

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC, SAMSUNG ELECTRONICS CO. LTD., and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioners

v.

EYESMATCH LTD.,
Patent Owner

Case No. IPR2024-00856
U.S. Patent No. 8,982,109

**DECLARATION OF DR. DAVID FORSYTH IN SUPPORT OF PATENT
OWNER EYESMATCH LTD.'S RESPONSE TO PETITION FOR *INTER*
PARTES REVIEW OF U.S. PATENT NO. 8,982,109**

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I, Dr. David Forsyth, hereby declare as follows:

I. INTRODUCTION

1. Counsel for EyesMatch Ltd. (“Patent Owner”) has retained me as an expert in this matter to provide my independent opinion in regard to the matters at issue in *inter partes* review of U.S. Patent No. 8,982,109 (the “109 Patent”) in IPR2024-00856.

2. I submit my opinions in this declaration based on my study of the evidence; my education, training, research, knowledge, and personal and professional experience; and my understanding as an expert in the field.

3. This declaration contains statements of my opinions formed to date and the bases and reasons for those opinions. I may offer additional opinions based on further review of materials in this case, to rebut opinions offered by any of Petitioners’ experts, and to address issues raised by Petitioners in their briefing to the extent permitted by the Patent and Trademark Appeal Board.

A. Education and Professional Experience

4. My qualifications and credentials are fully set forth in my *curriculum vitae*, attached as Attachment 1.

5. I am currently the Fulton-Watson-Copp Chair in Computer Science at the University of Illinois at Urbana-Champaign. I believe that my background and expertise qualify me as an expert in the technical issues in this matter. My full

Curriculum Vitae is attached to this Opinion as Attachment 1. A summary of my qualifications is included below.

6. My education began in Cape Town, South Africa. I was an undergraduate at the University of the Witwatersrand, Johannesburg, and I hold a Bachelor of Science (1984) and Master of Science in Electrical Engineering from that University. I was awarded the Diocesan College Rhodes Scholarship in 1984 to attend Oxford University. I hold a Master of Arts by special election from Oxford University and a Doctorate of Philosophy in Engineering Science from Balliol College, Oxford. I was appointed Fellow by Examination of Magdalen College, Oxford in 1989. I was then appointed Assistant Professor of Computer Science at the University of Iowa in 1991; in 1994, I was promoted to Associate Professor of Computer Science, and went on leave of absence to take up an appointment as Assistant Professor of Computer Science at U.C. Berkeley. I was promoted to Associate Professor of Computer Science at U.C. Berkeley in 1996, and to Professor of Computer Science in 2002. I went on leave of absence from U.C. Berkeley to take up an appointment as Professor of Computer Science at the University of Illinois at Urbana-Champaign in 2004. I am currently the Fulton-Watson-Copp Chair in Computer Science at the University of Illinois at Urbana-Champaign.

7. I have studied Computer Vision since my final year as an undergraduate in 1984, when I engaged in an undergraduate project on the topic. My Ph.D. thesis

treats a traditional problem in computer vision, known as “color constancy,” and the paper that resulted from this work is still quite regularly cited. As a Fellow by Examination, I studied illumination and shading effects in vision, and geometric methods to recognize objects. I have published papers on a wide range of topics in computer vision, computer graphics, machine learning and human-computer interfaces. I have published about 220 refereed papers and 10 book chapters. I have published one textbook on computer vision in two editions and four languages, one research monograph, and two recent textbooks on machine learning. I have edited six volumes of collected papers. A reasonably complete list of my publications is contained in my curriculum vitae in Attachment 1.

8. In addition, I have occupied various leadership posts within my discipline. I was (or will be) program co-chair for the Institute of Electrical and Electronics Engineers (“IEEE”) Conference on Computer Vision and Pattern Recognition (“CVPR”) in 2000, 2011, 2018 and 2021, and for the European Conference on Computer Vision (“ECCV”) in 2008. I was general co-chair for CVPR in 2006 and again held the position for CVPR 2015. I was general co-chair for the IEEE International Conference on Computer Vision in 2019. I am an Associate Editor of the International Journal of Computer Vision; of the Association for Computing Machinery (“ACM”) Transactions on Graphics; and of the Journal of the ACM. I was the Editor in Chief of the IEEE Transactions on Pattern Analysis

and Machine Intelligence (“TPAMI”) for four years. TPAMI is a journal which receives approximately 1000 submissions per year, and which is usually seen as the leading journal in the discipline. I also served for three years on a committee of the National Research Council, convened to study methods to protect children from pornography and other inappropriate material on the internet.

9. Throughout my career I have received a variety of awards. In 1993, the Marr prize for Best Paper at the International Conference on Computer Vision was awarded to “Extracting Projective Structure from Single Perspective Views of 3D Point Sets,” a paper I wrote with Charles A. Rothwell, Andrew Zisserman, and Joseph L. Mundy. In 2002, the award for Best Paper in Cognitive Computer Vision at the European Conference in Computer Vision was awarded to “Object recognition as machine translation: Learning a lexicon for a fixed image vocabulary,” a paper I wrote with P. Duygulu, K. Barnard, and J.F.G. de Freitas. I was awarded an IEEE Technical Achievement Award in 2005 for my work on Computer Vision. I became an IEEE Fellow in 2009, and an ACM Fellow in 2014. In 2024, I received the Mark Everingham Prize at the European Conference in Computer Vision.

10. My work is extensively cited in computer vision literature, with 45,185 citations recorded by Google scholar in Jan, 2025.

11. My appended CV lists all publications authored in the past 10 years, with perhaps a few exceptions that I have forgotten.

12. I have made extensive contributions to computer vision education. I am lead co-author of a widely used textbook in the discipline, “Computer Vision - A Modern Approach”, which has appeared in two editions and four languages. I have written two other textbooks, and am the lead co-author of the computer vision chapter in the leading Artificial Intelligence textbook. I have trained 35 Ph.D. students. I have trained people who are very well known academics in computer vision. Tamara Berg was associate professor of computer science at the University of North Carolina at Chapel Hill and is now an entrepreneur. Ali Farhadi is professor of computer science at the University of Washington and CEO of the Allen Institute for Artificial Intelligence. Deva Ramanan is a tenured professor of computer science at Carnegie Mellon University. Gang Wang was assistant professor of computer science at Nanyang Technological University in Singapore, and moved to become the senior lead in AI research at Alibaba. Zicheng Liao is a professor of computer science at Zhejiang University. Kobus Barnard is professor of computer science at University of Arizona. Each is seen as a young leader in the field.

13. Based on my above-described 35 years of experience in the field of computer vision and the acceptance of my publications and professional recognition by societies in my field, I believe that I am considered to be an expert in the field of computer vision (including image analysis).

B. Compensation

14. I am being compensated for my time in connection with this case at my standard legal consulting rate, which is \$450 per hour. I have no personal or financial interest in the outcome of this proceeding.

C. Materials Reviewed and Relied Upon

15. In formulating my opinions, I have considered: U.S. Patent Nos. 8,982,109 and 8,982,110 and their corresponding file histories; Patent Owner's Response filed concurrently herewith including all documents cited therein; all documents cited in this declaration; the Petition in IPR2024-00856 (Paper 1) and all Exhibits thereto including the Expert Declaration of Dr. Lina Karam; the Patent Owner's Preliminary Response (Paper 12) and all Exhibits thereto; the Institution Decision (Paper 15), the claim construction briefing and Claim Construction Order in *EyesMatch Ltd. v. Samsung Electronics Co., Ltd., et al.*, No. 2:23-cv-363 (E.D. Tex.) ("the District Court Litigation"), and the deposition of Dr. Lina Karam taken on February 26, 2025 in connection with this IPR. If Petitioners' expert submits an additional declaration, I may submit a supplemental declaration addressing any new opinions or additional explanations, as appropriate and if permitted.

D. Legal Principles

16. I am not a lawyer. I have been provided with an understanding of the legal principles that govern claim construction and patent validity. I have conducted

my analysis in conformance with these principles. I set forth those understandings below.

1. Claim Construction

17. I understand that in assessing the patentability of a claim, the Patent Office generally construes claim terms in accordance with their ordinary and customary meaning as understood by a person of skill in the art (“POSITA”) at the time of the invention in view of the claim language in light of the specification and file history.

18. I understand that various sources are available that may help show what a claim term should mean. These sources include the text of the claims themselves, the patent’s specification, the prosecution history of the patent, and the prior art cited in a patent or in the prosecution history. Together, I understand that these sources are called “intrinsic” evidence. I also understand that other sources, for example concerning relevant scientific principles, dictionaries or technical dictionaries, and other information concerning the state of the art is called “extrinsic” evidence. I understand that extrinsic evidence may not be used to contradict the claim language.

19. I understand that claim terms should generally be given their ordinary meaning, which is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention

20. I understand that the context in which a claim term is used can be highly instructive. Other claims of the patent in question, both asserted and not asserted, can also be valuable sources as to the meaning of a claim term. Because claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims. Differences among claims can also be a useful guide in understanding the meaning of particular claim terms.

21. I understand that a person of ordinary skill in the art is deemed to read a claim term not only in the context of the particular claim in which the disputed term appears, but also in the context of the entire patent, including the specification. The specification is the primary basis for construing the claims and is considered the single best guide to the meaning of a disputed term. For this reason, the words of the claim must be interpreted in view of the specification. The interpretation of a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to cover within the claim.

22. A claim term should not be interpreted to exclude embodiments disclosed in the specification absent probative evidence on the contrary. I further understand that, in general, the claimed invention is not limited to a preferred embodiment, even if the specification does not describe any other embodiment.

23. In addition to consulting the specification, one should also consider the patent's prosecution history, if it is available. The prosecution history consists of the complete record of the proceedings before the Patent Office and includes cited prior art. The prosecution history can inform the meaning of the claim language by demonstrating how the inventor understood the invention. I understand that the prior art cited in a patent, or the prosecution history of the patent also constitutes intrinsic evidence.

24. I have been asked to offer my opinion regarding the level of ordinary skill in the art at the time of the invention or the effective filing date, which I understand to be December 2012 for the 109 Patent. I have considered the types of problems encountered in the art, the prior solutions to those problems found in prior art references, the rapidity with which innovations are made, the sophistication of the technology, the level of education of active workers in the field and my own experience working with those of skill in the art at the time of inventions.

25. I understand that Petitioner Samsung is a Defendant in *EyesMatch Ltd. v. Samsung Electronics Co., Ltd., et al.*, No. 2:23-cv-363 (E.D. Tex.) ("the District Court Litigation") in which the 109 Patent is also asserted. I understand that the District Court issued a claim construction order in the District Court Litigation. Ex.2008. I further understand that the PTAB will consider this claim construction order and may find the District Court's reasoning to be persuasive. In reviewing

Petitioners’ asserted prior art and forming my opinions in this Declaration, I have applied the constructions from the District Court Litigation Claim Construction Order.

a. “it appears to mimic a reflection of a mirror”

26. With respect to the 109 Patent, I understand that the claim construction order in the District Court Litigation construed the following term that is relevant to the 109 Patent, limitation 1(c): “it appears to mimic a reflection of a mirror”. The term “it appears to mimic a reflection of a mirror” was construed as “an image where the user sees their reversed reflection appearing at roughly double the distance from the camera and the reflection maintains roughly the same size regardless of the user movement.” Ex.2008 at 19.

b. “transformation mapping”

27. With respect to the 109 Patent, I understand that the claim construction order in the District Court Litigation construed the following term that is relevant to the 109 Patent, limitation 1(c). The term “transformation mapping” was construed as a “selected set of image transformations”. Ex.2008 at 14.

c. “varying the rate at which the non-ordered steps are performed on the series of images according to the distance”

28. With respect to the 109 Patent, I understand that the claim construction order in the District Court Litigation construed the following term that is relevant to the 109 Patent, limitation 1(h). The term “varying the rate at which the non-ordered

steps are performed on the series of images according to the distance” was construed as “varying rate at which one or more non-ordered steps are performed on the series of images according to the distance.” Ex.2008 at 28.

2. Pre-America Invents Act

29. I understand Petitioners seek cancellation of Claims 1-18 of the 109 Patent under pre-AIA 35 U.S.C. §§ 102 and 103.

30. I understand that the pre-AIA patent statute applies to the 109 Patent because it was filed before March 16, 2013 (filed March 15, 2013) and the challenged claims claim priority to a provisional application that was filed before March 16, 2013 (Provisional Application No. 61/738,957, filed December 18, 2012).

31. I understand effective filing date to mean either: (1) the actual date on which the patent application containing the claimed invention was filed; or (2) the filing date of an earlier patent application (*e.g.*, provisional and non-provisional applications, domestic and foreign) upon which patent application containing the claimed invention relies for priority.

32. I understand the date of the claimed invention to be either: (1) the effective filing date of the patent; or (2) when the claimed invention was conceived or reduced to practice.

3. Presumption of Validity and Burden of Proof

33. I have been informed that an issued patent is presumed valid, and a party seeking to challenge the validity of a claim of an issued patent must submit proof that each claim is invalid. I understand that in this IPR, Samsung bears the burden of proving unpatentability by a preponderance of the evidence.

4. Invalidity: Anticipation

34. I understand and have been informed that in order for an inventor to be entitled to a patent, the invention must be “new” and the inventor must not have lost his or her right to a patent by delaying filing of a patent application directed to the invention. There are a number of ways that an invention can be “anticipated”—that is, not new.

35. One such way is when the invention was already patented or described in a printed publication, anywhere in the world before the date of invention by the inventor. Additionally, a patented invention may not be new if it was described in an application for a patent filed in the United States that later issued as a patent, so long as the earlier application pre-dates the date of invention. If the subject matter covered by a patent claim is found within the “four corners” of a prior art reference, the claim is said to be anticipated by that reference.

36. A patent claim can be said to be anticipated if each and every limitation of the patent claim is found either expressly or inherently in a single prior art

reference. While a prior art reference need not use the same words as a patent claim to anticipate the claim, the prior art reference must describe the requirements of the claim with sufficient clarity such that a person of ordinary skill in the art would have been able to make and use the claimed invention based on the reference and their knowledge in the applicable technical field without undue experimentation. To constitute anticipation, the prior art reference must describe the claimed invention in sufficient detail to place it in the possession of a person of ordinary skill in the field of the invention.

37. The disclosure of a feature of a claimed invention can be either “express” or “inherent.” A feature is expressly disclosed if the text, figures, or other content of a reference actually disclose the aspects of the patent claim. I have been informed and understand that in order to establish that an element of a claim is “inherent” in the disclosure of a prior art reference, it must be clear to a POSITA that the element (although not expressly disclosed) is an inevitable part of what is explicitly described in the reference, and that it would have been recognized as necessarily present by a person skilled in the art. Inherency cannot be established by probabilities or possibilities, and the mere fact that something may result from some teaching found in the prior art is not enough to establish inherency. Unless all the elements are found in a single piece of prior art in exactly the same situation and united the same way to perform the identical function, there is no anticipation.

38. I have been informed that a claim is invalid under 35 U.S.C. § 102(a) only if an invention reflected in a patent claim was known or used by others in the United States, or patented or described in a printed publication in the United States or a foreign country, before the invention date of that patent claim.

39. I have been informed that a claim is invalid under 35 U.S.C. § 102(b) only if an invention reflected in a patent claim was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country more than one year before the earliest priority date for that patent claim.

40. I have been informed that a claim is invalid under 35 U.S.C. § 102(e) only if an invention reflected in a patent claim was disclosed in another patent that was granted from a United States patent application filed before the invention date of the patent claim at issue.

41. I have been informed that a claim is invalid under 35 U.S.C. § 102(g) only if an invention reflected in a patent claim was invented before the invention date of the patent claim at issue by another inventor in the United States and not abandoned, suppressed, or concealed by that earlier inventor.

42. I understand that to qualify as a “printed publication,” a reference must have been sufficiently accessible to the public interested in the art and that a reference is sufficiently accessible if it was disseminated or otherwise made

available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence can locate it.

5. Invalidity: Obviousness

43. I have been informed that if a single reference does not contain every limitation of a patent claim, it can only invalidate that claim if it would be obvious when considered in light of other prior art references or devices without viewing the combination with hindsight bias. The claim is invalid only if the differences between the claimed invention and the prior art are such that the claimed invention, as a whole, would have been obvious to a person having ordinary skill in the art at the time the invention was made (without the benefit of hindsight bias).

44. I have been informed that the prior art references can be combined to show a patent is invalid as obvious under 35 U.S.C. § 103.

45. I understand that an obviousness evaluation can be made on a single reference or a combination of several prior art references. For example, a single reference, when considered in view of the knowledge of a person of ordinary skill in the art, could render a claim obvious.

46. I have been informed that the analysis of obviousness involves several factual inquiries including (1) level of ordinary skill in the pertinent art; (2) the scope and content of the prior art; (3) the differences between the prior art as a whole and the claim at issue; and (4) objective indicia of non-obviousness (also known as

secondary considerations of non-obviousness). I understand that the patentee has the burden of production on any objective indicia of non-obviousness.

47. I have been informed that the test for analogous art is very specific. I have been informed that art is non-analogous unless it is: (1) from the same field of endeavor as the claimed invention; or (2) reasonably pertinent to the particular problem faced by the inventor. I have been informed that an art citation that is not from the same field of endeavor as a claimed invention must be “reasonably pertinent” to the problem addressed by the inventor. I have been informed that art is “reasonably pertinent” when it would “logically commend itself” to an inventor’s attention in considering his problem. Conversely, I have been informed that when art is directed to a different purpose than a claimed invention, an inventor would have less motivation or occasion to consider it.

48. I have been informed that the fact that prior art references all concern the same field of endeavor is not in itself sufficient rationale for making the combination. Many types of techniques and systems exist in the same field of endeavor. That fact alone would not make it obvious to combine their features. I have been informed that a proper obviousness determination must show reason why a person of ordinary skill in the art would have thought to combine particular available elements of knowledge, as evidenced by the prior art, to reach the claimed invention.

49. I have been informed that a party seeking to invalidate a patent on obviousness grounds must demonstrate that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.

50. I understand for a claim to be obvious where not every element of a claim is taught by the prior art, a party trying to show obviousness must show why it would have been obvious to a person of ordinary skill in the art to both combine the prior art references and overcome the differences and make modifications between the claimed invention and the prior art. I also understand that the existence of every element of the claimed invention in the prior art does not necessarily mean a skilled artisan would have been motivated to combine those references. I also understand that a skilled artisan must have had a reason to combine the elements in the same way as the claimed invention. Conclusory statements that a skilled artisan would have been motivated to combine the prior art or would have thought it obvious to modify the prior art are insufficient to show obviousness.

51. I have been informed that, when assessing if there was motivation to combine the prior art references, important factors include (1) whether the claimed invention was merely the predictable result of using prior art elements according to their known functions; (2) whether the claimed invention provides an obvious

solution to a known problem in the relevant field; (3) whether the prior art teaches or suggests the desirability of combining elements in the invention; (4) whether the prior art teaches away from combining elements in the claimed inventions; and (5) whether it would have been obvious to try the combinations of elements, such as when there is a design incentive or market pressure to solve a problem and there are a finite number of identified, predictable solutions.

52. I have been informed that to establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art.

53. I understand that Petitioners, as the challengers asserting obviousness based on a combination of prior-art references, must demonstrate that a POSITA would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of successfully achieving the claimed invention from the combination.

54. I understand that a showing that a prior art reference teaches away from a given combination is evidence that one of skill in the art would not have been motivated to make that combination to arrive at the claimed invention. A reference may be said to teach away when a POSITA, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a

direction divergent from the path that was taken by the applicant. If the proposed invention would defeat the purpose of a reference, for example, that reference teaches away from the invention. To teach away, the reference must criticize, discredit, or otherwise discourage the solution reached by the proposed invention. I also understand that the absence of a formal teaching away in one reference does not automatically establish a motivation to combine it with another reference in the same field.

55. I have been informed that if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious.

56. I have been informed that to determine whether a combination of known elements would have been obvious to a person of ordinary skill in the art at the time of the invention, one must consider the references in their entirety to ascertain whether the disclosures in those references render the combination obvious to such a person.

57. I have been informed that the combination of familiar elements according to known methods may be obvious when it does no more than yield predictable results. Additionally, I understand that a patent may be invalid for obviousness if a POSITA can implement a predictable variation or if there existed at

the time of the invention a known problem for which there was an obvious solution encompassed by the patent's claims. I understand that the obvious solution only needs to be a known solution for solving the problem, and not an improvement over other solutions. A combination is not obvious, however, where the combination cannot be implemented without undue experimentation or when the motivation to create the combination comes from hindsight.

58. I have been informed that when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a POSITA has good reason to pursue the known options within his or her technical grasp. I understand that, if this leads to anticipated success, it may be the product not of innovation, but rather of ordinary skill and common sense. I have been informed that the fact that a combination was obvious to try might show that the patent claim was obvious.

59. I have been informed that, even when all claim limitations can be found in a combination of prior art references, the fact-finder must consider as part of the obviousness determination not only what the prior art teaches, but whether the prior art teaches away from the claimed invention and whether there is a motivation to combine teachings from separate references in the manner claimed.

6. Invalidity: Objective Indicia of Non-Obviousness

60. I have been informed that, in assessing whether a claimed invention is obvious, objective indicia of non-obviousness (sometimes referred to as “secondary considerations”) should be considered. I understand that the weight accorded to objective indicia evidence depends on that evidence being reasonably commensurate with the scope of the claims and the existence of a nexus between the merits of the claimed invention and the evidence of objective indicia. I have been informed that objective indicia that may weigh towards the non-obviousness of the invention include the following:

- Whether the claimed invention satisfied a long-felt need;
- Whether the claimed invention was preceded by a history of failures by others to solve a problem or problems solved by such invention;
- Whether the claimed invention achieved a surprising or unexpected result;
- Whether the claimed invention exhibited performance superior to prior art devices and/or methods;
- Whether the claimed invention has achieved commercial success;
- Evidence of industry acquiescence;
- Licenses;
- Whether the claimed invention has been copied;
- Whether the particular claimed invention was the subject of skepticism by the industry; and
- Whether the prior art taught away from the claimed invention.

61. I have been informed that evidence of a long felt but unresolved need tends to show non-obviousness because it is reasonable to infer that the need would have not persisted had the solution been obvious. I understand that objective considerations such as failures by others to solve the problem and copying may often be the most probative and cogent evidence of non-obviousness. I understand that the significance of licensing a patent as an objective indicium in enhancing the non-obviousness of an invention is that an independent third party with an interest in being free of the patent has chosen to respect it and pay a royalty under it rather than litigate and invalidate it. I understand that there is a nexus between the patent and the licensing activity when the factfinder can infer that the licensing arose out of recognition and acceptance of the subject matter claimed in the patent. I understand that the commercial response to an invention is significant to determinations of non-obviousness.

E. Level of Ordinary Skill in the Art

62. Based upon my experience in this area, a person of ordinary skill in the art (“POSITA”) in this field at the relevant time frame would have been familiar with the design of, theory behind, principles of operation of, intended use of, and the underlying technology used in computer vision. This typically would consist of a minimum of a bachelor in science in Computer Science or Electrical Engineering (or related engineering field) plus either a year of graduate training or 2-4 years of

relevant experience, with the graduate training or relevant experience including experience in computer vision techniques and principles.

63. I would qualify as a POSITA as of the priority date of the 109 Patent and have applied the understanding of such a POSITA in forming my opinions.

II. BACKGROUND

A. The 109 Patent

64. U.S. Patent No. 8,982,109 (the “109 Patent”) issued on March 17, 2015, and is entitled “Devices, Systems and Methods of Capturing and Displaying Appearances”. It lists Nissi Vilcovsky and Ofer Saban as inventors.

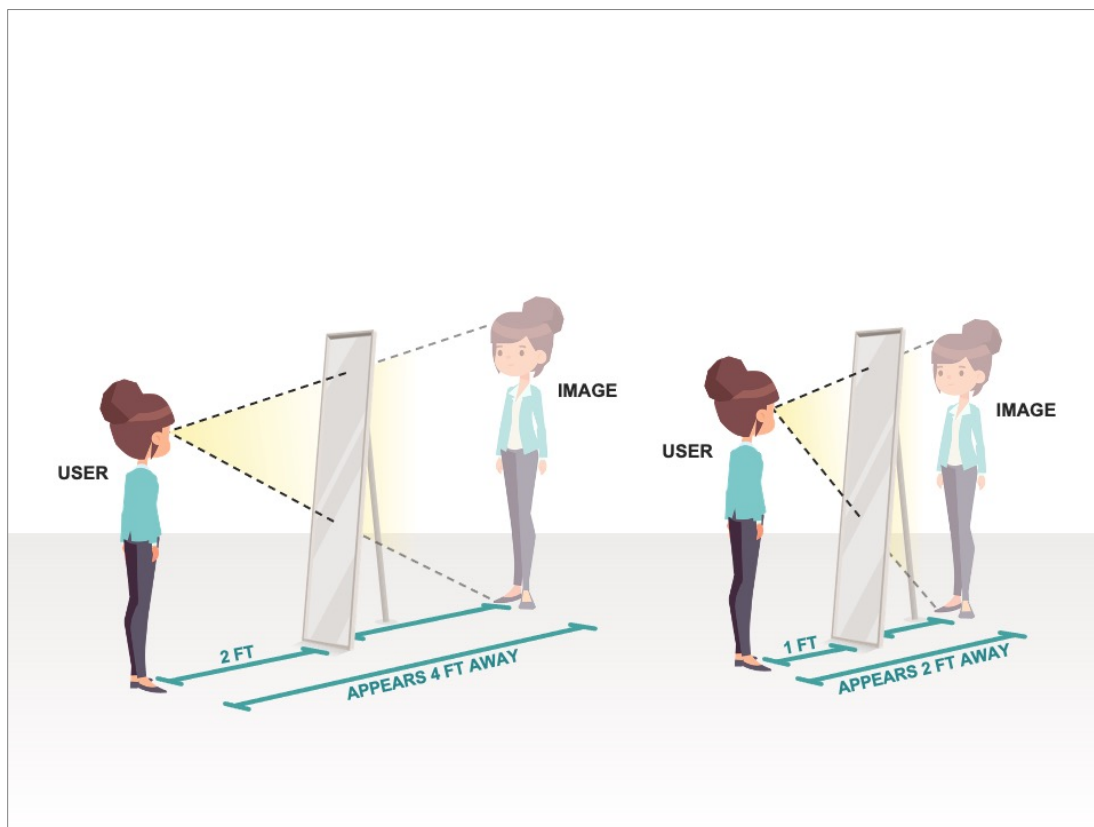
65. The 109 Patent is directed to digital mirror systems that emulate conventional mirrors. The 109 Patent discloses a series of software transformations of the received image that cause a camera and conventional computer to mimic a mirror with a captured video stream. For example, the image is flipped, a “transformation mapping” is applied to modify the image such that it mimics a reflection in a conventional mirror, the image is resized based on the user’s distance from the camera, and the system applies these transformations at a rate that varies based on the user’s distance to the camera. *See, e.g.*, Ex.1001, Claim 1.

66. As of the December 2012 priority date, the 109 Patent claims and teaches an unconventional way to create a digital mirror system that convincingly mimics a conventional mirror.

B. General Optical Properties of a Conventional Mirror

67. With a conventional mirror, the image of the person looking into the mirror appears left-right reversed.

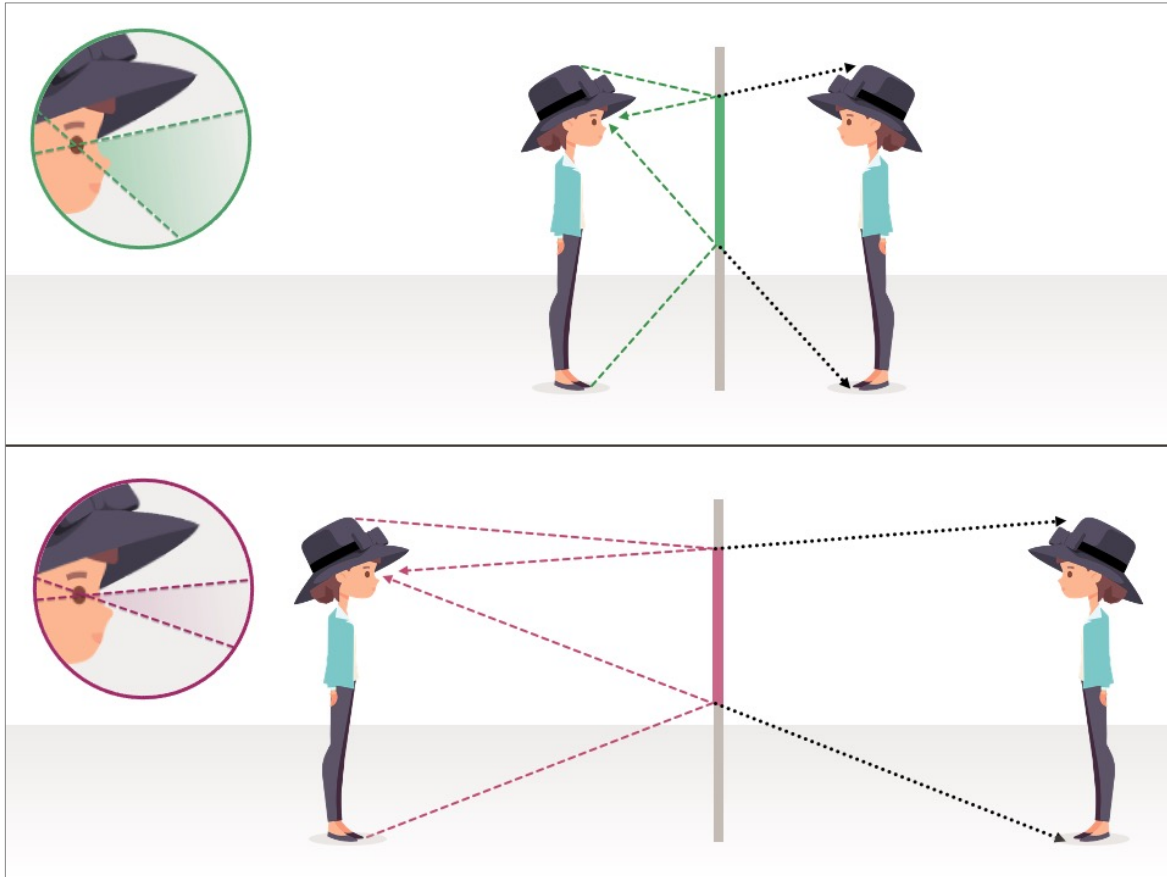
68. With a conventional mirror, the image of the person looking into the mirror appears at approximately double the distance that the person is standing from the mirror.



