normal mirror would show the face, but only part of the hat. By using a magnification smaller than 1, it does become possible to see the hat even at relatively small distances from the mirror. This would also be useful in small size changing cubicles.” *See* paras. [0074]-[0076].<br><br>  <br>FIG. 8<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the |

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| | teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | Haan expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing n. *See*, *e.g.*, disclosures below.<br><br>"To this end the mirror device in accordance with a first aspect of the invention comprises:<br><br>a display device with a display screen<br><br>at least one image recording device to record an image<br><br>a means to determine a position of a body part with respect to the display screen of the display device, said means outputting a [*sic*] indication signal to indicate the position of the body part of a viewer in front of the display screen<br><br>a means to change the view point from which the image is recorded in dependence on said indication signal<br><br>a means to display the recorded image on the display device." *See* paras. [0006]-[0011].<br><br>"FIG. 2 illustrates a first embodiment of the invention. The mirror device 1 comprises a number of cameras 2 and a display 3. The recorded images by cameras 2 are fed to a position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be |

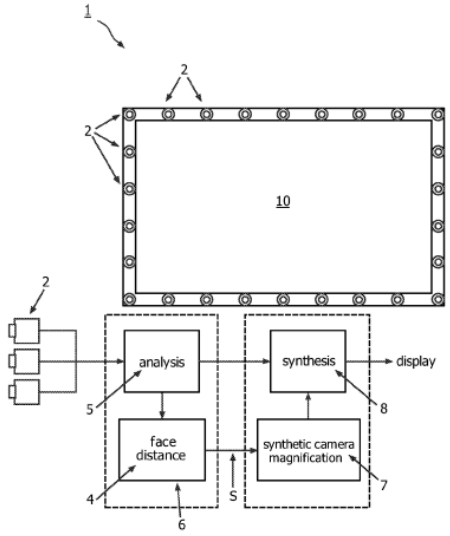
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| | taken as a measure for the angle. When two images are taken 3-D analysis can be used to determine the angle of rotation of the head in respect of the mirror device and to determine the distance to the display screen. The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image." *See* paras. [0056] – [0058].<br><br>*See* Fig. 2: |

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| |  <br>FIG. 2<br><br>*See* Claim 1:<br><br>“1. Mirror device (1) comprising a display device (3) with a display screen<br><br>at least one image recording device (2) to record an image |

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| | a means (4, 41) to determine a position of a body part with respect to the display screen of the display device (3), said means outputting a [*sic*] indication signal (S) to indicate the position of the body part of a viewer in front of the display screen<br><br>a means to change (7) the view point from which the image is recorded in dependence on said indication signal (S)<br><br>a means to display the recorded image on the display screen of the display device (3)." *See* claim 1.<br><br>"FIG. 7 illustrates a further embodiment of the invention. When one looks into a flat mirror the perceived distance at which the image is formed is the same as the distance between the object and the mirror. It is possible to use a convex mirror which allows magnification of the object. However this is a fixed magnification. Within embodiments of the invention the displayed image is magnified as a function of the distance to the mirror device. Typically, a viewer holds and maintains a certain distance to a mirror. When he/she wants to take a better look at a detail he/she reduces the distance to the mirror. FIG. 7 illustrates an embodiment of the invention." *See* para. [0072].<br><br>For distances d larger than a threshold value, for instance in this example 35 cm distance, the magnification is kept at a fixed value of, in this example 1. This can be done for instance by using the device as a simple mirror, i.e. not displaying an image on the display device, but using the device in the reflective mode. For smaller distances, as the viewer moves his head or torso closer to the display screen, an enlarged image is displayed, i.e. with a magnification larger than 1. To avoid a sudden jump in the image there is a smooth transition between the two regions. In embodiment there can be a range of distances for which the magnification factor is less than 1. This can be for instance useful when a hat is tried on, a normal mirror would show the face, but only part of the hat. By using a magnification smaller than 1, it does become possible to see the hat even |

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| | at relatively small distances from the mirror. This would also be useful in small size changing cubicles." *See* para. [0076].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Haan expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"The invention is also embodied in a device or system as shown in FIG. 14. In this aspect of the invention the display itself is not part of the device or system according to the invention, but the device comprises a frame with a recording device to record an image for a display device, a means 4 to determine a position of a body part with respect to the frame, said means outputting a [*sic*] indication signal (S) to indicate the position of the body part of a viewer with respect to the frame, a means to change (7) the view point from which the image is recorded in dependence on said indication signal (S), a means to generate an image signal (I) of the recorded image for display on a display screen of a display device.<br><br>FIG. 14 illustrates such embodiments. On position 10 a display can be provided.<br><br>This aspect of the invention provides a device or system to convert a regular TV or PC into a mirror device. The advantage is that any display device, or at least many, can be used to provide the advantages of the present invention. |

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| | The frame with hard and/or software would form a means for upgrading the TV or PC to provide the TV or PC with a mirror function, with extra possibilities, that it did not have before.<br><br>In various different ways such an embodiment of the invention can be made.<br><br>For instance, all the necessary soft-and hard-ware can be enclosed within the frame of the device. The device provides a signal to be sent to a display device. Such embodiments can be used to convert a normal TV into a mirror device. The frame is positioned around a screen of a normal TV and the signal is fed to the TV. As an alternative the device could have a frame and a separate box wherein the necessary hard- or soft-ware is provided. Any normal TV can then be converted into a magical mirror.<br><br>For use with a PC, or laptop, a somewhat different embodiment is within the scope of the present invention. Around the display screen of the monitor of a PC, or of the laptop, a frame with one or more cameras is positioned. The means for indicating the position and providing a signal S and providing image signal I are preferably in the form of computer programs. The computer programs are loaded on the PC or laptop, a connection is made between the frame and the computer and the image is displayed on the monitor. The frame may comprise a semi-reflective layer. The frame is, in embodiments of a size corresponding to a display device of a laptop.<br><br>In the above examples the means for determining orientation are mainly optical means; they could also be acoustical means or other means. Such embodiments form preferred embodiments. An example of another means is, when the device is used in a beauty parlour, the angle of rotation of the chair at which the customer is sitting. By turning the chair slightly, the hairdresser can show the customer the results." *See* paras. [0099]-[0106]. |

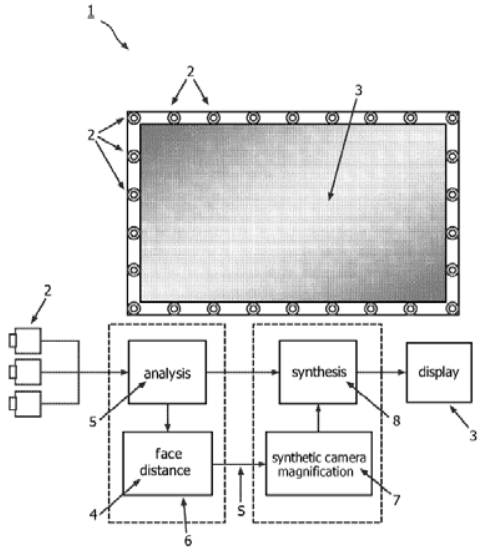
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| |  <br>FIG. 14<br><br>“The recorded images by cameras 2 are fed to a position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be taken as a measure for the angle. When two images are taken 3-D analysis can be used to determine the angle of rotation of the head in respect of the mirror device and to determine the distance to the display screen. The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and |

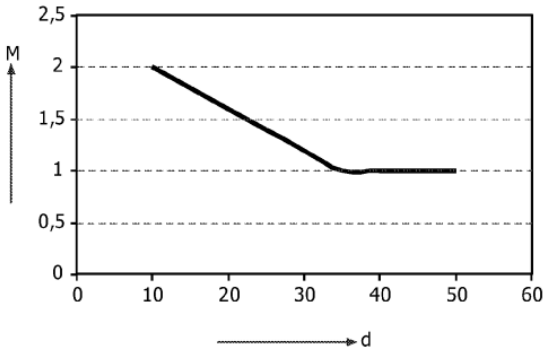
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| | magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image." *See* para. [0058].<br><br>"For distances d larger than a threshold value, for instance in this example 35 cm distance, the magnification is kept at a fixed value of, in this example 1. This can be done for instance by using the device as a simple mirror, i.e. not displaying an image on the display device, but using the device in the reflective mode. For smaller distances, as the viewer moves his head or torso closer to the display screen, an enlarged image is displayed, i.e. with a magnification larger than 1. To avoid a sudden jump in the image there is a smooth transition between the two regions. In embodiment there can be a range of distances for which the magnification factor is less than 1. This can be for instance useful when a hat is tried on, a normal mirror would show the face, but only part of the hat. By using a magnification smaller than 1, it does become possible to see the hat even at relatively small distances from the mirror. This would also be useful in small size changing cubicles." *See* para. [0076].<br><br>"FIG. 12 illustrates an embodiment. In front of the display device 3 a switchable reflective layer R/T is positioned. The signal S determines the mode of this layer, i.e. whether it is reflective or transmitting. The switch-over between the two modes is not a step-function, but an S-function wherein the mid-point of the S-curve is at the threshold value for switching from one mode to another. The drive D2 of this switchable layer is provided with signal S. The intensity I of the display is likewise a function of the signal S, and likewise an S-function wherein the midpoint of the S-curve is at the threshold value for switching on the display device. Drive D1 for driving the display is provided with signal S. Of course, instead of the signal S a signal indicative of or derive from the original signal S can also be used. |

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| | Such gradual change could introduce some fuzziness in the image as seen by the viewer, but would prevent sudden jumps in the image." *See* paras. [0084]-[0085]<br><br>"In those embodiments wherein the distance is measured, the field of view of the cameras is, in embodiments, changed in dependence on the measured distance d. When the subject moves closer to the mirror, not only the magnification is changed, but also the cameras are rotated so that the cameras are pointed at the position of the viewer. This improves the image. To this end the mirror device is provided with means to rotate the means for recording. FIG. 13 illustrates such embodiments. The signal S in indicative of the distance, drive D3 rotates the cameras 2 so that they are pointing at the position of the head of the viewer.<br><br>In the above embodiments the display device formed part of the device according to the invention.<br><br>The invention is also embodied in a device or system as shown in FIG. 14. In this aspect of the invention the display itself is not part of the device or system according to the invention, but the device comprises a frame with a recording device to record an image for a display device, a means 4 to determine a position of a body part with respect to the frame, said means outputting a [*sic*] indication signal (S) to indicate the position of the body part of a viewer with respect to the frame, a means to change (7) the view point from which the image is recorded in dependence on said indication signal (S), a means to generate an image signal (I) of the recorded image for display on a display screen of a display device." *See* paras. [0097]-[0099].<br><br>"In the above examples the mirror image shown is a composite of the recorded image with some artificial compounds. In most extreme examples the mirror image could be completely or almost completely artificial, though still in pose corresponding in large part to the person sitting or standing in front of the mirror device. For instance in games people often choose a character to represent themselves in the game. The synthesized image would be that of the chosen character. The size of the head would for instance still be in accordance with that of the person sitting in front of the mirror. The viewer can |

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| | look in the "mirror" and, turning his of [*sic*] her head or body, see a reflected image of the chosen character moving in the same way as the viewer, but with increased angles of view. The viewer can get familiar with the chosen character. Often such characters can be provided with accessories, as in real life. The invention, in this embodiment, allows a viewer to "try on" these accessories in a very natural manner and see the result in the mirror with improved viewing possibilities." *See* para. [0118].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Haan expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video feed. *See*, *e.g.*, disclosures below.<br><br>"The position may comprise one or more of the positional parameters, for instance the distance to the display screen, angle of turn of the head of torso in respect of the display screen, or derivates in time of such position parameters, such as movements to and/or from the display screen, i.e. changes in distances, or nodding of the head, i.e. a chance in turning angle, or in coordinates: x, y and or z coordinates, and/or angles of turn and/or dx/dt, dz/dt etc. The indication signal can, dependent on the embodiment of the invention, indicate the orientation of the head or body." *See* para. [0014].<br><br>"The recorded images by cameras 2 are fed to a position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be taken as a measure for the angle. When two images are taken 3-D analysis can be used to determine the angle of rotation of the |

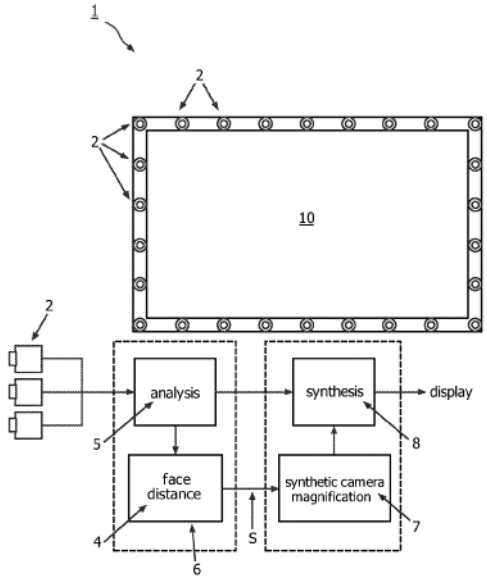
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| | head in respect of the mirror device and to determine the distance to the display screen. The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image." *See* para. [0058].<br><br>"FIG. 7 illustrates a further embodiment of the invention. When one looks into a flat mirror the perceived distance at which the image is formed is the same as the distance between the object and the mirror. It is possible to use a convex mirror which allows magnification of the object. However this is a fixed magnification. Within embodiments of the invention the displayed image is magnified as a function of the distance to the mirror device. Typically, a viewer holds and maintains a certain distance to a mirror. When he/she wants to take a better look at a detail he/she reduces the distance to the mirror. FIG. 7 illustrates an embodiment of the invention." *See* para. [0072].<br><br>"In FIG. 7 face distance determining means determine the distance of the face in respect of the mirror device. This determination determines the magnification of the displayed image. It is remarked that magnification is in fact equivalent to moving a camera with fixed magnification closer to the object, so all applications can be seen, in fact as changing the point of view, or in other words the position of the camera, be it a real camera or a virtual camera. Exaggerating the angle of rotation means in fact that one shifts the point of view from which the image is recorded further to the left or to the right then one would do for a mirror, amplification equals a shift of the point of view towards the object." *See* para. [0073]. |

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| |  <br>FIG. 7<br><br>“Distance can be determined in various ways, for instance, when using a single camera, the size of object provides a rough estimation of the distance; when two camera’s [*sic*] are used, distance can be determined in much the same way as human eyes and brains determine distance namely by the parallax. Ultrasound means can also be used to measure distance, or such means as are regularly used for cameras to focus can be used.<br><br>FIG. 8 illustrates an exemplary relation between the magnification M of the image and the distance d in centimeter to the mirror.<br><br>For distances d larger than a threshold value, for instance in this example 35 cm distance, the magnification is kept at a fixed value of, in this example 1. This can be done for |

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| | instance by using the device as a simple mirror, i.e. not displaying an image on the display device, but using the device in the reflective mode. For smaller distances, as the viewer moves his head or torso closer to the display screen, an enlarged image is displayed, i.e. with a magnification larger than 1. To avoid a sudden jump in the image there is a smooth transition between the two regions. In embodiment there can be a range of distances for which the magnification factor is less than 1. This can be for instance useful when a hat is tried on, a normal mirror would show the face, but only part of the hat. By using a magnification smaller than 1, it does become possible to see the hat even at relatively small distances from the mirror. This would also be useful in small size changing cubicles." *See* paras. [0074]-[0076].<br><br>  <br><br>FIG. 8<br><br>"For simplicity and ease of understanding FIGS. 3, 4 and 7 show set-ups in which the orientation (FIGS. 3, 4) respectively the distance (FIG. 7) is measured. Combinations of the two, in which both orientation and distance are measured, form preferred embodiments. |

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| | In FIGS. 3, 4 and 7 the cameras are shown in fixed positions. Even if the cameras are in fixed positions, the angle at which the cameras are positioned in respect of the mirror device may still be changed by rotating one or more cameras. Some of the cameras may be fixed in position and angle, while some of the cameras may be movable and/or rotatable.<br><br>In those embodiments wherein the distance is measured, the field of view of the cameras is, in embodiments, changed in dependence on the measured distance d. When the subject moves closer to the mirror, not only the magnification is changed, but also the cameras are rotated so that the cameras are pointed at the position of the viewer. This improves the image. To this end the mirror device is provided with means to rotate the means for recording. FIG. 13 illustrates such embodiments. The signal S in indicative of the distance, drive D3 rotates the cameras 2 so that they are pointing at the position of the head of the viewer." *See* para. [0095]-[0097].<br><br>"The invention is also embodied in a device or system as shown in FIG. 14. In this aspect of the invention the display itself is not part of the device or system according to the invention, but the device comprises a frame with a recording device to record an image for a display device, a means 4 to determine a position of a body part with respect to the frame, said means outputting a [*sic*] indication signal (S) to indicate the position of the body part of a viewer with respect to the frame, a means to change (7) the view point from which the image is recorded in dependence on said indication signal (S), a means to generate an image signal (I) of the recorded image for display on a display screen of a display device.<br><br>FIG. 14 illustrates such embodiments. On position 10 a display can be provided.<br><br>This aspect of the invention provides a device or system to convert a regular TV or PC into a mirror device. The advantage is that any display device, or at least many, can be used to provide the advantages of the present invention. |

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| | The frame with hard and/or software would form a means for upgrading the TV or PC to provide the TV or PC with a mirror function, with extra possibilities, that it did not have before.<br><br>In various different ways such an embodiment of the invention can be made.<br><br>For instance, all the necessary soft-and hard-ware can be enclosed within the frame of the device. The device provides a signal to be sent to a display device. Such embodiments can be used to convert a normal TV into a mirror device. The frame is positioned around a screen of a normal TV and the signal is fed to the TV. As an alternative the device could have a frame and a separate box wherein the necessary hard- or soft-ware is provided. Any normal TV can then be converted into a magical mirror.<br><br>For use with a PC, or laptop, a somewhat different embodiment is within the scope of the present invention. Around the display screen of the monitor of a PC, or of the laptop, a frame with one or more cameras is positioned. The means for indicating the position and providing a signal S and providing image signal I are preferably in the form of computer programs. The computer programs are loaded on the PC or laptop, a connection is made between the frame and the computer and the image is displayed on the monitor. The frame may comprise a semi-reflective layer. The frame is, in embodiments of a size corresponding to a display device of a laptop.<br><br>In the above examples the means for determining orientation are mainly optical means; they could also be acoustical means or other means. Such embodiments form preferred embodiments. An example of another means is, when the device is used in a beauty parlour, the angle of rotation of the chair at which the customer is sitting. By turning the chair slightly, the hairdresser can show the customer the results." *See* paras. [0099]-[0106]. |

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| |  <br>FIG. 14<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Haan expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. |

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| | "In all embodiments wherein the mirror device switches between a reflective mode and a transparent mode smooth transitions between reflective mode and display mode are preferred embodiments.<br><br>A smooth transition can for instance be accomplished by a fade-over, i.e. a gradual change of one mode to another." *See* paras. [0080]-[0081].<br><br>"One such fade-over would be, in embodiments wherein a switchable reflective layer is used to switch the reflective layer from the first, reflective state, to the second, transparent state gradually, for instance in a range of angles $x-\Delta$ to $x+\Delta$ where x stands for the angle of orientation or the distance at which the mirror device changes from reflective mode to display mode, and $\Delta$ stands for a relatively small range around the transition values." *See* para. [0082].<br><br>"In those embodiments wherein the distance is measured, the field of view of the cameras is, in embodiments, changed in dependence on the measured distance d. When the subject moves closer to the mirror, not only the magnification is changed, but also the cameras are rotated so that the cameras are pointed at the position of the viewer. This improves the image. To this end the mirror device is provided with means to rotate the means for recording. FIG. 13 illustrates such embodiments. The signal S in indicative of the distance, drive D3 rotates the cameras 2 so that they are pointing at the position of the head of the viewer." *See* para. [0097].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | Haan expressly and/or inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. *See*, *e.g.*, disclosures below.<br><br>"In embodiments the point of view is changeable in one direction, in more sophisticated embodiments in more than one direction. If one wants to look at the side of the head an enlargement of viewing possibilities in a left-right direction is useful; however, if one wants to look into one's own mouth an up-down increase in viewing angles is useful. In embodiments the position of recording can also be changed in a direction perpendicular to the display surface. In such embodiments an enlarged image can be provided." *See* para. [0028].<br><br>"The recorded images by cameras 2 are fed to a position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be taken as a measure for the angle. When two images are taken 3-D analysis can be used to determine the angle of rotation of the head in respect of the mirror device and to determine the distance to the display screen. The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent |

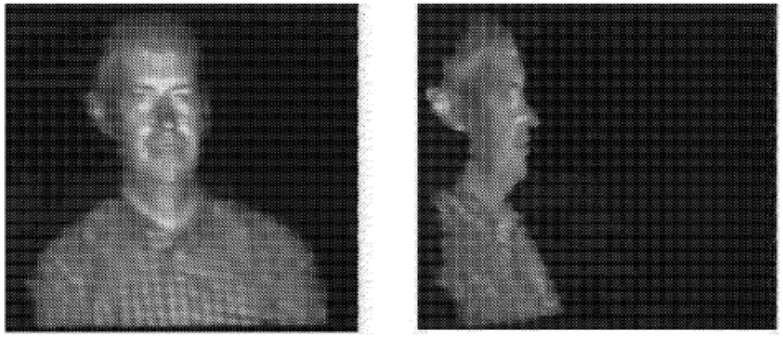
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| | on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image." *See* para. [0058].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

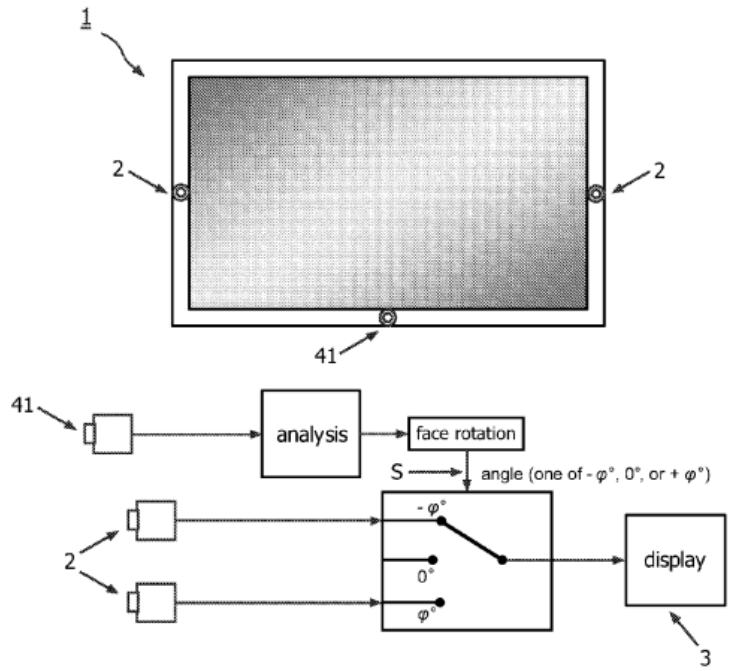
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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Haan expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[a]. obtaining a reference image; | Haan expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below.<br><br>"In more sophisticated embodiments more freedom in the position of the camera can be obtained by combining electronically the images of more than one camera into a combined image. Such more sophisticated embodiments allow changing the position of the camera in a gradual manner and electronically by mixing signals of various cameras. |

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| | A virtual camera position can be made and one is no longer bounded by the actual positions of the camera(s). All of the cameras can be fixed, or a mix of fixed and movable cameras can be used." *See* para. [0027].<br><br>"The mirror device 1 comprises a number of cameras 2 and a display 3.<br><br>The recorded images by cameras 2 are fed to a position determination means 4." *See* paras. [0057]-[0058].<br><br>"In simple embodiments, instead of a synthesized image, the image of a particular camera is used for a particular range of orientation of the head. Such a solution, although within the scope of the invention, however could lead to an image that jumps from one camera position to another. An embodiment intermediate to the two above described embodiments is that, dependent on the signal S, the number of camera [*sic*] used for synthesizing the image is limited to a small number, for instance two or three around the optimal virtual position, instead of using all of the data from all the cameras." *See* para. [0059].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Haan expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"In more sophisticated embodiments more freedom in the position of the camera can be obtained by combining electronically the images of more than one camera into a combined image. Such more sophisticated embodiments allow changing the position of the camera in a gradual manner and electronically by mixing signals of various cameras. A virtual camera position can be made and one is no longer bounded by the actual |

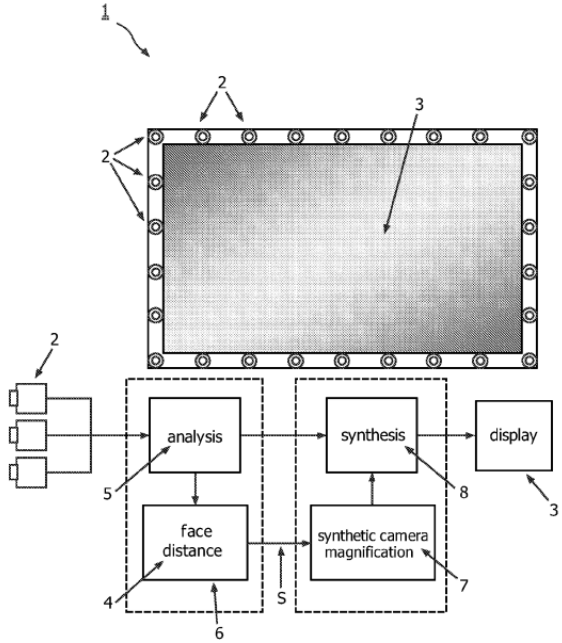
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| | positions of the camera(s). All of the cameras can be fixed, or a mix of fixed and movable cameras can be used." *See* para. [0027].<br><br>"The recorded images by cameras 2 are fed to a position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be taken as a measure for the angle. When two images are taken 3-D analysis can be used to determine the angle of rotation of the head in respect of the mirror device and to determine the distance to the display screen. The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image.<br><br>In simple embodiments, instead of a synthesized image, the image of a particular camera is used for a particular range of orientation of the head. Such a solution, although within the scope of the invention, however could lead to an image that jumps from one camera position to another. An embodiment intermediate to the two above described embodiments is that, dependent on the signal S, the number of camera [*sic*] used for synthesizing the image is limited to a small number, for instance two or three around the optimal virtual position, instead of using all of the data from all the cameras. |

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| | FIG. 3 illustrates the effect of the invention.<br><br>The orientation determining means establish for instance that the angle of turn of the head is 12 degrees. A normal mirror would then show the head being turned 12 degrees. This is shown for example in part 31. In the mirror device of the invention, the turning of the head can be exaggerated so that, instead of the head being displayed at a turning angle of 12 degrees, the turning angle (and thereby the camera position, i.e. the point of view from the image is recorded) is increased for instance 7-fold, so that a 12 degree turn of the head causes the head, as displayed on the display screen, to be turned 84 degrees.<br><br>FIG. 3 is a somewhat exaggerated example. In most applications the ratio between the actual turning angle of the head and the turning angle of the displayed head will be closer to 1 for instance a factor of 1.2 to 3, preferably between 1.3 and 2.<br><br>The amplification of the rotation should be great enough to have an appreciable effect, yet not so great that the enlargement of view and amplified rotation would not be perceived by the user intuitively as using a normal mirror." *See* paras. [0058]-[0063]. |

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| |  <br>31 32<br>FIG. 3<br><br>"FIG. 4 shows an embodiment of the invention.<br><br>In this embodiment the means for determining the orientation comprise an orientation sensing camera 41. The image taken by the orientation sensing camera determines the angle of rotation of the head in respect of the mirror. This is done in analysis means 42. When the determined angle is below a threshold value, the display device is not turned on, and the device acts as a normal mirror. When it is determined that the head is turned to the left or right over an angle more than the threshold, the right side camera is switched on and the image of the right side camera is displayed on the display device and vice versa." *See* paras. [0065]-[0066]. |

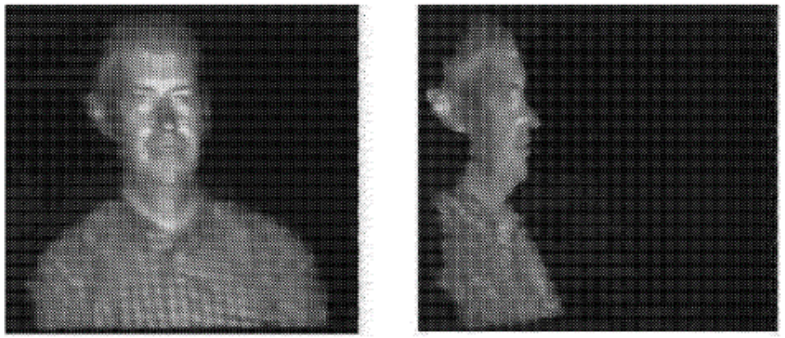
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| |  <br>FIG. 4<br><br>“This embodiment is a variation of the embodiment of FIG. 4. However, instead of an orientation sensing camera being used, the images of the left and right camera are sent to an analysis means. In the analysis means the image of the left and right image (or both combined) are analyzed. When it is found that the viewer is looking straight at (with a margin of a number of degrees) the mirror, no signal is sent to the display device and the device acts as a simple mirror due to the semi-transparent reflective layer. When the person is looking in the direction of the right hand camera, the image of the left hand camera is displayed on the display screen and vice versa.” *See* para. [0069]. |

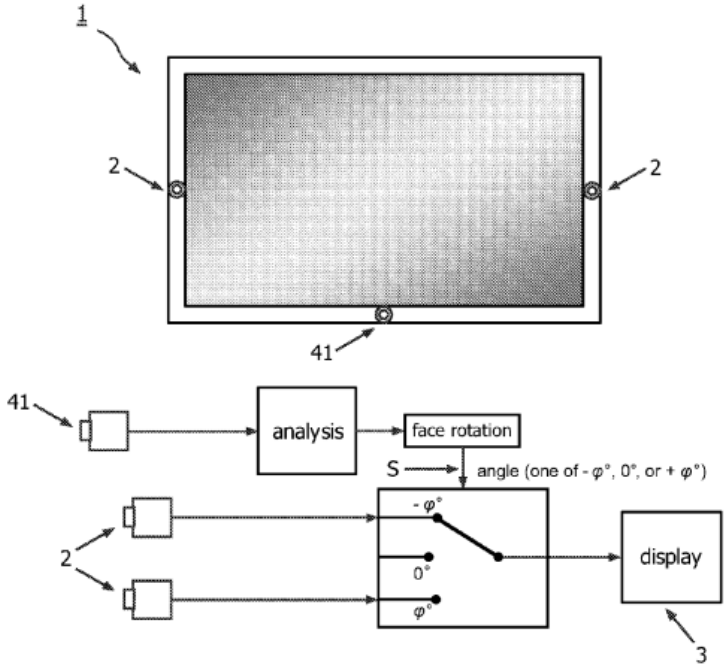
| Asserted Claim of the '109 Patent | Exemplary Citations to Haan |
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| | "FIG. 7 illustrates a further embodiment of the invention. When one looks into a flat mirror the perceived distance at which the image is formed is the same as the distance between the object and the mirror. It is possible to use a convex mirror which allows magnification of the object. However this is a fixed magnification. Within embodiments of the invention the displayed image is magnified as a function of the distance to the mirror device. Typically, a viewer holds and maintains a certain distance to a mirror. When he/she wants to take a better look at a detail he/she reduces the distance to the mirror. FIG. 7 illustrates an embodiment of the invention.<br><br>In FIG. 7 face distance determining means determine the distance of the face in respect of the mirror device. This determination determines the magnification of the displayed image. It is remarked that magnification is in fact equivalent to moving a camera with fixed magnification closer to the object, so all applications can be seen, in fact as changing the point of view, or in other words the position of the camera, be it a real camera or a virtual camera. Exaggerating the angle of rotation means in fact that one shifts the point of view from which the image is recorded further to the left or to the right then one would do for a mirror, amplification equals a shift of the point of view towards the object.<br><br>Distance can be determined in various ways, for instance, when using a single camera, the size of object provides a rough estimation of the distance; when two camera's [*sic*] are used, distance can be determined in much the same way as human eyes and brains determine distance namely by the parallax. Ultrasound means can also be used to measure distance, or such means as are regularly used for cameras to focus can be used." *See* paras. [0072]-[0074]. |

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| |  <br>FIG. 7<br><br>“In the above examples the mirror image shown is a composite of the recorded image with some artificial compounds. In most extreme examples the mirror image could be completely or almost completely artificial, though still in pose corresponding in large part to the person sitting or standing in front of the mirror device. For instance in games people often choose a character to represent themselves in the game. The synthesized image would be that of the chosen character. The size of the head would for instance still be in accordance with that of the person sitting in front of the mirror. The viewer can look in the “mirror” and, turning his of her head or body, see a reflected image of the chosen character moving in the same way as the viewer, but with increased angles of |

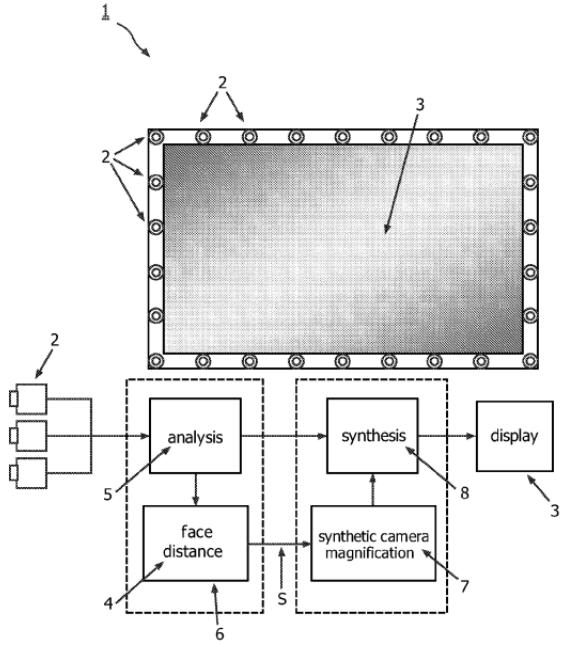
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| | view. The viewer can get familiar with the chosen character. Often such characters can be provided with accessories, as in real life. The invention, in this embodiment, allows a viewer to "try on" these accessories in a very natural manner and see the result in the mirror with improved viewing possibilities." *See* para. [0118].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Haan expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping. *See*, *e.g.*, disclosures below.<br><br>"In more sophisticated embodiments more freedom in the position of the camera can be obtained by combining electronically the images of more than one camera into a combined image. Such more sophisticated embodiments allow changing the position of the camera in a gradual manner and electronically by mixing signals of various cameras. A virtual camera position can be made and one is no longer bounded by the actual positions of the camera(s). All of the cameras can be fixed, or a mix of fixed and movable cameras can be used." *See* para. [0027].<br><br>"The recorded images by cameras 2 are fed to a position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be taken as a measure for the angle. When two images are taken 3-D analysis can be used to determine the angle of rotation of the head in respect of the mirror device and to determine the distance to the display screen. |

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| | The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image.<br><br>In simple embodiments, instead of a synthesized image, the image of a particular camera is used for a particular range of orientation of the head. Such a solution, although within the scope of the invention, however could lead to an image that jumps from one camera position to another. An embodiment intermediate to the two above described embodiments is that, dependent on the signal S, the number of camera used for synthesizing the image is limited to a small number, for instance two or three around the optimal virtual position, instead of using all of the data from all the cameras.<br><br>FIG. 3 illustrates the effect of the invention.<br><br>The orientation determining means establish for instance that the angle of turn of the head is 12 degrees. A normal mirror would then show the head being turned 12 degrees. This is shown for example in part 31. In the mirror device of the invention, the turning of the head can be exaggerated so that, instead of the head being displayed at a turning angle of 12 degrees, the turning angle (and thereby the camera position, i.e. the point of view from the image is recorded) is increased for instance 7-fold, so that a 12 degree turn of the head causes the head, as displayed on the display screen, to be turned 84 degrees. |

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| | FIG. 3 is a somewhat exaggerated example. In most applications the ratio between the actual turning angle of the head and the turning angle of the displayed head will be closer to 1 for instance a factor of 1.2 to 3, preferably between 1.3 and 2.<br><br>The amplification of the rotation should be great enough to have an appreciable effect, yet not so great that the enlargement of view and amplified rotation would not be perceived by the user intuitively as using a normal mirror." *See* paras. [0058]-[0063].<br><br>  <br>31 32<br>FIG. 3<br><br>"FIG. 4 shows an embodiment of the invention.<br><br>In this embodiment the means for determining the orientation comprise an orientation sensing camera 41. The image taken by the orientation sensing camera determines the angle of rotation of the head in respect of the mirror. This is done in analysis means 42. When the determined angle is below a threshold value, the display device is not turned on, and the device acts as a normal mirror. When it is determined that the head is turned to the left or right over an angle more than the threshold, the right side camera is switched |

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| | on and the image of the right side camera is displayed on the display device and vice versa." *See* paras. [0065]-[0066].<br>  <br><br>FIG. 4<br>"This embodiment is a variation of the embodiment of FIG. 4. However, instead of an orientation sensing camera being used, the images of the left and right camera are sent to an analysis means. In the analysis means the image of the left and right image (or both combined) are analyzed. When it is found that the viewer is looking straight at (with a margin of a number of degrees) the mirror, no signal is sent to the display device and the device acts as a simple mirror due to the semi-transparent reflective layer. When the |

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| | person is looking in the direction of the right hand camera, the image of the left hand camera is displayed on the display screen and vice versa." *See* para. [0069].<br><br>"FIG. 7 illustrates a further embodiment of the invention. When one looks into a flat mirror the perceived distance at which the image is formed is the same as the distance between the object and the mirror. It is possible to use a convex mirror which allows magnification of the object. However this is a fixed magnification. Within embodiments of the invention the displayed image is magnified as a function of the distance to the mirror device. Typically, a viewer holds and maintains a certain distance to a mirror. When he/she wants to take a better look at a detail he/she reduces the distance to the mirror. FIG. 7 illustrates an embodiment of the invention.<br><br>In FIG. 7 face distance determining means determine the distance of the face in respect of the mirror device. This determination determines the magnification of the displayed image. It is remarked that magnification is in fact equivalent to moving a camera with fixed magnification closer to the object, so all applications can be seen, in fact as changing the point of view, or in other words the position of the camera, be it a real camera or a virtual camera. Exaggerating the angle of rotation means in fact that one shifts the point of view from which the image is recorded further to the left or to the right then one would do for a mirror, amplification equals a shift of the point of view towards the object.<br><br>Distance can be determined in various ways, for instance, when using a single camera, the size of object provides a rough estimation of the distance; when two camera's [*sic*] are used, distance can be determined in much the same way as human eyes and brains determine distance namely by the parallax. Ultrasound means can also be used to measure distance, or such means as are regularly used for cameras to focus can be used." *See* paras. [0072]-[0074]. |

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| |  <br>FIG. 7<br><br>"In the above examples the mirror image shown is a composite of the recorded image with some artificial compounds. In most extreme examples the mirror image could be completely or almost completely artificial, though still in pose corresponding in large part to the person sitting or standing in front of the mirror device. For instance in games people often choose a character to represent themselves in the game. The synthesized image would be that of the chosen character. The size of the head would for instance still be in accordance with that of the person sitting in front of the mirror. The viewer can look in the "mirror" and, turning his of [*sic*] her head or body, see a reflected image of the chosen character moving in the same way as the viewer, but with increased angles of |

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| | view. The viewer can get familiar with the chosen character. Often such characters can be provided with accessories, as in real life. The invention, in this embodiment, allows a viewer to "try on" these accessories in a very natural manner and see the result in the mirror with improved viewing possibilities." *See* para. [0118].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 8** | |
| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Haan expressly and/or inherently discloses and/or renders obvious applying a translation transformation to move the image within display area of the monitor. *See*, *e.g.*, disclosures below.<br><br>"a means to determine a position of a body part with respect to the display screen of the display device, said means outputting a [*sic*] indication signal to indicate the position of the body part of a viewer in front of the display screen<br><br>a means to change the view point from which the image is recorded in dependence on said indication signal<br><br>a means to display the recorded image on the display device." *See* paras. [0009]-[0011]. |

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| | "In embodiments the indication signal indicates changes in positions, such as movement of the head or body turning the face or body or moving the face or body to and/or from the mirror.<br><br>An example of a change in orientation is a swift nod of the head to the right. The movement determining means interprets such a nod as indicating that a left side view of the head is to shown." *See* paras. [0015]-[0016].<br><br>"In embodiments, the means to change the view point are arranged to increase the angle of turn of the display imaged in respect of a reflected image. The angle of turn is the angle at which a head of body is displayed in the mirror in comparison to displaying a face looking straight at the mirror. This angle is, for mirrors, determined by the simple rule that the angle of incidence equals the angle of reflection, i.e. the turn angle is the same as the angle at which the head is turned. If one turns the head 10 degrees to the right standing in front of a normal mirror the image of the face one sees in the normal mirror is also turned 10 degrees. In a device according to this preferred embodiment the image of the head would be turned more than 10 degrees, for instance 20 degrees." *See* para. [0018].<br><br>"In another aspect of the invention a device is provided that comprises a frame with a recording device to record an image for a display device, a means to determine a position of a body part with respect to the frame, said means outputting a indication signal to indicate the position of the body part of a viewer with respect to the frame, a means to change the view point from which the image is recorded in dependence on said indication signal, a means to generate an image signal of the recorded image for display on a display screen of a display device." *See* para. [0036].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

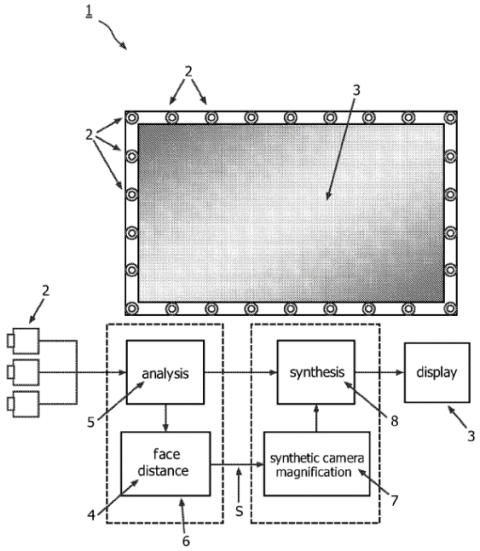
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| | Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

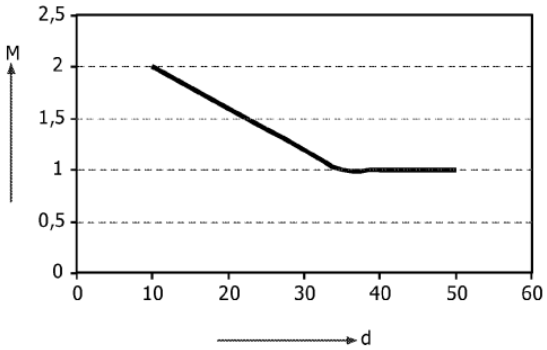
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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Haan expressly and/or inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. *See*, *e.g.*, disclosures below.<br><br>"The generated image is the image of the viewer, but as it would look after application of the make-up, i.e. colors, extent of make-up etc. A computer program would overlay and adjust the recorded image to simulate applied make-up. The viewer can than take a good look, and at various angles and maybe even at artificial light conditions or at a magnification to judge the effect of the application of make-up. Only when the viewer is satisfied and has made his/her choice the make up or grime is applied. This safes [*sic*] time and money." *See* para. [0113].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 11** | |

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| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Haan expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | Haan expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*:<br><br>"The recorded images by cameras 2 are fed to a position determination means 4. In the position determination means the images are analyzed in analyzing means 5 and in this example face orientation is determined in means 6. When a single image is analyzed, a coarse measure for the orientation of a head is for instance the ratio between the size of the head and the distance between the eyes, or the ratio between the distance between the eyes and the distance between the eyes and the mouth. Also clues such as the relative size (in horizontal direction) of the ears can be taken as a measure for the angle. When two images are taken 3-D analysis can be used to determine the angle of rotation of the head in respect of the mirror device and to determine the distance to the display screen. The face orientation is fed into a means for determining the position at which the image that is to be displayed is recorded. Using several cameras one can, by synthesis of the various images, construct a virtual camera position and/or magnification. The output of the face orientation determining means 6 is fed in to a synthetic position and magnification means 7, which determines the parameters for synthesizing the image to be displayed, which synthesizing is performed in synthesis means 8. The synthesized image is displayed on a display screen of the display device 3. The data from a number |

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| | of cameras is, in this example, combined by the processing means to arrive at a single image signal from a virtual view point. The position of the virtual viewpoint is dependent on the determined face orientation, i.e. signal S. One could use the date of all, or a large number of the cameras for synthesizing the image." *See* para. [0058].<br><br>In FIG. 7 face distance determining means determine the distance of the face in respect of the mirror device. This determination determines the magnification of the displayed image. It is remarked that magnification is in fact equivalent to moving a camera with fixed magnification closer to the object, so all applications can be seen, in fact as changing the point of view, or in other words the position of the camera, be it a real camera or a virtual camera. Exaggerating the angle of rotation means in fact that one shifts the point of view from which the image is recorded further to the left or to the right then one would do for a mirror, amplification equals a shift of the point of view towards the object.<br><br>Distance can be determined in various ways, for instance, when using a single camera, the size of object provides a rough estimation of the distance; when two camera's [*sic*] are used, distance can be determined in much the same way as human eyes and brains determine distance namely by the parallax. Ultrasound means can also be used to measure distance, or such means as are regularly used for cameras to focus can be used." *See* paras. [0073]-[0074]. |

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| |  <br>FIG. 7<br><br>"Distance can be determined in various ways, for instance, when using a single camera, the size of object provides a rough estimation of the distance; when two camera's [*sic*] are used, distance can be determined in much the same way as human eyes and brains determine distance namely by the parallax. Ultrasound means can also be used to measure distance, or such means as are regularly used for cameras to focus can be used.<br><br>FIG. 8 illustrates an exemplary relation between the magnification M of the image and the distance d in centimeter to the mirror.<br><br>For distances d larger than a threshold value, for instance in this example 35 cm distance, the magnification is kept at a fixed value of, in this example 1. This can be done for instance by using the device as a simple mirror, i.e. not displaying an image on the display device, but using the device in the reflective mode. For smaller distances, as the |

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| | viewer moves his head or torso closer to the display screen, an enlarged image is displayed, i.e. with a magnification larger than 1. To avoid a sudden jump in the image there is a smooth transition between the two regions. In embodiment there can be a range of distances for which the magnification factor is less than 1. This can be for instance useful when a hat is tried on, a normal mirror would show the face, but only part of the hat. By using a magnification smaller than 1, it does become possible to see the hat even at relatively small distances from the mirror. This would also be useful in small size changing cubicles." *See* paras. [0074]-[0076].<br><br>  <br><br>FIG. 8<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' invalidity contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | Haan expressly and/or inherently discloses and/or renders obvious varying resolution of the image according to the distance. *See*, *e.g.*, disclosures below. |

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| | "Distance can be determined in various ways, for instance, when using a single camera, the size of object provides a rough estimation of the distance; when two camera's [*sic*] are used, distance can be determined in much the same way as human eyes and brains determine distance namely by the parallax. Ultrasound means can also be used to measure distance, or such means as are regularly used for cameras to focus can be used." *See* para. [0074].<br><br>"In all embodiments wherein the mirror device switches between a reflective mode and a transparent mode smooth transitions between reflective mode and display mode are preferred embodiments.<br><br>A smooth transition can for instance be accomplished by a fade-over, i.e. a gradual change of one mode to another." *See* paras. [0080]-[0081].<br><br>"One such fade-over would be, in embodiments wherein a switchable reflective layer is used to switch the reflective layer from the first, reflective state, to the second, transparent state gradually, for instance in a range of angles $x-\Delta$ to $x+\Delta$ where x stands for the angle of orientation or the distance at which the mirror device changes from reflective mode to display mode, and $\Delta$ stands for a relatively small range around the transition values." *See* para. [0082].<br><br>"In those embodiments wherein the distance is measured, the field of view of the cameras is, in embodiments, changed in dependence on the measured distance d. When the subject moves closer to the mirror, not only the magnification is changed, but also the cameras are rotated so that the cameras are pointed at the position of the viewer. This improves the image. To this end the mirror device is provided with means to rotate the means for recording. FIG. 13 illustrates such embodiments. The signal S in indicative of the distance, drive D3 rotates the cameras 2 so that they are pointing at the position of the head of the viewer." *See* para. [0097].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Haan alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the |

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| | teachings with respect to this claim element as detailed in the cover document of Defendants’ invalidity contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

# Exhibit A-05: Invalidity of U.S. Patent No. 8,982,109 in view of JP Patent Pub. No. 2010-177777 A ("Hatanaka")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

Hatanaka was originally filed January 27, 2009 and published on August 12, 2010, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a) and (b).

Hatanaka anticipates the Asserted Claims of the '109 Patent. To the extent it is found Hatanaka does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Hatanaka does not anticipate the Asserted Claims, Hatanaka renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Hatanaka expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"This invention pertains to an image communication system as well as an image-processing control device and method. For example, they can be applied to systems that distribute live video images." *See* para. [0001].<br><br>"Consequently, there have been demands for ways to reduce the throughput of image-data-related processing in image communication systems that are configured to encode images on the transmitting side and then -- on the receiving side -- decode the encoded images for display.<br><br>The image communication system according to the first invention of the present application is an image communication system provided with (1) an encoding means for encoding an image to create the encoded image data, a decoding means for decoding the encoded image data, and a representation output part which outputs the representation of the decoded image to viewers; said image communication system characterized by comprising (2) a viewer detection means for performing detections about the relative position between the above-mentioned representation output part and a viewer(s), and (3) an encoding-content setting means for setting the content of the encoding performed by the above-mentioned encoding means according to the result detected by the above-mentioned viewer detection means.<br><br>The image-processing control device according to the second invention of the present application is an image-processing control device that controls the content of image-related processing in an image communication system provided with (1) an encoding means for encoding an image to create the encoded image data, a decoding means for decoding the encoded image data, and a representation output part which outputs the representation of the decoded image to viewers; said image-processing control device characterized by comprising (2) a viewer detection means for performing detections |

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| | about the relative position between the above-mentioned representation output part and a viewer(s), and (3) an encoding-content setting means for setting the content of the encoding performed by the above-mentioned encoding means according to the result detected by the above-mentioned viewer detection means.<br><br>The image-processing control method according to the second invention of the present application is an image-processing control method used to control the content of image-related processing in an image communication system provided with (1) an encoding means for encoding an image to create the encoded image data, a decoding means for decoding the encoded image data, and a representation output part which outputs the representation of the decoded image to viewers; said image-processing control method characterized by comprising (2) a viewer detection means and an encoding-content setting means, wherein:<br><br>(3) The above-mentioned viewer detection means performs detections about the relative position between the above-mentioned representation output part and a viewer; and<br><br>(4) The above-mentioned encoding-content setting means sets the content of the encoding performed by the above-mentioned encoding means, doing so according to the result detected by the above-mentioned viewer detection means.<br><br>The present inventions make it possible to reduce the throughput of image-data-related processing in an image communication system configured to encode images on the transmitting side and then decode the encoded data on the receiving side to output the representation of the images.<br><br>Figure 1 shows a block diagram that illustrates the overall configuration of the image communication system and image-processing control device claimed in the first embodiment. |

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| | Figure 2 shows an illustrative drawing that explains the viewing distance according to the image-processing control device claimed in the first embodiment.<br><br>Figure 3 shows a flowchart that illustrates the operation of the image-processing control device claimed in the first embodiment.<br><br>Figure 4 shows a block diagram that illustrates the overall configuration of the image communication system and image-processing control device claimed in the second embodiment.<br><br>Figure 5 shows an illustrative drawing that explains the viewing distance and viewing angle according to the image-processing control device claimed in the second embodiment.<br><br>Figure 6 shows a flowchart that illustrates the operation of the image-processing control device claimed in the second embodiment." *See* paras. [0008]-[0013].<br><br>"**(A-1) Configuration of the First Embodiment**<br>Figure 1 shows a block diagram that illustrates the overall configuration of image communication system 1 and image-processing control device 40 according to the present embodiment.<br><br>Image communication system 1 has camera 10, transmission device 20, receiving device 30, and representation apparatus 50. Transmission device 20 has capturer 21, encoder 22, and encoding controller 23. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>In Figure 1, image-processing control device 40 is illustrated as having at least sensor 41 and assessment part 42. However, encoding controller 23 may be installed on the image-processing-control-device-40 side. In Figure 1, image-processing control device |

| Asserted Claim of the '109 Patent | Exemplary Citations to Hatanaka |
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| | 40 is shown as being installed on the receiving-device-30 side, but it may be constructed as an independent discrete device.<br><br>Camera 10 captures video images and provides signals representing the captured video images to transmission device 20. Camera 10 may be a conventional CCD camera or video camera. There is no restriction on the type of the camera. It should be noted that while images captured by camera 10 may be video or still images, video images are used in the first embodiment to illustrate images captured by camera 10.<br><br>Transmission device 20 encodes video image signals provided by camera 10 and provides the encoded video image data to receiving device 30. Communication between transmission device 20 and receiving device 30 may be achieved via a network such as the Internet or a public telephone network, or it may be achieved through a direct connection. There is no restriction on the method of communication.<br><br>Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50." *See* paras. [0015]-[0020].<br><br>"Representation apparatus 50 outputs the representation of the video image to the audience (which may be hereinafter referred to as the "viewer") 60 according to the video image signals provided by receiving device 30. Representation apparatus 50 may be a conventional display device or any other device that can display information on a screen. There is no restriction on the type of the representation apparatus. It should be noted that, though not illustrated in Figure 1, the transmission-device-20 side may be configured so as to use a microphone to acquire audio as camera 10 captures video images as well as to encode the audio thus acquired and transmit it to the receiving-device-30 side so that the audio and the video image are output together to audience 60.<br><br>The following is an explanation of the internal configuration of transmission device 20: Transmission device 20 has capturer 21, encoder 22, and encoding controller 23. |

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| | Capturer 21 and encoder 22 in transmission device 20 are responsible for uploading and encoding the video image signals output from camera 10. If video image signals provided by camera 10 are analog signals, capturer 21 converts them to digital signals. However, if video image signals provided by camera 10 are digital signals, capturer 21 handles the signals in the as-is state. Then, capturer 21 gives the video image data to encoder 22. The video image data are then encoded by encoder 22 (which may use, for example, a conventional encoding scheme such as MPEG4) and are sent to receiving device 30. While transmission device 20 is equipped with capturer 21 in Figure 1, capturer 21 may be omitted if camera 10 provides video image data in the digital format or if a camera equipped with a capturer is used.<br><br>Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to the control communicated from receiving device 30 (i.e., assessment part 42, which shall be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section." *See* paras. [0021]-[0024].<br><br>"Representation control part 32 converts the image data decoded by decoder 31 into an image signal of the size that can be displayed on representation apparatus 50 and then provides the image signal of said display size to representation apparatus 50. Representation control part 32 may be installed on the representation apparatus-50 side. Representation control part 32 applicable herein may be any means for converting image data to be displayed into a signal of an image of the size that can be displayed on a display used to output the representation of said image according to the resolution of the image data, doing so in a conventional display device or computer, for example." *See* para. [0027].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | Hatanaka expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below.<br><br>"This invention pertains to an image communication system as well as an image-processing control device and method. For example, they can be applied to systems that distribute live video images.<br><br>Conventionally, the devices described in patent documents 1 and 2 have been used to encode images, such as live video images.<br><br>The device described in Patent Document 1 can dynamically alter the encoding resolution according to the amount of movement in the video image." *See* paras. [0001]-[0003].<br><br>"**(A-1) Configuration of the First Embodiment**<br>Figure 1 shows a block diagram that illustrates the overall configuration of image communication system 1 and image-processing control device 40 according to the present embodiment.<br><br>Image communication system 1 has camera 10, transmission device 20, receiving device 30, and representation apparatus 50. Transmission device 20 has capturer 21, encoder 22, and encoding controller 23. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>In Figure 1, image-processing control device 40 is illustrated as having at least sensor 41 and assessment part 42. However, encoding controller 23 may be installed on the image-processing-control-device-40 side. In Figure 1, image-processing control device |

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| | 40 is shown as being installed on the receiving-device-30 side, but it may be constructed as an independent discrete device.<br><br>Camera 10 captures video images and provides signals representing the captured video images to transmission device 20. Camera 10 may be a conventional CCD camera or video camera. There is no restriction on the type of the camera. It should be noted that while images captured by camera 10 may be video or still images, video images are used in the first embodiment to illustrate images captured by camera 10.<br><br>Transmission device 20 encodes video image signals provided by camera 10 and provides the encoded video image data to receiving device 30. Communication between transmission device 20 and receiving device 30 may be achieved via a network such as the Internet or a public telephone network, or it may be achieved through a direct connection. There is no restriction on the method of communication.<br><br>Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50.” *See* paras. [0015]-[0020].<br><br>“Representation apparatus 50 outputs the representation of the video image to the audience (which may be hereinafter referred to as the "viewer") 60 according to the video image signals provided by receiving device 30. Representation apparatus 50 may be a conventional display device or any other device that can display information on a screen. There is no restriction on the type of the representation apparatus. It should be noted that, though not illustrated in Figure 1, the transmission-device-20 side may be configured so as to use a microphone to acquire audio as camera 10 captures video images as well as to encode the audio thus acquired and transmit it to the receiving-device-30 side so that the audio and the video image are output together to audience 60.<br><br>The following is an explanation of the internal configuration of transmission device 20: Transmission device 20 has capturer 21, encoder 22, and encoding controller 23. |

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| | Capturer 21 and encoder 22 in transmission device 20 are responsible for uploading and encoding the video image signals output from camera 10. If video image signals provided by camera 10 are analog signals, capturer 21 converts them to digital signals. However, if video image signals provided by camera 10 are digital signals, capturer 21 handles the signals in the as-is state. Then, capturer 21 gives the video image data to encoder 22. The video image data are then encoded by encoder 22 (which may use, for example, a conventional encoding scheme such as MPEG4) and are sent to receiving device 30. While transmission device 20 is equipped with capturer 21 in Figure 1, capturer 21 may be omitted if camera 10 provides video image data in the digital format or if a camera equipped with a capturer is used.<br><br>Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to the control communicated from receiving device 30 (i.e., assessment part 42, which shall be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section." *See* paras. [0021]-[0024].<br><br>"Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For |

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| | example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22." *See* paras. [0037]-[0038].<br><br>"Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103)." *See* paras. [0041]-[0045].<br><br>"In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network. |

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| | For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0049]-[0051].<br><br>"Image communication system 1A has camera 10, transmission device 20, receiving device 30, and representation apparatus 50. Camera 10, transmission device 20, and representation apparatus 50 are similar to those illustrated in the first embodiment. Accordingly, the explanation thereof shall be omitted hereafter.<br><br>Receiving device 30A has decoder 31, representation control part 32, and image-processing control device 40A. Decoder 31 and representation control part 32 are similar to those illustrated in the first embodiment. Accordingly, the explanation thereof shall be omitted hereafter.<br><br>Image-processing control device 40A has sensor 41A and assessment part 42A." *See* paras. [0055]-[0057].<br><br>"Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A.<br><br>It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing. |

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| | First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202).<br><br>Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203)." *See* paras. [0071]-[0075].<br><br>"**(C-3)** All the embodiments described above assume that the encoder uploads and encodes live video images captured by the camera. However, the subjects of encoding performed by the encoder are not limited to live video images captured by the camera. For example, video images recorded on a medium, such as a videotape or DVD, may be encoded in a format used for transmission to the receiving device." *See* para. [0086].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Hatanaka expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Hatanaka expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror. *See*, *e.g.*, disclosures below.<br><br>"Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50." *See* para. [0020].<br><br>"Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to the control communicated from receiving device 30 (i.e., assessment part 42, which shall be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section.<br><br>Next is an explanation of the internal configuration of receiving device 30. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>Decoder 31 decodes the encoded image data provided by transmission device 20 and provides the decoded image data to representation control part 32. Decoder 31 applicable herein may be, for example, a conventional device that can decode video images.<br><br>Representation control part 32 converts the image data decoded by decoder 31 into an image signal of the size that can be displayed on representation apparatus 50 and then provides the image signal of said display size to representation apparatus 50. Representation control part 32 may be installed on the representation apparatus-50 side. Representation control part 32 applicable herein may be any means for converting image data to be displayed into a signal of an image of the size that can be displayed on a display used to output the representation of said image according to the resolution of the image data, doing so in a conventional display device or computer, for example. |

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| | The following is an explanation of the configuration of image-processing control device 40. Image-processing control device 40 has sensor 41 and assessment part 42. *See* paras. [0024]-[0028].<br><br>"Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the |

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| | image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0037]-[0039].<br><br>"**(A-2) Operation of the First Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1, having the configuration described above according to the first embodiment.<br><br>Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103).<br><br>In step S103, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22. |

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| | Incidentally, the operation in steps S101 through S103 described above may be repeated continuously or periodically, or according to sensor 41's detection of audience 60's movement. There is no restriction on the timing of executing the process." *See* paras. [0040]-[0047].<br><br>"**(A-3) Effects of the First Embodiment**<br>The first embodiment demonstrates the following effects:<br><br>In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>Additionally, data encoded at a reduced encoding resolution by encoder 22 is decoded by decoder 31. This makes it possible to reduce the amount of decoding throughput in decoder 31.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience |

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| | in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0048]-[0051].<br><br>"While assessment part 42A in the first embodiment makes an assessment based only on viewing distance D, assessment part 42A in the present embodiment uses viewing distance D and viewing angle θ to make an assessment as mentioned above.<br><br>Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 gives instructions to encoding controller 23 so as to cause the amount of encoding throughput and the amount of post-encoding data to decrease as viewing distance D increases.<br><br>For example, assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the transverse (horizontal) resolution to be lowered as viewing angle θ increases — e.g., so as to use a resolution applied based only on viewing distance D for comparison and multiply it by √3/2 when viewing angle θ is 30° but by 1/2 when viewing angle θ is 60° to obtain the transverse (horizontal) resolution. Incidentally, when detecting the direction of audience 60 relative to representation apparatus 50 three-dimensionally (i.e., when including the elevation angle associated with the direction of audience 60 in the measurement), assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the longitudinal (vertical) resolution to be lowered as the elevation angle increases, for example." *See* paras. [0067]-[0069].<br><br>"**(B-2) Operation of the Second Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1A, having the configuration described above according to the second embodiment. |

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| | Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A.<br><br>It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202).<br><br>Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203).<br><br>In step S203, similar to step S103 in the first embodiment described above, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Also, similar to the case of steps S101 through S103 in the first embodiment, there is no restriction on the timing of executing the process involved in the operation performed in steps S201 to S203." *See* paras. [0070]-[0077].<br><br>"**(B-3) Effects of the Second Embodiment** |

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| | The second embodiment demonstrates the following effects in addition to the effects of the first embodiment:<br><br>Image communication system 1A takes into account not only viewing distance D but also viewing angle θ to determine the content of the encoding performed by encoder 22. This makes it possible to include viewing angle θ in consideration for the determination of the content of the encoding performed by encoder 22 if viewing distance D is the same, thus making it possible to reduce the amount of throughput associated with the encoding and the amount of post-encoding data more than the first embodiment." *See* paras. [0078]-[0079].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Hatanaka expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera. *See*, *e.g.*, disclosures below.<br><br>"Representation control part 32 converts the image data decoded by decoder 31 into an image signal of the size that can be displayed on representation apparatus 50 and then provides the image signal of said display size to representation apparatus 50. Representation control part 32 may be installed on the representation apparatus-50 side. Representation control part 32 applicable herein may be any means for converting image data to be displayed into a signal of an image of the size that can be displayed on a display used to output the representation of said image according to the resolution of the image data, doing so in a conventional display device or computer, for example." *See* para. [0027]. |

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| | "For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0038]-[0039].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | Hatanaka expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below.<br><br>"Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50." *See* para. [0020]. |

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| | "Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to the control communicated from receiving device 30 (i.e., assessment part 42, which shall be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section.<br><br>Next is an explanation of the internal configuration of receiving device 30. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>Decoder 31 decodes the encoded image data provided by transmission device 20 and provides the decoded image data to representation control part 32. Decoder 31 applicable herein may be, for example, a conventional device that can decode video images.<br><br>Representation control part 32 converts the image data decoded by decoder 31 into an image signal of the size that can be displayed on representation apparatus 50 and then provides the image signal of said display size to representation apparatus 50. Representation control part 32 may be installed on the representation apparatus-50 side. Representation control part 32 applicable herein may be any means for converting image data to be displayed into a signal of an image of the size that can be displayed on a display used to output the representation of said image according to the resolution of the image data, doing so in a conventional display device or computer, for example.<br><br>The following is an explanation of the configuration of image-processing control device 40. Image-processing control device 40 has sensor 41 and assessment part 42. *See* paras. [0024]-[0028].<br><br>"Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way |

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| | as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0037]-[0039].<br><br>"**(A-2) Operation of the First Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1, having the configuration described above according to the first embodiment.<br><br>Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system. |

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| | In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103).<br><br>In step S103, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Incidentally, the operation in steps S101 through S103 described above may be repeated continuously or periodically, or according to sensor 41's detection of audience 60's movement. There is no restriction on the timing of executing the process." *See* paras. [0040]-[0047].<br><br>"**(A-3) Effects of the First Embodiment**<br>The first embodiment demonstrates the following effects:<br><br>In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. |

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| | Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>Additionally, data encoded at a reduced encoding resolution by encoder 22 is decoded by decoder 31. This makes it possible to reduce the amount of decoding throughput in decoder 31.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0048]-[0051].<br><br>"While assessment part 42A in the first embodiment makes an assessment based only on viewing distance D, assessment part 42A in the present embodiment uses viewing distance D and viewing angle θ to make an assessment as mentioned above.<br><br>Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 gives instructions to encoding controller 23 so as to cause the amount of encoding throughput and the amount of post-encoding data to decrease as viewing distance D increases. |

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| | For example, assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the transverse (horizontal) resolution to be lowered as viewing angle θ increases — e.g., so as to use a resolution applied based only on viewing distance D for comparison and multiply it by √3/2 when viewing angle θ is 30° but by 1/2 when viewing angle θ is 60° to obtain the transverse (horizontal) resolution. Incidentally, when detecting the direction of audience 60 relative to representation apparatus 50 three-dimensionally (i.e., when including the elevation angle associated with the direction of audience 60 in the measurement), assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the longitudinal (vertical) resolution to be lowered as the elevation angle increases, for example." *See* paras. [0067]-[0069].<br><br>"**(B-2) Operation of the Second Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1A, having the configuration described above according to the second embodiment.<br><br>Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A.<br><br>It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding |

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| | according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202).<br><br>Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203).<br><br>In step S203, similar to step S103 in the first embodiment described above, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Also, similar to the case of steps S101 through S103 in the first embodiment, there is no restriction on the timing of executing the process involved in the operation performed in steps S201 to S203." *See* paras. [0070]-[0077].<br><br>"**(B-3) Effects of the Second Embodiment**<br>The second embodiment demonstrates the following effects in addition to the effects of the first embodiment:<br><br>Image communication system 1A takes into account not only viewing distance D but also viewing angle θ to determine the content of the encoding performed by encoder 22. This makes it possible to include viewing angle θ in consideration for the determination of the content of the encoding performed by encoder 22 if viewing distance D is the same, thus making it possible to reduce the amount of throughput associated with the encoding and the amount of post-encoding data more than the first embodiment." *See* paras. [0078]-[0079]. |

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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Hatanaka expressly and/or inherently discloses and/or renders obvious the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"This invention pertains to an image communication system as well as an image-processing control device and method. For example, they can be applied to systems that distribute live video images.<br><br>Conventionally, the devices described in patent documents 1 and 2 have been used to encode images, such as live video images.<br><br>The device described in Patent Document 1 can dynamically alter the encoding resolution according to the amount of movement in the video image." *See* paras. [0001]-[0003].<br><br>"Camera 10 captures video images and provides signals representing the captured video images to transmission device 20. Camera 10 may be a conventional CCD camera or video camera. There is no restriction on the type of the camera. It should be noted that while images captured by camera 10 may be video or still images, video images are used in the first embodiment to illustrate images captured by camera 10.<br><br>Transmission device 20 encodes video image signals provided by camera 10 and provides the encoded video image data to receiving device 30. Communication between transmission device 20 and receiving device 30 may be achieved via a network such as |

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| | the Internet or a public telephone network, or it may be achieved through a direct connection. There is no restriction on the method of communication.<br><br>Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50. re para. 0019: if elements 20 and 30 are directly connected (e.g., same device), then Camera 10 is capturing a video of Viewer 60 with a frame rate and resolution determined based on the distance of Viewer 60 to Display 50.<br><br>Representation apparatus 50 outputs the representation of the video image to the audience (which may be hereinafter referred to as the "viewer") 60 according to the video image signals provided by receiving device 30. Representation apparatus 50 may be a conventional display device or any other device that can display information on a screen. There is no restriction on the type of the representation apparatus. It should be noted that, though not illustrated in Figure 1, the transmission-device-20 side may be configured so as to use a microphone to acquire audio as camera 10 captures video images as well as to encode the audio thus acquired and transmit it to the receiving-device-30 side so that the audio and the video image are output together to audience 60.<br><br>The following is an explanation of the internal configuration of transmission device 20: Transmission device 20 has capturer 21, encoder 22, and encoding controller 23.<br><br>Capturer 21 and encoder 22 in transmission device 20 are responsible for uploading and encoding the video image signals output from camera 10. If video image signals provided by camera 10 are analog signals, capturer 21 converts them to digital signals. However, if video image signals provided by camera 10 are digital signals, capturer 21 handles the signals in the as-is state. Then, capturer 21 gives the video image data to encoder 22. The video image data are then encoded by encoder 22 (which may use, for example, a conventional encoding scheme such as MPEG4) and are sent to receiving device 30. While transmission device 20 is equipped with capturer 21 in Figure 1, |

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| | capturer 21 may be omitted if camera 10 provides video image data in the digital format or if a camera equipped with a capturer is used.<br><br>Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to the control communicated from receiving device 30 (i.e., assessment part 42, which shall be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section.<br><br>Next is an explanation of the internal configuration of receiving device 30. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>Decoder 31 decodes the encoded image data provided by transmission device 20 and provides the decoded image data to representation control part 32. Decoder 31 applicable herein may be, for example, a conventional device that can decode video images." *See* paras. [0018]-[0026].<br><br>"Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this |

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| | event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22." *See* paras. [0037]-[0038].<br><br>"Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103)." *See* paras. [0041]-[0045].<br><br>"In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from |

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| | transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0049]-[0051].<br><br>"Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A.<br><br>It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202).<br><br>Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and |

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| | subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203)." *See* paras. [0071]-[0075].<br><br>"**(C-3)** All the embodiments described above assume that the encoder uploads and encodes live video images captured by the camera. However, the subjects of encoding performed by the encoder are not limited to live video images captured by the camera. For example, video images recorded on a medium, such as a videotape or DVD, may be encoded in a format used for transmission to the receiving device." *See* para. [0086].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Hatanaka expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video feed. *See*, *e.g.*, disclosures below.<br><br>"The device described in Patent Document 2 includes a conventional system that uses the distance and positional relationship between the audience and the representation apparatus. The distance between the audience and the representation apparatus is used for the execution of the processing performed to make the identification of images projected on the representation apparatus difficult." *See* para. [0004].<br><br>"However, the device described in Patent Document 1 poses a problem because merely lowering the encoding resolution without taking into account the distance between the audience and the representation apparatus does not resolve the issue that the encoding is performed at the same resolution regardless of whether the audience looks at the representation apparatus from a distance or at close range, meaning that the processing load on the encoder remains higher than necessary. |

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| | With the device described in Patent Document 2, the processing load on the encoder also remains higher than necessary because said device uses the distance between the audience and the representation apparatus as a criterion for the processing performed to make the identification of images projected on a representation apparatus difficult, although such processing with a conventional technology allows for communications with less psychological burdens." *See* paras. [0006]-[0007].<br><br>"Figure 1 shows a block diagram that illustrates the overall configuration of the image communication system and image-processing control device claimed in the first embodiment.<br><br>Figure 2 shows an illustrative drawing that explains the viewing distance according to the image-processing control device claimed in the first embodiment.<br><br>Figure 3 shows a flowchart that illustrates the operation of the image-processing control device claimed in the first embodiment.<br><br>Figure 4 shows a block diagram that illustrates the overall configuration of the image communication system and image-processing control device claimed in the second embodiment.<br><br>Figure 5 shows an illustrative drawing that explains the viewing distance and viewing angle according to the image-processing control device claimed in the second embodiment.<br><br>Figure 6 shows a flowchart that illustrates the operation of the image-processing control device claimed in the second embodiment." *See* para. [0013].<br><br>"Camera 10 captures video images and provides signals representing the captured video images to transmission device 20. Camera 10 may be a conventional CCD camera or video camera. There is no restriction on the type of the camera. It should be noted that |

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| | while images captured by camera 10 may be video or still images, video images are used in the first embodiment to illustrate images captured by camera 10.<br><br>Transmission device 20 encodes video image signals provided by camera 10 and provides the encoded video image data to receiving device 30. Communication between transmission device 20 and receiving device 30 may be achieved via a network such as the Internet or a public telephone network, or it may be achieved through a direct connection. There is no restriction on the method of communication." *See* paras. [0018]-[0019].<br><br>"The following is an explanation of the configuration of image-processing control device 40. Image-processing control device 40 has sensor 41 and assessment part 42.<br><br>Sensor 41 measures the distance between audience 60 and representation apparatus 50 (hereinafter referred to as "viewing distance D") and provides assessment part 42 with the measurement result. Incidentally, sensor 41 may be placed around representation apparatus 50 so as to measure the distance between representation apparatus 50 and audience 60 and deem the distance thus measured as viewing distance D." *See* paras. [0028]-[0029].<br><br>"Figure 2 shows an example of viewing distance D, i.e., the distance between representation apparatus 50 and audience 60.<br><br>Figure 2 (a) shows an example of representation apparatus 50 (a display device in this example) in the state in which representation apparatus 50 (a display device) is viewed from the front.<br><br>Figure 2 (b) shows an illustrative drawing that illustrates an example of viewing distance D, i.e., the distance between representation apparatus 50 and audience 60, in the state in which representation apparatus 50 shown in Figure 2 (a) is viewed from the top. In Figure 2 (b), viewing distance D is illustrated as the distance from the center of |

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| | representation apparatus 50 to audience 60; however, it may be the distance from another section of representation apparatus 50 to audience 60.<br><br>An example of the method used to measure viewing distance D in sensor 41 may involve the use of, for example, a motion sensor, a wireless IC tag, or the like as described in relation to the “proximity detection means” according to Patent Document 2.<br><br>Another example of the method used to measure viewing distance D in sensor 41 may involve having audience 60 hold a wireless communication terminal (which, for example, may be built into a terminal used to operate representation apparatus 50, etc., such as a remote control terminal, a mobile phone terminal, or the like) and installing sensor 41 around representation apparatus 50 so that sensor 41 communicates with the above-described wireless communication terminal to thereby measure the distance between the above-described wireless communication terminal and sensor 41, i.e., viewing distance D. The above-described distance between the wireless communication terminal and sensor 41 may be measured based, for example, on the intensity of the signal received or the transmission lag time. Wireless communication between the above-described wireless communication terminal and sensor 41 may be achieved through the use of light, such as radio waves or infrared rays. However, there is no restriction on the communication method insofar as viewing distance D can be measured.<br><br>Yet another example of the method used to measure viewing distance D in sensor 41 may involve installing multiple motion sensors around representation apparatus 50 and pre-registering the respective viewing distance for each motion sensor so as to recognize the distance of the audience based on which motion sensor has detected the audience. For example, motion sensors may be placed at equal distances from representation apparatus 50 to measure audience distance L. Incidentally, conventional motion sensors can be used as the motion sensors adopted for sensor 41. |

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| | However, there is no restriction on the method used in sensor 41 insofar as viewing distance D can be measured.<br><br>Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0030]-[0039]. |

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| | "Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103)." *See* paras. [0041]-[0045].<br><br>"In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a |

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| | camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0049]-[0051].<br><br>"**(B-1) Configuration of the Second Embodiment**<br>In the first embodiment, sensor 41 measures viewing distance D only, and assessment part 42 uses only viewing distance D for processing. However, in the second embodiment, not only viewing distance D but also the direction in which audience 60 is located relative to representation apparatus 50 is included as an element used to determine the encoding content." *See* para. [0053].<br><br>"Image-processing control device 40A has sensor 41A and assessment part 42A.<br><br>As described above, sensor 41 in the first embodiment measures viewing distance D only. However, sensor 41A in the present embodiment differs from sensor 41 in that sensor 41A also measures the direction in which audience 60 is located relative to representation apparatus 50 (hereinafter, the "viewing direction").<br><br>Figure 5 shows an illustrative drawing that illustrates an example of viewing distance D (which is the distance between representation apparatus 50 and audience 60) and the audience direction.<br><br>Figure 5 (a) shows an example of representation apparatus 50 (a display device in this example) in the state in which representation apparatus 50 (a display device) is viewed from the front.<br><br>Figure 5 (b) shows an illustrative drawing that illustrates examples of viewing distance D, i.e., the distance between representation apparatus 50 and audience 60, and |

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| | the viewing direction in the state in which representation apparatus 50 shown in Figure 5 (a) is viewed from the top.<br><br>The method used to measure viewing distance D in sensor 41A is similar to that of the first embodiment. Accordingly, the explanation thereof shall be omitted hereafter." *See* paras. [0057]-[0062].<br><br>"In the same way as in the case of viewing distance D, an example of the method used to measure viewing angle θ in sensor 41A may involve the use of, for example, a motion sensor, a wireless IC tag, or the like, as described in relation to the "proximity detection means" according to Patent Document 2, whereby sensor 41A recognizes the positional relationship between audience 60 and representation apparatus 50 to thereby determine viewing angle θ. Figure 5 shows an example of detecting the two-dimensional direction of audience 60 relative to representation apparatus 50. However, sensor 41A may also be configured to detect the direction of audience 60 relative to representation apparatus 50 three-dimensionally (including the elevation angle)." *See* para. [0064].<br><br>"While assessment part 42A in the first embodiment makes an assessment based only on viewing distance D, assessment part 42A in the present embodiment uses viewing distance D and viewing angle θ to make an assessment as mentioned above.<br><br>Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 gives instructions to encoding controller 23 so as to cause the amount of encoding throughput and the amount of post-encoding data to decrease as viewing distance D increases.<br><br>For example, assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the transverse (horizontal) resolution to be lowered as viewing angle θ increases — e.g., so as to use a resolution applied based only on viewing distance D for comparison and multiply it by √3/2 when viewing angle θ is 30° but by 1/2 when viewing angle θ is 60° to obtain the transverse (horizontal) resolution. |

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| | Incidentally, when detecting the direction of audience 60 relative to representation apparatus 50 three-dimensionally (i.e., when including the elevation angle associated with the direction of audience 60 in the measurement), assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the longitudinal (vertical) resolution to be lowered as the elevation angle increases, for example." *See* paras. [0067]-[0069].<br><br>"First, sensor 41A measures the viewing distance D and the viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202)." *See* paras. [0073]-[0074].<br><br>"**(B-3) Effects of the Second Embodiment**<br>The second embodiment demonstrates the following effects in addition to the effects of the first embodiment:<br><br>Image communication system 1A takes into account not only viewing distance D but also viewing angle θ to determine the content of the encoding performed by encoder 22. This makes it possible to include viewing angle θ in consideration for the determination of the content of the encoding performed by encoder 22 if viewing distance D is the same, thus making it possible to reduce the amount of throughput associated with the encoding and the amount of post-encoding data more than the first embodiment." *See* paras. [0078]-[0079].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Hatanaka expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. *See*, *e.g.*, disclosures below.<br><br>"Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* para. [0039].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | Hatanaka expressly and/or inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. *See*, *e.g.*, disclosures below. |



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| | "Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50." *See* para. [0020].<br><br>"Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to the control communicated from receiving device 30 (i.e., assessment part 42, which shall be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section.<br><br>Next is an explanation of the internal configuration of receiving device 30. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>Decoder 31 decodes the encoded image data provided by transmission device 20 and provides the decoded image data to representation control part 32. Decoder 31 applicable herein may be, for example, a conventional device that can decode video images.<br><br>Representation control part 32 converts the image data decoded by decoder 31 into an image signal of the size that can be displayed on representation apparatus 50 and then provides the image signal of said display size to representation apparatus 50. Representation control part 32 may be installed on the representation apparatus-50 side. Representation control part 32 applicable herein may be any means for converting image data to be displayed into a signal of an image of the size that can be displayed on a display used to output the representation of said image according to the resolution of the image data, doing so in a conventional display device or computer, for example.<br><br>The following is an explanation of the configuration of image-processing control device 40. Image-processing control device 40 has sensor 41 and assessment part 42." *See* paras. [0024]-[0028]. |

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| | "Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0037]-[0039].<br><br>"**(A-2) Operation of the First Embodiment** |

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| | The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1, having the configuration described above according to the first embodiment.<br><br>Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103).<br><br>In step S103, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Incidentally, the operation in steps S101 through S103 described above may be repeated continuously or periodically, or according to sensor 41's detection of audience 60's |

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| | movement. There is no restriction on the timing of executing the process." *See* paras. [0040]-[0047].<br><br>"**(A-3) Effects of the First Embodiment**<br>The first embodiment demonstrates the following effects:<br><br>In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>Additionally, data encoded at a reduced encoding resolution by encoder 22 is decoded by decoder 31. This makes it possible to reduce the amount of decoding throughput in decoder 31.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0048]-[0051]. |

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| | "While assessment part 42A in the first embodiment makes an assessment based only on viewing distance D, assessment part 42A in the present embodiment uses viewing distance D and viewing angle θ to make an assessment as mentioned above.<br><br>Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 gives instructions to encoding controller 23 so as to cause the amount of encoding throughput and the amount of post-encoding data to decrease as viewing distance D increases.<br><br>For example, assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the transverse (horizontal) resolution to be lowered as viewing angle θ increases — e.g., so as to use a resolution applied based only on viewing distance D for comparison and multiply it by √3/2 when viewing angle θ is 30° but by 1/2 when viewing angle θ is 60° to obtain the transverse (horizontal) resolution. Incidentally, when detecting the direction of audience 60 relative to representation apparatus 50 three-dimensionally (i.e., when including the elevation angle associated with the direction of audience 60 in the measurement), assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the longitudinal (vertical) resolution to be lowered as the elevation angle increases, for example." *See* paras. [0067]-[0069].<br><br>"**(B-2) Operation of the Second Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1A, having the configuration described above according to the second embodiment.<br><br>Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A. |

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| | It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202).<br><br>Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203).<br><br>In step S203, similar to step S103 in the first embodiment described above, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Also, similar to the case of steps S101 through S103 in the first embodiment, there is no restriction on the timing of executing the process involved in the operation performed in steps S201 to S203." *See* paras. [0070]-[0077].<br><br>"**(B-3) Effects of the Second Embodiment**<br>The second embodiment demonstrates the following effects in addition to the effects of the first embodiment: |

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| | Image communication system 1A takes into account not only viewing distance D but also viewing angle θ to determine the content of the encoding performed by encoder 22. This makes it possible to include viewing angle θ in consideration for the determination of the content of the encoding performed by encoder 22 if viewing distance D is the same, thus making it possible to reduce the amount of throughput associated with the encoding and the amount of post-encoding data more than the first embodiment." *See* paras. [0078]-[0079].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Hatanaka expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| 7[a]. obtaining a reference image; | Hatanaka expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below.<br><br>"This invention pertains to an image communication system as well as an image-processing control device and method. For example, they can be applied to systems that distribute live video images.<br><br>Conventionally, the devices described in patent documents 1 and 2 have been used to encode images, such as live video images.<br><br>The device described in Patent Document 1 can dynamically alter the encoding resolution according to the amount of movement in the video image." *See* paras. [0001]-[0003].<br><br>"**(A-1) Configuration of the First Embodiment**<br>Figure 1 shows a block diagram that illustrates the overall configuration of image communication system 1 and image-processing control device 40 according to the present embodiment.<br><br>Image communication system 1 has camera 10, transmission device 20, receiving device 30, and representation apparatus 50. Transmission device 20 has capturer 21, encoder 22, and encoding controller 23. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>In Figure 1, image-processing control device 40 is illustrated as having at least sensor 41 and assessment part 42. However, encoding controller 23 may be installed on the image-processing-control-device-40 side. In Figure 1, image-processing control device 40 is shown as being installed on the receiving-device-30 side, but it may be constructed as an independent discrete device.<br><br>Camera 10 captures video images and provides signals representing the captured video images to transmission device 20. Camera 10 may be a conventional CCD camera or |

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| | video camera. There is no restriction on the type of the camera. It should be noted that while images captured by camera 10 may be video or still images, video images are used in the first embodiment to illustrate images captured by camera 10.<br><br>Transmission device 20 encodes video image signals provided by camera 10 and provides the encoded video image data to receiving device 30. Communication between transmission device 20 and receiving device 30 may be achieved via a network such as the Internet or a public telephone network, or it may be achieved through a direct connection. There is no restriction on the method of communication.<br><br>Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50.” *See* paras. [0015]-[0020].<br><br>“Representation apparatus 50 outputs the representation of the video image to the audience (which may be hereinafter referred to as the "viewer") 60 according to the video image signals provided by receiving device 30. Representation apparatus 50 may be a conventional display device or any other device that can display information on a screen. There is no restriction on the type of the representation apparatus. It should be noted that, though not illustrated in Figure 1, the transmission-device-20 side may be configured so as to use a microphone to acquire audio as camera 10 captures video images as well as to encode the audio thus acquired and transmit it to the receiving-device-30 side so that the audio and the video image are output together to audience 60.<br><br>The following is an explanation of the internal configuration of transmission device 20: Transmission device 20 has capturer 21, encoder 22, and encoding controller 23.<br><br>Capturer 21 and encoder 22 in transmission device 20 are responsible for uploading and encoding the video image signals output from camera 10. If video image signals provided by camera 10 are analog signals, capturer 21 converts them to digital signals. However, if video image signals provided by camera 10 are digital signals, capturer 21 handles the signals in the as-is state. Then, capturer 21 gives the video image data to |

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| | encoder 22. The video image data are then encoded by encoder 22 (which may use, for example, a conventional encoding scheme such as MPEG4) and are sent to receiving device 30. While transmission device 20 is equipped with capturer 21 in Figure 1, capturer 21 may be omitted if camera 10 provides video image data in the digital format or if a camera equipped with a capturer is used.<br><br>Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to the control communicated from receiving device 30 (i.e., assessment part 42, which shall be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section." *See* paras. [0021]-[0024].<br><br>"Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22." *See* paras. [0037]-[0038].<br><br>"Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system. |

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| | In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103)." *See* paras. [0041]-[0045].<br><br>"In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video |

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| | images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0049]-[0051].<br><br>"Image communication system 1A has camera 10, transmission device 20, receiving device 30, and representation apparatus 50. Camera 10, transmission device 20, and representation apparatus 50 are similar to those illustrated in the first embodiment. Accordingly, the explanation thereof shall be omitted hereafter.<br><br>Receiving device 30A has decoder 31, representation control part 32, and image-processing control device 40A. Decoder 31 and representation control part 32 are similar to those illustrated in the first embodiment. Accordingly, the explanation thereof shall be omitted hereafter.<br><br>Image-processing control device 40A has sensor 41A and assessment part 42A." *See* paras. [0055]-[0057].<br><br>"Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A.<br><br>It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding |

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| | according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202).<br><br>Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203)." *See* paras. [0071]-[0075].<br><br>"**(C-3)** All the embodiments described above assume that the encoder uploads and encodes live video images captured by the camera. However, the subjects of encoding performed by the encoder are not limited to live video images captured by the camera. For example, video images recorded on a medium, such as a videotape or DVD, may be encoded in a format used for transmission to the receiving device." *See* para. [0086].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Hatanaka expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50." *See* para. [0020].<br><br>"Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to the control communicated from receiving device 30 (i.e., assessment part 42, which shall |

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| | be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section.<br><br>Next is an explanation of the internal configuration of receiving device 30. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>Decoder 31 decodes the encoded image data provided by transmission device 20 and provides the decoded image data to representation control part 32. Decoder 31 applicable herein may be, for example, a conventional device that can decode video images.<br><br>Representation control part 32 converts the image data decoded by decoder 31 into an image signal of the size that can be displayed on representation apparatus 50 and then provides the image signal of said display size to representation apparatus 50. Representation control part 32 may be installed on the representation apparatus-50 side. Representation control part 32 applicable herein may be any means for converting image data to be displayed into a signal of an image of the size that can be displayed on a display used to output the representation of said image according to the resolution of the image data, doing so in a conventional display device or computer, for example.<br><br>The following is an explanation of the configuration of image-processing control device 40. Image-processing control device 40 has sensor 41 and assessment part 42." *See* paras. [0024]-[0028].<br><br>"Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding |

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| | throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0037]-[0039].<br><br>"**(A-2) Operation of the First Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1, having the configuration described above according to the first embodiment.<br><br>Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to |

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| | representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103).<br><br>In step S103, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Incidentally, the operation in steps S101 through S103 described above may be repeated continuously or periodically, or according to sensor 41's detection of audience 60's movement. There is no restriction on the timing of executing the process." *See* paras. [0040]-[0047].<br><br>"**(A-3) Effects of the First Embodiment**<br>The first embodiment demonstrates the following effects:<br><br>In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be |

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| | lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>Additionally, data encoded at a reduced encoding resolution by encoder 22 is decoded by decoder 31. This makes it possible to reduce the amount of decoding throughput in decoder 31.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0048]-[0051].<br><br>"While assessment part 42A in the first embodiment makes an assessment based only on viewing distance D, assessment part 42A in the present embodiment uses viewing distance D and viewing angle θ to make an assessment as mentioned above.<br><br>Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 gives instructions to encoding controller 23 so as to cause the amount of encoding throughput and the amount of post-encoding data to decrease as viewing distance D increases. |

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| | For example, assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the transverse (horizontal) resolution to be lowered as viewing angle θ increases — e.g., so as to use a resolution applied based only on viewing distance D for comparison and multiply it by √3/2 when viewing angle θ is 30° but by 1/2 when viewing angle θ is 60° to obtain the transverse (horizontal) resolution. Incidentally, when detecting the direction of audience 60 relative to representation apparatus 50 three-dimensionally (i.e., when including the elevation angle associated with the direction of audience 60 in the measurement), assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the longitudinal (vertical) resolution to be lowered as the elevation angle increases, for example." *See* paras. [0067]-[0069].<br><br>"**(B-2) Operation of the Second Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1A, having the configuration described above according to the second embodiment.<br><br>Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A.<br><br>It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202). |

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| | Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203).<br><br>In step S203, similar to step S103 in the first embodiment described above, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Also, similar to the case of steps S101 through S103 in the first embodiment, there is no restriction on the timing of executing the process involved in the operation performed in steps S201 to S203." *See* paras. [0070]-[0077].<br><br>"**(B-3) Effects of the Second Embodiment**<br>The second embodiment demonstrates the following effects in addition to the effects of the first embodiment:<br><br>Image communication system 1A takes into account not only viewing distance D but also viewing angle θ to determine the content of the encoding performed by encoder 22. This makes it possible to include viewing angle θ in consideration for the determination of the content of the encoding performed by encoder 22 if viewing distance D is the same, thus making it possible to reduce the amount of throughput associated with the encoding and the amount of post-encoding data more than the first embodiment." *See* paras. [0078]-[0079].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Hatanaka expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping. *See*, *e.g.*, disclosures below.<br><br>"Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50." *See* para. [0020].<br><br>"Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to the control communicated from receiving device 30 (i.e., assessment part 42, which shall be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section.<br><br>Next is an explanation of the internal configuration of receiving device 30. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>Decoder 31 decodes the encoded image data provided by transmission device 20 and provides the decoded image data to representation control part 32. Decoder 31 applicable herein may be, for example, a conventional device that can decode video images.<br><br>Representation control part 32 converts the image data decoded by decoder 31 into an image signal of the size that can be displayed on representation apparatus 50 and then provides the image signal of said display size to representation apparatus 50. Representation control part 32 may be installed on the representation apparatus-50 side. Representation control part 32 applicable herein may be any means for converting image data to be displayed into a signal of an image of the size that can be displayed on a |

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| | display used to output the representation of said image according to the resolution of the image data, doing so in a conventional display device or computer, for example.<br><br>The following is an explanation of the configuration of image-processing control device 40. Image-processing control device 40 has sensor 41 and assessment part 42." *See* paras. [0024]-[0028].<br><br>"Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is |

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| | assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0037]-[0039].<br><br>"**(A-2) Operation of the First Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1, having the configuration described above according to the first embodiment.<br><br>Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103).<br><br>In step S103, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a |

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| | different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Incidentally, the operation in steps S101 through S103 described above may be repeated continuously or periodically, or according to sensor 41's detection of audience 60's movement. There is no restriction on the timing of executing the process." *See* paras. [0040]-[0047].<br><br>"**(A-3) Effects of the First Embodiment**<br>The first embodiment demonstrates the following effects:<br><br>In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>Additionally, data encoded at a reduced encoding resolution by encoder 22 is decoded by decoder 31. This makes it possible to reduce the amount of decoding throughput in decoder 31.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment |

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| | allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0048]-[0051].<br><br>"While assessment part 42A in the first embodiment makes an assessment based only on viewing distance D, assessment part 42A in the present embodiment uses viewing distance D and viewing angle θ to make an assessment as mentioned above.<br><br>Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 gives instructions to encoding controller 23 so as to cause the amount of encoding throughput and the amount of post-encoding data to decrease as viewing distance D increases.<br><br>For example, assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the transverse (horizontal) resolution to be lowered as viewing angle θ increases — e.g., so as to use a resolution applied based only on viewing distance D for comparison and multiply it by √3/2 when viewing angle θ is 30° but by 1/2 when viewing angle θ is 60° to obtain the transverse (horizontal) resolution. Incidentally, when detecting the direction of audience 60 relative to representation apparatus 50 three-dimensionally (i.e., when including the elevation angle associated with the direction of audience 60 in the measurement), assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the longitudinal (vertical) resolution to be lowered as the elevation angle increases, for example." *See* paras. [0067]-[0069].<br><br>"**(B-2) Operation of the Second Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1A, having the configuration described above according to the second embodiment. |

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| | Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A.<br><br>It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202).<br><br>Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203).<br><br>In step S203, similar to step S103 in the first embodiment described above, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Also, similar to the case of steps S101 through S103 in the first embodiment, there is no restriction on the timing of executing the process involved in the operation performed in steps S201 to S203." *See* paras. [0070]-[0077].<br><br>"**(B-3) Effects of the Second Embodiment** |

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| | The second embodiment demonstrates the following effects in addition to the effects of the first embodiment:<br><br>Image communication system 1A takes into account not only viewing distance D but also viewing angle θ to determine the content of the encoding performed by encoder 22. This makes it possible to include viewing angle θ in consideration for the determination of the content of the encoding performed by encoder 22 if viewing distance D is the same, thus making it possible to reduce the amount of throughput associated with the encoding and the amount of post-encoding data more than the first embodiment." *See* paras. [0078]-[0079].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 8** | |
| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Hatanaka expressly and/or inherently discloses and/or renders obvious applying a translation transformation to move the image within display area of the monito. *See*, *e.g.*, disclosures below.<br><br>"Receiving device 30 — upon receipt of encoded video-image data from transmission device 20 — decodes the data and outputs a video image signal to representation apparatus 50." *See* para. [0020].<br><br>"Encoding controller 23 is responsible for controlling the content of the video-image encoding process performed by capturer 21 and encoding controller 22 in response to |

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| | the control communicated from receiving device 30 (i.e., assessment part 42, which shall be described in a later section). The detailed description of the control provided by encoding controller 23 shall be described in a later section.<br><br>Next is an explanation of the internal configuration of receiving device 30. Receiving device 30 has decoder 31, representation control part 32, and image-processing control device 40.<br><br>Decoder 31 decodes the encoded image data provided by transmission device 20 and provides the decoded image data to representation control part 32. Decoder 31 applicable herein may be, for example, a conventional device that can decode video images.<br><br>Representation control part 32 converts the image data decoded by decoder 31 into an image signal of the size that can be displayed on representation apparatus 50 and then provides the image signal of said display size to representation apparatus 50. Representation control part 32 may be installed on the representation apparatus-50 side. Representation control part 32 applicable herein may be any means for converting image data to be displayed into a signal of an image of the size that can be displayed on a display used to output the representation of said image according to the resolution of the image data, doing so in a conventional display device or computer, for example.<br><br>The following is an explanation of the configuration of image-processing control device 40. Image-processing control device 40 has sensor 41 and assessment part 42." *See* paras. [0024]-[0028].<br><br>"Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to |

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| | adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0037]-[0039].<br><br>"**(A-2) Operation of the First Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1, having the configuration described above according to the first embodiment.<br><br>Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to |

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| | representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101).<br><br>Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103).<br><br>In step S103, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Incidentally, the operation in steps S101 through S103 described above may be repeated continuously or periodically, or according to sensor 41’s detection of audience 60's movement. There is no restriction on the timing of executing the process.” *See* paras. [0040]-[0047].<br><br>“**(A-3) Effects of the First Embodiment**<br>The first embodiment demonstrates the following effects:<br><br>In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be |

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| | lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>Additionally, data encoded at a reduced encoding resolution by encoder 22 is decoded by decoder 31. This makes it possible to reduce the amount of decoding throughput in decoder 31.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0048]-[0051].<br><br>"While assessment part 42A in the first embodiment makes an assessment based only on viewing distance D, assessment part 42A in the present embodiment uses viewing distance D and viewing angle θ to make an assessment as mentioned above.<br><br>Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 gives instructions to encoding controller 23 so as to cause the amount of encoding throughput and the amount of post-encoding data to decrease as viewing distance D increases. |

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| | For example, assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the transverse (horizontal) resolution to be lowered as viewing angle θ increases — e.g., so as to use a resolution applied based only on viewing distance D for comparison and multiply it by √3/2 when viewing angle θ is 30° but by 1/2 when viewing angle θ is 60° to obtain the transverse (horizontal) resolution. Incidentally, when detecting the direction of audience 60 relative to representation apparatus 50 three-dimensionally (i.e., when including the elevation angle associated with the direction of audience 60 in the measurement), assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the longitudinal (vertical) resolution to be lowered as the elevation angle increases, for example." *See* paras. [0067]-[0069].<br><br>"**(B-2) Operation of the Second Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1A, having the configuration described above according to the second embodiment.<br><br>Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A.<br><br>It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202). |

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| | Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203).<br><br>In step S203, similar to step S103 in the first embodiment described above, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Also, similar to the case of steps S101 through S103 in the first embodiment, there is no restriction on the timing of executing the process involved in the operation performed in steps S201 to S203." *See* paras. [0070]-[0077].<br><br>"**(B-3) Effects of the Second Embodiment**<br>The second embodiment demonstrates the following effects in addition to the effects of the first embodiment:<br><br>Image communication system 1A takes into account not only viewing distance D but also viewing angle θ to determine the content of the encoding performed by encoder 22. This makes it possible to include viewing angle θ in consideration for the determination of the content of the encoding performed by encoder 22 if viewing distance D is the same, thus making it possible to reduce the amount of throughput associated with the encoding and the amount of post-encoding data more than the first embodiment." *See* paras. [0078]-[0079].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Hatanaka expressly and/or inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Hatanaka expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| 11[a]. determining distance to a user appearing in the image; and, | Hatanaka expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*:<br><br>"The device described in Patent Document 2 includes a conventional system that uses the distance and positional relationship between the audience and the representation apparatus. The distance between the audience and the representation apparatus is used for the execution of the processing performed to make the identification of images projected on the representation apparatus difficult." *See* para. [0004].<br><br>"However, the device described in Patent Document 1 poses a problem because merely lowering the encoding resolution without taking into account the distance between the audience and the representation apparatus does not resolve the issue that the encoding is performed at the same resolution regardless of whether the audience looks at the representation apparatus from a distance or at close range, meaning that the processing load on the encoder remains higher than necessary.<br><br>With the device described in Patent Document 2, the processing load on the encoder also remains higher than necessary because said device uses the distance between the audience and the representation apparatus as a criterion for the processing performed to make the identification of images projected on a representation apparatus difficult, although such processing with a conventional technology allows for communications with less psychological burdens." *See* paras. [0006]-[0007].<br><br>"Figure 1 shows a block diagram that illustrates the overall configuration of the image communication system and image-processing control device claimed in the first embodiment. |

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| | Figure 2 shows an illustrative drawing that explains the viewing distance according to the image-processing control device claimed in the first embodiment.<br><br>Figure 3 shows a flowchart that illustrates the operation of the image-processing control device claimed in the first embodiment.<br><br>Figure 4 shows a block diagram that illustrates the overall configuration of the image communication system and image-processing control device claimed in the second embodiment.<br><br>Figure 5 shows an illustrative drawing that explains the viewing distance and viewing angle according to the image-processing control device claimed in the second embodiment.<br><br>Figure 6 shows a flowchart that illustrates the operation of the image-processing control device claimed in the second embodiment." *See* para. [0013].<br><br>"Camera 10 captures video images and provides signals representing the captured video images to transmission device 20. Camera 10 may be a conventional CCD camera or video camera. There is no restriction on the type of the camera. It should be noted that while images captured by camera 10 may be video or still images, video images are used in the first embodiment to illustrate images captured by camera 10.<br><br>Transmission device 20 encodes video image signals provided by camera 10 and provides the encoded video image data to receiving device 30. Communication between transmission device 20 and receiving device 30 may be achieved via a network such as the Internet or a public telephone network, or it may be achieved through a direct connection. There is no restriction on the method of communication." *See* paras. [0018]-[0019]. |

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| | “The following is an explanation of the configuration of image-processing control device 40. Image-processing control device 40 has sensor 41 and assessment part 42.<br><br>Sensor 41 measures the distance between audience 60 and representation apparatus 50 (hereinafter referred to as "viewing distance D") and provides assessment part 42 with the measurement result. Incidentally, sensor 41 may be placed around representation apparatus 50 so as to measure the distance between representation apparatus 50 and audience 60 and deem the distance thus measured as viewing distance D.” *See* paras. [0028]-[0029].<br><br>“Figure 2 shows an example of viewing distance D, i.e., the distance between representation apparatus 50 and audience 60.<br><br>Figure 2 (a) shows an example of representation apparatus 50 (a display device in this example) in the state in which representation apparatus 50 (a display device) is viewed from the front.<br><br>Figure 2 (b) shows an illustrative drawing that illustrates an example of viewing distance D, i.e., the distance between representation apparatus 50 and audience 60, in the state in which representation apparatus 50 shown in Figure 2 (a) is viewed from the top. In Figure 2 (b), viewing distance D is illustrated as the distance from the center of representation apparatus 50 to audience 60; however, it may be the distance from another section of representation apparatus 50 to audience 60.<br><br>An example of the method used to measure viewing distance D in sensor 41 may involve the use of, for example, a motion sensor, a wireless IC tag, or the like as described in relation to the “proximity detection means” according to Patent Document 2.<br><br>Another example of the method used to measure viewing distance D in sensor 41 may involve having audience 60 hold a wireless communication terminal (which, for example, may be built into a terminal used to operate representation apparatus 50, etc., |

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| | such as a remote control terminal, a mobile phone terminal, or the like) and installing sensor 41 around representation apparatus 50 so that sensor 41 communicates with the above-described wireless communication terminal to thereby measure the distance between the above-described wireless communication terminal and sensor 41, i.e., viewing distance D. The above-described distance between the wireless communication terminal and sensor 41 may be measured based, for example, on the intensity of the signal received or the transmission lag time. Wireless communication between the above-described wireless communication terminal and sensor 41 may be achieved through the use of light, such as radio waves or infrared rays. However, there is no restriction on the communication method insofar as viewing distance D can be measured.<br><br>Yet another example of the method used to measure viewing distance D in sensor 41 may involve installing multiple motion sensors around representation apparatus 50 and pre-registering the respective viewing distance for each motion sensor so as to recognize the distance of the audience based on which motion sensor has detected the audience. For example, motion sensors may be placed at equal distances from representation apparatus 50 to measure audience distance L. Incidentally, conventional motion sensors can be used as the motion sensors adopted for sensor 41.<br><br>However, there is no restriction on the method used in sensor 41 insofar as viewing distance D can be measured.<br><br>Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount |

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| | of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60.<br><br>For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0030]-[0039].<br><br>"Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101). |

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| | Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103)." *See* paras. [0041]-[0045].<br><br>"In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0049]-[0051].<br><br>"**(B-1) Configuration of the Second Embodiment** |

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| | In the first embodiment, sensor 41 measures viewing distance D only, and assessment part 42 uses only viewing distance D for processing. However, in the second embodiment, not only viewing distance D but also the direction in which audience 60 is located relative to representation apparatus 50 is included as an element used to determine the encoding content." *See* para. [0053].<br><br>"Image-processing control device 40A has sensor 41A and assessment part 42A.<br><br>As described above, sensor 41 in the first embodiment measures viewing distance D only. However, sensor 41A in the present embodiment differs from sensor 41 in that sensor 41A also measures the direction in which audience 60 is located relative to representation apparatus 50 (hereinafter, the "viewing direction").<br><br>Figure 5 shows an illustrative drawing that illustrates an example of viewing distance D (which is the distance between representation apparatus 50 and audience 60) and the audience direction.<br><br>Figure 5 (a) shows an example of representation apparatus 50 (a display device in this example) in the state in which representation apparatus 50 (a display device) is viewed from the front.<br><br>Figure 5 (b) shows an illustrative drawing that illustrates examples of viewing distance D, i.e., the distance between representation apparatus 50 and audience 60, and the viewing direction in the state in which representation apparatus 50 shown in Figure 5 (a) is viewed from the top.<br><br>The method used to measure viewing distance D in sensor 41A is similar to that of the first embodiment. Accordingly, the explanation thereof shall be omitted hereafter." *See* paras. [0057]-[0062].<br><br>"In the same way as in the case of viewing distance D, an example of the method used to measure viewing angle θ in sensor 41A may involve the use of, for example, a motion |

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| | sensor, a wireless IC tag, or the like, as described in relation to the "proximity detection means" according to Patent Document 2, whereby sensor 41A recognizes the positional relationship between audience 60 and representation apparatus 50 to thereby determine viewing angle θ. Figure 5 shows an example of detecting the two-dimensional direction of audience 60 relative to representation apparatus 50. However, sensor 41A may also be configured to detect the direction of audience 60 relative to representation apparatus 50 three-dimensionally (including the elevation angle)." *See* para. [0064].<br><br>"While assessment part 42A in the first embodiment makes an assessment based only on viewing distance D, assessment part 42A in the present embodiment uses viewing distance D and viewing angle θ to make an assessment as mentioned above.<br><br>Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 gives instructions to encoding controller 23 so as to cause the amount of encoding throughput and the amount of post-encoding data to decrease as viewing distance D increases.<br><br>For example, assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the transverse (horizontal) resolution to be lowered as viewing angle θ increases — e.g., so as to use a resolution applied based only on viewing distance D for comparison and multiply it by √3/2 when viewing angle θ is 30° but by 1/2 when viewing angle θ is 60° to obtain the transverse (horizontal) resolution. Incidentally, when detecting the direction of audience 60 relative to representation apparatus 50 three-dimensionally (i.e., when including the elevation angle associated with the direction of audience 60 in the measurement), assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the longitudinal (vertical) resolution to be lowered as the elevation angle increases, for example." *See* paras. [0067]-[0069].<br><br>"First, sensor 41A measures the viewing distance D and the viewing angle θ (S201). |

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| | Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202)." *See* paras. [0073]-[0074].<br><br>"**(B-3) Effects of the Second Embodiment**<br>The second embodiment demonstrates the following effects in addition to the effects of the first embodiment:<br><br>Image communication system 1A takes into account not only viewing distance D but also viewing angle θ to determine the content of the encoding performed by encoder 22. This makes it possible to include viewing angle θ in consideration for the determination of the content of the encoding performed by encoder 22 if viewing distance D is the same, thus making it possible to reduce the amount of throughput associated with the encoding and the amount of post-encoding data more than the first embodiment." *See* paras. [0078]-[0079].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | Hatanaka expressly and/or inherently discloses and/or renders obvious varying resolution of the image according to the distance. *See*, *e.g.*, disclosures below.<br><br>"However, the device described in Patent Document 1 poses a problem because merely lowering the encoding resolution without taking into account the distance between the audience and the representation apparatus does not resolve the issue that the encoding is performed at the same resolution regardless of whether the audience looks at the |

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| | representation apparatus from a distance or at close range, meaning that the processing load on the encoder remains higher than necessary.<br><br>With the device described in Patent Document 2, the processing load on the encoder also remains higher than necessary because said device uses the distance between the audience and the representation apparatus as a criterion for the processing performed to make the identification of images projected on a representation apparatus difficult, although such processing with a conventional technology allows for communications with less psychological burdens." *See* paras. [0006]-[0007].<br><br>"Representation control part 32 converts the image data decoded by decoder 31 into an image signal of the size that can be displayed on representation apparatus 50 and then provides the image signal of said display size to representation apparatus 50. Representation control part 32 may be installed on the representation apparatus-50 side. Representation control part 32 applicable herein may be any means for converting image data to be displayed into a signal of an image of the size that can be displayed on a display used to output the representation of said image according to the resolution of the image data, doing so in a conventional display device or computer, for example." *See* para. [0027].<br><br>"Assessment part 42 provides instructions to encoding controller 23 so as to control the content to be encoded according to viewing distance D measured by sensor 41. Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 adjusts the content to be encoded in such a way as to reduce the amount of encoding throughput and the amount of post-encoding data as viewing distance D increases. Additionally, assessment part 42 may be configured to adjust the content to be encoded in such a way as to minimize the amount of encoding throughput and the amount of post-encoding data when sensor 41 does not detect any audience 60. |

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| | For example, suppose video image signals provided by camera 10 are analog signals (e.g., NTSC signals or the like). In this case, when the signal is uploaded to capturer 21 and converted to a digital image at a prescribed resolution, the resolution used in this event may be altered in response to the control provided by encoding controller 23. For example, a resolution in compliance with the instructions from encoding controller 23 may be used for the encoding rendered by encoder 22.<br><br>Assessment part 42 can also be configured in other ways. For example, it may be configured so as to provide encoding controller 23 with instructions so that encoding controller 23 adjusts the frame rate, quantization step size, compression ratio, etc., according to viewing distance D. It should be noted that there are no restrictions on the method used to adjust the resolution, frame rate, etc., according to viewing distance D. The adjustment may be achieved by means of altering the parameters applied to the codec or changing the codec itself. By way of example, in the present embodiment, it is assumed that assessment part 42 and encoding controller 23 control the resolution of the image encoded by capturer 21 and encoder 22 in such a way that the resolution is lowered as viewing distance D increases." *See* paras. [0037]-[0039].<br><br>"**(A-2) Operation of the First Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1, having the configuration described above according to the first embodiment.<br><br>Figure 3 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system.<br><br>In Figure 3, it is assumed that the video image data encoded by transmission device 20 is given to receiving device 30 and output from receiving device 30 to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41 measures viewing distance D (S101). |

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| | Next, upon receipt of viewing distance D from sensor 41, assessment part 42 sends out a signal, which controls the content to be encoded according to viewing distance D, to transmission device 20 (encoding controller 23) (S102).<br><br>Upon receipt of the decoding-content control signal from assessment part 42, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, and then capturer 21 and encoder 22 continue to encode video images according to that content (S103).<br><br>In step S103, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Incidentally, the operation in steps S101 through S103 described above may be repeated continuously or periodically, or according to sensor 41's detection of audience 60's movement. There is no restriction on the timing of executing the process." *See* paras. [0040]-[0047].<br><br>"**(A-3) Effects of the First Embodiment**<br>The first embodiment demonstrates the following effects:<br><br>In capturer 21 and encoder 22, video image data are encoded at the resolution determined by assessment part 42 based on viewing distance D measured by sensor 41. Then, the video image data thus encoded are decoded by decoder 31 and displayed on representation apparatus 50. In this event, the resolution of the video image can be lowered to the extent that the audience cannot recognize the image, thus reducing the amount of encoding throughput. Additionally, the reduction of the amount of post-encoding data makes it possible to reduce the amount of data transmitted from |

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| | transmission device 20 (encoder 22) to receiving device 30 (decoder 31), thereby reducing the load on the network.<br><br>Additionally, data encoded at a reduced encoding resolution by encoder 22 is decoded by decoder 31. This makes it possible to reduce the amount of decoding throughput in decoder 31.<br><br>For example, in a company having multiple offices, image communication system 1 is preferably adopted in a system that transmits live video images between multiple locations, for example, to distribute images of each office's sceneries as captured with a camera to other offices or distribute images of rivers, bays, etc., as captured with surveillance cameras to a monitoring center. In such a system that transmits live video images between multiple locations, the audience is not always near the representation apparatus (display) while the system is in operation. However, the present embodiment allows for the encoding/decoding at a lower resolution, etc., when there is no audience in the immediate vicinity of the representation apparatus (display), thus enabling efficient processing of images." *See* paras. [0048]-[0051].<br><br>"While assessment part 42A in the first embodiment makes an assessment based only on viewing distance D, assessment part 42A in the present embodiment uses viewing distance D and viewing angle θ to make an assessment as mentioned above.<br><br>Then, encoding controller 23 controls the content of the video-image encoding process performed by capturer 21 and encoder 22 according to the instructions from assessment part 42. For example, assessment part 42 gives instructions to encoding controller 23 so as to cause the amount of encoding throughput and the amount of post-encoding data to decrease as viewing distance D increases.<br><br>For example, assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the transverse (horizontal) resolution to be lowered as viewing angle θ increases — e.g., so as to use a resolution applied based only on viewing distance D for comparison and multiply it by √3/2 when viewing angle θ is 30° but by |

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| | 1/2 when viewing angle θ is 60° to obtain the transverse (horizontal) resolution. Incidentally, when detecting the direction of audience 60 relative to representation apparatus 50 three-dimensionally (i.e., when including the elevation angle associated with the direction of audience 60 in the measurement), assessment part 42A may be configured to give instructions to encoding controller 23 so as to cause the longitudinal (vertical) resolution to be lowered as the elevation angle increases, for example." *See* paras. [0067]-[0069].<br><br>"**(B-2) Operation of the Second Embodiment**<br>The following is an explanation of the image-processing control operation (image-processing control method according to the embodiment) in image communication system 1A, having the configuration described above according to the second embodiment.<br><br>Figure 6 shows a diagram that illustrates the sequence of the operation involved in the video image processing control in the image communication system 1A.<br><br>It is assumed, in Figure 6, that the video image data encoded by transmission device 20 is given to receiving device 30A and output from receiving device 30A to representation apparatus 50, and the video image is presented to audience 60 through representation apparatus 50 — from the beginning of the processing.<br><br>First, sensor 41A measures viewing distance D and viewing angle θ (S201).<br><br>Next, upon receipt of viewing distance D and viewing angle θ from sensor 41A, assessment part 42A sends out a signal, which controls the content of the encoding according to viewing distance D and viewing angle θ, to transmission device 20 (encoding controller 23) (S202).<br><br>Upon receipt of the encoding-content control signal from assessment part 42A, encoding controller 23 controls capturer 21 and encoder 22 according to said signal, |

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| | and subsequently, capturer 21 and encoder 22 continue to encode video images according to that content (S203).<br><br>In step S203, similar to step S103 in the first embodiment described above, encoding controller 23 may be configured so as to not send a resolution-change instruction to capturer 21 and encoder 22 if it receives the same encoding resolution as the last encoding resolution used. Or, if encoding controller 23 receives a different encoding resolution from the last encoding resolution used, it may send a new encoding resolution to capturer 21 and encoder 22.<br><br>Also, similar to the case of steps S101 through S103 in the first embodiment, there is no restriction on the timing of executing the process involved in the operation performed in steps S201 to S203." *See* paras. [0070]-[0077].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Hatanaka alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

# Exhibit A-06: Invalidity of U.S. Patent No. 8,982,109 in view of *Smart Makeup Mirror: Computer-Augmented Mirror to Aid Makeup Application*, Iwabuchi et al. ("Iwabuchi")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

Iwabuchi[1] was at least published by 2009 and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a) and (b).

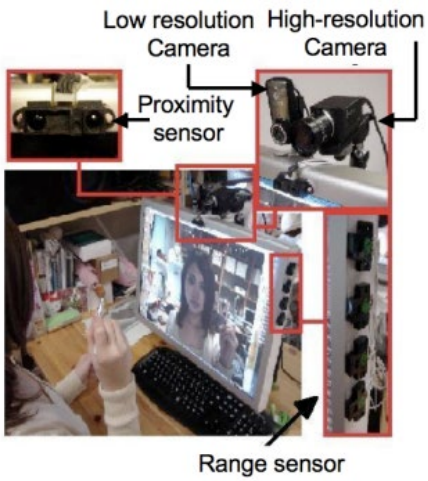
Iwabuchi anticipates the Asserted Claims of the '109 Patent. To the extent it is found Iwabuchi does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Iwabuchi does not anticipate the Asserted Claims, Iwabuchi renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

[1] Eriko Iwabuchi et al., *Smart Makeup Mirror: Computer-Augmented Mirror to Aid Makeup Application*, Human-Computer Interaction. Interacting in Various Application Domains, 495-503 (2009).