69. With a conventional mirror, the image of the person looking into the mirror is always approximately the same size regardless of the person's movement toward or away from the mirror.

70. The property of a conventional mirror by which the person looking into the mirror appears at approximately the same size regardless of the person's movement toward or away from the mirror may lead one to ask why people move very close to a mirror when they want to see something small on their face, like their iris for example. The actual size of the iris reflected in the mirror does not change as the person moves physically closer to the mirror. However, what does change is the angle at which the person sees their reflected iris. The change in this angle means that as the person gets closer to the mirror the portion of the mirror occupied by the iris is greater even though the actual size of the displayed iris has not itself increased. This can be seen in the image below. On the top, an observer wearing a hat stands close to a mirror (green, left). The observer sees their mirror image (green, right) at an equal distance on the other side of the mirror. The rays from the observer's feet and hat to the mirror (green, dotted) are reflected into the observer's eye along the line of the rays from the observer's feet and hat to the observer's eye (green, dashed). The observer then moves to the red position, but the section of mirror occupied by the observer does not change (compare red dashed to green dashed). However, an observer wanting to look at a facial detail will move closer to a mirror. This is because, although the size of the observer's reflection in the mirror does not change, the visual angle subtended by the reflection at the eye changes sharply. A relatively small range of rays arriving at the red observer's eye comes from the reflection (the

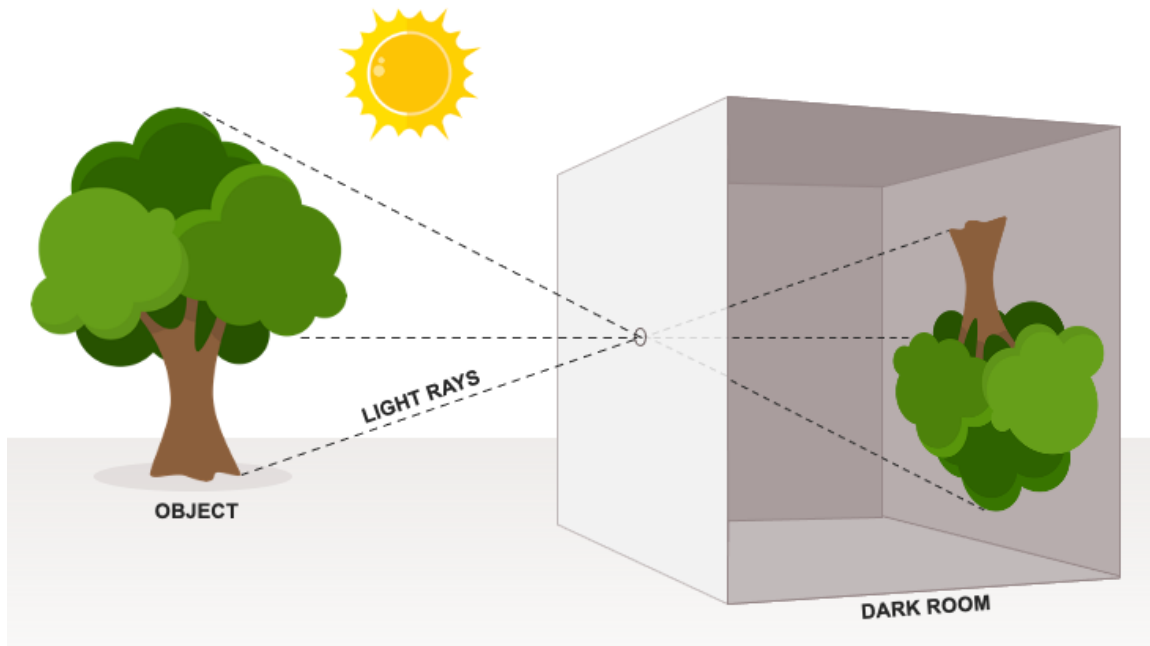
red angle), but a much larger range of rays arriving at the green observer's eye comes from the reflection. The difference between the angles of the observer's eyes (red vs green, below) show how substantial this effect is.



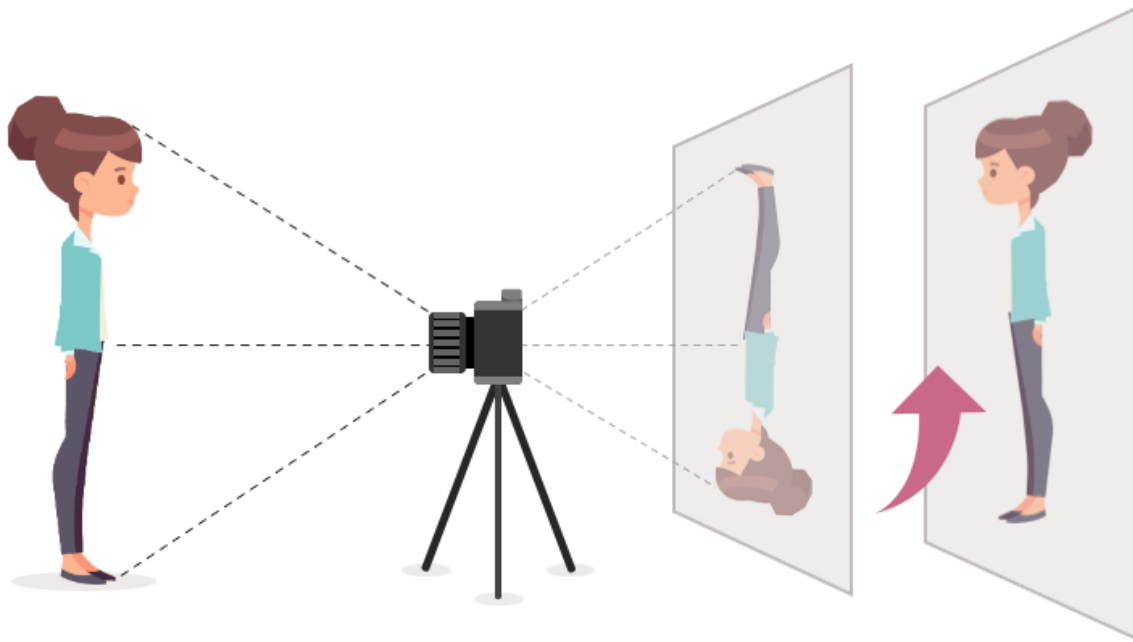
71. Unlike a mirror, which inverts the viewer's image, a camera captures the subject person's image as if another person would see the subject person.

72. The forerunner to the modern camera was the camera obscura based on pinhole projection. If a person entered a completely dark room and light entered only through a very small hole, e.g., a pinhole, the outside scenery would be

projected onto the opposite wall. However, the image would be upside-down and left-right reversed.



73. The camera obscura produces dark images because the hole is small and so collects relatively little light. Furthermore, the camera obscura has no method to capture the image on the wall. Modern cameras have lens systems, designed to collect larger amounts of light and ensure that the light remains focused, as well as an image capture system. For a wide range of purposes, the geometric properties of almost all cameras are accurately modelled by the camera obscura. Exceptions include very large field of view lenses and some other lenses that distort images and chromatic aberration in lens systems. Image capture systems used to involve chemical effects in film, but are now almost always solid state sensors. The image collected by the capture system can be rotated by 180 degrees before being displayed.



74. The key geometric feature of a camera is the focal point, corresponding to the hole in the camera obscura model. Light leaving a point in space passes through this focal point, and is then collected by the sensor. If the sensor is sufficiently large, rotating a camera about its focal point will change the image in a way that can be corrected using a form of transformation known as a homography. However, any movement of the camera in the scene that results in the focal point moving will produce a change in the image that cannot usually be corrected without detailed knowledge of the 3D geometry of the scene (exceptions include a plane scene). There is no pure transformation of an image that can reproduce the effect of moving a camera focal point toward or away from a scene, absent detailed 3D geometric information. In particular, moving a camera toward or away from a scene is not equivalent to making an image larger or smaller, because occlusion effects

between objects in the scene change. Magnifying or zooming an image is not the same as changing the point of view or changing the perspective, as the example in the figures below illustrates. This can be seen in the images below. In the first image, the coffee shop will appear to be about 6 inches high (because this is where the blue ray that just touches the top of the coffee shop strikes the ruler), and the top feature on the coffee shop is visible to the camera (red ray). When the camera moves closer to the coffee shop (second image), the front of the coffee shop occludes the top feature, and the coffee shop appears to be about 9 inches high. This means that there are regions of the first image that cannot be seen in the second image (the top feature on the coffee shop; the section of the ruler from 6 inches to 9 inches), meaning that reconstructing the second image from the first requires information that is not present in the first image. Therefore, magnification is *not* the equivalent to a change in camera position.

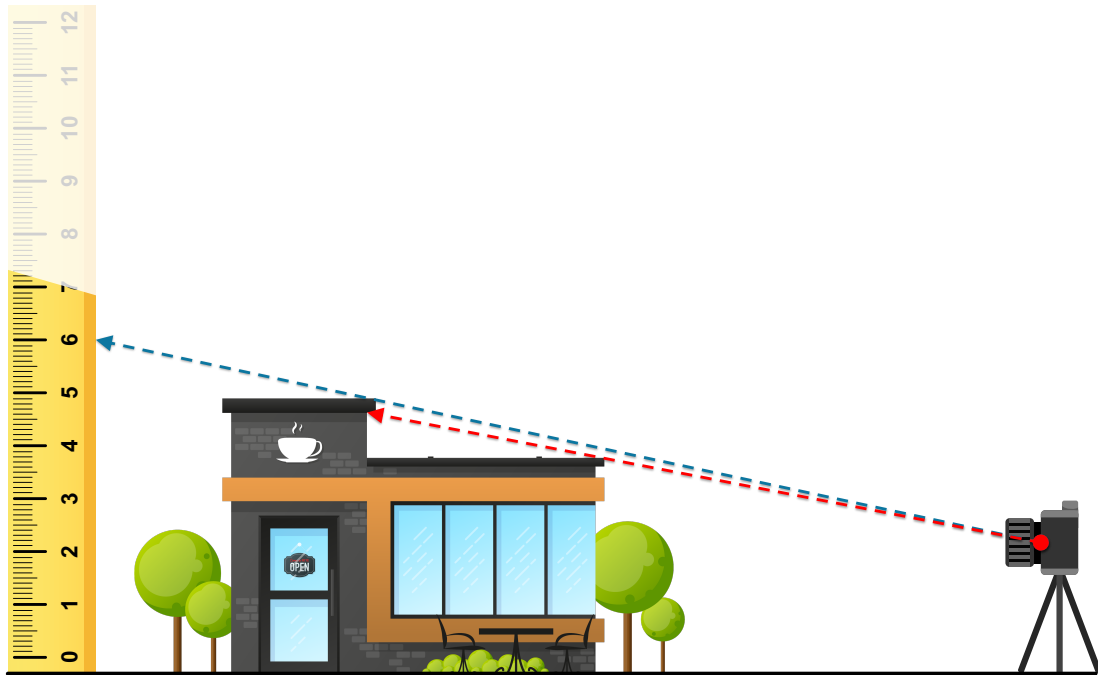


Image 1

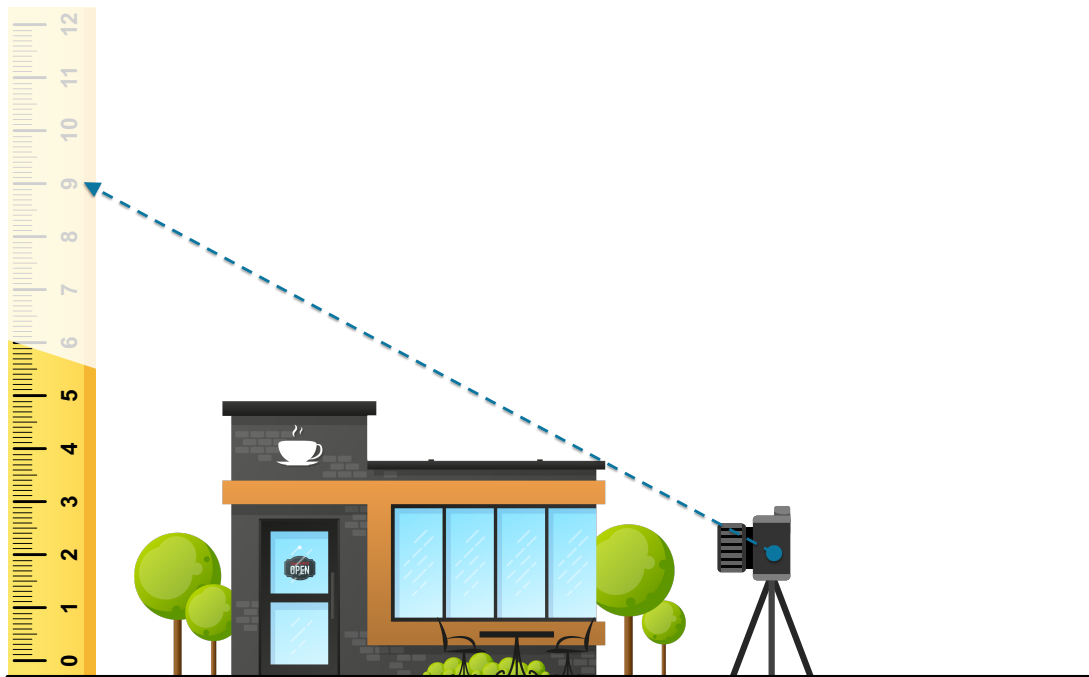


Image 2

C. Overview of the References

1. Rosenberg

75. Rosenberg discloses a “digital mirror system” which “emulates a traditional mirror by displaying real-time video imagery of a user who stands before it. Ex.1005 at Abstract. Rosenberg’s mirror system is also “adapted to provide real-time captured images that approximate what a user would see when viewing an ordinary mirror, with the addition of various other image processing features.” Ex.1005, ¶¶ 0006, 0050, 0075, 0077. *See also, id.*, ¶ 0028.

2. Nakazawa

76. Nakazawa is directed to gaze correction in photography: “a photographing device that is capable of image correction so that the line of sight of the captured image and the displayed image are aligned”. Ex.1007, ¶ 0007. Nakazawa discloses a “correcting means for correcting an orientation deviation of the face” based on magnification and reduction ratios depending on the distance of the user from the photographing means (*see, e.g.*, Ex.1007, ¶¶0008-0009, 0015, 0025) and discloses correction of the orientation of the user’s pupils to generate “a face image in which the line of sight is oriented toward the photographing means” (Ex.1007, ¶0028). In my opinion, a POSITA would not regard these corrections as being directed to modifying the image such that it appears to mimic a reflection of a mirror as recited by claims of the 109 Patent.

3. Hatanaka

77. Hatanaka is directed to the reduction of throughput for image data processing in a communication system. Ex.1009, Abstract, ¶ 0012.

4. Tripathi

78. Tripathi is directed to adjusting display frame rate in response to power status of the device, content type (e.g., dynamic or static), and/or affirmative user input. *See, e.g.*, Ex.1040, at Abstract, 1:60-62, 2:1-3, 6:10-20 10:40-44.

a. Tripathi Does Not Disclose Limitations 1(c) or 1(h)

79. My opinions for Grounds 1, 2, and 3 are incorporated herein by reference.

80. It is my opinion none of Rosenberg, Nakazawa, Tripathi, or Hatanaka, alone or in combination, meet limitations 1(c) and 1(h) of the 109 Patent.

81. Even assuming motivation to combine (but there would be no such motivation), a combination of Hatanaka and Tripathi would simply not meet limitations 1(c) and 1(h) for the reasons I have given above for Grounds 1, 2, and 3.

82. As I explained in my opinions for Grounds 2 and 3, a POSITA would not be motivated to combine Hatanaka and Tripathi for limitation 1(c) because neither reference is directed to attempting to modify a captured image such that it mimics a reflection of a mirror.

83. As I explained in my opinions for Ground 2, a POSITA would not regard Hatanaka as disclosing reversing an image of a user nor having that reversed reflection appear at roughly double the distance from the camera nor maintaining roughly the same size regardless of the user movement.

84. As I explained in Ground 3, a POSITA would not regard Tripathi as being directed to capturing images, let alone capturing an image of a user and attempting to mimic a reflection of a mirror with a digital device.

85. A POSITA would regard Tripathi as not disclosing capturing a user's image (or any image), not disclosing reversing a user's image (or any image), not disclosing that the reversed image appears at roughly double the distance from the camera, and not disclosing that the reversed image maintains roughly the same size regardless of user movement.

86. A POSITA would not have been motivated to combine Hatanaka and Tripathi for limitation 1(c) because neither are directed to replicating a mirror experience nor discloses this optical property at all.

87. With respect to limitation 1(h), a POSITA would not be motivated to combine Hatanaka and Tripathi for limitation 1(h) because neither discloses limitation 1(h).

88. A POSITA would have regarded Tripathi as directed to a variable frame rate display that can change the frame rate based on, *inter alia*, the device power supply, type of content displayed, or user input. Ex.1040, Abstract, 6:10-20.

An electronic device may be provided with a display. The display may be a variable frame rate display capable of adaptively adjusting a frame rate at which display frames are displayed in response to information associated with the current state of operation of the device. The information may be gathered using control circuitry in the electronic device. The control circuitry may gather the information for **adjusting the frame rate by monitoring the electronic device power supply configuration,**

other device components, the type of content to be displayed, and user-input signals. The control circuitry may adjust the frame rate based on the gathered information by increasing or decreasing the frame rate. The control circuitry may be formed as a portion of display control circuitry for the device such as a display driver integrated circuit or may be formed as a portion of storage and processing circuitry external to the display.

Ex.1040, Abstract.

The variable frame rate may be actively determined during operation of device 10 based on whether static or dynamic display content is to be displayed, based on whether device 10 is receiving power from a battery such as battery 34 or a power cable such as power cable 30, based on user input such as a swipe by a user finger 38, based on the operational status of other device components 40 such as a camera, a video card, or other components, or based on whether one or more particular software applications 36 with one or more settings has been launched.

Ex.1040, 6:10-20.

89. As discussed in my opinions for Ground 3, a POSITA would regard Tripathi's disclosure for varying the frame rate as based on affirmative user inputs. *See, e.g.*, Ex.1040, 10:40-50, Fig. 13, 11:11-24, Fig. 15, 12:54-67.

90. As discussed in my opinions for Ground 2, Hatanaka determines distance to a viewer of content (*see, e.g.*, Ex.1009, ¶¶0009, 0010), there is no

disclosure that the rate at which processing or encoding steps are performed is varied at all, let alone based on distance. In my opinion, a POSITA would regard Hatanaka's silence as to varying the rate of performing image processing steps as non-disclosure.

91. In my opinion, any argument that varying the rate based on distance would have been obvious to a POSITA reading Hatanaka and Tripathi is impermissibly based on hindsight bias.

5. Iwai

92. Iwai is directed to calibration of a digital camera based on registration between a base image and a picked-up image. Ex.1010, Abstract, 7:11-21, 8:23-34.

a. Iwai Does Not Disclose Limitation 1(c)

93. Limitation 1(c) of the 109 Patent requires: "applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror".

94. It is my opinion that Iwai does not disclose limitation 1(c) under the construction of "it appears to mimic reflection of a mirror" in the District Court Litigation.

95. POSITA would not have regarded Iwai as being directed to replicating a mirror-like experience for a user. Rather, a POSITA would have regarded Iwai as

directed to calibration of a digital camera based on registration between a base image and a picked-up image.

96. In my opinion, a POSITA would not have understood Iwai to disclose the presentation of images as if they were reflected from a conventional mirror. Nor would a POSITA regard Iwai as disclosing reversing an image of a user nor having that reversed reflection appear at roughly double the distance from the camera nor maintaining roughly the same size regardless of the user movement.

97. In my opinion, a POSITA would know that the camera calibration techniques disclosed in Iwai do not disclose generating a reversed reflection that appears at roughly double the distance from the camera and maintains roughly the same size regardless of the user movement.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Iwai with Respect to Limitation
1(c)**

98. My opinions for Ground 1 are incorporated herein by reference.

99. It is my opinion none of Rosenberg, Nakazawa, or Iwai, alone or in combination, meet limitation 1(c).

100. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Iwai to meet limitation 1(c).

101. In my opinion, a POSITA would recognize that unlike Rosenberg, Nakazawa, and the 109 Patent (which are focused on capturing images of the user

and the viewing experience of the user), Iwai is directed to calibration of a digital camera based on registration between a base image and a picked-up image. Ex.1010, Abstract, 7:11-21, 8:23-34.

102. A POSITA would understand that not only is Iwai not directed providing a mirror-like experience, but also that Iwai's camera calibration and parameter estimation is not comparable to manipulating an image to realistically reflect an image (as if it were in a mirror). In my opinion, Iwai would not suggest to a POSITA that its camera calibration and parameter estimation is relevant to how a user's image would be processed to mimic a mirror.

103. In my opinion, Rosenberg, Nakazawa, and Iwai would not suggest to a POSITA to incorporate the optical property of having a user's image appear at roughly double the distance of the user to the camera. This is because Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double the distance of the user to the camera, Nakazawa does not disclose this optical property at all, and Iwai is neither directed to replicating a mirror experience nor discloses this property at all.

104. [INTENTIONALLY LEFT BLANK]

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Iwai with Respect to
Limitation 1(c)**

105. My opinions for Ground 2 are incorporated herein by reference.

106. It is my opinion none of Rosenberg, Nakazawa, Hatanaka, or Iwai, alone or in combination, meet limitation 1(c).

107. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Iwai to meet limitation 1(c).

108. With respect to limitation 1(c), a POSITA would not be motivated to combine Hatanaka and Iwai because neither reference is directed to attempting to modify a captured image such that it mimics a reflection of a mirror. Hatanaka is directed to encoding and presentation of visual content based on a viewer's distance to a display. *See, e.g.*, Ex.1009, ¶¶ 0009, 0010. Iwai is directed to calibration of a digital camera based on registration between a base image and a picked-up image. Ex.1010, Abstract, 7:11-21, 8:23-34. Therefore, it would not be suggested to a POSITA reading Hatanaka and Iwai to combine these references to meet limitation 1(c).

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, and Iwai with Respect to
Limitation 1(c)**

109. My opinions for Ground 3 are incorporated herein by reference.

110. It is my opinion none of Rosenberg, Nakazawa, Tripathi, or Iwai, alone or in combination, meet limitation 1(c).

111. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Iwai to meet limitation 1(c).

112. With respect to limitation 1(c) a POSITA would not be motivated to combine Tripathi and Iwai because neither reference is directed to attempting to modify a captured image such that it mimics a reflection of a mirror. Tripathi is directed to adjusting display frame rate in response to power status of the device, content type (*e.g.*, dynamic or static), and/or affirmative user input. *See, e.g.*, Ex.1040, at Abstract, 1:60-62, 2:1-3, 6:11-20, 10:40-44. Iwai is directed to calibration of a digital camera based on registration between a base image and a picked-up image. *See, e.g.*, Ex.1010, Abstract, 7:11-21, 8:23-34. Therefore, it would not be suggested to a POSITA reading Tripathi and Iwai to combine these references to meet limitation 1(c) at all.

b. Iwai Does Not Disclose Limitation 1(h)

113. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

114. It is my opinion that Iwai does not disclose limitation 1(h).

115. Iwai does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance to the user as recited by claims of the 109 Patent. A POSITA would regard Iwai’s silence on this property as non-disclosure.

116. Iwai does not identify a problem or question which would require varying the rate of performing the image processing steps. Consequently, it would not have been suggested or otherwise obvious to a POSITA to vary the rate based on distance.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Iwai with Respect to Limitation
1(h)**

117. My opinions for Ground 1 are incorporated herein by reference.

118. It is my opinion none of Rosenberg, Nakazawa, Hatanaka, or Iwai, alone or in combination, meet limitation 1(h).

119. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Iwai to meet limitation 1(h).

120. A POSITA would have recognized that unlike Rosenberg, Nakazawa, and the 109 Patent (which are focused on capturing images of the user and the viewing experience of the user), Iwai is directed to calibration of a digital camera based on registration between a base image and a picked-up image. Ex.1010, Abstract, 7:11-21, 8:23-34.

121. In my opinion, Iwai would not suggest to a POSITA that its camera calibration and parameter estimation is relevant to varying the rate based on distance because Iwai does not disclose varying the rate of performance of any disclosed functionality, let alone based on distance.

122. In my opinion, a POSITA would not have been motivated to combine Rosenberg and Nakazawa with Tripathi as to limitation 1(h) simply because none of the references even suggest the varying required by this limitation. Nor would it have been obvious to a POSITA to include this property, and any suggestion that it would have been obvious is impermissibly based on hindsight.

123. [INTENTIONALLY LEFT BLANK]

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Iwai with Respect to
Limitation 1(h)**

124. My opinions for Ground 2 are incorporated herein by reference.

125. It is my opinion none of Rosenberg, Nakazawa, Hatanaka, or Iwai, alone or in combination, meet limitation 1(h).

126. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, Hatanaka, and Iwai to meet limitation 1(h).

127. With respect to limitation 1(h), a POSITA would not be motivated to combine Hatanaka and Iwai because neither reference disclosing varying the rate of any disclosed functionality. A POSITA would not regard Iwai's camera calibration and parameter estimation as relevant to varying the rate based on distance because Iwai does not disclose varying the rate of performance of any disclosed functionality, let alone based on distance. A POSITA would not regard Hatanaka's changes to encoding based on the viewer's distance to the display as comparable to varying the

rate at which image processing steps are performed on a user's image based on the user's distance.

128. A POSITA would understand that unlike Claim 1 of the 109 Patent, Hatanaka is focused on the distance of the viewer to the display because Hatanaka is concerned with image encoding, throughput efficiency, and display. A POSITA would not regard the distance of the viewer to the display for encoding and throughput efficiency purposes as relevant to varying the rate at which image processing steps are performed on a user's image based on distance. A POSITA would also not be motivated to combine Hatanaka with Iwai for limitation 1(h) because Hatanaka does not disclose or suggest varying the rate of performance of any disclosed functionality.

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, and Iwai with Respect to
Limitation 1(h)**

129. My opinions for Ground 3 are incorporated herein by reference.

130. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Iwai, alone or in combination, meet limitation 1(h).

131. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, Tripathi, and Iwai to meet limitation 1(h).

132. In my opinion, a POSITA would not be motivated to combine Tripathi and Iwai for limitation 1(h) because unlike the 109 Patent, Rosenberg, Nakazawa,

and Iwai, Tripathi is not directed to capturing images. As I opined for Ground 3, a POSITA would also recognize that unlike limitation 1(h), Tripathi's disclosure for varying the frame rate is based on affirmative user inputs. *See, e.g.*, Ex.1040, 10:40-50, Fig. 13, 11:11-24, Fig. 15, 12:54-67. A POSITA would also recognize that Tripathi's variation in frame rate is not based on the distance to a user as recited by limitation 1(h). In my opinion, it would not have been obvious to a POSITA to vary the frame rate absent affirmative user input, let alone to vary it based on distance.

133. It is my opinion that Iwai would not suggest to a POSITA that its camera calibration and parameter estimation is relevant to varying the rate based on distance because Iwai does not disclose varying the rate of performance of any disclosed functionality, let alone based on distance.

134. Therefore, it would not be suggested to a POSITA reading Tripathi and Iwai to combine these references to meet limitation 1(h) at all.

6. Kubota

135. Kubota is directed to providing "a liquid crystal display device capable of optimally setting the backlight control according to the viewing environment and the image display mode." Ex.1011, ¶ 0011; *see also* ¶ 0014.

a. Kubota Does Not Disclose Limitation 1(c)

136. Limitation 1(c) of the 109 Patent requires: “applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror”.

137. It is my opinion that Kubota does not disclose limitation 1(c) under the construction of “it appears to mimic reflection of a mirror” in the District Court Litigation.

138. Kubota is directed to providing “a liquid crystal display device capable of optimally setting the backlight control according to the viewing environment and the image display mode.” Ex.1011, ¶ 0011; *see also id.*, ¶ 0014. Because Kubota is silent as to capturing images at all, let alone images of a user, it is my opinion that a POSITA would not have understood Kubota to disclose either.

139. It is also my opinion that a POSITA would not have understood Kubota to disclose the presentation of images as if they were reflected from a conventional mirror. Once again, because Kubota is silent as to capturing images at all, let alone images of a user, it is my opinion that a POSITA would not have understood Kubota to disclose either. Similarly, a POSITA would not have understood Kubota to disclose other conventional mirror properties including reversing an image of a user nor having that reversed reflection appear at roughly double the distance from the camera nor maintaining roughly the same size regardless of the user movement.

140. [INTENTIONALLY LEFT BLANK]

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Kubota with Respect to
Limitation 1(c)**

141. My opinions for Ground 1 are incorporated herein by reference.

142. It is my opinion that none of Rosenberg, Nakazawa, or Kubota, alone or in combination, meet limitation 1(c).

143. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Kubota to meet limitation 1(c).

144. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Kubota to meet limitation 1(c) of the 109 Patent, because, as I discussed above, a POSITA would not regard any of these references as disclosing this limitation under the claim construction in the District Court Litigation.

145. It is also my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Kubota with respect to limitation 1(c) because unlike the 109 Patent and unlike Rosenberg and Nakazawa, Kubota is not directed to capturing images.

146. A POSITA would not regard Kubota as disclosing reversing such images or displaying them at roughly double the distance from the camera because

Kubota is not directed to capturing a user's image or attempting to mimic a mirror at all.

147. A POSITA would also not have been motivated to combine Rosenberg, Nakazawa, and Kubota to meet limitation 1(c) because a POSITA would have realized that unlike Rosenberg, Nakazawa, and the 109 Patent (which are focused on capturing images of the user and the viewing experience of the user), Kubota is directed to providing “a liquid crystal display device capable of optimally setting the backlight control according to the viewing environment and the image display mode.” Ex.1011, ¶ 0011; *see also id.*, ¶ 0014. A POSITA would understand that the user in Rosenberg, Nakazawa, and the 109 Patent is also the subject of the image and the capturing and manipulation of the user's image is intended to realistically reflect the user's image (as if it were in a mirror). Conversely, a POSITA would understand that Kubota is not directed to capturing images, let alone images of the viewer, and Kubota setting the backlight control according to the viewing environment and the image display mode is not comparable to manipulating a user's image to realistically reflect an image (as if it were in a mirror). It is my opinion that a POSITA would regard Kubota's disclosure of optimally setting the backlight control as accomplishing nothing required by limitation 1(c) and, therefore, Kubota would not suggest to a POSITA to combine it with Rosenberg and Nakazawa to meet limitation 1(c).