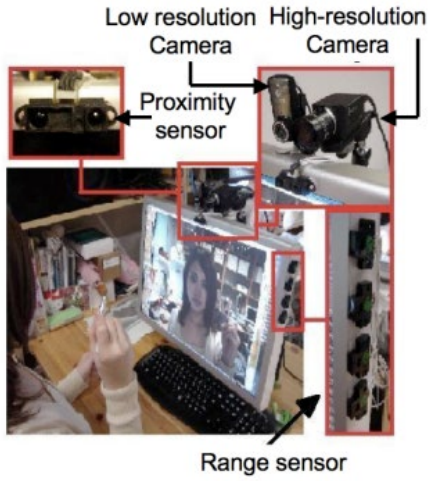
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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Iwabuchi expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"Figure 1 shows the over view of the proposed system. As part of this system, we place a high-resolution camera (Point Grey Research, Grasshopper, with IEEE-1394b connection, 1624 x 1224 pixels, 30 fps) above the computer display. The camera is trained on the woman, and a mirror image of the woman is shown on the screen; thus, the device functions and assists the woman in applying makeup effectively while looking at her image. There are some researches that use a standard-definition TV camera and display images as a mirror would [2][3]. In the proposed system, we use a high-resolution camera in order to enable practicable makeup application<br><br>In order to realize the functions described later in the paper, we processed the images captured by the camera. We set up a low-resolution camera (Logicool, Qcam Pro for Notebooks, in a 320 x 240 pixel mode, 30 fps) for such image processing. We used OpenCV in the image data processing and FlyCapture for the controlling the high-resolution camera. These cameras are connected to a PC (Gateway GT5092j) with Windows Vista OS.<br><br>Moreover, we set up an infra red range sensor and a proximity sensor for performing the following functions. These devices are controlled with a microcomputer, and communicate with the PC program through serial connection." *See* "Smart Makeup Mirror" at page 496. |

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| |  <br>**Fig. 1.** Overview of Smart Makeup Mirror<br><br>*See* "Smart Makeup Mirror" at page 496.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | Iwabuchi expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below.<br><br>"In this paper, we present a system that aids people in wearing makeup easily and make the process enjoyable. We call the proposed system the "Smart Makeup Mirror", which is an electronic dressing table that facilitates the process of makeup application. In this system, we place a high-resolution camera above a computer display and have added some functions such as "Automatic zoom to a specific part of the face", "Display the |

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| | face from various angles", "Simulation of lighting conditions", and "Internet voting on better makeup results" to facilitate the makeup application process. People who use this device for applying makeup will obtain highly satisfactory results, while enjoying the process." *See* "Abstract" at page 495.<br><br>"Figure 1 shows the over view of the proposed system. As part of this system, we place a high-resolution camera (Point Grey Research, Grasshopper, with IEEE-1394b connection, 1624 x 1224 pixels, 30 fps) above the computer display. The camera is trained on the woman, and a mirror image of the woman is shown on the screen; thus, the device functions and assists the woman in applying makeup effectively while looking at her image. There are some researches that use a standard-definition TV camera and display images as a mirror would [2][3]. In the proposed system, we use a high-resolution camera in order to enable practicable makeup application<br><br>In order to realize the functions described later in the paper, we processed the images captured by the camera. We set up a low-resolution camera (Logicool, Qcam Pro for Notebooks, in a 320 x 240 pixel mode, 30 fps) for such image processing. We used OpenCV in the image data processing and FlyCapture for the controlling the high-resolution camera. These cameras are connected to a PC (Gateway GT5092j) with Windows Vista OS.<br><br>Moreover, we set up an infra red range sensor and a proximity sensor for performing the following functions. These devices are controlled with a microcomputer, and communicate with the PC program through serial connection." *See* "Smart Makeup Mirror" at page 496.<br><br>"Using this system, users apply makeup while looking at the computer display where an image of the user's face is captured by the high-resolution camera is displayed. This configuration is slightly different from a realistic mirror because the user's gaze is not aligned with the image, because the camera takes pictures from the top of the display. The response of the image may be delayed because of computation. Further, the resolution is lower than that of a realistic mirror, and the image may be out of focus |

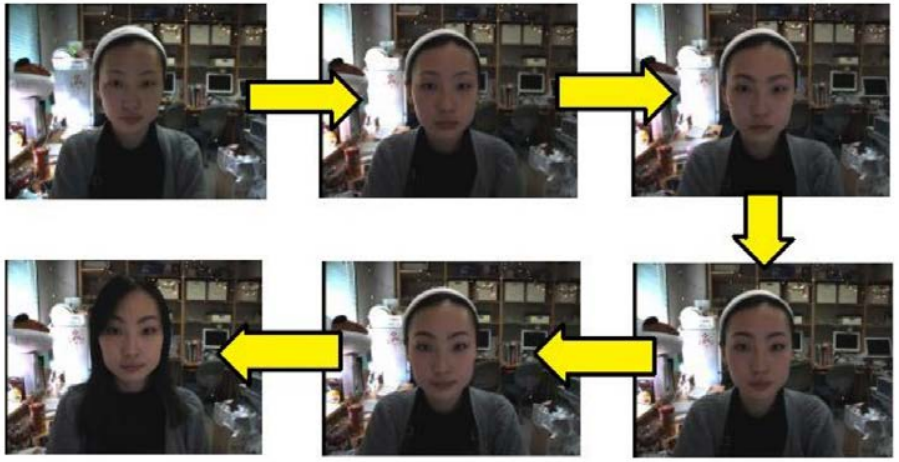
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| | where a user moves considerably from the focusing position of the camera. These differences may obstruct the makeup application process. The purpose of this research is to implement an artificial mirror with functions that cannot be achieved by using a realistic mirror in order to compensate for the abovementioned differences." *See* "3. Makeup Support Function" at pages 496-497.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Iwabuchi expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. *See*, *e.g.*, disclosures below.<br><br>"A professional makeup artist will always recommend checking a person's appearance from the viewpoint of another person standing in front, with the help of a left and right reversing mirror (the reversal mirror) [4]. The impression of the hairstyle: the shape of the eyebrow, eyes, and lips: and the positions of moles are different, when the face is seen in a reversal mirror. Therefore, we added this functionality to the proposed system, enabling the system to as display the image captured by the camera as a left and right reversing mirror would." *See* "3.3 Left and Right Reversing Mirror" at page 498.<br><br>"We have carried out an evaluation test (Fig. 4). Two women (age: 23 and 25 years) participated in the test. They are students in our laboratory and familiar with how to operate a computer. They applied eye shadow, eye liner, eye blowing out, mascara, lipstick, and blush on. The results are given below:<br><br>… |

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| | • They found the left and right reversing mirror function useful for checking of their appearance." *See* "4.2 Test by Ordinary Women" at page 500.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Iwabuchi expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror. *See*, *e.g.*, disclosures below.<br><br>"Figure 1 shows the over view of the proposed system. As part of this system, we place a high-resolution camera (Point Grey Research, Grasshopper, with IEEE-1394b connection, 1624 x 1224 pixels, 30 fps) above the computer display. The camera is trained on the woman, and a mirror image of the woman is shown on the screen; thus, the device functions and assists the woman in applying makeup effectively while looking at her image. There are some researches that use a standard-definition TV camera and display images as a mirror would [2][3]. In the proposed system, we use a high-resolution camera in order to enable practicable makeup application<br><br>In order to realize the functions described later in the paper, we processed the images captured by the camera. We set up a low-resolution camera (Logicool, Qcam Pro for Notebooks, in a 320 x 240 pixel mode, 30 fps) for such image processing. We used OpenCV in the image data processing and FlyCapture for the controlling the high-resolution camera. These cameras are connected to a PC (Gateway GT5092j) with Windows Vista OS.<br><br>Moreover, we set up an infra red range sensor and a proximity sensor for performing the following functions. These devices are controlled with a microcomputer, and |

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| | communicate with the PC program through serial connection." *See* "Smart Makeup Mirror" at page 496.<br><br>  <br><br>**Fig. 1.** Overview of Smart Makeup Mirror<br><br>*See* "Smart Makeup Mirror" at page 496.<br><br>"Using this system, users apply makeup while looking at the computer display where an image of the user's face is captured by the high-resolution camera is displayed. This configuration is slightly different from a realistic mirror because the user's gaze is not aligned with the image, because the camera takes pictures from the top of the display. The response of the image may be delayed because of computation. Further, the resolution is lower than that of a realistic mirror, and the image may be out of focus where a user moves considerably from the focusing position of the camera. These differences may obstruct the makeup application process. The purpose of this research is to implement an artificial mirror with functions that cannot be achieved by using a realistic mirror in order to compensate for the abovementioned differences. |

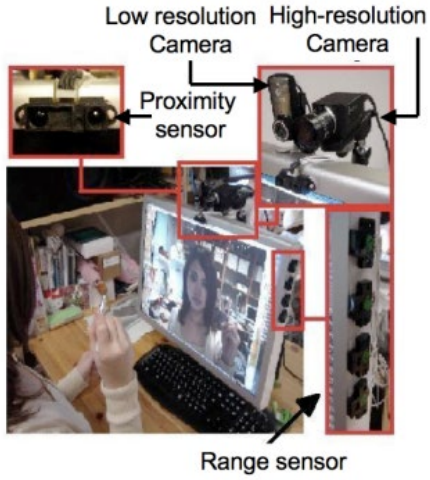
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| | In order to estimate the influence of the abovementioned differences on the makeup application process, we applied makeup using an early-stage prototype of our electronic mirror. The following observations were made.<br><br>• Satisfactory makeup application using the electronic mirror is generally possible.<br>• However, a function that enables gaze alignment is required. "<br><br>*See* "3 Makeup Support Function" at page 496-97.<br><br>"During the makeup application process, we usually bring our face close to the mirror in order to ensure that our makeup is satisfactory and to check the makeup near certain face parts such as the eyes and the mouth. This is a critical part of the makeup application process, is frequently needed, and is often the most troublesome as it requires a strenuous and awkward posture. For this purpose, we developed an automatic zoom function in the proposed system for zooming at a particular at part of the face. When a user brings the makeup tool, with an attached color marker (a small green sticky label), near her eyes, the camera recognizes the marker, zooms in, and switches to an enlarged image of the eye.<br><br>In order to detect the color marker, it is not practical to use the high-resolution camera image because the processing time will increase significantly and the response will be unacceptable: moreover, the accuracy of position detection achieved by the high-resolution camera is not required. Therefore, we use an additional low-resolution camera for recognizing markers. This enables users to apply makeup without having to physically approach the display." *See* "3.1 Automatic Zoom and Pan" at page 497.<br><br>"We developed a 'magnifying glass function' in order to provide finishing touches to the makeup application process, thereby improving the quality of the applied makeup. The proposed system uses an infrared range sensor to measure the distance between the camera and the face. Further, the magnification rate of the display image can be increased/decreased by simply and slightly approaching/leaving the display. A similar |

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| | technique was recently used for a document browser [5]." *See* "3.2 Intuitive Magnification Rate Control" at pages 497-498.<br><br>"A professional makeup artist will always recommend checking a person's appearance from the viewpoint of another person standing in front, with the help of a left and right reversing mirror (the reversal mirror) [4]. The impression of the hairstyle: the shape of the eyebrow, eyes, and lips: and the positions of moles are different, when the face is seen in a reversal mirror. Therefore, we added this functionality to the proposed system, enabling the system to as display the image captured by the camera as a left and right reversing mirror would." *See* "3.3 Left and Right Reversing Mirror" at page 498.<br><br>"In everyday life, the face is observed not only from the front but also from the side, from the bottom, and in the diagonal direction. Thus, while applying makeup, we must inspect the face from various angles. In the proposed system, the camera captures the image of our face and displays it for several seconds. By looking at that picture, we can inspect the makeup on the face from various angles. As a result, it is possible for us to check our profile and our view from the back, which is not possible to observe in a conventional mirror. When a user captures her face while she is looking at the camera, she can check the gaze-aligned view of her face that a conventional mirror always provides." *See* "3.4 Profile Check" at page 498.<br><br>"It is usual that to apply makeup in a place that is as bright as possible. However, the makeup of a user and hence her appearance may appear different under different lighting sources such as sunlight, fluorescent lamps, and incandescent lamps. This system simulates the lighting conditions depending on the surroundings. (Fig.2) The lighting conditions are makeup mode, office mode, cloudy mode, clear weather mode, red sunset mode, and candle mode. The selected lighting mode is displayed in the title bar of the interface and can be confirmed easily." *See* "3.5 Lighting Mode" at page 498. |

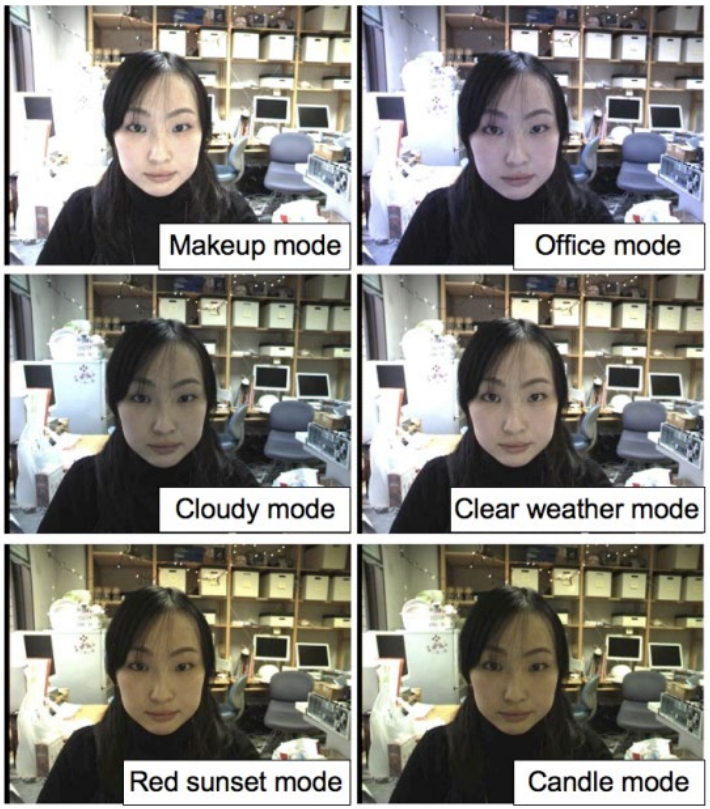
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| |  <br>**Fig. 3.** Steps from "no makeup" to :full makeup and hair arrangement."<br><br>*See* "4.1 Test by the Author" at page 500.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Iwabuchi expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera;. *See*, *e.g.*, disclosures below.<br><br>"When a user tries to see an enlarged view of her face and comes considerably close to the camera, the face image gets blurred as the camera does not have an auto-focus mechanism. From the above observations, we conclude that at least two additional functions are required to make the electronic mirror as effective as a realistic mirror in the makeup application process. One is to capture and display the user's face from the |

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| | front, and the other is to enlarge this image for ease of use. The details of these functions are explained in the following sections." *See* "3 Makeup Support Function" at page 497.<br><br>"During the makeup application process, we usually bring our face close to the mirror in order to ensure that our makeup is satisfactory and to check the makeup near certain face parts such as the eyes and the mouth. This is a critical part of the makeup application process, is frequently needed, and is often the most troublesome as it re quires a strenuous and awkward posture. For this purpose, we developed an automatic zoom function in the proposed system for zooming at a particular at part of the face. When a user brings the makeup tool, with an attached color marker (a small green sticky label), near her eyes, the camera recognizes the marker, zooms in, and switches to an enlarged image of the eye.<br><br>In order to detect the color marker, it is not practical to use the high-resolution camera image because the processing time will increase significantly and the response will be unacceptable: moreover, the accuracy of position detection achieved by the high-resolution camera is not required. Therefore, we use an additional low-resolution camera for recognizing markers. This enables users to apply makeup without having to physically approach the display." *See* "3.1 Automatic Zoom and Pan" at page 497.<br><br>"We developed a 'magnifying glass function' in order to provide finishing touches to the makeup application process, thereby improving the quality of the applied makeup. The proposed system uses an infrared range sensor to measure the distance between the camera and the face. Further, the magnification rate of the display image can be increased/decreased by simply and slightly approaching/leaving the display. A similar technique was recently used for a document browser [5]." *See* "3.2 Intuitive Magnification Rate Control" at pages 497-498.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

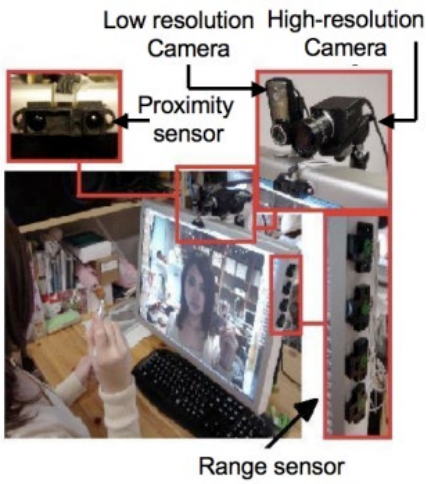
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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | Iwabuchi expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below.<br><br>"In this paper, we present a system that aids people in wearing makeup easily and make the process enjoyable. We call the proposed system the "Smart Makeup Mirror", which is an electronic dressing table that facilitates the process of makeup application. In this system, we place a high-resolution camera above a computer display and have added some functions such as "Automatic zoom to a specific part of the face", "Display the face from various angles", "Simulation of lighting conditions", and "Internet voting on better makeup results" to facilitate the makeup application process. People who use this device for applying makeup will obtain highly satisfactory results, while enjoying the process." *See* "Abstract" at page 495.<br><br>"Figure 1 shows the over view of the proposed system. As part of this system, we place a high-resolution camera (Point Grey Research, Grasshopper, with IEEE-1394b connection, 1624 x 1224 pixels, 30 fps) above the computer display. The camera is trained on the woman, and a mirror image of the woman is shown on the screen; thus, the device functions and assists the woman in applying makeup effectively while looking at her image. There are some researches that use a standard-definition TV camera and display images as a mirror would [2][3]. In the proposed system, we use a high-resolution camera in order to enable practicable makeup application<br><br>In order to realize the functions described later in the paper, we processed the images captured by the camera. We set up a low-resolution camera (Logicool, Qcam Pro for Notebooks, in a 320 x 240 pixel mode, 30 fps) for such image processing. We used OpenCV in the image data processing and FlyCapture for the controlling the high- |

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| | resolution camera. These cameras are connected to a PC (Gateway GT5092j) with Windows Vista OS.<br><br>Moreover, we set up an infra red range sensor and a proximity sensor for performing the following functions. These devices are controlled with a microcomputer, and communicate with the PC program through serial connection." *See* "Smart Makeup Mirror" at page 496.<br><br>  <br><br>**Fig. 1.** Overview of Smart Makeup Mirror<br><br>*See* "Smart Makeup Mirror" at page 496.<br><br>"Using this system, users apply makeup while looking at the computer display where an image of the user's face is captured by the high-resolution camera is displayed. This configuration is slightly different from a realistic mirror because the user's gaze is not aligned with the image, because the camera takes pictures from the top of the display. The response of the image may be delayed because of computation. Further, the resolution is lower than that of a realistic mirror, and the image may be out of focus |

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| | where a user moves considerably from the focusing position of the camera. These differences may obstruct the makeup application process. The purpose of this research is to implement an artificial mirror with functions that cannot be achieved by using a realistic mirror in order to compensate for the abovementioned differences.<br><br>In order to estimate the influence of the abovementioned differences on the makeup application process, we applied makeup using an early-stage prototype of our electronic mirror. The following observations were made.<br><br>• Satisfactory makeup application using the electronic mirror is generally possible.<br>• However, a function that enables gaze alignment is required.<br><br>When a user tries to see an enlarged view of her face and comes considerably close to the camera, the face image gets blurred as the camera does not have an auto-focus mechanism. From the above observations, we conclude that at least two additional functions are required to make the electronic mirror as effective as a realistic mirror in the makeup application process. One is to capture and display the user's face from the front, and the other is to enlarge this image for ease of use. The details of these functions are explained in the following sections." *See* "3 Makeup Support Function" at pages 496-497.<br><br>"When we change cosmetics, tools, or the method of makeup, it is difficult to find differences in the face between how our face looked with the old makeup and how it looks with the new makeup. Moreover, it is also difficult to see our own face objectively in a conventional mirror, because we usually hold a good expression in front of the mirror.<br><br>The smart makeup mirror allows us to save the image being displayed to a computer file with a particular file name and date. By using this function, we capture an image of our face after applying makeup. This will help us to accurately compare the color, brightness, |

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| | or texture that suits our face by capturing an image every time in the same environment.” *See* “3.6 Makeup Log” at 498.<br>  <br><br>**Fig. 2.** Differences in the face appearance in different lighting modes<br>*See* “3.6 Makeup Log” at 499. |

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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Iwabuchi expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"Figure 1 shows the over view of the proposed system. As part of this system, we place a high-resolution camera (Point Grey Research, Grasshopper, with IEEE-1394b connection, 1624 x 1224 pixels, 30 fps) above the computer display. The camera is trained on the woman, and a mirror image of the woman is shown on the screen; thus, the device functions and assists the woman in applying makeup effectively while looking at her image. There are some researches that use a standard-definition TV camera and display images as a mirror would [2][3]. In the proposed system, we use a high-resolution camera in order to enable practicable makeup application<br><br>In order to realize the functions described later in the paper, we processed the images captured by the camera. We set up a low-resolution camera (Logicool, Qcam Pro for Notebooks, in a 320 x 240 pixel mode, 30 fps) for such image processing. We used OpenCV in the image data processing and FlyCapture for the controlling the high-resolution camera. These cameras are connected to a PC (Gateway GT5092j) with Windows Vista OS.<br><br>Moreover, we set up an infra red range sensor and a proximity sensor for performing the following functions. These devices are controlled with a microcomputer, and communicate with the PC program through serial connection." *See* "Smart Makeup Mirror" at page 496. |

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| |  <br>**Fig. 1.** Overview of Smart Makeup Mirror<br><br>*See* “Smart Makeup Mirror” at page 496.<br><br>“Using this system, users apply makeup while looking at the computer display where an image of the user’s face is captured by the high-resolution camera is displayed. This configuration is slightly different from a realistic mirror because the user’s gaze is not aligned with the image, because the camera takes pictures from the top of the display. The response of the image may be delayed because of computation. Further, the resolution is lower than that of a realistic mirror, and the image may be out of focus where a user moves considerably from the focusing position of the camera. These differences may obstruct the makeup application process. The purpose of this research is to implement an artificial mirror with functions that cannot be achieved by using a realistic mirror in order to compensate for the abovementioned differences.” *See* “3 Makeup Support Function” at page 496. |

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| | "During the makeup application process, we usually bring our face close to the mirror in order to ensure that our makeup is satisfactory and to check the makeup near certain face parts such as the eyes and the mouth. This is a critical part of the makeup application process, is frequently needed, and is often the most troublesome as it re quires a strenuous and awkward posture. For this purpose, we developed an automatic zoom function in the proposed system for zooming at a particular at part of the face. When a user brings the makeup tool, with an attached color marker (a small green sticky label), near her eyes, the camera recognizes the marker, zooms in, and switches to an enlarged image of the eye.<br><br>In order to detect the color marker, it is not practical to use the high-resolution camera image because the processing time will increase significantly and the response will be unacceptable: moreover, the accuracy of position detection achieved by the high-resolution camera is not required. Therefore, we use an additional low-resolution camera for recognizing markers. This enables users to apply makeup without having to physically approach the display." *See* "3.1 Automatic Zoom and Pan" at page 497.<br><br>"In everyday life, the face is observed not only from the front but also from the side, from the bottom, and in the diagonal direction. Thus, while applying makeup, we must inspect the face from various angles. In the proposed system, the camera captures the image of our face and displays it for several seconds. By looking at that picture, we can inspect the makeup on the face from various angles. As a result, it is possible for us to check our profile and our view from the back, which is not possible to observe in a conventional mirror. When a user captures her face while she is looking at the camera, she can check the gaze-aligned view of her face that a conventional mirror always provides." *See* "3.4 Profile Check" at page 498.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Iwabuchi expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video feed. *See*, *e.g.*, disclosures below.<br><br>"During the makeup application process, we usually bring our face close to the mirror in order to ensure that our makeup is satisfactory and to check the makeup near certain face parts such as the eyes and the mouth. This is a critical part of the makeup application process, is frequently needed, and is often the most troublesome as it requires a strenuous and awkward posture. For this purpose, we developed an automatic zoom function in the proposed system for zooming at a particular at part of the face. When a user brings the makeup tool, with an attached color marker (a small green sticky label), near her eyes, the camera recognizes the marker, zooms in, and switches to an enlarged image of the eye.<br><br>In order to detect the color marker, it is not practical to use the high-resolution camera image because the processing time will increase significantly and the response will be unacceptable: moreover, the accuracy of position detection achieved by the high-resolution camera is not required. Therefore, we use an additional low-resolution camera for recognizing markers. This enables users to apply makeup without having to physically approach the display." *See* "3.1 Automatic Zoom and Pan" at page 497.<br><br>"We developed a 'magnifying glass function' in order to provide finishing touches to the makeup application process, thereby improving the quality of the applied makeup. The proposed system uses an infrared range sensor to measure the distance between the camera and the face. Further, the magnification rate of the display image can be increased/decreased by simply and slightly approaching/leaving the display. A similar technique was recently used for a document browser [5]." *See* "3.2 Intuitive Magnification Rate Control" at pages 497-498. |

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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Iwabuchi expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. *See*, *e.g.*, disclosures below.<br><br>"During the makeup application process, we usually bring our face close to the mirror in order to ensure that our makeup is satisfactory and to check the makeup near certain face parts such as the eyes and the mouth. This is a critical part of the makeup application process, is frequently needed, and is often the most troublesome as it re1quires a strenuous and awkward posture. For this purpose, we developed an automatic zoom function in the proposed system for zooming at a particular at part of the face. When a user brings the makeup tool, with an attached color marker (a small green sticky label), near her eyes, the camera recognizes the marker, zooms in, and switches to an enlarged image of the eye.<br><br>In order to detect the color marker, it is not practical to use the high-resolution camera image because the processing time will increase significantly and the response will be unacceptable: moreover, the accuracy of position detection achieved by the high-resolution camera is not required. Therefore, we use an additional low-resolution camera for recognizing markers. This enables users to apply makeup without having to physically approach the display." *See* "3.1 Automatic Zoom and Pan" at page 497.<br><br>"We developed a 'magnifying glass function' in order to provide finishing touches to the makeup application process, thereby improving the quality of the applied makeup. The proposed system uses an infrared range sensor to measure the distance between the camera and the face. Further, the magnification rate of the display image can be increased/decreased by simply and slightly approaching/leaving the display. A similar |

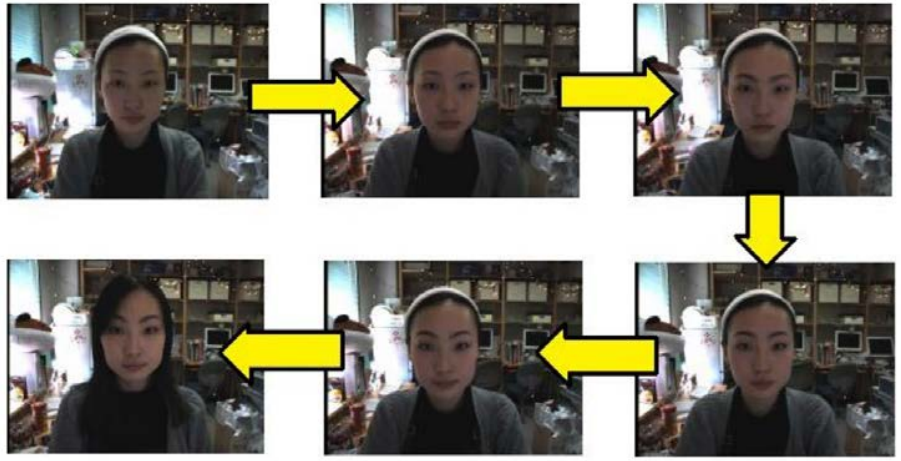
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| | technique was recently used for a document browser [5]." *See* "3.2 Intuitive Magnification Rate Control" at pages 497-498.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

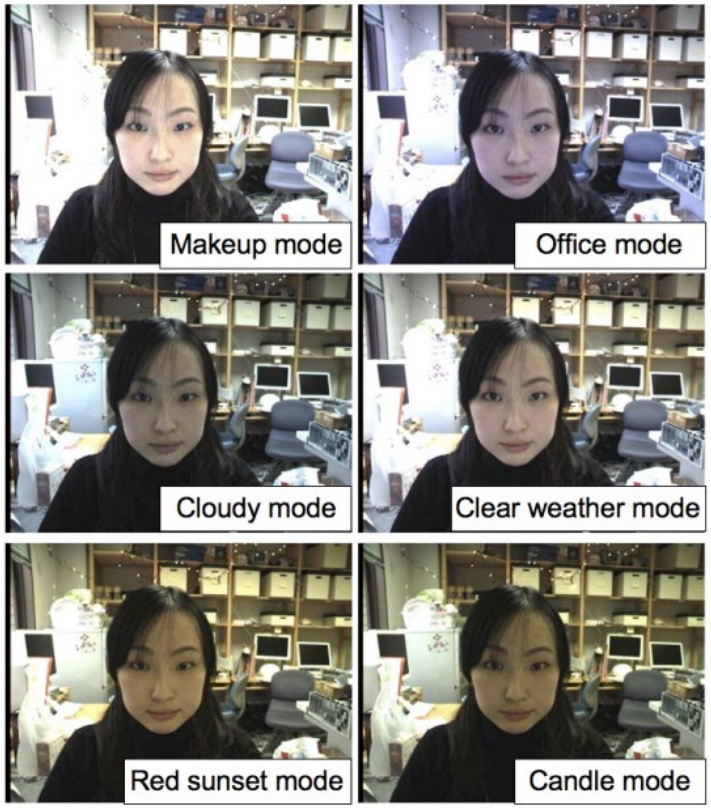
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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | Iwabuchi expressly and/or inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. *See*, *e.g.*, disclosures below.<br><br>"Using this system, users apply makeup while looking at the computer display where an image of the user's face is captured by the high-resolution camera is displayed. This configuration is slightly different from a realistic mirror because the user's gaze is not aligned with the image, because the camera takes pictures from the top of the display. The response of the image may be delayed because of computation. Further, the resolution is lower than that of a realistic mirror, and the image may be out of focus where a user moves considerably from the focusing position of the camera. These differences may obstruct the makeup application process. The purpose of this research is to implement an artificial mirror with functions that cannot be achieved by using a realistic mirror in order to compensate for the abovementioned differences. |

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| | In order to estimate the influence of the abovementioned differences on the makeup application process, we applied makeup using an early-stage prototype of our electronic mirror. The following observations were made.<br><br>• Satisfactory makeup application using the electronic mirror is generally possible.<br>• However, a function that enables gaze alignment is required. "<br><br>*See* "3 Makeup Support Function" at page 496-97.<br><br>"In everyday life, the face is observed not only from the front but also from the side, from the bottom, and in the diagonal direction. Thus, while applying makeup, we must inspect the face from various angles. In the proposed system, the camera captures the image of our face and displays it for several seconds. By looking at that picture, we can inspect the makeup on the face from various angles. As a result, it is possible for us to check our profile and our view from the back, which is not possible to observe in a conventional mirror. When a user captures her face while she is looking at the camera, she can check the gaze-aligned view of her face that a conventional mirror always provides." *See* "3.4 Profile Check" at page 498.<br><br>"In order to decrease the difficulty in applying makeup to the upper eyelid, we carefully observed users when they applied makeup to the eyelid. When they applied makeup to the upper eyelid using a mirror, they wanted to see their face from below. For this purpose, they raised their head and lowered their line of vision. (Fig. 5 left) Conversely, when they applied makeup to the lower eyelid, they lowered their head and glanced upward (Fig. 5 right). In the prototype system, the image is displayed at the upper part of the display: therefore, users felt that it was easier to apply makeup to the lower eyelid than to the upper eyelid. |

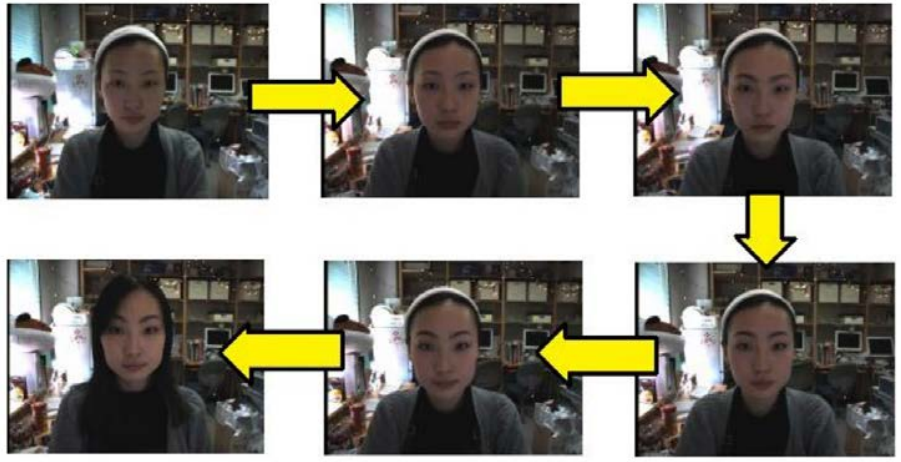
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| |  <br>**Fig. 5.** Application of makeup to upper eyelid (left) and lower eyelid (right)<br><br>This problem could be solved by changing the display position of the image according to the makeup activity to the lower and upper eyelids. Thus we have implemented a function that displays a magnified image of the eyes at the upper part of the display when the user applies makeup to the upper eyelid, and displays the magnified image at the lower part of the display when the user applies makeup to the lower eyelid. The user’s activity of applying makeup to the upper or lower eyelids is detected by means of computer vision through the low-resolution camera. Thus, users easily apply makeup not only to the lower eyelid but also to the upper eyelid.” *See* “5 Adjusting Position of Display” at pages 501-502.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants’ Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

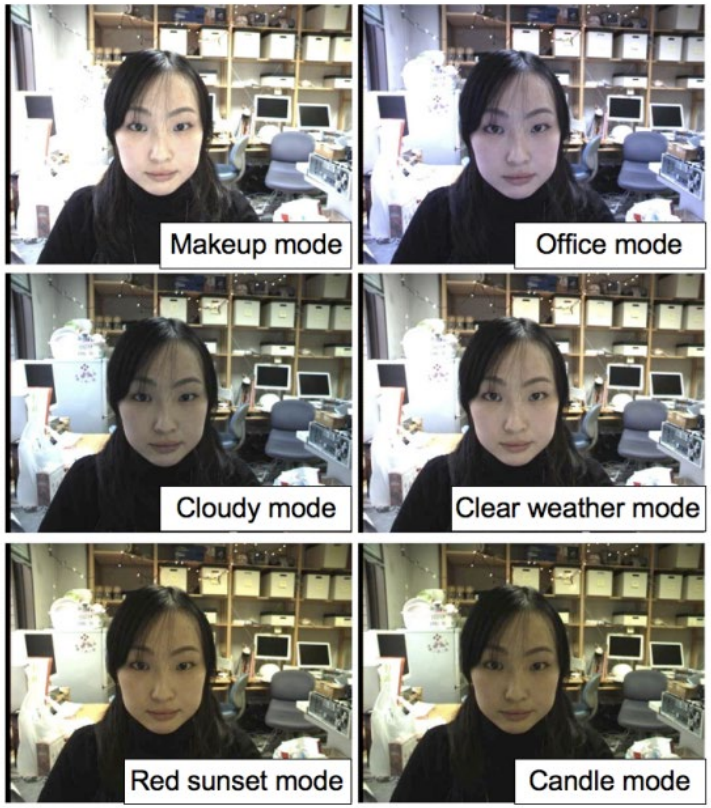
| Asserted Claim of the '109 Patent | Exemplary Citations to Iwabuchi |
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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Iwabuchi expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[a]. obtaining a reference image; | Iwabuchi expressly and/or inherently discloses and/or renders obvious obtaining a reference image n. *See*, *e.g.*, disclosures below.<br><br>"In order to realize the functions described later in the paper, we processed the images captured by the camera. We set up a low-resolution camera (Logicool, Qcam Pro for Notebooks, in a 320 x 240 pixel mode, 30 fps) for such image processing. We used OpenCV in the image data processing and FlyCapture for the controlling the high-resolution camera. These cameras are connected to a PC (Gateway GT5092j) with Windows Vista OS." *See* "2 Smart Makeup Mirror" at page 496.<br><br>"It is usual that to apply makeup in a place that is as bright as possible. However, the makeup of a user and hence her appearance may appear different under different lighting sources such as sunlight, fluorescent lamps, and incandescent lamps. This system simulates the lighting conditions depending on the surroundings. (Fig.2) The lighting conditions are makeup mode, office mode, cloudy mode, clear weather mode, red sunset mode, and candle mode. The selected lighting mode is displayed in the title bar of the interface and can be confirmed easily." *See* "3.5 Lighting Mode" at page 498. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Iwabuchi |
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| |  <br>**Fig. 3.** Steps from "no makeup" to :full makeup and hair arrangement."<br><br>*See* "4.1 Test by the Author" at page 500.<br><br>"When we change cosmetics, tools, or the method of makeup, it is difficult to find differences in the face between how our face looked with the old makeup and how it looks with the new makeup. Moreover, it is also difficult to see our own face objectively in a conventional mirror, because we usually hold a good expression in front of the mirror.<br><br>The smart makeup mirror allows us to save the image being displayed to a computer file with a particular file name and date. By using this function, we capture an image of our face after applying makeup. This will help us to accurately compare the color, brightness, or texture that suits our face by capturing an image every time in the same environment." *See* "3.6 Makeup Log" at 498. |

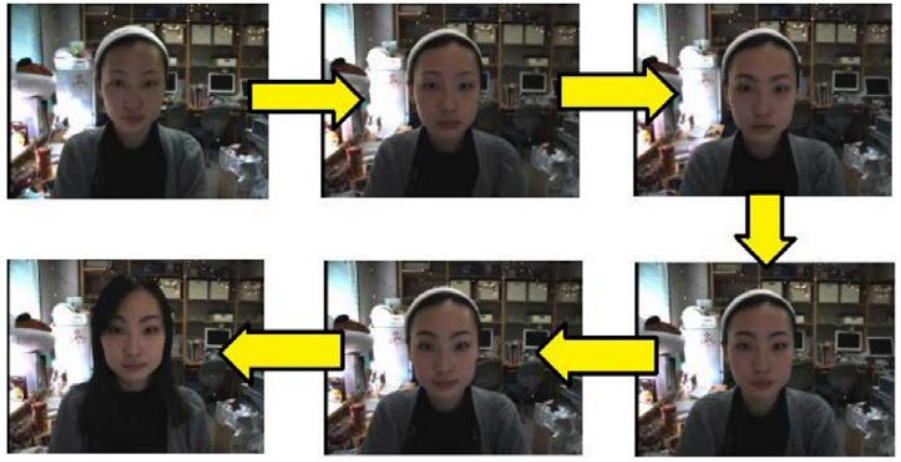
| Asserted Claim of the '109 Patent | Exemplary Citations to Iwabuchi |
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| |  <br>**Fig. 2.** Differences in the face appearance in different lighting modes<br><br>*See* "3.6 Makeup Log" at 499.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

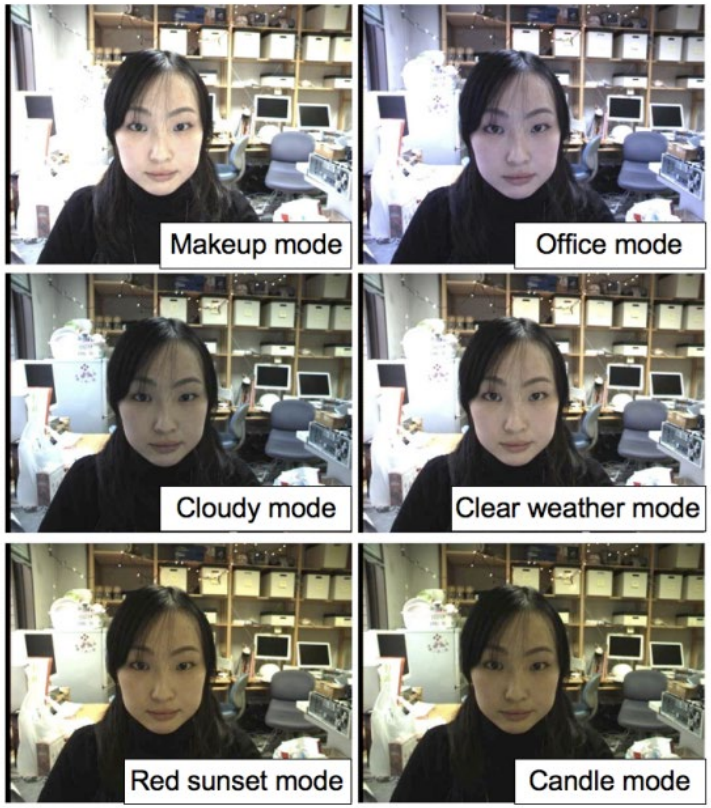
| Asserted Claim of the '109 Patent | Exemplary Citations to Iwabuchi |
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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Iwabuchi expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"In order to realize the functions described later in the paper, we processed the images captured by the camera. We set up a low-resolution camera (Logicool, Qcam Pro for Notebooks, in a 320 x 240 pixel mode, 30 fps) for such image processing. We used OpenCV in the image data processing and FlyCapture for the controlling the high-resolution camera. These cameras are connected to a PC (Gateway GT5092j) with Windows Vista OS." *See* "2 Smart Makeup Mirror" at page 496.<br><br>"It is usual that to apply makeup in a place that is as bright as possible. However, the makeup of a user and hence her appearance may appear different under different lighting sources such as sunlight, fluorescent lamps, and incandescent lamps. This system simulates the lighting conditions depending on the surroundings. (Fig.2) The lighting conditions are makeup mode, office mode, cloudy mode, clear weather mode, red sunset mode, and candle mode. The selected lighting mode is displayed in the title bar of the interface and can be confirmed easily." *See* "3.5 Lighting Mode" at page 498. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Iwabuchi |
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| |  <br>**Fig. 3.** Steps from "no makeup" to :full makeup and hair arrangement."<br><br>*See* "4.1 Test by the Author" at page 500.<br><br>"When we change cosmetics, tools, or the method of makeup, it is difficult to find differences in the face between how our face looked with the old makeup and how it looks with the new makeup. Moreover, it is also difficult to see our own face objectively in a conventional mirror, because we usually hold a good expression in front of the mirror.<br><br>The smart makeup mirror allows us to save the image being displayed to a computer file with a particular file name and date. By using this function, we capture an image of our face after applying makeup. This will help us to accurately compare the color, brightness, or texture that suits our face by capturing an image every time in the same environment." *See* "3.6 Makeup Log" at 498. |

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| |  <br>**Fig. 2.** Differences in the face appearance in different lighting modes<br><br>*See* "3.6 Makeup Log" at 499.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

| Asserted Claim of the '109 Patent | Exemplary Citations to Iwabuchi |
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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Iwabuchi expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping. *See*, *e.g.*, disclosures below.<br><br>"In order to realize the functions described later in the paper, we processed the images captured by the camera. We set up a low-resolution camera (Logicool, Qcam Pro for Notebooks, in a 320 x 240 pixel mode, 30 fps) for such image processing. We used OpenCV in the image data processing and FlyCapture for the controlling the high-resolution camera. These cameras are connected to a PC (Gateway GT5092j) with Windows Vista OS." *See* "2 Smart Makeup Mirror" at page 496.<br><br>"It is usual that to apply makeup in a place that is as bright as possible. However, the makeup of a user and hence her appearance may appear different under different lighting sources such as sunlight, fluorescent lamps, and incandescent lamps. This system simulates the lighting conditions depending on the surroundings. (Fig.2) The lighting conditions are makeup mode, office mode, cloudy mode, clear weather mode, red sunset mode, and candle mode. The selected lighting mode is displayed in the title bar of the interface and can be confirmed easily." *See* "3.5 Lighting Mode" at page 498. |

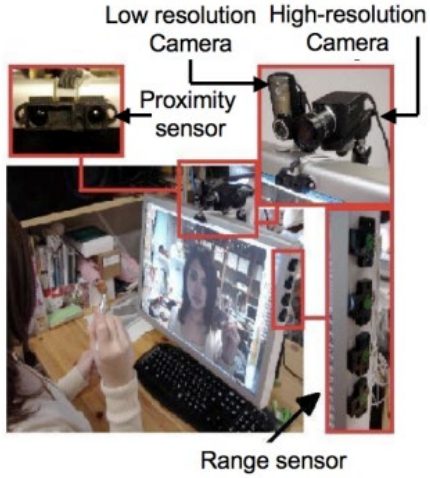
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| |  <br>**Fig. 3.** Steps from "no makeup" to :full makeup and hair arrangement."<br><br>*See* "4.1 Test by the Author" at page 500.<br><br>"When we change cosmetics, tools, or the method of makeup, it is difficult to find differences in the face between how our face looked with the old makeup and how it looks with the new makeup. Moreover, it is also difficult to see our own face objectively in a conventional mirror, because we usually hold a good expression in front of the mirror.<br><br>The smart makeup mirror allows us to save the image being displayed to a computer file with a particular file name and date. By using this function, we capture an image of our face after applying makeup. This will help us to accurately compare the color, brightness, or texture that suits our face by capturing an image every time in the same environment." *See* "3.6 Makeup Log" at 498. |

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| |  <br>**Fig. 2.** Differences in the face appearance in different lighting modes<br><br>*See* "3.6 Makeup Log" at 499.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

| Asserted Claim of the '109 Patent | Exemplary Citations to Iwabuchi |
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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

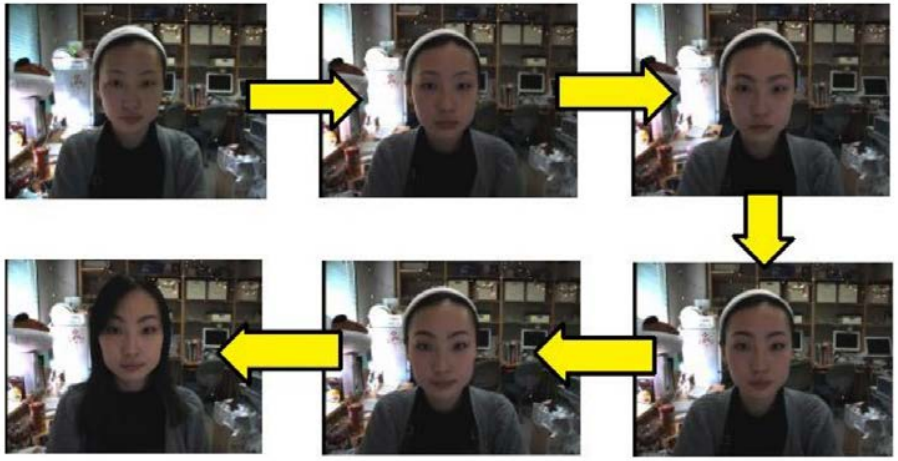
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| **Claim 8** | |
| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Iwabuchi expressly and/or inherently discloses and/or renders obvious applying a translation transformation to move the image within display area of the monitor. *See*, *e.g.*, disclosures below.<br><br>"In order to decrease the difficulty in applying makeup to the upper eyelid, we carefully observed users when they applied makeup to the eyelid. When they applied makeup to the upper eyelid using a mirror, they wanted to see their face from below. For this purpose, they raised their head and lowered their line of vision. (Fig. 5 left) Conversely, when they applied makeup to the lower eyelid, they lowered their head and glanced upward (Fig. 5 right). In the prototype system, the image is displayed at the upper part of the display: therefore, users felt that it was easier to apply makeup to the lower eyelid than to the upper eyelid. |

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| |  <br>**Fig. 5.** Application of makeup to upper eyelid (left) and lower eyelid (right)<br><br>This problem could be solved by changing the display position of the image according to the makeup activity to the lower and upper eyelids. Thus we have implemented a function that displays a magnified image of the eyes at the upper part of the display when the user applies makeup to the upper eyelid, and displays the magnified image at the lower part of the display when the user applies makeup to the lower eyelid. The user’s activity of applying makeup to the upper or lower eyelids is detected by means of computer vision through the low-resolution camera. Thus, users easily apply makeup not only to the lower eyelid but also to the upper eyelid.” *See* “5 Adjusting Position of Display” at pages 501-502.<br><br>“Figure 1 shows the over view of the proposed system. As part of this system, we place a high-resolution camera (Point Grey Research, Grasshopper, with IEEE-1394b connection, 1624 x 1224 pixels, 30 fps) above the computer display. The camera is trained on the woman, and a mirror image of the woman is shown on the screen; thus, the device functions and assists the woman in applying makeup effectively while looking at her image. There are some researches that use a standard-definition TV camera and display images as a mirror would [2][3]. In the proposed system, we use a high-resolution camera in order to enable practicable makeup application |

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| | In order to realize the functions described later in the paper, we processed the images captured by the camera. We set up a low-resolution camera (Logicool, Qcam Pro for Notebooks, in a 320 x 240 pixel mode, 30 fps) for such image processing. We used OpenCV in the image data processing and FlyCapture for the controlling the high-resolution camera. These cameras are connected to a PC (Gateway GT5092j) with Windows Vista OS.<br><br>Moreover, we set up an infra red range sensor and a proximity sensor for performing the following functions. These devices are controlled with a microcomputer, and communicate with the PC program through serial connection." *See* "Smart Makeup Mirror" at page 496.<br><br>  <br><br>**Fig. 1.** Overview of Smart Makeup Mirror<br><br>*See* "Smart Makeup Mirror" at page 496.<br><br>"During the makeup application process, we usually bring our face close to the mirror in order to ensure that our makeup is satisfactory and to check the makeup near certain face |

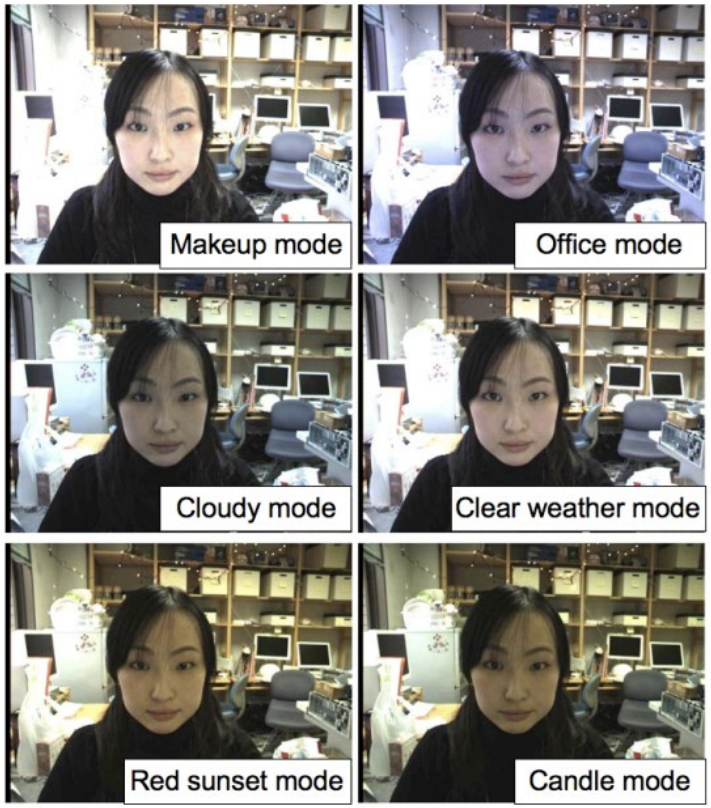
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| | parts such as the eyes and the mouth. This is a critical part of the makeup application process, is frequently needed, and is often the most troublesome as it re1quires a strenuous and awkward posture. For this purpose, we developed an automatic zoom function in the proposed system for zooming at a particular at part of the face. When a user brings the makeup tool, with an attached color marker (a small green sticky label), near her eyes, the camera recognizes the marker, zooms in, and switches to an enlarged image of the eye.<br><br>In order to detect the color marker, it is not practical to use the high-resolution camera image because the processing time will increase significantly and the response will be unacceptable: moreover, the accuracy of position detection achieved by the high-resolution camera is not required. Therefore, we use an additional low-resolution camera for recognizing markers. This enables users to apply makeup without having to physically approach the display." *See* "3.1 Automatic Zoom and Pan" at page 497.<br><br>"We developed a 'magnifying glass function' in order to provide finishing touches to the makeup application process, thereby improving the quality of the applied makeup. The proposed system uses an infrared range sensor to measure the distance between the camera and the face. Further, the magnification rate of the display image can be increased/decreased by simply and slightly approaching/leaving the display. A similar technique was recently used for a document browser [5]." *See* "3.2 Intuitive Magnification Rate Control" at pages 497-498.<br><br>"A professional makeup artist will always recommend checking a person's appearance from the viewpoint of another person standing in front, with the help of a left and right reversing mirror (the reversal mirror) [4]. The impression of the hairstyle: the shape of the eyebrow, eyes, and lips: and the positions of moles are different, when the face is seen in a reversal mirror. Therefore, we added this functionality to the proposed system, enabling the system to as display the image captured by the camera as a left and right reversing mirror would." *See* "3.3 Left and Right Reversing Mirror" at page 498. |

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| | "In everyday life, the face is observed not only from the front but also from the side, from the bottom, and in the diagonal direction. Thus, while applying makeup, we must inspect the face from various angles. In the proposed system, the camera captures the image of our face and displays it for several seconds. By looking at that picture, we can inspect the makeup on the face from various angles. As a result, it is possible for us to check our profile and our view from the back, which is not possible to observe in a conventional mirror. When a user captures her face while she is looking at the camera, she can check the gaze-aligned view of her face that a conventional mirror always provides." *See* "3.4 Profile Check" at page 498.<br><br>"It is usual that to apply makeup in a place that is as bright as possible. However, the makeup of a user and hence her appearance may appear different under different lighting sources such as sunlight, fluorescent lamps, and incandescent lamps. This system simulates the lighting conditions depending on the surroundings. (Fig.2) The lighting conditions are makeup mode, office mode, cloudy mode, clear weather mode, red sunset mode, and candle mode. The selected lighting mode is displayed in the title bar of the interface and can be confirmed easily." *See* "3.5 Lighting Mode" at page 498. |

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| |  <br>**Fig. 3.** Steps from “no makeup” to :full makeup and hair arrangement.”<br><br>*See* “4.1 Test by the Author” at page 500.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants’ Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 9** | |

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| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Iwabuchi expressly and/or inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. *See*, *e.g.*, disclosures below.<br><br>"It is usual that to apply makeup in a place that is as bright as possible. However, the makeup of a user and hence her appearance may appear different under different lighting sources such as sunlight, fluorescent lamps, and incandescent lamps. This system simulates the lighting conditions depending on the surroundings. (Fig.2) The lighting conditions are makeup mode, office mode, cloudy mode, clear weather mode, red sunset mode, and candle mode. The selected lighting mode is displayed in the title bar of the interface and can be confirmed easily." *See* "3.5 Lighting Mode" at page 498.<br><br>"When we change cosmetics, tools, or the method of makeup, it is difficult to find differences in the face between how our face looked with the old makeup and how it looks with the new makeup. Moreover, it is also difficult to see our own face objectively in a conventional mirror, because we usually hold a good expression in front of the mirror.<br><br>The smart makeup mirror allows us to save the image being displayed to a computer file with a particular file name and date. By using this function, we capture an image of our face after applying makeup. This will help us to accurately compare the color, brightness, or texture that suits our face by capturing an image every time in the same environment." *See* "3.6 Makeup Log" at 498. |

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| |  <br>**Fig. 2.** Differences in the face appearance in different lighting modes<br><br>*See* "3.6 Makeup Log" at 499.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Iwabuchi expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | Iwabuchi expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*:<br><br>"In everyday life, the face is observed not only from the front but also from the side, from the bottom, and in the diagonal direction. Thus, while applying makeup, we must inspect the face from various angles. In the proposed system, the camera captures the image of our face and displays it for several seconds. By looking at that picture, we can inspect the makeup on the face from various angles. As a result, it is possible for us to check our profile and our view from the back, which is not possible to observe in a conventional mirror. When a user captures her face while she is looking at the camera, |

| Asserted Claim of the '109 Patent | Exemplary Citations to Iwabuchi |
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| | she can check the gaze-aligned view of her face that a conventional mirror always provides." *See* "3.4 Profile Check" at page 498.<br><br>"During the makeup application process, we usually bring our face close to the mirror in order to ensure that our makeup is satisfactory and to check the makeup near certain face parts such as the eyes and the mouth. This is a critical part of the makeup application process, is frequently needed, and is often the most troublesome as it re quires a strenuous and awkward posture. For this purpose, we developed an automatic zoom function in the proposed system for zooming at a particular at part of the face. When a user brings the makeup tool, with an attached color marker (a small green sticky label), near her eyes, the camera recognizes the marker, zooms in, and switches to an enlarged image of the eye.<br><br>In order to detect the color marker, it is not practical to use the high-resolution camera image because the processing time will increase significantly and the response will be unacceptable: moreover, the accuracy of position detection achieved by the high-resolution camera is not required. Therefore, we use an additional low-resolution camera for recognizing markers. This enables users to apply makeup without having to physically approach the display." *See* "3.1 Automatic Zoom and Pan" at page 497.<br><br>"We developed a 'magnifying glass function' in order to provide finishing touches to the makeup application process, thereby improving the quality of the applied makeup. The proposed system uses an infrared range sensor to measure the distance between the camera and the face. Further, the magnification rate of the display image can be increased/decreased by simply and slightly approaching/leaving the display. A similar technique was recently used for a document browser [5]." *See* "3.2 Intuitive Magnification Rate Control" at pages 497-498.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

| Asserted Claim of the '109 Patent | Exemplary Citations to Iwabuchi |
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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | Iwabuchi expressly and/or inherently discloses and/or renders obvious varying resolution of the image according to the distance. *See*, *e.g.*, disclosures below.<br><br>"In everyday life, the face is observed not only from the front but also from the side, from the bottom, and in the diagonal direction. Thus, while applying makeup, we must inspect the face from various angles. In the proposed system, the camera captures the image of our face and displays it for several seconds. By looking at that picture, we can inspect the makeup on the face from various angles. As a result, it is possible for us to check our profile and our view from the back, which is not possible to observe in a conventional mirror. When a user captures her face while she is looking at the camera, she can check the gaze-aligned view of her face that a conventional mirror always provides." *See* "3.4 Profile Check" at page 498.<br><br>"During the makeup application process, we usually bring our face close to the mirror in order to ensure that our makeup is satisfactory and to check the makeup near certain face parts such as the eyes and the mouth. This is a critical part of the makeup application process, is frequently needed, and is often the most troublesome as it re quires a strenuous and awkward posture. For this purpose, we developed an automatic zoom function in the proposed system for zooming at a particular at part of the face. When a user brings the makeup tool, with an attached color marker (a small green sticky label), near her eyes, the camera recognizes the marker, zooms in, and switches to an enlarged image of the eye.<br><br>In order to detect the color marker, it is not practical to use the high-resolution camera image because the processing time will increase significantly and the response will be unacceptable: moreover, the accuracy of position detection achieved by the high-resolution camera is not required. Therefore, we use an additional low-resolution camera |

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| | for recognizing markers. This enables users to apply makeup without having to physically approach the display." *See* "3.1 Automatic Zoom and Pan" at page 497.<br><br>"We developed a 'magnifying glass function' in order to provide finishing touches to the makeup application process, thereby improving the quality of the applied makeup. The proposed system uses an infrared range sensor to measure the distance between the camera and the face. Further, the magnification rate of the display image can be increased/decreased by simply and slightly approaching/leaving the display. A similar technique was recently used for a document browser [5]." *See* "3.2 Intuitive Magnification Rate Control" at pages 497-498.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Iwabuchi alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

# Exhibit A-07: Invalidity of U.S. Patent No. 8,982,109 in view of U.S. Patent Pub. No. 2008/0297589 ("Kurtz")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

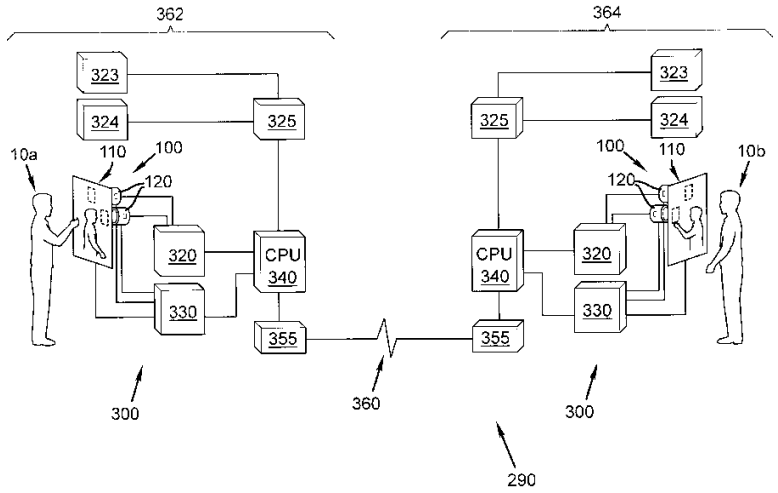
Kurtz was originally filed May 31, 2007 and published on December 4, 2008, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a), (b), and (e).

Kurtz anticipates the Asserted Claims of the '109 Patent. To the extent it is found Kurtz does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Kurtz does not anticipate the Asserted Claims, Kurtz renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

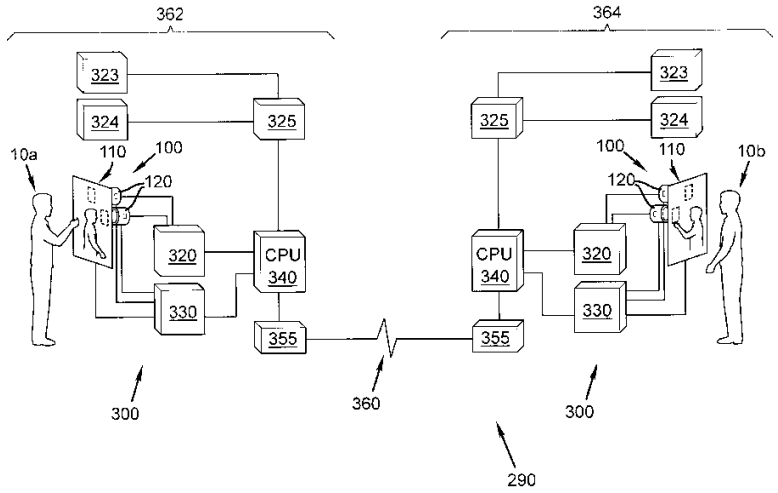
Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

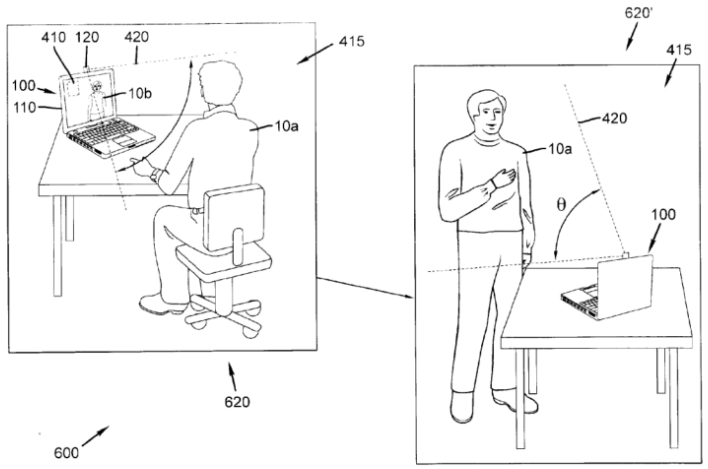
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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Kurtz expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"The block diagram of FIG. 1 shows one embodiment of such a two-way video communications system 290 having a video communication device 300 located at a local site and a video communication device 300 at a remote site. In the illustrated embodiment, communication devices 300 have an electronic imaging device 100, including a display 110 and an image capture device 120 for communication between a viewer 10 a at a first site 362 and a viewer 10 b at a second site 364. Each device 300 manages the capture, processing, transmission or receipt of video images across a network 360, subject to handshake protocols, privacy protocols, and bandwidth constraints. The network 360, which can be supported by remote servers (not shown), connects two sites 362 and 364, each of which has a system 300. Each viewer 10 a, 10 b has an electronic imaging device 100 comprising a display 110 with one or more image capture devices 120. A computer (or control logic processor (CPU)) 340 coordinates control of an image processor 320 and a system controller 330 that provides display driver and image capture control functions. System controller 330 can be integrated into computer 340 or not as desired. Computer 340 is nominally located locally, at a communication device 300 located at a given site for example local site 362, but some portions of functions can be located remotely at a remote server in system 290 or at a communication device 300 at remote site 364. Controller 330 can provide commands to an image capture device 120, controlling the camera view angle, focus, or other characteristics. A communications controller 355 acts as interface to a communication channel, such as a wireless or wired network channel, for transferring image and other data from one site to the other." *See* para. [0042]. |

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| |  <br>FIG. 1<br><br>*See* Fig. 1.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | Kurtz expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below.<br><br>"Video communication systems and methods for communicating between an individual in a local environment, and a remote viewer in a remote environment are provided. The system has an image display device; at least one image capture device which acquires |

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| | video images for fields of view of a local environment, and any individuals therein; an audio system having an audio emission device and an audio capture device; a computer, which includes a contextual interface having a gaze adapting process, and image processor; and a communication controller which transmits and receives video images of the local environment and the remote environment, and data regarding video scene characteristics thereof across a network between the local environment and the remote environment; wherein the gaze adapting process identifies video scene characteristics of the local environment indicative of eye gaze image capture and altering the video images when the characteristics are indicative." *See* Abstract.<br><br>"The block diagram of FIG. 1 shows one embodiment of such a two-way video communications system 290 having a video communication device 300 located at a local site and a video communication device 300 at a remote site. In the illustrated embodiment, communication devices 300 have an electronic imaging device 100, including a display 110 and an image capture device 120 for communication between a viewer 10 a at a first site 362 and a viewer 10 b at a second site 364. Each device 300 manages the capture, processing, transmission or receipt of video images across a network 360, subject to handshake protocols, privacy protocols, and bandwidth constraints. The network 360, which can be supported by remote servers (not shown), connects two sites 362 and 364, each of which has a system 300. Each viewer 10 a, 10 b has an electronic imaging device 100 comprising a display 110 with one or more image capture devices 120. A computer (or control logic processor (CPU)) 340 coordinates control of an image processor 320 and a system controller 330 that provides display driver and image capture control functions. System controller 330 can be integrated into computer 340 or not as desired. Computer 340 is nominally located locally, at a communication device 300 located at a given site for example local site 362, but some portions of functions can be located remotely at a remote server in system 290 or at a communication device 300 at remote site 364. Controller 330 can provide commands to an image capture device 120, controlling the camera view angle, focus, or other characteristics. A communications controller 355 acts as interface to a communication |

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| | channel, such as a wireless or wired network channel, for transferring image and other data from one site to the other.<br><br>"The two-way video communication system 290 is intended to advantageously support video conferencing or video-telephony, particularly from one residential location to another. During a video communication event (600), comprising one or more video scenes (620), a system typically transmits both local video signals and local audio signals to the remote site and receives remote video and remote audio signals from the remote site. As would be expected, a local viewer 10 a at a first site 362 is able to see a remote viewer 10 b (located at a second site 364) as an image displayed locally on display 110, thereby enhancing human interaction for teleconferencing. Image processor 320 can provide a number of functions to facilitate two-way communication, including improving the quality of image capture at the first site 362, improving the quality of images displayed at the local display 110, and handling the data for remote communication (by improving the image quality, data compression, encryption, etc.). It must be noted that FIG. 1 shows a general arrangement of components that serve an embodiment. Image capture devices 120 and display 110 can be assembled into a single frame or housing (not shown) as part of the integration for device 300. This device housing can also include other components for device 300 at site 362 or 364, such as image processor 320, communications controller 355, computer 340, and system controller 330." *See* paras. [0042]-[0043]. |

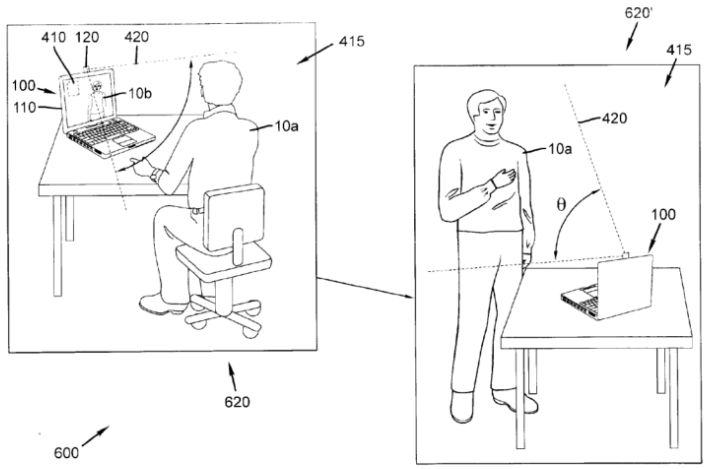
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| |  <br>FIG. 1<br><br>*See* Fig. 1.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Kurtz expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. *See*, *e.g.*, disclosures below. |

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| |  <br>*FIG. 4C*<br><br>“FIGS. 3A and 3B then illustrate the architecture for one embodiment of a video communication device 300 having an electronic imaging device 100. FIG. 3A, in particular, expands upon the construction of the electronic imaging device 100, which is shown as including an image capture device 120 and an image display device (display 110), having a screen 115. The computer 340, system controller 330, data storage 345, and communications controller 355 can be assembled within the housing 146, or located separately, and be connected wirelessly or via wires to an electronic imaging device 100. The electronic imaging device 100 also includes at least one microphone 144 and at least one speaker (audio emitter) 125. The display 110 has picture-in-picture display ability, such that a split screen (or partial screen) image 410 can be displayed on a portion of the screen 115. Each image capture device 120 is nominally an electronic or digital camera, using an imaging lens system (not shown) and an image sensor (not shown), the latter likely being a CCD or CMOS type array device, having a resolution of 1-10 megapixels. The image display device (display 110) may be a liquid crystal display (LCD) device, an organic light emitting diode (OLED) device, a CRT, a projected display, a light |

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| | guiding display, or other type of electronic display appropriate for this task. The electronic imaging device 100 can also include a motion detector 142 and an ambient light detector 140, as separate devices that can be integrated within the housing 146 of the electronic imaging device 100. It is also possible that the ambient light sensing functions can be supported directly by an image capture device 120, without having a separate dedicated sensor (ambient light detector 140). Likewise, an image capture device 120 and a microphone 144 may support the motion detection functions, without having a separated dedicated sensor (motion detector 142). FIG. 3A also illustrates that the electronic imaging device 100 can have interface controls 190 integrated into the housing 146. These user interface controls 190 can use buttons, dials, touch screens, or a combination thereof or other interface components." *See* para. [0046].<br><br>"As a further privacy control, the video communication devices 300 are provided with a picture-in-picture or split screen image 410, as shown in FIG. 3A. In particular, while the primary portion of the screen 115 of display 110 can supply incoming imagery from remote users 10 b at a remote second site 364, the split screen image 410 can display the outgoing video image captured at the local site 362. Thus, via the split screen image portion of the display, the local users 10 can have a direct visual presentation of the images being captured and/or transmitted (to a remote site 364) by their device 300. This feature gives the local users 10 the opportunity to verify that the transmitted image has the privacy level that is desired and adjustments can be made as required." *See* para. [0062].<br><br>"Likewise, user identity classification can assist the contextual interface 450 in the interpretation of events when it is supporting a communication event occurring in a local environment 415 in an automatic mode. For example, if a known subject or user 10 is within the image field of view 420 (as seen by a WFOV camera), but is lingering near the periphery of the WFOV, or at least outside the transmitted NFOV, the contextual interface 450 can recognize (using user identification process 470) that this individual is important within the context of the local users 10. Effectively, user identity is used a hierarchical tool to prioritize video capture. The contextual interface 450 can then expand the image field of view 420 to include the activities of both the primary or initial |

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| | users 10 and this peripherally located individual or user 10. Alternately, the activities of this peripherally located individual can be presented on the local display 110 as a second split screen image 410′. Likewise, the images of the primary local users 10 and the peripherally located users 10 can be presented to the remote users 10 b as split screen images. This is illustrated in FIG. 6, which depicts the display screen 115 of a remote viewer (at a site 364), in which a split screen image 410 would display imagery from the remote viewer's environment (site 364), and the greater portion of the display screen 115 displays split screen images (410′ and 410″) of two separated areas of activity in the local environment of a site 362. In such circumstances, the split screen image 410 at the local site 362 can also display two outgoing images from that site (362) or a WFOV image capturing all the activity. More generally a user 10 may have their display output multiple split screen images on their display 110, including the split screen image 410 for their locally captured content, a split screen image 410′ showing a WFOV 420 at the remote location 364, and a split screen image 410″ showing a NFOV 420 at the remote location. It is noted that multiple displays can be used instead of split screen or picture-in-picture displays.” *See* para. [0087].<br><br>“The video communication system 290 and devices 300 can be adapted to other purposes beyond residential communications, particularly ones in which privacy management or contextual management is valued. As an example, it is anticipated that systems of this type can be used in educational applications in which, for example, a student and teacher are interacting through the system. In another example, it is anticipated that systems of this type will be used in business environments where coworkers at different locations virtually share a desk to create a common workspace through video communication. It is also noted that the video communication system 290 has been principally described as a system in which the local display 110 is displaying images of one or more remote users, along with a split screen image 410 of a local user 10 in the local environment 415. The system can display a remote environment at a remote site 364 without a remote user 10 b, as most simply, the remote user 10 b may temporarily disappear. Alternately, the device 300 can display a remote environment 415 entirely lacking a remote user 10 b. As another example of other purposes, the video communication system 290 can be used to display a video view as supplied from a remote site continuously to create the illusion |

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| | that the display is a window looking out at the remote site, such as a favorite holiday destination or some other scenic view." *See* para. [0160].<br><br>"As a variation on the alternate image theme, a local user 10 a could view a program of wildlife scenes or dance scenes while the device 300 captures the responses and participation of the local user, within the limitations of the predetermined privacy and contextual settings. This type of operational model, might lend itself to numerous applications, in various fields, including education, market research, and behavioral and drug research. Additionally, the video communication system 290 and devices 300 can be used to enable a multi-way communication event in which at each site a displayed image shows common video (such as a television show), while other displayed images show the local users 10 a or participants and the remote users 10 b or participants. For instance, the display 100 of FIG. 6, which shows three image sets, can be displaying the television program on the left side image (410′), the remote participants on the right side image (410″), and the local users 10 in the inset split screen image 410. As a result, both local and remote participants can share a common viewing experience of a featured program (such as a sports event)." *See* para. [0161].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Kurtz expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror. *See*, *e.g.*, disclosures below. |

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| |  <br>FIG. 4C<br><br>“FIGS. 3A and 3B then illustrate the architecture for one embodiment of a video communication device 300 having an electronic imaging device 100. FIG. 3A, in particular, expands upon the construction of the electronic imaging device 100, which is shown as including an image capture device 120 and an image display device (display 110), having a screen 115. The computer 340, system controller 330, data storage 345, and communications controller 355 can be assembled within the housing 146, or located separately, and be connected wirelessly or via wires to an electronic imaging device 100. The electronic imaging device 100 also includes at least one microphone 144 and at least one speaker (audio emitter) 125. The display 110 has picture-in-picture display ability, such that a split screen (or partial screen) image 410 can be displayed on a portion of the screen 115. Each image capture device 120 is nominally an electronic or digital camera, using an imaging lens system (not shown) and an image sensor (not shown), the latter likely being a CCD or CMOS type array device, having a resolution of 1-10 megapixels. The image display device (display 110) may be a liquid crystal display (LCD) device, an organic light emitting diode (OLED) device, a CRT, a projected display, a light |

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| | guiding display, or other type of electronic display appropriate for this task. The electronic imaging device 100 can also include a motion detector 142 and an ambient light detector 140, as separate devices that can be integrated within the housing 146 of the electronic imaging device 100. It is also possible that the ambient light sensing functions can be supported directly by an image capture device 120, without having a separate dedicated sensor (ambient light detector 140). Likewise, an image capture device 120 and a microphone 144 may support the motion detection functions, without having a separated dedicated sensor (motion detector 142). FIG. 3A also illustrates that the electronic imaging device 100 can have interface controls 190 integrated into the housing 146. These user interface controls 190 can use buttons, dials, touch screens, or a combination thereof or other interface components." *See* para. [0046].<br><br>"As a further privacy control, the video communication devices 300 are provided with a picture-in-picture or split screen image 410, as shown in FIG. 3A. In particular, while the primary portion of the screen 115 of display 110 can supply incoming imagery from remote users 10 b at a remote second site 364, the split screen image 410 can display the outgoing video image captured at the local site 362. Thus, via the split screen image portion of the display, the local users 10 can have a direct visual presentation of the images being captured and/or transmitted (to a remote site 364) by their device 300. This feature gives the local users 10 the opportunity to verify that the transmitted image has the privacy level that is desired and adjustments can be made as required." *See* para. [0062].<br><br>"Alternately, a local user 10 can electronically modify the image captured to form a modified image for transmission that removes a portion of the field of view 420 denoted as image area 422. Although users 10 may define image areas 422 for exclusion from video capture for various reasons, maintenance of personal or family privacy is likely the key motivator. As shown in FIG. 4A, an image capture device 120 (the WFOV camera) has a portion of its image field of view 420, indicated by image area 422, modified, for example, by cropping image area 422 out of the captured image before image transmission across network 360 to a remote site 364. The local user 10 can utilize the privacy interface 400 and the contextual interface 450 to establish human perceptible |

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| | modifications to a privacy sensitive image area 422. It is expected that a user 10 may pre-determine privacy settings, based partially on human perception and emotional sensitivity to image features or content, during a preview mode prior to a video communication event, although users 10 may want to modify the captured image area during the course of an ongoing event. Preview mode setting may be done with images displayed on the larger display screen 115, or on the split screen image 410." *See* para. [0066].<br><br>"Likewise, user identity classification can assist the contextual interface 450 in the interpretation of events when it is supporting a communication event occurring in a local environment 415 in an automatic mode. For example, if a known subject or user 10 is within the image field of view 420 (as seen by a WFOV camera), but is lingering near the periphery of the WFOV, or at least outside the transmitted NFOV, the contextual interface 450 can recognize (using user identification process 470) that this individual is important within the context of the local users 10. Effectively, user identity is used a hierarchical tool to prioritize video capture. The contextual interface 450 can then expand the image field of view 420 to include the activities of both the primary or initial users 10 and this peripherally located individual or user 10. Alternately, the activities of this peripherally located individual can be presented on the local display 110 as a second split screen image 410′. Likewise, the images of the primary local users 10 and the peripherally located users 10 can be presented to the remote users 10 b as split screen images. This is illustrated in FIG. 6, which depicts the display screen 115 of a remote viewer (at a site 364), in which a split screen image 410 would display imagery from the remote viewer's environment (site 364), and the greater portion of the display screen 115 displays split screen images (410′ and 410″) of two separated areas of activity in the local environment of a site 362. In such circumstances, the split screen image 410 at the local site 362 can also display two outgoing images from that site (362) or a WFOV image capturing all the activity. More generally a user 10 may have their display output multiple split screen images on their display 110, including the split screen image 410 for their locally captured content, a split screen image 410′ showing a WFOV 420 at the remote location 364, and a split screen image 410″ showing a NFOV 420 at the remote |

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| | location. It is noted that multiple displays can be used instead of split screen or picture-in-picture displays." *See* para. [0087].<br><br>"The video communication system 290 and devices 300 can be adapted to other purposes beyond residential communications, particularly ones in which privacy management or contextual management is valued. As an example, it is anticipated that systems of this type can be used in educational applications in which, for example, a student and teacher are interacting through the system. In another example, it is anticipated that systems of this type will be used in business environments where coworkers at different locations virtually share a desk to create a common workspace through video communication. It is also noted that the video communication system 290 has been principally described as a system in which the local display 110 is displaying images of one or more remote users, along with a split screen image 410 of a local user 10 in the local environment 415. The system can display a remote environment at a remote site 364 without a remote user 10 b, as most simply, the remote user 10 b may temporarily disappear. Alternately, the device 300 can display a remote environment 415 entirely lacking a remote user 10 b. As another example of other purposes, the video communication system 290 can be used to display a video view as supplied from a remote site continuously to create the illusion that the display is a window looking out at the remote site, such as a favorite holiday destination or some other scenic view." *See* para. [0160].<br><br>"As a variation on the alternate image theme, a local user 10 a could view a program of wildlife scenes or dance scenes while the device 300 captures the responses and participation of the local user, within the limitations of the predetermined privacy and contextual settings. This type of operational model, might lend itself to numerous applications, in various fields, including education, market research, and behavioral and drug research. Additionally, the video communication system 290 and devices 300 can be used to enable a multi-way communication event in which at each site a displayed image shows common video (such as a television show), while other displayed images show the local users 10 a or participants and the remote users 10 b or participants. For instance, the display 100 of FIG. 6, which shows three image sets, can be displaying the television program on the left side image (410′), the remote participants on the right side |

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| | image (410″), and the local users 10 in the inset split screen image 410. As a result, both local and remote participants can share a common viewing experience of a featured program (such as a sports event)." *See* para. [0161].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Kurtz expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera. *See*, *e.g.*, disclosures below.<br><br>"As an example, FIG. 4C depicts a video communication event 600 occurring in a local environment 415 involving a local individual (user 10 a). In a first video scene or video interaction (620), a user 10 a is sitting at a table, looking at a display 110 where an image of a remote user 10 b is displayed. If, for example, users 10 a and 10 b are engaged in a purposeful conversation regarding serious concerns, then the image field of view 420 may be relatively narrow. As the communication event continues, the participating users (10 a and 10 b) may relax, and transition into a more spontaneous event, where a wider image field of view 420 may be more appropriate. Such a scenario is depicted in FIG. 4C, where user 10 a goes from a sitting position in a first video scene 620 to a more relaxed behavior in a second video scene 620′. In general, in the present invention, it is intended that the contextual interface 450 of video communication device 300 will manage the human interactive operation of the device 300 through transitions in scene content, particularly when the device 300 is operating automatically." *See* para. [0072].<br><br>The scenario depicted in FIG. 4C illustrates one common use case scenario that can be anticipated for device 300. Alternately, there are many use case scenarios where the communication event may be initially more relaxed and spontaneous, and the initial image capture field of view 420 will be relatively wide. Thus, it can be anticipated that |

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| | the default settings for camera control at the beginning of many communication events will have a WFOV image capture device 120 capture imagery for all or most of its image capture field of view 420. As a result, a remote user 10 b will at least initially observe a local user 10 a in the larger context of their local environment 415. As a typical communication event continues, either a local user 10 a or a remote user 10 b may desire the image capture to be closed in on localized activity (a NFOV) within the local environment 415. For example, the remote user 10 b make seek to have the direction of narrow field image capture change from an initial NFOV 420 to an alternate NFOV 420 (for example, from the table to the children, as depicted in FIG. 4B). Either the local user 10 a or the remote user 10 b can initiate this transition, using interface controls 190. As the video capture transition occurs, a local user 10 a will be able to observe the outgoing transmitted imagery on the split screen image 410. The privacy interface 400 can also enable the local user 10 a to decline or modify requests by a remote user 10 b to capture a localized field of view 420. The reduction of the field of view 420 can be attained via the image processor 320, which can crop and zoom in the images for outgoing transmission across a network 360. However, at some point, the resulting image quality (particularly the resolution) obtained by electronic zooming will be sufficiently reduced that use of optical zooming or a NFOV image capture device 120 (or the combination thereof) will be appropriate. It is noted that a camera lens with optical zoom capabilities is typically equipped with several internal moving lens groups. The device 300 can also apply the user tracking process 480, to lock onto and track a local user 10 a around within the local environment 415, as bounded by the image field of view 420." *See* para. [0072].<br><br>"Further complications arise when an individual enters (or leaves) the field of view of a local environment 415 during an ongoing communication event. In the instance that a local user 10 (particularly the only local user at the moment) leaves the local environment, the device 300 can adapt to this transition in the local image content. For example, the device 300 can modify the subsequent video capture to be either a WFOV [wide field of view] image or a NFOV [narrow field of view] image. As one option, these image capture transitions (changes in participating individuals or their activities) can be provided by direct user input. Alternately, the device 300 can transition the image capture according to prior user-established settings. As another option, the device 300 |

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| | can transmit paused imagery or alternate imagery of other than the local environment 415, until the local user 10 returns. The video communication device 300 also needs to adapt to the circumstance that an additional individual enters the field of view. As before, a local user 10 who is previously engaged in a communication event will typically be aware of the arrival of an additional individual. This prior local user 10 can, for example, then control the device 300 to expand (reduce, or re-direct) the image field of view 420 to include (or exclude) the new individual." *See* para. [0075].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | Kurtz expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below.<br><br>"Wherein the gaze adapting process uses a scene analysis algorithm to identify video scene characteristics of the local environment indicative of eye gaze image capture; and wherein the gaze adapting process alters image capture or image processing of the video images of the local individual when the characteristics are indicative of eye gaze image capture, so as to provide eye-contact video images to the remote viewer wherein the eyes of the local individual appear to be looking at the eyes of the remote viewer in the remote environment and in a manner consistent with the video scene characteristics for both the local environment and remote environments." See para. [0019].<br><br>""Likewise, the geometry and issues for eye contact image display can be considered in greater depth. Considering again FIG. 10, the image of a remote user is to be displayed on display 110 to a local user 10 (much as in FIG. 4C, scene 620). The typical video-conferencing systems would present this image with direct-on centered view, such that a user 10 positioned along optical axis 170 would observe the remote user with the |

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| | sensation of eye-to-eye contact. However, as shown in FIG. 10, the user 10 (particularly their face 25) may not be situated along optical axis 170, and therefore the displayed image of the remote user would not appear to be looking towards the face of user 10. As a method to compensate for this issue, the video communication device 300 can utilize an algorithm to estimate direction or location of a user 10 in their local environment 415 relative to a display 110. In particular, this algorithm would determine the angular direction or location of the users face (tracking pose) or eyes (eye-tracking) in three-dimensional space relative to display (or center thereof) 110. The video communication device 300 can utilize a variety of techniques, including stereo camera imaging or optical or sonar/audio based range finding and mapping to determine the location of the user 10. In some instances, the image processor 320 can then apply a gaze adapting process 495 to the images of the remote user to be shown on display 110, to change the appearance of their eyes, to have their image appear to be looking at the user 10." *See* para. [0139].<br><br>"As can now be appreciated, eye gaze corrected residential video communications can be beset with dynamic geometry and context issues that effect both eye gaze related image capture (how and when to obtain an eye contact image of a local user for remote display) and eye gaze related image display (relative to the direction and manner of image alteration of the remote viewer's eye gaze, to have it be best seen locally). As described, eye gaze correction can simultaneously depend on user positioning and context at both the local and remote sites. This is partially shown by FIG. 7D, which depicts the interactions of two video communications devices 300 of a video communication system 290 during a video communication event 600. To address this, during a video scene 620, communication event analysis 655 uses scene analysis algorithms with context rules to examine the local video scene characteristics relative to a variety of factors, including gaze metrics (amount of head or eye motion, rate of movement, direction or pose to camera 120), field of view, personal cues (including behavior or speech), and video context (event classification), to determine whether eye gaze image capture or correction is appropriate. For example, if a local user 10 a is engaged in a purposeful event, context rules would indicate that directed eye gaze is likely needed, supported by a range of gaze metrics. Whereas, if a local participant is involved in large group event, and glances at the display 110, without particularly |

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| | communicating with a remote viewer, then directed eye gaze is not likely needed. Generally, the gaze context rules can anticipate that as the capture field of view is decreased and directed to fewer individuals, then the sensitivity and need for directed eye gaze image capture or correction increases. Even in such situations, the scene analysis algorithm can assess, for example using pose angle estimations and trigger or threshold levels, whether a local user 10 a is intending to look at a display 110 to communicate directly with the remote viewer. These pose angle estimates can be obtained from a gaze tracking process, which follows the gaze direction of a viewer to observe where a person's attention is focused. While it is desirable to track the actual movement of the eyes, it is frequently sufficient to infer the gaze direction from the head pose, as described in “Model-Based Head Pose Estimation for Air-Traffic Controllers”, by Xavier L. C. Brolly, Constantinos Stratelos and Jeffrey B. Mulligan (published at ICIP 2003, the IEEE Conference on Image Processing).<br><br>“The eye-gaze correction scene analysis algorithm can use a set of eye-gaze context rules to associate the sensitivity (using triggers or threshold levels) or need for eye gaze correction with the video context for a current video scene, including event classification and capture field of view. These context rules can define a range of variation for the participant gaze metrics or characteristics indicative of eye gaze image capture based upon the current video context. Likewise, the context rules can define a range of gaze metrics indicative of remote scene characteristics that will affect eye gaze image display. As with the prior uses of scene analysis algorithms, the gaze analysis process can calculate current gaze metrics and associated gaze confidence values as statistical quality assessment metrics. The current gaze metrics can then be compared to the range of gaze metrics expected for participants in the current video scene. If the contextual interface 450, via communication event analysis concludes with high gaze direction confidence values that gaze directed image capture or image processing of a local user is appropriate, then the gaze adapting process 495 can provide direction to the cameras 120 to adjust image capture (camera selection and settings (zoom, pan, and tilt)) to acquire images for eye contact viewing for the remote viewer. The gaze adapting process 495 can also provide input to the image processor 320, via scene capture management 650, to alter |

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| | the captured images as necessary to provide eye contact image video imagery for the remote viewer." *See* paras. [0143]-[0144].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Kurtz expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"The video communications device 300 can utilize a variety of networking technologies to communicate with remote participants, including telephone or data streaming landlines (cable, optical fiber), wireless, satellite based communications, and the Internet." *See* para. [0061].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Kurtz expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video feed. *See*, *e.g.*, disclosures below.<br><br>"The video communication device 300 can also enable the users 10 to change the capture conditions, and particularly the image capture field of view 420. As shown in FIG. 2, a device 300 may view a local site 362, such as a kitchen. However, as an example, the entire image capture field of view 420 that can be captured by a camera 120 may extend further within a residence than just the kitchen. For any variety of reasons, the local user |

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| | may want to limit the image field of view 420. This may be done simply by closing a door or turning off some locally positioned room lighting. The local image capture can also be limited by using the privacy settings to predefine that only a NFOV image capture device 120 be used. As a further step, the pan tilt and zoom controls for a NFOV image capture device 120 can also be restricted, thereby limiting the expanded field of view and motion tracking capabilities of device 300 for a communication event." [0065].<br><br>"Alternately, a local user 10 can electronically modify the image captured to form a modified image for transmission that removes a portion of the field of view 420 denoted as image area 422. Although users 10 may define image areas 422 for exclusion from video capture for various reasons, maintenance of personal or family privacy is likely the key motivator. As shown in FIG. 4A, an image capture device 120 (the WFOV camera) has a portion of its image field of view 420, indicated by image area 422, modified, for example, by cropping image area 422 out of the captured image before image transmission across network 360 to a remote site 364. The local user 10 can utilize the privacy interface 400 and the contextual interface 450 to establish human perceptible modifications to a privacy sensitive image area 422. It is expected that a user 10 may pre-determine privacy settings, based partially on human perception and emotional sensitivity to image features or content, during a preview mode prior to a video communication event, although users 10 may want to modify the captured image area during the course of an ongoing event. Preview mode setting may be done with images displayed on the larger display screen 115, or on the split screen image 410." [0066].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Kurtz expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | Kurtz expressly and/or inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. *See*, *e.g.*, disclosures below.<br><br>"The eye-gaze correction scene analysis algorithm can use a set of eye-gaze context rules to associate the sensitivity (using triggers or threshold levels) or need for eye gaze correction with the video context for a current video scene, including event classification and capture field of view. These context rules can define a range of variation for the participant gaze metrics or characteristics indicative of eye gaze image capture based upon the current video context. Likewise, the context rules can define a range of gaze metrics indicative of remote scene characteristics that will affect eye gaze image display. As with the prior uses of scene analysis algorithms, the gaze analysis process can calculate current gaze metrics and associated gaze confidence values as statistical quality assessment metrics. The current gaze metrics can then be compared to the range of gaze metrics expected for participants in the current video scene. If the contextual interface 450, via communication event analysis concludes with high gaze direction confidence values that gaze directed image capture or image processing of a local user is appropriate, then the gaze adapting process 495 can provide direction to the cameras 120 to adjust |

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| | image capture (camera selection and settings (zoom, pan, and tilt)) to acquire images for eye contact viewing for the remote viewer. The gaze adapting process 495 can also provide input to the image processor 320, via scene capture management 650, to alter the captured images as necessary to provide eye contact image video imagery for the remote viewer." *See* para. [0144].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Kurtz expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[a]. obtaining a reference image; | Kurtz expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below. |

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| | "As another aspect, in using the video communication device 300 in the residential environment, and particularly with a family, it can be advantageous for the device 300 to recognize individual identities using identity classification as cues to define a video context and an appropriate video capture mode. As mentioned previously, the device 300 can be provided with a user identification process 470 that can use face recognition, voice recognition, biometrics (such as fingerprints), or other techniques, either individually, or in combination to recognize the identity of individuals within the capture field of view. As an example, in the case of the family setting, a device 300 can be programmed with facial images of family members. The device 300 could be operated through an initial set-up process, in which good facial images of each of the family members (users 10) living within a residence are captured by the device 300. The supporting face recognition process can initiate image processing and analysis algorithms to determine whether the captured facial image is sufficient, relative to lighting and pose, for robust identification on an ongoing basis. As an example, the face recognition algorithm of commonly assigned U.S. Pat. No. 7,058,209, "Method And Computer Program Product For Locating Facial Features", by Shoupu et al., could be used for this purpose. This set-up process can then generate one or more quality facial images for each individual, which can be retained as reference images 460 (see FIG. 5A)." *See* para. [0085].<br><br>"Types of system data include: . . . Reference images 460[.]" *See* para. [0104], Table 3.<br><br>"Video capture modes, defining video capture and processing settings, can then be associated with the video context classifications. Video context classification can be supported by a set of quantitative activity attributes (such as the number of people (or faces), areas of significant activity or distributions of people, FOV, rates of motion, or patterns of motion). Video context (event) classification can also be supported by a library of pre-defined reference images, with associated supporting reference data and statistics. For example, the quantitative measures related to one or two local users engaged in a purposeful activity would typically be quite different from the quantitative |

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| | measures for a large number of people (15, for example) engaged in a party." *See* para. [0108].<br><br>"Other contextual issues are often evidenced in personal human interactions. For example, it is not uncommon to clean the house or residence, or at least part thereof, before having visitors over. As previously suggested, users 10 may have similar concerns when using the video communications system 290. It is possible that some users 10 may want their video communication device 300 to assist in the process of having their local environment 415 appear cleaner or more organized. This type of issue can be addressed by providing an optional appearance altering interface 490, which can be an additional feature to the contextual interface 450. As an example, video communication device 300 can employ a set-up process to acquire one or more reference images 460 of the local environment 415, as illustrated in FIG. 5B. As these reference images 460 basically represent calibration standards, the users 10 would be encouraged to have the local environment 415 clean and clear, as well as well lit, for this process. Then, subsequently when a local user 10 desires that the device 300 enhance the appearance of a local environment, the device can access the appropriate reference images, and assemble and apply an alteration to the captured imagery of the local environment. For example, the interface controls 190 can include a "de-clutter" button that a user 10 can use to activate this process one or more times. A first application may remove the appearance of dust and small debris. Further applications could remove larger objects 260 (such as the lamp of FIG. 2). Of course, if a user 10, during the course of a communication event 600, then interacts with a hidden object, such as the lamp, the visual incongruities for the remote viewer could be interesting. Presumably, such a hidden object would then be included in the subsequent imagery acquired during that communication event. Users 10 would provide their input through the user interface portion of the appearance altering interface 490. The interface 490, in turn would provide direction or input to scene capture management 650 relative to the video processing effects applied to an ongoing video capture." *See* para. [0122].<br><br>"It can also be anticipated that some users 10 may potentially also desire that the appearance altering interface 490 have capabilities to alter personal appearance, relative |

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| | to their skin, hair, clothing, or other aspects. For example, a user 10 may have the video communication device 300; through the appearance altering interface 490 of the contextual interface 450, for cosmetic reasons, change the appearance of their face 25, hair 40, or color of clothes. In such instances, it can be useful to use a reference image 460 of the user 10, in addition to current images of the same user 10, to create these effects. A comparable process can also be provided for altering the voice characteristics of the users 10." *See* para. [0123].<br><br>"The reference images 460 can also be used as targets for providing acceptable image quality, by adjusting the current color values towards the expectation color values present in these images." *See* para. [0125].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Kurtz expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"As another aspect, in using the video communication device 300 in the residential environment, and particularly with a family, it can be advantageous for the device 300 to recognize individual identities using identity classification as cues to define a video context and an appropriate video capture mode. As mentioned previously, the device 300 can be provided with a user identification process 470 that can use face recognition, voice recognition, biometrics (such as fingerprints), or other techniques, either individually, or in combination to recognize the identity of individuals within the capture field of view. As an example, in the case of the family setting, a device 300 can be programmed with facial images of family members. The device 300 could be operated through an initial set-up process, in which good facial images of each of the family members (users 10) living within a residence are captured by the device 300. The |

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| | supporting face recognition process can initiate image processing and analysis algorithms to determine whether the captured facial image is sufficient, relative to lighting and pose, for robust identification on an ongoing basis. As an example, the face recognition algorithm of commonly assigned U.S. Pat. No. 7,058,209, "Method And Computer Program Product For Locating Facial Features", by Shoupu et al., could be used for this purpose. This set-up process can then generate one or more quality facial images for each individual, which can be retained as reference images 460 (see FIG. 5A)." *See* para. [0085].<br><br>"Types of system data include: . . . Reference images 460[.]" *See* para. [0104], Table 3.<br><br>"Video capture modes, defining video capture and processing settings, can then be associated with the video context classifications. Video context classification can be supported by a set of quantitative activity attributes (such as the number of people (or faces), areas of significant activity or distributions of people, FOV, rates of motion, or patterns of motion). Video context (event) classification can also be supported by a library of pre-defined reference images, with associated supporting reference data and statistics. For example, the quantitative measures related to one or two local users engaged in a purposeful activity would typically be quite different from the quantitative measures for a large number of people (15, for example) engaged in a party." *See* para. [0108].<br><br>"Other contextual issues are often evidenced in personal human interactions. For example, it is not uncommon to clean the house or residence, or at least part thereof, before having visitors over. As previously suggested, users 10 may have similar concerns when using the video communications system 290. It is possible that some users 10 may want their video communication device 300 to assist in the process of having their local environment 415 appear cleaner or more organized. This type of issue can be addressed by providing an optional appearance altering interface 490, which can be an additional feature to the contextual interface 450. As an example, video communication device 300 can employ a set-up process to acquire one or more reference images 460 of the local environment 415, as illustrated in FIG. 5B. As these reference images 460 basically |

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| | represent calibration standards, the users 10 would be encouraged to have the local environment 415 clean and clear, as well as well lit, for this process. Then, subsequently when a local user 10 desires that the device 300 enhance the appearance of a local environment, the device can access the appropriate reference images, and assemble and apply an alteration to the captured imagery of the local environment. For example, the interface controls 190 can include a "de-clutter" button that a user 10 can use to activate this process one or more times. A first application may remove the appearance of dust and small debris. Further applications could remove larger objects 260 (such as the lamp of FIG. 2). Of course, if a user 10, during the course of a communication event 600, then interacts with a hidden object, such as the lamp, the visual incongruities for the remote viewer could be interesting. Presumably, such a hidden object would then be included in the subsequent imagery acquired during that communication event. Users 10 would provide their input through the user interface portion of the appearance altering interface 490. The interface 490, in turn would provide direction or input to scene capture management 650 relative to the video processing effects applied to an ongoing video capture." *See* para. [0122].<br><br>"It can also be anticipated that some users 10 may potentially also desire that the appearance altering interface 490 have capabilities to alter personal appearance, relative to their skin, hair, clothing, or other aspects. For example, a user 10 may have the video communication device 300; through the appearance altering interface 490 of the contextual interface 450, for cosmetic reasons, change the appearance of their face 25, hair 40, or color of clothes. In such instances, it can be useful to use a reference image 460 of the user 10, in addition to current images of the same user 10, to create these effects. A comparable process can also be provided for altering the voice characteristics of the users 10." *See* para. [0123].<br><br>"The reference images 460 can also be used as targets for providing acceptable image quality, by adjusting the current color values towards the expectation color values present in these images." *See* para. [0125]. |

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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Kurtz expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping. *See*, *e.g.*, disclosures below.<br><br>"As another aspect, in using the video communication device 300 in the residential environment, and particularly with a family, it can be advantageous for the device 300 to recognize individual identities using identity classification as cues to define a video context and an appropriate video capture mode. As mentioned previously, the device 300 can be provided with a user identification process 470 that can use face recognition, voice recognition, biometrics (such as fingerprints), or other techniques, either individually, or in combination to recognize the identity of individuals within the capture field of view. As an example, in the case of the family setting, a device 300 can be programmed with facial images of family members. The device 300 could be operated through an initial set-up process, in which good facial images of each of the family members (users 10) living within a residence are captured by the device 300. The supporting face recognition process can initiate image processing and analysis algorithms to determine whether the captured facial image is sufficient, relative to lighting and pose, for robust identification on an ongoing basis. As an example, the face recognition algorithm of commonly assigned U.S. Pat. No. 7,058,209, "Method And Computer Program Product For Locating Facial Features", by Shoupu et al., could be used for this purpose. This set-up process can then generate one or more quality facial images for each individual, which can be retained as reference images 460 (see FIG. 5A)." *See* para. [0085].<br><br>"Types of system data include: . . . Reference images 460[.]" *See* para. [0104], Table 3. |

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| | "Video capture modes, defining video capture and processing settings, can then be associated with the video context classifications. Video context classification can be supported by a set of quantitative activity attributes (such as the number of people (or faces), areas of significant activity or distributions of people, FOV, rates of motion, or patterns of motion). Video context (event) classification can also be supported by a library of pre-defined reference images, with associated supporting reference data and statistics. For example, the quantitative measures related to one or two local users engaged in a purposeful activity would typically be quite different from the quantitative measures for a large number of people (15, for example) engaged in a party." *See* para. [0108].<br><br>"Other contextual issues are often evidenced in personal human interactions. For example, it is not uncommon to clean the house or residence, or at least part thereof, before having visitors over. As previously suggested, users 10 may have similar concerns when using the video communications system 290. It is possible that some users 10 may want their video communication device 300 to assist in the process of having their local environment 415 appear cleaner or more organized. This type of issue can be addressed by providing an optional appearance altering interface 490, which can be an additional feature to the contextual interface 450. As an example, video communication device 300 can employ a set-up process to acquire one or more reference images 460 of the local environment 415, as illustrated in FIG. 5B. As these reference images 460 basically represent calibration standards, the users 10 would be encouraged to have the local environment 415 clean and clear, as well as well lit, for this process. Then, subsequently when a local user 10 desires that the device 300 enhance the appearance of a local environment, the device can access the appropriate reference images, and assemble and apply an alteration to the captured imagery of the local environment. For example, the interface controls 190 can include a "de-clutter" button that a user 10 can use to activate this process one or more times. A first application may remove the appearance of dust and small debris. Further applications could remove larger objects 260 (such as the lamp of FIG. 2). Of course, if a user 10, during the course of a communication event 600, then interacts with a hidden object, such as the lamp, the visual incongruities for the remote viewer could be interesting. Presumably, such a hidden object would then be included in |

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| | the subsequent imagery acquired during that communication event. Users 10 would provide their input through the user interface portion of the appearance altering interface 490. The interface 490, in turn would provide direction or input to scene capture management 650 relative to the video processing effects applied to an ongoing video capture.” *See* para. [0122].<br><br>“It can also be anticipated that some users 10 may potentially also desire that the appearance altering interface 490 have capabilities to alter personal appearance, relative to their skin, hair, clothing, or other aspects. For example, a user 10 may have the video communication device 300; through the appearance altering interface 490 of the contextual interface 450, for cosmetic reasons, change the appearance of their face 25, hair 40, or color of clothes. In such instances, it can be useful to use a reference image 460 of the user 10, in addition to current images of the same user 10, to create these effects. A comparable process can also be provided for altering the voice characteristics of the users 10.” *See* para. [0123].<br><br>“The reference images 460 can also be used as targets for providing acceptable image quality, by adjusting the current color values towards the expectation color values present in these images.” *See* para. [0125].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants’ Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 8** | |

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| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Kurtz expressly and/or inherently discloses and/or renders obvious further comprising applying a translation transformation to move the image within display area of the monitor n. *See*, *e.g.*, disclosures below.<br><br>"Most simply and obviously, the user interface 440 can include interface controls 190 such as a system on/off switch, an audio output volume control, a display brightness control, and other common user controls typical to televisions and computer monitors . . . Additionally, these interface controls 190 can provide or enable control of an image capture device 120, relative to zooming, panning, tilting, and other camera type functions." *See* para. [0048].<br><br>"However, the NFOV camera can have automatic pan, tilt, and zoom adjustment capabilities, such that its NFOV 420 can be changed in size and location, in response to signals from a remote device or from computer 340 enabling device 300 to follow activity within a local environment 415. While the narrow field of view information can be extracted in image processing from the images captured by a WFOV camera, the image quality is likely to be better by having a separate dedicated NFOV camera." *See* para. [0049].<br><br>"As described, the contextual interface 450 can have several operational modes (or video capture modes) to enable it to assist users 10 in capturing and sharing their activities with remote viewers. Although the device 300 can operate in a WFOV only mode, in practice, many users 10 will want the device 300 to use zoom, pan, and tilt functions to localize and track activities within an environment 415." *See* para. [0090].<br><br>"However, small intra-scene changes in the video capture (such as panning a camera to include a second (new) local individual can provide a benefit to a remote viewer beyond just compensating for image or audio quality losses." *See* para. [0099].<br><br>"The quality of image capture to obtain images that enable enhanced eye contact can depend on the configuration of the video communication device 300. As an example, a device 300 can include a wide angle image capture device 120, a second image capture |

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| | device 120 which is imbedded behind the display screen 115, and a third image capture device 120 which is mounted somewhere outside the image display screen 1 15. The second image capture device 120 likely has a NFOV and zoom capability. Its pan and tilt capabilities can be limited by the construction of the display 110 (if for example, it is a device of the type of FIG. 9B), and it may be best used along an optical axis 170′ (see FIG. 10). The third image capture device 120 also likely has a NFOV and zoom capability, but as it is not imbedded behind the display screen 115, its pan and tilt capabilities can be larger. This image capture device 120 can acquire quality images from the local environment 415 under more diverse circumstances, such as along an optical axis 170″ (see FIG. 10). Thus, it can potentially capture direct-on images of local users 10 a (or objects 260) over a wider range of capture geometries. In the manner of Hillis et al. '417, multiple non-imbedded, panning and tilting, cameras 120 can be used to provide facial images of a user 10, from which a composite eye contact image can be created. However, a user 10 may simply not be looking towards display 110 or a camera 120. Thus at some point, image capture that enables good eye contact may neither be contextually relevant or technically possible." *See* para. [0138].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the | Kurtz expressly and/or inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. *See*, *e.g.*, disclosures below. |

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| monitor, so as to enhance shading or illumination in the image. | "Most simply and obviously, the user interface 440 can include interface controls 190 such as a system on/off switch, an audio output volume control, a display brightness control, and other common user controls typical to televisions and computer monitors." *See* para. [0048].<br><br>"Alternately, an image area 422 can be modified or obscured with other visual effects, such as distorting, blurring (lowering resolution), or shading (reducing brightness or contrast). For example, the shading can be applied as a gradient, to simulate a natural illumination fall-off." *See* para. [0067].<br><br>"As an example, the purposeful event of video scene 620 of FIG. 4C has become a more relaxed and spontaneous event in video scene 620′ for which a larger field of view, aided by gradual pan, tilting, and zooming, and brightness and contrast corrections might be appropriate to provide enhanced video to the remote viewers." *See* para. [0112].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Kurtz expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h]. |

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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | Kurtz expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*:<br><br>"The video communication device 300 can also enable the users 10 to change the capture conditions, and particularly the image capture field of view 420. As shown in FIG. 2, a device 300 may view a local site 362, such as a kitchen. However, as an example, the entire image capture field of view 420 that can be captured by a camera 120 may extend further within a residence than just the kitchen. For any variety of reasons, the local user may want to limit the image field of view 420. This may be done simply by closing a door or turning off some locally positioned room lighting. The local image capture can also be limited by using the privacy settings to predefine that only a NFOV image capture device 120 be used. As a further step, the pan tilt and zoom controls for a NFOV image capture device 120 can also be restricted, thereby limiting the expanded field of view and motion tracking capabilities of device 300 for a communication event." *See* para. [0065].<br><br>"Alternately, a local user 10 can electronically modify the image captured to form a modified image for transmission that removes a portion of the field of view 420 denoted as image area 422. Although users 10 may define image areas 422 for exclusion from video capture for various reasons, maintenance of personal or family privacy is likely the key motivator. As shown in FIG. 4A, an image capture device 120 (the WFOV camera) has a portion of its image field of view 420, indicated by image area 422, modified, for example, by cropping image area 422 out of the captured image before image transmission across network 360 to a remote site 364. The local user 10 can utilize |

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| | the privacy interface 400 and the contextual interface 450 to establish human perceptible modifications to a privacy sensitive image area 422. It is expected that a user 10 may pre-determine privacy settings, based partially on human perception and emotional sensitivity to image features or content, during a preview mode prior to a video communication event, although users 10 may want to modify the captured image area during the course of an ongoing event. Preview mode setting may be done with images displayed on the larger display screen 115, or on the split screen image 410." *See* para. [0066].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | Kurtz expressly and/or inherently discloses and/or renders obvious varying resolution of the image according to the distance. *See*, *e.g.*, disclosures below.<br><br>"Thus, it can be anticipated that the default settings for camera control at the beginning of many communication events will have a WFOV image capture device 120 capture imagery for all or most of its image capture field of view 420. As a result, a remote user 10 b will at least initially observe a local user 10 a in the larger context of their local environment 415. As a typical communication event continues, either a local user 10 a or a remote user 10 b may desire the image capture to be closed in on localized activity (a NFOV) within the local environment 415 . . . However, at some point, the resulting image quality (particularly the resolution) obtained by electronic zooming will be sufficiently reduced that use of optical zooming or a NFOV image capture device 120 (or the combination thereof) will be appropriate." *See* para. [0073].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Kurtz alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| | Defendants’ Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |



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# Exhibit A-08: Invalidity of U.S. Patent No. 8,982,109 in view of WO Patent Pub. No. 2006/108279 ("Lizee")

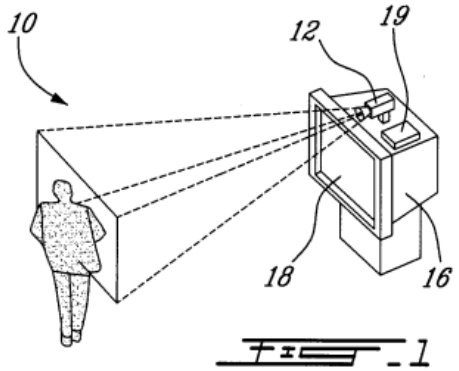
This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

Lizee was originally filed April 11, 2006 and published October 19, 2006, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a) and (b).

Lizee anticipates the Asserted Claims of the '109 Patent. To the extent it is found Lizee does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Lizee does not anticipate the Asserted Claims, Lizee renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

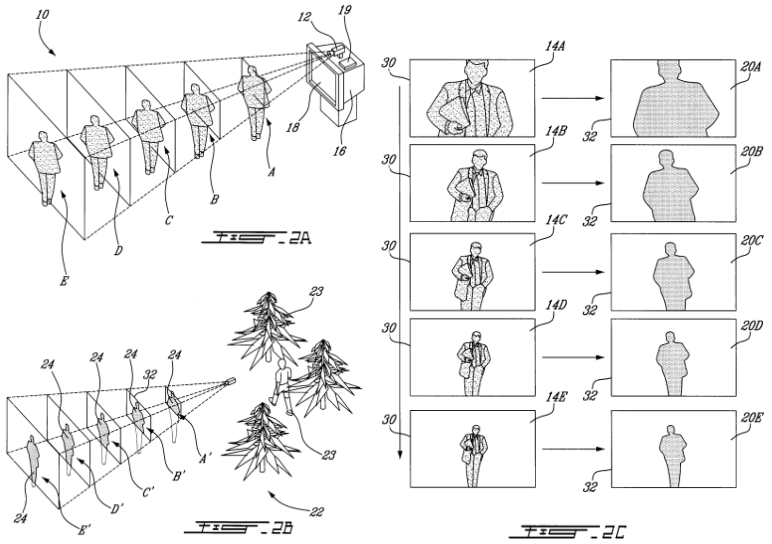
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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Lizee expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"Referring to Figure 1, a virtual presence system, generally referred to using the reference numeral 10 and in accordance with an illustrative embodiment of the present invention, will now be presented. The virtual presence system 10 generally comprises an image capture device 12 for capturing images of a user, as in reference 14 of Figure 1A, a display 16 comprising a display screen 18, and a computing device 19 for interpreting the captured images 14 provided by the image capture device 12 and communicating a corresponding image, as in reference 20 of Figure 1B, for display on the screen 18. As a result, the processed image 20, derived from the captured images 14 of the user, is provided on the screen 18 (Figure 1C) and virtually immersed in the virtual environment 22 of the system 10, as illustrated in Figure 1D." See para. [0029].<br><br>  <br><br>Fig. 1<br><br>See Fig. 1.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the |

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| | teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | Lizee expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera *See*, *e.g.*, disclosures below.<br><br>"Referring to Figure 1, a virtual presence system, generally referred to using the reference numeral 10 and in accordance with an illustrative embodiment of the present invention, will now be presented. The virtual presence system 10 generally comprises an image capture device 12 for capturing images of a user, as in reference 14 of Figure 1A, a display 16 comprising a display screen 18, and a computing device 19 for interpreting the captured images 14 provided by the image capture device 12 and communicating a corresponding image, as in reference 20 of Figure 1B, for display on the screen 18. As a result, the processed image 20, derived from the captured images 14 of the user, is provided on the screen 18 (Figure 1C) and virtually immersed in the virtual environment 22 of the system 10, as illustrated in Figure 1D.<br><br>"To implement the system, various image capture devices 12 may be considered. For instance, the image capture device may comprise a digital video camera coupled to a screen grabber software or hardware interacting with and/or in the computing device 19, an analog camera providing a continuous video feed to an analog-to-digital (A/D) converter used in conjunction with the computing device 19, as well as any other conventional or specialized imaging device such as infra-red (IR) devices, thermal imaging devices, sonar devices and the like. Other such imaging devices will be apparent to a person of ordinary skill in the art." *See* paras. [0029]-[0030].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Lizee expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. *See*, *e.g.*, disclosures below.<br><br>"With particular reference now to Figures 1C and 1D, the image 20 projected on the screen 18 is illustratively represented by a translucent mirrored silhouette transformation (hereinafter referred to as a silhouette image 20) of the captured image 14. In other words, the captured image 14 is isolated by the computing device 19, inverted from left to right about a vertical axis, and transformed into a translucent silhouette image 20 (Figure 1B) for display on the screen 18 (Figure 1C)." *See* para. [0034].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Lizee expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror. *See*, *e.g.*, disclosures below.<br><br>"(As will be discussed further hereinbelow, estimated and/or extrapolated data could be used to enhance visualization of the silhouette model in areas where real-time data is unavailable.)" *See* para. [0048].<br><br>"As mentioned hereinabove, the lateral motion of the user may also be used to control actions of the silhouette model 24 and the virtual camera 28 in the virtual environment 22. For instance, when the user moves to the left, the silhouette image 20 will be moved to the left side of the frame 32 thereof. By detecting this lateral displacement, the |

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| | silhouette model 24 could also be correspondingly displaced in the virtual environment 22. Alternatively, a position or viewpoint of the virtual camera 28 could be moved to reflect a change in the viewing direction of the virtual silhouette 24." *See* para. [0057].<br><br>"As such, a person skilled in the art will recognize that the typical camera movements used in 3D software, like zooming and panning can be available with this system 10, as well as other movements such as moving and dollying. To enhance the visualization of the latter two, additional software and hardware algorithms may be used to address various reorientations of the silhouette model 24 and various perspective inconsistencies attributed thereto.<br><br>"Furthermore, other visual effects may be generated by the motion of the user relative to the image capture device 12. For example, the displacement of the user and/or his position relative to the video capture device 12 may be used in conjunction with state information in the virtual environment 22 to control the position and/or the orientation of the silhouette model 24. For instance, in a game setting, a user moving from the left to the right of the image capture device 12 could instruct a silhouette model 24 to orbit around an object rather than to strictly move from left to right. Alternatively, a user moving three (3) feet to the left could instruct a silhouette model 24 to move four times as much to give the user a feeling of power or speed.<br><br>"Many other examples may also be considered. For instance, as the system 10 detects a motion of the user, the computing device 19 may be configured to implement various motions and/or displacements of the silhouette model 24 in the virtual environment 22, or again implement various modifications to a visualization thereof from the perspective of the virtual camera 28. For example, user arm, leg, hand, head and body motions may be mapped by corresponding motions of the virtual model 24 in the virtual environment 22. Also, user motions may be used to implement virtual displacements of the virtual model 24 such as a forward displacement, a backward displacement, an orbital displacement, a rotational displacement and a side displacement. Alternatively, user motions may be detected and used to control various virtual camera perspective modifications, which may include moving, rotating, panning, zooming, orbiting and/or |

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| | dollying the virtual camera relative to the silhouette model 24 and/or the virtual environment. A person skilled in the art, namely in the art of video game and virtual reality system development, will understand that such controller mapping features and options used to generate and enhance user immersion, impressions, and experiences may be readily adapted to the system 10 without departing from the general scope and nature of the present disclosure." *See* para. [0061]-[0063].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Lizee expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera. *See*, *e.g.*, disclosures below.<br><br>"As illustrated by Figures 2A and 2B, the projection 26 is adapted to compensate for the displacement of the user relative to the image capture device 12, which displacement is also used to move the silhouette model 24 in the virtual environment 22. For instance, as the user moves from positions A to E in the real world (Figure 2A), the position of the silhouette model 24 moves from corresponding positions A' to E' in the virtual environment 22 (Figure 2B), yet the size of the silhouette remains the same. Additionally, as the user moves from side to side, the silhouette model 24 can also move accordingly.<br><br>"In Figure 2C, the captured images 14A to 14E and their respective silhouette images 2OA to 2OE are presented for the aforementioned positions A to E in the real world of Figure 2A. As the user moves backward from position A to E, the size of the captured and silhouette images 14 and 20 change within their respective frames 30 and 32." *See* paras. [0040]-[0041]. |

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| | "To position the silhouette model 24 within the virtual environment 22 and to adapt the projection 26 to compensate for the displacement of the user relative to the image capture device 12, an estimate distance of the user from the image capture device 12 is used." *See* para. [0043].<br><br>"Referring now to Figure 4, the framing 34 of the virtual camera 28 may also be altered dynamically to provide a zooming action. For instance, the user may use a backward motion to implement a zoom-out function in the application. As the distance of the user from the image capture device 12 increases, the virtual camera framing 34 may also increase, thereby providing a zoom-out effect that may optionally be dynamically coupled to a rearward motion of the silhouette model 24 in the virtual environment 22." *See* para. [0056].<br><br>  <br><br>*See* Figs. 2A-C. |

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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | Lizee expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below.<br><br>"With particular reference now to Figures 1C and 1D, the image 20 projected on the screen 18 is illustratively represented by a translucent mirrored silhouette transformation (hereinafter referred to as a silhouette image 20) of the captured image 14. In other words, the captured image 14 is isolated by the computing device 19, inverted from left to right about a vertical axis, and transformed into a translucent silhouette image 20 (Figure 1B) for display on the screen 18 (Figure 1C)." See para. [0034].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Lizee expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"To implement the system, various image capture devices 12 may be considered. For instance, the image capture device may comprise a digital video camera coupled to a screen grabber software or hardware interacting with and/or in the computing device 19, an analog camera providing a continuous video feed to an analog-to-digital (A/D) converter used in conjunction with the computing device 19, as well as any other |

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| | conventional or specialized imaging device such as infra-red (IR) devices, thermal imaging devices, sonar devices and the Like. Other such imaging devices will be apparent to a person of ordinary skill in the art." *See* para. [0030].<br><br>"By implementing such a calculation in the system 10 in real-time for each captured image 12 and corresponding silhouette image 20, or again periodically at a predetermined imaging rate, the position of the user relative to the image capture device 12 may be calculated in real-time. This information can then be used to control the position and orientation of the silhouette model 24 in the virtual environment 22, and that again in real-time." *See* para. [0045].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Lizee expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video feed. *See*, *e.g.*, disclosures below.<br><br>"To position the silhouette model 24 within the virtual environment 22 and to adapt the projection 26 to compensate for the displacement of the user relative to the image capture device 12, an estimate distance of the user from the image capture device 12 is used. Illustratively, by comparing the number of pixels used to render the silhouette image 20 of a selected part or portion of the user at a given position (portions/parts including, but not limited to the user's head, arm, hand, torso or again any object carried by the user), with the number of pixels used to render a same part or portion at a known position, the distance between the two positions may be estimated." *See* para. [0043].<br><br>"As will be apparent to a person of skill in the art, other such methods and algorithms may be used to calculate user distances and motion without departing from the general scope and nature of the present disclosure. For instance, the average number of pixels |

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| | used in each scan line of the silhouette image 20, or of a predefined part or portion thereof, may be used to linearly interpolate the distance of the user from the image capture device 12. Alternatively, the distance between the user and the video capture device 12 may be computed using a tracking object having a known shape and size and identifying its relative distance to the image capture device 12, and thus the distance of the user carrying it, using conventional image recognition techniques. In this latter method, tracking object orientation, and thus user orientation, may also be calculated by tracking variations in the captured shape thereof. For example, a circular object may provide an elliptical image when the object is rotated, and thus provide a means to establish the object's orientation based on the eccentricity of the perceived ellipse." *See* para. [0046].<br><br>"Additional position tracking systems may also be coupled to the system to provide distance measurements to the system 10. For instance, one or more sonic and/or optical radar devices and techniques may be used in conjunction with the image capture device 12 to provide accurate distance measurements. Such complementary or supplementary positioning device(s) could be coupled to the system 10 to provide user distance and positioning data thereto to supplement data acquired via the image capture device 12." *See* para. [0047].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Lizee expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. *See*, *e.g.*, disclosures below.<br><br>"The computing device 19 may also comprise one or more processors, possibly interacting with active RAM, to implement and control the various software and |

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| | hardware components, instructions and programs, and other such components that should be readily apparent to a person of skill in the art." *See* para. [0032].<br><br>"[0036] As will be apparent to a person of skill in the art, various image processing and combination software and hardware algorithms may be implemented by the computing device 19 to produce similar effects. Namely, a user image may first be extracted from the captured image 14 and then transformed into a silhouette representation thereof for subsequent reversal and combination on the screen 18. As will be discussed further hereinbelow, other image rendering and transfer techniques including, but not limited to, image outlines, graphical overlays, shadows, 3D meshes and mappings and the like, may also be used to produce a similar effect. For the sake of simplicity, the following discussion will concentrate on the use of a silhouette image, as in 20 of Figure 1 B, to represent the user via silhouette model 24 in the virtual environment 22, though the above and other user visualization techniques may be considered therein without extending the scope and general nature of the present disclosure.<br><br>"To generate the silhouette image 20, various image processing and isolation techniques and methods may be considered. For example, the silhouette image 20 may be obtained from the captured image 14 using a difference matte. This technique requires that a background image be captured without the user. The silhouette image 20 is then computed once the user is in place in front of the matte by detecting color differences of the pixels respectively corresponding to the background image and the captured image 14. A detected color difference greater than a predefined threshold will identify a pixel that is to be part of the silhouette image 20, thereby isolating the image of the user from the background. A person skilled in the art will understand that any of the other conventional or proprietary difference matte algorithms may be considered to achieve a similar result." *See* paras. [0036]-[0037].<br><br>"Referring now to Figure 4, the framing 34 of the virtual camera 28 may also be altered dynamically to provide a zooming action. For instance, the user may use a backward motion to implement a zoom-out function in the application. As the distance of the user from the image capture device 12 increases, the virtual camera framing 34 may also |

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| | increase, thereby providing a zoom-out effect that may optionally be dynamically coupled to a rearward motion of the silhouette model 24 in the virtual environment 22." *See* para. [0036]."<br><br>"As will be apparent to a person of ordinary skill in the art, various image enhancing and processing algorithms may be used to improve the visualization of the system 10, namely to adjust any distortion or perceptual inconsistencies associated with a plural-bodied silhouette model 24. For instance, various simulated image corrections could be implemented to address size inconsistencies between objects tracked at different relative distances from the image capture device 12. For example, in the boxing setting presented hereinabove, the images could be processed to compensate for potential perspective errors induced when the user moves his/her fists towards the video capture device. Without visual compensation, the imaged fist would become bigger when it should be getting smaller since the fist moves away from the virtual camera 28. Using visual compensation for movements of the fists relative to the body, these inconsistencies could be addressed. Yet, even without using any elaborate image processing and compensation algorithms, the system 10 will still provide a realistic immersive virtual experience for the user." *See* para. [0084].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image | Lizee inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level |

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| appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | height and pointing horizontally. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Lizee expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[a]. obtaining a reference image; | Lizee expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below.<br><br>"To calibrate the system, that is to provide a known or estimated distance from which other user distances may be calculated, a calibration stage could, for example, ask the user to align his/her head with an on-screen marker predetermined to position an average user at a desired distance. For instance, the image of the head of an average user could coincide with the marker when the user stands at approximately four (4) feet from the image capture device 12. To calibrate the hands of the user, the user could be asked to |

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| | put his/her hands substantially vertically above his/her head, or again lined- up with additional screen markers, such that the hands and head of the user are at a substantially same distance from the image capture device 12 during calibration. A predefined line at the top of the screen could guide this action such that the hands of an average user would exceed that line when standing at the pre-selected distance with his/her hands in the air. In one example, the game could be started once the image of the user's hands has been properly positioned above this calibration line." *See* para. [0081].<br><br>"19. The virtual presence system of any one of Claims 15 to 18, wherein said computing system is further calibrated by defining a reference position for which a calibration image of the user satisfies a pre-selected calibration characteristic, said user position being calculated from a variation of said user image relative to said calibration image." *See* claim 19.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Lizee expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image n. *See*, *e.g.*, disclosures below.<br><br>"To calibrate the system, that is to provide a known or estimated distance from which other user distances may be calculated, a calibration stage could, for example, ask the user to align his/her head with an on-screen marker predetermined to position an average user at a desired distance. For instance, the image of the head of an average user could coincide with the marker when the user stands at approximately four (4) feet from the image capture device 12. To calibrate the hands of the user, the user could be asked to put his/her hands substantially vertically above his/her head, or again lined- up with additional screen markers, such that the hands and head of the user are at a substantially same distance from the image capture device 12 during calibration. A predefined line at |

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| | the top of the screen could guide this action such that the hands of an average user would exceed that line when standing at the pre-selected distance with his/her hands in the air. In one example, the game could be started once the image of the user's hands has been properly positioned above this calibration line." *See* para. [0081].<br><br>"19. The virtual presence system of any one of Claims 15 to 18, wherein said computing system is further calibrated by defining a reference position for which a calibration image of the user satisfies a pre-selected calibration characteristic, said user position being calculated from a variation of said user image relative to said calibration image." *See* claim 19.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Lizee expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping . *See*, *e.g.*, disclosures below.<br><br>"To calibrate the system, that is to provide a known or estimated distance from which other user distances may be calculated, a calibration stage could, for example, ask the user to align his/her head with an on-screen marker predetermined to position an average user at a desired distance. For instance, the image of the head of an average user could coincide with the marker when the user stands at approximately four (4) feet from the image capture device 12. To calibrate the hands of the user, the user could be asked to put his/her hands substantially vertically above his/her head, or again lined- up with additional screen markers, such that the hands and head of the user are at a substantially same distance from the image capture device 12 during calibration. A predefined line at the top of the screen could guide this action such that the hands of an average user would exceed that line when standing at the pre-selected distance with his/her hands in the air. |

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| | In one example, the game could be started once the image of the user's hands has been properly positioned above this calibration line." *See* para. [0081].<br><br>"19. The virtual presence system of any one of Claims 15 to 18, wherein said computing system is further calibrated by defining a reference position for which a calibration image of the user satisfies a pre-selected calibration characteristic, said user position being calculated from a variation of said user image relative to said calibration image." *See* claim 19.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 8** | |
| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Lizee expressly and/or inherently discloses and/or renders obvious further comprising applying a translation transformation to move the image within display area of the monitor. *See*, *e.g.*, disclosures below.<br><br>"As mentioned hereinabove, the lateral motion of the user may also be used to control actions of the silhouette model 24 and the virtual camera 28 in the virtual environment 22. For instance, when the user moves to the left, the silhouette image 20 will be moved to the left side of the frame 32 thereof. By detecting this lateral displacement, the silhouette model 24 could also be correspondingly displaced in the virtual environment 22. Alternatively, a position or viewpoint of the virtual camera 28 could be moved to reflect a change in the viewing direction of the virtual silhouette 24." *See* para. [0057]. |

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| | This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Lizee or inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Lizee expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>See Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the |

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| | teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | Lizee expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*:<br><br>"To position the silhouette model 24 within the virtual environment 22 and to adapt the projection 26 to compensate for the displacement of the user relative to the image capture device 12, an estimate distance of the user from the image capture device 12 is used. Illustratively, by comparing the number of pixels used to render the silhouette image 20 of a selected part or portion of the user at a given position (portions/parts including, but not limited to the user's head, arm, hand, torso or again any object carried by the user), with the number of pixels used to render a same part or portion at a known position, the distance between the two positions may be estimated." See para. [0043].<br><br>"As will be apparent to a person of skill in the art, other such methods and algorithms may be used to calculate user distances and motion without departing from the general scope and nature of the present disclosure. For instance, the average number of pixels used in each scan line of the silhouette image 20, or of a predefined part or portion thereof, may be used to linearly interpolate the distance of the user from the image capture device 12. Alternatively, the distance between the user and the video capture device 12 may be computed using a tracking object having a known shape and size and identifying its relative distance to the image capture device 12, and thus the distance of the user carrying it, using conventional image recognition techniques. In this latter method, tracking object orientation, and thus user orientation, may also be calculated by tracking variations in the captured shape thereof. For example, a circular object may provide an elliptical image when the object is rotated, and thus provide a means to |

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| | establish the object's orientation based on the eccentricity of the perceived ellipse." See para. [0046].<br><br>"Additional position tracking systems may also be coupled to the system to provide distance measurements to the system 10. For instance, one or more sonic and/or optical radar devices and techniques may be used in conjunction with the image capture device 12 to provide accurate distance measurements. Such complementary or supplementary positioning device(s) could be coupled to the system 10 to provide user distance and positioning data thereto to supplement data acquired via the image capture device 12." See para. [0047].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | Lizee inherently discloses and/or renders obvious varying resolution of the image according to the distance. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Lizee alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

# Exhibit A-09: Invalidity of U.S. Patent No. 8,982,109 in view of JP Patent Pub. No. 2006-236013 A ("Miyaoku")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

Miyaoku was originally filed on February 25, 2005 and published on September 7, 2006, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a) and (b).