148. It is my opinion that a POSITA would not have been motivated to combine these references for limitation 1(c) because Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double the distance of the user to the camera, Nakazawa does not disclose this optical property at all, and Kubota is neither directed to capturing an image of a user nor attempting to replicate a mirror experience nor discloses this optical property at all.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, Kubota With Respect to
Limitation 1(c)**

149. My opinions for Ground 2 are incorporated herein by reference.

150. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Kubota, alone or in combination, meet limitation 1(c).

151. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, Hatanaka, and Kubota to meet limitation 1(c).

152. With respect to limitation 1(c) a POSITA would not be motivated to combine Hatanaka and Kubota because neither reference is directed to attempting to modify a captured image such that it mimics a reflection of a mirror. A POSITA would regard Hatanaka as directed to encoding and presentation of visual content based on a viewer's distance to a display. *See, e.g.,* Ex.1009, ¶¶ 0009, 0010. And a POSITA would regard Kubota as directed to providing "a liquid crystal display device capable of optimally setting the backlight control according to the viewing

environment and the image display mode.” Ex.1011, ¶ 0011; *see also* ¶ 0014. It is therefore my opinion that reading Hatanaka and Kubota would not suggest to a POSITA to combine these references to meet limitation 1(c).

(3) No Motivation to Combine Rosenberg, Nakazawa, Tripathi, and Kubota With Respect to Limitation 1(c)

153. My opinions from Ground 3 are incorporated herein by reference.

154. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Kubota, alone or in combination, meet limitation 1(c).

155. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Kubota to meet limitation 1(c).

156. With respect to limitation 1(c) a POSITA would not be motivated to combine Tripathi and Kubota because neither reference is directed to capturing an image, let alone attempting to modify a captured image such that it mimics a reflection of a mirror. It is my opinion, therefore, that reading Tripathi and Kubota would not suggest to a POSITA to combine these references to meet limitation 1(c).

b. Kubota Does Not Disclose Limitation 1(h)

157. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

158. It is my opinion that Kubota does not disclose limitation 1(h).

159. A POSITA would realize that unlike the 109 Patent (which is directed to replicating a mirror-like experience for the user), Kubota is not directed to capturing images at all, but rather is directed to providing “a liquid crystal display device capable of optimally setting the backlight control according to the viewing environment and the image display mode.” Ex.1011, ¶ 0011; *see also* ¶ 0014. A POSITA would recognize that Kubota does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h) and would regard Kubota’s silence as to this property as non-disclosure. A POSITA would further recognize that Kubota fails to identify a problem or question which would require varying the rate of performing the processing steps.

160. Given that Kubota does not disclose varying the performance of any steps based on distance and given that Kubota fails to identify a problem or question which would require varying the rate of performing the processing steps, it is my opinion that any argument that varying the rate of performance based on distance in Kubota would have been obvious to a POSITA reading Kubota is impermissibly based on hindsight bias.

161. [INTENTIONALLY LEFT BLANK]

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Kubota with Respect to
Limitation 1(h)**

162. My opinions for Ground 1 are incorporated herein by reference.

163. It is my opinion that none of Rosenberg, Nakazawa, or Kubota, alone or in combination, meet limitation 1(h).

164. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Kubota to meet limitation 1(h).

165. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Kubota to meet limitation 1(h) of the 109 Patent, because, as I discussed above, a POSITA would not regard any of these references as disclosing this limitation under the claim construction in the District Court Litigation. It is also my opinion that it would not have been obvious to a POSITA to vary the rate based on distance and any suggestion that it would have been obvious is impermissibly based on hindsight.

166. A POSITA would recognize that unlike the 109 Patent, Rosenberg, and Nakazawa, Kubota is not directed to capturing an image at all. Rather, Kubota is directed to providing “a liquid crystal display device capable of optimally setting the backlight control according to the viewing environment and the image display mode.” Ex.1011, ¶ 0011; *see also* ¶ 0014.

167. I disagree with Petitioners' contention that a POSITA would have been motivated to combine Rosenberg and Kubota because Rosenberg is "concerned with power efficiency." Pet. at 68. The passages from Rosenberg that Petitioners cite to concern a low-power idle mode for when the user is *not* present. *See, e.g.*, Ex.1005, ¶¶ 0025, 0032, 0033, 0069, 0070, 0071, 0072.

[0025] Embodiments of the present invention replace the common household wall mirror with a digital mirror system that provides numerous inventive features and functions. The 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. For example, the integrated digital mirror of the present invention enables users to quickly and easily view not only a mirror image of themselves (i.e., a left-right inverted representation) as is displayed by a traditional mirror, but also a non-inverted image of themselves (i.e. a view similar to that which a third person would see if standing across from the user at the location of the mirror). Also, the integrated digital mirror of the present invention enables users to quickly and easily view not only their frontal image when looking in the digital mirror, but also profile images and rear images. The digital mirror also enables the user to view composite images that include a concurrent display of current and previous reflective images, thereby allowing users to view changes over time in their appearance. The digital mirror further enables users to quickly

and easily adjust zoom-in and zoom-out the reflective image, enabling users to focus in on particular areas of their own reflection. The digital mirror also includes unique hands-free user interface functionality in which simple vocal commands can select and adjust features and functions of the digital mirror. The digital mirror further includes a novel proximity and/or motion sensor for detecting when a user is physically present before and/or approaches and/or stands before the display screen of the mirror within some proximity range and automatically engages the digital mirror functionality of the present invention. The digital mirror also provides for dual-state operation embodiments in which the system displays digitized wall artwork or photographs when not in a mirroring mode and wherein the system automatically enters a mirroring mode when a user steps in front of the display screen for more than a threshold amount of time and/or when the user utters a particular verbal command. The digital mirror also provides for dual-state operation embodiments in which the system automatically enters a power-conservation mode, **sending reduced power to the display screen when a user is not standing before the mirror for more than a threshold amount of time** and wherein the system automatically enters a mirroring mode when a user steps in front of the display screen and/or when the user utters a particular verbal command.

Ex.1005, ¶ 0025.

[0032] Some embodiments of the present invention include one

or more proximity and/or motion sensors for detecting a person located before the display screen. The proximity and/or motion sensors enable a **highly valuable function in which the digital mirror can automatically turn on its display features when a person steps before it.** In this way, the screen **can remain off or in a low-power idle state such that when a person is not standing before the mirror,** the display is not wasting power by continually displaying imagery. This auto-activation feature is generally enabled by the proximity and/or motion sensor sending data to the processor indicating that an object has come within a certain region before the display screen. There are many forms of proximity and/or motion sensors. Many operate using emitter-detector pairs. For example, in one embodiment an infra-red light source emitter emits light, aiming the emission out in front of the digital mirror display screen. An infra-red light detector is also included, detecting the level of intra-red light that is reflected back. The proximity and/or motion sensor generally operates by detecting a threshold level of reflected light and/or a certain change in the reflected light level to determine that a person is standing before the digital mirror screen. Other sensors may employ sensor means, including but not limited to ultrasonic emitters and detectors.

Ex.1005, ¶ 0032.

[0033] In addition to the auto-activation feature described above, some embodiments of the present invention employ an **auto-shut-down feature where the display screen is turned off**

and/or switched to a low power idle mode when it is determined that a user has stepped away from the mirror for more than some threshold amount of time. Because people often move back and forth in front of bathroom mirrors, when, for example, getting dressed and going to and from a closet, the threshold amount of time is generally set long enough so that the digital mirror display screen will not turn itself off and/or enter an idle mode every time the user heads to the closet for a short time. Thus, in some embodiments the threshold amount of time for the auto-shut-down feature may be set to ten minutes. This is a configuration generally set in the software of the present invention. **The processor may determine, based upon data from one or more sensors, that if a user has stepped away from the digital mirror display screen for more than ten minutes, and then the processor turns off the display screen and/or puts the display screen in a low power idle mode.** In some embodiment of the present invention the user can set the threshold time used for the auto-shut-down feature in a configuration mode.

Ex.1005, ¶ 0033.

[0069] As also shown in FIG. 3, some embodiments of the present invention include one or more proximity and/or motion sensors 305 for detecting whether a person (or a similar object) is located before and/or moves before the display screen. The proximity and/or motion sensor enables valuable functions in which hardware and/or software of the digital mirror can

selectively switch between a plurality of states in response to a person standing before and/or stepping before and/or stepping away from the display screen. For example, in one highly valuable feature of the present invention, the sensors 305 are used along with software routines of the present invention to automatically turn on the mirror display 301 and enable a mirroring mode of operation when a person steps before the screen area. In this way, **the screen can remain off or in a low-power idle state such that when a person is not standing before the mirror**, the display 301 is not wasting power by continually displaying mirroring imagery when there is nobody looking in the mirror. Thus a digital mirror in a person's bathroom can be configured only to power (or fully power) the display screen when it is detected that a person is within the bathroom. This auto-activation feature is generally enabled by the proximity and/or motion sensor sending data to the processor indicating that an object has come within a defined region before the display screen and/or motion has been detected before the display screen that meets certain magnitude and timing parameters. There are many forms of proximity and/or motion sensors. Many operate using emitter-detector pairs. For example, in one embodiment an infra-red light source emitter emits light, aiming the emission out in front of the digital mirror display screen. An infra-red light detector is also included, detecting the level of intra-red light that is reflected back. The proximity and/or motion sensor generally operates by detecting a threshold level of reflected light and/or a certain change in the reflected

light level to determine that a person is standing before the digital mirror screen within some defined proximity distance. Other sensors may be used to detect if a person is standing before and/or moves before the display screen area, including but not limited to ultrasonic emitters and detectors, sound detectors, vibration detectors, digital camera, heat detectors, and/or optical detectors.

Ex.1005, ¶ 0069.

[0070] In addition to the auto-activation feature described above, some embodiments of the present invention employ an **auto-shut-down feature wherein the mirroring display screen is turned off or otherwise switched a low power state when it is determined that a user has stepped away from the mirror for more than some threshold amount of time and/or if a period of time has passed wherein sufficient motion was not detected before the screen.** Because people often move back and forth in front of bathroom mirrors, when for example getting dressed and therefore going too and from a closet or dresser, the threshold amount of time is generally set long enough that the digital mirror display screen will not automatically be switched to a low-power state every time the user moves away for a short amount time. Thus, in some embodiments the threshold amount of time for the auto-shut-down feature of the present invention may be set to a sufficient number of minutes, for example ten minutes. This is a configuration generally set in the software of the present invention. The processor of display 301 thus determines, based

upon data from one or more sensors 305, whether or not the user has stepped away for a sufficient duration of time. **If the user has stepped away from the digital mirror display screen for more than ten minutes (i.e., if the sensor data indicates that no person has come before the display's 301 screen for a period of ten minutes and/or whether the sensor has not detected sufficient motion before the display screen for a period of time minutes), the processor then turns off the display screen and/or puts the display screen in a dimmed low power state.** In some embodiment of the present invention the user can set the threshold time used for the auto-shut-down feature in a configuration mode.

Ex.1005, ¶ 0070.

[0071] In some embodiments of the auto-shut down feature, two time thresholds are used in combination to determine when the mirror display should automatically switched to and from a low-power state. An "Away Threshold" is used to determine how long of a time must elapse before it is assumed that a person who had been standing in front of the mirror is now finished using the mirror. A "Use Threshold" is used to determine how long a person must spend in front of the mirror such that the person is determined to be using the mirror and not just passing by it (as a person may often do with respect to a hallway mirror). The Away Threshold may be set to a long period of time, for example, 10 minutes. The Use Threshold may be set to a much shorter period of time, for example, 5 seconds. **Thus the software is**

configured to determine whether a user has stepped up to the mirror with an intent to use it based upon the proximity and/or motion sensor reporting data indicative of user presence that lasts for more than the Use Threshold number of seconds. Similarly, the software is configured to determine whether a user who has been using the mirror has now finished using the mirror based upon the proximity and/or motion sensor data reporting the lack of a user presence for more than the Away Threshold amount of time.

Ex.1005, ¶ 0071.

[0072] Thus if the mirror is in an low-power state and a user is suddenly detected before the mirror, but the user has not been detected for more than the Use Threshold number of seconds, the mirror will remain in the low-power state. In the event that the mirror is in a low-power state and a user has been detected before the mirror for more than the Use Threshold number of seconds, the mirror will automatically transition from the low-power state to an active digital mirroring state. If the mirror is in a digital mirroring state and **proximity or motion sensor reports that the user to no longer in front of the mirror and has not been for a period of time that is longer than the Away Threshold number of minutes, the display screen is automatically switched to the low-power state.** In this way a user may pass quickly before the mirror without inadvertently activating it. Similarly, a user may step away from a mirror during use for a short periods of time without inadvertently deactivating it.

Ex.1005, ¶ 0072.

168. A POSITA would recognize that unlike Rosenberg's power efficiency solution, Kubota's power efficiency solution involves controlling illumination intensity of each backlight cell in an LCD display for when the display device is in use, *e.g.*, "in-store demonstration mode", "power reduction mode", and "high image quality mode". *See, e.g.*, Ex.1011, ¶¶ 0012, 0054.

[0012] In accordance with an aspect of the present invention, there is provided a liquid crystal display device comprising a liquid crystal panel and a backlight which illuminates the liquid crystal panel with light, wherein the liquid crystal panel is segmented into a plurality of areas of pixels by dividing the pixels on the panel into a plurality of pixel groups, and the backlight is formed by a plurality of backlight cells corresponding to the areas, respectively. The liquid crystal display device comprises: an area control section which sets a light control value, as a value for individually controlling illumination intensity of each backlight cell, based on a brightness level of an image signal for the area corresponding to the backlight cell; light control value correcting sections which corrects the light control values set by the area control section; and a controller which controls operations of the area control section and the light control value correcting sections. **The controller controls the illumination by the backlight by switching the operations of the light control value correcting sections according to an image display mode selected by a**

user.

Ex.1011, ¶ 0012.

[0054] Concrete examples of the switching of the control will be explained below. In the **in-store demonstration mode** (a), it is desirable to **maximize the brightness of the display screen** since the illuminance of the surrounding environment is high. Therefore, the power control and the shading control are set to OFF. Incidentally, it is also possible to set the shading control to ON while increasing the backlight power consumption in the in-store demonstration mode. In the **power reduction mode** (b), high priority is given to the **reduction of power consumption**. Therefore, the power control and the shading control are set to ON while setting the black area control to OFF. In this mode, the user is allowed to select the threshold value, etc. of the power control and the shading control (i.e., the amount of electric power saving). In the **high image quality mode** (c), high priority is given to the **image quality such as the brightness and the contrast** of the display screen. Therefore, it is effective to suppress the so-called “black floating” (phenomenon (graying of black) specific to liquid crystal displays) by setting the spatial filter control at HIGH (or MIDDLE) (see the definition of “HIGH” given in the explanation of the step S408 of FIG. 4).

Ex.1011, ¶ 0054.

169. A POSITA would have realized that unlike Kubota, Rosenberg’s solution to power consumption is to reduce power when the user is *not* present by

putting the display in an idle or off mode, and there is no suggestion in Rosenberg that other solutions to power consumption are desirable. Consequently, it is my opinion that a POSITA would not have been motivated to combine these references which have starkly different and complete solutions to power consumption.

170. A POSITA would not have been motivated to combine Rosenberg and Nakazawa with Kubota for limitation 1(h) because Kubota does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h), nor does Kubota identify a problem or question which would require varying the rate of performing the image processing steps.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, Kubota With Respect to
Limitation 1(h)**

171. My opinions for Ground 2 are incorporated herein by reference.

172. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Kubota, alone or in combination, meet limitation 1(h).

173. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, Hatanaka, and Kubota to meet limitation 1(h).

174. With respect to limitation 1(h) a POSITA would not be motivated to combine Hatanaka and Kubota because neither reference is directed to varying the rate of performance of image processing steps according to a user's distance. A

POSITA would recognize that Hatanaka discloses determining the distance between the *viewer* of content and the display in order to adjust the quality of encoding of the content in order to reduce *throughput* for image data processing. Ex.1009, Abstract. ¶ 0012. A POSITA would have understood that Hatanaka's changes to encoding based on the viewer's distance to the display is not comparable to varying the rate at which image processing steps are performed on a user's image based on the user's distance.

175. A POSITA would have also realized that unlike Claim 1 of the 109 Patent, Hatanaka is focused on the distance of the *viewer* to the display because Hatanaka is concerned with image encoding, throughput efficiency, and display. It is my opinion that Hatanaka would not suggest to a POSITA that the distance of the viewer to the display for encoding and throughput efficiency purposes is relevant varying the rate at which image processing steps are performed on a user's image based on distance. A POSITA would recognize that Hatanaka neither discloses nor suggests varying the rate of performance of image processing steps. It is my opinion that any argument that varying the rate of performance based on distance in Kubota would have been obvious to a POSITA reading Kubota is impermissibly based on hindsight bias.

176. A POSITA would understand that Kubota reduces *power consumption of a device* by controlling the illumination intensity of each backlight cell of an LCD

display. *See, e.g.*, Ex.1011, ¶ 0012. A POSITA would have realized that Kubota does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h). A POSITA would regard Kubota's silence as to this property as non-disclosure. A POSITA would also have recognized that Kubota does not identify a problem or question which would require varying the rate of performing the image processing steps. It is my opinion that any argument that varying the rate of performance based on distance in Kubota would have been obvious to a POSITA reading Kubota is impermissibly based on hindsight bias.

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, and Kubota With Respect
to Limitation 1(h)**

177. My opinions from Ground 3 are incorporated herein by reference.

178. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Kubota, alone or in combination, meet limitation 1(h).

179. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Kubota to meet limitation 1(h).

180. With respect to limitation 1(h), it is my opinion that a POSITA would not be motivated to combine Tripathi and Kubota because neither reference is directed to capturing an image let alone varying the rate of performance of image processing steps according to a user's distance. Tripathi is directed to adjusting

display frame rate in response to power status of the device, content type (*e.g.*, dynamic or static), and/or affirmative user input. *See, e.g.*, Ex.1040, at Abstract, 1:60-62, 2:1-3, 6:11-20, 10:40-44. Whereas Kubota is directed to reduction in *power consumption of a device* by controlling the illumination intensity of each backlight cell of an LCD display. *See, e.g.*, Ex.1011, ¶ 0012.

181. A POSITA would recognize that Kubota does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h). A POSITA would regard Kubota's silence as to this property as non-disclosure. It is my opinion that a POSITA would also have recognized that Kubota does not identify a problem or question which would require varying the rate of performing the image processing steps. It is my opinion that any argument that varying the rate of performance based on distance in Kubota would have been obvious to a POSITA reading Kubota is impermissibly based on hindsight bias.

182. In my opinion, a POSITA would have realized that unlike limitation 1(h), Tripathi's disclosure for varying the frame rate is based on affirmative user inputs. *See, e.g.*, Ex.1040, 10:40-50, Fig. 13, 11:11-24, Fig. 15, 12:54-67. Additionally, a POSITA would have recognized that Tripathi's varying the frame rate was not based on distance as required by limitation 1(h). It is my opinion that

any argument that varying the frame rate based on distance in Tripathi would have been obvious to a POSITA reading Tripathi is impermissibly based on hindsight bias.

7. Cho

183. Cho is directed to a digital camera with distortion correction based on a focal length to correct wide-angle or optical distortion with coordinate transform processing using an appropriate coefficient from a coefficient table. *See, e.g.*, Ex.1012, Abstract, ¶¶ 0017, 0059, 0063, 0111-0112.

a. Cho Does Not Disclose Limitation 1(c)

184. Limitation 1(c) of the 109 Patent requires: “applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror”.

185. It is my opinion that Cho does not disclose limitation 1(c) under the construction of “it appears to mimic reflection of a mirror” in the District Court Litigation.

186. A POSITA would regard Cho as not being directed to replicating a mirror-like experience for a user. This is because is no disclosure of mirroring a user’s image, let alone disclosing more advanced mirror mimicking techniques such as ensuring the user’s image appears at roughly double the distance to the camera.

187. In my opinion, a POSITA would recognize that unlike the 109 Patent, which is focused mimicking a conventional mirror, Cho is directed to a digital

camera with distortion correction based on a focal length to correct wide-angle or optical distortion. *See, e.g.*, Ex.1012, Abstract, ¶¶ 0017, 0059, 0063, 0111-0112. A POSITA would not have understood Cho to disclose the presentation of images as if they were reflected from a conventional mirror.

188. A POSITA would also know that these techniques disclosed in Cho, to correct wide-angle or optical distortion, do not disclose generating a reversed reflection that appears at roughly double the distance from the camera and maintains roughly the same size regardless of the user movement.

**(1) No Motivation to Combine Rosenberg,
Nakazawa and Cho with Respect to Limitation
1(c)**

189. My opinions for Ground 1 are incorporated herein by reference.

190. It is my opinion that none of Rosenberg, Nakazawa, or Cho disclose limitation 1(c).

191. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Cho to meet limitation 1(c).

192. A POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Cho to meet limitation 1(c) of the 109 Patent because a POSITA would not regard any of these references as disclosing this limitation under the claim construction in the District Court Litigation.

193. As I discussed above, a POSITA would not have understood Cho to disclose even reversing the image, let alone incorporating other optical properties of a conventional mirror such as having the user's reflection appear at roughly double the distance from the camera and appearing at roughly the same size regardless of user movement. Therefore, a POSITA would not regard Cho as disclosing reversing such images or displaying them at roughly double the distance from the camera or at roughly the same size regardless of user movement.

194. Additionally, a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Cho with respect to limitation 1(c) because a POSITA would have recognized that unlike Rosenberg, Nakazawa, and the 109 Patent (which are focused on capturing images of the user and the viewing experience of the user), Cho is directed to a digital camera with distortion correction based on a focal length to correct wide-angle or optical distortion. *See, e.g.*, Ex.1012, Abstract, ¶¶ 0017, 0059, 0063, 0111-0112. A POSITA would understand that Cho is not directed to providing a mirror-like experience and Cho's distortion correction is not comparable to manipulating an image to realistically reflect an image (as if it were in a mirror).

195. Furthermore, as I discussed above for Ground 11(a), a POSITA would also know that these techniques disclosed in Cho, to correct wide-angle or optical distortion, do not disclose generating a reversed reflection that appears at roughly double the distance from the camera and maintains roughly the same size regardless

of the user movement. It is my opinion that Cho would not suggest to a POSITA that its distortion correction is relevant to how a user's image would be processed to mimic a mirror.

196. Rosenberg, Nakazawa, and Cho would not suggest to a POSITA to incorporate the optical property of having a user's image appear at roughly double the distance of the user to the camera.

197. In my opinion, a POSITA would not have been motivated to combine these references for limitation 1(c) because Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double the distance of the user to the camera, Nakazawa does not disclose this optical property at all, and Cho is neither directed to replicating a mirror experience nor discloses this property at all.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Cho With Respect to
Limitation 1(c)**

198. My opinions for Ground 2 are incorporated herein by reference.

199. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Cho disclose limitation 1(c).

200. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Cho to meet limitation 1(c).

201. With respect to limitation 1(c), in my opinion, a POSITA would not be motivated to combine Hatanaka and Cho for limitation 1(c) because neither reference is directed to attempting to modify a captured image such that it mimics a reflection of a mirror. Therefore, reading Hatanaka and Cho would not suggest to a POSITA to combine these references to meet limitation 1(c).

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, and Cho With Respect to
Limitation 1(c)**

202. My opinions for Ground 3 are incorporated herein by reference.

203. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Cho, alone or in combination, disclose limitation 1(c).

204. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Cho to meet limitation 1(c).

205. With respect to limitation 1(c), a POSITA would not be motivated to combine Tripathi and Cho for limitation 1(c) because Tripathi is not even directed to capturing an image at all, and neither reference discloses attempting to modify a captured image such that it mimics a reflection of a mirror. In my opinion, reading Tripathi and Cho would not suggest to a POSITA to combine these references to meet limitation 1(c).

b. Cho Does Not Disclose Limitation 1(h)

206. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

207. It is my opinion that Cho does not disclose limitation 1(h).

208. It is my opinion that a POSITA would recognize that unlike the 109 Patent (which is directed to replicating a mirror-like experience for the user), Cho is directed to a digital camera with distortion correction based on a focal length to correct wide-angle or optical distortion. *See, e.g.*, Ex.1012, Abstract, ¶¶ 0017, 0059, 0063, 0111-0112.

209. In my opinion, a POSITA would regard Cho as neither disclosing measuring the distance between the object of interest and the cameras nor resizing the images based on that distance as required by limitation 1(h).

210. Cho uses focal length to determine image transformations. [*See, e.g.*, Ex.1012, Abstract, ¶¶ 0059, 0063-0064, 0078, 0081-0082, 0102, 0105, 0111-0113, 0147, Figs. 8, 10-11, 13, 15, 17-19]. A POSITA would know that focal length determines the lens’ field of view – the shorter the focal length the wider the view and the longer the focal length the narrower the view. A POSTIA would also know that Focal length is not the distance of the object to the camera – a distance that is required to be determined by claims of the 109 Patent.

211. A POSITA would recognize that Cho does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h). It is also my opinion that a POSITA would regard Cho's silence on this property to constitute non-disclosure.

212. A POSITA would recognize that Cho does not identify a problem or question which would require varying the rate of performing the image processing processing steps. And a POSITA would also recognize that there is no disclosure in Cho that the processing steps are non-ordered based on the user's/object's distance.

213. Therefore, in my opinion, any argument that it would have been obvious to a POSITA reading Cho to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Cho with Respect to Limitation
1(h)**

214. My opinions for Ground 1 are incorporated herein by reference.

215. It is my opinion that none of Rosenberg, Nakazawa, or Cho, alone or in combination, disclose limitation 1(h).

216. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Cho to meet limitation 1(h).

217. In my opinion, a POSITA would not have been motivated to combine Rosenberg and Nakazawa with Cho for limitation 1(h) because none of these references disclose limitation 1(h) and, even assuming motivation to combine, which there is not, the limitation would not be met.

218. Additionally, it is my opinion that it would not have been obvious to a POSITA to vary the rate based on distance and any suggestion that it would have been obvious is impermissibly based on hindsight.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Cho With Respect to
Limitation 1(h)**

219. My opinions for Ground 2 are incorporated herein by reference.

220. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Cho disclose limitation 1(h).

221. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Cho to meet limitation 1(h).

222. With respect to limitation 1(h), it is my opinion that a POSITA would not be motivated to combine Hatanaka and Cho for limitation 1(h) because neither reference discloses varying the rate of performance of any disclosed functionality.

223. In my opinion, a POSITA would recognize that although Hatanaka determines distance to a viewer of content (*see, e.g.*, Ex.1009, ¶¶0009, 0010), there is no disclosure that the rate at which processing or encoding steps are varied at all,

let alone based on distance. A POSITA would regard Hatanaka's silence as to varying the rate of performing image processing steps as non-disclosure.

224. A POSITA would also realize that neither Hatanaka nor Cho identifies a problem or question which would require varying the rate of performing the image processing steps, let alone based on the user's/object's distance. Reading Hatanaka and Cho would not suggest to a POSITA to combine these references to meet limitation 1(h).

225. In my opinion, any argument that it would have been obvious to a POSITA reading Hatanaka and Cho to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, and Cho With Respect to
Limitation 1(h)**

226. My opinions for Ground 3 are incorporated herein by reference.

227. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Cho, alone or in combination, disclose limitation 1(h).

228. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Cho to meet limitation 1(h).

229. With respect to limitation 1(h), a POSITA would not be motivated to combine Tripathi with Cho for limitation 1(h) because neither identifies a problem or question which would require varying the rate of performing the image processing

steps, let alone based on the user's/object's distance. In my opinion, reading Hatanaka and Cho would not suggest to a POSITA to combine these references to meet limitation 1(h).

230. In my opinion, any argument that it would have been obvious to a POSITA reading Tripathi and Cho to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

8. Park

231. Park is directed to an image capturing apparatus and image capturing method to compensate for 3D distortion which occurs when the user's image is captured while looking down towards a camera, such as a phone camera, based on the determined tilt of the device capturing the image. Ex.1016, ¶¶ 0009, 0010.

a. Park Does Not Disclose Limitation 1(c)

232. Limitation 1(c) of the 109 Patent requires: “applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror”.

233. It is my opinion that Park does not disclose limitation 1(c) under the construction of “it appears to mimic reflection of a mirror” in the District Court Litigation.

234. Park is directed to tilt correction in a mobile device. At most, a POSITA would have understood Park to disclose basic image inversion. A POSITA would

not have understood Park to disclose other optical properties of a conventional mirror. It is my opinion that a POSITA would have regarded Park as only disclosing, at most, basic image inversion and, consequently, a POSITA would not have understood Park to disclose the more difficult technical issue of having the inverted image appear at roughly double the distance of the user to the camera.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Park with Respect to Limitation
1(c)**

235. My opinions for Ground 1 are incorporated herein by reference.

236. It is my opinion that none of Rosenberg, Nakazawa, or Park, alone or in combination, disclose limitation 1(c).

237. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Park to meet limitation 1(c).

238. In my opinion, a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Park to meet limitation 1(c) because a POSITA would not regard any of these references as disclosing this limitation under the claim construction in the District Court Litigation.

239. Additionally, it is also my opinion that a POSITA would not have been motivated to combine Rosenberg and Nakazawa with Park to meet limitation 1(c) because a POSITA would regard Rosenberg as teaching away from having a user's image appear at roughly double the distance of the user to the camera. A POSITA

would regard Nakazawa not to disclose this optical property at all and a POSITA would understand Park to disclose, at most, basic image inversion.

240. It is my opinion that although the optical properties of conventional mirrors have been known for millennia, it is likely that a POSITA reading Rosenberg and Park would not have considered the relative importance of including these optical properties beyond simple inversion. In my opinion, it would not have been suggested to a POSITA reading Rosenberg and Park that it was even worthwhile to have the user's image appear roughly double the distance to the camera or roughly the same size regardless of distance.

241. In my opinion, since Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double the distance of the user to the camera and neither Nakazawa nor Park disclose it at all, this combination of references would not suggest to a POSITA inclusion of this optical property of a conventional mirror.

242. In my opinion, any argument that a POSITA would be motivated to combine Rosenberg (which teaches away from incorporating this property) and Nakazawa (which does not even acknowledge this property) with Park (which does not even acknowledge this property) to meet limitation 1(c) as construed in the District Court Litigation is impermissibly based on hindsight bias.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Park for Limitation
1(c)**

243. My opinions for Ground 2 are incorporated herein by reference.

244. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Park, alone or in combination, disclose limitation 1(c).

245. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Park to meet limitation 1(c).

246. With respect to limitation 1(c), a POSITA would not be motivated to combine Hatanaka with Park for limitation 1(c) because Hatanaka does not disclose even basic image inversion (let alone the more advanced optical properties of the reflected image appearing at roughly double the distance to the camera and roughly double the same size regardless of user movement) and Park only discloses, at most, basic inversion and does not disclose the more advanced optical properties of the reflected image appearing at roughly double the distance to the camera and roughly double the same size regardless of user movement.

247. It is my opinion that, although the optical properties of conventional mirrors have been known for millennia, it is likely that a POSITA reading Park (alone or with Hatanaka) would not have considered the relative *importance* of including these optical properties beyond simple inversion.

248. It is my opinion that it would not have been suggested to a POSITA reading Park (alone or with Hatanaka) that it was even worthwhile to have the user's image appear roughly double the distance to the camera or roughly the same size regardless of distance.

249. It is also my opinion that any argument that a POSITA would be motivated to combine Hatanaka (which does not capture the images displayed by the system) with Park (which does not even acknowledge these optical properties of a conventional mirror) to meet limitation 1(c) as construed in the District Court Litigation is impermissibly based on hindsight bias.

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, Park for Limitation 1(c)**

250. My opinions for Ground 3 are incorporated herein by reference.

251. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Park, alone or in combination, disclose limitation 1(c).

252. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Park to meet limitation 1(c).

253. It is also my opinion that a POSITA would not be motivated to combine Tripathi with Park for limitation 1(c) because Park only discloses, at most, basic inversion and does not disclose the more advanced optical properties of the reflected image appearing at roughly double the distance to the camera and roughly double the same size regardless of user movement.

254. In my opinion, even though the optical properties of conventional mirrors have been known for millennia, it is likely that a POSITA reading Park (alone or with Tripathi) would not have considered the relative importance of including these optical properties beyond simple inversion. It would not have been suggested to a POSITA reading Park (alone or with Tripathi) that it was even worthwhile to have the user's image appear roughly double the distance to the camera or roughly the same size regardless of distance.

255. In my opinion, any argument that a POSITA would be motivated to combine Tripathi (which does not even involve image capture) with Park (which does not even acknowledge these optical properties of a conventional mirror) to meet limitation 1(c) as construed in the District Court Litigation would be impermissibly based on hindsight bias.

b. Park Does Not Disclose Limitation 1(h)

256. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

257. It is my opinion that Park does not disclose limitation 1(h).

258. A POSITA would recognize that Park does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them

according to the distance of the user as required by limitation 1(h). A POSITA would regard Park's silence with regard to this property to constitute non-disclosure.

259. A POSITA would also realize that Park does not identify a problem or question which would require varying the rate of performing the image processing steps.

260. It is my opinion that any argument that it would have been obvious to a POSITA reading Park to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Park with Respect to Limitation
1(c)**

261. My opinions for Ground 1 are incorporated herein by reference.

262. It is my opinion that none of Rosenberg, Nakazawa, or Park, alone or in combination, disclose limitation 1(h).

263. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Park to meet limitation 1(h).

264. It is my opinion that a POSITA would not have been motivated to combine Rosenberg and Nakazawa with Park for limitation 1(h) because none of these references disclose limitation 1(h) and, even assuming motivation to combine, which there is not, the limitation would not be met.

265. It is also my opinion that it would not have been obvious to a POSITA to vary the rate based on distance and any suggestion that it would have been obvious is impermissibly based on hindsight.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Park for Limitation
1(h)**

266. My opinions for Ground 2 are incorporated herein by reference.

267. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Park, alone or in combination, disclose limitation 1(h).

268. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Park to meet limitation 1(h).

269. With respect to limitation 1(h), a POSITA would not be motivated to combine Hatanaka and Park for limitation 1(h) because neither reference discloses varying the rate of performance of any disclosed functionality.

270. In my opinion, a POSITA would recognize that even though Hatanaka determines distance to a viewer of content (*see, e.g.*, Ex.1009, ¶¶0009, 0010), there is no disclosure that the rate at which processing or encoding steps are varied at all, let alone based on distance. A POSITA would regard Hatanaka's silence as to varying the rate of performing image processing steps as non-disclosure.

271. A POSITA would further recognize that neither Hatanaka nor Park identifies a problem or question which would require varying the rate of performing

the image processing steps, let alone based on the user's/object's distance. In my opinion, reading Hatanaka and Park would not suggest to a POSITA to combine these references to meet limitation 1(h).

272. In my opinion, any argument that it would have been obvious to a POSITA reading Hatanaka and Park to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, Park for Limitation 1(h)**

273. My opinions for Ground 3 are incorporated herein by reference.

274. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Park, alone or in combination, disclose limitation 1(h).

275. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Park to meet limitation 1(h).

276. With respect to limitation 1(h), it is my opinion that a POSITA would not be motivated to combine Tripathi and Park for limitation 1(h) because neither Tripathi nor Park discloses limitation 1(h). Unlike limitation 1(h), Tripathi's disclosure for varying the frame rate is based on affirmative user inputs. *See, e.g.,* Ex.1040, 10:40-50, Fig. 13, 11:11-24, Fig. 15, 12:54-67. A POSITA would realize

that this variation in frame rate is not based on the user's/object's distance from the camera as required by limitation 1(h).

During operation of a device such as device 10, the user input may be provided to device 10 (e.g., using input-output components such as buttons, keyboards, or touch-sensor electrodes in the display) that generates a change in display content to be displayed. Examples of user-input that may generate a change in display content include swiping a finger across the display to scroll through text or pinching the display with multiple fingers to zoom into or out of a map or other image. **Illustrative steps that may be used in setting a display frame rate based on detected user input to a device are shown in FIG. 13.**

Ex.1040, 10:40-50.

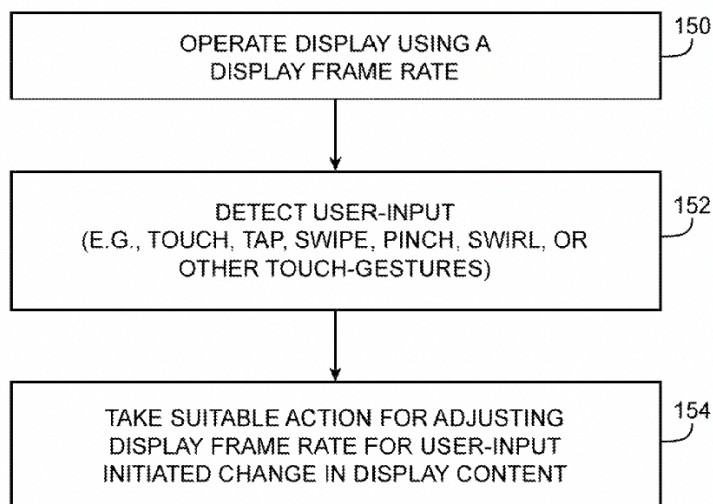


FIG. 13

Ex.1040, Fig. 13 (detecting affirmative user input results in change in frame rate).

As shown in FIG. 15, display 14 may display a page such as page 170 of a virtual book when device 10 is running, for example, an electronic reader software application. A user may use a finger such as finger 162 to swipe touch sensitive components such as touch-sensor electrodes 99 in display 14 as indicated by arrows 164. Swiping touch-sensor electrodes 99 may cause page 170 to be changed on display 14 as indicated by arrow 172 (e.g., portions of page 170 may move across display 14 with a common motion vector). **If desired, the frame rate for display 14 may be set in response to detection of any or all of the common-vector motion display content, user-input signals detected by electrodes 99 and the electronic-reader-specific display content.**

Ex.1040, 11:11-24.

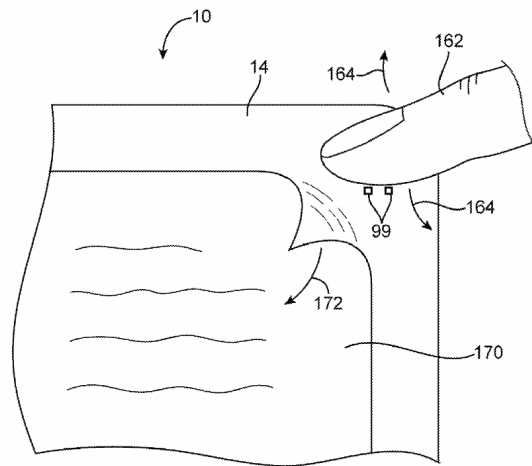


FIG. 15

Ex.1040, Fig. 15 (showing a user affirmatively interacting with the display).

As shown in FIG. 21, **a user prompt** such as prompt 224 may

be displayed on a portion of display 14 to provide a text question to the user of the device **to choose whether or not to enter the frame rate optimization mode**. The user may, as an example, **use touch-sensor electrodes 99 in the display to enter an affirmative response** using virtual button 226 or a negative response using virtual button 228. However, this is merely illustrative. **Any user input component may be used to input a response to prompt 224. In response to an affirmative response**, circuitry such as circuitry 12 of FIG. 1 **may begin actively adjusting (e.g., increasing or decreasing) the frame rate for display 14** in response to monitored operation of the electronic device as described above in connection with FIGS. 1-21.

Ex.1040, 12:54-67.

277. In my opinion, a POSITA would recognize that Park does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h).

278. In my opinion, a POSITA would realize that Park does not identify a problem or question which would require varying the rate of performing the image processing steps. A POSITA would regard Park's silence as to this property to constitute non-disclosure.

279. It is my opinion that any argument that varying the rate at which image processing steps were performed would have been obvious to a POSITA reading Tripathi and Park is impermissibly based on hindsight bias.

280. In my opinion, reading Hatanaka and Park would not suggest to a POSITA to combine these references to meet limitation 1(h).

9. Kuranov

281. Kuranov is directed to constructing a “panorama” by “joining and stitching multiple images or videos taken from different locations or angles and viewpoints.” Ex.1013, ¶ 0005.

a. Kuranov Does Not Disclose Limitation 1(c)

282. Limitation 1(c) of the 109 Patent requires: “applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror”.

283. It is my opinion that Kuranov does not disclose limitation 1(c) under the construction of “it appears to mimic reflection of a mirror” in the District Court Litigation.

284. A POSITA would have recognized that Kuranov does not disclose mirroring a user’s image, let alone disclose more advanced mirror mimicking techniques such as ensuring the user’s image appears at roughly double the distance to the camera.

285. A POSITA would have also recognized that unlike the 109 Patent, which is focused mimicking a conventional mirror, Kuranov is directed to constructing a “panorama” by “joining and stitching multiple images or videos taken from different locations or angles and viewpoints.” Ex.1013, ¶ 0005. A POSITA would not have understood Kuranov to disclose the presentation of images as if they were reflected from a conventional mirror. Additionally, a POSITA would not regard Kuranov as disclosing reversing an image of a user nor having that reversed reflection appear at roughly double the distance from the camera nor maintaining roughly the same size regardless of the user movement.

286. It is also my opinion that regardless of the possible applicability of Kuranov’s disclosure of joining and stitching images to create a panorama in the context of a digital mirror, a POSITA would know that these techniques disclosed in Kuranov do not disclose generating a reversed reflection that appear at roughly double the distance from the camera and maintains roughly the same size regardless of the user movement as required by limitation 1(c) as construed by the District Court Litigation or otherwise.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Kuranov With Respect to
Limitation 1(c)**

287. My opinions for Ground 1 are incorporated herein by reference.

288. It is my opinion that none of Rosenberg, Nakazawa, or Kuranov, alone or in combination, disclose limitation 1(c).

289. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Kuranov to meet limitation 1(c).

290. A POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Kuranov to meet limitation 1(c) of the 109 Patent, because a POSITA would not regard any of these references as disclosing this limitation under the claim construction in the District Court Litigation.

291. In my opinion, because Kuranov is not directed to attempting to mimic a mirror, a POSITA would not regard Kuranov as disclosing reversing such images or displaying them at roughly double the distance from the camera or at roughly the same size regardless of user movement.

292. A POSITA would have recognized that unlike Rosenberg, Nakazawa, and the 109 Patent, which are directed to images of the user – Rosenberg (mirror), Nakazawa (correcting user's image for line of sight distortion), and 109 Patent (mirror) – Kuranov's image stitching and panorama creation is not only not necessarily related to a user's image, but there is nothing in Kuranov to suggest to a POSITA that its image stitching and panorama creation is relevant to how a user's image would be processed to mimic a mirror. It is my opinion that this combination

of references would not suggest to a POSITA to incorporate the optical property of having a user's image appear at roughly double the distance of the user to the camera.

293. A POSITA would not have been motivated to combine these references for limitation 1(c) because Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double the distance of the user to the camera, Nakazawa does not disclose this optical property at all, and Kuranov neither attempts to replicate a mirror experience nor discloses this optical property at all.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Kuranov With
Respect to Limitation 1(c)**

294. My opinions for Ground 2 are incorporated herein by reference.

295. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Kuranov, alone or in combination, disclose limitation 1(c).

296. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Kuranov to meet limitation 1(c).

297. With respect to limitation 1(c), it is my opinion that a POSITA would not be motivated to combine Hatanaka with Kuranov for limitation 1(c) because, unlike the Rosenberg, Nakazawa, Kuranov, or the 109 Patent, Hatanaka is directed to encoding and presentation of visual content based on a viewer's distance to a display. Ex.1009, ¶¶ 0009, 0010. It is also my opinion that a POSITA would

understand that regardless of possible applicability to a digital mirror system, Kuranov's disclosures of image stitching to create a panorama (*see, e.g.*, Ex.1013, ¶ 0005) would not meet the elements of limitation 1(c). In my opinion, reading Hatanaka and Kuranov would not suggest to a POSITA to combine these references to meet limitation 1(c).

(3) No Motivation to Combine of Rosenberg, Nakazawa, Tripathi, and Kuranov With Respect to Limitation 1(c)

298. My opinions for Ground 3 are incorporated herein by reference.

299. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Kuranov, alone or in combination, disclose limitation 1(c).

300. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Kuranov to meet limitation 1(c).

301. A POSITA would not be motivated to combine Tripathi and Kuranov for limitation 1(c) because a POSITA would recognize that unlike the Rosenberg, Nakazawa, Kuranov, or the 109 Patent, Tripathi is not directed to image capture at all but rather directed to adjusting display frame rate in response to power status of the device, content type (*e.g.*, dynamic or static), and/or affirmative user input. *See, e.g.*, Ex.1040, at Abstract, 1:60-62, 2:1-3, 6:11-20, 10:40-44.

302. A POSITA would understand that regardless of possible applicability to a digital mirror system, Kuranov's disclosures of image stitching to create a

panorama (*see, e.g.*, Ex.1013, ¶ 0005) would not meet the elements of limitation 1(c). In my opinion, reading Tripathi and Kuranov would not suggest to a POSITA to combine these references to meet limitation 1(c).

b. Kuranov Does Not Disclose Limitation 1(h)

303. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

304. It is my opinion that Kuranov does not disclose limitation 1(h).

305. A POSITA would realize that Kuranov does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h). A POSITA would regard Kuranov’s silence with regard to this property to constitute non-disclosure.

306. A POSITA would also recognize that Kuranov does not identify a problem or question which would require varying the rate of performing the image processing steps. In my opinion, any argument that it would have been obvious to a POSITA reading Kuranov to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Kuranov With Respect to
Limitation 1(h)**

307. My opinions for Ground 1 are incorporated herein by reference.

308. It is my opinion that none of Rosenberg, Nakazawa, or Kuranov, alone or in combination, disclose limitation 1(h).

309. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Kuranov to meet limitation 1(h).

310. In my opinion, a POSITA would not have been motivated to combine Rosenberg and Nakazawa with Kuranov for limitation 1(h) because none of these references disclose limitation 1(h) and, even assuming motivation to combine, which there is not, the limitation would not be met.

311. It is also my opinion that it would not have been obvious to a POSITA to vary the rate based on distance and any suggestion that it would have been obvious is impermissibly based on hindsight.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Kuranov With
Respect to Limitation 1(h)**

312. My opinions for Ground 2 are incorporated herein by reference.

313. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Kuranov, alone or in combination, disclose limitation 1(h).

314. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Kuranov to meet limitation 1(h).

315. With respect to limitation 1(h), it is my opinion that a POSITA would not be motivated to combine Hatanaka and Kuranov for limitation 1(h) because neither reference discloses varying the rate of performance of any disclosed functionality. A POSITA would realize that even though Hatanaka determines distance to a viewer of content (*see, e.g.*, Ex.1009, ¶¶0009, 0010), there is no disclosure that the rate at which processing or encoding steps occur are varied at all, let alone based on distance. A POSITA would regard Hatanaka's silence as to varying the rate of performing image processing steps as non-disclosure.

316. In my opinion, neither Hatanaka nor Kuranov identifies a problem or question which would require varying the rate of performing the image processing steps, let alone based on the user's/object's distance.

317. It is my opinion that any argument that it would have been obvious to a POSITA reading Hatanaka and Kuranov to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

318. In my opinion, reading Hatanaka and Kuranov would not suggest to a POSITA to combine these references to meet limitation 1(h).

**(3) No Motivation to Combine of Rosenberg,
Nakazawa, Tripathi, and Kuranov With
Respect to Limitation 1(h)**

319. My opinions for Ground 3 are incorporated herein by reference.

320. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Kuranov, alone or in combination, disclose limitation 1(h).

321. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Kuranov to meet limitation 1(h).

322. With respect to limitation 1(h), a POSITA would not be motivated to combine Tripathi and Kuranov for limitation 1(h) because neither Tripathi nor Kuranov discloses limitation 1(h).

323. A POSITA would recognize that unlike limitation 1(h), Tripathi's disclosure for varying the frame rate is based on affirmative user inputs. *See, e.g.*, Ex.1040, 10:40-50, Fig. 13, 11:11-24, Fig. 15, 12:54-67. And it is my opinion that a POSITA would understand that this variation in frame rate is not based on the user's/object's distance from the camera as required by limitation 1(h).

During operation of a device such as device 10, the user input may be provided to device 10 (e.g., using input-output components such as buttons, keyboards, or touch-sensor electrodes in the display) that generates a change in display content to be displayed. Examples of user-input that may generate a change in display content include swiping a finger across the display to scroll through text or pinching the display

with multiple fingers to zoom into or out of a map or other image.

Illustrative steps that may be used in setting a display frame rate based on detected user input to a device are shown in FIG. 13.

Ex.1040, 10:40-50.

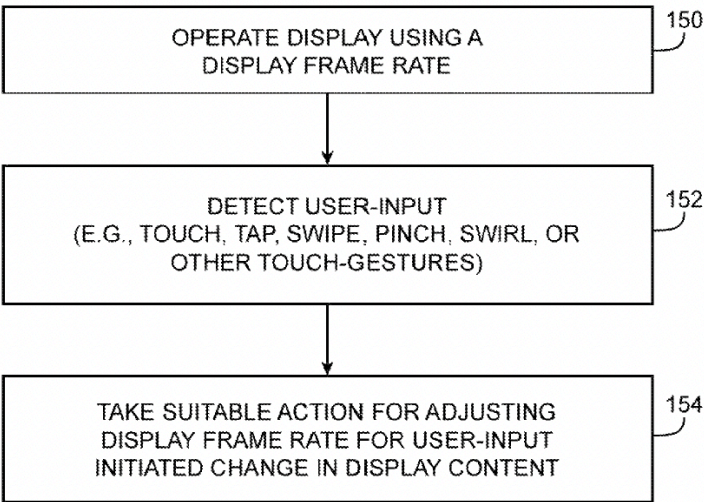


FIG. 13

Ex.1040, Fig. 13 (detecting affirmative user input results in change in frame rate).

As shown in FIG. 15, display 14 may display a page such as page 170 of a virtual book when device 10 is running, for example, an electronic reader software application. A user may use a finger such as finger 162 to swipe touch sensitive components such as touch-sensor electrodes 99 in display 14 as indicated by arrows 164. Swiping touch-sensor electrodes 99 may cause page 170 to be changed on display 14 as indicated by arrow 172 (e.g., portions of page 170 may move across display 14 with a common motion vector). **If desired, the frame rate for display 14 may**

be set in response to detection of any or all of the common-vector motion display content, user-input signals detected by electrodes 99 and the electronic-reader-specific display content.

Ex.1040, 11:11-24.

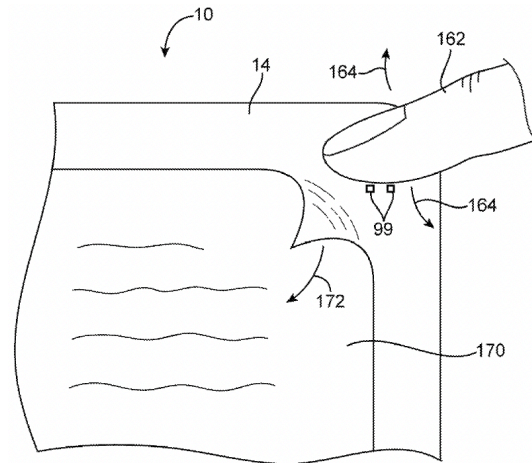


FIG. 15

Ex.1040, Fig. 15 (showing a user affirmatively interacting with the display).

As shown in FIG. 21, a **user prompt** such as prompt 224 may be displayed on a portion of display 14 to provide a text question to the user of the device **to choose whether or not to enter the frame rate optimization mode.** The user may, as an example, **use touch-sensor electrodes 99 in the display to enter an affirmative response** using virtual button 226 or a negative response using virtual button 228. However, this is merely illustrative. **Any user input component may be used to input a response to prompt 224. In response to an affirmative response,** circuitry such as circuitry 12 of FIG. 1 **may begin**

actively adjusting (e.g., increasing or decreasing) the frame rate for display 14 in response to monitored operation of the electronic device as described above in connection with FIGS. 1-21.

Ex.1040, 12:54-67.

324. A POSITA would also recognize that Kuranov does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h).

325. A POSITA would further realize that Kuranov does identify a problem or question which would require varying the rate of performing the image processing steps. A POSITA would regard Kuranov's silence as to this property to constitute non-disclosure.

326. It is my opinion that any argument that varying the rate would have been obvious to a POSITA reading Tripathi and Kuranov is impermissibly based on hindsight bias.

327. In my opinion, reading Tripathi and Kuranov would not suggest to a POSITA to combine these references to meet limitation 1(h).

10. Chang

328. Chang is directed to the use of multiple cameras to create a display system capable of generating 3D images as well as 2D images. Ex.1014, Abstract, ¶¶ 0003, 0013-0015, 0087, 0099.

a. Chang Does Not Disclose Limitation 1(c)

329. Limitation 1(c) of the 109 Patent requires: “applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror”.

330. It is my opinion that Chang does not disclose limitation 1(c) under the construction of “it appears to mimic reflection of a mirror” in the District Court Litigation.

331. A POSITA would not regard Chang as being directed to replicating a mirror-like experience for a user. A POSITA would realize that Chang has no disclosure of mirroring a user’s image, let alone disclose more advanced mirror mimicking techniques such as ensuring the user’s image appears at roughly double the distance to the camera. A POSITA would regard this silence as non-disclosure.

332. In my opinion, a POSITA would recognize that unlike the 109 Patent, which is focused mimicking a conventional mirror, Chang is directed to the use of multiple cameras to create a display system capable of generating 3D images. *See, e.g.,* Ex.1014, Abstract, ¶¶ 0003, 0013-0015, 0087, 0099. A POSITA would not have understood Chang to disclose the presentation of images as if they were reflected from a conventional mirror. In my opinion, a POSITA would not regard Chang as disclosing reversing an image of a user nor having that reversed reflection

appear at roughly double the distance from the camera nor maintaining roughly the same size regardless of the user movement.

333. It is also my opinion that a POSITA would also know that these techniques disclosed in Chang do not disclose generating a reversed reflection that appears at roughly double the distance from the camera and maintains roughly the same size regardless of the user movement.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Chang With Respect to
Limitation 1(c)**

334. My opinions for Ground 1 are incorporated herein by reference.

335. It is my opinion that none of Rosenberg, Nakazawa, or Chang, alone or in combination, disclose limitation 1(c).

336. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Chang to meet limitation 1(c).

337. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Chang for limitations 1(c) because a POSITA would not regard any of these references as disclosing this limitation under the claim construction in the District Court Litigation.

338. A POSITA would not have been motivated to combine these references for limitation 1(c) because Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double the distance of the user

to the camera, Nakazawa does not disclose this optical property at all, and Chang is neither directed to replicating a mirror experience nor discloses this property at all. In my opinion, this combination of references would not suggest to a POSITA to incorporate the optical property of having a user's image appear at roughly double the distance of the user to the camera.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Chang With Respect
to Limitation 1(c)**

339. My opinions for Ground 2 are incorporated herein by reference.

340. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Chang, alone or in combination, disclose limitation 1(c).

341. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Chang to meet limitation 1(c).

342. With respect to limitation 1(c), a POSITA would not be motivated to combine Hatanaka and Chang for limitation 1(c) because neither reference is directed to attempting to modify a captured image such that it mimics a reflection of a mirror. In my opinion, reading Hatanaka and Chang would not suggest to a POSITA to combine these references to meet limitation 1(c).

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, and Chang With Respect
to Limitation 1(c)**

343. My opinions for Ground 3 are incorporated herein by reference.

344. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Chang, alone or in combination, disclose limitation 1(c).

345. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Chang to meet limitation 1(c).

346. With respect to limitation 1(c), a POSITA would not be motivated to combine Tripathi and Chang for limitation 1(c) because Tripathi is not even directed to capturing an image at all and neither reference discloses attempting to modify a captured image such that it mimics a reflection of a mirror. In my opinion, reading Tripathi and Chang would not suggest to a POSITA to combine these references to meet limitation 1(c).

b. Chang Does Not Disclose Limitation 1(h)

347. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

348. It is my opinion that Chang does not disclose limitation 1(h).

349. A POSITA would realize that Chang does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user/object as required by limitation 1(h). A POSITA would regard silence on this property to constitute non-disclosure.

350. A POSITA would also recognize that Chang does not identify a problem or question which would require varying the rate of performing the image processing steps.

351. A POSITA would further understand that Chang also does not disclose measuring the distance between the object of interest and the cameras.

352. In my opinion, any argument that it would have been obvious to a POSITA reading Chang to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Chang With Respect to
Limitation 1(h)**

353. My opinions for Ground 1 are incorporated herein by reference.

354. It is my opinion that none of Rosenberg, Nakazawa, or Chang, alone or in combination, disclose limitation 1(h).

355. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Chang to meet limitation 1(h).

356. It is my opinion that a POSITA would not have been motivated to combine Rosenberg and Nakazawa with Chang for limitation 1(h) because none of these references disclose limitation 1(h) and, even assuming motivation to combine, which there is not, the limitation would not be met.

357. It is also my opinion that it would not have been obvious to a POSITA to vary the rate based on distance and any suggestion that it would have been obvious is impermissibly based on hindsight.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Chang With Respect
to Limitation 1(h)**

358. My opinions for Ground 2 are incorporated herein by reference.

359. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Chang, alone or in combination, disclose limitation 1(h).

360. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Chang to meet limitation 1(h).

361. With respect to limitation 1(h), a POSITA would not be motivated to combine Hatanaka and Chang for limitation 1(h) because neither reference discloses varying the rate of performance of any disclosed functionality. In my opinion, a POSITA would recognize that, even though Hatanaka determines distance to a viewer of content (*see, e.g.*, Ex.1009, ¶¶0009, 0010), there is no disclosure that the rate at which processing or encoding steps are varied at all, let alone based on distance. A POSITA would regard Hatanaka's silence as to varying the rate of performing image processing steps as non-disclosure.

362. In my opinion, a POSITA would recognize that neither Hatanaka nor Chang identifies a problem or question which would require varying the rate of

performing the image processing steps, let alone based on the user's/object's distance.

363. It is also my opinion that any argument that it would have been obvious to a POSITA reading Hatanaka and Chang to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

364. In my opinion, reading Hatanaka and Chang would not suggest to a POSITA to combine these references to meet limitation 1(h).

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, and Chang With Respect
to Limitation 1(h)**

365. My opinions for Ground 3 are incorporated herein by reference.

366. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Chang, alone or in combination, disclose limitation 1(h).

367. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Chang to meet limitation 1(h).

368. With respect to limitation 1(h), a POSITA would not be motivated to combine Tripathi and Chang for limitation 1(h) because neither Tripathi nor Chang discloses limitation 1(h). Unlike limitation 1(h), Tripathi's disclosure for varying the frame rate is based on affirmative user inputs. *See, e.g.,* Ex.1040, 10:40-50, Fig. 13, 11:11-24, Fig. 15, 12:54-67. A POSITA would recognize that this variation in frame

rate is not based on the user's/object's distance from the camera as required by limitation 1(h).

During operation of a device such as device 10, the user input may be provided to device 10 (e.g., using input-output components such as buttons, keyboards, or touch-sensor electrodes in the display) that generates a change in display content to be displayed. Examples of user-input that may generate a change in display content include swiping a finger across the display to scroll through text or pinching the display with multiple fingers to zoom into or out of a map or other image. **Illustrative steps that may be used in setting a display frame rate based on detected user input to a device are shown in FIG. 13.**

Ex.1040, 10:40-50.

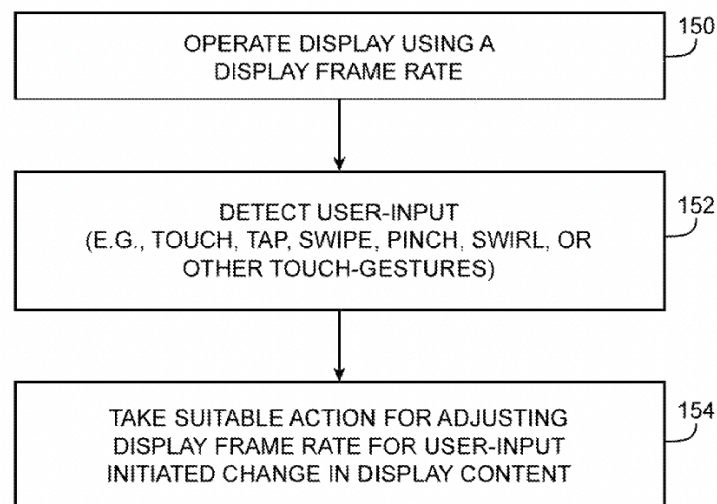


FIG. 13

Ex.1040, Fig. 13 (detecting affirmative user input results in change in frame rate).