Miyaoku anticipates the Asserted Claims of the '109 Patent. To the extent it is found Miyaoku does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Miyaoku does not anticipate the Asserted Claims, Miyaoku renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

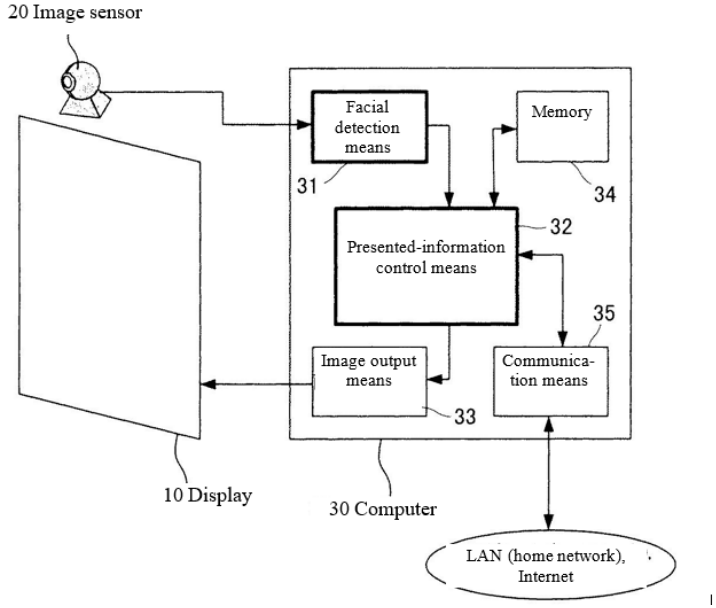
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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Miyaoku expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"OBJECTIVE: To perpetually present information in a form that is easy for the user to notice and visually recognize and further present information without hindering the original functions of the mirror.<br><br>MEANS FOR ACHIEVING THE OBJECTIVE: Facial detection means 31 detects the region representing a human face in the image projected from image sensor 20 that forms the image of the front region of display 10. And presented-information control means 32 alters the information presented and thus displayed on said display based on the position and shape of the facial region thus detected.<br><br>The means for achieving the objective include presenting information in ways suitable for the user's visual recognition according to the distance between the user and the display, presenting animation that moves at a faster or slower speed or stops moving depending on whether the distance to the user is close or far, and altering the magnification ratio of the information according to the variation in the distance between the user and the display." *See* Abstract.<br><br>"Systems that provide information to users through displays embedded in indoor walls and furniture have been proposed in the field of ubiquitous computing research. Such systems are intended to spontaneously increase the opportunities for users to notice such information throughout their everyday lives. Here, such systems shall be referred to as the "environmental information-presentation devices.<br><br>The most basic example configuration of an environmental information-presentation device is a wall-mounted display. It is a thin display with built-in computer and network communication features, such a thin display being mountable on an indoor wall. The wall-mounted display acquires and presents information sequentially from a prescribed |

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| | server on the network. For example, it regularly accesses a server that provides weather forecast information and presents that information.<br><br>The wall-mounted displays can not only present information but also have features for interactions. The wall-mounted displays are essentially the same as ordinary computers. If an input device, such as a button or a touch panel, is provided, the user can use it to manipulate the information to be displayed.<br><br>Videophones, which have become popular in recent years, can be used as a type of environmental information-presentation device. Videophones based on VoIP (Voice Over Internet Protocol) have the ability to obtain information from the Internet. This makes it possible for the videophones’ displays to present information environmentally when not on a call.<br><br>Furthermore, according to some systems that have been developed so far, the existing functions of household goods are extended with computers so that household goods can be used as environmental information-presentation devices. In particular, some mirror systems have been developed with additional features that allow the mirrors to act as wall-mounted displays, given that mirrors are often subject to users’ attention in their daily lives and also comprise surface areas suitable for presenting information.<br><br>For example, Non-Patent Literature 1 describes a system that presents information on a display placed behind a one-way mirror. Said system has an image sensor and also a feature that allows for the reception of optical signals from mobile terminals and the manipulation of information according to the content of the signals.<br><br>Additionally, Non-Patent Literature 2 proposes a system that allows the user to manipulate image information that is virtually presented in a mirror, doing by pointing the image with the hand of his or her own image projected in the mirror. In order to calculate the positional relationship between the user's own figure and the image information presented on the mirror, this system uses a video mirror, whereby an image |

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| | projected from a camera capturing the front of the system is displayed on the display." *See* paras. [0002]-[0008].<br><br>"Furthermore, it is important that the mirror-type environmental information-presentation device has both the original function of a mirror and the ability to present information. To begin with, a mirror is a tool the user uses to confirm his or her appearance based on his or her own reflection in the mirror. Such an original function of the mirror will be hindered if any information is superimposed on the same position as the user's reflection. The mirror-type environmental information-presentation device must have an information presentation mechanism that takes this point into account." *See* para. [0011].<br><br>"Given this factor, the environmental information-presentation device according to the present invention is characterized by comprising a display, an image sensor, a means for detecting faces, and a means for controlling the information presented, wherein:<br><br>The facial detection means detects the region representing a human face in the image projected from the image sensor that forms the image of the front region of the display; and<br><br>The presented-information control means alters the information presented and thus displayed on the display based on the position and shape of the facial region thus detected." *See* para. [0015].<br><br>"Furthermore, the mirror-type environmental information-presentation device has the following mechanism to prevent any interference with the user's act of viewing the mirror.<br><br>That is, in the environmental information-presentation device according to the present invention, the aforementioned presented-information control means calculates the facial presentation region and the truncal presentation region in the display viewport based on the facial region detected by the aforementioned facial detection means and then presents |

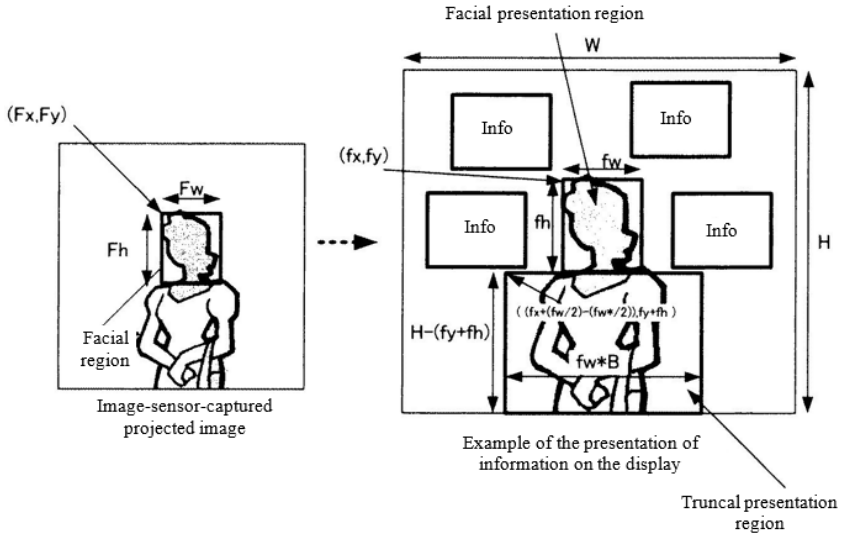
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| | information in regions within the viewport other than the facial and truncal presentation regions.<br><br>Additionally, the environmental information-presentation method according to the present invention is characterized by being adapted to devices equipped with a display, an image sensor, a facial detection means, and a presented-information control means and comprising each processing step performed in the above-mentioned processing means so as to achieve the presentation of environmental information.<br><br>Additionally, the program according to the present invention is characterized by being configured so as to allow the aforementioned environmental information-presentation method to be executed on a computer." [0022]-[0025].<br><br>"The basic example configuration of the environmental information-presentation device according to the present invention is shown in Figure 1. The figure consists of at least display 10, image sensor 20 that forms images of the area from which one can view said display (generally the area in front of the display), and computer 30 that processes projected images input from the image sensor and controls the information presented on the display. Here, computer 30 internally comprises facial detection means 31 that detects a facial region in the image projected from image sensor 20, and presented-information control means 32 that controls the presented information based on the position and shape of the facial region thus detected.<br><br>Facial detection means 31 and presented-information control means 32 may be implemented as software that runs on the OS of computer 30. In this case, computer 10 is equipped with an input/output interface means (e.g., image processing means 33, which is an interface device used to output images onto a display or the like) — such an input/output interface means being provided in order to enable each means (which is software) to process projected images as formed by image sensor 20 and control the output toward display 10 — and memory 34. Furthermore, facial detection means 31, in |

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| | particular, can be implemented using hardware dedicated to processing projected images to improve processing speed.<br><br>The information displayed on display 10 via presented-information control means 32 may be pre-stored in memory 34 of computer 30. Additionally, because a particularly important role of an environmental information-presentation device is to inform users of new information, the device may be configured so as to receive information over a network and present the information thus received. For this purpose, computer 30 is equipped with a communication means 35 for communicating with LAN and the Internet. In this case, presented-information control means 32 basically downloads information from a prescribed server in a sequential manner, converts it into a prescribed form suitable for the environmental information presentation, displays it on display 10, and perpetually repeats these steps.<br><br>The following is an explanation of the operation of the environmental information-presentation device according to the present invention: Image sensor 20 forms the image of the front area of display 10, as described above. Facial detection means 31 processes the projected image in real-time as it is formed by image sensor 20. First, it detects the presence of a human face. And, if a face is detected, it detects the region of the face (the facial region) in the projected image. For example, the technique described in Non-Patent Literature 3 below can be used for such processing. Furthermore, facial detection means 31 sends information about the position and shape of the facial region to presented-information control means 32." *See* paras. [0028]-[0031].<br><br>Figure 1: |

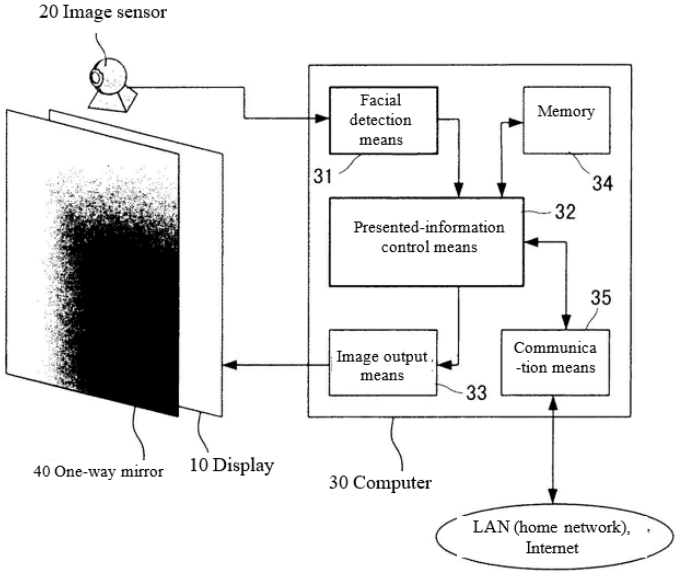
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| |  <br>"(Embodiment 4) Control Based on the Position of Facial region in Mirror-type Environmental Information-Presentation Device<br><br>Figure 6 shows an example configuration of the mirror-type environmental information-presentation device. In the example configuration shown in the figure, a video mirror acts as display 10A. Computer 30A horizontally flips the projected image formed by image sensor 20, converts the size to fit the display size, and thus presents the image on display 10A. As such, it virtually acts as a mirror. Information such as thumbnail images |

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| | presented by presented-information control means 32 is superimposed and thus presented on the image projected from image sensor 20. For this purpose, the present mirror-type environmental information-presentation device is equipped with an image horizontal-flip means 36 and image superimposition means 37, in addition to each means constituting the environmental information-presentation device shown in Figure 1.<br><br>When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:<br><br>First, upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31, the facial presentation region in the viewport on display 10A is calculated based on said facial region position/shape information thus received. For example, suppose that the resolution of the projected image, as formed by image sensor 20, is 500 × 400, and the resolution of the display viewport is 1000 × 800. In this case, the facial presentation region of the display viewport that corresponds to the facial region position/shape information [(Fx, Fy), Fw, and Fh] is a rectangular region with the upper-right-corner coordinates of (Fx*2, Fy*2), the width of Fw*2, and the height of Fh*2.<br><br>The user won't be able to see his or her own face projected in the mirror if an image or other information is displayed in the facial presentation region. Accordingly, presented-information control means 32 prevents information from being presented in the facial presentation region. Additionally, if any information has already been presented in the facial presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region.<br><br>Furthermore, presented-information control means 32 may be configured to control the presentation of information by estimating the truncal presentation region in the display viewport based on the facial region detected by facial detection means 31 so as to present information in regions other than the facial presentation region and the truncal |

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| | presentation region. Figure 7 shows an example presentation of information in such a case. Additionally, an example content of the processing performed by presented-information control means 32 is described below:<br><br>Suppose that the resolution of the viewport on display 10A is W × H, and the facial presentation region calculated by presented-information control means 32 is a rectangular region with the upper-right-corner coordinates of the display viewport being (Fx, Fy), the width being fw, and the height being fh. In this case, the trunk is located below the facial region. It also occupies a region that is wider than the facial region.<br><br>Accordingly, presented-information control means 32 uses a prescribed value B (value representing (Width of the truncal presentation region / Width of the facial presentation region)) to estimate that the truncal presentation region is a rectangular region with the upper right corner coordinate of ((fx+(fw/2)-(fw*B/2)), fy+fh), the width of fw*B, and the height of H-(fy+fh).<br><br>Presented-information control means 32 performs the steps described above to thereby prevent information from being presented in the facial and truncal presentation regions thus calculated. Additionally, if any information has already been presented in the facial or truncal presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region." *See* paras. [0073]-[0080].<br><br>Figure 7: |

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| |  <br>" Figure 8 shows another example configuration of the mirror-type environmental information-presentation device. The present mirror-type environmental information-presentation device has the same basic configuration as that of the environmental information-presentation device shown in Figure 1, except that one-way mirror 40 is affixed to the surface of display 10.<br><br>Technically speaking, it is extremely difficult to calculate where on the mirror's surface the user's figure is projected as viewed from the user's perspective. However, when the above-described steps performed by presented-information control means 32 in the mirror-type environmental information-presentation device that uses a video mirror is applied in the as-is state to the configuration shown in Figure 8, it becomes possible to present information in regions that do not overlap with the user's figure on the mirror. In |

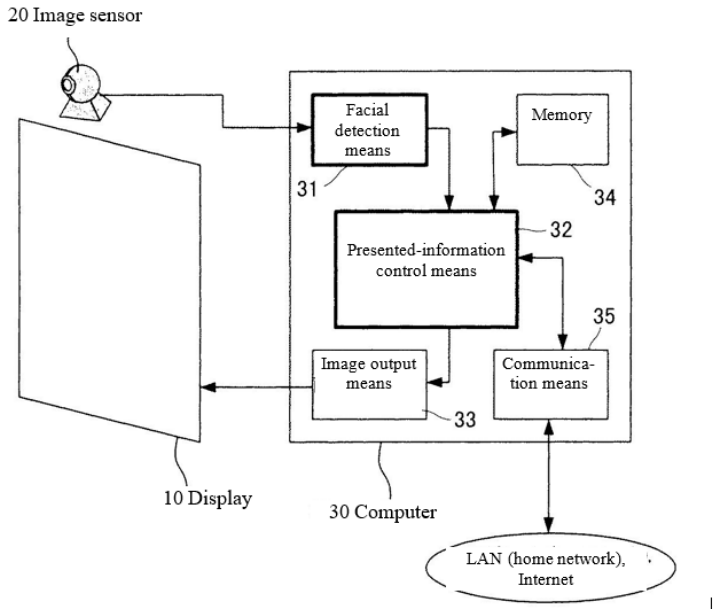
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| | other words, presented-information control means 32 of the mirror-type environmental information-presentation device shown in Figure 8 can also control the position of presented information, doing so through the steps described with reference to figures 6 and 7.<br><br>The embodiments of the environmental information-presentation device according to the present invention are as described above. The environmental information-presentation method according to the present invention corresponds to each presented-information control step performed by the presented-information control means in the environmental information-presentation device described above. The application of the environmental information-presentation method according to the present invention is not limited to the devices illustrated with reference to figures 1, 6, and 8. The environmental information-presentation method according to the present invention may be applied to any device that is equipped with an image sensor, a display, and a computer. For example, a mobile terminal equipped with an image sensor may further comprise facial detection means 31 and presented-information control means 32 in the form of software, etc., so as to present information according to the distance between the terminal and the user's face through the above-described steps.<br><br>Additionally, a part or all of the processing functions of the environmental information-presentation method according to the present invention can be configured as a program that can be executed on a computer." *See* paras. [0081]-[0084].<br><br>Figure 8: |

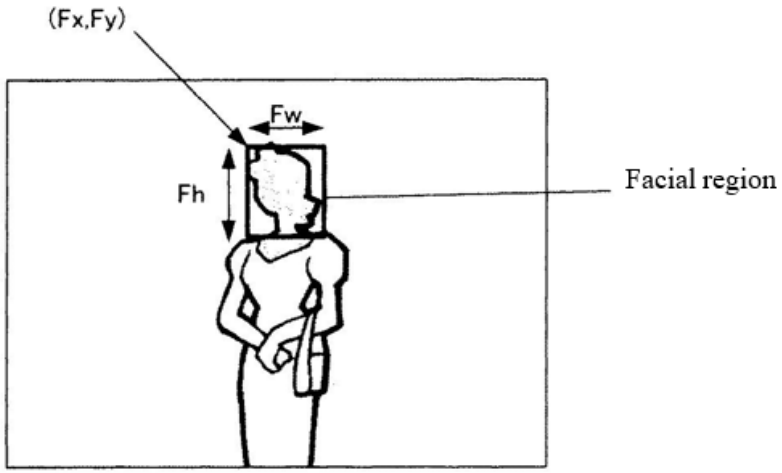
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| |  <br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | Miyaoku expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below. |

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| | "OBJECTIVE: To perpetually present information in a form that is easy for the user to notice and visually recognize and further present information without hindering the original functions of the mirror.<br><br>MEANS FOR ACHIEVING THE OBJECTIVE: Facial detection means 31 detects the region representing a human face in the image projected from image sensor 20 that forms the image of the front region of display 10. And presented-information control means 32 alters the information presented and thus displayed on said display based on the position and shape of the facial region thus detected.<br><br>The means for achieving the objective include presenting information in ways suitable for the user's visual recognition according to the distance between the user and the display, presenting animation that moves at a faster or slower speed or stops moving depending on whether the distance to the user is close or far, and altering the magnification ratio of the information according to the variation in the distance between the user and the display." *See* Abstract.<br><br>"For example, Non-Patent Literature 1 describes a system that presents information on a display placed behind a one-way mirror. Said system has an image sensor and also a feature that allows for the reception of optical signals from mobile terminals and the manipulation of information according to the content of the signals.<br><br>Additionally, Non-Patent Literature 2 proposes a system that allows the user to manipulate image information that is virtually presented in a mirror, doing by pointing the image with the hand of his or her own image projected in the mirror. In order to calculate the positional relationship between the user's own figure and the image information presented on the mirror, this system uses a video mirror, whereby an image projected from a camera capturing the front of the system is displayed on the display." *See* paras. [0007]-[0008].<br><br>"When the user's face is detected through an image sensor installed on the device side, the positional relationship between the device and the user can be estimated based on the |

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| | position and size of the facial region. It also becomes possible to present appropriate information based on the positional relationship thus estimated.<br><br>Given this factor, the environmental information-presentation device according to the present invention is characterized by comprising a display, an image sensor, a means for detecting faces, and a means for controlling the information presented, wherein:<br><br>The facial detection means detects the region representing a human face in the image projected from the image sensor that forms the image of the front region of the display; and<br><br>The presented-information control means alters the information presented and thus displayed on the display based on the position and shape of the facial region thus detected." *See* paras. [0014]-[0015].<br><br>"Additionally, the environmental information-presentation method according to the present invention is characterized by being adapted to devices equipped with a display, an image sensor, a facial detection means, and a presented-information control means and comprising each processing step performed in the above-mentioned processing means so as to achieve the presentation of environmental information." *See* para. [0024].<br><br>"Additionally, because the present invention uses an image sensor, it can be implemented in existing devices that are already equipped with an image sensor, e.g., videophones, thus lowering the cost." *See* para. [0027].<br><br>"The basic example configuration of the environmental information-presentation device according to the present invention is shown in Figure 1. The figure consists of at least display 10, image sensor 20 that forms images of the area from which one can view said display (generally the area in front of the display), and computer 30 that processes projected images input from the image sensor and controls the information presented on the display. Here, computer 30 internally comprises facial detection means 31 that detects a facial region in the image projected from image sensor 20, and presented- |

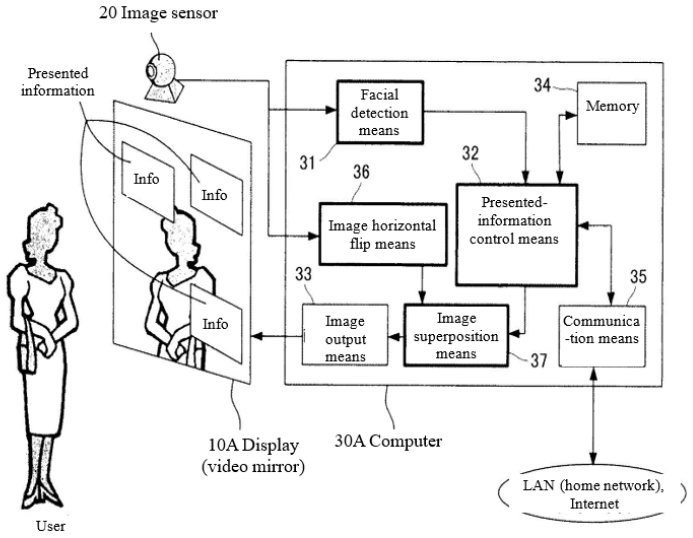
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| | information control means 32 that controls the presented information based on the position and shape of the facial region thus detected.<br><br>Facial detection means 31 and presented-information control means 32 may be implemented as software that runs on the OS of computer 30. In this case, computer 10 is equipped with an input/output interface means (e.g., image processing means 33, which is an interface device used to output images onto a display or the like) — such an input/output interface means being provided in order to enable each means (which is software) to process projected images as formed by image sensor 20 and control the output toward display 10 — and memory 34. Furthermore, facial detection means 31, in particular, can be implemented using hardware dedicated to processing projected images to improve processing speed.<br><br>The information displayed on display 10 via presented-information control means 32 may be pre-stored in memory 34 of computer 30. Additionally, because a particularly important role of an environmental information-presentation device is to inform users of new information, the device may be configured so as to receive information over a network and present the information thus received. For this purpose, computer 30 is equipped with a communication means 35 for communicating with LAN and the Internet. In this case, presented-information control means 32 basically downloads information from a prescribed server in a sequential manner, converts it into a prescribed form suitable for the environmental information presentation, displays it on display 10, and perpetually repeats these steps.<br><br>The following is an explanation of the operation of the environmental information-presentation device according to the present invention: Image sensor 20 forms the image of the front area of display 10, as described above. Facial detection means 31 processes the projected image in real-time as it is formed by image sensor 20. First, it detects the presence of a human face. And, if a face is detected, it detects the region of the face (the facial region) in the projected image. For example, the technique described in Non-Patent Literature 3 below can be used for such processing. Furthermore, facial detection |

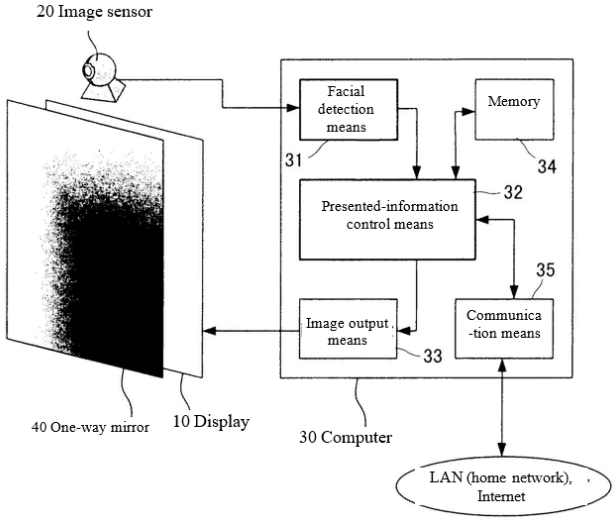
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| | means 31 sends information about the position and shape of the facial region to presented-information control means 32." *See* paras. [0028]-[0031].<br><br>Figure 1:<br><br>  <br><br><br>"Figure 2 shows an example of a facial region detected, by facial detection means 31, in a projected image as formed by image sensor 20. In this example, the facial region is detected as a rectangular region. When such a rectangular facial region is detected, facial detection means 31 sends, to presented-information control means 32, the coordinates (Fx, Fy) of the upper right corner of said rectangular region in the projected image as |

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| | well as the width Fw and the height Fh of the rectangular, all of which act as the facial region position/shape information." *See* para. [0033].<br><br>Figure 2:<br><br>  <br><br><br>"When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:<br><br>First, upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31, the facial presentation region in the viewport on |

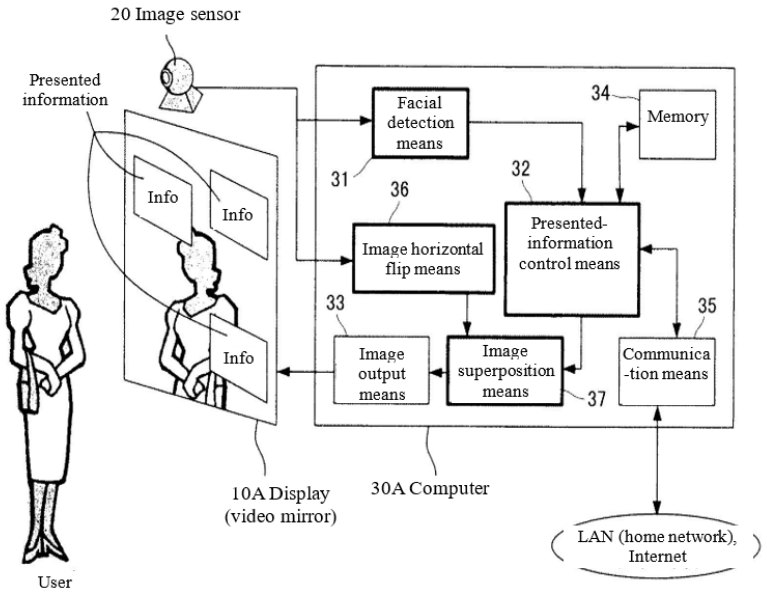
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| | display 10A is calculated based on said facial region position/shape information thus received. For example, suppose that the resolution of the projected image, as formed by image sensor 20, is 500 × 400, and the resolution of the display viewport is 1000 × 800. In this case, the facial presentation region of the display viewport that corresponds to the facial region position/shape information [(Fx, Fy), Fw, and Fh] is a rectangular region with the upper-right-corner coordinates of (Fx*2, Fy*2), the width of Fw*2, and the height of Fh*2." *See* paras. [0074]-[0075].<br><br>"The embodiments of the environmental information-presentation device according to the present invention are as described above. The environmental information-presentation method according to the present invention corresponds to each presented-information control step performed by the presented-information control means in the environmental information-presentation device described above. The application of the environmental information-presentation method according to the present invention is not limited to the devices illustrated with reference to figures 1, 6, and 8. The environmental information-presentation method according to the present invention may be applied to any device that is equipped with an image sensor, a display, and a computer. For example, a mobile terminal equipped with an image sensor may further comprise facial detection means 31 and presented-information control means 32 in the form of software, etc., so as to present information according to the distance between the terminal and the user's face through the above-described steps." *See* para. [0083].<br><br>Figure 6: |

**Commented [WM1]:** @Mathur, Pallavi @Friedman, Joshua - global edit on extra space

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| |  <br>Figure 8: |

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| |  <br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Miyaoku expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. *See*, *e.g.*, disclosures below. |

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| | "(Embodiment 4) Control Based on the Position of Facial region in Mirror-type Environmental Information-Presentation Device<br><br>Figure 6 shows an example configuration of the mirror-type environmental information-presentation device. In the example configuration shown in the figure, a video mirror acts as display 10A. Computer 30A horizontally flips the projected image formed by image sensor 20, converts the size to fit the display size, and thus presents the image on display 10A. As such, it virtually acts as a mirror. Information such as thumbnail images presented by presented-information control means 32 is superimposed and thus presented on the image projected from image sensor 20. For this purpose, the present mirror-type environmental information-presentation device is equipped with an image horizontal-flip means 36 and image superimposition means 37, in addition to each means constituting the environmental information-presentation device shown in Figure 1.<br><br>When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:" *See* paras. [0073]-[0074].<br><br>Figure 6: |

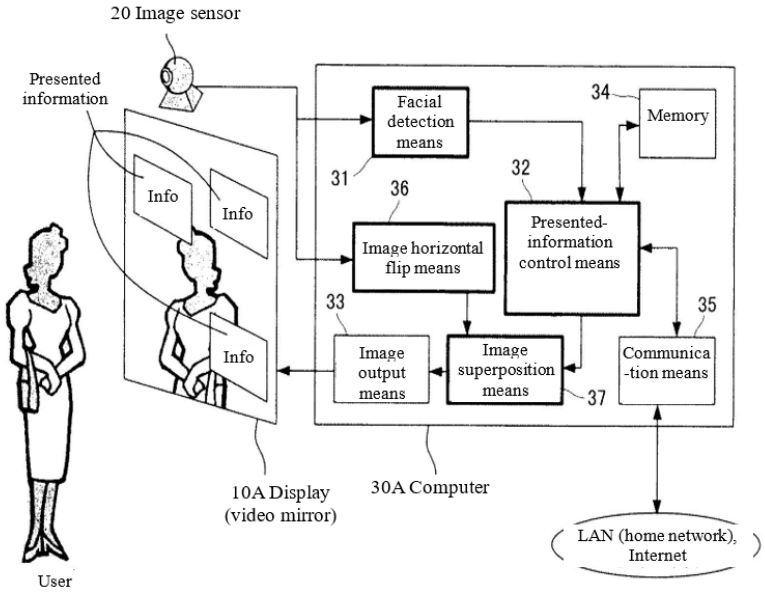
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| |  <br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants’ Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Miyaoku expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror. *See*, *e.g.*, disclosures below.<br><br>"When the user's face is detected through an image sensor installed on the device side, the positional relationship between the device and the user can be estimated based on the position and size of the facial region. It also becomes possible to present appropriate information based on the positional relationship thus estimated.<br><br>Given this factor, the environmental information-presentation device according to the present invention is characterized by comprising a display, an image sensor, a means for detecting faces, and a means for controlling the information presented, wherein:<br><br>The facial detection means detects the region representing a human face in the image projected from the image sensor that forms the image of the front region of the display; and<br><br>The presented-information control means alters the information presented and thus displayed on the display based on the position and shape of the facial region thus detected.<br><br>In particular, the size of the facial region detected is associated with the distance between the user and the device. Accordingly, the aforementioned presented-information control means presents information suitable for viewing from a distance when the size of the facial region detected by the facial detection means is small. However, when the size of the facial region detected by the facial detection means is large, the presented-information control means presents information suitable for viewing from a close range." *See* paras. [0014]-[0016]. |

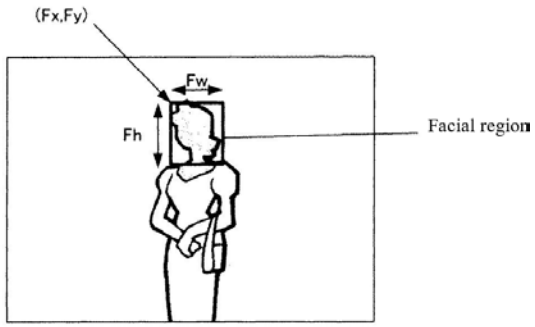
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| | "An environmental information-presentation device, comprising a display, an image sensor, a means for detecting faces, and a means for controlling the information presented, wherein:<br><br>The aforementioned image sensor has a means for forming the image of the frontal area of the aforementioned display;<br><br>The aforementioned facial detection means has a means for detecting the region representing a human face in the projected image formed by the aforementioned image sensor; and<br><br>The aforementioned presented-information control means has a means for altering the information presented and thus displayed on the aforementioned display based on the position and shape of the facial region detected by the aforementioned facial detection means." *See* claim 1.<br><br>"That is, the aforementioned presented-information control means of the aforementioned environmental information-presentation device according to the present invention is characterized by detecting chronological changes in the size of the facial region detected by the aforementioned facial detection means and altering the presented information upon detection of an increase in the size of the facial region.<br><br>Furthermore, the mirror-type environmental information-presentation device has the following mechanism to prevent any interference with the user's act of viewing the mirror.<br><br>That is, in the environmental information-presentation device according to the present invention, the aforementioned presented-information control means calculates the facial presentation region and the truncal presentation region in the display viewport based on the facial region detected by the aforementioned facial detection means and then presents |

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| | information in regions within the viewport other than the facial and truncal presentation regions.<br><br>Additionally, the environmental information-presentation method according to the present invention is characterized by being adapted to devices equipped with a display, an image sensor, a facial detection means, and a presented-information control means and comprising each processing step performed in the above-mentioned processing means so as to achieve the presentation of environmental information.<br><br>Additionally, the program according to the present invention is characterized by being configured so as to allow the aforementioned environmental information-presentation method to be executed on a computer." [0021]-[0025].<br><br>"Presented-information control means 32 modifies the information to be presented, doing so based on the facial region position/shape information received from facial detection means 31. The following is an explanation of embodiments of the control of information presented.<br><br>(Embodiment 1) Control Based on the Size of Facial Region<br>Presented-information control means 32 presets a threshold value Z for facial region sizes. Additionally, presented-information control means 32, at the initial stage, presents information in a form suitable for viewing from a distance. Said "form suitable for viewing from a distance" is, for example, a form of display whereby most characters are in large font and only a small amount of information is presented, e.g., to the extent of headings only. In terms of images or videos, they are displayed in forms enlarged enough to allow the subjects to be identified even from a distance.<br><br>Presented-information control means 32 — upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31 — calculates the facial region size (the area size of the rectangular facial region) Fw*Fh. Then, if Fw*Fh≧ Z, the information presented is altered to a form suitable for viewing from a close range. Said "form suitable for viewing from a close range" is, for example, a |

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| | form in which characters are in relatively small font presenting detailed information. In terms of images or videos, they are displayed in sizes suitable for viewing from a close range and in forms that may include the display of text information, such as telops.<br><br>However, when Fw*Fh<Z, presented-information control means 32 continues to present information in a form suitable for viewing from a distance. Suppose that the information has already been switched to and thus presented in a form suitable for viewing from a close range because Fw*Fh was equal to or greater than Z (Fw*Fh≧ Z). In this case, the information will be switched back to and thus presented in a form suitable for viewing from a distance when Fw*Fh becomes smaller than Z (Fw*Fh<Z).” *See* paras. [0034]-[0037].<br><br>“(Embodiment 4) Control Based on the Position of Facial region in Mirror-type Environmental Information-Presentation Device<br><br>Figure 6 shows an example configuration of the mirror-type environmental information-presentation device. In the example configuration shown in the figure, a video mirror acts as display 10A. Computer 30A horizontally flips the projected image formed by image sensor 20, converts the size to fit the display size, and thus presents the image on display 10A. As such, it virtually acts as a mirror. Information such as thumbnail images presented by presented-information control means 32 is superimposed and thus presented on the image projected from image sensor 20. For this purpose, the present mirror-type environmental information-presentation device is equipped with an image horizontal-flip means 36 and image superimposition means 37, in addition to each means constituting the environmental information-presentation device shown in Figure 1.<br><br>When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:” *See* paras. [0073]-[0074]. |

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| | Figure 6:<br>  <br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Miyaoku expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera. *See*, *e.g.*, disclosures below.<br><br>"Furthermore, the environmental information-presentation device according to the present invention adopts a creative approach in order to make presented information more visually recognizable, doing so through a mechanism that actively expands information and presents more details to the user who is about to approach the device." *See* para. [0020].<br><br>"Figure 2 shows an example of a facial region detected, by facial detection means 31, in a projected image as formed by image sensor 20. In this example, the facial region is detected as a rectangular region. When such a rectangular facial region is detected, facial detection means 31 sends, to presented-information control means 32, the coordinates (Fx, Fy) of the upper right corner of said rectangular region in the projected image as well as the width Fw and the height Fh of the rectangular, all of which act as the facial region position/shape information.<br><br>Presented-information control means 32 modifies the information to be presented, doing so based on the facial region position/shape information received from facial detection means 31. The following is an explanation of embodiments of the control of information presented." *See* paras. [0033]-[0034].<br><br>Figure 2: |

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| |  <br>Projected image as captured by an image sensor<br><br>"(Embodiment 1) Control Based on the Size of Facial Region<br>Presented-information control means 32 presets a threshold value Z for facial region sizes. Additionally, presented-information control means 32, at the initial stage, presents information in a form suitable for viewing from a distance. Said "form suitable for viewing from a distance" is, for example, a form of display whereby most characters are in large font and only a small amount of information is presented, e.g., to the extent of headings only. In terms of images or videos, they are displayed in forms enlarged enough to allow the subjects to be identified even from a distance.<br><br>Presented-information control means 32 — upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31 — calculates the facial region size (the area size of the rectangular facial region) Fw*Fh. Then, if Fw*Fh $\geqq$ Z, the information presented is altered to a form suitable for viewing from a close range. Said "form suitable for viewing from a close range" is, for example, a form in which characters are in relatively small font presenting detailed information. In terms of images or videos, they are displayed in sizes suitable for viewing from a close range and |

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| | in forms that may include the display of text information, such as telops." *See* paras. [0035]-[0036].<br><br>"(Embodiment 2) Control Based on Facial region Size and Application to Animation Presented-information control means 32 may use animation when presenting information. Human vision is responsive to moving objects. By nature, it instinctively fixates on a moving object that is present in the field of view. Therefore, animation is a useful means for attracting the attention of users located in the vicinity of the environmental information-presentation device.<br><br>Given this factor, presented-information control means 32 may, for example, present multiple thumbnail images and apply animation in such a way that each thumbnail moves through the viewport on display 10. Figure 5 shows an example of the animation of moving thumbnails. Additionally, various types of animation can be used. Examples include animated text, images, and other objects that expand and shrink in size in a repetitive manner, appear and disappear in a repetitive manner, and so on.<br><br>Furthermore, the animated motion of objects in the viewport on display 10 is easy to visually recognize from a distance. For example, the characteristic position-shifting patterns, such as vertical movement, horizontal movement, etc., as well as actions, such as zooming in/out action, showing/hiding action (blinking), can catch one's eye even from a distance at which images and text information presented within an object may not be visible. The inclusion of information in animated motions can be said to be one of the information presentation forms suggested for viewing from a distance.<br><br>By including information in animated motions, it becomes possible, for example, to express the importance of the information by the speed of the movement or the blinking speed. It becomes also possible to associate a specific behavior pattern to a specific meaning, for example, to a type of information. |

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| | In this way, animation can be used to draw users' attention and make distant users recognize the attributes of the information. Also, by presenting images of fish instead of thumbnail images and animating each image of fish as if swimming in water, it becomes possible to add an aquarium-like anesthetic value to the environmental information-presentation device. In this case, it is also possible to make the users recognize the attributes of the information by means of the color and movement of the fish.<br><br>However, such animation can get in the way of nearby users trying to see the detailed information presented on display 10. For example, it will be very difficult to read text if the thumbnail images containing text information move up and down, left to right, etc.<br><br>Given this factor, the present embodiment executes the following processing to enable the effective use of animation in environmental information presentation.<br><br>First, presented-information control means 32 presets a threshold Z associated with the facial region size. Furthermore, presented-information control means 32 manages animation specifications A0 predefined for the cases of Fw*Fh<Z and animation specifications A1 predefined for the cases of Fw*Fh≧Z, doing so in a memory accessible by said presented-information control means 32. Incidentally, the term “animation specifications” refers to a description of the specifications of animation to be displayed in the display viewport.<br><br>In the case of animated thumbnail images shown in Figure 5, the animation specifications include information such as the image display size, image blinking pattern, image blinking speed, image motion pattern, image motion range, image motion speed, etc. Presented-information control means 32 executes the animation of each thumbnail image according to such animation specifications.<br><br>Presented-information control means 32 calculates the facial region size (area size of the rectangular facial region) Fw*Fh upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31. If Fw*Fh<Z, |

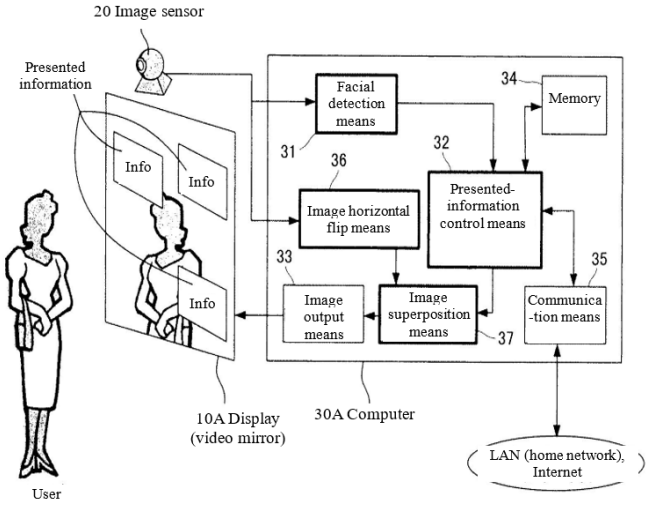
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| | presented-information control means 32 controls the presentation of thumbnail images according to animation specifications A0. However, if Fw*Fh≧Z, it controls the presentation of thumbnail images according to animation specifications A1.<br><br>Fast-moving animation is suitable for presenting information to distant users, and slow-moving animation is suitable for presenting information to nearby users. Accordingly, in the present embodiment, the above-mentioned processing may be set so as to accelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh<Z (i.e., when the facial image size is small) but decelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh≧Z (i.e., when the facial image size is large). This makes it possible to adapt the animation speed to the distance between the user and the device." *See* paras. [0052]-[0062].<br><br>"Fast-moving animation is suitable for presenting information to distant users, and slow-moving animation is suitable for presenting information to nearby users. Accordingly, in the present embodiment, the above-mentioned processing may be set so as to accelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh<Z (i.e., when the facial image size is small) but decelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh≧Z (i.e., when the facial image size is large). This makes it possible to adapt the animation speed to the distance between the user and the device.<br><br>Incidentally, it is also possible to implement incremental motion control in the control of animation, doing so through the same steps described in Embodiment 1 above. In this case, presented-information control means 32 retains thresholds Z(0), . . ., Z(n-1) predefined for n facial image sizes. Additionally, presented-information control means 32 retains n+1 sets of animation specifications An (n=0, 1, . . ., n) corresponding to the cases of the facial image size Fw*Fh<Z(0), the cases of Z(k-1)≦Fw*Fh<Z(k) (where k = 1, 2, . . ., n-1), and the cases of Z(n-1)≦Fw*Fh. |

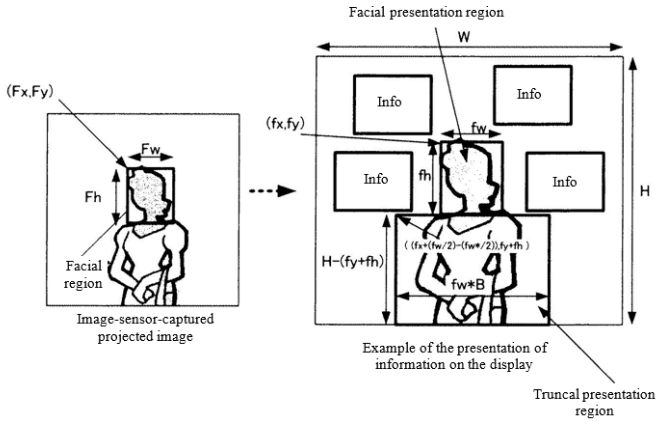
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<tr><th>Asserted Claim of the ’109 Patent</th><th>Exemplary Citations to Miyaoku</th></tr>
<tr><td></td><td>The content of the processing is the same as the steps described in Embodiment 1, except that the animation specifications are used in place of the character display specifications and that the subject of the control is animation, not the text display, as shown in Table 3 below by way of example.<br><br>Through such processing, it becomes possible to control the animation, for example, in such a way that the motion speed of the animation gradually slows down as the size of the facial region Fw*Fh increases.” See paras. [0063]-[0066].<br><br>Table 3:<br><br>
<table>
<tr><td>Name of specification item</td><td>Description of specification</td></tr>
<tr><td>Image display size</td><td>320×240</td></tr>
<tr><td>Image blinking pattern</td><td>Blink with difference brightness levels</td></tr>
<tr><td>Image blinking speed</td><td>5 times per second</td></tr>
<tr><td>Image behavior pattern</td><td>Vertical movement</td></tr>
<tr><td>Image movement range</td><td>Upper/lower ±100 pixels</td></tr>
<tr><td>Image movement speed</td><td>100 pixels per second</td></tr>
<tr><td>. . .</td><td></td></tr>
</table>
<br>“Incidentally, presented-information control means 32 may be implemented in such a way that it manages multiple sets of character display specifications Dn (n = 0, 1, . . ., n) and animation specifications An (n = 0, 1, . . ., n) concurrently so that the text display control and the animation control described in embodiments 1 and 2 are performed concurrently.<br><br>(Embodiment 3) Control Based on Size Variation of Facial region<br>Presented-information control means 32 presets a threshold value V for the size variation of the facial region. It retains, in memory 34, facial region position/shape</td></tr>
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| | information [(Fx(i), Fy(i), Fw(i), and Fh(i)], which is sequentially received from facial detection means 31. Each time the facial region position/shape information is received, the facial-region size variation value is calculated as follows:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))<br><br>The facial-region size variation value represents the ratio of the most recently detected size Fw(i)*Fh(i) of the facial region to the size Fw(i-1)*Fh(i-1) of the facial region detected one before said most recent size. If it is greater than 1, the facial region size has become larger. If it is less than 1, the facial region's size has become smaller.<br><br>The direction in which the user moves can be estimated based on the variation in the size of the facial region. That is, if the size of a user's facial region increases, it can be determined that the user is approaching the environmental information-presentation device. The threshold V for the facial-region size variation is used as an indicator to determine whether the user’s movement is intentional. Suppose the facial-region size variation value is somewhat high, indicating a value equal to or greater than 1. In that case, it can be determined that the user is approaching the environmental information-presentation device at a relatively fast speed. In other words, it is determined that the user is intentionally moving toward the environmental information-presentation device.<br><br>As such, the presented-information control means determines that the user is approaching the device because he or she is interested in the presented information and thus performs the processing required to alter, e.g., expand, the presented information when the following condition is satisfied:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))≧V<br><br>It should be noted that the above illustration is an example of the present embodiment. Presented-information control means 32 may set a threshold value V’, which is less than 1, so as to perform the processing required to present a message to attract the user's |

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| | interest when the following condition is satisfied, i.e., when the user is moving in the direction away from the environmental information-presentation device:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))<V'" *See* paras. [0067]-[0072].<br><br>"(Embodiment 4) Control Based on the Position of Facial region in Mirror-type Environmental Information-Presentation Device<br><br>Figure 6 shows an example configuration of the mirror-type environmental information-presentation device. In the example configuration shown in the figure, a video mirror acts as display 10A. Computer 30A horizontally flips the projected image formed by image sensor 20, converts the size to fit the display size, and thus presents the image on display 10A. As such, it virtually acts as a mirror. Information such as thumbnail images presented by presented-information control means 32 is superimposed and thus presented on the image projected from image sensor 20. For this purpose, the present mirror-type environmental information-presentation device is equipped with an image horizontal-flip means 36 and image superimposition means 37, in addition to each means constituting the environmental information-presentation device shown in Figure 1.<br><br>When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:<br><br>First, upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31, the facial presentation region in the viewport on display 10A is calculated based on said facial region position/shape information thus received. For example, suppose that the resolution of the projected image, as formed by image sensor 20, is 500 × 400, and the resolution of the display viewport is 1000 × 800. In this case, the facial presentation region of the display viewport that corresponds to the facial region position/shape information [(Fx, Fy), Fw, and Fh] is a rectangular region with the |

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| | upper-right-corner coordinates of (Fx*2, Fy*2), the width of Fw*2, and the height of Fh*2.<br><br>The user won't be able to see his or her own face projected in the mirror if an image or other information is displayed in the facial presentation region. Accordingly, presented-information control means 32 prevents information from being presented in the facial presentation region. Additionally, if any information has already been presented in the facial presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region.<br><br>Furthermore, presented-information control means 32 may be configured to control the presentation of information by estimating the truncal presentation region in the display viewport based on the facial region detected by facial detection means 31 so as to present information in regions other than the facial presentation region and the truncal presentation region. Figure 7 shows an example presentation of information in such a case. Additionally, an example content of the processing performed by presented-information control means 32 is described below:<br><br>Suppose that the resolution of the viewport on display 10A is W × H, and the facial presentation region calculated by presented-information control means 32 is a rectangular region with the upper-right-corner coordinates of the display viewport being (Fx, Fy), the width being fw, and the height being fh. In this case, the trunk is located below the facial region. It also occupies a region that is wider than the facial region.<br><br>Accordingly, presented-information control means 32 uses a prescribed value B (value representing (Width of the truncal presentation region / Width of the facial presentation region)) to estimate that the truncal presentation region is a rectangular region with the upper right corner coordinate of ((fx+(fw/2)-(fw*B/2)), fy+fh), the width of fw*B, and the height of H-(fy+fh).<br><br>Presented-information control means 32 performs the steps described above to thereby prevent information from being presented in the facial and truncal presentation regions |

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| | thus calculated. Additionally, if any information has already been presented in the facial or truncal presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region.” *See* paras. [0073]-[0080].<br><br>Figure 6:<br><br>  <br><br><br>Figure 7: |

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| |  <br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | To the extent the preamble is limiting, Miyaoku expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below.<br><br>"OBJECTIVE: To perpetually present information in a form that is easy for the user to notice and visually recognize and further present information without hindering the original functions of the mirror. |

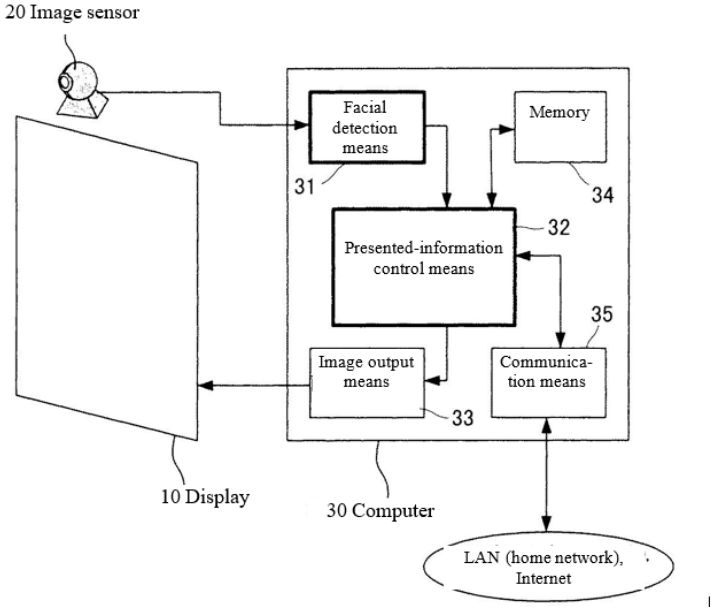
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| | MEANS FOR ACHIEVING THE OBJECTIVE: Facial detection means 31 detects the region representing a human face in the image projected from image sensor 20 that forms the image of the front region of display 10. And presented-information control means 32 alters the information presented and thus displayed on said display based on the position and shape of the facial region thus detected.<br><br>The means for achieving the objective include presenting information in ways suitable for the user's visual recognition according to the distance between the user and the display, presenting animation that moves at a faster or slower speed or stops moving depending on whether the distance to the user is close or far, and altering the magnification ratio of the information according to the variation in the distance between the user and the display." *See* Abstract.<br><br>"Systems that provide information to users through displays embedded in indoor walls and furniture have been proposed in the field of ubiquitous computing research. Such systems are intended to spontaneously increase the opportunities for users to notice such information throughout their everyday lives. Here, such systems shall be referred to as the "environmental information-presentation devices.<br><br>The most basic example configuration of an environmental information-presentation device is a wall-mounted display. It is a thin display with built-in computer and network communication features, such a thin display being mountable on an indoor wall. The wall-mounted display acquires and presents information sequentially from a prescribed server on the network. For example, it regularly accesses a server that provides weather forecast information and presents that information.<br><br>The wall-mounted displays can not only present information but also have features for interactions. The wall-mounted displays are essentially the same as ordinary computers. If an input device, such as a button or a touch panel, is provided, the user can use it to manipulate the information to be displayed. |

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| | Videophones, which have become popular in recent years, can be used as a type of environmental information-presentation device. Videophones based on VoIP (Voice Over Internet Protocol) have the ability to obtain information from the Internet. This makes it possible for the videophones’ displays to present information environmentally when not on a call.<br><br>Furthermore, according to some systems that have been developed so far, the existing functions of household goods are extended with computers so that household goods can be used as environmental information-presentation devices. In particular, some mirror systems have been developed with additional features that allow the mirrors to act as wall-mounted displays, given that mirrors are often subject to users’ attention in their daily lives and also comprise surface areas suitable for presenting information.<br><br>For example, Non-Patent Literature 1 describes a system that presents information on a display placed behind a one-way mirror. Said system has an image sensor and also a feature that allows for the reception of optical signals from mobile terminals and the manipulation of information according to the content of the signals.<br><br>Additionally, Non-Patent Literature 2 proposes a system that allows the user to manipulate image information that is virtually presented in a mirror, doing by pointing the image with the hand of his or her own image projected in the mirror. In order to calculate the positional relationship between the user's own figure and the image information presented on the mirror, this system uses a video mirror, whereby an image projected from a camera capturing the front of the system is displayed on the display.” *See* paras. [0002]-[0008].<br><br>“Furthermore, it is important that the mirror-type environmental information-presentation device has both the original function of a mirror and the ability to present information. To begin with, a mirror is a tool the user uses to confirm his or her appearance based on his or her own reflection in the mirror. Such an original function of the mirror will be hindered if any information is superimposed on the same position as the user's reflection. The mirror-type environmental information-presentation device |

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| | must have an information presentation mechanism that takes this point into account." *See* para. [0011].<br><br>"Given this factor, the environmental information-presentation device according to the present invention is characterized by comprising a display, an image sensor, a means for detecting faces, and a means for controlling the information presented, wherein:<br><br>The facial detection means detects the region representing a human face in the image projected from the image sensor that forms the image of the front region of the display; and<br><br>The presented-information control means alters the information presented and thus displayed on the display based on the position and shape of the facial region thus detected." *See* para. [0015].<br><br>"Furthermore, the mirror-type environmental information-presentation device has the following mechanism to prevent any interference with the user's act of viewing the mirror.<br><br>That is, in the environmental information-presentation device according to the present invention, the aforementioned presented-information control means calculates the facial presentation region and the truncal presentation region in the display viewport based on the facial region detected by the aforementioned facial detection means and then presents information in regions within the viewport other than the facial and truncal presentation regions.<br><br>Additionally, the environmental information-presentation method according to the present invention is characterized by being adapted to devices equipped with a display, an image sensor, a facial detection means, and a presented-information control means and comprising each processing step performed in the above-mentioned processing means so as to achieve the presentation of environmental information. |

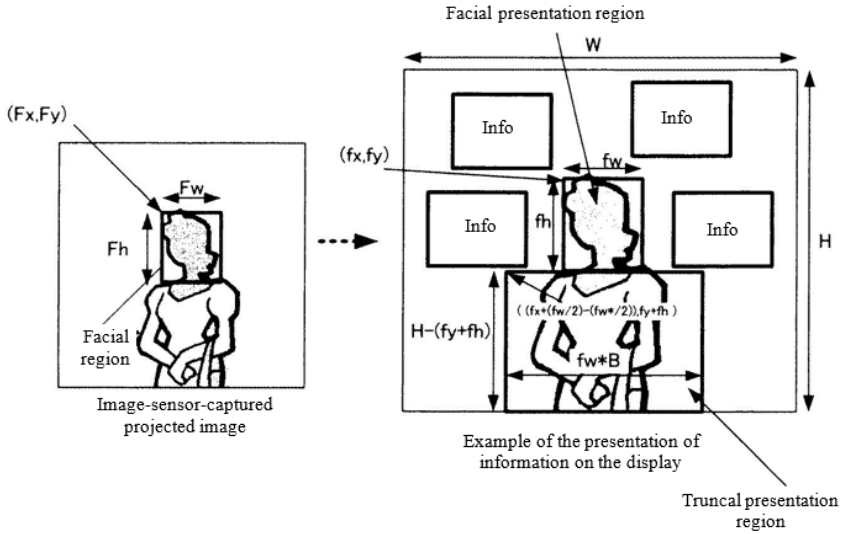
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| | Additionally, the program according to the present invention is characterized by being configured so as to allow the aforementioned environmental information-presentation method to be executed on a computer." [0022]-[0025].<br><br>"The basic example configuration of the environmental information-presentation device according to the present invention is shown in Figure 1. The figure consists of at least display 10, image sensor 20 that forms images of the area from which one can view said display (generally the area in front of the display), and computer 30 that processes projected images input from the image sensor and controls the information presented on the display. Here, computer 30 internally comprises facial detection means 31 that detects a facial region in the image projected from image sensor 20, and presented-information control means 32 that controls the presented information based on the position and shape of the facial region thus detected.<br><br>Facial detection means 31 and presented-information control means 32 may be implemented as software that runs on the OS of computer 30. In this case, computer 10 is equipped with an input/output interface means (e.g., image processing means 33, which is an interface device used to output images onto a display or the like) — such an input/output interface means being provided in order to enable each means (which is software) to process projected images as formed by image sensor 20 and control the output toward display 10 — and memory 34. Furthermore, facial detection means 31, in particular, can be implemented using hardware dedicated to processing projected images to improve processing speed.<br><br>The information displayed on display 10 via presented-information control means 32 may be pre-stored in memory 34 of computer 30. Additionally, because a particularly important role of an environmental information-presentation device is to inform users of new information, the device may be configured so as to receive information over a network and present the information thus received. For this purpose, computer 30 is equipped with a communication means 35 for communicating with LAN and the Internet. In this case, presented-information control means 32 basically downloads information from a prescribed server in a sequential manner, converts it into a prescribed |

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| | form suitable for the environmental information presentation, displays it on display 10, and perpetually repeats these steps.<br><br>The following is an explanation of the operation of the environmental information-presentation device according to the present invention: Image sensor 20 forms the image of the front area of display 10, as described above. Facial detection means 31 processes the projected image in real-time as it is formed by image sensor 20. First, it detects the presence of a human face. And, if a face is detected, it detects the region of the face (the facial region) in the projected image. For example, the technique described in Non-Patent Literature 3 below can be used for such processing. Furthermore, facial detection means 31 sends information about the position and shape of the facial region to presented-information control means 32." *See* paras. [0028]-[0031].<br><br>Figure 1: |

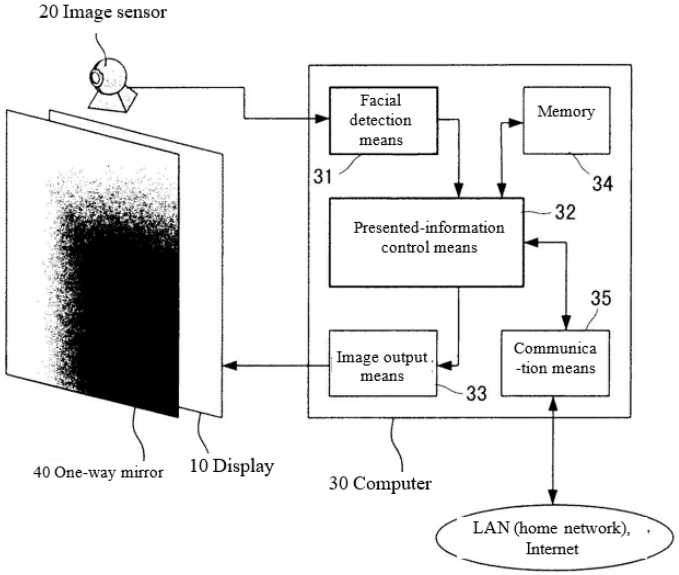
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| |  <br>"(Embodiment 4) Control Based on the Position of Facial region in Mirror-type Environmental Information-Presentation Device<br><br>Figure 6 shows an example configuration of the mirror-type environmental information-presentation device. In the example configuration shown in the figure, a video mirror acts as display 10A. Computer 30A horizontally flips the projected image formed by image sensor 20, converts the size to fit the display size, and thus presents the image on display 10A. As such, it virtually acts as a mirror. Information such as thumbnail images |

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| | presented by presented-information control means 32 is superimposed and thus presented on the image projected from image sensor 20. For this purpose, the present mirror-type environmental information-presentation device is equipped with an image horizontal-flip means 36 and image superimposition means 37, in addition to each means constituting the environmental information-presentation device shown in Figure 1.<br><br>When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:<br><br>First, upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31, the facial presentation region in the viewport on display 10A is calculated based on said facial region position/shape information thus received. For example, suppose that the resolution of the projected image, as formed by image sensor 20, is 500 × 400, and the resolution of the display viewport is 1000 × 800. In this case, the facial presentation region of the display viewport that corresponds to the facial region position/shape information [(Fx, Fy), Fw, and Fh] is a rectangular region with the upper-right-corner coordinates of (Fx*2, Fy*2), the width of Fw*2, and the height of Fh*2.<br><br>The user won't be able to see his or her own face projected in the mirror if an image or other information is displayed in the facial presentation region. Accordingly, presented-information control means 32 prevents information from being presented in the facial presentation region. Additionally, if any information has already been presented in the facial presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region.<br><br>Furthermore, presented-information control means 32 may be configured to control the presentation of information by estimating the truncal presentation region in the display viewport based on the facial region detected by facial detection means 31 so as to present information in regions other than the facial presentation region and the truncal |

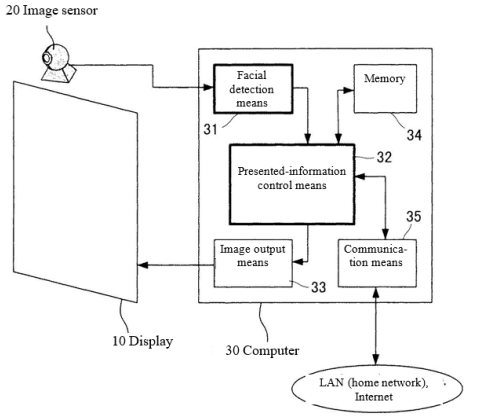
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| | presentation region. Figure 7 shows an example presentation of information in such a case. Additionally, an example content of the processing performed by presented-information control means 32 is described below:<br><br>Suppose that the resolution of the viewport on display 10A is W × H, and the facial presentation region calculated by presented-information control means 32 is a rectangular region with the upper-right-corner coordinates of the display viewport being (Fx, Fy), the width being fw, and the height being fh. In this case, the trunk is located below the facial region. It also occupies a region that is wider than the facial region.<br><br>Accordingly, presented-information control means 32 uses a prescribed value B (value representing (Width of the truncal presentation region / Width of the facial presentation region)) to estimate that the truncal presentation region is a rectangular region with the upper right corner coordinate of ((fx+(fw/2)-(fw*B/2)), fy+fh), the width of fw*B, and the height of H-(fy+fh).<br><br>Presented-information control means 32 performs the steps described above to thereby prevent information from being presented in the facial and truncal presentation regions thus calculated. Additionally, if any information has already been presented in the facial or truncal presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region." *See* paras. [0073]-[0080].<br><br>Figure 7: |

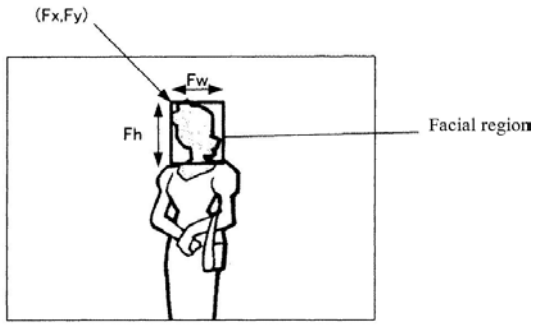
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| |  <br>" Figure 8 shows another example configuration of the mirror-type environmental information-presentation device. The present mirror-type environmental information-presentation device has the same basic configuration as that of the environmental information-presentation device shown in Figure 1, except that one-way mirror 40 is affixed to the surface of display 10.<br><br>Technically speaking, it is extremely difficult to calculate where on the mirror's surface the user's figure is projected as viewed from the user's perspective. However, when the above-described steps performed by presented-information control means 32 in the mirror-type environmental information-presentation device that uses a video mirror is applied in the as-is state to the configuration shown in Figure 8, it becomes possible to present information in regions that do not overlap with the user's figure on the mirror. In |

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| | other words, presented-information control means 32 of the mirror-type environmental information-presentation device shown in Figure 8 can also control the position of presented information, doing so through the steps described with reference to figures 6 and 7.<br><br>The embodiments of the environmental information-presentation device according to the present invention are as described above. The environmental information-presentation method according to the present invention corresponds to each presented-information control step performed by the presented-information control means in the environmental information-presentation device described above. The application of the environmental information-presentation method according to the present invention is not limited to the devices illustrated with reference to figures 1, 6, and 8. The environmental information-presentation method according to the present invention may be applied to any device that is equipped with an image sensor, a display, and a computer. For example, a mobile terminal equipped with an image sensor may further comprise facial detection means 31 and presented-information control means 32 in the form of software, etc., so as to present information according to the distance between the terminal and the user's face through the above-described steps.<br><br>Additionally, a part or all of the processing functions of the environmental information-presentation method according to the present invention can be configured as a program that can be executed on a computer." *See* paras. [0081]-[0084].<br><br>Figure 8: |

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| |  <br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Miyaoku expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera.<br><br>"The basic example configuration of the environmental information-presentation device according to the present invention is shown in Figure 1. The figure consists of at least |

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| | display 10, image sensor 20 that forms images of the area from which one can view said display (generally the area in front of the display), and computer 30 that processes projected images input from the image sensor and controls the information presented on the display. Here, computer 30 internally comprises facial detection means 31 that detects a facial region in the image projected from image sensor 20, and presented-information control means 32 that controls the presented information based on the position and shape of the facial region thus detected.<br><br>Facial detection means 31 and presented-information control means 32 may be implemented as software that runs on the OS of computer 30. In this case, computer 10 is equipped with an input/output interface means (e.g., image processing means 33, which is an interface device used to output images onto a display or the like) — such an input/output interface means being provided in order to enable each means (which is software) to process projected images as formed by image sensor 20 and control the output toward display 10 — and memory 34. Furthermore, facial detection means 31, in particular, can be implemented using hardware dedicated to processing projected images to improve processing speed.<br><br>The information displayed on display 10 via presented-information control means 32 may be pre-stored in memory 34 of computer 30. Additionally, because a particularly important role of an environmental information-presentation device is to inform users of new information, the device may be configured so as to receive information over a network and present the information thus received. For this purpose, computer 30 is equipped with a communication means 35 for communicating with LAN and the Internet. In this case, presented-information control means 32 basically downloads information from a prescribed server in a sequential manner, converts it into a prescribed form suitable for the environmental information presentation, displays it on display 10, and perpetually repeats these steps.<br><br>The following is an explanation of the operation of the environmental information-presentation device according to the present invention: Image sensor 20 forms the image of the front area of display 10, as described above. Facial detection means 31 processes |