As shown in FIG. 15, display 14 may display a page such as page 170 of a virtual book when device 10 is running, for example, an electronic reader software application. A user may use a finger such as finger 162 to swipe touch sensitive components such as touch-sensor electrodes 99 in display 14 as indicated by arrows 164. Swiping touch-sensor electrodes 99 may cause page 170 to be changed on display 14 as indicated by arrow 172 (e.g., portions of page 170 may move across display 14 with a common motion vector). **If desired, the frame rate for display 14 may be set in response to detection of any or all of the common-vector motion display content, user-input signals detected by electrodes 99 and the electronic-reader-specific display content.**

Ex.1040, 11:11-24.

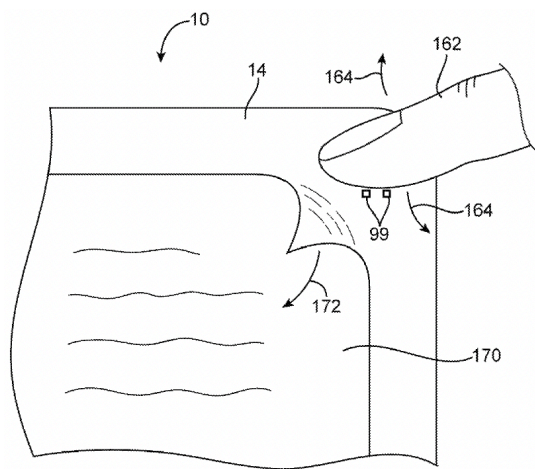


FIG. 15

Ex.1040, Fig. 15 (showing a user affirmatively interacting with the display).

As shown in FIG. 21, **a user prompt** such as prompt 224 may

be displayed on a portion of display 14 to provide a text question to the user of the device **to choose whether or not to enter the frame rate optimization mode**. The user may, as an example, **use touch-sensor electrodes 99 in the display to enter an affirmative response** using virtual button 226 or a negative response using virtual button 228. However, this is merely illustrative. **Any user input component may be used to input a response to prompt 224. In response to an affirmative response**, circuitry such as circuitry 12 of FIG. 1 **may begin actively adjusting (e.g., increasing or decreasing) the frame rate for display 14** in response to monitored operation of the electronic device as described above in connection with FIGS. 1-21.

Ex.1040, 12:54-67.

369. In my opinion, a POSITA would realize that Chang does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h).

370. A POSITA would also recognize that Chang does not identify a problem or question which would require varying the rate of performing the image processing steps. In my opinion, a POSITA would regard Chang's silence as to this property to constitute nondisclosure.

371. It is my opinion that any argument that varying the rate would have been obvious to a POSITA reading Tripathi and Chang is impermissibly based on hindsight bias.

372. It is also my opinion that reading Tripathi and Chang would not suggest to a POSITA to combine these references to meet limitation 1(h).

11. Lizee

373. Lizee is directed to a virtual presence system. Ex.1017 Abstract. Lizee discloses an image capture device to capture a user's image "from which a virtual representation of the user may be generated and displayed" "by applying a mirrored silhouette transformation to the user image" Ex.1017, Abstract, ¶¶ 0012, 0014.

a. Lizee Does Not Disclose Limitation 1(c)

374. Limitation 1(c) of the 109 Patent requires: "applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror".

375. It is my opinion that Lizee does not disclose limitation 1(c) under the construction of "it appears to mimic reflection of a mirror" in the District Court Litigation.

376. A POSITA would understand that unlike the 109 Patent, Lizee does not use the actual image of the user, but rather uses the user's silhouette: "it would be harder to respect the artistic direction of the virtual environment 22 if an actual image

was used to overlay the virtual environment graphics.” Ex.1017, ¶ 0073. A POSITA would also find Lizee’s additional statement that unlike a “true image overlay[]” which “may be intimidating for some users” using silhouettes “provides a less threatening experience accessible to all”. Ex.1017, ¶ 0073. In my opinion, a POSITA would regard this disclosure as teaching away from use of a user’s actual image at all, let alone to provide a “reversed reflection” as required by the construction of “mirror tracking mode” in the District Court Litigation.

Also, the use of a silhouette image 20 provides for the easy harmonization of the projected image 26 in a stylized virtual environment 22. For instance, **it would be harder** to respect the artistic direction of the virtual environment 22 **if an actual image was used** to overlay the virtual environment graphics. Furthermore, **while true image overlays may be intimidating for some users, the use of silhouettes, while still providing an adequate identification of the user** on the screen 18, provides a **less threatening experience** accessible to all.

Ex.1017, ¶ 0073.

377. It is also my opinion that a POSITA would recognize that unlike the 109 Patent which seeks to replicate what a person would see in a conventional mirror, Lizee does not seek to replicate a user’s appearance as would be seen in a conventional mirror. Lizee’s disclosure in paragraph 73 of using a silhouette of the user rather than the user’s actual image, not only because a silhouette is less

threatening but also because the silhouette is only used to provide “an adequate identification of the user on the screen,” would reinforce the point to a POSITA that, unlike the 109 Patent, Lizee is not directed to replicating a user’s image as it would be seen in a conventional mirror.

378. In my opinion, a POSITA would regard Lizee as teaching away from simulating a mirror. A POSITA understands Lizee to teach away from mimicking a conventional mirror based on Lizee’s disclosure that conventional virtual gaming systems provide a “mirror representation” of the user that “feels unnatural and requires significant adaptation from the player”. Ex.1017, ¶ 0008. A POSITA would regard Lizee as teaching away from a conventional mirror because Lizee states that “when the virtual camera used to generate the display is behind the controlled character” – an avatar in a virtual environment – it “is more intuitive to the player”. Ex.1017, ¶ 0009.

[0008] In addition, the **Sony application** discloses the use of a mirror captured image to create a representation of the player in the game. As a result, **the player sees a mirror representation of him/herself that feels unnatural and requires significant adaptation** from the player since the character on screen and the player share a same left and right side but not a same orientation. Ultimately, the character on the screen is looking at the player, like in a mirror, but not where the player is looking.

Ex.1017, ¶ 0008.

[0009] As it is known in the art, the player controlled **character** in a third-person 3D game (or an avatar in a virtual environment) is **more intuitive to the player when the virtual camera used to generate the display is behind the controlled character** because the controlled character and the player perception of the display share the same direction, i.e. left is left, right is right, forward is forward and backward is backward, both on screen and using the controls. Yet, since conventional capture systems involve a front facing capture camera, conventional techniques using captured images from these systems can't be implemented without first simulating the skeleton of the controlled character, as with the Antigrav game published by Sony on the EyeToy.

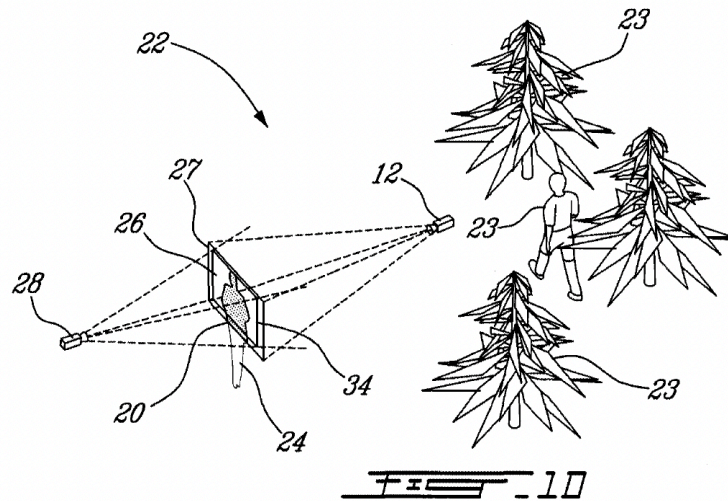
Ex.1017, ¶ 0009.

379. A POSITA would regard Lizée as teaching away from a conventional mirror because in Lizée's invention, "the projected image 26 is viewed by a virtual camera 28 positioned *behind* the silhouette model 24 and providing a *rear view* thereof". Ex.1017, ¶ 0039; *see also id.* ¶¶ 0071, 0072, 0083. This is contrary to how users view themselves in conventional mirrors.

[0039] With reference now to Figure 1D, the silhouette model 24, possibly representing a virtual character in a video game or a video entertainment system, is conceptually defined by the projection 26 of the silhouette image 20 (Figure 1 B) on a virtual panel 27 in the virtual environment 22, the back of the silhouette

model 24 referring to the side on which the silhouette image 20 is projected. Figuratively, **the projected image 26 is viewed by a virtual camera 28 positioned behind the silhouette model 24 and providing a rear view thereof** such that the user and the silhouette model 24 share a substantially same orientation.

Ex.1017, ¶ 0039.



Ex.1017, Fig. 1D.

[0071] The system 10 thus **provides the user with the illusion that his/her silhouette has been captured from behind** and projected inside the virtual environment 22 and, through this silhouette image 20, he/she can interact in the virtual environment 22 in a natural way. Namely, since the user and the user's visual representation, illustratively provided by the user's silhouette model 24, share a same general orientation, the user is provided with a better sense of direction and can thus better interact within the virtual environment 22. **This provides a very intuitive control of the virtual silhouette 24** as the user is

provided with the illusion that his/her shadow is cast on the display screen 18 and can directly interact in the virtual environment 22.

Ex.1017, ¶ 0071.

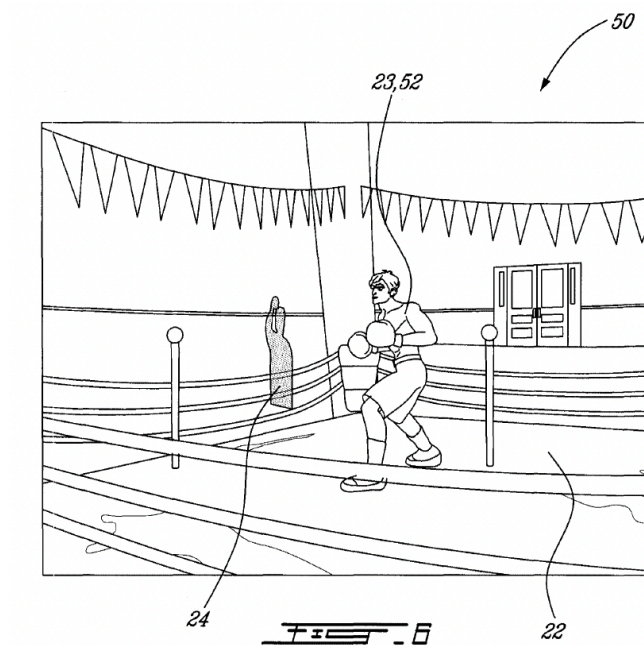
[0072] In addition, the system 10 **provides the user silhouette, as it would be observed from behind, while capturing the image for the generation thereof from the front of the user.** This permits the system 10 to be installed conventionally, such that the user faces both the display 16 and the video capture device 12. Moreover, by positioning the image capture device 12 in front of the user, a frontal image of the user is obtained that provides greater visual cues usable in the implementation of the system 10, such as the position of the hands of the user and any object carried thereby. As will be apparent to a person of ordinary skill in the art, various visual cues such as tags, interactive pointers and the like may be used to enhance the visualization effect and facilitate interaction within the virtual environment 22.

Ex.1017, ¶ 0072.

[0083] Yet, though the player interacts with the game in a 3D environment, the projected image 26 remains as a 2D representation of the user. As seen in Figure 6, which provides an exemplary screen display of the same setting as Figure 5 but from the vantage point of an additional virtual camera, the **virtual camera projecting the silhouette image 20 remains behind the virtual user** and need only project a 2D image

thereof. When the player and the silhouette model 24 share a same orientation, the illusion of 3D virtual presence is obtained nonetheless, avoiding the heavy implementation of a full 3D virtual image.

Ex.1017, ¶ 0083.



Ex.1017, Fig. 6.

380. In my opinion it is irrelevant that the silhouette representation of the user disclosed in Lizée is captured from the front (Ex.1017, ¶ 0072) and inverted (*id.*, ¶ 0034) because the user is not seeing their “reversed reflection” as though it were in a conventional mirror. *See also* Ex.1017, ¶¶ 0039, 0071, 0083. Even the benefits of having a frontal capture of the user that Lizée discloses is all about positioning of appendages, not rendering an image that a user would see in a

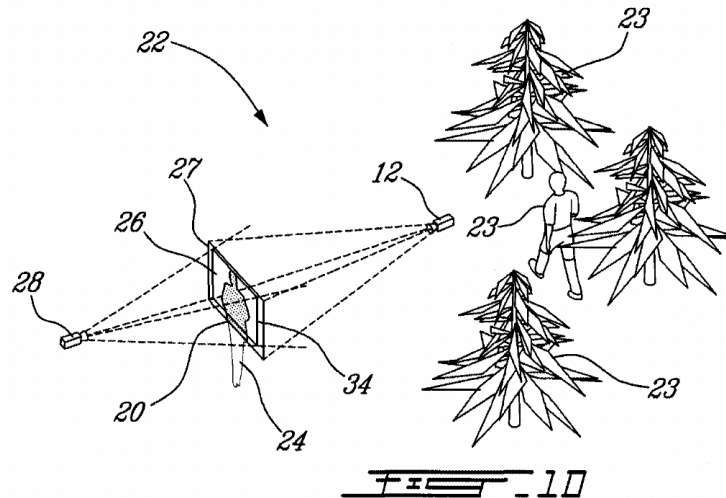
conventional mirror. *See, e.g.,* Ex.1017, ¶ 0072 (“Moreover, by positioning the image capture device 12 in front of the user, a frontal image of the user is obtained that provides greater visual cues usable in the implementation of the system 10, such as the position of the hands of the user and any object carried thereby”).

[0034] With particular reference now to Figures 1 C and 1 D, 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 1 B) for display on the screen 18 (Figure 1C).**

Ex.1017, ¶ 0034.

[0039] With reference now to Figure 1 D, the silhouette model 24, possibly representing a virtual character in a video game or a video entertainment system, is conceptually defined by the projection 26 of the silhouette image 20 (Figure 1 B) on a virtual panel 27 in the virtual environment 22, the back of the silhouette model 24 referring to the side on which the silhouette image 20 is projected. Figuratively, **the projected image 26 is viewed by a virtual camera 28 positioned behind the silhouette model 24 and providing a rear view thereof** such that the user and the silhouette model 24 share a substantially same orientation.

Ex.1017, ¶ 0039.



Ex.1017, Fig. 1D.

[0071] The system 10 thus **provides the user with the illusion that his/her silhouette has been captured from behind** and projected inside the virtual environment 22 and, through this silhouette image 20, he/she can interact in the virtual environment 22 in a natural way. Namely, since the user and the user's visual representation, illustratively provided by the user's silhouette model 24, share a same general orientation, the user is provided with a better sense of direction and can thus better interact within the virtual environment 22. **This provides a very intuitive control of the virtual silhouette 24** as the user is provided with the illusion that his/her shadow is cast on the display screen 18 and can directly interact in the virtual environment 22.

Ex.1017, ¶ 0071.

[0072] In addition, the system 10 **provides the user silhouette, as it would be observed from behind, while capturing the**

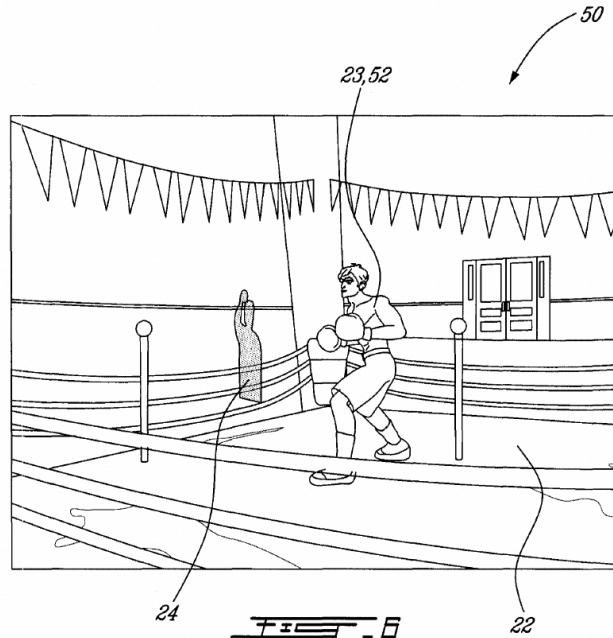
image for the generation thereof from the front of the user.

This permits the system 10 to be installed conventionally, such that the user faces both the display 16 and the video capture device 12. Moreover, by positioning the image capture device 12 in front of the user, a frontal image of the user is obtained that provides greater visual cues usable in the implementation of the system 10, such as the position of the hands of the user and any object carried thereby. As will be apparent to a person of ordinary skill in the art, various visual cues such as tags, interactive pointers and the like may be used to enhance the visualization effect and facilitate interaction within the virtual environment 22.

Ex.1017, ¶ 0072.

[0083] Yet, though the player interacts with the game in a 3D environment, the projected image 26 remains as a 2D representation of the user. As seen in Figure 6, which provides an exemplary screen display of the same setting as Figure 5 but from the vantage point of an additional virtual camera, the **virtual camera projecting the silhouette image 20 remains behind the virtual user** and need only project a 2D image thereof. When the player and the silhouette model 24 share a same orientation, the illusion of 3D virtual presence is obtained nonetheless, avoiding the heavy implementation of a full 3D virtual image.

Ex.1017, ¶ 0083.



Ex.1017, Fig. 6.

381. A POSITA would have also recognized that Lizee makes no disclosure that the user’s virtual representation appears at “roughly double the distance from the camera” as required by limitation 1(f) as construed in the District Court Litigation. A POSITA would regard Lizee’s silence as to this optical property of a conventional mirror as a lack of disclosure.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Lizee With Respect to
Limitation 1(c)**

382. My opinions for Ground 1 are incorporated herein by reference.

383. It is my opinion that none of Rosenberg, Nakazawa, of Lizee, alone or in combination, disclose limitation 1(c).

384. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Lizee to meet limitation 1(c).

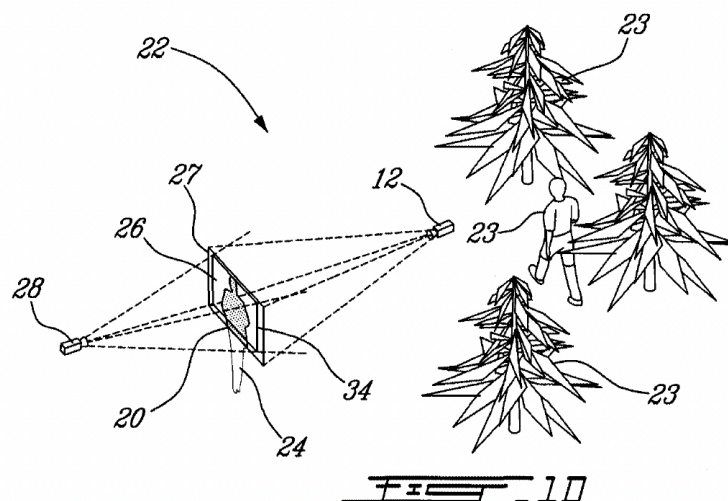
385. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Lizee to meet limitation 1(c) of the 109 Patent because a POSITA would not regard any of these references as disclosing this limitation under the claim construction in the District Court Litigation.

386. In my opinion, a POSITA would not have been motivated to combine Rosenberg with Lizee to meet limitation 1(c) because a POSITA would have realized that unlike the 109 Patent and Rosenberg which are directed to digital mirror systems, Lizee teaches away from simulating a mirror. As I discussed above for Ground 23(a), Lizee states that conventional virtual gaming systems provide a “mirror representation” of the user that “feels unnatural and requires significant adaptation from the player”. Ex.1017, ¶ 0008.

387. It is also my opinion that a POSITA would not have been motivated to combine Rosenberg and Nakazawa with Lizee to meet limitation 1(c) because unlike Rosenberg (mirror) and Nakazawa (correcting the line of sight of a user’s captured image), Lizee does not position its camera to capture a user’s face at all. A POSITA would have understood that in Lizee’s invention, the virtual camera is positioned behind the silhouette model and provides a rear view of that model. Ex.1017, ¶ 0039; *see also, id.*, ¶¶ 0071-0072, 0083.

[0039] With reference now to Figure 1 D, the silhouette model 24, possibly representing a virtual character in a video game or a video entertainment system, is conceptually defined by the projection 26 of the silhouette image 20 (Figure 1 B) on a virtual panel 27 in the virtual environment 22, the back of the silhouette model 24 referring to the side on which the silhouette image 20 is projected. Figuratively, **the projected image 26 is viewed by a virtual camera 28 positioned behind the silhouette model 24 and providing a rear view thereof** such that the user and the silhouette model 24 share a substantially same orientation.

Ex.1017, ¶ 0039.



Ex.1017, Fig. 1D.

[0071] The system 10 thus **provides the user with the illusion that his/her silhouette has been captured from behind** and projected inside the virtual environment 22 and, through this silhouette image 20, he/she can interact in the virtual environment 22 in a natural way. Namely, since the user and the

user's visual representation, illustratively provided by the user's silhouette model 24, share a same general orientation, the user is provided with a better sense of direction and can thus better interact within the virtual environment 22. **This provides a very intuitive control of the virtual silhouette 24** as the user is provided with the illusion that his/her shadow is cast on the display screen 18 and can directly interact in the virtual environment 22.

Ex.1017, ¶ 0071.

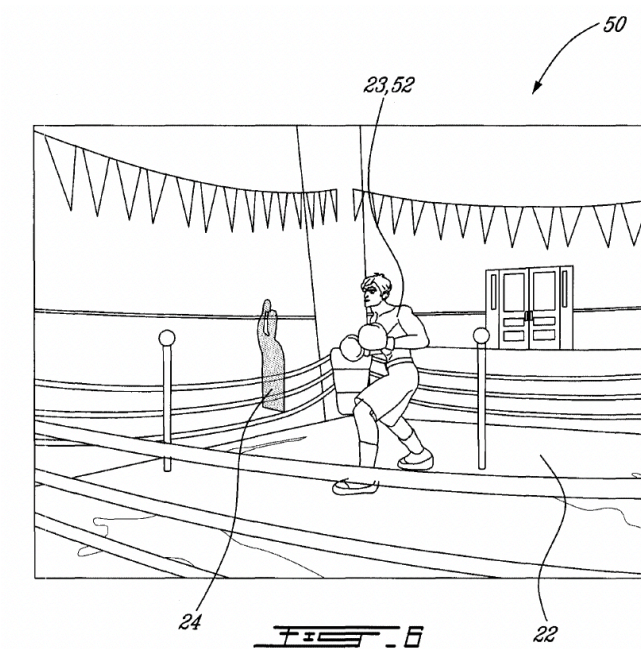
[0072] In addition, the system 10 **provides the user silhouette, as it would be observed from behind, while capturing the image for the generation thereof from the front of the user.** This permits the system 10 to be installed conventionally, such that the user faces both the display 16 and the video capture device 12. Moreover, by positioning the image capture device 12 in front of the user, a frontal image of the user is obtained that provides greater visual cues usable in the implementation of the system 10, such as the position of the hands of the user and any object carried thereby. As will be apparent to a person of ordinary skill in the art, various visual cues such as tags, interactive pointers and the like may be used to enhance the visualization effect and facilitate interaction within the virtual environment 22.

Ex.1017, ¶ 0072.

[0083] Yet, though the player interacts with the game in a 3D environment, the projected image 26 remains as a 2D

representation of the user. As seen in Figure 6, which provides an exemplary screen display of the same setting as Figure 5 but from the vantage point of an additional virtual camera, the **virtual camera projecting the silhouette image 20 remains behind the virtual user** and need only project a 2D image thereof. When the player and the silhouette model 24 share a same orientation, the illusion of 3D virtual presence is obtained nonetheless, avoiding the heavy implementation of a full 3D virtual image.

Ex.1017, ¶ 0083.



Ex.1017, Fig. 6.

388. In my opinion a POSITA would not have been motivated to combine Rosenberg and Nakazawa with Lizee for limitation 1(c) because, unlike Rosenberg (mirror) and Nakazawa (correcting user's image for line of sight distortion), Lizee

is not directed to generating images that correspond to a user's real-life appearance. Rather, Lizee is directed to rendering an avatar of the user in a virtual environment. Ex.1017, Abstract. ¶¶ 0012, 0013, 0029, 0088, Fig. 7. A POSITA would have recognized that unlike Rosenberg and Nakazawa and the 109 Patent, a POSITA would regard Lizee as explicitly teaching away from using the user's actual appearance even to create the avatar. Ex.1017, ¶ 0073.

Also, the use of a silhouette image 20 provides for the easy harmonization of the projected image 26 in a stylized virtual environment 22. For instance, **it would be harder** to respect the artistic direction of the virtual environment 22 **if an actual image was used** to overlay the virtual environment graphics. Furthermore, **while true image overlays may be intimidating for some users, the use of silhouettes, while still providing an adequate identification of the user** on the screen 18, provides a **less threatening experience** accessible to all.

Ex.1017, ¶ 0073.

389. It is also my opinion that a POSITA would not be motivated to combine Lizee with Rosenberg and Nakazawa for limitation 1(c) not only because of this teaching away, but also because a POSITA would understand that the rendering of a user avatar in a virtual environment would not be the same as rendering a user's image to appear as if it were in a conventional mirror; it would be substantially different. A POSITA would understand that an avatar of a user does not appear as

the user does in the mirror, an avatar is a caricature of the user, it is not a mirror reflection of the user's real-life appearance. A POSITA would know that the skills and techniques used to create the virtual avatar in Lizee would be substantially different from those needed to render a user's image as it would be reflected in a conventional mirror as in the 109 Patent.

390. It is my opinion that a POSITA would not have been motivated to combine these references for limitation 1(c) because Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double the distance of the user to the camera, Nakazawa does not disclose this optical property at all, and Lizee is neither directed to generating a real-life appearance of the user nor discloses the optical property of a conventional mirror "in which the user sees their reversed reflection appearing at roughly double the distance from the camera" and in fact, teaches away from using a "mirror representation".

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Lizee With Respect
to Limitation 1(c)**

391. My opinions for Ground 2 are incorporated herein by reference.

392. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Lizee, alone or in combination, disclose limitation 1(c).

393. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Lizee to meet limitation 1(c).

394. With respect to limitation 1(c), it is my opinion that a POSITA would not be motivated to combine Hatanaka and Lizee for limitation 1(c) because neither reference is directed to attempting to modify a captured image such that it mimics a reflection of a mirror.

395. As I discussed above for Ground 23, Lizee teaches away from a mirror representation of a user, is not directed to generating a real-life image of the user but rather is directed to generating an avatar of a user to be placed in a virtual environment, teaches away from even using a user's actual image to generate the avatar, and teaches away from using a mirror representation of the user and even places the virtual camera *behind* the user such that the user's forward facing appearance cannot be seen.

396. A POSITA would not be motivated to combine Hatanaka with Lizee for limitation 1(c) not only because of Lizee's teaching away on actual image, mirrored representation, and camera positioning to capture a user's face, but also because a POSITA would understand that the rendering of a user avatar in a virtual environment would not be the same as rendering a user's image to appear as if it were in a conventional mirror; it would be substantially different.

397. A POSITA would understand that an avatar of a user does not appear as the user does in the mirror; an avatar is a caricature of the user, it is not a mirror reflection of the user's real-life appearance. A POSITA would further understand

that the skills and techniques used to create the virtual avatar in Lizee would be substantially different from those needed to render a user's image as it would be reflected in a conventional mirror as in the 109 Patent and, in any event, would not meet the elements of limitation 1(c).

398. In my opinion, reading Hatanaka and Lizee would not suggest to a POSITA to combine these references to meet limitation 1(c).

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, and Lizee With Respect to
Limitation 1(c)**

399. My opinions for Ground 3 are incorporated herein by reference.

400. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Lizee, alone or in combination, disclose limitation 1(c).

401. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Lizee to meet limitation 1(c).

402. With respect to limitation 1(c), a POSITA would not be motivated to combine Tripathi and Lizee for limitation 1(c) because neither reference is directed to attempting to modify a captured image such that it mimics a reflection of a mirror. A POSITA would realize that Tripathi is not even directed to capturing an image at all.

403. It is my opinion that a POSITA would also not be motivated to combine Tripathi and Lizee for limitation 1(c) because neither reference is directed to

attempting to modify a captured image such that it mimics a reflection of a mirror. As I discussed above for Ground 23, Lizee teaches away from a mirror representation of a user, is not directed to generating a real-life image of the user but rather is directed to generating an avatar of a user to be placed in a virtual environment, teaches away from even using a user's actual image to generate the avatar, and teaches away from using a mirror representation of the user and even places the virtual camera *behind* the user such that the user's forward facing appearance cannot be seen.

404. A POSITA would not be motivated to combine Tripathi with Lizee for limitation 1(c) not only because of Lizee's teaching away on actual image, mirrored representation, and camera positioning to capture a user's face, but also because a POSITA would understand that the rendering of a user avatar in a virtual environment would not be the same as rendering a user's image to appear as if it were in a conventional mirror; it would be substantially different.

405. A POSITA would know that an avatar is a caricature of the user, it is not a mirror reflection of the user's real-life appearance. A POSITA would also know that the skills and techniques used to create the virtual avatar in Lizee would be substantially different from those needed to render a user's image as it would be reflected in a conventional mirror as in the 109 Patent and, in any event, would not meet the elements of limitation 1(c).

406. In my opinion, reading Tripathi and Lizee would not suggest to a POSITA to combine these references to meet limitation 1(c).

b. Lizee Does Not Disclose Limitation 1(h)

407. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

408. It is my opinion that Lizee does not disclose limitation 1(h).

409. A POSITA would realize that Lizee does not disclose varying the frame rate or rate of performing the processing steps at all, let alone varying them according to the distance of the user as required by limitation 1(h). A POSITA would recognize that instead, Lizee discloses using a “predetermined imaging rate”. Ex.1017, ¶ 0045. A POSITA would understand Lizee’s “predetermined imaging rate” to teach away from a variable rate, let alone a variable rate based on a user’s distance.

[0045] 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.

Ex.1017, ¶ 0045.

410. It is also my opinion that a POSITA would realize that Lizee does not identify a problem or question which would require varying the rate of performing the image processing steps.

**(1) No Motivation to Combine Rosenberg,
Nakazawa, and Lizee With Respect to
Limitation 1(h)**

411. My opinions for Ground 1 are incorporated herein by reference.

412. It is my opinion that none of Rosenberg, Nakazawa, of Lizee, alone or in combination, disclose limitation 1(h).

413. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, and Lizee to meet limitation 1(h).