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| | the projected image in real-time as it is formed by image sensor 20. First, it detects the presence of a human face. And, if a face is detected, it detects the region of the face (the facial region) in the projected image. For example, the technique described in Non-Patent Literature 3 below can be used for such processing. Furthermore, facial detection means 31 sends information about the position and shape of the facial region to presented-information control means 32." *See* paras. [0028]-[0031].<br><br>Figure 1:<br><br>  <br><br><br>"Figure 2 shows an example of a facial region detected, by facial detection means 31, in a projected image as formed by image sensor 20. In this example, the facial region is detected as a rectangular region. When such a rectangular facial region is detected, facial detection means 31 sends, to presented-information control means 32, the coordinates (Fx, Fy) of the upper right corner of said rectangular region in the projected image as well as the width Fw and the height Fh of the rectangular, all of which act as the facial region position/shape information. |

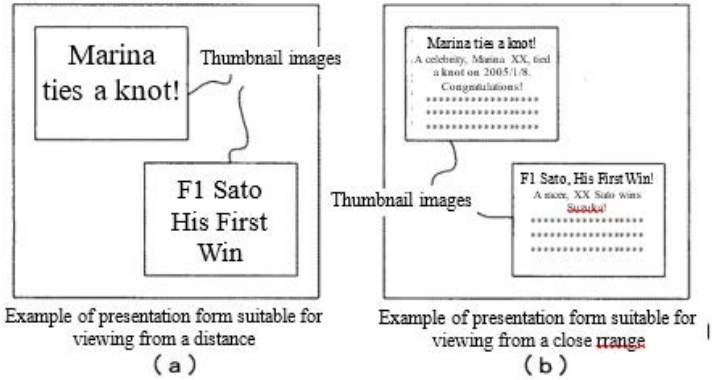
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| | Presented-information control means 32 modifies the information to be presented, doing so based on the facial region position/shape information received from facial detection means 31. The following is an explanation of embodiments of the control of information presented." *See* paras. [0033]-[0034].<br><br>Figure 2:<br><br>  <br><br><br>"(Embodiment 1) Control Based on the Size of Facial Region<br>Presented-information control means 32 presets a threshold value Z for facial region sizes. Additionally, presented-information control means 32, at the initial stage, presents information in a form suitable for viewing from a distance. Said "form suitable for viewing from a distance" is, for example, a form of display whereby most characters are in large font and only a small amount of information is presented, e.g., to the extent of headings only. In terms of images or videos, they are displayed in forms enlarged enough to allow the subjects to be identified even from a distance.<br><br>Presented-information control means 32 — upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31 — calculates the |

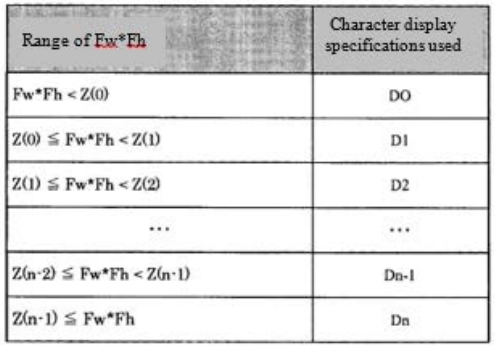
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| | facial region size (the area size of the rectangular facial region) Fw*Fh. Then, if Fw*Fh≧ Z, the information presented is altered to a form suitable for viewing from a close range. Said "form suitable for viewing from a close range" is, for example, a form in which characters are in relatively small font presenting detailed information. In terms of images or videos, they are displayed in sizes suitable for viewing from a close range and in forms that may include the display of text information, such as telops." *See* paras. [0035]-[0036].<br><br>"(Embodiment 4) Control Based on the Position of Facial region in Mirror-type Environmental Information-Presentation Device<br><br>Figure 6 shows an example configuration of the mirror-type environmental information-presentation device. In the example configuration shown in the figure, a video mirror acts as display 10A. Computer 30A horizontally flips the projected image formed by image sensor 20, converts the size to fit the display size, and thus presents the image on display 10A. As such, it virtually acts as a mirror. Information such as thumbnail images presented by presented-information control means 32 is superimposed and thus presented on the image projected from image sensor 20. For this purpose, the present mirror-type environmental information-presentation device is equipped with an image horizontal-flip means 36 and image superimposition means 37, in addition to each means constituting the environmental information-presentation device shown in Figure 1.<br><br>When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:<br><br>First, upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31, the facial presentation region in the viewport on display 10A is calculated based on said facial region position/shape information thus received. For example, suppose that the resolution of the projected image, as formed by image |

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| | sensor 20, is 500 × 400, and the resolution of the display viewport is 1000 × 800. In this case, the facial presentation region of the display viewport that corresponds to the facial region position/shape information [(Fx, Fy), Fw, and Fh] is a rectangular region with the upper-right-corner coordinates of (Fx*2, Fy*2), the width of Fw*2, and the height of Fh*2." *See* paras. [0073]-[0075].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Miyaoku expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video fee. *See*, *e.g.*, disclosures below.<br><br>"OBJECTIVE: To perpetually present information in a form that is easy for the user to notice and visually recognize and further present information without hindering the original functions of the mirror.<br><br>MEANS FOR ACHIEVING THE OBJECTIVE: Facial detection means 31 detects the region representing a human face in the image projected from image sensor 20 that forms the image of the front region of display 10. And presented-information control means 32 alters the information presented and thus displayed on said display based on the position and shape of the facial region thus detected.<br><br>The means for achieving the objective include presenting information in ways suitable for the user's visual recognition according to the distance between the user and the display, presenting animation that moves at a faster or slower speed or stops moving depending on whether the distance to the user is close or far, and altering the magnification ratio of the information according to the variation in the distance between the user and the display." *See* Abstract. |

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| | "In particular, because the distance between a user and the environmental information-presentation device is not fixed, the present system must take into account the distance from the user when displaying information. For example, it is meaningless to present detailed information that contains a large amount of text in a small font to a user who is far away from the device because the user cannot read it. The environmental information-presentation device is useless unless one can visually recognize the content of the presented information when he or she happens to turn their eyes toward the device. Accordingly, it must be able to present information in a form that is easy for the user to visually recognize according to the distance." *See* para. [0010].<br><br>"In particular, the size of the facial region detected is associated with the distance between the user and the device. Accordingly, the aforementioned presented-information control means presents information suitable for viewing from a distance when the size of the facial region detected by the facial detection means is small. However, when the size of the facial region detected by the facial detection means is large, the presented-information control means presents information suitable for viewing from a close range.<br><br>Users far away from the environmental information-presentation device cannot visually recognize details in a text shown on the display screen. Animation is a possible option to express information in such a way that it is easy to understand for users located far away from the device. Objects displayed on the screen can convey simple attributes of information to the user by making characteristic motions (gestures) consisting of combinations of rotations, position changes, etc. Animation is also effective for making users at a distance aware of the existence of the information.<br><br>However, nearby users can read text, etc., to obtain more specific information. In this case, it is not advisable to apply animation (i.e., a moving object, including text), as it will interfere with the user's visual recognition of the text. In other words, when using animation, its behavior must be controlled according to the distance from the user." *See* paras. [0016]-[0018]. |

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| | "Presented-information control means 32 modifies the information to be presented, doing so based on the facial region position/shape information received from facial detection means 31. The following is an explanation of embodiments of the control of information presented.<br><br>(Embodiment 1) Control Based on the Size of Facial Region<br>Presented-information control means 32 presets a threshold value Z for facial region sizes. Additionally, presented-information control means 32, at the initial stage, presents information in a form suitable for viewing from a distance. Said "form suitable for viewing from a distance" is, for example, a form of display whereby most characters are in large font and only a small amount of information is presented, e.g., to the extent of headings only. In terms of images or videos, they are displayed in forms enlarged enough to allow the subjects to be identified even from a distance.<br><br>Presented-information control means 32 — upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31 — calculates the facial region size (the area size of the rectangular facial region) Fw*Fh. Then, if Fw*Fh ≧ Z, the information presented is altered to a form suitable for viewing from a close range. Said "form suitable for viewing from a close range" is, for example, a form in which characters are in relatively small font presenting detailed information. In terms of images or videos, they are displayed in sizes suitable for viewing from a close range and in forms that may include the display of text information, such as telops.<br><br>However, when Fw*Fh<Z, presented-information control means 32 continues to present information in a form suitable for viewing from a distance. Suppose that the information has already been switched to and thus presented in a form suitable for viewing from a close range because Fw*Fh was equal to or greater than Z (Fw*Fh≧Z). In this case, the information will be switched back to and thus presented in a form suitable for viewing from a distance when Fw*Fh becomes smaller than Z (Fw*Fh<Z)." *See* paras. [0034]-[0037]. |

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| | Figure 3:<br>  <br><br>"Such control is achieved by utilizing the fact that the distance between the user and the device is greater when the facial region size is smaller while the distance between the user and the device is closer when the facial region size is larger. In the example illustrated above, a single threshold Z is used as the value that triggers the switch between the character display specifications suitable for viewing from a distance and the character display specifications suitable for viewing from a close range.<br><br>Incidentally, presented-information control method 32 may use multiple thresholds Z(0), . . ., Z(n-1), (where Z(0)<Z(1)< . . . <Z(n-1)) to control n+1 types of presentation form in incremental steps. The following is an explanation of such incremental control of multiple presentation forms with reference to the above-mentioned character display control by way of example.<br><br>Presented-information control means 32 retains predefined thresholds Z(0), . . ., Z(n-1) for n facial image sizes. Additionally, presented-information control means 32 retains |

| Asserted Claim of the '109 Patent | Exemplary Citations to Miyaoku |
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| | n+1 sets of character display specifications Dn (n=0, 1,. . ., n) corresponding to the cases of the facial image size Fw*Fh<Z(0), the cases of Z(k-1)≦Fw*Fh<Z(k) (where k = 1, 2, . . ., n-1), and the cases of Z(n-1)≦Fw*Fh. That is, the table shown in Table 2 below is retained so as to manage the correlation between the size of the facial image detected and the respective set of character display specifications D0 through Dn.<br><br>[TABLE 2]<br>  <br>Here, suppose that character display specifications D0 represent the form most suitable for viewing from a distance, and character display specifications Dn represent the form most suitable for viewing from a close distance. In this case, character display specifications D0 could be the character display specifications for presenting the largest font with the least number of characters, whereas character display specifications Dn could be the character display specifications for displaying many characters in the smallest font." *See* paras. [0045]-[0049].<br><br>"Furthermore, the animated motion of objects in the viewport on display 10 is easy to visually recognize from a distance. For example, the characteristic position-shifting patterns, such as vertical movement, horizontal movement, etc., as well as actions, such |

| Range of Fw*Fh | Character display specifications used |
|---|---|
| Fw*Fh < Z(0) | D0 |
| Z(0) ≦ Fw*Fh < Z(1) | D1 |
| Z(1) ≦ Fw*Fh < Z(2) | D2 |
| ... | ... |
| Z(n-2) ≦ Fw*Fh < Z(n-1) | Dn-1 |
| Z(n-1) ≦ Fw*Fh | Dn |

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| | as zooming in/out action, showing/hiding action (blinking), can catch one's eye even from a distance at which images and text information presented within an object may not be visible. The inclusion of information in animated motions can be said to be one of the information presentation forms suggested for viewing from a distance." *See* para. [0054].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Miyaoku expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. *See*, *e.g.*, disclosures below.<br><br>"Facial detection means 31 and presented-information control means 32 may be implemented as software that runs on the OS of computer 30. In this case, computer 10 is equipped with an input/output interface means (e.g., image processing means 33, which is an interface device used to output images onto a display or the like) — such an input/output interface means being provided in order to enable each means (which is software) to process projected images as formed by image sensor 20 and control the output toward display 10 — and memory 34. Furthermore, facial detection means 31, in particular, can be implemented using hardware dedicated to processing projected images to improve processing speed." *See* para. [0029].<br><br>"The display of text information is described in the embodiment above. It should be noted that, in addition to text, the present invention can also control the presentation of images, videos, or media, such as multimedia content that combines text, images, video, and 3D graphics. In these cases, presented-information control means 32 pre-defines media display specifications corresponding to the aforementioned character display specifications for the respective media, doing so for each Fw*Fh-value range. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Miyaoku |
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| | Then, the corresponding media display specifications are selected based on the detected Fw*Fh value, after which the display form of the prescribed media is altered according to the media display specifications thus selected.<br><br>(Embodiment 2) Control Based on Facial region Size and Application to Animation Presented-information control means 32 may use animation when presenting information. Human vision is responsive to moving objects. By nature, it instinctively fixates on a moving object that is present in the field of view. Therefore, animation is a useful means for attracting the attention of users located in the vicinity of the environmental information-presentation device.<br><br>Given this factor, presented-information control means 32 may, for example, present multiple thumbnail images and apply animation in such a way that each thumbnail moves through the viewport on display 10. Figure 5 shows an example of the animation of moving thumbnails. Additionally, various types of animation can be used. Examples include animated text, images, and other objects that expand and shrink in size in a repetitive manner, appear and disappear in a repetitive manner, and so on.<br><br>Furthermore, the animated motion of objects in the viewport on display 10 is easy to visually recognize from a distance. For example, the characteristic position-shifting patterns, such as vertical movement, horizontal movement, etc., as well as actions, such as zooming in/out action, showing/hiding action (blinking), can catch one's eye even from a distance at which images and text information presented within an object may not be visible. The inclusion of information in animated motions can be said to be one of the information presentation forms suggested for viewing from a distance.<br><br>By including information in animated motions, it becomes possible, for example, to express the importance of the information by the speed of the movement or the blinking speed. It becomes also possible to associate a specific behavior pattern to a specific meaning, for example, to a type of information. |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Miyaoku |
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| | In this way, animation can be used to draw users' attention and make distant users recognize the attributes of the information. Also, by presenting images of fish instead of thumbnail images and animating each image of fish as if swimming in water, it becomes possible to add an aquarium-like anesthetic value to the environmental information-presentation device. In this case, it is also possible to make the users recognize the attributes of the information by means of the color and movement of the fish.” *See* paras. [0051]-[0056].<br><br>“In the case of animated thumbnail images shown in Figure 5, the animation specifications include information such as the image display size, image blinking pattern, image blinking speed, image motion pattern, image motion range, image motion speed, etc. Presented-information control means 32 executes the animation of each thumbnail image according to such animation specifications.<br><br>Presented-information control means 32 calculates the facial region size (area size of the rectangular facial region) Fw*Fh upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31. If Fw*Fh<Z, presented-information control means 32 controls the presentation of thumbnail images according to animation specifications A0. However, if Fw*Fh≧Z, it controls the presentation of thumbnail images according to animation specifications A1.<br><br>Fast-moving animation is suitable for presenting information to distant users, and slow-moving animation is suitable for presenting information to nearby users. Accordingly, in the present embodiment, the above-mentioned processing may be set so as to accelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh<Z (i.e., when the facial image size is small) but decelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh≧Z (i.e., when the facial image size is large). This makes it possible to adapt the animation speed to the distance between the user and the device. |

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| | Incidentally, it is also possible to implement incremental motion control in the control of animation, doing so through the same steps described in Embodiment 1 above. In this case, presented-information control means 32 retains thresholds Z(0), . . ., Z(n-1) predefined for n facial image sizes. Additionally, presented-information control means 32 retains n+1 sets of animation specifications An (n=0, 1, . . ., n) corresponding to the cases of the facial image size Fw*Fh<Z(0), the cases of Z(k-1)≦Fw*Fh<Z(k) (where k = 1, 2, . . ., n-1), and the cases of Z(n-1)≦Fw*Fh.<br><br>The content of the processing is the same as the steps described in Embodiment 1, except that the animation specifications are used in place of the character display specifications and that the subject of the control is animation, not the text display, as shown in Table 3 below by way of example.<br><br>Through such processing, it becomes possible to control the animation, for example, in such a way that the motion speed of the animation gradually slows down as the size of the facial region Fw*Fh increases." *See* paras. [0060]-[0066].<br><br>Table 3:<br><br>Name of specification item / Description of specification<br>Image display size / 320×240<br>Image blinking pattern / Blink with difference brightness levels<br>Image blinking speed / 5 times per second<br>Image behavior pattern / Vertical movement<br>Image movement range / Upper/lower ±100 pixels<br>Image movement speed / 100 pixels per second<br>. . . |

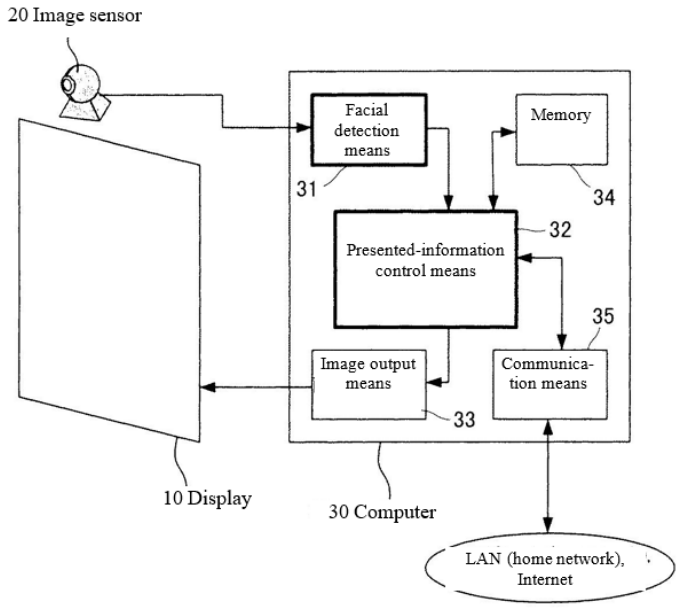
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| | "Incidentally, presented-information control means 32 may be implemented in such a way that it manages multiple sets of character display specifications Dn (n = 0, 1, . . ., n) and animation specifications An (n = 0, 1, . . ., n) concurrently so that the text display control and the animation control described in embodiments 1 and 2 are performed concurrently.<br><br>(Embodiment 3) Control Based on Size Variation of Facial region<br>Presented-information control means 32 presets a threshold value V for the size variation of the facial region. It retains, in memory 34, facial region position/shape information [(Fx(i), Fy(i), Fw(i), and Fh(i)], which is sequentially received from facial detection means 31. Each time the facial region position/shape information is received, the facial-region size variation value is calculated as follows:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))<br><br>The facial-region size variation value represents the ratio of the most recently detected size Fw(i)*Fh(i) of the facial region to the size Fw(i-1)*Fh(i-1) of the facial region detected one before said most recent size. If it is greater than 1, the facial region size has become larger. If it is less than 1, the facial region's size has become smaller.<br><br>The direction in which the user moves can be estimated based on the variation in the size of the facial region. That is, if the size of a user's facial region increases, it can be determined that the user is approaching the environmental information-presentation device. The threshold V for the facial-region size variation is used as an indicator to determine whether the user's movement is intentional. Suppose the facial-region size variation value is somewhat high, indicating a value equal to or greater than 1. In that case, it can be determined that the user is approaching the environmental information-presentation device at a relatively fast speed. In other words, it is determined that the user is intentionally moving toward the environmental information-presentation device. |

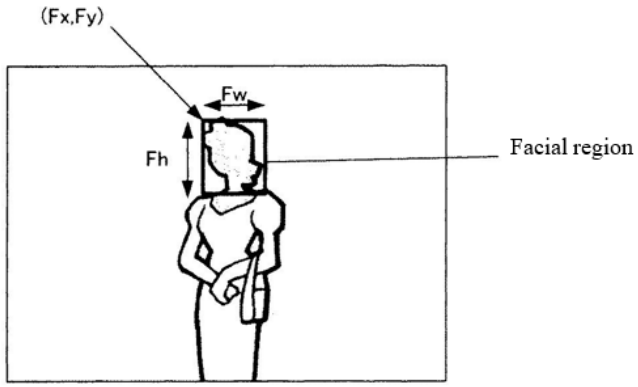
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| | As such, the presented-information control means determines that the user is approaching the device because he or she is interested in the presented information and thus performs the processing required to alter, e.g., expand, the presented information when the following condition is satisfied:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))≧V<br><br>It should be noted that the above illustration is an example of the present embodiment. Presented-information control means 32 may set a threshold value V', which is less than 1, so as to perform the processing required to present a message to attract the user's interest when the following condition is satisfied, i.e., when the user is moving in the direction away from the environmental information-presentation device:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))<V'" *See* paras. [0067]-[0072].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

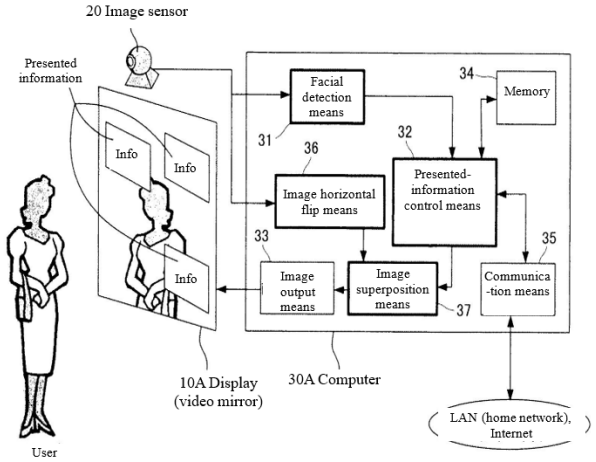
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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a | Miyaoku expressly and/or inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. *See*, *e.g.*, disclosures below. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Miyaoku |
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| camera positioned at eye-level height and pointing horizontally. | "When the user's face is detected through an image sensor installed on the device side, the positional relationship between the device and the user can be estimated based on the position and size of the facial region. It also becomes possible to present appropriate information based on the positional relationship thus estimated.<br><br>Given this factor, the environmental information-presentation device according to the present invention is characterized by comprising a display, an image sensor, a means for detecting faces, and a means for controlling the information presented, wherein:<br><br>The facial detection means detects the region representing a human face in the image projected from the image sensor that forms the image of the front region of the display; and<br><br>The presented-information control means alters the information presented and thus displayed on the display based on the position and shape of the facial region thus detected." *See* paras. [0014]-[0015].<br><br>"Additionally, because the present invention uses an image sensor, it can be implemented in existing devices that are already equipped with an image sensor, e.g., videophones, thus lowering the cost." *See* para. [0027].<br><br>"The basic example configuration of the environmental information-presentation device according to the present invention is shown in Figure 1. The figure consists of at least display 10, image sensor 20 that forms images of the area from which one can view said display (generally the area in front of the display), and computer 30 that processes projected images input from the image sensor and controls the information presented on the display. Here, computer 30 internally comprises facial detection means 31 that detects a facial region in the image projected from image sensor 20, and presented-information control means 32 that controls the presented information based on the position and shape of the facial region thus detected. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Miyaoku |
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| | Facial detection means 31 and presented-information control means 32 may be implemented as software that runs on the OS of computer 30. In this case, computer 10 is equipped with an input/output interface means (e.g., image processing means 33, which is an interface device used to output images onto a display or the like) — such an input/output interface means being provided in order to enable each means (which is software) to process projected images as formed by image sensor 20 and control the output toward display 10 — and memory 34. Furthermore, facial detection means 31, in particular, can be implemented using hardware dedicated to processing projected images to improve processing speed.<br><br>The information displayed on display 10 via presented-information control means 32 may be pre-stored in memory 34 of computer 30. Additionally, because a particularly important role of an environmental information-presentation device is to inform users of new information, the device may be configured so as to receive information over a network and present the information thus received. For this purpose, computer 30 is equipped with a communication means 35 for communicating with LAN and the Internet. In this case, presented-information control means 32 basically downloads information from a prescribed server in a sequential manner, converts it into a prescribed form suitable for the environmental information presentation, displays it on display 10, and perpetually repeats these steps.<br><br>The following is an explanation of the operation of the environmental information-presentation device according to the present invention: Image sensor 20 forms the image of the front area of display 10, as described above. Facial detection means 31 processes the projected image in real-time as it is formed by image sensor 20. First, it detects the presence of a human face. And, if a face is detected, it detects the region of the face (the facial region) in the projected image. For example, the technique described in Non-Patent Literature 3 below can be used for such processing. Furthermore, facial detection means 31 sends information about the position and shape of the facial region to presented-information control means 32." *See* paras. [0028]-[0031]. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Miyaoku |
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| | Figure 1:<br>  <br><br>"Figure 2 shows an example of a facial region detected, by facial detection means 31, in a projected image as formed by image sensor 20. In this example, the facial region is detected as a rectangular region. When such a rectangular facial region is detected, facial detection means 31 sends, to presented-information control means 32, the coordinates (Fx, Fy) of the upper right corner of said rectangular region in the projected image as well as the width Fw and the height Fh of the rectangular, all of which act as the facial region position/shape information." *See* para. [0033]. |

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| | Figure 2:<br>  <br><br>"(Embodiment 4) Control Based on the Position of Facial region in Mirror-type Environmental Information-Presentation Device<br><br>Figure 6 shows an example configuration of the mirror-type environmental information-presentation device. In the example configuration shown in the figure, a video mirror acts as display 10A. Computer 30A horizontally flips the projected image formed by image sensor 20, converts the size to fit the display size, and thus presents the image on display 10A. As such, it virtually acts as a mirror. Information such as thumbnail images presented by presented-information control means 32 is superimposed and thus presented on the image projected from image sensor 20. For this purpose, the present mirror-type environmental information-presentation device is equipped with an image |

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| | horizontal-flip means 36 and image superimposition means 37, in addition to each means constituting the environmental information-presentation device shown in Figure 1.<br><br>When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:" *See* paras. [0073]-[0074].<br><br>Figure 6:<br><br>  <br><br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

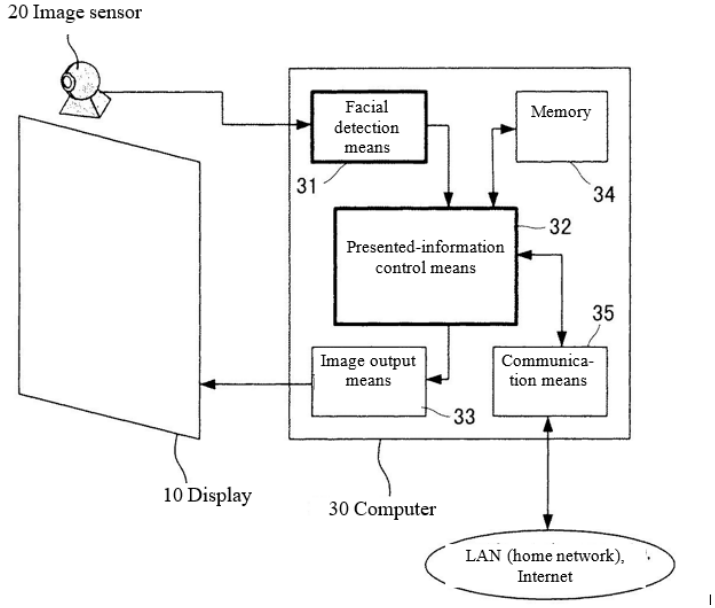
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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

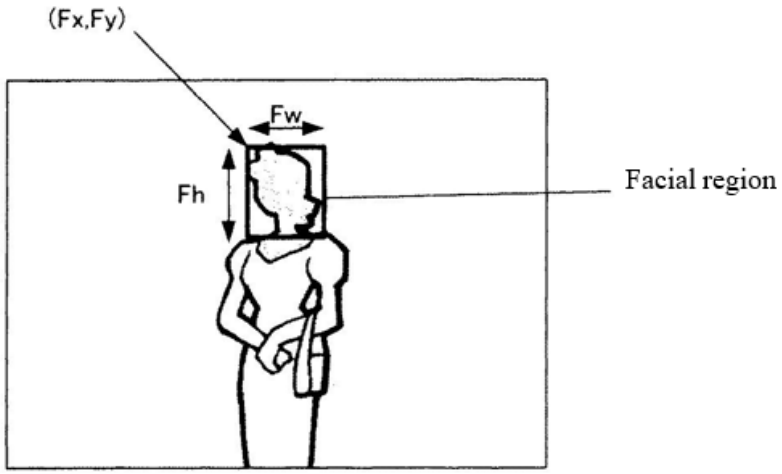
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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Miyaoku expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[a]. obtaining a reference image; | Miyaoku expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below.<br><br>"OBJECTIVE: To perpetually present information in a form that is easy for the user to notice and visually recognize and further present information without hindering the original functions of the mirror.<br><br>MEANS FOR ACHIEVING THE OBJECTIVE: Facial detection means 31 detects the region representing a human face in the image projected from image sensor 20 that forms the image of the front region of display 10. And presented-information control means 32 alters the information presented and thus displayed on said display based on the position and shape of the facial region thus detected. |

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| | The means for achieving the objective include presenting information in ways suitable for the user's visual recognition according to the distance between the user and the display, presenting animation that moves at a faster or slower speed or stops moving depending on whether the distance to the user is close or far, and altering the magnification ratio of the information according to the variation in the distance between the user and the display.” *See* Abstract.<br><br>“For example, Non-Patent Literature 1 describes a system that presents information on a display placed behind a one-way mirror. Said system has an image sensor and also a feature that allows for the reception of optical signals from mobile terminals and the manipulation of information according to the content of the signals.<br><br>Additionally, Non-Patent Literature 2 proposes a system that allows the user to manipulate image information that is virtually presented in a mirror, doing by pointing the image with the hand of his or her own image projected in the mirror. In order to calculate the positional relationship between the user's own figure and the image information presented on the mirror, this system uses a video mirror, whereby an image projected from a camera capturing the front of the system is displayed on the display.” *See* paras. [0007]-[0008].<br><br>“When the user's face is detected through an image sensor installed on the device side, the positional relationship between the device and the user can be estimated based on the position and size of the facial region. It also becomes possible to present appropriate information based on the positional relationship thus estimated.<br><br>Given this factor, the environmental information-presentation device according to the present invention is characterized by comprising a display, an image sensor, a means for detecting faces, and a means for controlling the information presented, wherein: |

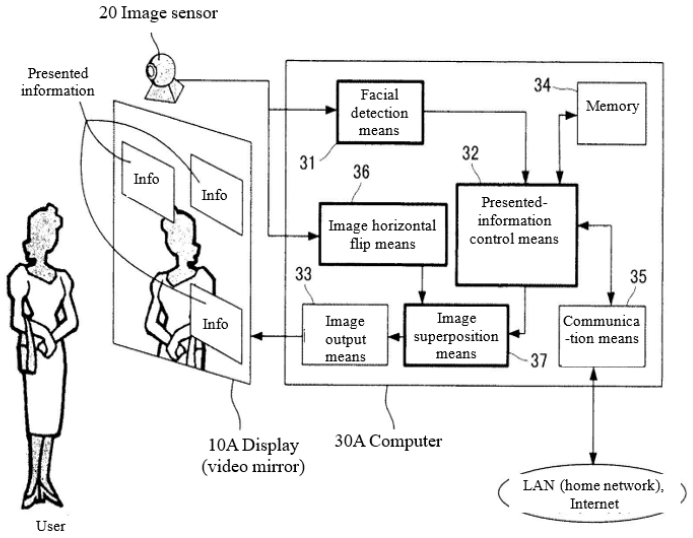
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| | The facial detection means detects the region representing a human face in the image projected from the image sensor that forms the image of the front region of the display; and<br><br>The presented-information control means alters the information presented and thus displayed on the display based on the position and shape of the facial region thus detected." *See* paras. [0014]-[0015].<br><br>"Additionally, the environmental information-presentation method according to the present invention is characterized by being adapted to devices equipped with a display, an image sensor, a facial detection means, and a presented-information control means and comprising each processing step performed in the above-mentioned processing means so as to achieve the presentation of environmental information." *See* para. [0024].<br><br>"Additionally, because the present invention uses an image sensor, it can be implemented in existing devices that are already equipped with an image sensor, e.g., videophones, thus lowering the cost." *See* para. [0027].<br><br>"The basic example configuration of the environmental information-presentation device according to the present invention is shown in Figure 1. The figure consists of at least display 10, image sensor 20 that forms images of the area from which one can view said display (generally the area in front of the display), and computer 30 that processes projected images input from the image sensor and controls the information presented on the display. Here, computer 30 internally comprises facial detection means 31 that detects a facial region in the image projected from image sensor 20, and presented-information control means 32 that controls the presented information based on the position and shape of the facial region thus detected.<br><br>Facial detection means 31 and presented-information control means 32 may be implemented as software that runs on the OS of computer 30. In this case, computer 10 is equipped with an input/output interface means (e.g., image processing means 33, which is an interface device used to output images onto a display or the like) — such an |

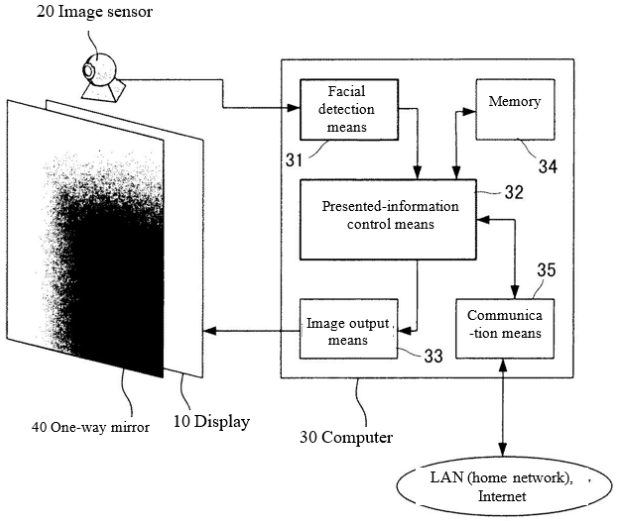
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| | input/output interface means being provided in order to enable each means (which is software) to process projected images as formed by image sensor 20 and control the output toward display 10 — and memory 34. Furthermore, facial detection means 31, in particular, can be implemented using hardware dedicated to processing projected images to improve processing speed.<br><br>The information displayed on display 10 via presented-information control means 32 may be pre-stored in memory 34 of computer 30. Additionally, because a particularly important role of an environmental information-presentation device is to inform users of new information, the device may be configured so as to receive information over a network and present the information thus received. For this purpose, computer 30 is equipped with a communication means 35 for communicating with LAN and the Internet. In this case, presented-information control means 32 basically downloads information from a prescribed server in a sequential manner, converts it into a prescribed form suitable for the environmental information presentation, displays it on display 10, and perpetually repeats these steps.<br><br>The following is an explanation of the operation of the environmental information-presentation device according to the present invention: Image sensor 20 forms the image of the front area of display 10, as described above. Facial detection means 31 processes the projected image in real-time as it is formed by image sensor 20. First, it detects the presence of a human face. And, if a face is detected, it detects the region of the face (the facial region) in the projected image. For example, the technique described in Non-Patent Literature 3 below can be used for such processing. Furthermore, facial detection means 31 sends information about the position and shape of the facial region to presented-information control means 32." *See* paras. [0028]-[0031].<br><br>Figure 1: |

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| |  <br>"Figure 2 shows an example of a facial region detected, by facial detection means 31, in a projected image as formed by image sensor 20. In this example, the facial region is detected as a rectangular region. When such a rectangular facial region is detected, facial detection means 31 sends, to presented-information control means 32, the coordinates (Fx, Fy) of the upper right corner of said rectangular region in the projected image as well as the width Fw and the height Fh of the rectangular, all of which act as the facial region position/shape information." *See* para. [0033].<br><br>Figure 2: |

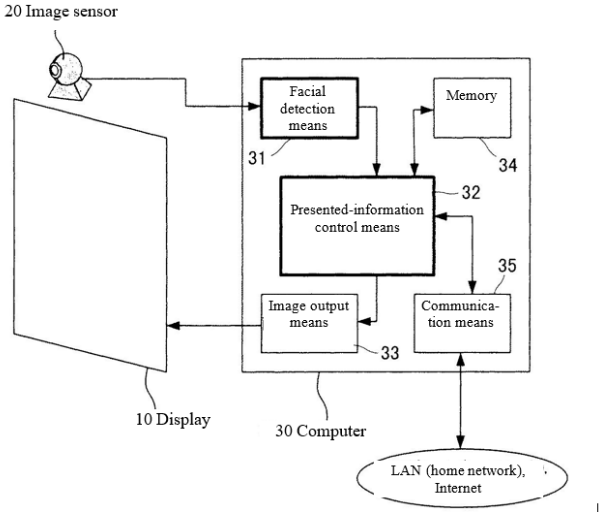
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| |  <br>Projected image as captured by an image sensor<br><br>"When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:<br><br>First, upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31, the facial presentation region in the viewport on display 10A is calculated based on said facial region position/shape information thus received. For example, suppose that the resolution of the projected image, as formed by image sensor 20, is 500 × 400, and the resolution of the display viewport is 1000 × 800. In this case, the facial presentation region of the display viewport that corresponds to the facial |

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| | region position/shape information [(Fx, Fy), Fw, and Fh] is a rectangular region with the upper-right-corner coordinates of (Fx*2, Fy*2), the width of Fw*2, and the height of Fh*2.” *See* paras. [0074]-[0075].<br><br>“The embodiments of the environmental information-presentation device according to the present invention are as described above. The environmental information-presentation method according to the present invention corresponds to each presented-information control step performed by the presented-information control means in the environmental information-presentation device described above. The application of the environmental information-presentation method according to the present invention is not limited to the devices illustrated with reference to figures 1, 6, and 8. The environmental information-presentation method according to the present invention may be applied to any device that is equipped with an image sensor, a display, and a computer. For example, a mobile terminal equipped with an image sensor may further comprise facial detection means 31 and presented-information control means 32 in the form of software, etc., so as to present information according to the distance between the terminal and the user's face through the above-described steps.” *See* para. [0083].<br><br>Figure 6: |

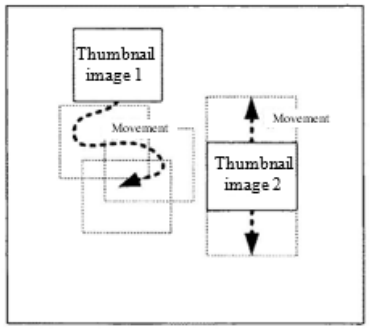
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| |  <br>Figure 8: |

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| |  <br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Miyaoku expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"The basic example configuration of the environmental information-presentation device according to the present invention is shown in Figure 1. The figure consists of at least |

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| | display 10, image sensor 20 that forms images of the area from which one can view said display (generally the area in front of the display), and computer 30 that processes projected images input from the image sensor and controls the information presented on the display. Here, computer 30 internally comprises facial detection means 31 that detects a facial region in the image projected from image sensor 20, and presented-information control means 32 that controls the presented information based on the position and shape of the facial region thus detected.<br><br>Facial detection means 31 and presented-information control means 32 may be implemented as software that runs on the OS of computer 30. In this case, computer 10 is equipped with an input/output interface means (e.g., image processing means 33, which is an interface device used to output images onto a display or the like) — such an input/output interface means being provided in order to enable each means (which is software) to process projected images as formed by image sensor 20 and control the output toward display 10 — and memory 34. Furthermore, facial detection means 31, in particular, can be implemented using hardware dedicated to processing projected images to improve processing speed.<br><br>The information displayed on display 10 via presented-information control means 32 may be pre-stored in memory 34 of computer 30. Additionally, because a particularly important role of an environmental information-presentation device is to inform users of new information, the device may be configured so as to receive information over a network and present the information thus received. For this purpose, computer 30 is equipped with a communication means 35 for communicating with LAN and the Internet. In this case, presented-information control means 32 basically downloads information from a prescribed server in a sequential manner, converts it into a prescribed form suitable for the environmental information presentation, displays it on display 10, and perpetually repeats these steps.<br><br>The following is an explanation of the operation of the environmental information-presentation device according to the present invention: Image sensor 20 forms the image of the front area of display 10, as described above. Facial detection means 31 processes |

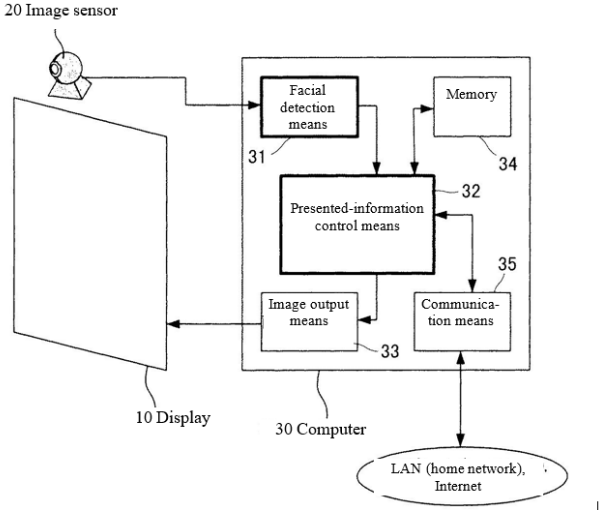
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| | the projected image in real-time as it is formed by image sensor 20. First, it detects the presence of a human face. And, if a face is detected, it detects the region of the face (the facial region) in the projected image. For example, the technique described in Non-Patent Literature 3 below can be used for such processing. Furthermore, facial detection means 31 sends information about the position and shape of the facial region to presented-information control means 32." *See* paras. [0028]-[0031].<br>  <br><br>"First, presented-information control means 32 presets a threshold Z associated with the facial region size. Furthermore, presented-information control means 32 manages animation specifications A0 predefined for the cases of Fw*Fh<Z and animation specifications A1 predefined for the cases of Fw*Fh≧Z, doing so in a memory accessible by said presented-information control means 32. Incidentally, the term |

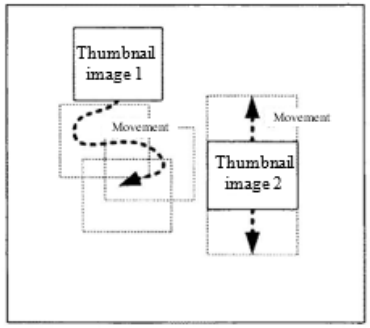
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| | "animation specifications" refers to a description of the specifications of animation to be displayed in the display viewport.<br><br>In the case of animated thumbnail images shown in Figure 5, the animation specifications include information such as the image display size, image blinking pattern, image blinking speed, image motion pattern, image motion range, image motion speed, etc. Presented-information control means 32 executes the animation of each thumbnail image according to such animation specifications.<br><br>Presented-information control means 32 calculates the facial region size (area size of the rectangular facial region) Fw*Fh upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31. If Fw*Fh<Z, presented-information control means 32 controls the presentation of thumbnail images according to animation specifications A0. However, if Fw*Fh≧Z, it controls the presentation of thumbnail images according to animation specifications A1." *See* paras. [0059]-[0061].<br><br>Figure 5: |

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| |  <br>Example of animation of moving thumbnail images<br><br>"(Embodiment 3) Control Based on Size Variation of Facial region<br>Presented-information control means 32 presets a threshold value V for the size variation of the facial region. It retains, in memory 34, facial region position/shape information [(Fx(i), Fy(i), Fw(i), and Fh(i)], which is sequentially received from facial detection means 31. Each time the facial region position/shape information is received, the facial-region size variation value is calculated as follows:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))<br><br>The facial-region size variation value represents the ratio of the most recently detected size Fw(i)*Fh(i) of the facial region to the size Fw(i-1)*Fh(i-1) of the facial region detected one before said most recent size. If it is greater than 1, the facial region size has become larger. If it is less than 1, the facial region's size has become smaller." *See* paras. [0068]-[0069].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) |

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| | the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Miyaoku expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping. *See*, *e.g.*, disclosures below.<br><br>"The basic example configuration of the environmental information-presentation device according to the present invention is shown in Figure 1. The figure consists of at least display 10, image sensor 20 that forms images of the area from which one can view said display (generally the area in front of the display), and computer 30 that processes projected images input from the image sensor and controls the information presented on the display. Here, computer 30 internally comprises facial detection means 31 that detects a facial region in the image projected from image sensor 20, and presented-information control means 32 that controls the presented information based on the position and shape of the facial region thus detected.<br><br>Facial detection means 31 and presented-information control means 32 may be implemented as software that runs on the OS of computer 30. In this case, computer 10 is equipped with an input/output interface means (e.g., image processing means 33, which is an interface device used to output images onto a display or the like) — such an input/output interface means being provided in order to enable each means (which is software) to process projected images as formed by image sensor 20 and control the output toward display 10 — and memory 34. Furthermore, facial detection means 31, in particular, can be implemented using hardware dedicated to processing projected images to improve processing speed.<br><br>The information displayed on display 10 via presented-information control means 32 may be pre-stored in memory 34 of computer 30. Additionally, because a particularly important role of an environmental information-presentation device is to inform users of new information, the device may be configured so as to receive information over a |

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| | network and present the information thus received. For this purpose, computer 30 is equipped with a communication means 35 for communicating with LAN and the Internet. In this case, presented-information control means 32 basically downloads information from a prescribed server in a sequential manner, converts it into a prescribed form suitable for the environmental information presentation, displays it on display 10, and perpetually repeats these steps.<br><br>The following is an explanation of the operation of the environmental information-presentation device according to the present invention: Image sensor 20 forms the image of the front area of display 10, as described above. Facial detection means 31 processes the projected image in real-time as it is formed by image sensor 20. First, it detects the presence of a human face. And, if a face is detected, it detects the region of the face (the facial region) in the projected image. For example, the technique described in Non-Patent Literature 3 below can be used for such processing. Furthermore, facial detection means 31 sends information about the position and shape of the facial region to presented-information control means 32." *See* paras. [0028]-[0031]. |

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| |  <br>"First, presented-information control means 32 presets a threshold Z associated with the facial region size. Furthermore, presented-information control means 32 manages animation specifications A0 predefined for the cases of Fw*Fh<Z and animation specifications A1 predefined for the cases of Fw*Fh≧Z, doing so in a memory accessible by said presented-information control means 32. Incidentally, the term "animation specifications" refers to a description of the specifications of animation to be displayed in the display viewport.<br><br>In the case of animated thumbnail images shown in Figure 5, the animation specifications include information such as the image display size, image blinking pattern, image blinking speed, image motion pattern, image motion range, image motion speed, etc. Presented-information control means 32 executes the animation of each thumbnail image according to such animation specifications. |

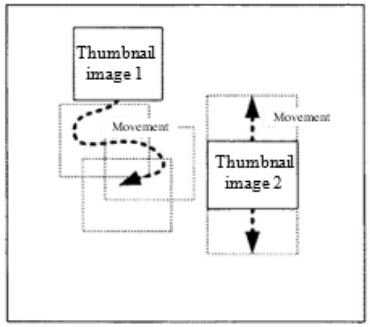
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| | Presented-information control means 32 calculates the facial region size (area size of the rectangular facial region) Fw*Fh upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31. If Fw*Fh<Z, presented-information control means 32 controls the presentation of thumbnail images according to animation specifications A0. However, if Fw*Fh≧Z, it controls the presentation of thumbnail images according to animation specifications A1." *See* paras. [0059]-[0061].<br><br>Figure 5:<br>  <br><br>Example of animation of moving thumbnail images<br><br>"(Embodiment 3) Control Based on Size Variation of Facial region<br>Presented-information control means 32 presets a threshold value V for the size variation of the facial region. It retains, in memory 34, facial region position/shape information [(Fx(i), Fy(i), Fw(i), and Fh(i)], which is sequentially received from facial detection means 31. Each time the facial region position/shape information is received, the facial-region size variation value is calculated as follows: |

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| | ((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))<br><br>The facial-region size variation value represents the ratio of the most recently detected size Fw(i)*Fh(i) of the facial region to the size Fw(i-1)*Fh(i-1) of the facial region detected one before said most recent size. If it is greater than 1, the facial region size has become larger. If it is less than 1, the facial region's size has become smaller." *See* paras. [0068]-[0069].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 8** | |
| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Miyaoku expressly and/or inherently discloses and/or renders obvious applying a translation transformation to move the image within display area of the monitor. *See*, *e.g.*, disclosures below.<br><br>"The display of text information is described in the embodiment above. It should be noted that, in addition to text, the present invention can also control the presentation of images, videos, or media, such as multimedia content that combines text, images, video, and 3D graphics. In these cases, presented-information control means 32 pre-defines media display specifications corresponding to the aforementioned character display specifications for the respective media, doing so for each Fw*Fh-value range. Then, the corresponding media display specifications are selected based on the |

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| | detected Fw*Fh value, after which the display form of the prescribed media is altered according to the media display specifications thus selected.<br><br>(Embodiment 2) Control Based on Facial region Size and Application to Animation Presented-information control means 32 may use animation when presenting information. Human vision is responsive to moving objects. By nature, it instinctively fixates on a moving object that is present in the field of view. Therefore, animation is a useful means for attracting the attention of users located in the vicinity of the environmental information-presentation device.<br><br>Given this factor, presented-information control means 32 may, for example, present multiple thumbnail images and apply animation in such a way that each thumbnail moves through the viewport on display 10. Figure 5 shows an example of the animation of moving thumbnails. Additionally, various types of animation can be used. Examples include animated text, images, and other objects that expand and shrink in size in a repetitive manner, appear and disappear in a repetitive manner, and so on.<br><br>Furthermore, the animated motion of objects in the viewport on display 10 is easy to visually recognize from a distance. For example, the characteristic position-shifting patterns, such as vertical movement, horizontal movement, etc., as well as actions, such as zooming in/out action, showing/hiding action (blinking), can catch one's eye even from a distance at which images and text information presented within an object may not be visible. The inclusion of information in animated motions can be said to be one of the information presentation forms suggested for viewing from a distance.<br><br>By including information in animated motions, it becomes possible, for example, to express the importance of the information by the speed of the movement or the blinking speed. It becomes also possible to associate a specific behavior pattern to a specific meaning, for example, to a type of information. |

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| | In this way, animation can be used to draw users' attention and make distant users recognize the attributes of the information. Also, by presenting images of fish instead of thumbnail images and animating each image of fish as if swimming in water, it becomes possible to add an aquarium-like anesthetic value to the environmental information-presentation device. In this case, it is also possible to make the users recognize the attributes of the information by means of the color and movement of the fish." *See* paras. [0051]-[0056].<br><br>"First, presented-information control means 32 presets a threshold Z associated with the facial region size. Furthermore, presented-information control means 32 manages animation specifications A0 predefined for the cases of Fw*Fh<Z and animation specifications A1 predefined for the cases of Fw*Fh≧Z, doing so in a memory accessible by said presented-information control means 32. Incidentally, the term "animation specifications" refers to a description of the specifications of animation to be displayed in the display viewport.<br><br>In the case of animated thumbnail images shown in Figure 5, the animation specifications include information such as the image display size, image blinking pattern, image blinking speed, image motion pattern, image motion range, image motion speed, etc. Presented-information control means 32 executes the animation of each thumbnail image according to such animation specifications.<br><br>Presented-information control means 32 calculates the facial region size (area size of the rectangular facial region) Fw*Fh upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31. If Fw*Fh<Z, presented-information control means 32 controls the presentation of thumbnail images according to animation specifications A0. However, if Fw*Fh≧Z, it controls the presentation of thumbnail images according to animation specifications A1." *See* paras. [0059]-[0061]. |

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| | Figure 5:<br>  <br><br>Example of animation of moving thumbnail images<br><br>"(Embodiment 3) Control Based on Size Variation of Facial region<br>Presented-information control means 32 presets a threshold value V for the size variation of the facial region. It retains, in memory 34, facial region position/shape information [(Fx(i), Fy(i), Fw(i), and Fh(i)], which is sequentially received from facial detection means 31. Each time the facial region position/shape information is received, the facial-region size variation value is calculated as follows:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))<br><br>The facial-region size variation value represents the ratio of the most recently detected size Fw(i)*Fh(i) of the facial region to the size Fw(i-1)*Fh(i-1) of the facial region detected one before said most recent size. If it is greater than 1, the facial region size has become larger. If it is less than 1, the facial region's size has become smaller." *See* paras. [0068]-[0069]. |

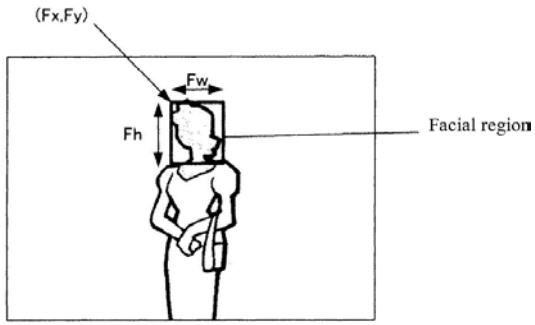
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| | "First, upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31, the facial presentation region in the viewport on display 10A is calculated based on said facial region position/shape information thus received. For example, suppose that the resolution of the projected image, as formed by image sensor 20, is 500 × 400, and the resolution of the display viewport is 1000 × 800. In this case, the facial presentation region of the display viewport that corresponds to the facial region position/shape information [(Fx, Fy), Fw, and Fh] is a rectangular region with the upper-right-corner coordinates of (Fx*2, Fy*2), the width of Fw*2, and the height of Fh*2.<br><br>The user won't be able to see his or her own face projected in the mirror if an image or other information is displayed in the facial presentation region. Accordingly, presented-information control means 32 prevents information from being presented in the facial presentation region. Additionally, if any information has already been presented in the facial presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region." *See* paras. [0075]-[0076].<br><br>"Presented-information control means 32 performs the steps described above to thereby prevent information from being presented in the facial and truncal presentation regions thus calculated. Additionally, if any information has already been presented in the facial or truncal presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region." *See* para. [0080].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Miyaoku expressly and/or inherently discloses and/or renders obvious this limitation. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Miyaoku expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | Miyaoku expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image9. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*: |

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| | "In particular, because the distance between a user and the environmental information-presentation device is not fixed, the present system must take into account the distance from the user when displaying information. For example, it is meaningless to present detailed information that contains a large amount of text in a small font to a user who is far away from the device because the user cannot read it. The environmental information-presentation device is useless unless one can visually recognize the content of the presented information when he or she happens to turn their eyes toward the device. Accordingly, it must be able to present information in a form that is easy for the user to visually recognize according to the distance." *See* para. [0010].<br><br>"In particular, the size of the facial region detected is associated with the distance between the user and the device. Accordingly, the aforementioned presented-information control means presents information suitable for viewing from a distance when the size of the facial region detected by the facial detection means is small. However, when the size of the facial region detected by the facial detection means is large, the presented-information control means presents information suitable for viewing from a close range." *See* para. [0016].<br><br>"Such control is achieved by utilizing the fact that the distance between the user and the device is greater when the facial region size is smaller while the distance between the user and the device is closer when the facial region size is larger. In the example illustrated above, a single threshold Z is used as the value that triggers the switch between the character display specifications suitable for viewing from a distance and the character display specifications suitable for viewing from a close range." *See* para. [0045].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| 11[b]. varying resolution of the image according to the distance. | Miyaoku expressly and/or inherently discloses and/or renders obvious varying resolution of the image according to the distance. *See*, *e.g.*, disclosures below.<br><br>"Furthermore, the environmental information-presentation device according to the present invention adopts a creative approach in order to make presented information more visually recognizable, doing so through a mechanism that actively expands information and presents more details to the user who is about to approach the device." *See* para. [0020].<br><br>"Figure 2 shows an example of a facial region detected, by facial detection means 31, in a projected image as formed by image sensor 20. In this example, the facial region is detected as a rectangular region. When such a rectangular facial region is detected, facial detection means 31 sends, to presented-information control means 32, the coordinates (Fx, Fy) of the upper right corner of said rectangular region in the projected image as well as the width Fw and the height Fh of the rectangular, all of which act as the facial region position/shape information.<br><br>Presented-information control means 32 modifies the information to be presented, doing so based on the facial region position/shape information received from facial detection means 31. The following is an explanation of embodiments of the control of information presented." *See* paras. [0033]-[0034].<br><br>Figure 2: |

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| |  <br>Projected image as captured by an image sensor<br><br>"(Embodiment 1) Control Based on the Size of Facial Region<br>Presented-information control means 32 presets a threshold value Z for facial region sizes. Additionally, presented-information control means 32, at the initial stage, presents information in a form suitable for viewing from a distance. Said "form suitable for viewing from a distance" is, for example, a form of display whereby most characters are in large font and only a small amount of information is presented, e.g., to the extent of headings only. In terms of images or videos, they are displayed in forms enlarged enough to allow the subjects to be identified even from a distance.<br><br>Presented-information control means 32 — upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31 — calculates the facial region size (the area size of the rectangular facial region) Fw*Fh. Then, if Fw*Fh≧ Z, the information presented is altered to a form suitable for viewing from a close range. Said "form suitable for viewing from a close range" is, for example, a form in which characters are in relatively small font presenting detailed information. In terms of images or videos, they are displayed in sizes suitable for viewing from a close |

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| | range and in forms that may include the display of text information, such as telops." *See* paras. [0035]-[0036].<br><br>"(Embodiment 2) Control Based on Facial region Size and Application to Animation Presented-information control means 32 may use animation when presenting information. Human vision is responsive to moving objects. By nature, it instinctively fixates on a moving object that is present in the field of view. Therefore, animation is a useful means for attracting the attention of users located in the vicinity of the environmental information-presentation device.<br><br>Given this factor, presented-information control means 32 may, for example, present multiple thumbnail images and apply animation in such a way that each thumbnail moves through the viewport on display 10. Figure 5 shows an example of the animation of moving thumbnails. Additionally, various types of animation can be used. Examples include animated text, images, and other objects that expand and shrink in size in a repetitive manner, appear and disappear in a repetitive manner, and so on.<br><br>Furthermore, the animated motion of objects in the viewport on display 10 is easy to visually recognize from a distance. For example, the characteristic position-shifting patterns, such as vertical movement, horizontal movement, etc., as well as actions, such as zooming in/out action, showing/hiding action (blinking), can catch one's eye even from a distance at which images and text information presented within an object may not be visible. The inclusion of information in animated motions can be said to be one of the information presentation forms suggested for viewing from a distance.<br><br>By including information in animated motions, it becomes possible, for example, to express the importance of the information by the speed of the movement or the blinking speed. It becomes also possible to associate a specific behavior pattern to a specific meaning, for example, to a type of information. |

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| | In this way, animation can be used to draw users' attention and make distant users recognize the attributes of the information. Also, by presenting images of fish instead of thumbnail images and animating each image of fish as if swimming in water, it becomes possible to add an aquarium-like anesthetic value to the environmental information-presentation device. In this case, it is also possible to make the users recognize the attributes of the information by means of the color and movement of the fish.<br><br>However, such animation can get in the way of nearby users trying to see the detailed information presented on display 10. For example, it will be very difficult to read text if the thumbnail images containing text information move up and down, left to right, etc.<br><br>Given this factor, the present embodiment executes the following processing to enable the effective use of animation in environmental information presentation.<br><br>First, presented-information control means 32 presets a threshold Z associated with the facial region size. Furthermore, presented-information control means 32 manages animation specifications A0 predefined for the cases of Fw*Fh<Z and animation specifications A1 predefined for the cases of Fw*Fh≧Z, doing so in a memory accessible by said presented-information control means 32. Incidentally, the term “animation specifications” refers to a description of the specifications of animation to be displayed in the display viewport.<br><br>In the case of animated thumbnail images shown in Figure 5, the animation specifications include information such as the image display size, image blinking pattern, image blinking speed, image motion pattern, image motion range, image motion speed, etc. Presented-information control means 32 executes the animation of each thumbnail image according to such animation specifications. |

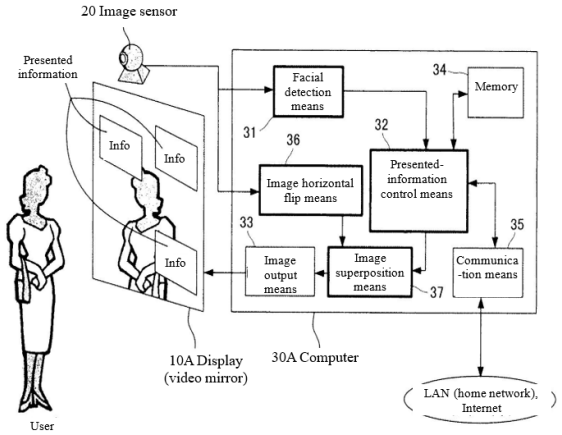
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| | Presented-information control means 32 calculates the facial region size (area size of the rectangular facial region) Fw*Fh upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31. If Fw*Fh<Z, presented-information control means 32 controls the presentation of thumbnail images according to animation specifications A0. However, if Fw*Fh≧Z, it controls the presentation of thumbnail images according to animation specifications A1.<br><br>Fast-moving animation is suitable for presenting information to distant users, and slow-moving animation is suitable for presenting information to nearby users. Accordingly, in the present embodiment, the above-mentioned processing may be set so as to accelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh<Z (i.e., when the facial image size is small) but decelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh≧Z (i.e., when the facial image size is large). This makes it possible to adapt the animation speed to the distance between the user and the device." *See* paras. [0052]-[0062].<br><br>"Fast-moving animation is suitable for presenting information to distant users, and slow-moving animation is suitable for presenting information to nearby users. Accordingly, in the present embodiment, the above-mentioned processing may be set so as to accelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh<Z (i.e., when the facial image size is small) but decelerate the image blinking speed and image operation speed according to animation specifications A0 when Fw*Fh≧Z (i.e., when the facial image size is large). This makes it possible to adapt the animation speed to the distance between the user and the device.<br><br>Incidentally, it is also possible to implement incremental motion control in the control of animation, doing so through the same steps described in Embodiment 1 above. In this case, presented-information control means 32 retains thresholds Z(0), . . ., Z(n-1) predefined for n facial image sizes. Additionally, presented-information control means |

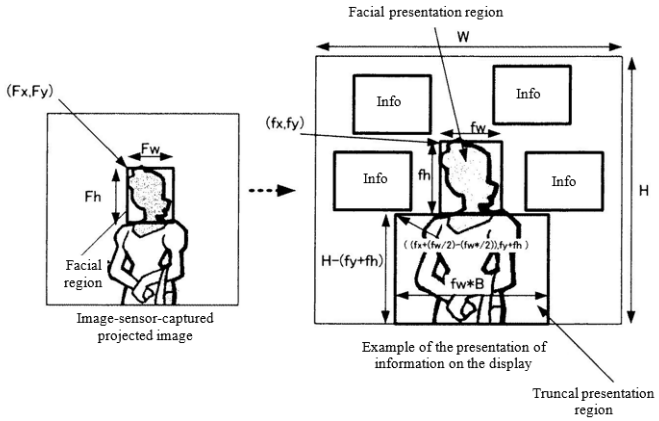
<table>
<tr><th>Asserted Claim of the ’109 Patent</th><th>Exemplary Citations to Miyaoku</th></tr>
<tr><td></td><td>32 retains n+1 sets of animation specifications An (n=0, 1, . . ., n) corresponding to the cases of the facial image size Fw*Fh<Z(0), the cases of Z(k-1)≦Fw*Fh<Z(k) (where k = 1, 2, . . ., n-1), and the cases of Z(n-1)≦Fw*Fh.<br><br>The content of the processing is the same as the steps described in Embodiment 1, except that the animation specifications are used in place of the character display specifications and that the subject of the control is animation, not the text display, as shown in Table 3 below by way of example.<br><br>Through such processing, it becomes possible to control the animation, for example, in such a way that the motion speed of the animation gradually slows down as the size of the facial region Fw*Fh increases.” See paras. [0063]-[0066].<br><br>Table 3:<br><br><table><tr><td>Name of specification item</td><td>Description of specification</td></tr><tr><td>Image display size</td><td>320×240</td></tr><tr><td>Image blinking pattern</td><td>Blink with difference brightness levels</td></tr><tr><td>Image blinking speed</td><td>5 times per second</td></tr><tr><td>Image behavior pattern</td><td>Vertical movement</td></tr><tr><td>Image movement range</td><td>Upper/lower ±100 pixels</td></tr><tr><td>Image movement speed</td><td>100 pixels per second</td></tr><tr><td>. . .</td><td></td></tr></table><br>“Incidentally, presented-information control means 32 may be implemented in such a way that it manages multiple sets of character display specifications Dn (n = 0, 1, . . ., n) and animation specifications An (n = 0, 1, . . ., n) concurrently so that the text</td></tr>
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| | display control and the animation control described in embodiments 1 and 2 are performed concurrently.<br><br>(Embodiment 3) Control Based on Size Variation of Facial region<br>Presented-information control means 32 presets a threshold value V for the size variation of the facial region. It retains, in memory 34, facial region position/shape information [(Fx(i), Fy(i), Fw(i), and Fh(i)], which is sequentially received from facial detection means 31. Each time the facial region position/shape information is received, the facial-region size variation value is calculated as follows:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))<br><br>The facial-region size variation value represents the ratio of the most recently detected size Fw(i)*Fh(i) of the facial region to the size Fw(i-1)*Fh(i-1) of the facial region detected one before said most recent size. If it is greater than 1, the facial region size has become larger. If it is less than 1, the facial region's size has become smaller.<br><br>The direction in which the user moves can be estimated based on the variation in the size of the facial region. That is, if the size of a user's facial region increases, it can be determined that the user is approaching the environmental information-presentation device. The threshold V for the facial-region size variation is used as an indicator to determine whether the user's movement is intentional. Suppose the facial-region size variation value is somewhat high, indicating a value equal to or greater than 1. In that case, it can be determined that the user is approaching the environmental information-presentation device at a relatively fast speed. In other words, it is determined that the user is intentionally moving toward the environmental information-presentation device.<br><br>As such, the presented-information control means determines that the user is approaching the device because he or she is interested in the presented information and thus performs the processing required to alter, e.g., expand, the presented information when the following condition is satisfied: |

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| | ((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))≧V<br><br>It should be noted that the above illustration is an example of the present embodiment. Presented-information control means 32 may set a threshold value V', which is less than 1, so as to perform the processing required to present a message to attract the user's interest when the following condition is satisfied, i.e., when the user is moving in the direction away from the environmental information-presentation device:<br><br>((Fw(i)*Fh(i))/(Fw(i-1)*Fh(i-1)))<V'" *See* paras. [0067]-[0072].<br><br>"(Embodiment 4) Control Based on the Position of Facial region in Mirror-type Environmental Information-Presentation Device<br><br>Figure 6 shows an example configuration of the mirror-type environmental information-presentation device. In the example configuration shown in the figure, a video mirror acts as display 10A. Computer 30A horizontally flips the projected image formed by image sensor 20, converts the size to fit the display size, and thus presents the image on display 10A. As such, it virtually acts as a mirror. Information such as thumbnail images presented by presented-information control means 32 is superimposed and thus presented on the image projected from image sensor 20. For this purpose, the present mirror-type environmental information-presentation device is equipped with an image horizontal-flip means 36 and image superimposition means 37, in addition to each means constituting the environmental information-presentation device shown in Figure 1.<br><br>When a mirror-type environmental information-presentation device presents information, it is expected that the information thus presented does not interfere with the user's own figure projected in the mirror. Given this factor, presented-information control means 32 performs the following processing steps:<br><br>First, upon receipt of facial region position/shape information [(Fx, Fy), Fw, and Fh] from facial detection means 31, the facial presentation region in the viewport on display |

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| | 10A is calculated based on said facial region position/shape information thus received. For example, suppose that the resolution of the projected image, as formed by image sensor 20, is 500 × 400, and the resolution of the display viewport is 1000 × 800. In this case, the facial presentation region of the display viewport that corresponds to the facial region position/shape information [(Fx, Fy), Fw, and Fh] is a rectangular region with the upper-right-corner coordinates of (Fx*2, Fy*2), the width of Fw*2, and the height of Fh*2.<br><br>The user won't be able to see his or her own face projected in the mirror if an image or other information is displayed in the facial presentation region. Accordingly, presented-information control means 32 prevents information from being presented in the facial presentation region. Additionally, if any information has already been presented in the facial presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region.<br><br>Furthermore, presented-information control means 32 may be configured to control the presentation of information by estimating the truncal presentation region in the display viewport based on the facial region detected by facial detection means 31 so as to present information in regions other than the facial presentation region and the truncal presentation region. Figure 7 shows an example presentation of information in such a case. Additionally, an example content of the processing performed by presented-information control means 32 is described below:<br><br>Suppose that the resolution of the viewport on display 10A is W × H, and the facial presentation region calculated by presented-information control means 32 is a rectangular region with the upper-right-corner coordinates of the display viewport being (Fx, Fy), the width being fw, and the height being fh. In this case, the trunk is located below the facial region. It also occupies a region that is wider than the facial region.<br><br>Accordingly, presented-information control means 32 uses a prescribed value B (value representing (Width of the truncal presentation region / Width of the facial presentation region)) to estimate that the truncal presentation region is a rectangular region with the |

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| | upper right corner coordinate of ((fx+(fw/2)-(fw*B/2)), fy+fh), the width of fw*B, and the height of H-(fy+fh).<br><br>Presented-information control means 32 performs the steps described above to thereby prevent information from being presented in the facial and truncal presentation regions thus calculated. Additionally, if any information has already been presented in the facial or truncal presentation region, presented-information control means 32 changes the position of the information to a position outside the facial presentation region." *See* paras. [0073]-[0080].<br><br>Figure 6:<br><br>  <br><br><br>Figure 7: |

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| |  <br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Miyaoku alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

# Exhibit A-10: Invalidity of U.S. Patent No. 8,982,109 in view of U.S. Patent No. 7,999,843 ("Ohba")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

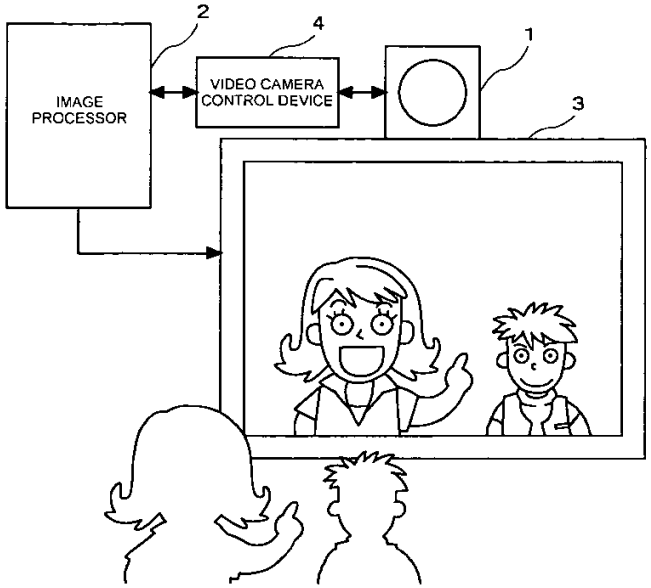
Ohba was originally filed January 28, 2005 and issued on August 16, 2011, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a), (b), and (e).