414. In my opinion, a POSITA would not have been motivated to combine Rosenberg and Nakazawa with Lizee for limitation 1(h) because neither of these references disclose limitation 1(h), and, even assuming motivation to combine, which there is not, the limitation would not be met.

415. It is also my opinion that it would not have been obvious to a POSITA to vary the rate based on distance and any suggestion that it would have been obvious is impermissibly based on hindsight.

416. As I discussed above for Ground 23(c), a POSITA would have understood Lizee's "predetermined imaging rate" to teach away from a variable rate, let alone a variable rate based on a user's distance.

[0045] 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.

Ex.1017, ¶ 0045.

**(2) No Motivation to Combine Rosenberg,
Nakazawa, Hatanaka, and Lizée With Respect
to Limitation 1(h)**

417. My opinions for Ground 2 are incorporated herein by reference.

418. It is my opinion that none of Rosenberg, Nakazawa, Hatanaka, or Lizée, alone or in combination, disclose limitation 1(h).

419. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Hatanaka, and Lizée to meet limitation 1(h).

420. With respect to limitation 1(h), it is my opinion that a POSITA would not be motivated to combine Hatanaka and Lizée for limitation 1(h) because neither reference discloses varying the rate of performance of any disclosed functionality. A POSITA would recognize that even though Hatanaka determines distance to a viewer of content (*see, e.g.,* Ex.1009, ¶¶0009, 0010), there is no disclosure that the rate at which processing or encoding steps are varied at all, let alone based on

distance. A POSITA would regard Hatanaka's silence as to varying the rate of performing image processing steps as non-disclosure.

421. A POSITA would further realize that neither Hatanaka nor Lizee identifies a problem or question which would require varying the rate of performing the image processing steps, let alone based on the user's/object's distance. In my opinion, any argument that it would have been obvious to a POSITA reading Hatanaka and Lizee to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

422. It is my opinion that a POSITA would have understood Lizee's "predetermined imaging rate" to teach away from a variable rate, let alone a variable rate based on a user's distance. Ex.1017, ¶ 0045.

[0045] 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.

Ex.1017, ¶ 0045.

**(3) No Motivation to Combine Rosenberg,
Nakazawa, Tripathi, and Lizee With Respect to
Limitation 1(h)**

423. My opinions for Ground 3 are incorporated herein by reference.

424. It is my opinion that none of Rosenberg, Nakazawa, Tripathi, or Lizee, alone or in combination, disclose limitation 1(h).

425. It is my opinion that a POSITA would not be motivated to combine Rosenberg, Nakazawa, Tripathi, and Lizee to meet limitation 1(h).

426. With respect to limitation 1(h), a POSITA would not be motivated to combine Tripathi and Lizee for limitation 1(h) because neither reference discloses varying the rate of performance of any disclosed functionality. A POSITA would regard this silence as to varying the rate of performing image processing steps as non-disclosure.

427. A POSITA would also realize that neither Tripathi nor Lizee identifies a problem or question which would require varying the rate of performing the image processing steps, let alone based on the user's/object's distance. It is my opinion that any argument that it would have been obvious to a POSITA reading Tripathi and Lizee to vary the rate at which the distortion correction processes are performed based on distance is improperly based on hindsight bias.

428. In my opinion, a POSITA would understand Lizee’s “predetermined imaging rate” to teach away from a variable rate, let alone a variable rate based on a user’s distance. Ex.1017, ¶ 0045.

[0045] 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.

Ex.1017, ¶ 0045.

429. In my opinion, reading Tripathi and Lizee would not suggest to a POSITA to combine these references to meet limitation 1(h).

III. PETITION GROUNDS

A. **Ground 1: Petitioners Fail to Show Unpatentability of Claims 1-6, 8, and 17 in View of Rosenberg and Nakazawa**

430. It is my opinion that neither Rosenberg nor Nakazawa, alone or in combination, meet limitations 1(c) and 1(h) of the 109 Patent. All the claims challenged under this combination, directly or via claim dependency, require these limitations of Claim 1. Therefore, it is my opinion that neither Rosenberg nor Nakazawa, alone or in combination, invalidate any of Claims 1-6, 8, and 17.

1. Neither Rosenberg Nor Nakazawa Disclose Limitation 1(c)

431. Limitation 1(c) of the 109 Patent requires: “applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror”.

432. It is my opinion that Rosenberg does not disclose limitation 1(c) under the construction of “it appears to mimic reflection of a mirror” in the District Court Litigation. Nor does Nakazawa, and the combination of these references would not disclose it.

433. Rosenberg discloses two primary inventive methods: (1) mirror-image freeze and (2) mirror-image buffering. Ex.1005, ¶ 0037. In mirror-image freeze the user can selectively freeze a current mirror image of the user which is then statically displayed on the device. Ex.1005, ¶¶ 0039, 0087, Fig.7. The displayed image will not change in size regardless of user movement. In mirror-image buffering, a certain number of real-time images of the user are stored which the user can play back. Ex.1005, ¶ 0044. The played-back buffered images will not change even if the user’s distance to the camera changes.

[0037] In 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. This is performed using one of two different inventive methods. A first method is called mirror image-freeze and**

the second method is called mirror image-buffering. Such mirroring features may be employed during either of the traditional mirror emulation mode of the digital mirror or the third-person mirror mode of the digital mirror.

Ex.1005, ¶0037.

[0039] When employing the **mirror image-freeze feature**, the user is given the ability to selectively freeze the image displayed upon the screen such that it ceases being updated for a period of time with new video imagery from the camera. Instead a previous image that was captured at the time (or nearly at the time) that the image-freeze feature was engaged is displayed for that period of time. When in a traditional mirror emulation mode, the frozen image is a left-right inverted image of the user. When in a third person mirror mode, the frozen image is a non-inverted image of the user. Thus a user may be looking in the mirror, engage the mirror image-freeze feature, and have the then current (or substantially current) image that was displayed upon engaging the feature, freeze upon the screen for an extended period. This will allow the user, for example, to examine the frozen image in detail. This is particularly useful for a user who wishes to change his or her distance and/or location with respect to the mirror to get a better view of his or her image, but NOT have the image change as the user moves. For example, a user may wish to step closer to the mirror and view a portion of his or her face from only a few inches away. With a traditional optical mirror, such an act would cause the reflected image to change such that the

user who is just a few inches away ends up staring into his or her own eyes. In reality he may wish to freeze the image, step close, and then view some other portion of the face. The mirror image-freeze feature of the present invention enables this enhanced mirroring operation. It works by saving a current frame (i.e., a frame that was captured at or substantially at the time the user engaged the image freeze feature) in memory and using the stored image to update the graphical display such that the user views the frozen image over an extended period. When the user wishes to end the image-freeze function he or she may selectively end the feature and return to the real-time mirroring mode that was in operation prior to the freeze feature. In this way a real-time mirror mode will resume in which the image is continuously updated.

Ex.1005, ¶0039.

[0044] When employing the **mirror image-buffering feature** of the present invention, the user is given the ability to selectively store a certain amount of real-time video imagery from the camera in memory and view is playing back upon the mirror. The imagery may be stored in inverted or non-inverted form. Some embodiments of the present invention are configured to continually store in memory (i.e., buffer) a certain number of recently displayed image frames. For example, if the system is capturing and displaying 100 frames per second, the system may be configured to always store the previous 1000 frames captured and displayed to the user. As new frames come in, old frames are

over-written. In this way the image frame buffer maintains in memory the last 10 seconds of live imagery captured. These 1000 frames, which in this example correspond to 10 seconds of live imagery, are referred to as the “mirror image buffer.” Various embodiments of the present invention may be configured to store image buffers of different size and thereby can store differing lengths of live imagery. In this way, a portion of the buffering feature is operative in the background during real-time mirror viewing modes, background routines of the present invention continually storing some number of previous image frames.

Ex.1005, ¶0044.

[0087] **To view a left profile view of himself or herself, the user can turn and face to his right** such that the front plane of his body is approximately orthogonal to the mirror display screen he is standing before. He or she then **engages the image freeze** feature by uttering the word “freeze” or some other defined command utterance. The user then turns back toward the mirror and views it in a normal manner. Upon the display is the user's left profile view. **FIG. 7 illustrates a frozen digital image of a user's left profile view according to at least on embodiment of the invention.** As shown, a user 701 has just performed the image freeze operation as described above (i.e., froze the image while having his left profile aimed at the display screen). The user 701 then turns back around. Thus the user 701 stands before the mirror and views a frozen image of himself 702 as displayed in left profile. To end the mode, the user 701 may issue a

command such as uttering “end freeze” and then resume viewing himself in a standard mirroring manner.

Ex.1005, ¶0087.

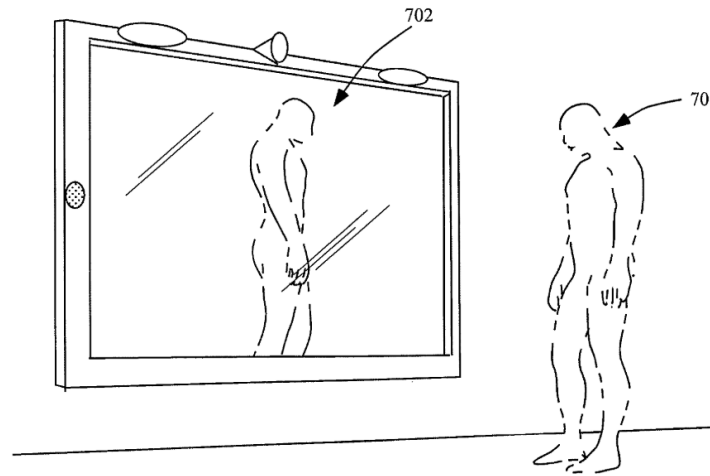


Fig. 7

Ex. 1005, Fig.7.

434. Rosenberg also discloses multi-view mirroring, in which a composite image of the user is created based on frozen or buffered images. Ex.1005, ¶ 0048 Those composite images will not change regardless of the user’s distance to the camera.

435. Rosenberg also discloses zoom-in and/or zoom-out functionality based on the user’s affirmative commands, not based on the user’s distance to the camera. Ex.1005, ¶¶0026, 0050-0052. This functionality may render an image that appears to be much greater or much less than roughly double the user’s distance to the camera.

436. It is my opinion that a POSITA would have understood Rosenberg to not disclose the optical property of a conventional mirror whereby the image of the person looking into the mirror appears at approximately double the distance to the mirror. And it is also my opinion that a POSITA would have understood Rosenberg to regard this optical property of a conventional mirror as undesirable because it does not permit the benefits (such as closer inspection of the user's own image) that Rosenberg is trying to achieve. Paragraph 39 of Rosenberg states in part:

[0039] When employing the mirror image-freeze feature, the user is given the ability to selectively freeze the image displayed upon the screen such that it ceases being updated for a period of time with new video imagery from the camera. Instead a previous image that was captured at the time (or nearly at the time) that the image-freeze feature was engaged is displayed for that period of time. When in a traditional mirror emulation mode, the frozen image is a left-right inverted image of the user. When in a third person mirror mode, the frozen image is a non-inverted image of the user. Thus a user may be looking in the mirror, **engage the mirror image-freeze feature**, and have the then current (or substantially current) image that was displayed upon engaging the feature, freeze upon the screen for an extended period. **This will allow the user, for example, to examine the frozen image in detail. This is particularly useful for a user who wishes to change his or her distance and/or location with respect to the mirror to get a better view of his or her image, but NOT have**

the image change as the user moves. For example, a user may wish to step closer to the mirror and view a portion of his or her face from only a few inches away. **With a traditional optical mirror, such an act would cause the reflected image to change such that the user who is just a few inches away ends up staring into his or her own eyes. In reality he may wish to freeze the image, step close, and then view some other portion of the face. The mirror image-freeze feature of the present invention enables this enhanced mirroring operation.** It works by saving a current frame (i.e., a frame that was captured at or substantially at the time the user engaged the image freeze feature) in memory and using the stored image to update the graphical display such that the user views the frozen image over an extended period. When the user wishes to end the image-freeze function he or she may selectively end the feature and return to the real-time mirroring mode that was in operation prior to the freeze feature. In this way a real-time mirror mode will resume in which the image is continuously updated.

Ex.1005, ¶ 0039 (emphasis added, capitalization in original).

437. It is my opinion that a POSITA would understand Rosenberg to find the optical property of a conventional mirror whereby the person looking into the mirror appears at double the distance from the mirror to be suboptimal. A POSITA would also understand that Rosenberg affirmatively chose not to include this optical property in his invention.

438. Additionally, Rosenberg discloses basic image inversion repeatedly without disclosing other conventional mirror properties.

[0026] Embodiments of the present invention replace the common household mirrors with digital embodiments that provide numerous inventive features and functions. As described herein, embodiments of the present invention provide a wall-mounted flat panel display and one or more digital camera(s) configured to provide real-time images of a user who stands before the display. In a **traditional mirror mode** of an embodiment of the present invention, the real-time images are streamed video images captured by a camera mounted upon the display, **the real-time streamed video images being a left-right inverted representation** of the video signal captured by the camera. **This 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.** The left-right inversion process 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). **This left-right inversion process is performed to present the user with a traditional mirror image view of himself or herself, inverted in a similar was as would be seen in a traditional**

optical mirror.

Ex.1005, ¶ 0026.

[0027] In this way the user can view his or her own image quickly and conveniently by simply stepping before the display portion of the digital mirror. In addition, embodiments of the present invention may be configured to provide a plurality of digital mirror display modes that may be selectively engaged by the user through hands-free user interactions. In a basic mode of operation, referred to herein a **traditional mirror emulation mode**, the digital mirror is operative to replicate the performance of a standard household mirror, **providing the user with a left-right reversed frontal image of himself or herself when standing before the display. This is achieved by streaming a left-right inverted representation of the real-time video imagery** from a camera aimed at the user to a screen portion of the display, the camera being mounted and aimed such that it points back at the user from a position on or near the display. In a preferred embodiment, the camera is positioned such that it is centered with respect to the screen area of the display. In basic embodiments the camera is mounted directly above the screen area of the display, generally near the center. This is non-ideal because it provides the user with a view of himself or herself from a somewhat unnatural perspective as compared to a traditional mirror. In more advanced embodiments the camera is mounted within the screen area of the display itself, approximately at eye-level of typical users, for example,

positioned behind the display surface and aimed through a transparent portion of the display. Such embedded-camera embodiments provide a superior arrangement because they provide the user with a natural and accurate visual perspective of himself or herself as compared to a traditional mirror. In many such embedded-camera embodiments the camera imaging frame rate is interlaced with the display imagery frame rate such that camera images are captured during off times between the image display. Thus by mounting the camera at such a location and in such a manner, the user will get the most closely approximated mirror image captured by the camera and projected upon the display. However, embodiments which have a camera mounted above the screen area may still be configured to provide an effective image, but the vantage point will simply be slightly higher than the eye-level vantage point with which users are familiar. This raised vantage point is sometimes advantageous, giving users an increased view of the top of their head, an area that is often the focus of hair brushing.

Ex.1005, ¶ 0027.

439. Rosenberg discloses basic image inversion. *See, e.g.*, Ex.1005, ¶ 0026 (“This left-right inversion process is performed to present the user with a traditional mirror image view of himself or herself, inverted in a similar way [sic] as would be seen in a traditional optical mirror.”). Consequently, it is my opinion that a POSITA would not have understood Rosenberg to address what is the difficult and more

complex technical issue of having the inverted image appear at roughly double the distance of the user to the camera. This failure to address more complex mirror mimicking techniques in combination with Rosenberg's disclosure in paragraph 39, stating that it is undesirable to have the user's image appear at approximately double the distance to the camera, would cause a POSITA to: (1) regard Rosenberg's invention as not including this optical property of a conventional mirror; and (2) be discouraged from attempting to implement this optical property of a conventional mirror because it does not permit the benefits (such as closer inspection of the user's own image) that Rosenberg is trying to achieve.

440. I disagree with Dr. Karam's opinion that paragraph 77 of Rosenberg means the image in Rosenberg appears at roughly double the distance from the camera. Ex.2012, 59:7-60:20. In my opinion, a POSITA would not have understood the use of the phrase "with a displayed size and scaling such that it appears like a traditional life-size mirror image" in paragraph 77 of Rosenberg to mean that the image appears at roughly double the distance from the camera and/or roughly the same size regardless of user distance to the camera. A POSITA would not have understood this to be what paragraph 77 discloses. A POSITA would have understood that paragraph 77 makes clear just what Rosenberg regards as constituting a "traditional mirror emulation" – simple left-right inversion, nothing more. Given that Rosenberg's "traditional mirror mode" discloses only flipping an

image, it would be apparent to a POSITA that Rosenberg did not consider the importance of addressing these optical properties, or implement them.

[0077] FIG. 5 illustrates a computer rendering of a human user 501 standing in front of a wall-mounted embodiment of the advanced digital mirror system 502 according to at least one embodiment of the present invention. The user's image is captured as a real-time video image by a camera upon or within the digital mirror 502 as described previously. A representation of that real-time video image is then displayed upon the wall mounted screen of the digital mirror 502 **with a displayed size and scaling such that it appears like a traditional life-size mirror image 503.** **In a traditional mirror emulation mode, the real-time video image is left-right inverted prior to display upon the screen.** Thus the user 501 standing before the digital display is given the visual impression that he or she is standing before a traditional wall mirror, viewing a traditional mirror image of himself or herself.

Ex.1005, ¶ 0077.

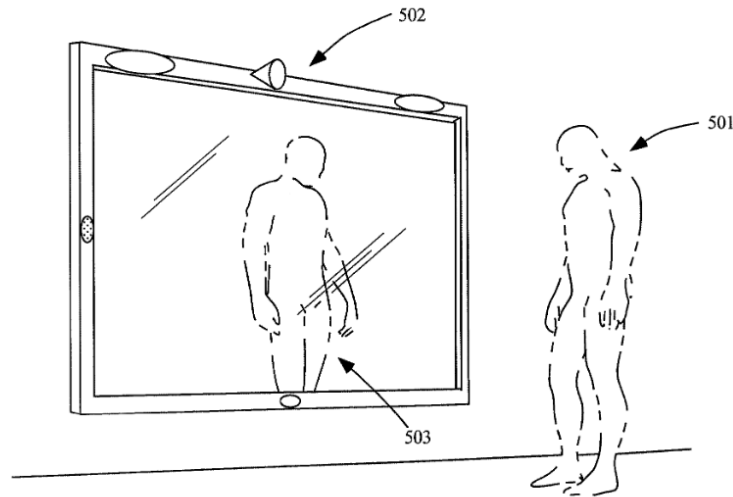


Fig. 5

Ex.1005, Fig. 5.

441. Consequently, it is my opinion that a POSITA would not have understood Rosenberg to address what is the difficult and more complex technical issue of having the inverted image appear at roughly double the distance of the user to the camera. This failure to address more complex mirror mimicking techniques in combination with Rosenberg's disclosure in paragraph 39 stating that it is undesirable to have the user's image appear at approximately double the distance to the camera, would cause a POSITA to: (1) regard Rosenberg's invention as affirmatively not including this optical property of a conventional mirror; and (2) be discouraged from attempting to implement this optical property of a conventional mirror.

442. It is my opinion that Nakazawa does not disclose limitation 1(c) under the construction of “it appears to mimic reflection of a mirror” in the District Court Litigation.

443. Nakazawa is directed to a photographing device that corrects the line of sight of a captured facial image. *See, e.g.*, Ex.1007, ¶¶0001, 0007.

444. At most, a POSITA may consider Nakazawa as disclosing simple inversion of the image.

445. Nakazawa is silent as to more advanced mirror mimicking techniques such as ensuring the user’s image appears at roughly double the distance to the camera. A POSITA would regard this silence as constituting non-disclosure.

446. Nakazawa’s disclosure of magnifying the user’s image is limited to the user’s face (not the whole body) and is for purposes of orienting the user’s face to correct the user’s line of sight. *See, e.g.*, Ex.1007, ¶¶0034, 0036. A POSITA would not regard this technique as disclosing that the user’s “reflection appearing at roughly double the distance from the camera”.

2. Petitioners Fail to Show Motivation to Combine Rosenberg and Nakazawa for Limitation 1(c)

447. It is my opinion that a POSITA would not have been motivated to combine Rosenberg and Nakazawa for limitation 1(c).

448. A POSITA would not have been motivated to combine Rosenberg and Nakazawa to meet limitation 1(c) because, as discussed above, a POSITA would not have regarded either reference as disclosing this limitation.

449. Additionally, a POSITA would not have been motivated to combine Rosenberg and Nakazawa because Rosenberg teaches away from having the user's image appear at roughly double the distance from the camera and because Nakazawa (at most) only discloses basic image inversion and does not disclose the user appearing at roughly double the distance to the camera.

450. It is my opinion that any assertion that a POSITA reading Rosenberg and Nakazawa would have automatically been able to easily and without undue experimentation implement the known optical properties of a conventional mirror that the user's image appears roughly double the distance to the mirror and roughly the same size regardless of user movement, relies on hindsight bias. Although these optical properties of conventional mirrors likely have been known for millennia, it is my opinion that a POSITA reading Rosenberg and Nakazawa would not have considered the relative importance of including these optical properties beyond simple inversion. This is because Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double the distance of the user to the camera and Nakazawa does not disclose it at all. Therefore, in my

opinion a purported combination of Rosenberg and Nakazawa would not have suggested inclusion of these optical properties to a POSITA.

451. Given that neither of these references disclose limitation 1(c), any argument that it would have been obvious to a POSITA reading them is impermissibly based on hindsight bias.

3. Neither Rosenberg Nor Nakazawa Disclose Limitation 1(h)

452. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

453. It is my opinion that Rosenberg does not disclose limitation 1(h). Nor does Nakazawa, and the combination of these references would not disclose it.

454. Rosenberg does not suggest varying the rate of performing image processing steps at all, let alone based on distance. It is my opinion that a POSITA would regard Rosenberg’s silence as to varying the rate of performing image processing steps as non-disclosure.

455. Rosenberg discloses proximity detection in connection with turning on and off various modes of operation but not in connection with varying the rate of one or more steps that are performed to transform a captured image.

[0025] Embodiments of the present invention replace the common household wall mirror with a digital mirror system that provides numerous inventive features and functions. The 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. For example, the integrated digital mirror of the present invention enables users to quickly and easily view not only a mirror image of themselves (i.e., a left-right inverted representation) as is displayed by a traditional mirror, but also a non-inverted image of themselves (i.e. a view similar to that which a third person would see if standing across from the user at the location of the mirror). Also, the integrated digital mirror of the present invention enables users to quickly and easily view not only their frontal image when looking in the digital mirror, but also profile images and rear images. The digital mirror also enables the user to view composite images that include a concurrent display of current and previous reflective images, thereby allowing users to view changes over time in their appearance. The digital mirror further enables users to quickly and easily adjust zoom-in and zoom-out the reflective image, enabling users to focus in on particular areas of their own reflection. The digital mirror also includes unique hands-free user interface functionality in which simple vocal commands can select and adjust features and functions of the digital mirror. The digital mirror further includes a novel **proximity and/or motion sensor for detecting when a user is physically present before and/or approaches and/or stands before the display screen of the mirror within some proximity range and automatically engages the digital mirror functionality** of the present

invention. The digital mirror also provides for dual-state operation embodiments in which the system displays digitized wall artwork or photographs when not in a mirroring mode and wherein the system automatically enters a mirroring mode when a user steps in front of the display screen for more than a threshold amount of time and/or when the user utters a particular verbal command. The digital mirror also provides for dual-state operation embodiments in which the **system automatically enters a power-conservation mode, sending reduced power to the display screen when a user is not standing before the mirror for more than a threshold amount of time and wherein the system automatically enters a mirroring mode when a user steps in front of the display screen and/or when the user utters a particular verbal command.**

Ex.1005, ¶ 0025.

[0032] Some embodiments of the present invention include one or more **proximity and/or motion sensors for detecting a person** located before the display screen. The proximity and/or motion sensors enable a highly valuable function in which the digital mirror can **automatically turn on its display features when a person steps before it.** In this way, the screen can remain off or in a low-power idle state such that when a person is not standing before the mirror, the display is not wasting power by continually displaying imagery. **This auto-activation feature is generally enabled by the proximity and/or motion sensor sending data to the processor indicating that an object has**

come within a certain region before the display screen. There are many forms of proximity and/or motion sensors. Many operate using emitter-detector pairs. For example, in one embodiment an infra-red light source emitter emits light, aiming the emission out in front of the digital mirror display screen. An infra-red light detector is also included, detecting the level of intra-red light that is reflected back. The proximity and/or motion sensor generally operates by detecting a threshold level of reflected light and/or a certain change in the reflected light level to determine that a person is standing before the digital mirror screen. Other sensors may employ sensor means, including but not limited to ultrasonic emitters and detectors.

Ex.1005, ¶ 0032.

[0069] As also shown in FIG. 3, some embodiments of the present invention include one or more proximity and/or motion sensors 305 for detecting whether a person (or a similar object) is located before and/or moves before the display screen. **The proximity and/or motion sensor enables valuable functions in which hardware and/or software of the digital mirror can selectively switch between a plurality of states in response to a person standing before and/or stepping before and/or stepping away from the display screen.** For example, in one highly valuable feature of the present invention, the sensors 305 are used along with software routines of the present invention to **automatically turn on the mirror display 301 and enable a mirroring mode of operation when a person steps before the**

screen area. In this way, the screen can remain off or in a low-power idle state such that when a person is not standing before the mirror, the display 301 is not wasting power by continually displaying mirroring imagery when there is nobody looking in the mirror. Thus a digital mirror in a person's bathroom can be configured only to power (or fully power) the display screen when it is detected that a person is within the bathroom. **This auto-activation feature is generally enabled by the proximity and/or motion sensor** sending data to the processor indicating that an object has come within a defined region before the display screen and/or motion has been detected before the display screen that meets certain magnitude and timing parameters. There are many forms of proximity and/or motion sensors. Many operate using emitter-detector pairs. For example, in one embodiment an infra-red light source emitter emits light, aiming the emission out in front of the digital mirror display screen. An infra-red light detector is also included, detecting the level of intra-red light that is reflected back. The proximity and/or motion sensor generally operates by detecting a threshold level of reflected light and/or a certain change in the reflected light level to determine that a person is standing before the digital mirror screen within some defined proximity distance. Other sensors may be used to detect if a person is standing before and/or moves before the display screen area, including but not limited to ultrasonic emitters and detectors, sound detectors, vibration detectors, digital camera, heat detectors, and/or optical detectors.

[0114] Another novel aspect of the multi-function product embodiments described above are the innovative methods by which the system **intelligently switches between states**. As described above, a multi-function embodiment of the present invention may include a digital picture frame state and a digital mirroring state that are operative at different moments in time. The present invention also includes software routines for **automatically switching between states based upon one or more sensor readings**. As described previously the present invention may include a proximity and/or motion sensor operative to detect if a person is standing and/or moving in an area or region in front of the display screen. The proximity and/or motion sensor, for example, may be configured to detect if a person (or other moving object) comes within an area that extends, for example, six to eight feet in front of the screen area. **Based upon the motion and/or proximity data, routines of the present invention may be configured to automatically switch between operational states**. In a preferred embodiment of the present invention, the software routines automatically put the system into digital picture frame state when it is determined that nobody is standing and/or moving in front of the screen for more than some threshold amount of time. In one such embodiment the threshold amount of time is 300 seconds. Thus when a counter within the electronics of the present invention determines that 300 seconds have elapsed during which time no presence

and/or motion was detected in a particular area before the display screen (as determined by data from the proximity and/or motion sensors), the system is put into a digital picture frame state. Conversely when the system is in digital picture frame state and it is determined (based upon data from the proximity and/or motion sensor data) that a person is standing before the display screen for more than some threshold amount of time (for example, 6 seconds), the routines of the present invention put the system into a digital mirroring state. A threshold amount of time is used to ensure that the system does not shift into digital mirroring state by virtue of a person just walking past the display screen. Instead the inventive method of the present invention is configured to determine that the person is present in front of the display screen for more than some threshold amount of time (for example, 6 seconds), thereby assuring that only a person who stops and looks in the mirror from a particular area directly before it, will trigger the system to enter digital mirroring state.

Ex.1005, ¶ 0114.

456. It is my opinion that a POSITA reading Rosenberg would not have considered the need for varying the rate of performing processing steps within any one mode based on a user's distance.

457. I have read the deposition of Petitioners' expert, Dr. Karam. In her deposition, Dr. Karam advanced a theory that all the modes in Rosenberg are just parts of a "super mode". Rosenberg discloses no such "super mode" nor is there any

suggestion in Rosenberg that the discrete modes disclosed in Rosenberg should be viewed as a whole. Rather, a POSITA would have understood that, as disclosed in Rosenberg, each discrete mode has its own processes. Therefore, a POSITA would not have understood each of these discrete modes to be merely part of some undisclosed operational “super mode”.

458. In her deposition Dr. Karam further testified that turning on and off the disclosed modes in Rosenberg as part of this undisclosed “super mode” meets limitation 1(h). A POSITA would not have regarded switching discrete modes in Rosenberg based on proximity sensors as meeting limitation 1(h): “varying rate at which the non-ordered steps are performed on the series of images according to the distance”. This is because the discrete modes in Rosenberg are not steps and proximity to the camera only determines whether to turn on or off the mirror display functionality – not the specific modes utilizing the mirror display as a mirror.

[0032] Some embodiments of the present invention include one or more proximity and/or motion sensors for detecting a person located before the display screen. **The proximity and/or motion sensors enable a highly valuable function in which the digital mirror can automatically turn on its display features when a person steps before it. In this way, the screen can remain off or in a low-power idle state such that when a person is not standing before the mirror, the display is not wasting power by continually displaying imagery. This auto-activation feature is**

generally enabled by the proximity and/or motion sensor sending data to the processor indicating that an object has come within a certain region before the display screen. There are many forms of proximity and/or motion sensors. Many operate using emitter-detector pairs. For example, in one embodiment an infra-red light source emitter emits light, aiming the emission out in front of the digital mirror display screen. An infra-red light detector is also included, detecting the level of intra-red light that is reflected back. The proximity and/or motion sensor generally operates by detecting a threshold level of reflected light and/or a certain change in the reflected light level to determine that a person is standing before the digital mirror screen. Other sensors may employ sensor means, including but not limited to ultrasonic emitters and detectors.

Ex.1005, ¶ 0032.