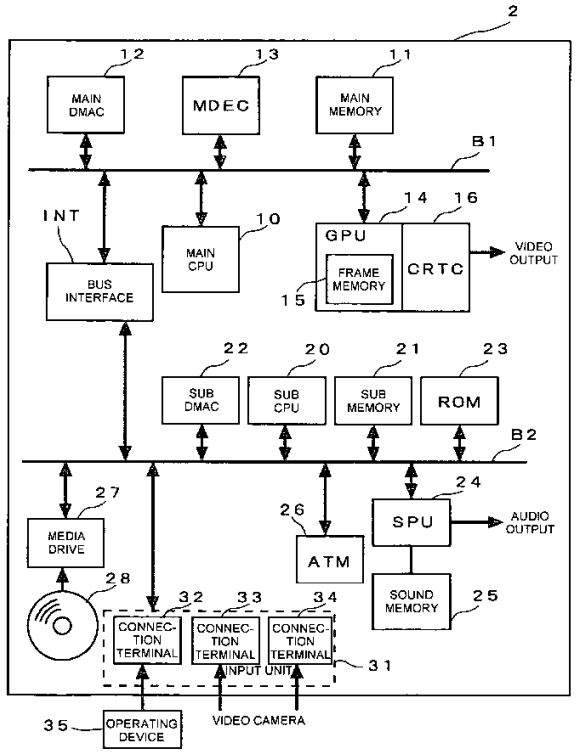
Ohba anticipates the Asserted Claims of the '109 Patent. To the extent it is found Ohba does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Ohba does not anticipate the Asserted Claims, Ohba renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Ohba expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"This image processing system comprises an analog or digital video camera 1 which is an example of an image capturing device, an image processor 2, a display device 3, and a video camera control device 4. The image processing system captures, with the video camera 1, pictures of a candidate operator facing against the display device 3, and continuously supplies the resulting video image features to the image processor 2 in time series to generate mirrored video image features as well as combines the mirrored video image features with an object image associated with an object such as a menu or a cursor to generate combined images (which also serve as video image features), to thereby achieve real-time production of the combined images on the display device 3. The object image is combined so that it is displayed in a certain range where the candidate operator in the mirrored video image feature can access." *See* 5:14-29.<br><br>"The image processor 2 is implemented by a computer that provides a desired function based on a computer program." *See* 5:52-53<br><br>"To the main bus B1 connected are a main CPU 10, which is a main semiconductor device, a main memory 11 formed of a RAM, a main DMAC (Direct Memory Access Controller) 12, an MPEG (Moving Picture Experts Group) decoder (MDEC) 13, and a graphic processing unit (Graphic Processing Unit, hereinafter "GPU") having therein a frame memory 15 which serves as a graphic memory." *See* 5:60-66. |

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| |  <br>FIG. 1<br>*See* Fig. 1. |

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| |  <br>FIG. 2<br><br>*See* Fig. 2.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |

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| 1[a]. obtaining a digital image from a camera; | Ohba expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below.<br><br>"This image processing system comprises an analog or digital video camera 1 which is an example of an image capturing device, an image processor 2, a display device 3, and a video camera control device 4. The image processing system captures, with the video camera 1, pictures of a candidate operator facing against the display device 3, and continuously supplies the resulting video image features to the image processor 2 in time series to generate mirrored video image features as well as combines the mirrored video image features with an object image associated with an object such as a menu or a cursor to generate combined images (which also serve as video image features), to thereby achieve real-time production of the combined images on the display device 3. The object image is combined so that it is displayed in a certain range where the candidate operator in the mirrored video image feature can access." *See* 5:14-29.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Ohba expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. *See*, *e.g.*, disclosures below.<br><br>"The mirrored video image features may be generated by means of mirroring (interchanging the right and left sides of the image) the video image features received from the video camera 1, by the image processor 2." *See* 5:34-37. |

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| | "The image reversing section 102 performs mirroring processing, that is, interchanging the right and left sides of the captured image received by the image input section 101, to form a mirrored video image feature." *See* 7:25-28.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Ohba expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror. *See*, *e.g.*, disclosures below.<br><br>"The mirrored video image features may be generated by means of mirroring (interchanging the right and left sides of the image) the video image features received from the video camera 1, by the image processor 2. Alternatively, a mirror may be placed in front of the video camera 1 and the video image features on the mirror in which the candidate operator(s) is/are reflected may be captured to generate the mirrored video image features. Alternatively, the video camera 1 itself may have a function to generate mirrored video image features. In any way, a combined image of the mirrored video image features and the object image, of which display appearance changes in real time depending on the motion of the operator, is displayed on the display device 3." *See* 5:34-46.<br><br>"The image reversing section 102 performs mirroring processing, that is, interchanging the right and left sides of the captured image received by the image input section 101, to form a mirrored video image feature. It should be noted that no image reversing section 102 is required when a captured image received by the image processor 2 is a mirrored video image feature because a mirror is placed in front of the video camera 1 for the |

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| | picture capturing with the video camera 1 or because the video camera 1 has a function of generating a mirrored image." *See* 7:25-34.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Ohba expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera. *See*, *e.g.*, disclosures below.<br><br>"The video camera control device for controlling the video camera 1 directs the video camera 1 to do zooming, panning, and tilting, in response to an instruction of the image processor 2. It may be contained within the video camera 1 or the image processor 2." *See* 5:43-51.<br><br>"The display controller section 108 converts the combined image generated by the image combining section 106 to a video signal and supplies it to the display device 3. In addition, the display controller section 108 is for zooming, panning, and tilting on the operator selected by the operator detector section 109. The zooming, panning, and tilting operations may be done by digital processing of the image drawn in the frame memory. Alternatively, zooming, panning, and tilting of the video camera 1 may be done by the video camera control device 4." *See* 8:34-43.<br><br>"The individual candidate presentation areas may have the same size for all candidate operators depending on the priority. However, in FIG. 7, they have different sizes for each candidate operators. In FIG. 7, the left candidate operator is larger than the right candidate operator on the screen, so that the candidate presentation area for the left candidate operator is larger than the candidate presentation area for the right candidate operator. This means that the size of the candidate presentation area is changed |

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| | depending on the size of the area of the face of the candidate operator. The size of the candidate operator may be determined by detecting the size of the face by the operator detector section 109." *See* 9:43-54.<br><br>"8. The image processor as claimed in claim 7 further comprising means for selecting, when said object image is accessed, the image of the candidate operator who has accessed the object image, as the image of said operator, and display control means for zooming, panning or tilting the image of the selected candidate operator.<br><br>"9. The image processor as claimed in claim 8 wherein said display control means is adapted to do zooming, panning and/or tilting of the image of the selected candidate operator by digital processing.<br><br>"10. The image processor as claimed in claim 8 wherein said display control means is adapted to do zooming, panning or tilting of the image of the selected candidate operator by controlling the image capturing device for capturing said mirrored video image feature. *See* Claims 8-10.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | Ohba expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below.<br><br>"This image processing system comprises an analog or digital video camera 1 which is an example of an image capturing device, an image processor 2, a display device 3, and a video camera control device 4. The image processing system captures, with the video camera 1, pictures of a candidate operator facing against the display device 3, and |

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| | continuously supplies the resulting video image features to the image processor 2 in time series to generate mirrored video image features as well as combines the mirrored video image features with an object image associated with an object such as a menu or a cursor to generate combined images (which also serve as video image features), to thereby achieve real-time production of the combined images on the display device 3. The object image is combined so that it is displayed in a certain range where the candidate operator in the mirrored video image feature can access."<br><br>"The display controller section 108 converts the combined image generated by the image combining section 106 to a video signal and supplies it to the display device 3. In addition, the display controller section 108 is for zooming, panning, and tilting on the operator selected by the operator detector section 109. The zooming, panning, and tilting operations may be done by digital processing of the image drawn in the frame memory. Alternatively, zooming, panning, and tilting of the video camera 1 may be done by the video camera control device 4.<br><br>"The display device 3 displays the combined images (video image features) on a screen using this video signal supplied from the display controller section 108." *See* 8:34-43.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Ohba expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"This image processing system comprises an analog or digital video camera 1 which is an example of an image capturing device, an image processor 2, a display device 3, and a video camera control device 4. The image processing system captures, with the video |

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| | camera 1, pictures of a candidate operator facing against the display device 3, and continuously supplies the resulting video image features to the image processor 2 in time series to generate mirrored video image features as well as combines the mirrored video image features with an object image associated with an object such as a menu or a cursor to generate combined images (which also serve as video image features), to thereby achieve real-time production of the combined images on the display device 3. The object image is combined so that it is displayed in a certain range where the candidate operator in the mirrored video image feature can access." *See* 5:14-29.<br><br>"The mirrored video image features may be generated by means of mirroring (interchanging the right and left sides of the image) the video image features received from the video camera 1, by the image processor 2. Alternatively, a mirror may be placed in front of the video camera 1 and the video image features on the mirror in which the candidate operator(s) is/are reflected may be captured to generate the mirrored video image features. Alternatively, the video camera 1 itself may have a function to generate mirrored video image features. In any way, a combined image of the mirrored video image features and the object image, of which display appearance changes in real time depending on the motion of the operator, is displayed on the display device 3." *See* 5:34-46.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Ohba expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video feed. *See*, *e.g.*, disclosures below.<br><br>"The area that the image of the hand of the operator can reach may be, for example around the position of the face of the operator. When an object image is displayed around the position of the face, for example, said detection means is adapted to detect the |

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| | position of the face of the operator in the image of said operator, and said image combining means is adapted to combine said object image and said mirrored video image feature in such a manner that said object image is displayed in an area suitable to the detected position of the face. In such a case, said image combining means may be adapted to combine an image representing a marker that indicates that the operator has detected, at the position of the image of said operator detected by said detection means." *See* 2:26-38.<br><br>"When said mirrored video image feature contains images of multiple candidate operators who can be an operator, said detection means is adapted to detect the position of an image of a candidate operator for each of said multiple candidate operators, and said image combining means may be adapted to combine said object image and said mirrored video image feature in such a manner that said object image is displayed in a range that the images of the hands of the individual candidate operators can reach, depending on the positions of the images of said multiple candidate operators detected by said detection means." *See* 2:64-3:6.<br><br>"The operator detector section 109 is for detecting, for example, the position and the size of the face of the candidate operator in the mirrored video image feature. For example, a known face sensing technique is used to detect, for example, the position and the size of the face of the candidate operator." *See* 8:22-26.<br><br>"The image processor 2 detects, by the operator detector section 109, the position of the face of the candidate operator in the mirrored video image feature by using a face sensing technique and encloses the detected positions with rectangular marker images 51 and 52 (step S101)." *See* 9:4-8.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Ohba inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance . This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |

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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | Ohba inherently discloses and/or renders obvious wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |

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| **Claim 7** | |

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| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Ohba expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 7[a]. obtaining a reference image; | Ohba expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below.<br><br>"In the computer having the above-mentioned configuration, the main CPU 10, the sub CPU 20 and the GPU 14 read and execute a desired computer program out of the recording medium such as the ROM 23 and the medium 28 to form functional blocks that are necessary for serving as the image processor 2, i.e., an image input section 101, an image reversing section 102, an object data storage section 103, an object data acquisition section 104, an object image generator section 105, an image combining section 106, an image comparing section 107, a display controller section 108, and an operator detector section 109 as shown in FIG. 3.<br><br>"In the relationship with the hardware shown in FIG. 2, the image input section 101 is formed of the input unit 31 and the sub CPU 20 that controls the operation thereof. The image reversing section 102, the object data acquisition section 104, the object image generator section 105, the image comparing section 107, and the operator detector section 109 are formed of the main CPU 10. The image combining section 106 is formed of the GPU 14. The display controller section 108 is formed of the GPU 14 and the CRTC 16 that are cooperating with each other. The object data storage section 103 is |

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| | formed in a memory area such as the main memory 11 accessible from the main CPU 10." *See* 6:62-7:17.<br><br>"The image comparing section 107 compares, on a frame by frame basis, the mirrored video image features and generates an image representing a difference between the mirrored video image features of the preceding and following frames. Furthermore, the image comparing section 107 compares, on a frame by frame basis, the mirrored video image features to detect any change in color in individual areas in the mirrored video image features between frames." *See* 7:57-64.<br><br>"The image combining section 106 selects the area where the menu image is actually presented from the candidate presentation areas for the menu image (step S103). The presentation area may be selected depending on, for example, the frequency of movements of the candidate operators in each portion of the mirrored video image feature or the change in color of the areas in the mirrored video image feature, which are detected by the image comparing section 107. The area where the candidate operator can be accessed most easily is selected according to the frequency of movements of the candidate operator and/or the change in color, from the candidate presentation areas. This area corresponds to the area where the menu image is presented." *See* 9:55-67.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Ohba expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"In the computer having the above-mentioned configuration, the main CPU 10, the sub CPU 20 and the GPU 14 read and execute a desired computer program out of the recording medium such as the ROM 23 and the medium 28 to form functional blocks |

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| | that are necessary for serving as the image processor 2, i.e., an image input section 101, an image reversing section 102, an object data storage section 103, an object data acquisition section 104, an object image generator section 105, an image combining section 106, an image comparing section 107, a display controller section 108, and an operator detector section 109 as shown in FIG. 3.<br><br>"In the relationship with the hardware shown in FIG. 2, the image input section 101 is formed of the input unit 31 and the sub CPU 20 that controls the operation thereof. The image reversing section 102, the object data acquisition section 104, the object image generator section 105, the image comparing section 107, and the operator detector section 109 are formed of the main CPU 10. The image combining section 106 is formed of the GPU 14. The display controller section 108 is formed of the GPU 14 and the CRTC 16 that are cooperating with each other. The object data storage section 103 is formed in a memory area such as the main memory 11 accessible from the main CPU 10." *See* 6:62-7:17.<br><br>"The image comparing section 107 compares, on a frame by frame basis, the mirrored video image features and generates an image representing a difference between the mirrored video image features of the preceding and following frames. Furthermore, the image comparing section 107 compares, on a frame by frame basis, the mirrored video image features to detect any change in color in individual areas in the mirrored video image features between frames." *See* 7:57-64.<br><br>"The image combining section 106 selects the area where the menu image is actually presented from the candidate presentation areas for the menu image (step S103). The presentation area may be selected depending on, for example, the frequency of movements of the candidate operators in each portion of the mirrored video image feature or the change in color of the areas in the mirrored video image feature, which are detected by the image comparing section 107. The area where the candidate operator can be accessed most easily is selected according to the frequency of movements of the |

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| | candidate operator and/or the change in color, from the candidate presentation areas. This area corresponds to the area where the menu image is presented." *See* 9:55-67.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Ohba expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping. *See*, *e.g.*, disclosures below.<br><br>"In the computer having the above-mentioned configuration, the main CPU 10, the sub CPU 20 and the GPU 14 read and execute a desired computer program out of the recording medium such as the ROM 23 and the medium 28 to form functional blocks that are necessary for serving as the image processor 2, i.e., an image input section 101, an image reversing section 102, an object data storage section 103, an object data acquisition section 104, an object image generator section 105, an image combining section 106, an image comparing section 107, a display controller section 108, and an operator detector section 109 as shown in FIG. 3.<br><br>"In the relationship with the hardware shown in FIG. 2, the image input section 101 is formed of the input unit 31 and the sub CPU 20 that controls the operation thereof. The image reversing section 102, the object data acquisition section 104, the object image generator section 105, the image comparing section 107, and the operator detector section 109 are formed of the main CPU 10. The image combining section 106 is formed of the GPU 14. The display controller section 108 is formed of the GPU 14 and the CRTC 16 that are cooperating with each other. The object data storage section 103 is formed in a memory area such as the main memory 11 accessible from the main CPU 10." *See* 6:62-7:17. |

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| | "The image comparing section 107 compares, on a frame by frame basis, the mirrored video image features and generates an image representing a difference between the mirrored video image features of the preceding and following frames. Furthermore, the image comparing section 107 compares, on a frame by frame basis, the mirrored video image features to detect any change in color in individual areas in the mirrored video image features between frames." *See* 7:57-64.<br><br>"The image combining section 106 selects the area where the menu image is actually presented from the candidate presentation areas for the menu image (step S103). The presentation area may be selected depending on, for example, the frequency of movements of the candidate operators in each portion of the mirrored video image feature or the change in color of the areas in the mirrored video image feature, which are detected by the image comparing section 107. The area where the candidate operator can be accessed most easily is selected according to the frequency of movements of the candidate operator and/or the change in color, from the candidate presentation areas. This area corresponds to the area where the menu image is presented." *See* 9:55-67.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |

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| **Claim 8** | |
| 8. The method of claim 1, further comprising applying a translation | Ohba expressly and/or inherently discloses and/or renders obvious applying a translation transformation to move the image within display area of the monitor. *See*, *e.g.*, disclosures below. |

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| transformation to move the image within display area of the monitor. | "When an operator is selected out of the multiple candidate operators, said display control means may do zooming, panning and/or tilting the image of the selected candidate operator by digital processing or by controlling the image capturing device for capturing said mirrored video image feature, in order to provide clear distinction of the operator with the operator being allowed to be displayed larger at the center of the screen." *See* 3:40-47.<br><br>"The video camera control device for controlling the video camera 1 directs the video camera 1 to do zooming, panning, and tilting, in response to an instruction of the image processor 2. It may be contained within the video camera 1 or the image processor 2." *See* 5:47-51.<br><br>"The display controller section 108 converts the combined image generated by the image combining section 106 to a video signal and supplies it to the display device 3. In addition, the display controller section 108 is for zooming, panning, and tilting on the operator selected by the operator detector section 109. The zooming, panning, and tilting operations may be done by digital processing of the image drawn in the frame memory. Alternatively, zooming, panning, and tilting of the video camera 1 may be done by the video camera control device 4." *See* 8:34-43.<br><br>"8. The image processor as claimed in claim 7 further comprising means for selecting, when said object image is accessed, the image of the candidate operator who has accessed the object image, as the image of said operator, and display control means for zooming, panning or tilting the image of the selected candidate operator.<br><br>"9. The image processor as claimed in claim 8 wherein said display control means is adapted to do zooming, panning and/or tilting of the image of the selected candidate operator by digital processing.<br><br>"10. The image processor as claimed in claim 8 wherein said display control means is adapted to do zooming, panning or tilting of the image of the selected candidate operator |

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| | by controlling the image capturing device for capturing said mirrored video image feature." *See* Claims 8-10.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |

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| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Ohba inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |

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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Ohba expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below. |

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| | *See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | Ohba expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*:<br><br>"The area that the image of the hand of the operator can reach may be, for example around the position of the face of the operator. When an object image is displayed around the position of the face, for example, said detection means is adapted to detect the position of the face of the operator in the image of said operator, and said image combining means is adapted to combine said object image and said mirrored video image feature in such a manner that said object image is displayed in an area suitable to the detected position of the face. In such a case, said image combining means may be adapted to combine an image representing a marker that indicates that the operator has detected, at the position of the image of said operator detected by said detection means." *See* 2:26-38.<br><br>"When said mirrored video image feature contains images of multiple candidate operators who can be an operator, said detection means is adapted to detect the position of an image of a candidate operator for each of said multiple candidate operators, and said image combining means may be adapted to combine said object image and said mirrored video image feature in such a manner that said object image is displayed in a range that the images of the hands of the individual candidate operators can reach, |

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| | depending on the positions of the images of said multiple candidate operators detected by said detection means." *See* 2:64-3:6.<br><br>"The operator detector section 109 is for detecting, for example, the position and the size of the face of the candidate operator in the mirrored video image feature. For example, a known face sensing technique is used to detect, for example, the position and the size of the face of the candidate operator." *See* 8:22-26.<br><br>"The image processor 2 detects, by the operator detector section 109, the position of the face of the candidate operator in the mirrored video image feature by using a face sensing technique and encloses the detected positions with rectangular marker images 51 and 52 (step S101)." *See* 9:4-8.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | Ohba expressly and/or inherently discloses and/or renders obvious varying resolution of the image according to the distance . This limitation would have been obvious to a person of ordinary skill in the art based on (1) Ohba alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II. B of the cover document. |

# Exhibit A-11: Invalidity of U.S. Patent No. 8,982,109 in view of *High-speed Gaze Controller for Millisecond-order Pan/tilt Camera*, Okumura et al. ("Okumura I")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

Okumura I was originally published May 9-13, 2011, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a) and (b).

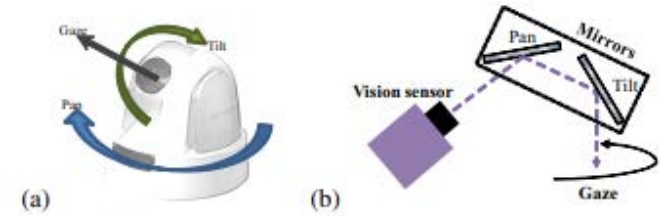
Okumura I anticipates the Asserted Claims of the '109 Patent. To the extent it is found Okumura I does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Okumura I does not anticipate the Asserted Claims, Okumura I renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

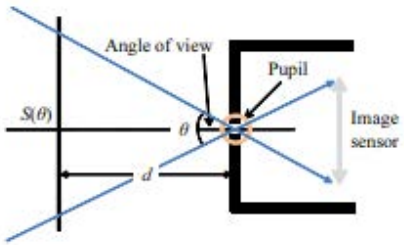
In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

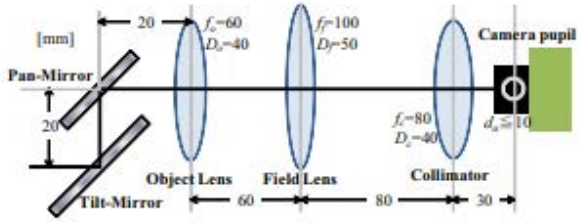
Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.

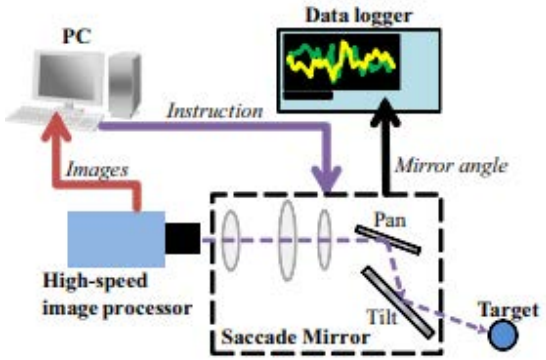
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| **Claim 1** | |
| 1[pre]. A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising: | To the extent the preamble is limiting, Okumura I expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>"Abstract—We developed an optical high-speed gaze controller, called the "Saccade Mirror", and used it to realize a high-speed pan/tilt camera with a high-speed image processor. Generally, in a pan/tilt camera, the gaze is controlled mechanically by rotational actuators. However, because pan/tilt cameras will be expected to use high-speed image processing (≥ 1000 fps), sufficiently high-speed performance of the gaze controller, comparable to the high frame rate, cannot be obtained with the usual method. In our system, the camera itself was fixed, and an external Saccade Mirror subsystem was used for optical gaze control. An arbitrary gaze direction within ±30 deg could be achieved in less than 3.5 ms." *See* page 6186.<br><br>"The purpose of our study was to realize a high-speed pan/tilt camera that has the ability to change its gaze direction extremely quickly, at speeds comparable to the processing speed of a high-speed image processor, while still providing a sufficient angle of view. The term "gaze" used here means the direction in which images are captured by the camera, and "high-speed image processor" means a kind of camera (a vision sensor) that can realize both capturing and processing of more than 1000 images per second. The background of this research follows. It is said that more than 80 % of the sensory information that humans obtain is from the visual organs. For robots as well, visual servo systems have been widely used to grasp changing external environments. Vision sensors with a frame rate of 30 fps, such as CCDs, are mainly used in visual information processing. However, this approach cannot realize high-speed visual control because the image sampling rate in visual information processing is restricted to at most 30 Hz. In such cases, a high-speed image processor has been demonstrated to be quite useful [1]. On the other hand, in some applications, it is necessary to acquire images over a range wider than the camera's original angle of view. Hence, cameras whose gaze can be controlled, called pan/tilt cameras (or active vision systems), have been developed mainly for the purpose of monitoring, inspection, and so on. In a general pan/tilt camera, |

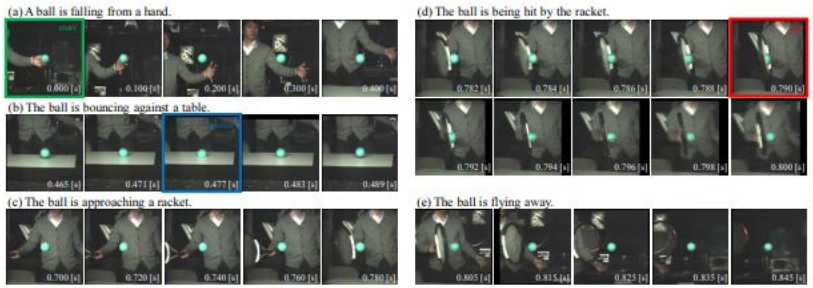
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| | the camera is mounted on a two-axis rotational platform including actuators (Fig. 1(a)) [2].<br><br>If a high-speed image processor can control its gaze at a speed sufficiently high compared with its frame rate, various advanced applications are expected. Some examples are:<br><br>• Observation of high-speed dynamic objects without motion blur.<br><br>• Quasi-extension of the angle of view by combining multiple images taken from different gaze directions in real time.<br><br>• Displaying multiple images from different gaze directions in real time using only one vision sensor. This kind of system is expected to be valuable in many vision applications, including robot vision, medical services, and broadcasting." *See* page 6186.<br><br>"However, sufficient high-speed performance cannot be obtained even if the gaze direction of the high-speed image processor is controlled mechanically by rotational actuators. The time required to reach the desired gaze direction is usually more than 20 ms [3], whereas the imaging cycle of the high-speed image processor is less than 1 ms. This is a critical bottleneck to realize a high-speed pan/tilt camera, particularly for a visual servo system. To solve this issue, we developed an external high-speed gaze controller, called the Saccade Mirror. This name is based on the rapid movement of the human eye known as a saccade. Two-axis rotational mirrors, the critical parts of the system, respond in millisecond-order to rapidly control the gaze direction optically (Fig.1(b))." *See* page 6186. |

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| |  <br>Fig. 1. (a) Illustration of a general pan/tilt camera, and (b) our method involving gaze control using two-axis rotational mirrors.<br><br>“A. Two-axis Rotational Mirrors for High-speed Gaze Control There have been several studies aimed at realizing a highspeed pan/tilt camera even with a conventional structure. However, the required level of performance has not been obtained. For example, Y. Nakabo has developed a 1 ms target tracking system, which is a good example of a pan/tilt camera with a high-speed image processor [3]. In this system, a high-speed image processor called Column Parallel Vision 1 (CPV1) is mounted on a two-axis rotational platform including high-speed actuators. Nevertheless, its response time for switching the gaze direction is more than 20 ms, much longer than the control cycle period of 1 ms. Also, the cutoff frequency of the gaze control in the visual feedback system is approximately 10 Hz, whereas the regulation, or imaging, rate is 1 kHz. For the millisecond-order control that we aim for, the inertia of the rotating parts must be reduced as much as possible.<br><br>We focused attention on two-axis rotational mirrors for gaze control, as described in the introduction section. In this case, because the only rotating parts are the two mirrors, the inertia of that subsystem can be considerably reduced. However, two-axis rotational mirrors have not been adopted often for pan/tilt cameras. They are mainly used for scanning non-diverging bundles of rays, such as laser beams. For example, J. Taylor et al. and H. Kim et al. both developed depth measurement systems (a kind of laser range finder) using a camera, a laser, and two-axis rotational mirrors [4], [5]. |

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| | If we use rotational mirrors for the pan/tilt camera, one critical issue is that the obtained angle of view is significantly restricted because the mirrors are small and are constructed to rotate on two axes.<br><br>A model of the system geometry now follows. A pinhole camera model is shown in Fig. 2 [6]. The angle of view θ in Fig. 2 is defined as the angular extent of a given scene in the camera. Rays from the scene are concentrated at the pinhole. The point where the bundle of rays is concentrated is called the pupil. The relationship between θ and S(θ) in Fig. 2 is presented here. S(θ) is the area of a certain image plane a distance d away from the center of the pupil. If θ becomes larger, S(θ) will also obviously become larger.<br><br>For gaze control with mirrors, if a wide angle of view is required, large mirrors will also be required. Thus, it is not easy to realize both a wide angle of view and high-speed performance at the same time because large mirrors are difficult to drive quickly. This will be even more difficult particularly when using independent two-axis mirrors. We call the mirror near the pupil the "pan-mirror" and the other one the "tilt-mirror." If a certain wide controllable gaze range is needed, the required size of the tilt-mirror will be larger than that of the pan-mirror because the area through which rays pass on the tilt-mirror varies depending on the driven angle of the pan-mirror." *See* page 6187.<br><br>  <br>Fig. 2. Angle of view in the model of a pinhole camera.<br><br>"IV. PROTOTYPE SACCADE MIRROR |

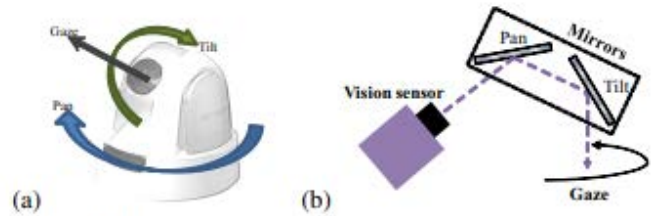
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| | In this section, we describe a prototype Saccade Mirror developed with some commercially available devices.<br><br>A. Optical Setup<br><br>For high-speed gaze control, we used rotational mirrors originally designed for laser scanning (galvanometer mirrors M2 manufactured by GSI Group), and for the pupil shift lenses, we used three achromatic lenses (Edmund Optics). The setup is shown in Fig. 9, and the optical specifications were as follows:<br><br>• Gazing angle range, ϕ: ±30 deg<br><br>• Maximum beam aperture: 30 mm<br><br>• Maximum angle of view, β: 38.6 deg (measured), 40 deg (designed)" *See* page 6189.<br><br>  <br><br>Fig. 9. The optical setup of the prototype.<br><br>"V. MILLISECOND-ORDER HIGH-SPEED PAN/TILT CAMERA<br><br>A. Setup for Target Tracking<br><br>We developed a millisecond-order high-speed pan/tilt camera using the prototype Saccade Mirror described above and a high-speed image processor. We used the camera to implement a target tracking application (Fig. 11). We used IDP-512e as the high-speed |

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| | image processor [9] and a PC for both image processing and mirror control. The detailed specifications are as follows:<br><br>• PC: DELL Precision T7400.<br><br>• CPU: Xeon, 2.83 GHz.<br><br>• RAM: 3.25 GB.<br><br>• OS: Windows XP Professional, Service Pack 2." *See* page 6190.<br><br>  <br><br>Fig. 11. System setup for target tracking.<br><br>"D. Observation of Moving Ball<br><br>Our millisecond-order pan/tilt camera should be useful for observing or evaluating high-speed dynamic phenomena with high resolution and no motion blur. If only a high-speed camera is used, the entire range of the dynamic motion must be let into the visual field of the camera using a wide-angle lens. Thus, the resolution of the desired area becomes |

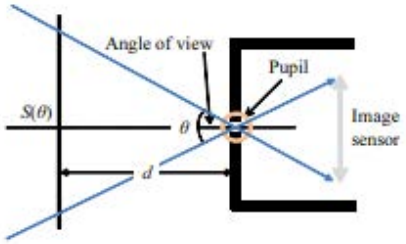
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| | relatively low. Moreover, motion blur also appears because the target moves at high speed.<br><br>We focused on applications in the field of sports. Balls in baseball, football or tennis are difficult to observe continuously because the velocity vectors of the balls fluctuate extremely rapidly during games. The ability to acquire dynamic images of the fast-moving balls would make significant contributions to broadcasting techniques, practice for players, product development for sports goods manufacturers, and so on.<br><br>Therefore, as an exploratory experiment, we observed a dynamic rubber ball using our millisecond-order pan/tilt camera. The target suddenly came into the visual field, bounced against a table, and was finally hit by a racket.<br><br>The image sequences are shown in Fig. 13. To keep the images of the target ball stationary, they are corrected so that the center of mass in each image is placed at the center. Although the instant where the ball bounces or is hit (change of the velocity vector) is conventionally difficult to capture, clearly observable image sequences could be successfully obtained with our system. The ball’s estimated trajectory is also shown in Fig. 14.” *See* page 6190-6191.<br><br>  <br><br>Fig. 13. Image sequences of a dynamic rubber ball: The ball is (a) falling from a hand, (b) bouncing against a table, (c) approaching a racket, (d) being hit by the racket, and (e) flying away.<br><br>“VI. CONCLUSION |

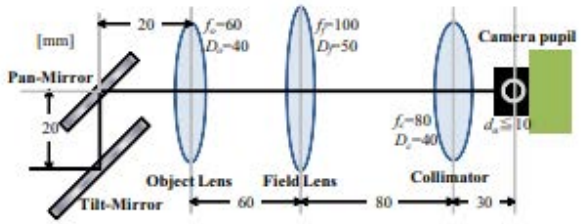
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| | In this paper, we proposed an optical high-speed gaze controller, called the Saccade Mirror. The developed prototype successfully demonstrated a response time as low as 3.5 ms. We also developed a millisecond-order pan/tilt camera using this prototype and a high-speed image processor, and we used it to implement a target tracking application. The performance (in terms of cutoff frequency) was almost ten times higher than that of a conventional mechanical pan/tilt camera. We demonstrated the utility of the system for the field of sports with an exploratory experiment in which a fast-moving rubber ball was observed.<br><br>In future work, we intend to make improvements to the prototype and other systems to be developed, such as construction of a higher performance prototype, implementing other practical applications, and so on." *See* page 6191.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[a]. obtaining a digital image from a camera; | To the extent the preamble is limiting, Okumura I expressly and/or inherently discloses and/or renders obvious obtaining a digital image from a camera. *See*, *e.g.*, disclosures below.<br><br>"Abstract—We developed an optical high-speed gaze controller, called the "Saccade Mirror", and used it to realize a high-speed pan/tilt camera with a high-speed image processor. Generally, in a pan/tilt camera, the gaze is controlled mechanically by rotational actuators. However, because pan/tilt cameras will be expected to use high-speed image processing (≥ 1000 fps), sufficiently high-speed performance of the gaze controller, comparable to the high frame rate, cannot be obtained with the usual method. In our system, the camera itself was fixed, and an external Saccade Mirror subsystem |

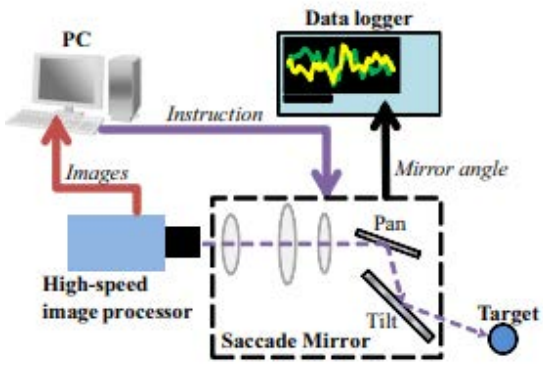
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| | was used for optical gaze control. An arbitrary gaze direction within ±30 deg could be achieved in less than 3.5 ms." *See* page 6186.<br><br>"The purpose of our study was to realize a high-speed pan/tilt camera that has the ability to change its gaze direction extremely quickly, at speeds comparable to the processing speed of a high-speed image processor, while still providing a sufficient angle of view. The term "gaze" used here means the direction in which images are captured by the camera, and "high-speed image processor" means a kind of camera (a vision sensor) that can realize both capturing and processing of more than 1000 images per second. The background of this research follows. It is said that more than 80 % of the sensory information that humans obtain is from the visual organs. For robots as well, visual servo systems have been widely used to grasp changing external environments. Vision sensors with a frame rate of 30 fps, such as CCDs, are mainly used in visual information processing. However, this approach cannot realize high-speed visual control because the image sampling rate in visual information processing is restricted to at most 30 Hz. In such cases, a high-speed image processor has been demonstrated to be quite useful [1]. On the other hand, in some applications, it is necessary to acquire images over a range wider than the camera's original angle of view. Hence, cameras whose gaze can be controlled, called pan/tilt cameras (or active vision systems), have been developed mainly for the purpose of monitoring, inspection, and so on. In a general pan/tilt camera, the camera is mounted on a two-axis rotational platform including actuators (Fig. 1(a)) [2].<br><br>If a high-speed image processor can control its gaze at a speed sufficiently high compared with its frame rate, various advanced applications are expected. Some examples are:<br><br>• Observation of high-speed dynamic objects without motion blur.<br><br>• Quasi-extension of the angle of view by combining multiple images taken from different gaze directions in real time. |

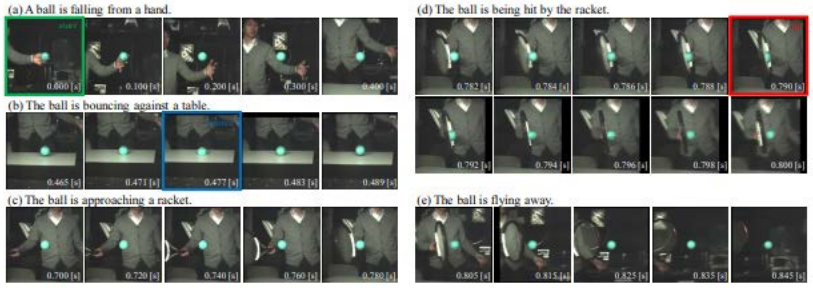
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| | • Displaying multiple images from different gaze directions in real time using only one vision sensor. This kind of system is expected to be valuable in many vision applications, including robot vision, medical services, and broadcasting." *See* page 6186.<br><br>"However, sufficient high-speed performance cannot be obtained even if the gaze direction of the high-speed image processor is controlled mechanically by rotational actuators. The time required to reach the desired gaze direction is usually more than 20 ms [3], whereas the imaging cycle of the high-speed image processor is less than 1 ms. This is a critical bottleneck to realize a high-speed pan/tilt camera, particularly for a visual servo system. To solve this issue, we developed an external high-speed gaze controller, called the Saccade Mirror. This name is based on the rapid movement of the human eye known as a saccade. Two-axis rotational mirrors, the critical parts of the system, respond in millisecond-order to rapidly control the gaze direction optically (Fig.1(b))." *See* page 6186.<br><br>  <br>Fig. 1. (a) Illustration of a general pan/tilt camera, and (b) our method involving gaze control using two-axis rotational mirrors.<br><br>"A. Two-axis Rotational Mirrors for High-speed Gaze Control There have been several studies aimed at realizing a high1speed pan/tilt camera even with a conventional structure. However, the required level of performance has not been obtained. For example, Y. Nakabo has developed a 1 ms target tracking system, which is a good example of a pan/tilt camera with a high-speed image processor [3]. In this system, a high-speed image processor called Column Parallel Vision 1 (CPV1) is mounted on a two-axis rotational platform including high-speed actuators. Nevertheless, its response time for switching the gaze direction is more than 20 ms, much longer than the control |

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| | cycle period of 1 ms. Also, the cutoff frequency of the gaze control in the visual feedback system is approximately 10 Hz, whereas the regulation, or imaging, rate is 1 kHz. For the millisecond-order control that we aim for, the inertia of the rotating parts must be reduced as much as possible.<br><br>We focused attention on two-axis rotational mirrors for gaze control, as described in the introduction section. In this case, because the only rotating parts are the two mirrors, the inertia of that subsystem can be considerably reduced. However, two-axis rotational mirrors have not been adopted often for pan/tilt cameras. They are mainly used for scanning non-diverging bundles of rays, such as laser beams. For example, J. Taylor et al. and H. Kim et al. both developed depth measurement systems (a kind of laser range finder) using a camera, a laser, and two-axis rotational mirrors [4], [5].<br><br>If we use rotational mirrors for the pan/tilt camera, one critical issue is that the obtained angle of view is significantly restricted because the mirrors are small and are constructed to rotate on two axes.<br><br>A model of the system geometry now follows. A pinhole camera model is shown in Fig. 2 [6]. The angle of view θ in Fig. 2 is defined as the angular extent of a given scene in the camera. Rays from the scene are concentrated at the pinhole. The point where the bundle of rays is concentrated is called the pupil. The relationship between θ and S(θ) in Fig. 2 is presented here. S(θ) is the area of a certain image plane a distance d away from the center of the pupil. If θ becomes larger, S(θ) will also obviously become larger.<br><br>For gaze control with mirrors, if a wide angle of view is required, large mirrors will also be required. Thus, it is not easy to realize both a wide angle of view and high-speed performance at the same time because large mirrors are difficult to drive quickly. This will be even more difficult particularly when using independent two-axis mirrors. We call the mirror near the pupil the "pan-mirror" and the other one the "tilt-mirror." If a certain wide controllable gaze range is needed, the required size of the tilt-mirror will be |

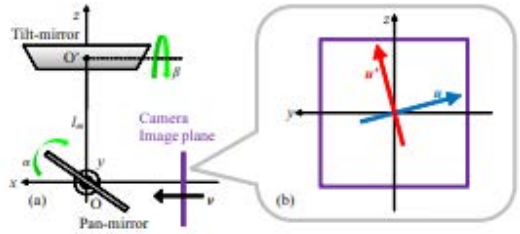
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| | larger than that of the pan-mirror because the area through which rays pass on the tilt-mirror varies depending on the driven angle of the pan-mirror." *See* page 6187.<br><br>  <br><br>Fig. 2. Angle of view in the model of a pinhole camera.<br><br>"IV. PROTOTYPE SACCADE MIRROR<br><br>In this section, we describe a prototype Saccade Mirror developed with some commercially available devices.<br><br>A. Optical Setup<br><br>For high-speed gaze control, we used rotational mirrors originally designed for laser scanning (galvanometer mirrors M2 manufactured by GSI Group), and for the pupil shift lenses, we used three achromatic lenses (Edmund Optics). The setup is shown in Fig. 9, and the optical specifications were as follows:<br><br>• Gazing angle range, ϕ: ±30 deg<br><br>• Maximum beam aperture: 30 mm<br><br>• Maximum angle of view, β: 38.6 deg (measured), 40 deg (designed)" *See* page 6189. |

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| |  <br>Fig. 9. The optical setup of the prototype.<br><br>"V. MILLISECOND-ORDER HIGH-SPEED PAN/TILT CAMERA<br><br>A. Setup for Target Tracking<br><br>We developed a millisecond-order high-speed pan/tilt camera using the prototype Saccade Mirror described above and a high-speed image processor. We used the camera to implement a target tracking application (Fig. 11). We used IDP-512e as the high-speed image processor [9] and a PC for both image processing and mirror control. The detailed specifications are as follows:<br><br>• PC: DELL Precision T7400.<br><br>• CPU: Xeon, 2.83 GHz.<br><br>• RAM: 3.25 GB.<br><br>• OS: Windows XP Professional, Service Pack 2." *See* page 6190. |

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| |  <br>Fig. 11. System setup for target tracking.<br><br>"D. Observation of Moving Ball<br><br>Our millisecond-order pan/tilt camera should be useful for observing or evaluating high-speed dynamic phenomena with high resolution and no motion blur. If only a high-speed camera is used, the entire range of the dynamic motion must be let into the visual field of the camera using a wide-angle lens. Thus, the resolution of the desired area becomes relatively low. Moreover, motion blur also appears because the target moves at high speed.<br><br>We focused on applications in the field of sports. Balls in baseball, football or tennis are difficult to observe continuously because the velocity vectors of the balls fluctuate extremely rapidly during games. The ability to acquire dynamic images of the fast-moving balls would make significant contributions to broadcasting techniques, practice for players, product development for sports goods manufacturers, and so on.<br><br>Therefore, as an exploratory experiment, we observed a dynamic rubber ball using our millisecond-order pan/tilt camera. The target suddenly came into the visual field, bounced against a table, and was finally hit by a racket. |

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| | The image sequences are shown in Fig. 13. To keep the images of the target ball stationary, they are corrected so that the center of mass in each image is placed at the center. Although the instant where the ball bounces or is hit (change of the velocity vector) is conventionally difficult to capture, clearly observable image sequences could be successfully obtained with our system. The ball's estimated trajectory is also shown in Fig. 14." *See* page 6190-6191.<br><br>  <br><br>Fig. 13. Image sequences of a dynamic rubber ball: The ball is (a) falling from a hand, (b) bouncing against a table, (c) approaching a racket, (d) being hit by the racket, and (e) flying away.<br><br>"VI. CONCLUSION<br><br>In this paper, we proposed an optical high-speed gaze controller, called the Saccade Mirror. The developed prototype successfully demonstrated a response time as low as 3.5 ms. We also developed a millisecond-order pan/tilt camera using this prototype and a high-speed image processor, and we used it to implement a target tracking application. The performance (in terms of cutoff frequency) was almost ten times higher than that of a conventional mechanical pan/tilt camera. We demonstrated the utility of the system for the field of sports with an exploratory experiment in which a fast-moving rubber ball was observed. |

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| | In future work, we intend to make improvements to the prototype and other systems to be developed, such as construction of a higher performance prototype, implementing other practical applications, and so on." *See* page 6191.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[b]. flipping the image about a vertical axis so as to reverse right and left sides of the image; | Okumura I expressly and/or inherently discloses and/or renders obvious flipping the image about a vertical axis so as to reverse right and left sides of the image. *See*, *e.g.*, disclosures below.<br><br>"III. DETAILED OPTICAL THEORY<br><br>A. Gaze and Visibility Model<br><br>Here, the gaze direction and appearance of an image through two mirrors are mathematically considered. The two mirrors are mounted as shown in Fig.4. |

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| |  <br>Fig. 4. (a) Mirror alignment, and (b) appearance of an image through the mirrors.<br><br>The pan-mirror surface ($z = (\tan\alpha)x$) includes the origin, and its rotational axis is the y-axis. The tilt-mirror surface ($z = (\tan\beta)y + l_m$) includes $\mathbf{O}'(0, 0, l_m)$, and its rotational axis is parallel to the x-axis. The original gaze direction lies in the $+x$-axis direction ($\boldsymbol{v} = ^T (1, 0, 0)$).<br><br>A matrix Sp that gives a line-symmetric transformation with respect to the pan-mirror surface and a matrix St that gives a line-symmetric transformation with respect to the tilt-mirror surface are expressed as: |

$$\begin{cases} \mathbf{S_p} = \begin{bmatrix} \cos(2\alpha) & 0 & \sin(2\alpha) \\ 0 & 1 & 0 \\ -\sin(2\alpha) & 0 & \cos(2\alpha) \end{bmatrix} \\ \mathbf{S_t} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(2\alpha) & -\sin(2\alpha) \\ 0 & \sin(2\alpha) & -\cos(2\alpha) \end{bmatrix} \end{cases} \quad (1)$$

Position vectors, $\boldsymbol{a} =^T (a_x, a_y, a_z)$ and $\boldsymbol{b} =^T (b_x, b_y, b_z)$ that satisfy $x < 0$ near the x-axis are considered. $\boldsymbol{a}^*$, the line-symmetric displacement mapping of $\boldsymbol{a}$ with respect to the two mirrors, is calculated as:

$$\boldsymbol{a}^* = \mathbf{S_t}\left(\mathbf{S_p}\begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix} - \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix}\right) + \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix} \quad (2)$$

When $a_1 = b_1 - 1$, $a_2 = b_2$, and $a_3 = b_3$ are assumed, $\boldsymbol{b} - \boldsymbol{a} = \boldsymbol{v}$. Thus, the gaze direction through the mirrors, $\boldsymbol{b}^* - \boldsymbol{a}^* = \boldsymbol{v}^*$, is calculated using (2):

$$\boldsymbol{v}^* = \begin{bmatrix} -\sin\phi_p \\ \cos\phi_p \cos\phi_t \\ \cos\phi_p \sin\phi_t \end{bmatrix} \quad (3)$$

where $2\alpha = \frac{\pi}{2} + \phi_p$, $2\beta = \frac{\pi}{2} + \phi_t$. In addition, a general pan/tilt camera has a gaze vector $\boldsymbol{v_g}$:

$$\boldsymbol{v_g} = \begin{bmatrix} -\sin\phi_p \cos\phi_t \\ \cos\phi_p \\ \sin\phi_t \end{bmatrix} \quad (4)$$

On the other hand, when $a_1 = b_1$, $b_2 - a_2 = \cos\theta$, and $b_3 - a_3 = \sin\theta$ are assumed, $\boldsymbol{b} - \boldsymbol{a}$ is a vector $\boldsymbol{u} =^T (0, \cos\theta, \sin\theta)$ on the camera image plane. Then, its mapping with respect to the mirrors is as follows:

$$\boldsymbol{u}^* = \begin{bmatrix} \sin\theta\cos\phi_p \\ -\cos\theta\sin\phi_t + \sin\theta\sin\phi_t\cos\phi_t \\ \cos\theta\cos\phi_t + \sin\theta\sin\phi_p\sin\phi_t \end{bmatrix} \quad (5)$$

To compare $\boldsymbol{u}$ and $\boldsymbol{u}^*$, $\boldsymbol{u}^*$ is rotated onto the x-axis using a matrix:

$$\mathbf{R} = \begin{bmatrix} -\sin\phi_p & \cos\phi_p\cos\phi_t & \cos\phi_p\sin\phi_t \\ -\cos\phi_p & -\sin\phi_p\cos\phi_t & -\sin\phi_p\sin\phi_t \\ 0 & -\sin\phi_t & \cos\phi_t \end{bmatrix} \quad (6)$$

Then,

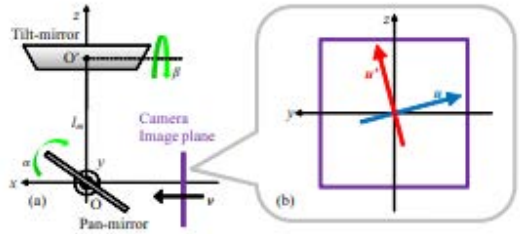
$$\boldsymbol{u}' = \mathbf{R}\boldsymbol{u}^* = \begin{bmatrix} 0 \\ -\sin\theta \\ cos\theta \end{bmatrix} = \begin{bmatrix} 0 \\ \cos(\theta + \frac{\pi}{2}) \\ \sin(\theta + \frac{\pi}{2}) \end{bmatrix} \quad (7)$$

is obtained. That is, the image through the mirrors is inclined at 90 deg, as shown in Fig. 4(b), and the camera should be tilted.