[0033] In addition to the auto-activation feature described above, some embodiments of the present invention employ an **auto-shut-down feature where the display screen is turned off and/or switched to a low power idle mode when it is determined that a user has stepped away from the mirror for more than some threshold amount of time**. Because people often move back and forth in front of bathroom mirrors, when, for example, getting dressed and going to and from a closet, the threshold amount of time is generally set long enough so that the digital mirror display screen will not turn itself off and/or enter an idle mode every time the user heads to the closet for a short

time. Thus, in some embodiments the threshold amount of time for the auto-shut-down feature may be set to ten minutes. This is a configuration generally set in the software of the present invention. The processor may determine, **based upon data from one or more sensors, that if a user has stepped away from the digital mirror display screen for more than ten minutes, and then the processor turns off the display screen and/or puts the display screen in a low power idle mode.** In some embodiment of the present invention the user can set the threshold time used for the auto-shut-down feature in a configuration mode.

Ex.1005, ¶ 0033.

[0056] Another aspect of the multi-function product embodiments described above are the innovative methods by which the system intelligently switches between operational states. As described above, a multi-state embodiment of the present invention may include a digital picture frame state and a digital mirroring state that are operative a different moments in time. Software routines are included for automatically switching between states based upon one or more sensor readings. As described previously the system may include a proximity and/or motion sensor operative to detect if a person is standing and/or moving in an area or region in front of the display screen. The proximity and/or motion sensor, for example, may be 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.

Based upon the motion and/or proximity data, the routines of embodiments of the present invention may be configured to automatically switch between operational states. In a preferred embodiment of the present invention, the software routines **automatically put the system into digital picture frame state when it is determined that nobody is standing and/or moving in front of the screen for more than some threshold amount of time.** Thus when a counter within the electronics of the present invention determines that the threshold time has elapsed during which no presence and/or motion was detected before the display screen (as determined by data from the proximity and/or motion sensors), the system is put into a digital picture frame state. **Conversely when the system is in digital picture frame state and it is determined (based upon data from the proximity and/or motion sensor data) that a person is standing before the display screen for more than some threshold amount of time (e.g., 6 seconds), the routines put the system into a digital mirroring state.** In some embodiments the system enables the user to purposefully change states based upon verbal commands, in addition to and/or instead of, the automatic state changing method described above.

Ex.1005, ¶ 0056.

[0069] As also shown in FIG. 3, some embodiments of the present invention include one or more proximity and/or motion sensors 305 for detecting whether a person (or a similar object) is located before and/or moves before the display screen. The

proximity and/or motion sensor enables valuable functions in which hardware and/or software of the digital mirror can selectively switch between a plurality of states in response to a person standing before and/or stepping before and/or stepping away from the display screen. For example, in one highly valuable feature of the present invention, the sensors 305 are used along with software routines of the present invention to **automatically turn on the mirror display 301 and enable a mirroring mode of operation when a person steps before the screen area. In this way, the screen can remain off or in a low-power idle state such that when a person is not standing before the mirror, the display 301 is not wasting power by continually displaying mirroring imagery when there is nobody looking in the mirror. Thus a digital mirror in a person's bathroom can be configured only to power (or fully power) the display screen when it is detected that a person is within the bathroom.** This auto-activation feature is generally enabled by the proximity and/or motion sensor sending data to the processor indicating that an object has come within a defined region before the display screen and/or motion has been detected before the display screen that meets certain magnitude and timing parameters. There are many forms of proximity and/or motion sensors. Many operate using emitter-detector pairs. For example, in one embodiment an infra-red light source emitter emits light, aiming the emission out in front of the digital mirror display screen. An infra-red light detector is also included, detecting the level of intra-red light that is reflected back. The

proximity and/or motion sensor generally operates by detecting a threshold level of reflected light and/or a certain change in the reflected light level to determine that a person is standing before the digital mirror screen within some defined proximity distance. Other sensors may be used to detect if a person is standing before and/or moves before the display screen area, including but not limited to ultrasonic emitters and detectors, sound detectors, vibration detectors, digital camera, heat detectors, and/or optical detectors.

Ex.1005, ¶ 0069.

[0071] In some embodiments of the auto-shut down feature, two time thresholds are used in combination to determine when the mirror display should automatically switched to and from a low-power state. **An “Away Threshold” is used to determine how long of a time must elapse before it is assumed that a person who had been standing in front of the mirror is now finished using the mirror. A “Use Threshold” is used to determine how long a person must spend in front of the mirror such that the person is determined to be using the mirror and not just passing by it** (as a person may often do with respect to a hallway mirror). The Away Threshold may be set to a long period of time, for example, 10 minutes. The Use Threshold may be set to a much shorter period of time, for example, 5 seconds. Thus the software is configured to determine **whether a user has stepped up to the mirror with an intent to use it based upon the proximity and/or motion sensor reporting data indicative of**

user presence that lasts for more than the Use Threshold number of seconds. Similarly, the software is configured to determine **whether a user who has been using the mirror has now finished using the mirror based upon the proximity and/or motion sensor data reporting the lack of a user presence for more than the Away Threshold amount of time.**

Ex.1005, ¶ 0071.

[0072] Thus if the mirror is in an low-power state and a user is suddenly detected before the mirror, but the user has not been detected for more than the Use Threshold number of seconds, the mirror will remain in the low-power state. In the event that the mirror is in a low-power state and a user has been detected before the mirror for more than the Use Threshold number of seconds, the mirror will automatically transition from the low-power state to an active digital mirroring state. **If the mirror is in a digital mirroring state and proximity or motion sensor reports that the user to no longer in front of the mirror and has not been for a period of time that is longer than the Away Threshold number of minutes, the display screen is automatically switched to the low-power state.** In this way a user may pass quickly before the mirror without inadvertently activating it. Similarly, a user may step away from a mirror during use for a short periods of time without inadvertently deactivating it.

Ex.1005, ¶ 0072.

[0114] Another novel aspect of the multi-function product

embodiments described above are the innovative methods by which the system intelligently switches between states. As described above, a multi-function embodiment of the present invention may include a digital picture frame state and a digital mirroring state that are operative at different moments in time. The present invention also includes software routines for automatically switching between states based upon one or more sensor readings. As described previously the present invention may include a proximity and/or motion sensor operative to detect if a person is standing and/or moving in an area or region in front of the display screen. The proximity and/or motion sensor, for example, may be configured to detect if a person (or other moving object) comes within an area that extends, for example, six to eight feet in front of the screen area. Based upon the motion and/or proximity data, routines of the present invention may be configured to automatically switch between operational states. In a preferred embodiment of the present invention, the software routines automatically put the system into digital picture frame state when it is determined that nobody is standing and/or moving in front of the screen for more than some threshold amount of time. In one such embodiment the threshold amount of time is 300 seconds. **Thus when a counter within the electronics of the present invention determines that 300 seconds have elapsed during which time no presence and/or motion was detected in a particular area before the display screen (as determined by data from the proximity and/or motion sensors), the system is put into a digital picture frame**

state. Conversely when the system is in digital picture frame state and it is determined (based upon data from the proximity and/or motion sensor data) that a person is standing before the display screen for more than some threshold amount of time (for example, 6 seconds), the routines of the present invention put the system into a digital mirroring state. A threshold amount of time is used to ensure that the system does not shift into digital mirroring state by virtue of a person just walking past the display screen. Instead the inventive method of the present invention is configured to determine that the person is present in front of the display screen for more than some threshold amount of time (for example, 6 seconds), thereby assuring that only a person who stops and looks in the mirror from a particular area directly before it, will trigger the system to enter digital mirroring state.

Ex.1005, ¶ 0114.

459. It is my opinion that Nakazawa does not disclose limitation 1(h).

460. Nakazawa does not suggest varying the rate of performing image processing steps at all, let alone based on distance. It is my opinion that a POSITA would regard Nakazawa's silence as to varying the rate of performing image processing steps as non-disclosure.

461. Given that neither Rosenberg nor Nakazawa discloses limitation 1(h), it is my opinion that any argument that it would have been obvious to a POSITA

reading either reference to vary the rate based on distance is impermissibly based on hindsight.

4. Petitioners Fail to Show Motivation to Combine Rosenberg and Nakazawa for Limitation 1(h)

462. A POSITA would not have been motivated to combine Rosenberg and Nakazawa to meet limitation 1(h) because, as discussed above, a POSITA would not have regarded either reference as disclosing this limitation.

463. Neither reference suggests varying the frame rate or rate of performing any steps at all, let alone based on distance.

464. Given that neither Rosenberg nor Nakazawa discloses limitation 1(h), it is my opinion that any argument that it would have been obvious to a POSITA reading these references in combination to vary the rate based on distance is impermissibly based on hindsight.

B. Ground 2: Petitioners Fail to Show Unpatentability of Claims 1-6, 8, 11, and 17 in View of Rosenberg, Nakazawa, and Hatanaka

465. My opinions for Ground 1 are incorporated herein by reference.

466. It is my opinion none of Rosenberg, Nakazawa, or Hatanaka, alone or in combination, meet limitations 1(c) and 1(h) of the 109 Patent. All the claims challenged under this combination, directly or via claim dependency, require these limitations of Claim 1. Therefore it is my opinion that neither Rosenberg,

Nakazawa, or Hatanaka, alone or in combination, invalidate any of Claims 1-6, 8, 11, and 17.

1. Hatanaka, Alone Or In Combination With Rosenberg/Nakazawa, Does Not Disclose Limitation 1(c)

467. Limitation 1(c) of the 109 Patent requires: “applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror”.

468. It is my opinion that Hatanaka does not disclose limitation 1(c) under the construction of “it appears to mimic reflection of a mirror” in the District Court Litigation. Nor does Rosenberg or Nakazawa, and the combination of these references would not disclose it.

469. A POSITA would have understood Hatanaka as directed to reduction of throughput in image processing. *See, e.g.*, Ex.1009, Abstract, ¶0012. A POSITA would have understood that Hatanaka achieves this by adjusting encoding and presentation of visual content based on a viewer’s distance to a display. *See, e.g.*, Ex.1009, ¶¶0009, 0010., Fig. 1, Fig. 2

[0009]

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.

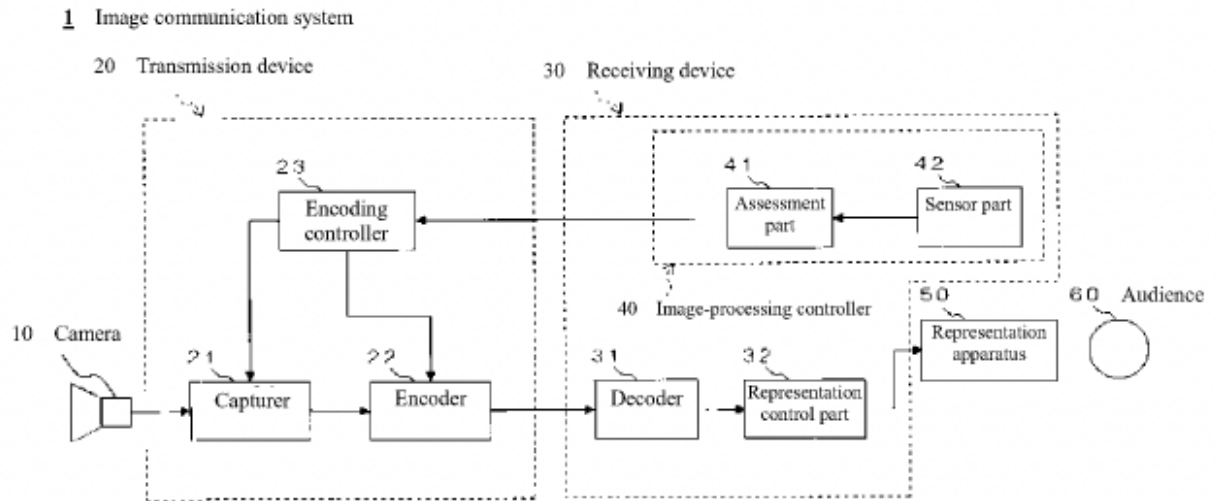
Ex.1009, ¶0009.

[0010]

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 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.

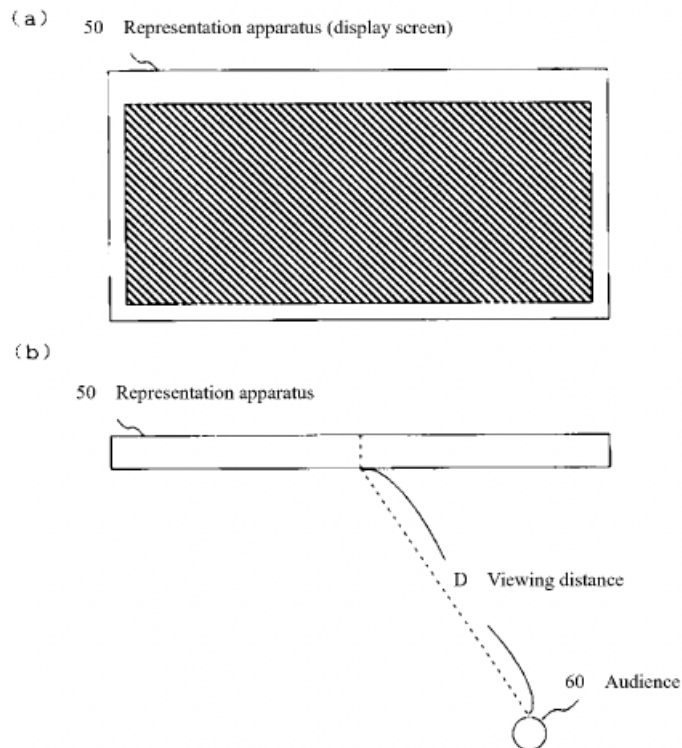
Ex.1009, ¶0010.

Figure 1



Ex.1009, Fig.1.

Figure 2



Ex.1009, Fig. 2.

470. A POSITA would not have understood Hatanaka to disclose the presentation of images as if they were reflected from a conventional mirror. A POSITA would have recognized that Hatanaka does not disclose mirroring of the images that have been captured and that Hatanaka does not disclose mirroring of the images that are presented.

471. A POSITA would realize that Hatanaka does not even disclose a left-right flip of the images – a basic mirror mimicking property. And a POSITA would also recognize Hatanaka does not disclose more advanced mirror mimicking techniques such as having the user’s image appear at roughly double the distance from the camera. A POSITA would not regard Hatanaka as disclosing reversing an image of a user nor having that reversed reflection appear at roughly double the distance from the camera nor maintaining roughly the same size regardless of the user movement.

2. Petitioners Fail to Show Motivation to Combine Rosenberg, Nakazawa, and Hatanaka for Limitation 1(c)

472. My opinions for Ground 1 are incorporated herein by reference.

473. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Hatanaka for limitation 1(c).

474. A POSITA would regard Rosenberg as teaching away from having a user’s image appear at roughly double the distance of the user to the camera.

475. A POSITA would regard Hatanaka as not disclosing reversing the images displayed to a viewer.

476. A POSITA would understand that Hatanaka is not directed to attempting to mimic a mirror. Therefore, a POSITA would not regard Hatanaka as disclosing reversing such images or displaying them at roughly double the distance from the camera.

477. Unlike Rosenberg, Nakazawa, and the 109 Patent, which are focused on capturing images of the user and the viewing experience of the user, Hatanaka is focused on encoding and presentation of visual content based on a viewer's distance to a display. *See, e.g.,* Ex, 1009, ¶¶0009, 0010. A POSITA would not regard Hatanaka's viewer to be the same as the user in Rosenberg, Nakazawa, and the 109 Patent. A POSITA would not regard Hatanaka's changes to encoding based on the viewer's distance to the display as comparable to manipulating an image to realistically reflect an image (as if it were in a mirror).

478. Unlike Claim 1 of the 109 Patent, Hatanaka is focused on the distance of the viewer to the display because Hatanaka is concerned with image encoding, throughput efficiency, and display. Hatanaka would not suggest to a POSITA that the distance of the viewer to the display for encoding and throughput efficiency purposes is relevant to how a user's image would be processed to mimic a mirror.

479. It is my opinion that there would be no motivation to combine these references to meet limitation 1(c) because Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double the distance of the user to the camera, Nakazawa does not disclose this optical property at all, and Hatanaka neither attempts to replicate a mirror experience nor discloses this optical property at all.

**3. Hatanaka, Alone or In Combination With
Rosenberg/Nakazawa, Does Not Disclose Limitation 1(h)**

480. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

481. It is my opinion that Hatanaka does not disclose limitation 1(h). Nor does Rosenberg or Nakazawa, and the combination of these references would not disclose it.

482. A POSITA would understand that Hatanaka is directed to encoding and presentation of visual content based on a viewer's distance to a display. *See, e.g.*, Ex.1009, ¶¶0009, 0010.

483. In my opinion, a POSITA would also understand that even though Hatanaka determines distance from a display apparatus (a “representation output part”) to a viewer of content (*see, e.g.*, Ex.1009, ¶¶0009, 0010), and can change the **resolution** at which video is encoded according to the distance of the viewer to the

display device, or change some other encoding parameter, such as “frame rate, quantization step size, compression ratio” (*id.* at ¶0039), there is no disclosure that the rate at which processing or encoding steps are varied at all, let alone based on distance. A POSITA would know that varying the *resolution* at which an image is encoded does not change the frequency or rate at which that encoding (or any other processing step) occurs. A POSITA would know that the encoding will still occur, but at a lower resolution.

484. A POSITA would know that Hatanaka’s disclosure of varying encoding parameters such as resolution or frame rate is varying a property of a system that is very different from the rate at which processing steps are performed, which is disclosed in the 109 Patent, and for a different purpose. A POSITA would recognize that Hatanaka is not directed toward transformation of captured images, such as by flipping, resizing, or applying other image transformations so that the image “appears to mimic a mirror” under the construction in the District Court Litigation. And a POSITA would not regard Hatanaka as disclosing any of those things.

485. A POSITA would have regarded Hatanaka as being concerned with varying the parameters of an encoder so that it encodes content to have different resolutions, frame rate, quantization step size, compression ratio and so on to reduce throughput. Ex.1009, ¶¶0009, 0010. A POSITA would have known that each of

these variations in encoder parameters can be achieved with image processing at a fixed rate.

486. A POSITA would have recognized that no disclosure in Hatanaka explicitly states that a POSITA should vary the rate at which image processing steps are applied, nor does any disclosure implicitly require varying the rate at which image processing steps are applied.

487. In my opinion a POSITA would understand that combining Hatanaka’s encoding changes with Rosenberg’s simplistic mirror emulation (which the 109 Patent describes as insufficient in any event) would not result in varying the image transformation *steps* recited in the 109 Patent. Instead, a POSITA would understand that such a combination would result in a system which varied encoding parameters but not the performance of image transformations – resulting in images which were not transformed, but just encoded for transmission at different resolutions or frame rates.

488. It is also my opinion that it would not have been obvious to a POSITA to modify Rosenberg/Nakazawa in view of Hatanaka providing the *concept* of varying some aspect of image processing, to achieve the claimed varying of image transformation *steps* of the 109 Patent, as Petitioners appear to contend (Pet. at 49-50). I disagree with Petitioners’ assertion that this modification would merely “apply[] a known technique to improve a similar device in the same way to yield the

predictable result of efficient image processing.” Pet. at 50. This assertion by Petitioners is not supported. In my opinion not only would a POSITA not regard Rosenberg’s mirror device and Hatanaka’s display system as similar devices, but as noted above, Hatanaka’s disclosure that image encoding can be variable based on distance from a display to an audience is a different technical concept than either Rosenberg’s disclosure of performing a simple image transformation (flipping an image along its vertical axis) (*e.g.*, Ex.1005, ¶¶0039), and the 109 Patent’s disclosure of varying the rate at which image transformation *steps* are applied based on distance to the subject captured in a series of images. A POSITA would be aware of image encoding and variations in encoding resolution and frame rate as techniques to provide efficient processing and throughput. However, it is my opinion that the leap from that knowledge to modifying the rate at which a set of image transformation steps were applied to a series of captured images so that they “appear to mimic a mirror” would not be obvious to a POSITA. In my opinion, although both are within the broad general category of “image processing,” they are different technical concepts, with different technical considerations.

489. For example, Hatanaka explains image encoding converts the data representing an image into a format suitable for storage and transfer (such as to Hatanaka’s display) for subsequent decoding and display. Ex.1009, Abstract, ¶¶0019, 0020. But Rosenberg discloses transforming the appearance of an image

itself by manipulating the pixels of the image, *i.e.*, by flipping the image along a vertical axis, in a simple attempt to emulate a traditional mirror. Ex.1005, ¶0026 (explaining that in Rosenberg’s “traditional mirror mode,” images are “a left-right inverted representation of the video signal captured by the camera.”). *See also id.* at ¶¶0027, 0036, 0039, 0041. In my opinion, a POSITA would not find it obvious in view of Hatanaka to vary the rate at which Rosenberg’s technically different kind of “image processing” steps occur and in my opinion a POSITA would not expect it to be functional or desirable.

490. In my opinion, a POSITA would not find it obvious to rely on Hatanaka teaching the general concept of rate varying for image processing (which it does not) to combine with Rosenberg’s flipping, as it would not be apparent which image processing steps could be applied with varying frequency, because different kinds of image processing steps have different computational demands and will have different effects on the user experience. A POSITA would realize from reading the 109 Patent that this impact on user experience is an important consideration. Ex.1001, 27:41-49.

Another feature that may be implemented in any of the above described embodiments is the frequency of transformation parameter update. That is, at times the user may prefer a stable image when he is standing stationary in front of the screen that mimics the mirror. Having the transformation mapping engine

change while user is stationary may create an uncomfortable feeling. On the other hand, when the user is moving faster toward or backward from the screen, it may be fine to update the transformation parameters faster.

Ex.1001, 27:41-49.

491. A POSITA would understand that the 109 Patent teaches a specific set of steps which (a) can be executed fast enough to be effective and (b) produce the correct user experience. In my opinion, Hatanaka's very different disclosure of variations in image encoding would not make its application to Rosenberg/Nakazawa to achieve the claimed variation in image processing steps obvious to a POSITA.

492. It is my opinion that any argument that varying the rate would have been obvious to a POSITA to implement with Rosenberg from reading Hatanaka is impermissibly based on hindsight bias.

4. Petitioners Fail to Show Motivation to Combine Rosenberg, Nakazawa, and Hatanaka for Limitation 1(h)

493. My opinions for Ground 1 are incorporated herein by reference.

494. A POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Hatanaka to meet limitation 1(h) because, as discussed above, a POSITA would not have regarded any of these references as disclosing this limitation.

495. Given that none of these references disclose limitation 1(h), any argument that it would have been obvious to a POSITA reading Hatanaka is impermissibly based on hindsight bias.

496. Unlike Rosenberg, Nakazawa, and the 109 Patent (which are focused on capturing images of the user and the viewing experience of the user), Hatanaka is focused on encoding and presentation of visual content based on a viewer's distance to a display. *See, e.g.*, Ex.1009, ¶¶ 0009, 0010. A POSITA would not regard Hatanaka's viewer to be the same as the user in Rosenberg, Nakazawa, and the 109 Patent. A POSITA would not regard Hatanaka's changes to encoding based on the viewer's distance to the display as comparable to manipulating an image to realistically reflect an image (as if it were in a mirror).

497. A POSITA would not have understood the user in Rosenberg, Nakazawa, and the 109 Patent to be akin to the viewer in Hatanaka. A POSITA would understand that the user in Rosenberg, Nakazawa, and the 109 Patent is also the subject of the image and the capturing and manipulation of the user's image is intended to realistically reflect the user's image (as if it were in a mirror).

498. A POSITA would recognize that unlike Claim 1 of the 109 Patent, Hatanaka is focused on the distance of the viewer to the display because Hatanaka is concerned with image encoding, throughput efficiency, and display. In my opinion Hatanaka would not suggest to a POSITA that the distance of the viewer to the

display for encoding and throughput efficiency purposes is relevant to how a user's image would be processed to mimic a mirror. And a POSITA would realize that Hatanaka does not disclose or suggest varying the rate of performance of image processing steps. Therefore, it is my opinion that Hatanaka would not suggest to a POSITA that the distance of the viewer to the display for encoding and throughput efficiency purposes is relevant to how a user's image would be processed to mimic a mirror.

C. Ground 3: Petitioners Fail to Show Unpatentability of Claims 1-6, 8, and 17 in View of Rosenberg, Nakazawa, and Tripathi

499. My opinions for Ground 1 are incorporated herein by reference.

500. It is my opinion that none of Rosenberg, Nakazawa, or Tripathi, alone or in combination, meet limitations 1(c) and 1(h) of the 109 Patent. All the claims challenged under this combination, directly or via claim dependency, require these limitations of Claim 1. Therefore, it is my opinion that neither Rosenberg, Nakazawa, or Tripathi, alone or in combination, invalidate any of Claims 1-6, 8, and 17.

1. Tripathi Does Not Disclose Limitation 1(c)

501. Limitation 1(c) of the 109 Patent requires: “applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror”.

502. It is my opinion that Tripathi does not disclose limitation 1(c) under the construction of “it appears to mimic reflection of a mirror” in the District Court Litigation. Nor does Rosenberg or Nakazawa, and the combination of these references would not disclose it.

503. It is my opinion that a POSITA would regard Tripathi as not disclosing mirror mimicking properties.

504. A POSITA would understand that Tripathi is directed to adjusting display frame rate in response to power status of the device, content type (*e.g.*, dynamic or static), and/or affirmative user input. *See, e.g.*, Ex.1040, at Abstract, 1:60-62, 2:1-3, 6:11-20 10:40-44.

505. A POSITA would realize that unlike the 109 Patent, Tripathi is not directed to capturing images, let alone capturing an image of a user and attempting to mimic a reflection of a mirror with a digital device.

506. It is my opinion that a POSITA would regard Tripathi as not disclosing capturing a user’s image (or any image), nor disclosing reversing a user’s image, nor disclosing that the reversed image appears at roughly double the distance from the camera, nor disclosing that the reversed image maintains roughly the same size regardless of user movement. Therefore, it is my opinion that a POSITA would not regard Tripathi, either alone or in combination with Rosenberg/Nakazawa as

disclosing limitation 1(c) under the claim construction in the District Court Litigation or otherwise.

2. Petitioners Fail to Show Motivation to Combine Rosenberg, Nakazawa, and Tripathi for Limitation 1(c)

507. My opinions for Ground 1 and Ground 2 are incorporated herein by reference.

508. A POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Tripathi to meet limitation 1(c) because, as discussed above, a POSITA would not have regarded any of these references as disclosing this limitation

509. Given that none of these references disclose limitation 1(c), any argument that it would have been obvious to a POSITA reading Tripathi is impermissibly based on hindsight bias.

510. A POSITA would not have been motivated to combine Rosenberg and Nakazawa with Tripathi to meet limitation 1(c) because unlike the 109 Patent and unlike Rosenberg and Nakazawa, Tripathi is not directed to capturing images.

511. A POSITA would not regard Tripathi as disclosing reversing such images or displaying them at roughly double the distance from the camera because Tripathi is not directed to capturing a user's image or attempting to mimic a mirror.

512. A POSITA would also not be motivated to combine these references because Tripathi is focused on adjusting display frame rate in response to power

status of the device, content type (*e.g.*, dynamic or static), and/or affirmative user input (*see, e.g.*, Ex.1040, at Abstract, 1:60-62, 2:1-3, 6:11-20, 10:40-44), whereas Rosenberg, Nakazawa, and the 109 Patent are focused on capturing images of the user and the viewing experience of the user.

513. A POSITA would understand that the user in Rosenberg, Nakazawa, and the 109 Patent is also the subject of the image and the capturing and manipulation of the user's image is intended to realistically reflect the user's image (as if it were in a mirror).

514. A POSITA would understand that Tripathi is not directed to capturing images, let alone images of the viewer, and Tripathi changes the frame rate based on the poser status of the device, content type, or affirmative user input is not comparable to manipulating a user's image to realistically reflect an image (as if it were in a mirror).

515. Tripathi would not suggest to a POSITA to combine Tripathi with Rosenberg and Nakazawa to meet limitation 1(c) because Tripathi's disclosure of adjusting frame rate (*see, e.g.*, Ex.1040, 6:10-20) accomplishes nothing required by limitation 1(c).

516. It is my opinion that there would be no motivation to combine these references to meet limitation 1(c) because Rosenberg teaches away from incorporating the optical property of having a user's image appear at roughly double

the distance of the user to the camera, Nakazawa does not disclose this optical property at all, and Tripathi is neither directed to capturing an image of a user, nor attempting to replicate a mirror experience, nor discloses this optical property at all.

3. Tripathi Does Not Disclose Limitation 1(h)

517. Limitation 1(h) of the 109 Patent requires: “and, varying rate at which the non-ordered steps are performed on the series of images according to the distance.”

518. It is my opinion that Tripathi does not disclose limitation 1(h). Nor does Rosenberg or Nakazawa, and the combination of these references would not disclose it.

519. A POSITA would understand Tripathi to be directed to a variable frame rate display that can change the frame rate based on, *inter alia*, the device power supply, type of content displayed, or user input. Ex.1040, Abstract, 6:10-20.

520. A POSITA would regard Tripathi as neither directed to capturing images nor to transforming them.

521. A POSITA would realize that Tripathi does not disclose varying the rate of performing image processing steps according to distance.

522. Tripathi’s disclosure for varying the frame rate is based on affirmative user inputs, and this variation in frame rate is not based on the distance to a user as

recited by limitation 1(h). This is shown in the passages, figures, and claims from Tripathi below.

During operation of a device such as device 10, the user input may be provided to device 10 (e.g., using input-output components such as buttons, keyboards, or touch-sensor electrodes in the display) that generates a change in display content to be displayed. Examples of user-input that may generate a change in display content include swiping a finger across the display to scroll through text or pinching the display with multiple fingers to zoom into or out of a map or other image. **Illustrative steps that may be used in setting a display frame rate based on detected user input to a device are shown in FIG. 13.**

Ex.1040, 10:40-50.

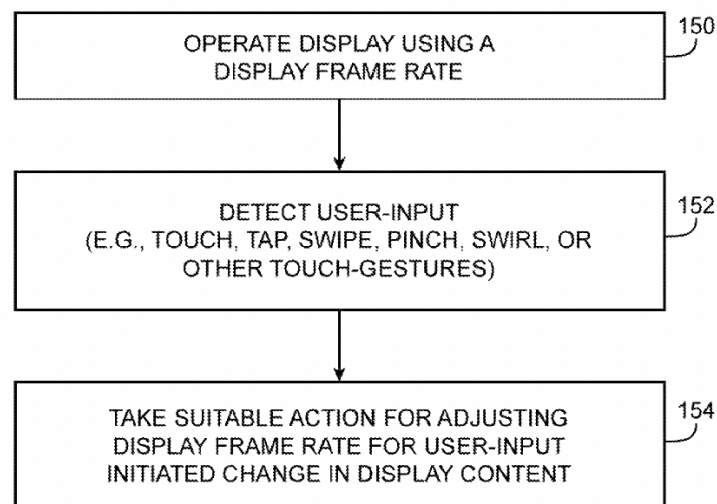


FIG. 13

Ex.1040, Fig. 13 (detecting affirmative user input results in change in frame rate).