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| | " *See* pages 6187-6188.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[c]. applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror; | Okumura I expressly and/or inherently discloses and/or renders obvious applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror . *See*, *e.g.*, disclosures below.<br><br>"III. DETAILED OPTICAL THEORY<br><br>A. Gaze and Visibility Model<br><br>Here, the gaze direction and appearance of an image through two mirrors are mathematically considered. The two mirrors are mounted as shown in Fig.4. |

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| |  <br>Fig. 4. (a) Mirror alignment, and (b) appearance of an image through the mirrors.<br><br>The pan-mirror surface ($z = (\tan\alpha)x$) includes the origin, and its rotational axis is the y-axis. The tilt-mirror surface ($z = (\tan\beta)y + l_m$) includes $\mathbf{O}'(0, 0, l_m)$, and its rotational axis is parallel to the x-axis. The original gaze direction lies in the $+x$-axis direction ($\boldsymbol{v} = ^T (1, 0, 0)$).<br><br>A matrix Sp that gives a line-symmetric transformation with respect to the pan-mirror surface and a matrix St that gives a line-symmetric transformation with respect to the tilt-mirror surface are expressed as: |

$$\begin{cases} \mathbf{S_p} = \begin{bmatrix} \cos(2\alpha) & 0 & \sin(2\alpha) \\ 0 & 1 & 0 \\ -\sin(2\alpha) & 0 & \cos(2\alpha) \end{bmatrix} \\ \mathbf{S_t} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(2\alpha) & -\sin(2\alpha) \\ 0 & \sin(2\alpha) & -\cos(2\alpha) \end{bmatrix} \end{cases} \quad (1)$$

Position vectors, $\boldsymbol{a} =^T (a_x, a_y, a_z)$ and $\boldsymbol{b} =^T (b_x, b_y, b_z)$ that satisfy $x < 0$ near the x-axis are considered. $\boldsymbol{a}^*$, the line-symmetric displacement mapping of $\boldsymbol{a}$ with respect to the two mirrors, is calculated as:

$$\boldsymbol{a}^* = \mathbf{S_t}\left(\mathbf{S_p}\begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix} - \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix}\right) + \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix} \quad (2)$$

When $a_1 = b_1 - 1$, $a_2 = b_2$, and $a_3 = b_3$ are assumed, $\boldsymbol{b} - \boldsymbol{a} = \boldsymbol{v}$. Thus, the gaze direction through the mirrors, $\boldsymbol{b}^* - \boldsymbol{a}^* = \boldsymbol{v}^*$, is calculated using (2):

$$\boldsymbol{v}^* = \begin{bmatrix} -\sin\phi_p \\ \cos\phi_p \cos\phi_t \\ \cos\phi_p \sin\phi_t \end{bmatrix} \quad (3)$$

where $2\alpha = \frac{\pi}{2} + \phi_p$, $2\beta = \frac{\pi}{2} + \phi_t$. In addition, a general pan/tilt camera has a gaze vector $\boldsymbol{v_g}$:

$$\boldsymbol{v_g} = \begin{bmatrix} -\sin\phi_p \cos\phi_t \\ \cos\phi_p \\ \sin\phi_t \end{bmatrix} \quad (4)$$

On the other hand, when $a_1 = b_1$, $b_2 - a_2 = \cos\theta$, and $b_3 - a_3 = \sin\theta$ are assumed, $\boldsymbol{b} - \boldsymbol{a}$ is a vector $\boldsymbol{u} =^T (0, \cos\theta, \sin\theta)$ on the camera image plane. Then, its mapping with respect to the mirrors is as follows:

$$\boldsymbol{u}^* = \begin{bmatrix} \sin\theta\cos\phi_p \\ -\cos\theta\sin\phi_t + \sin\theta\sin\phi_t\cos\phi_t \\ \cos\theta\cos\phi_t + \sin\theta\sin\phi_p\sin\phi_t \end{bmatrix} \quad (5)$$

To compare $\boldsymbol{u}$ and $\boldsymbol{u}^*$, $\boldsymbol{u}^*$ is rotated onto the x-axis using a matrix:

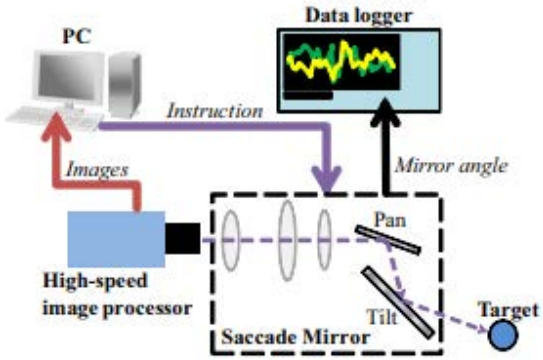
$$\mathbf{R} = \begin{bmatrix} -\sin\phi_p & \cos\phi_p\cos\phi_t & \cos\phi_p\sin\phi_t \\ -\cos\phi_p & -\sin\phi_p\cos\phi_t & -\sin\phi_p\sin\phi_t \\ 0 & -\sin\phi_t & \cos\phi_t \end{bmatrix} \quad (6)$$

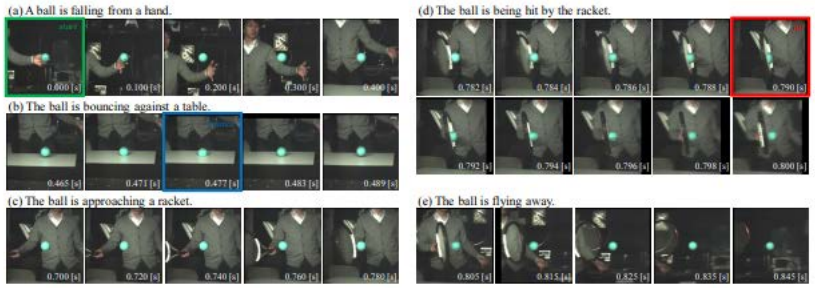
Then,

$$\boldsymbol{u}' = \mathbf{R}\boldsymbol{u}^* = \begin{bmatrix} 0 \\ -\sin\theta \\ cos\theta \end{bmatrix} = \begin{bmatrix} 0 \\ \cos(\theta + \frac{\pi}{2}) \\ \sin(\theta + \frac{\pi}{2}) \end{bmatrix} \quad (7)$$

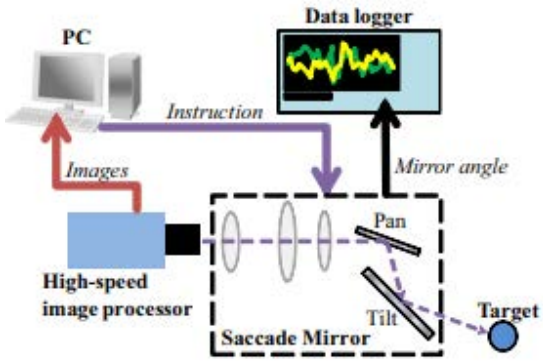
is obtained. That is, the image through the mirrors is inclined at 90 deg, as shown in Fig. 4(b), and the camera should be tilted. ”

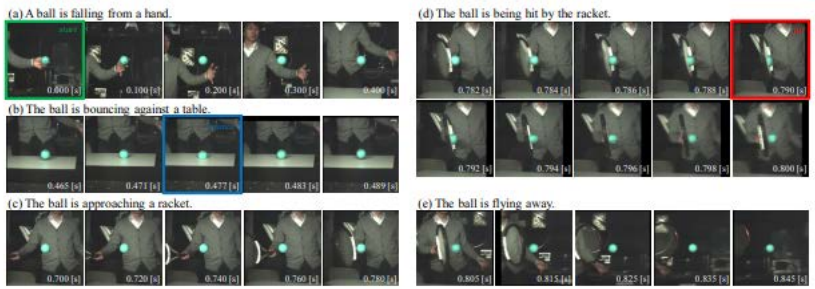
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| | *See* pages 6187-6188.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[d]. resizing the image to reduce variations caused by changes in object's distance to the camera; | Okumura I expressly and/or inherently discloses and/or renders obvious resizing the image to reduce variations caused by changes in object's distance to the camera. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[e]. displaying the image on the monitor after performing the flipping, transformation mapping, and resizing; | Okumura I expressly and/or inherently discloses and/or renders obvious displaying the image on the monitor after performing the flipping, transformation mapping, and resizing. *See*, *e.g.*, disclosures below.<br><br>"V. MILLISECOND-ORDER HIGH-SPEED PAN/TILT CAMERA<br><br>A. Setup for Target Tracking<br><br>We developed a millisecond-order high-speed pan/tilt camera using the prototype Saccade Mirror described above and a high-speed image processor. We used the camera to implement a target tracking application (Fig. 11). We used IDP-512e as the high-speed image processor [9] and a PC for both image processing and mirror control. The detailed specifications are as follows:<br><br>• PC: DELL Precision T7400. |

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| | • CPU: Xeon, 2.83 GHz.<br><br>• RAM: 3.25 GB.<br><br>• OS: Windows XP Professional, Service Pack 2." *See* page 6190.<br><br>  <br><br>Fig. 11. System setup for target tracking.<br><br>"D. Observation of Moving Ball<br><br>Our millisecond-order pan/tilt camera should be useful for observing or evaluating high-speed dynamic phenomena with high resolution and no motion blur. If only a high-speed camera is used, the entire range of the dynamic motion must be let into the visual field of the camera using a wide-angle lens. Thus, the resolution of the desired area becomes relatively low. Moreover, motion blur also appears because the target moves at high speed.<br><br>We focused on applications in the field of sports. Balls in baseball, football or tennis are difficult to observe continuously because the velocity vectors of the balls fluctuate extremely rapidly during games. The ability to acquire dynamic images of the fast- |

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| | moving balls would make significant contributions to broadcasting techniques, practice for players, product development for sports goods manufacturers, and so on.<br><br>Therefore, as an exploratory experiment, we observed a dynamic rubber ball using our millisecond-order pan/tilt camera. The target suddenly came into the visual field, bounced against a table, and was finally hit by a racket.<br><br>The image sequences are shown in Fig. 13. To keep the images of the target ball stationary, they are corrected so that the center of mass in each image is placed at the center. Although the instant where the ball bounces or is hit (change of the velocity vector) is conventionally difficult to capture, clearly observable image sequences could be successfully obtained with our system. The ball's estimated trajectory is also shown in Fig. 14." *See* page 6190-6191.<br><br>  <br><br>Fig. 13. Image sequences of a dynamic rubber ball: The ball is (a) falling from a hand, (b) bouncing against a table, (c) approaching a racket, (d) being hit by the racket, and (e) flying away.<br><br>"VI. CONCLUSION<br><br>In this paper, we proposed an optical high-speed gaze controller, called the Saccade Mirror. The developed prototype successfully demonstrated a response time as low as 3.5 ms. We also developed a millisecond-order pan/tilt camera using this prototype and a high-speed image processor, and we used it to implement a target tracking application. The performance (in terms of cutoff frequency) was almost ten times higher than that of |

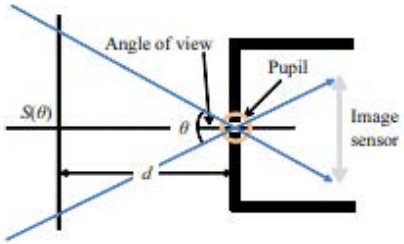
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| | a conventional mechanical pan/tilt camera. We demonstrated the utility of the system for the field of sports with an exploratory experiment in which a fast-moving rubber ball was observed.<br><br>In future work, we intend to make improvements to the prototype and other systems to be developed, such as construction of a higher performance prototype, implementing other practical applications, and so on." *See* page 6191.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[f]. wherein the non-ordered steps are performed on a series of images of a live video feed from the camera; | Okumura I expressly and/or inherently discloses and/or renders obvious wherein the non-ordered steps are performed on a series of images of a live video feed from the camera. *See*, *e.g.*, disclosures below.<br><br>"V. MILLISECOND-ORDER HIGH-SPEED PAN/TILT CAMERA<br><br>A. Setup for Target Tracking<br><br>We developed a millisecond-order high-speed pan/tilt camera using the prototype Saccade Mirror described above and a high-speed image processor. We used the camera to implement a target tracking application (Fig. 11). We used IDP-512e as the high-speed image processor [9] and a PC for both image processing and mirror control. The detailed specifications are as follows:<br><br>• PC: DELL Precision T7400.<br><br>• CPU: Xeon, 2.83 GHz. |

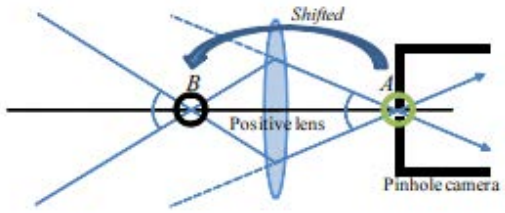
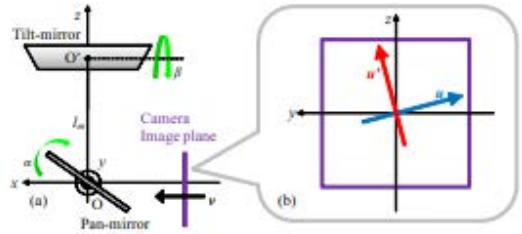
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| | • RAM: 3.25 GB.<br><br>• OS: Windows XP Professional, Service Pack 2." *See* page 6190.<br><br>  <br><br>Fig. 11. System setup for target tracking.<br><br>"D. Observation of Moving Ball<br><br>Our millisecond-order pan/tilt camera should be useful for observing or evaluating high-speed dynamic phenomena with high resolution and no motion blur. If only a high-speed camera is used, the entire range of the dynamic motion must be let into the visual field of the camera using a wide-angle lens. Thus, the resolution of the desired area becomes relatively low. Moreover, motion blur also appears because the target moves at high speed.<br><br>We focused on applications in the field of sports. Balls in baseball, football or tennis are difficult to observe continuously because the velocity vectors of the balls fluctuate extremely rapidly during games. The ability to acquire dynamic images of the fast-moving balls would make significant contributions to broadcasting techniques, practice for players, product development for sports goods manufacturers, and so on. |

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| | Therefore, as an exploratory experiment, we observed a dynamic rubber ball using our millisecond-order pan/tilt camera. The target suddenly came into the visual field, bounced against a table, and was finally hit by a racket.<br><br>The image sequences are shown in Fig. 13. To keep the images of the target ball stationary, they are corrected so that the center of mass in each image is placed at the center. Although the instant where the ball bounces or is hit (change of the velocity vector) is conventionally difficult to capture, clearly observable image sequences could be successfully obtained with our system. The ball's estimated trajectory is also shown in Fig. 14." *See* page 6190-6191.<br><br>  <br><br>Fig. 13. Image sequences of a dynamic rubber ball: The ball is (a) falling from a hand, (b) bouncing against a table, (c) approaching a racket, (d) being hit by the racket, and (e) flying away.<br><br>"VI. CONCLUSION<br><br>In this paper, we proposed an optical high-speed gaze controller, called the Saccade Mirror. The developed prototype successfully demonstrated a response time as low as 3.5 ms. We also developed a millisecond-order pan/tilt camera using this prototype and a high-speed image processor, and we used it to implement a target tracking application. The performance (in terms of cutoff frequency) was almost ten times higher than that of a conventional mechanical pan/tilt camera. We demonstrated the utility of the system for |

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| | the field of sports with an exploratory experiment in which a fast-moving rubber ball was observed.<br><br>In future work, we intend to make improvements to the prototype and other systems to be developed, such as construction of a higher performance prototype, implementing other practical applications, and so on." *See* page 6191.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[g]. determining distance to a user appearing in the live video feed; and | Okumura I expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the live video feed. *See*, *e.g.*, disclosures below.<br><br>"A. Two-axis Rotational Mirrors for High-speed Gaze Control<br><br>There have been several studies aimed at realizing a high1speed pan/tilt camera even with a conventional structure. However, the required level of performance has not been obtained. For example, Y. Nakabo has developed a 1 ms target tracking system, which is a good example of a pan/tilt camera with a high-speed image processor [3]. In this system, a high-speed image processor called Column Parallel Vision 1 (CPV1) is mounted on a two-axis rotational platform including high-speed actuators. Nevertheless, its response time for switching the gaze direction is more than 20 ms, much longer than the control cycle period of 1 ms. Also, the cutoff frequency of the gaze control in the visual feedback system is approximately 10 Hz, whereas the regulation, or imaging, rate is 1 kHz. For the millisecond-order control that we aim for, the inertia of the rotating parts must be reduced as much as possible.<br><br>We focused attention on two-axis rotational mirrors for gaze control, as described in the introduction section. In this case, because the only rotating parts are the two mirrors, the |

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| | inertia of that subsystem can be considerably reduced. However, two-axis rotational mirrors have not been adopted often for pan/tilt cameras. They are mainly used for scanning non-diverging bundles of rays, such as laser beams. For example, J. Taylor et al. and H. Kim et al. both developed depth measurement systems (a kind of laser range finder) using a camera, a laser, and two-axis rotational mirrors [4], [5].<br><br>If we use rotational mirrors for the pan/tilt camera, one critical issue is that the obtained angle of view is significantly restricted because the mirrors are small and are constructed to rotate on two axes.<br><br>A model of the system geometry now follows. A pinhole camera model is shown in Fig. 2 [6]. The angle of view θ in Fig. 2 is defined as the angular extent of a given scene in the camera. Rays from the scene are concentrated at the pinhole. The point where the bundle of rays is concentrated is called the pupil. The relationship between θ and S(θ) in Fig. 2 is presented here. S(θ) is the area of a certain image plane a distance d away from the center of the pupil. If θ becomes larger, S(θ) will also obviously become larger.<br><br>For gaze control with mirrors, if a wide angle of view is required, large mirrors will also be required. Thus, it is not easy to realize both a wide angle of view and high-speed performance at the same time because large mirrors are difficult to drive quickly. This will be even more difficult particularly when using independent two-axis mirrors. We call the mirror near the pupil the "pan-mirror" and the other one the "tilt-mirror." If a certain wide controllable gaze range is needed, the required size of the tilt-mirror will be larger than that of the pan-mirror because the area through which rays pass on the tilt-mirror varies depending on the driven angle of the pan-mirror." *See* page 6187. |

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| |  <br>Fig. 2. Angle of view in the model of a pinhole camera.<br><br>“B. Pupil Shift Lenses for Achieving Practical Angle of View<br><br>We solved the issue described above by using positive lenses called “pupil shift lenses” [7]. The basic theory of the function of a pupil shift lens with a pinhole camera model is shown in Fig. 3. A bundle of rays can be refracted by the positive lens. Some of the bundle of rays that would otherwise be concentrated at B are also concentrated at the desired point A using the positive lens. Thinking of A as the pupil of the camera, this vision system including the positive lens has two pupils, the original one A and the shifted one B.<br><br>This theory can be applied to our Saccade Mirror, enabling both a wide angle of view and high-speed performance to be realized at the same time. That is, if we need gaze control at a sufficiently high speed compared with the frame rate of a high-speed image processor, this combination should give a practical angle of view, or if we need a practical angle of view with a certain vision system, this combination give sufficiently high speed.<br><br>For example, to obtain a 30 deg angle of view without pupil shift lenses, the inertia of the tilt-mirror is estimated to be more than one-hundred times larger compared with the case where pupil shift lenses are used.” *See* page 6187. |

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| |  <br>Fig. 3. Shift of the pupil using a positive lens.<br><br>“III. DETAILED OPTICAL THEORY<br><br>A. Gaze and Visibility Model<br><br>Here, the gaze direction and appearance of an image through two mirrors are mathematically considered. The two mirrors are mounted as shown in Fig.4.<br><br>  <br>Fig. 4. (a) Mirror alignment, and (b) appearance of an image through the mirrors.<br><br>The pan-mirror surface ($z = (\tan\alpha)x$) includes the origin, and its rotational axis is the y-axis. The tilt-mirror surface ($z = (\tan\beta)y + l_m$) includes $\mathbf{O}'(0, 0, l_m)$, and its rotational axis is parallel to the x-axis. The original gaze direction lies in the $+x$-axis direction ($\boldsymbol{v} = ^T (1, 0, 0)$). |

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| | A matrix Sp that gives a line-symmetric transformation with respect to the pan-mirror surface and a matrix St that gives a line-symmetric transformation with respect to the tilt-mirror surface are expressed as: |

$$\begin{cases} \mathbf{S_p} = \begin{bmatrix} \cos(2\alpha) & 0 & \sin(2\alpha) \\ 0 & 1 & 0 \\ -\sin(2\alpha) & 0 & \cos(2\alpha) \end{bmatrix} \\ \mathbf{S_t} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(2\alpha) & -\sin(2\alpha) \\ 0 & \sin(2\alpha) & -\cos(2\alpha) \end{bmatrix} \end{cases} \quad (1)$$

Position vectors, $\boldsymbol{a} =^T (a_x, a_y, a_z)$ and $\boldsymbol{b} =^T (b_x, b_y, b_z)$ that satisfy $x < 0$ near the x-axis are considered. $\boldsymbol{a}^*$, the line-symmetric displacement mapping of $\boldsymbol{a}$ with respect to the two mirrors, is calculated as:

$$\boldsymbol{a}^* = \mathbf{S_t}\left(\mathbf{S_p}\begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix} - \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix}\right) + \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix} \quad (2)$$

When $a_1 = b_1 - 1$, $a_2 = b_2$, and $a_3 = b_3$ are assumed, $\boldsymbol{b} - \boldsymbol{a} = \boldsymbol{v}$. Thus, the gaze direction through the mirrors, $\boldsymbol{b}^* - \boldsymbol{a}^* = \boldsymbol{v}^*$, is calculated using (2):

$$\boldsymbol{v}^* = \begin{bmatrix} -\sin\phi_p \\ \cos\phi_p \cos\phi_t \\ \cos\phi_p \sin\phi_t \end{bmatrix} \quad (3)$$

where $2\alpha = \frac{\pi}{2} + \phi_p$, $2\beta = \frac{\pi}{2} + \phi_t$. In addition, a general pan/tilt camera has a gaze vector $\boldsymbol{v_g}$:

$$\boldsymbol{v_g} = \begin{bmatrix} -\sin\phi_p \cos\phi_t \\ \cos\phi_p \\ \sin\phi_t \end{bmatrix} \quad (4)$$

On the other hand, when $a_1 = b_1$, $b_2 - a_2 = \cos\theta$, and $b_3 - a_3 = \sin\theta$ are assumed, $\boldsymbol{b} - \boldsymbol{a}$ is a vector $\boldsymbol{u} =^T (0, \cos\theta, \sin\theta)$ on the camera image plane. Then, its mapping with respect to the mirrors is as follows:

$$\boldsymbol{u}^* = \begin{bmatrix} \sin\theta\cos\phi_p \\ -\cos\theta\sin\phi_t + \sin\theta\sin\phi_t\cos\phi_t \\ \cos\theta\cos\phi_t + \sin\theta\sin\phi_p\sin\phi_t \end{bmatrix} \quad (5)$$

To compare $\boldsymbol{u}$ and $\boldsymbol{u}^*$, $\boldsymbol{u}^*$ is rotated onto the x-axis using a matrix:

$$\mathbf{R} = \begin{bmatrix} -\sin\phi_p & \cos\phi_p\cos\phi_t & \cos\phi_p\sin\phi_t \\ -\cos\phi_p & -\sin\phi_p\cos\phi_t & -\sin\phi_p\sin\phi_t \\ 0 & -\sin\phi_t & \cos\phi_t \end{bmatrix} \quad (6)$$

Then,

$$\boldsymbol{u}' = \mathbf{R}\boldsymbol{u}^* = \begin{bmatrix} 0 \\ -\sin\theta \\ cos\theta \end{bmatrix} = \begin{bmatrix} 0 \\ \cos(\theta + \frac{\pi}{2}) \\ \sin(\theta + \frac{\pi}{2}) \end{bmatrix} \quad (7)$$

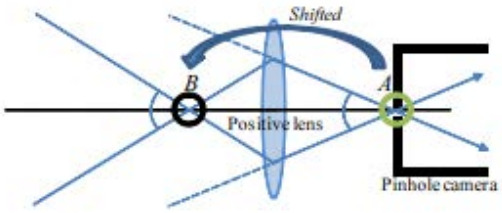
is obtained. That is, the image through the mirrors is inclined at 90 deg, as shown in Fig. 4(b), and the camera should be tilted.

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| | " *See* pages 6187-6188.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 1[h]. varying rate at which the non-ordered steps are performed on the series of images according to the distance. | Okumura I expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. *See*, *e.g.*, disclosures below.<br><br>"Abstract—We developed an optical high-speed gaze controller, called the "Saccade Mirror", and used it to realize a high-speed pan/tilt camera with a high-speed image processor. Generally, in a pan/tilt camera, the gaze is controlled mechanically by rotational actuators. However, because pan/tilt cameras will be expected to use high-speed image processing (≥ 1000 fps), sufficiently high-speed performance of the gaze controller, comparable to the high frame rate, cannot be obtained with the usual method. In our system, the camera itself was fixed, and an external Saccade Mirror subsystem was used for optical gaze control. An arbitrary gaze direction within ±30 deg could be achieved in less than 3.5 ms." *See* page 6186.<br><br>"The purpose of our study was to realize a high-speed pan/tilt camera that has the ability to change its gaze direction extremely quickly, at speeds comparable to the processing speed of a high-speed image processor, while still providing a sufficient angle of view. The term "gaze" used here means the direction in which images are captured by the camera, and "high-speed image processor" means a kind of camera (a vision sensor) that can realize both capturing and processing of more than 1000 images per second. The background of this research follows. It is said that more than 80 % of the sensory information that humans obtain is from the visual organs. For robots as well, visual servo systems have been widely used to grasp changing external environments. Vision sensors with a frame rate of 30 fps, such as CCDs, are mainly used in visual information |

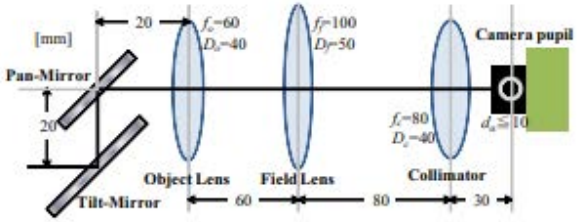
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| | processing. However, this approach cannot realize high-speed visual control because the image sampling rate in visual information processing is restricted to at most 30 Hz. In such cases, a high-speed image processor has been demonstrated to be quite useful [1]. On the other hand, in some applications, it is necessary to acquire images over a range wider than the camera's original angle of view. Hence, cameras whose gaze can be controlled, called pan/tilt cameras (or active vision systems), have been developed mainly for the purpose of monitoring, inspection, and so on. In a general pan/tilt camera, the camera is mounted on a two-axis rotational platform including actuators (Fig. 1(a)) [2].<br><br>If a high-speed image processor can control its gaze at a speed sufficiently high compared with its frame rate, various advanced applications are expected. Some examples are:<br><br>• Observation of high-speed dynamic objects without motion blur.<br><br>• Quasi-extension of the angle of view by combining multiple images taken from different gaze directions in real time.<br><br>• Displaying multiple images from different gaze directions in real time using only one vision sensor. This kind of system is expected to be valuable in many vision applications, including robot vision, medical services, and broadcasting." *See* page 6186.<br><br>"However, sufficient high-speed performance cannot be obtained even if the gaze direction of the high-speed image processor is controlled mechanically by rotational actuators. The time required to reach the desired gaze direction is usually more than 20 ms [3], whereas the imaging cycle of the high-speed image processor is less than 1 ms. This is a critical bottleneck to realize a high-speed pan/tilt camera, particularly for a visual servo system. To solve this issue, we developed an external high-speed gaze controller, called the Saccade Mirror. This name is based on the rapid movement of the human eye known as a saccade. Two-axis rotational mirrors, the critical parts of the |

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| | system, respond in millisecond-order to rapidly control the gaze direction optically (Fig.1(b)).” *See* page 6186.<br><br>“A. Two-axis Rotational Mirrors for High-speed Gaze Control<br><br>There have been several studies aimed at realizing a high speed pan/tilt camera even with a conventional structure. However, the required level of performance has not been obtained. For example, Y. Nakabo has developed a 1 ms target tracking system, which is a good example of a pan/tilt camera with a high-speed image processor [3]. In this system, a high-speed image processor called Column Parallel Vision 1 (CPV1) is mounted on a two-axis rotational platform including high-speed actuators. Nevertheless, its response time for switching the gaze direction is more than 20 ms, much longer than the control cycle period of 1 ms. Also, the cutoff frequency of the gaze control in the visual feedback system is approximately 10 Hz, whereas the regulation, or imaging, rate is 1 kHz. For the millisecond-order control that we aim for, the inertia of the rotating parts must be reduced as much as possible.” *See* pages 6186-6187.<br><br>“This theory can be applied to our Saccade Mirror, enabling both a wide angle of view and high-speed performance to be realized at the same time. That is, if we need gaze control at a sufficiently high speed compared with the frame rate of a high-speed image processor, this combination should give a practical angle of view, or if we need a practical angle of view with a certain vision system, this combination give sufficiently high speed. For example, to obtain a 30 deg angle of view without pupil shift lenses, the inertia of the tilt-mirror is estimated to be more than one-hundred times larger compared with the case where pupil shift lenses are used.” *See* page 6187.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

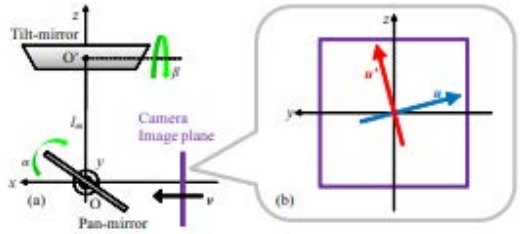
| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
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| **Claim 2** | |
| 2. The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally. | Okumura I expressly and/or inherently discloses and/or renders obvious varying rate at which the non-ordered steps are performed on the series of images according to the distance. *See*, *e.g.*, disclosures below.<br><br>"B. Pupil Shift Lenses for Achieving Practical Angle of View<br><br>We solved the issue described above by using positive lenses called "pupil shift lenses" [7]. The basic theory of the function of a pupil shift lens with a pinhole camera model is shown in Fig. 3. A bundle of rays can be refracted by the positive lens. Some of the bundle of rays that would otherwise be concentrated at B are also concentrated at the desired point A using the positive lens. Thinking of A as the pupil of the camera, this vision system including the positive lens has two pupils, the original one A and the shifted one B.<br><br>This theory can be applied to our Saccade Mirror, enabling both a wide angle of view and high-speed performance to be realized at the same time. That is, if we need gaze control at a sufficiently high speed compared with the frame rate of a high-speed image processor, this combination should give a practical angle of view, or if we need a practical angle of view with a certain vision system, this combination give sufficiently high speed.<br><br>For example, to obtain a 30 deg angle of view without pupil shift lenses, the inertia of the tilt-mirror is estimated to be more than one-hundred times larger compared with the case where pupil shift lenses are used." *See* page 6187. |

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| |  <br>Fig. 3. Shift of the pupil using a positive lens.<br><br>“A. Two-axis Rotational Mirrors for High-speed Gaze Control There have been several studies aimed at realizing a high speed pan/tilt camera even with a conventional structure. However, the required level of performance has not been obtained. For example, Y. Nakabo has developed a 1 ms target tracking system, which is a good example of a pan/tilt camera with a high-speed image processor [3]. In this system, a high-speed image processor called Column Parallel Vision 1 (CPV1) is mounted on a two-axis rotational platform including high-speed actuators. Nevertheless, its response time for switching the gaze direction is more than 20 ms, much longer than the control cycle period of 1 ms. Also, the cutoff frequency of the gaze control in the visual feedback system is approximately 10 Hz, whereas the regulation, or imaging, rate is 1 kHz. For the millisecond-order control that we aim for, the inertia of the rotating parts must be reduced as much as possible.<br><br>We focused attention on two-axis rotational mirrors for gaze control, as described in the introduction section. In this case, because the only rotating parts are the two mirrors, the inertia of that subsystem can be considerably reduced. However, two-axis rotational mirrors have not been adopted often for pan/tilt cameras. They are mainly used for scanning non-diverging bundles of rays, such as laser beams. For example, J. Taylor et al. and H. Kim et al. both developed depth measurement systems (a kind of laser range finder) using a camera, a laser, and two-axis rotational mirrors [4], [5]. |

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| | If we use rotational mirrors for the pan/tilt camera, one critical issue is that the obtained angle of view is significantly restricted because the mirrors are small and are constructed to rotate on two axes.<br><br>A model of the system geometry now follows. A pinhole camera model is shown in Fig. 2 [6]. The angle of view θ in Fig. 2 is defined as the angular extent of a given scene in the camera. Rays from the scene are concentrated at the pinhole. The point where the bundle of rays is concentrated is called the pupil. The relationship between θ and S(θ) in Fig. 2 is presented here. S(θ) is the area of a certain image plane a distance d away from the center of the pupil. If θ becomes larger, S(θ) will also obviously become larger.<br><br>For gaze control with mirrors, if a wide angle of view is required, large mirrors will also be required. Thus, it is not easy to realize both a wide angle of view and high-speed performance at the same time because large mirrors are difficult to drive quickly. This will be even more difficult particularly when using independent two-axis mirrors. We call the mirror near the pupil the "pan-mirror" and the other one the "tilt-mirror." If a certain wide controllable gaze range is needed, the required size of the tilt-mirror will be larger than that of the pan-mirror because the area through which rays pass on the tilt-mirror varies depending on the driven angle of the pan-mirror." *See* page 6187.<br><br>A. Optical Setup<br><br>For high-speed gaze control, we used rotational mirrors originally designed for laser scanning (galvanometer mirrors M2 manufactured by GSI Group), and for the pupil shift lenses, we used three achromatic lenses (Edmund Optics). The setup is shown in Fig. 9, and the optical specifications were as follows:<br><br>• Gazing angle range, ϕ: ±30 deg<br><br>• Maximum beam aperture: 30 mm |

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| | • Maximum angle of view, β: 38.6 deg (measured), 40 deg (designed)" *See* page 6189.<br>  <br><br>Fig. 9. The optical setup of the prototype.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

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| **Claim 7** | |
| 7[pre]. The method of claim 1, further comprising the steps: | To the extent the preamble is limiting, Okumura I expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of |

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| | Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[a]. obtaining a reference image; | Okumura I expressly and/or inherently discloses and/or renders obvious obtaining a reference image. *See*, *e.g.*, disclosures below.<br><br>"III. DETAILED OPTICAL THEORY<br><br>A. Gaze and Visibility Model<br><br>Here, the gaze direction and appearance of an image through two mirrors are mathematically considered. The two mirrors are mounted as shown in Fig.4.<br><br>  <br><br>Fig. 4. (a) Mirror alignment, and (b) appearance of an image through the mirrors.<br><br>The pan-mirror surface ($z = (\tan\alpha)x$) includes the origin, and its rotational axis is the y-axis. The tilt-mirror surface ($z = (\tan\beta)y + l_m$) includes $\mathbf{O}'(0, 0, l_m)$, and its rotational axis is parallel to the x-axis. The original gaze direction lies in the $+x$-axis direction ($\boldsymbol{v} = ^T (1, 0, 0)$). |

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| | A matrix Sp that gives a line-symmetric transformation with respect to the pan-mirror surface and a matrix St that gives a line-symmetric transformation with respect to the tilt-mirror surface are expressed as: |

$$\begin{cases} \mathbf{S_p} = \begin{bmatrix} \cos(2\alpha) & 0 & \sin(2\alpha) \\ 0 & 1 & 0 \\ -\sin(2\alpha) & 0 & \cos(2\alpha) \end{bmatrix} \\ \mathbf{S_t} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(2\alpha) & -\sin(2\alpha) \\ 0 & \sin(2\alpha) & -\cos(2\alpha) \end{bmatrix} \end{cases} \quad (1)$$

Position vectors, $\boldsymbol{a} =^T (a_x, a_y, a_z)$ and $\boldsymbol{b} =^T (b_x, b_y, b_z)$ that satisfy $x < 0$ near the x-axis are considered. $\boldsymbol{a}^*$, the line-symmetric displacement mapping of $\boldsymbol{a}$ with respect to the two mirrors, is calculated as:

$$\boldsymbol{a}^* = \mathbf{S_t}\left(\mathbf{S_p}\begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix} - \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix}\right) + \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix} \quad (2)$$

When $a_1 = b_1 - 1$, $a_2 = b_2$, and $a_3 = b_3$ are assumed, $\boldsymbol{b} - \boldsymbol{a} = \boldsymbol{v}$. Thus, the gaze direction through the mirrors, $\boldsymbol{b}^* - \boldsymbol{a}^* = \boldsymbol{v}^*$, is calculated using (2):

$$\boldsymbol{v}^* = \begin{bmatrix} -\sin\phi_p \\ \cos\phi_p \cos\phi_t \\ \cos\phi_p \sin\phi_t \end{bmatrix} \quad (3)$$

where $2\alpha = \frac{\pi}{2} + \phi_p$, $2\beta = \frac{\pi}{2} + \phi_t$. In addition, a general pan/tilt camera has a gaze vector $\boldsymbol{v_g}$:

$$\boldsymbol{v_g} = \begin{bmatrix} -\sin\phi_p \cos\phi_t \\ \cos\phi_p \\ \sin\phi_t \end{bmatrix} \quad (4)$$

On the other hand, when $a_1 = b_1$, $b_2 - a_2 = \cos\theta$, and $b_3 - a_3 = \sin\theta$ are assumed, $\boldsymbol{b} - \boldsymbol{a}$ is a vector $\boldsymbol{u} =^T (0, \cos\theta, \sin\theta)$ on the camera image plane. Then, its mapping with respect to the mirrors is as follows:

$$\boldsymbol{u}^* = \begin{bmatrix} \sin\theta\cos\phi_p \\ -\cos\theta\sin\phi_t + \sin\theta\sin\phi_t\cos\phi_t \\ \cos\theta\cos\phi_t + \sin\theta\sin\phi_p\sin\phi_t \end{bmatrix} \quad (5)$$

To compare $\boldsymbol{u}$ and $\boldsymbol{u}^*$, $\boldsymbol{u}^*$ is rotated onto the x-axis using a matrix:

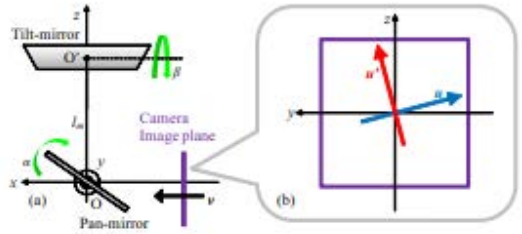
$$\mathbf{R} = \begin{bmatrix} -\sin\phi_p & \cos\phi_p\cos\phi_t & \cos\phi_p\sin\phi_t \\ -\cos\phi_p & -\sin\phi_p\cos\phi_t & -\sin\phi_p\sin\phi_t \\ 0 & -\sin\phi_t & \cos\phi_t \end{bmatrix} \quad (6)$$

Then,

$$\boldsymbol{u}' = \mathbf{R}\boldsymbol{u}^* = \begin{bmatrix} 0 \\ -\sin\theta \\ cos\theta \end{bmatrix} = \begin{bmatrix} 0 \\ \cos(\theta + \frac{\pi}{2}) \\ \sin(\theta + \frac{\pi}{2}) \end{bmatrix} \quad (7)$$

is obtained. That is, the image through the mirrors is inclined at 90 deg, as shown in Fig. 4(b), and the camera should be tilted.

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| | " *See* pages 6187-6188.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[b]. performing registration of the digital image with the reference image; | Okumura I expressly and/or inherently discloses and/or renders obvious performing registration of the digital image with the reference image. *See*, *e.g.*, disclosures below.<br><br>"III. DETAILED OPTICAL THEORY<br><br>A. Gaze and Visibility Model<br><br>Here, the gaze direction and appearance of an image through two mirrors are mathematically considered. The two mirrors are mounted as shown in Fig.4. |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Okumura I |
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| |  <br>Fig. 4. (a) Mirror alignment, and (b) appearance of an image through the mirrors.<br><br>The pan-mirror surface ($z = (\tan\alpha)x$) includes the origin, and its rotational axis is the y-axis. The tilt-mirror surface ($z = (\tan\beta)y + l_m$) includes $\mathbf{O}'(0, 0, l_m)$, and its rotational axis is parallel to the x-axis. The original gaze direction lies in the $+x$-axis direction ($\boldsymbol{v} = ^T (1, 0, 0)$).<br><br>A matrix Sp that gives a line-symmetric transformation with respect to the pan-mirror surface and a matrix St that gives a line-symmetric transformation with respect to the tilt-mirror surface are expressed as: |

$$\begin{cases} \mathbf{S_p} = \begin{bmatrix} \cos(2\alpha) & 0 & \sin(2\alpha) \\ 0 & 1 & 0 \\ -\sin(2\alpha) & 0 & \cos(2\alpha) \end{bmatrix} \\ \mathbf{S_t} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(2\alpha) & -\sin(2\alpha) \\ 0 & \sin(2\alpha) & -\cos(2\alpha) \end{bmatrix} \end{cases} \quad (1)$$

Position vectors, $\boldsymbol{a} =^T (a_x, a_y, a_z)$ and $\boldsymbol{b} =^T (b_x, b_y, b_z)$ that satisfy $x < 0$ near the x-axis are considered. $\boldsymbol{a}^*$, the line-symmetric displacement mapping of $\boldsymbol{a}$ with respect to the two mirrors, is calculated as:

$$\boldsymbol{a}^* = \mathbf{S_t}\left(\mathbf{S_p}\begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix} - \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix}\right) + \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix} \quad (2)$$

When $a_1 = b_1 - 1$, $a_2 = b_2$, and $a_3 = b_3$ are assumed, $\boldsymbol{b} - \boldsymbol{a} = \boldsymbol{v}$. Thus, the gaze direction through the mirrors, $\boldsymbol{b}^* - \boldsymbol{a}^* = \boldsymbol{v}^*$, is calculated using (2):

$$\boldsymbol{v}^* = \begin{bmatrix} -\sin\phi_p \\ \cos\phi_p \cos\phi_t \\ \cos\phi_p \sin\phi_t \end{bmatrix} \quad (3)$$

where $2\alpha = \frac{\pi}{2} + \phi_p$, $2\beta = \frac{\pi}{2} + \phi_t$. In addition, a general pan/tilt camera has a gaze vector $\boldsymbol{v_g}$:

$$\boldsymbol{v_g} = \begin{bmatrix} -\sin\phi_p \cos\phi_t \\ \cos\phi_p \\ \sin\phi_t \end{bmatrix} \quad (4)$$

On the other hand, when $a_1 = b_1$, $b_2 - a_2 = \cos\theta$, and $b_3 - a_3 = \sin\theta$ are assumed, $\boldsymbol{b} - \boldsymbol{a}$ is a vector $\boldsymbol{u} =^T (0, \cos\theta, \sin\theta)$ on the camera image plane. Then, its mapping with respect to the mirrors is as follows:

$$\boldsymbol{u}^* = \begin{bmatrix} \sin\theta\cos\phi_p \\ -\cos\theta\sin\phi_t + \sin\theta\sin\phi_t\cos\phi_t \\ \cos\theta\cos\phi_t + \sin\theta\sin\phi_p\sin\phi_t \end{bmatrix} \quad (5)$$

To compare $\boldsymbol{u}$ and $\boldsymbol{u}^*$, $\boldsymbol{u}^*$ is rotated onto the x-axis using a matrix:

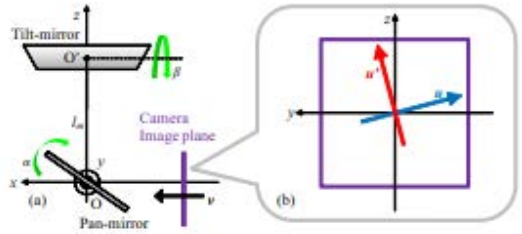
$$\mathbf{R} = \begin{bmatrix} -\sin\phi_p & \cos\phi_p\cos\phi_t & \cos\phi_p\sin\phi_t \\ -\cos\phi_p & -\sin\phi_p\cos\phi_t & -\sin\phi_p\sin\phi_t \\ 0 & -\sin\phi_t & \cos\phi_t \end{bmatrix} \quad (6)$$

Then,

$$\boldsymbol{u}' = \mathbf{R}\boldsymbol{u}^* = \begin{bmatrix} 0 \\ -\sin\theta \\ cos\theta \end{bmatrix} = \begin{bmatrix} 0 \\ \cos(\theta + \frac{\pi}{2}) \\ \sin(\theta + \frac{\pi}{2}) \end{bmatrix} \quad (7)$$

is obtained. That is, the image through the mirrors is inclined at 90 deg, as shown in Fig. 4(b), and the camera should be tilted.

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| | " *See* pages 6187-6188.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 7[c]. using data obtained from the registration to generate the transformation mapping. | Okumura I expressly and/or inherently discloses and/or renders obvious using data obtained from the registration to generate the transformation mapping. *See*, *e.g.*, disclosures below.<br><br>"III. DETAILED OPTICAL THEORY<br><br>A. Gaze and Visibility Model<br><br>Here, the gaze direction and appearance of an image through two mirrors are mathematically considered. The two mirrors are mounted as shown in Fig.4. |

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| |  <br>Fig. 4. (a) Mirror alignment, and (b) appearance of an image through the mirrors.<br><br>The pan-mirror surface ($z = (\tan\alpha)x$) includes the origin, and its rotational axis is the y-axis. The tilt-mirror surface ($z = (\tan\beta)y + l_m$) includes $\mathbf{O}'(0, 0, l_m)$, and its rotational axis is parallel to the x-axis. The original gaze direction lies in the $+x$-axis direction ($\boldsymbol{v} = ^T (1, 0, 0)$).<br><br>A matrix Sp that gives a line-symmetric transformation with respect to the pan-mirror surface and a matrix St that gives a line-symmetric transformation with respect to the tilt-mirror surface are expressed as: |

$$\begin{cases} \mathbf{S_p} = \begin{bmatrix} \cos(2\alpha) & 0 & \sin(2\alpha) \\ 0 & 1 & 0 \\ -\sin(2\alpha) & 0 & \cos(2\alpha) \end{bmatrix} \\ \mathbf{S_t} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(2\alpha) & -\sin(2\alpha) \\ 0 & \sin(2\alpha) & -\cos(2\alpha) \end{bmatrix} \end{cases} \quad (1)$$

Position vectors, $\boldsymbol{a} =^T (a_x, a_y, a_z)$ and $\boldsymbol{b} =^T (b_x, b_y, b_z)$ that satisfy $x < 0$ near the x-axis are considered. $\boldsymbol{a}^*$, the line-symmetric displacement mapping of $\boldsymbol{a}$ with respect to the two mirrors, is calculated as:

$$\boldsymbol{a}^* = \mathbf{S_t}\left(\mathbf{S_p}\begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix} - \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix}\right) + \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix} \quad (2)$$

When $a_1 = b_1 - 1$, $a_2 = b_2$, and $a_3 = b_3$ are assumed, $\boldsymbol{b} - \boldsymbol{a} = \boldsymbol{v}$. Thus, the gaze direction through the mirrors, $\boldsymbol{b}^* - \boldsymbol{a}^* = \boldsymbol{v}^*$, is calculated using (2):

$$\boldsymbol{v}^* = \begin{bmatrix} -\sin\phi_p \\ \cos\phi_p \cos\phi_t \\ \cos\phi_p \sin\phi_t \end{bmatrix} \quad (3)$$

where $2\alpha = \frac{\pi}{2} + \phi_p$, $2\beta = \frac{\pi}{2} + \phi_t$. In addition, a general pan/tilt camera has a gaze vector $\boldsymbol{v_g}$:

$$\boldsymbol{v_g} = \begin{bmatrix} -\sin\phi_p \cos\phi_t \\ \cos\phi_p \\ \sin\phi_t \end{bmatrix} \quad (4)$$

On the other hand, when $a_1 = b_1$, $b_2 - a_2 = \cos\theta$, and $b_3 - a_3 = \sin\theta$ are assumed, $\boldsymbol{b} - \boldsymbol{a}$ is a vector $\boldsymbol{u} =^T (0, \cos\theta, \sin\theta)$ on the camera image plane. Then, its mapping with respect to the mirrors is as follows:

$$\boldsymbol{u}^* = \begin{bmatrix} \sin\theta\cos\phi_p \\ -\cos\theta\sin\phi_t + \sin\theta\sin\phi_t\cos\phi_t \\ \cos\theta\cos\phi_t + \sin\theta\sin\phi_p\sin\phi_t \end{bmatrix} \quad (5)$$

To compare $\boldsymbol{u}$ and $\boldsymbol{u}^*$, $\boldsymbol{u}^*$ is rotated onto the x-axis using a matrix:

$$\mathbf{R} = \begin{bmatrix} -\sin\phi_p & \cos\phi_p\cos\phi_t & \cos\phi_p\sin\phi_t \\ -\cos\phi_p & -\sin\phi_p\cos\phi_t & -\sin\phi_p\sin\phi_t \\ 0 & -\sin\phi_t & \cos\phi_t \end{bmatrix} \quad (6)$$

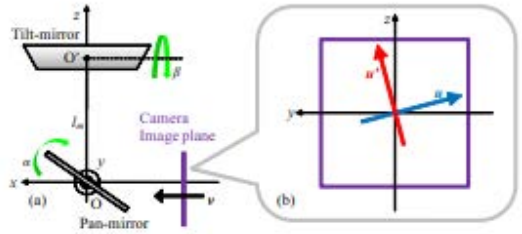
Then,

$$\boldsymbol{u}' = \mathbf{R}\boldsymbol{u}^* = \begin{bmatrix} 0 \\ -\sin\theta \\ cos\theta \end{bmatrix} = \begin{bmatrix} 0 \\ \cos(\theta + \frac{\pi}{2}) \\ \sin(\theta + \frac{\pi}{2}) \end{bmatrix} \quad (7)$$

is obtained. That is, the image through the mirrors is inclined at 90 deg, as shown in Fig. 4(b), and the camera should be tilted.

| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
|---|---|
| | " *See* pages 6187-6188.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
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| **Claim 8** | |
| 8. The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor. | Okumura I expressly and/or inherently discloses and/or renders obvious applying a translation transformation to move the image within display area of the monitor. *See*, *e.g.*, disclosures below.<br><br>"III. DETAILED OPTICAL THEORY<br><br>A. Gaze and Visibility Model<br><br>Here, the gaze direction and appearance of an image through two mirrors are mathematically considered. The two mirrors are mounted as shown in Fig.4. |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Okumura I |
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| |  <br>Fig. 4. (a) Mirror alignment, and (b) appearance of an image through the mirrors.<br><br>The pan-mirror surface ($z = (\tan\alpha)x$) includes the origin, and its rotational axis is the y-axis. The tilt-mirror surface ($z = (\tan\beta)y + l_m$) includes $\mathbf{O}'(0, 0, l_m)$, and its rotational axis is parallel to the x-axis. The original gaze direction lies in the $+x$-axis direction ($\boldsymbol{v} = ^T (1, 0, 0)$).<br><br>A matrix Sp that gives a line-symmetric transformation with respect to the pan-mirror surface and a matrix St that gives a line-symmetric transformation with respect to the tilt-mirror surface are expressed as: |

$$\begin{cases} \mathbf{S_p} = \begin{bmatrix} \cos(2\alpha) & 0 & \sin(2\alpha) \\ 0 & 1 & 0 \\ -\sin(2\alpha) & 0 & \cos(2\alpha) \end{bmatrix} \\ \mathbf{S_t} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(2\alpha) & -\sin(2\alpha) \\ 0 & \sin(2\alpha) & -\cos(2\alpha) \end{bmatrix} \end{cases} \quad (1)$$

Position vectors, $\boldsymbol{a} =^T (a_x, a_y, a_z)$ and $\boldsymbol{b} =^T (b_x, b_y, b_z)$ that satisfy $x < 0$ near the x-axis are considered. $\boldsymbol{a}^*$, the line-symmetric displacement mapping of $\boldsymbol{a}$ with respect to the two mirrors, is calculated as:

$$\boldsymbol{a}^* = \mathbf{S_t}\left(\mathbf{S_p}\begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix} - \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix}\right) + \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix} \quad (2)$$

When $a_1 = b_1 - 1$, $a_2 = b_2$, and $a_3 = b_3$ are assumed, $\boldsymbol{b} - \boldsymbol{a} = \boldsymbol{v}$. Thus, the gaze direction through the mirrors, $\boldsymbol{b}^* - \boldsymbol{a}^* = \boldsymbol{v}^*$, is calculated using (2):

$$\boldsymbol{v}^* = \begin{bmatrix} -\sin\phi_p \\ \cos\phi_p \cos\phi_t \\ \cos\phi_p \sin\phi_t \end{bmatrix} \quad (3)$$

where $2\alpha = \frac{\pi}{2} + \phi_p$, $2\beta = \frac{\pi}{2} + \phi_t$. In addition, a general pan/tilt camera has a gaze vector $\boldsymbol{v_g}$:

$$\boldsymbol{v_g} = \begin{bmatrix} -\sin\phi_p \cos\phi_t \\ \cos\phi_p \\ \sin\phi_t \end{bmatrix} \quad (4)$$

On the other hand, when $a_1 = b_1$, $b_2 - a_2 = \cos\theta$, and $b_3 - a_3 = \sin\theta$ are assumed, $\boldsymbol{b} - \boldsymbol{a}$ is a vector $\boldsymbol{u} =^T (0, \cos\theta, \sin\theta)$ on the camera image plane. Then, its mapping with respect to the mirrors is as follows:

$$\boldsymbol{u}^* = \begin{bmatrix} \sin\theta\cos\phi_p \\ -\cos\theta\sin\phi_t + \sin\theta\sin\phi_t\cos\phi_t \\ \cos\theta\cos\phi_t + \sin\theta\sin\phi_p\sin\phi_t \end{bmatrix} \quad (5)$$

To compare $\boldsymbol{u}$ and $\boldsymbol{u}^*$, $\boldsymbol{u}^*$ is rotated onto the x-axis using a matrix:

$$\mathbf{R} = \begin{bmatrix} -\sin\phi_p & \cos\phi_p\cos\phi_t & \cos\phi_p\sin\phi_t \\ -\cos\phi_p & -\sin\phi_p\cos\phi_t & -\sin\phi_p\sin\phi_t \\ 0 & -\sin\phi_t & \cos\phi_t \end{bmatrix} \quad (6)$$

Then,

$$\boldsymbol{u}' = \mathbf{R}\boldsymbol{u}^* = \begin{bmatrix} 0 \\ -\sin\theta \\ cos\theta \end{bmatrix} = \begin{bmatrix} 0 \\ \cos(\theta + \frac{\pi}{2}) \\ \sin(\theta + \frac{\pi}{2}) \end{bmatrix} \quad (7)$$

is obtained. That is, the image through the mirrors is inclined at 90 deg, as shown in Fig. 4(b), and the camera should be tilted.

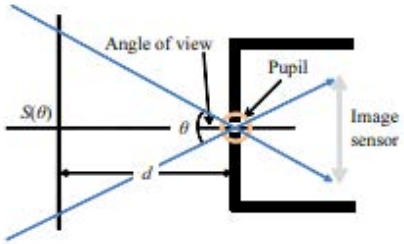
| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
|---|---|
| | " *See* pages 6187-6188.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

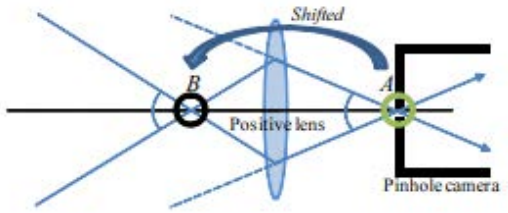
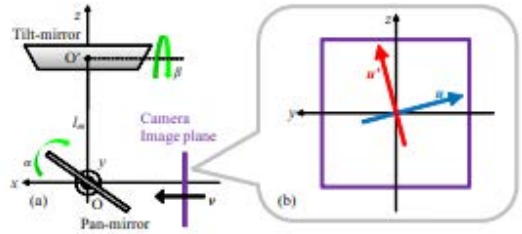
| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
|---|---|
| **Claim 9** | |
| 9. The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. | Okumura I expressly and/or inherently discloses and/or renders obvious changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image. This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
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| **Claim 11** | |
| 11[pre]. The method of claim 1, further comprising: | To the extent the preamble is limiting, Okumura I expressly and/or inherently discloses and/or renders obvious this limitation. *See*, *e.g.*, disclosures below. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
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| | *See* Claim Limitations 1[pre]-1[h].<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[a]. determining distance to a user appearing in the image; and, | Okumura I expressly and/or inherently discloses and/or renders obvious determining distance to a user appearing in the image. *See*, *e.g.*, disclosures below.<br><br>*See* Claim Limitation 1[g]. *See also*:<br><br>"A. Two-axis Rotational Mirrors for High-speed Gaze Control<br><br>There have been several studies aimed at realizing a high1speed pan/tilt camera even with a conventional structure. However, the required level of performance has not been obtained. For example, Y. Nakabo has developed a 1 ms target tracking system, which is a good example of a pan/tilt camera with a high-speed image processor [3]. In this system, a high-speed image processor called Column Parallel Vision 1 (CPV1) is mounted on a two-axis rotational platform including high-speed actuators. Nevertheless, its response time for switching the gaze direction is more than 20 ms, much longer than the control cycle period of 1 ms. Also, the cutoff frequency of the gaze control in the visual feedback system is approximately 10 Hz, whereas the regulation, or imaging, rate is 1 kHz. For the millisecond-order control that we aim for, the inertia of the rotating parts must be reduced as much as possible.<br><br>We focused attention on two-axis rotational mirrors for gaze control, as described in the introduction section. In this case, because the only rotating parts are the two mirrors, the inertia of that subsystem can be considerably reduced. However, two-axis rotational mirrors have not been adopted often for pan/tilt cameras. They are mainly used for scanning non-diverging bundles of rays, such as laser beams. For example, J. Taylor et |

| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
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| | al. and H. Kim et al. both developed depth measurement systems (a kind of laser range finder) using a camera, a laser, and two-axis rotational mirrors [4], [5].<br><br>If we use rotational mirrors for the pan/tilt camera, one critical issue is that the obtained angle of view is significantly restricted because the mirrors are small and are constructed to rotate on two axes.<br><br>A model of the system geometry now follows. A pinhole camera model is shown in Fig. 2 [6]. The angle of view θ in Fig. 2 is defined as the angular extent of a given scene in the camera. Rays from the scene are concentrated at the pinhole. The point where the bundle of rays is concentrated is called the pupil. The relationship between θ and S(θ) in Fig. 2 is presented here. S(θ) is the area of a certain image plane a distance d away from the center of the pupil. If θ becomes larger, S(θ) will also obviously become larger.<br><br>For gaze control with mirrors, if a wide angle of view is required, large mirrors will also be required. Thus, it is not easy to realize both a wide angle of view and high-speed performance at the same time because large mirrors are difficult to drive quickly. This will be even more difficult particularly when using independent two-axis mirrors. We call the mirror near the pupil the "pan-mirror" and the other one the "tilt-mirror." If a certain wide controllable gaze range is needed, the required size of the tilt-mirror will be larger than that of the pan-mirror because the area through which rays pass on the tilt-mirror varies depending on the driven angle of the pan-mirror." *See* page 6187. |

| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
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| |  <br>Fig. 2. Angle of view in the model of a pinhole camera.<br><br>"B. Pupil Shift Lenses for Achieving Practical Angle of View<br><br>We solved the issue described above by using positive lenses called "pupil shift lenses" [7]. The basic theory of the function of a pupil shift lens with a pinhole camera model is shown in Fig. 3. A bundle of rays can be refracted by the positive lens. Some of the bundle of rays that would otherwise be concentrated at B are also concentrated at the desired point A using the positive lens. Thinking of A as the pupil of the camera, this vision system including the positive lens has two pupils, the original one A and the shifted one B.<br><br>This theory can be applied to our Saccade Mirror, enabling both a wide angle of view and high-speed performance to be realized at the same time. That is, if we need gaze control at a sufficiently high speed compared with the frame rate of a high-speed image processor, this combination should give a practical angle of view, or if we need a practical angle of view with a certain vision system, this combination give sufficiently high speed.<br><br>For example, to obtain a 30 deg angle of view without pupil shift lenses, the inertia of the tilt-mirror is estimated to be more than one-hundred times larger compared with the case where pupil shift lenses are used." *See* page 6187. |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Okumura I |
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| |  <br>Fig. 3. Shift of the pupil using a positive lens.<br><br>“III. DETAILED OPTICAL THEORY<br><br>A. Gaze and Visibility Model<br><br>Here, the gaze direction and appearance of an image through two mirrors are mathematically considered. The two mirrors are mounted as shown in Fig.4.<br><br>  <br>Fig. 4. (a) Mirror alignment, and (b) appearance of an image through the mirrors.<br><br>The pan-mirror surface ($z = (\tan\alpha)x$) includes the origin, and its rotational axis is the y-axis. The tilt-mirror surface ($z = (\tan\beta)y + l_m$) includes $\mathbf{O}'(0, 0, l_m)$, and its rotational axis is parallel to the x-axis. The original gaze direction lies in the $+x$-axis direction ($\boldsymbol{v} = ^T (1, 0, 0)$). |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Okumura I |
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| | A matrix Sp that gives a line-symmetric transformation with respect to the pan-mirror surface and a matrix St that gives a line-symmetric transformation with respect to the tilt-mirror surface are expressed as: |

$$\begin{cases} \mathbf{S_p} = \begin{bmatrix} \cos(2\alpha) & 0 & \sin(2\alpha) \\ 0 & 1 & 0 \\ -\sin(2\alpha) & 0 & \cos(2\alpha) \end{bmatrix} \\ \mathbf{S_t} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(2\alpha) & -\sin(2\alpha) \\ 0 & \sin(2\alpha) & -\cos(2\alpha) \end{bmatrix} \end{cases} \quad (1)$$

Position vectors, $\boldsymbol{a} =^T (a_x, a_y, a_z)$ and $\boldsymbol{b} =^T (b_x, b_y, b_z)$ that satisfy $x < 0$ near the x-axis are considered. $\boldsymbol{a}^*$, the line-symmetric displacement mapping of $\boldsymbol{a}$ with respect to the two mirrors, is calculated as:

$$\boldsymbol{a}^* = \mathbf{S_t}\left(\mathbf{S_p}\begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix} - \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix}\right) + \begin{bmatrix} 0 \\ 0 \\ l_m \end{bmatrix} \quad (2)$$

When $a_1 = b_1 - 1$, $a_2 = b_2$, and $a_3 = b_3$ are assumed, $\boldsymbol{b} - \boldsymbol{a} = \boldsymbol{v}$. Thus, the gaze direction through the mirrors, $\boldsymbol{b}^* - \boldsymbol{a}^* = \boldsymbol{v}^*$, is calculated using (2):

$$\boldsymbol{v}^* = \begin{bmatrix} -\sin\phi_p \\ \cos\phi_p \cos\phi_t \\ \cos\phi_p \sin\phi_t \end{bmatrix} \quad (3)$$

where $2\alpha = \frac{\pi}{2} + \phi_p$, $2\beta = \frac{\pi}{2} + \phi_t$. In addition, a general pan/tilt camera has a gaze vector $\boldsymbol{v_g}$:

$$\boldsymbol{v_g} = \begin{bmatrix} -\sin\phi_p \cos\phi_t \\ \cos\phi_p \\ \sin\phi_t \end{bmatrix} \quad (4)$$

On the other hand, when $a_1 = b_1$, $b_2 - a_2 = \cos\theta$, and $b_3 - a_3 = \sin\theta$ are assumed, $\boldsymbol{b} - \boldsymbol{a}$ is a vector $\boldsymbol{u} =^T (0, \cos\theta, \sin\theta)$ on the camera image plane. Then, its mapping with respect to the mirrors is as follows:

$$\boldsymbol{u}^* = \begin{bmatrix} \sin\theta\cos\phi_p \\ -\cos\theta\sin\phi_t + \sin\theta\sin\phi_t\cos\phi_t \\ \cos\theta\cos\phi_t + \sin\theta\sin\phi_p\sin\phi_t \end{bmatrix} \quad (5)$$

To compare $\boldsymbol{u}$ and $\boldsymbol{u}^*$, $\boldsymbol{u}^*$ is rotated onto the x-axis using a matrix:

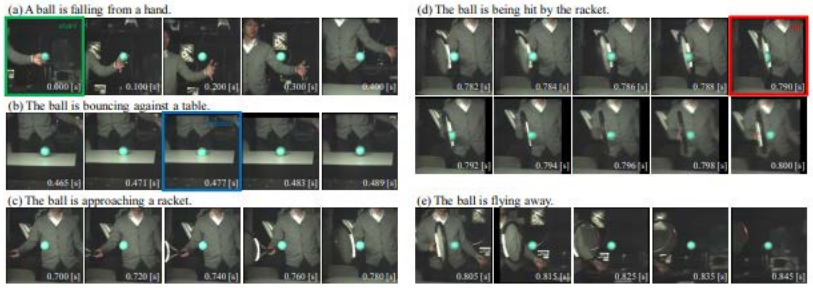
$$\mathbf{R} = \begin{bmatrix} -\sin\phi_p & \cos\phi_p\cos\phi_t & \cos\phi_p\sin\phi_t \\ -\cos\phi_p & -\sin\phi_p\cos\phi_t & -\sin\phi_p\sin\phi_t \\ 0 & -\sin\phi_t & \cos\phi_t \end{bmatrix} \quad (6)$$

Then,

$$\boldsymbol{u}' = \mathbf{R}\boldsymbol{u}^* = \begin{bmatrix} 0 \\ -\sin\theta \\ cos\theta \end{bmatrix} = \begin{bmatrix} 0 \\ \cos(\theta + \frac{\pi}{2}) \\ \sin(\theta + \frac{\pi}{2}) \end{bmatrix} \quad (7)$$

is obtained. That is, the image through the mirrors is inclined at 90 deg, as shown in Fig. 4(b), and the camera should be tilted.

| Asserted Claim of the '109 Patent | Exemplary Citations to Okumura I |
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| | " *See* pages 6187-6188.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants' Invalidity Contentions and Defendants' other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |
| 11[b]. varying resolution of the image according to the distance. | Okumura I expressly and/or inherently discloses and/or renders obvious varying resolution of the image according to the distance. *See*, *e.g.*, disclosures below.<br><br>"D. Observation of Moving Ball<br><br>Our millisecond-order pan/tilt camera should be useful for observing or evaluating high-speed dynamic phenomena with high resolution and no motion blur. If only a high-speed camera is used, the entire range of the dynamic motion must be let into the visual field of the camera using a wide-angle lens. Thus, the resolution of the desired area becomes relatively low. Moreover, motion blur also appears because the target moves at high speed.<br><br>We focused on applications in the field of sports. Balls in baseball, football or tennis are difficult to observe continuously because the velocity vectors of the balls fluctuate extremely rapidly during games. The ability to acquire dynamic images of the fast-moving balls would make significant contributions to broadcasting techniques, practice for players, product development for sports goods manufacturers, and so on.<br><br>Therefore, as an exploratory experiment, we observed a dynamic rubber ball using our millisecond-order pan/tilt camera. The target suddenly came into the visual field, bounced against a table, and was finally hit by a racket.<br><br>The image sequences are shown in Fig. 13. To keep the images of the target ball stationary, they are corrected so that the center of mass in each image is placed at the |

| Asserted Claim of the ’109 Patent | Exemplary Citations to Okumura I |
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| | center. Although the instant where the ball bounces or is hit (change of the velocity vector) is conventionally difficult to capture, clearly observable image sequences could be successfully obtained with our system. The ball’s estimated trajectory is also shown in Fig. 14.” *See* pages 6190-6191.<br>  <br><br>Fig. 13. Image sequences of a dynamic rubber ball: The ball is (a) falling from a hand, (b) bouncing against a table, (c) approaching a racket, (d) being hit by the racket, and (e) flying away.<br><br>This limitation would have been obvious to a person of ordinary skill in the art based on (1) Okumura I alone; (2) knowledge of a personal of ordinary skill in the art, and/or (3) the teachings with respect to this claim element as detailed in the cover document of Defendants’ Invalidity Contentions and Defendants’ other invalidity charts. Exemplary combinations are provided in Section II.B of the cover document. |

# Exhibit A-12: Invalidity of U.S. Patent No. 8,982,109 in view of U.S. Patent Pub. No. 2011/0254691 ("Ooi")

This chart is subject to all reservations, objections, and disclaimers in Defendants' Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety.

Ooi was originally filed August 25, 2010 and published on October 20, 2011, and thus is available as prior art to U.S. Patent No. 8,982,109 (the "'109 Patent") under at least 35 U.S.C. §§ 102(a), (b) and (e).

Ooi anticipates the Asserted Claims of the '109 Patent. To the extent it is found Ooi does not expressly disclose certain limitations in the Asserted Claims, such limitations are at least implicitly or inherently disclosed. Moreover, to the extent it is found that Ooi does not anticipate the Asserted Claims, Ooi renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art.

In these contentions, Defendants have relied in part on Plaintiff's Infringement Contentions. In those contentions, Plaintiff appears to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Plaintiff's apparent claim interpretations. In relying on Plaintiff's apparent claim interpretations, Defendants do not admit that Plaintiff's apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the Asserted Claims are invalid.