As shown in FIG. 15, display 14 may display a page such as page 170 of a virtual book when device 10 is running, for example, an electronic reader software application. A user may use a finger such as finger 162 to swipe touch sensitive components such as touch-sensor electrodes 99 in display 14 as indicated by arrows 164. Swiping touch-sensor electrodes 99 may cause page 170 to be changed on display 14 as indicated by arrow 172 (e.g., portions of page 170 may move across display 14 with a common motion vector). **If desired, the frame rate for display 14 may be set in response to detection of any or all of the common-vector motion display content, user-input signals detected by electrodes 99 and the electronic-reader-specific display content.**

Ex.1040, 11:11-24.

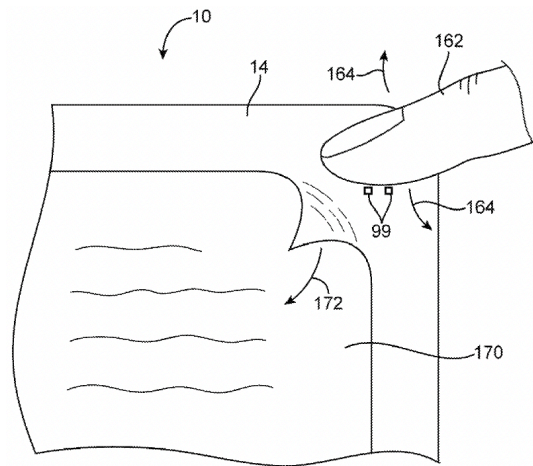


FIG. 15

Ex.1040, Fig. 15 (showing a user affirmatively interacting with the display).

As shown in FIG. 21, **a user prompt** such as prompt 224 may

be displayed on a portion of display 14 to provide a text question to the user of the device **to choose whether or not to enter the frame rate optimization mode**. The user may, as an example, **use touch-sensor electrodes 99 in the display to enter an affirmative response** using virtual button 226 or a negative response using virtual button 228. However, this is merely illustrative. **Any user input component may be used to input a response to prompt 224. In response to an affirmative response**, circuitry such as circuitry 12 of FIG. 1 **may begin actively adjusting (e.g., increasing or decreasing) the frame rate for display 14** in response to monitored operation of the electronic device as described above in connection with FIGS. 1-21.

Ex.1040, 12:54-67.

523. I disagree with Dr. Karam's opinion, that Tripathi's disclosure of adjusting frame rate based on the detection of dynamic content constitutes adjusting frame rate based on distance. Ex.1004, ¶¶ 223; Ex.2012, 145:18-146:18, 147:16-148:6. It is my opinion that Dr. Karam's assertion is unsupported by the reference. Dr. Karam relied on Figure 11 of Tripathi to support her opinion. A POSITA would understand that this variation in frame rate is not based on the distance to a user as recited by limitation 1(h).

524. A POSITA would recognize that Tripathi discloses that frame rate may, in general, be adjusted based on (1) type of display content to be displayed (e.g.,

static or dynamic); (2) user-input signals (*e.g.*, swipe, pinch, tap); (3) device power supply status; (4) other aspects of device operation. *See, e.g.*, Ex.1040, Abstract, 1:52-59, 5:42-51, 5:58-6:3, 6:29-39. A POSITA would realize that the only expressly user-related category is affirmative user actions – “user-input signals”.

An electronic device may be provided with a display. The display may be a variable frame rate display capable of adaptively adjusting a frame rate at which display frames are displayed in response to information associated with the current state of operation of the device. The information may be gathered using control circuitry in the electronic device. The control circuitry may gather the information for **adjusting the frame rate** by monitoring the electronic **device power supply configuration, other device components, the type of content to be displayed, and user-input signals**. The control circuitry may adjust the frame rate based on the gathered information by increasing or decreasing the frame rate. The control circuitry may be formed as a portion of display control circuitry for the device such as a display driver integrated circuit or may be formed as a portion of storage and processing circuitry external to the display.

Ex.1040, Abstract.

Monitoring the device operating environment and other aspects of the operation of the electronic device may include monitoring the status of a frame buffer that stores display data to be displayed on the display, monitoring the **type of display content** to be displayed with the display, monitoring **user-input signals**,

monitoring the **device power supply status**, and/or monitoring other aspects of the operation of the electronic device.

Ex.1040, 1:52-59.

Circuitry 12 may be used to monitor various attributes of the operation of the electronic device such as the activity of frame buffer 32 (e.g., the rate at which the frame buffer is updated with new display data to be displayed display), the **type of display content** to be displayed with the display (e.g., dynamic content, video content, high-frame-rate video content, common-vector motion content, and static content), **user-input signals** such as touch-sensor input signals, the **device power supply status**, and/or **other aspects of the operating environment** of the electronic device.

Ex.1040, 5:42-51.

Control circuitry 12 may be used to monitor operating environment attributes and other aspects of device operations (e.g., the rate at which new display data is provided to frame buffer 32, **the display content** being delivered to frame buffer 32, **user-input signals**, the **operational status** of other components, and the **device power supply status**) and provide signals to display driver circuitry 20 resulting in an increased or decreased the display frame rate. Increasing the display frame rate may result in a higher perceived display resolution for a user of the electric device. Decreasing the display frame rate may reduce power consumption for the device and may allow

powering down of memory associated with, for example, frame buffer 32.

Ex.1040, 5:58-6:3.

At step 50, control circuitry may be used to monitor the status of a frame buffer such a frame buffer 32, **the type of display content to be displayed** (e.g., **static** display content, **dynamic** display content, video display content, scrolling display content, application-specific display content, partially-moving display content, moving display content, etc.), **user-input signals** (e.g., **display-touch signals**, **swiping** gestures, **pinching** gestures, **tapping** gestures, button presses, etc.), **device power supply status** (e.g., a battery power supply or line power supply, and/or **other aspects of the operating environment** of the device.

Ex.1040, 6:29-39.

525. Therefore, any argument that it would have been obvious to a POSITA reading Tripathi to vary frame rate based on distance rather than affirmative user inputs is impermissibly based on hindsight bias.

4. Petitioners Fail to Show Motivation to Combine Rosenberg, Nakazawa, and Tripathi for Limitation 1(h)

526. My opinions for Grounds 1 and 3 are incorporated herein by reference.

527. It is my opinion that a POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Tripathi for limitation 1(h).

528. A POSITA would not have been motivated to combine Rosenberg, Nakazawa, and Tripathi to meet limitation 1(h) because, as discussed above, a POSITA would not have regarded any of these references as disclosing this limitation.

529. Given that none of these references disclose limitation 1(h), any argument that it would have been obvious to a POSITA reading Tripathi is impermissibly based on hindsight bias.

530. A POSITA would understand that Tripathi is directed to a variable frame rate display that can change the frame rate based on, *inter alia*, the device power supply, type of content displayed, or user input. Ex.1040, Abstract, 6:10-20. A POSITA would regard Tripathi to be unlike Rosenberg, Nakazawa, and the 109 Patent which are focused on capturing images of the user and the viewing experience of the user. In other words, a POSITA would regard Tripathi to be unlike the 109 Patent, Rosenberg, and Nakazawa in both its subject matter and technical approach.

531. I disagree with Petitioners' assertion that a POSITA would have been motivated to combine Rosenberg and Tripathi because Rosenberg "seeks to reduce power consumption." Pet. at 54. A POSITA would have found it significant that the passages from Rosenberg that Petitioners cite to concern a low-power idle mode for when the user is not present (*see, e.g.*, Ex.1005, ¶¶ 0025, 0032, 0033, 0069, 0070, 0071, 0072) whereas, by contrast, Tripathi's solution is directed to varying the frame

rate when the display device is in use: “The variable frame rate may be actively determined *during operation* of device 10 based on whether static or dynamic display content is to be displayed”. Ex.1040 at 6:10-12. Rosenberg’s solution to power consumption is to reduce power when the user is not present by putting the display in an idle or off mode; there is no suggestion in Rosenberg that other solutions to power consumption are desirable and Tripathi’s solution for power-saving is for when the device is in use. The difference between Rosenberg and Tripathi regarding power-saving solutions would have not suggested to a POSITA to combine theses references to meet limitation 1(h).

532. Additionally, a POSITA would not have been motivated to combine Tripathi with Rosenberg and Nakazawa to meet limitation 1(h) because unlike limitation 1(h) Tripathi’s disclosure for varying the frame rate is based on affirmative user inputs and this variation in frame rate is not based on the distance to a user as recited by limitation 1(h). This is shown in the passages, figures, and claims from Tripathi below.

During operation of a device such as device 10, the user input may be provided to device 10 (e.g., using input-output components such as buttons, keyboards, or touch-sensor electrodes in the display) that generates a change in display content to be displayed. Examples of user-input that may generate a change in display content include swiping a finger across the display to scroll through text or pinching the display

with multiple fingers to zoom into or out of a map or other image. **Illustrative steps that may be used in setting a display frame rate based on detected user input to a device are shown in FIG. 13.**

Ex.1040, 10:40-50.

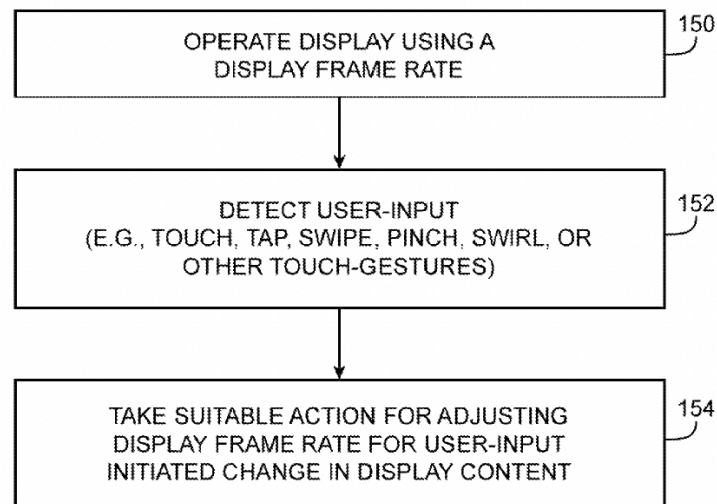


FIG. 13

Ex.1040, Fig. 13 (detecting affirmative user input results in change in frame rate).

As shown in FIG. 15, display 14 may display a page such as page 170 of a virtual book when device 10 is running, for example, an electronic reader software application. A user may use a finger such as finger 162 to swipe touch sensitive components such as touch-sensor electrodes 99 in display 14 as indicated by arrows 164. Swiping touch-sensor electrodes 99 may cause page 170 to be changed on display 14 as indicated by arrow 172 (e.g., portions of page 170 may move across display 14 with a common motion vector). **If desired, the frame rate for display 14 may**

be set in response to detection of any or all of the common-vector motion display content, user-input signals detected by electrodes 99 and the electronic-reader-specific display content.

Ex.1040, 11:11-24.

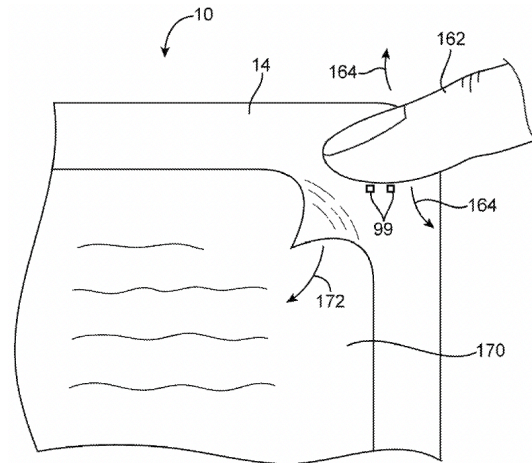


FIG. 15

Ex.1040, Fig. 15 (showing a user affirmatively interacting with the display).

As shown in FIG. 21, a **user prompt** such as prompt 224 may be displayed on a portion of display 14 to provide a text question to the user of the device **to choose whether or not to enter the frame rate optimization mode.** The user may, as an example, **use touch-sensor electrodes 99 in the display to enter an affirmative response** using virtual button 226 or a negative response using virtual button 228. However, this is merely illustrative. **Any user input component may be used to input a response to prompt 224. In response to an affirmative response,** circuitry such as circuitry 12 of FIG. 1 **may begin**

actively adjusting (e.g., increasing or decreasing) the frame rate for display 14 in response to monitored operation of the electronic device as described above in connection with FIGS. 1-21.

Ex.1040, 12:54-67.

533. Dr Karam offers the opinion that Tripathi's disclosure of adjusting frame rate based on the detection of dynamic content constitutes adjusting frame rate based on distance. Ex.1004, ¶ 223; Ex.2012, 145:18-146:18, 147:16-148:6. I disagree with this opinion. Dr. Karam relied on Figure 11 of Tripathi to support her opinion. A POSITA would understand that Figure 11 of Tripathi refers solely to adjusting frame rate based on the dynamic properties of the content to be displayed. The POSITA is presumed to have read Tripathi, where the POSITA would find in column 6, lines 29-39 examples of (a) the kind of dynamic content variations the device should respond to and (b) the kind of "user input signals" the device should respond to. Tripathi is clear that the user provides explicit signals. There is no support in Tripathi for the idea that variation in frame rate is based on distance to a user, and Figure 11 certainly does not support this idea. A POSITA would understand that this variation in frame rate is not based on the distance to a user as recited by limitation 1(h).

534. A POSITA would recognize that Tripathi discloses that frame rate may, in general, be adjusted based on (1) type of display content to be displayed (e.g.,

static or dynamic); (2) user-input signals (*e.g.*, swipe, pinch, tap); (3) device power supply status; (4) other aspects of device operation. *See, e.g.*, Ex.1040, Abstract, 1:52-59, 5:42-51, 5:58-6:3, 6:29-39. A POSITA would realize that the only expressly user-related category is affirmative user actions – “user-input signals”.

An electronic device may be provided with a display. The display may be a variable frame rate display capable of adaptively adjusting a frame rate at which display frames are displayed in response to information associated with the current state of operation of the device. The information may be gathered using control circuitry in the electronic device. The control circuitry may gather the information for **adjusting the frame rate** by monitoring the electronic **device power supply configuration**, **other device components**, **the type of content to be displayed**, and **user-input signals**. The control circuitry may adjust the frame rate based on the gathered information by increasing or decreasing the frame rate. The control circuitry may be formed as a portion of display control circuitry for the device such as a display driver integrated circuit or may be formed as a portion of storage and processing circuitry external to the display.

Ex.1040, Abstract.

Monitoring the device operating environment and other aspects of the operation of the electronic device may include monitoring the status of a frame buffer that stores display data to be displayed on the display, monitoring the **type of display content** to be displayed with the display, monitoring **user-input signals**,

monitoring the **device power supply status**, and/or monitoring other aspects of the operation of the electronic device.

Ex.1040, 1:52-59.

Circuitry 12 may be used to monitor various attributes of the operation of the electronic device such as the activity of frame buffer 32 (e.g., the rate at which the frame buffer is updated with new display data to be displayed display), the **type of display content** to be displayed with the display (e.g., dynamic content, video content, high-frame-rate video content, common-vector motion content, and static content), **user-input signals** such as touch-sensor input signals, the **device power supply status**, and/or **other aspects of the operating environment** of the electronic device.

Ex.1040, 5:42-51.

Control circuitry 12 may be used to monitor operating environment attributes and other aspects of device operations (e.g., the rate at which new display data is provided to frame buffer 32, **the display content** being delivered to frame buffer 32, **user-input signals**, the **operational status** of other components, and the **device power supply status**) and provide signals to display driver circuitry 20 resulting in an increased or decreased the display frame rate. Increasing the display frame rate may result in a higher perceived display resolution for a user of the electric device. Decreasing the display frame rate may reduce power consumption for the device and may allow

powering down of memory associated with, for example, frame buffer 32.

Ex.1040, 5:58-6:3.

At step 50, control circuitry may be used to monitor the status of a frame buffer such a frame buffer 32, **the type of display content to be displayed** (e.g., **static** display content, **dynamic** display content, video display content, scrolling display content, application-specific display content, partially-moving display content, moving display content, etc.), **user-input signals** (e.g., **display-touch signals**, **swiping** gestures, **pinching** gestures, **tapping** gestures, button presses, etc.), **device power supply status** (e.g., a battery power supply or line power supply, and/or **other aspects of the operating environment** of the device.

Ex.1040, 6:29-39.

535. A POSITA would not have been motivated to combine Rosenberg and Nakazawa with Tripathi as to limitation 1(h) simply because neither reference even suggests the varying required by this limitation. It would not have been obvious to a POSITA to include this property and any suggestion that it would have been obvious is impermissibly based on hindsight.

IV. CONCLUSION

536. For the reasons above, it is my opinion that Petitioners' Grounds so not invalidate the challenged claims.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge based on the information available to me at this time, and that this declaration was executed on March 6, 2025, in Urbana, Illinois.

A handwritten signature in red ink, consisting of a series of stylized, overlapping strokes that form a cursive-like pattern.

Dr. David Forsyth

Attachment 1

Curriculum Vitae:

D.A. Forsyth

Birth

2 May, 1963, Cape Town, South Africa.

Degrees

1. B.Sc., Electrical Engineering, U. of the Witwatersrand, Johannesburg, 1984
2. B.Sc., Electrical Engineering, U. of the Witwatersrand, Johannesburg, 1986
3. M.A., (procedural degree), Oxford University, 1989
4. D.Phil., Oxford University, 1989

Appointments

1. Fellow, Magdalen College, Oxford, Jan. 1989-Jan. 1992
2. Assistant Professor, Dept. of Computer Science, U. of Iowa, Sept. 1991-Jul. 1994
3. Associate Professor, Dept. of Computer Science, U. of Iowa, July 1994-Jul. 1996
4. Assistant Professor, Dept. of Computer Science, U. of California, Berkeley, Jul. 1994-Jun. 1996
5. Associate Professor, Dept. of Computer Science, U. of California, Berkeley, Jul. 1996-Jun. 2002
6. Full Professor, Dept. of Computer Science, U. of California, Berkeley, Jul. 2002-Jun 2006
7. Full Professor, Dept. of Computer Science, U. of Illinois, Aug. 2004-Present
8. Fulton Watson Copp Chair in Computer Science, U. of Illinois, May 2014-Present

Honors and Awards

1. Diocesan College Rhodes Scholar, 1985
2. National Science Foundation Research Initiation Award, 1992
3. National Science Foundation Young Investigator Award, 1992
4. Marr Prize, Best Paper at 1993 ICCV, 1993
5. Best Paper in Cognitive Computer Vision, ECCV, 2002
6. Okawa Foundation Fellowship, 2003
7. IEEE Technical Achievement Award, 2006
8. IEEE Fellow, 2009
9. ACM Fellow, 2014

Consulting Activities

1. Consultant, intellectual property law firm, 65 hours billed, 1998-99
2. Consultant on retainer, FujiFilm Software CA, 2001-2006
3. Consultant, venture capital firm, 3 hours billed, 2002
4. Consultant, intellectual property law firm, 13 hours billed, 2003
5. Consultant, State's attorney's general, 1 hour, 2006
6. Technical Advisor, Euclid Media, 2007-2008
7. Technical Advisor, Animate-me, 2007-2008, helped them get NSF SBIR award

8. Technical Advisor, Snap-and-buy, 2007-2008
9. Technical Advisor, Lumenous, 2015-present, helped them get NSF SBIR award.
10. Technical Advisor, Depix, 2020-present
11. Technical Advisor, Revery.ai, 2020-present
12. Consultant, Foley+Lardner, 2009-2010
including reading and report preparation, 10 hours deposition, attendance at trial, about 4 hours direct examination at trial, about 2 hours cross examination at trial. Matter was 337-TA-680 in the ITC
13. Consultant, Sheridan and Ross (IP law firm), 2012-2013;
including reading, search and report preparation; district court case number 6:11-cv-00494
14. Consultant, Fish and Richardson, 2014-2015
including reading and report preparation, deposition in IPR invalidity, deposition on non-infringement, presenting to district court judge on technical tutorial. Matter was IpLearn-Focus, LLC vs Microsoft Corp, district court case number 3:14-cv-00151-JD. IPR's were IPR2015-00095; IPR2015-00096; IPR2015-00097.
15. Consultant, Irell and Manella, 2016-2018
including reading, search and report preparation; 3 full day depositions; IPR petitions; *Legend3D, Inc. v. Prime Focus Creative Services Canada Inc.*, IPR2016-00806; *Prime Focus Creative Services Canada Inc. v. Legend3D, Inc.*, IPR2016-01243; and *Prime Focus Creative Services Canada Inc. v. Legend3D, Inc.*, IPR2016-01491. Parties were: Legend 3D and Prime Focus Creative Services Canada
16. Consultant, Klarquist Sparkman, 2019-current
Including reading, search and report preparation for invalidity and non-infringement, for district court matter. 1 full day deposition. *Kewazinga Corp. v. Microsoft Corporation*, Southern District of New York, 1:2018-cv-04500 (SDNY)
Parties were: Microsoft Inc. and Kewazinga Corp.
17. Consultant, Scientific Advice to Apple, 2021
18. Consultant, Kerr, Russell and Weber,
2020-2022, Parties were Innovision and Autis: engaged, but only 1 hr work done.,
19. Consultant, Oblon, 2021,
Parties were: Eagle View Technologies Inc.; Pictometry International Corp; Nearmap US Inc; Nearmap Australia, Pty, Ltd and Nearmap Ltd)
21. Consultant, Tensegrity Law group, 2021
Parties were: Facebook, Inc.; MTA Platforms, Inc; Instagram LLC; Whatsapp, Inc; Eyesmatch, Ltd; Memomi Labs, Inc. The activities involved preparing materials for IPRs involving U.S. Patent Nos. 7,948,481, and 8,624,883
22. Consultant, Quinn Emmanuel, 2021
The matter was: Certain Barcode Scanners, Mobile Computers with Barcode Scanning Capabilities, Scan Engines, and Components Thereof (Inv. No. 337-TA-1285); Honeywell Int'l Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. v. Zebra Techs. Corp., Civil Action No. 6:21-cv-01008-ADA; Honeywell Int'l Inc., Hand Held Products, Inc., and Metrologic Instruments, Inc. v. Zebra Techs. Corp., Civil Action No. 6:21-cv-01010-ADA;
23. Consultant, Fish and Richardson, 2022-present
Including reading, search, report preparation and deposition for five IPR's:
IPR2022-00733, IPR2022-00734, IPR2022-00735, IPR2022-01090, IPR2022-01009
Parties are: Eagle View Technologies Inc.; Pictometry International Corp; Nearmap US Inc; Nearmap Australia, Pty, Ltd and Nearmap Ltd)
24. Consultant, Groombridge Wu, present
Parties are: Eagle View Technologies Inc.; Pictometry International Corp; Nearmap US Inc; Nearmap Australia, Pty, Ltd and Nearmap Ltd)
25. Consultant, Tensegrity, present
Parties are: Eyesmatch Ltd; Samsung Electronics, Ltd
EyesMatch Ex2013
Google et al. v. EyesMatch, IPR2024-00856

Graduated PhD Students

1. C.A. Rothwell (co advised with A. Zisserman)
2. J.Haddon
3. F.S.Cho
4. S.J. Chenney
5. S.Ioffe
6. P.Duygulu (co-advised)
7. O.Arikan
8. D.Ramanan
9. T.Berg (nee Miller)
10. J.Edwards
11. R.White
12. L.Ikemoto
13. N.Loeff
14. A.Farhadi
15. D.Tran
16. A.Sorokin
17. G.Wang
18. V.Hedau (joint with D. Hoiem)
19. B.Jones (joint with B. Bailey)
20. R.Sodhi (joint with B. Bailey)
21. K.Karsch
22. A.Sadeghi
23. Z.Liao
24. S. Singh
25. D. Tsatsoulis
26. J. Lu
27. J. Rock
28. A. Deshpande
29. M. Vasileva
30. D. Roberts (joint with M. Golparvar Fard)
31. T. Issaranon
32. M-J. Chong
33. Anand Bhattad
34. Kedan Li

Editorial Boards

1. Associate Editor, IEEE Trans. Multimedia
2. Editorial Board, Int. J. Computer Vision
3. Associate Editor, IEEE Trans Pattern Analysis and Machine Intelligence, 2 terms
4. Associate Editor, J. ACM, since 2011
5. Associate Editor, ACM Transactions on Graphics, since 2011
6. Editor in Chief, IEEE Trans. Pattern Analysis and Machine Intelligence, 2013-2017

Service and Administration

1. Committee member, U.C. Berkeley Committee on Admissions, Enrollment and Preparatory Education, 1995-2001 (Dealt with the University's response to the UC Regents order on affirmative action; established now well-known new admission policy for UC Berkeley, currently being taken up by other UC campuses).
2. Committee member, U.C. Berkeley Rhodes and Marshall Scholarship Committee, 1999-2003.
3. Member, National Research Council Committee on Tools and Strategies for Protecting Kids from Pornography and Their Applicability to Other Inappropriate Internet Content. (3 years of hearings, both closed and public, and an extensive report that was very well received by the popular press)
4. Founder and Member, Executive Committee of the Board, Berkeley Foundation for Opportunity in Information Technology. (Foundation seeks to ensure that Demographics of California University Computer Science Departments reflects that of the state, by helping targeted schoolchildren improve their understanding of science and their college application packets; by offering scholarships; and by various other means.)
5. Program Co-Chair: ECCV2008, CVPR 2000, CVPR2011, CVPR2018, CVPR2021, ICCV2025
(Note: For vision conferences, program chairs cannot submit papers; PC is a major administrative task; CVPR2018 had approx. 5000 submissions and CVPR 2021 had approx. 7000 submissions)
6. General Co-Chair: CVPR2006, CVPR2015, ICCV2019
7. Senior Advisor to Program Chairs: CVPR2024
8. Associate Department Chair, UIUC CS Department, 2011-2015
9. Adjunct Professor, TTIC, 2015-ongoing
10. Scientific Advisory Board, Allen Institute for Artificial Intelligence, 2015-to date
11. Scientific Advisory Board, KAUST Visual Computing Institute, 2016-ongoing
12. Scientific Advisory Board, Baidu Research, 2017-ongoing
13. Editor in Chief, IEEE Trans. Pattern Analysis and Machine Intelligence, 2013-2017
14. Committee member, UIUC Senate Committee on Student Discipline, 2017-present
15. Ombud, CVPR, 2018-present
16. Member, 8'th Senate review commission, UIUC 2018-2019
17. Chair, UIUC Senate committee for Academic Freedom and Tenure, 2020-present
Duties included: Significant Article X Hearing (40 hours of testimony) and managing difficult academic freedom disputes
18. Technical Advisory board, Depix, 2019-present
19. Scientific advisor, Revery.ai, 2020-present
20. Moderator for Computer Vision, ArXiv, 2017(?) -present
21. Chair, search committee for EIC IEEE TPAMI, 2021

US Patents

1. US 9330500 B2 Inserting objects into content, Kevin Karsch, Varsha Chandrashekhara Hedau, David A. Forsyth, Derek Hoiem
2. US 8842118 B1 Automated image replacement using deformation and illumination estimation, Ryan White, David Forsyth
3. US 9,471,967, Relighting Fragments For Insertion Into Content, Kevin Karsch, Zicheng Liao, David Forsyth,

Publications

Authored books

1. Forsyth, D.A. and Ponce, J., *Computer Vision: A Modern Approach*, Prentice-Hall, 2002.
2. Forsyth, D.A. and Ponce, J., *Computer Vision: A Modern Approach*, 2002. Chinese Language Edition
3. Forsyth, D.A. and Ponce, J., *Computer Vision: A Modern Approach*, 2002. Russian Language Edition
4. Forsyth, D.A. and Ponce, J., *Computer Vision: A Modern Approach*, 2002. Japanese Language Edition
5. Forsyth, D.A., Arikan, O., Ikemoto, L., O'Brien, J., and Ramanan, D., *Computational Studies of Human Motion: Part 1, Tracking and Motion Synthesis*, ISBN: 1-933019-30-1 178pp July 2006 (also available as *Foundations and Trends in Computer Graphics and Vision Volume 1 Issue 2/3* (255pp), 2006)
6. Forsyth, D.A. and Ponce, J., *Computer Vision: A Modern Approach* (2e), Prentice Hall, 2011 (heavily revised edition, about 50% new material)
7. Forsyth, D.A., *Probability and Statistics for Computer Science*, Springer Verlag, 2018
8. Forsyth, D.A., *Applied Machine Learning*, Springer Verlag, 2019

Edited books

1. *Computer Vision - ECCV 2008. 10'th European Conference on Computer Vision, Part I*, D.A. Forsyth, P.H.S. Torr and A. Zisserman, Springer Verlag LNCS 5302, 801 pp, 2008
2. *Computer Vision - ECCV 2008. 10'th European Conference on Computer Vision, Part II*, D.A. Forsyth, P.H.S. Torr and A. Zisserman, Springer Verlag LNCS 5303, 851pp., 2008
3. *Computer Vision - ECCV 2008. 10'th European Conference on Computer Vision, Part II*, D.A. Forsyth, P.H.S. Torr and A. Zisserman, Springer Verlag LNCS 5304, 893pp., 2008
4. *Computer Vision - ECCV 2008. 10'th European Conference on Computer Vision, Part II*, D.A. Forsyth, P.H.S. Torr and A. Zisserman, Springer Verlag LNCS 5305, 827pp., 2008
5. *Applications of Invariance in Computer Vision*, J.L. Mundy, A. Zisserman and D.A. Forsyth, (ed.s), Springer LNCS 825, 1994.
6. *Shape, contour and grouping in computer vision*, D.A. Forsyth, J.L. Mundy, R. Cipolla and V. DiGes'u (ed.s), Springer-Verlag LNCS 1681, 2000.

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1. Forsyth, D.A., "Colour constancy," in Blake, A. and Troscianko, T. (eds.), *AI and the Eye*, John Wiley and Sons, 1990.
2. A. Zisserman, C.A. Rothwell, D. A. Forsyth and J. L. Mundy, "Fast Recognition using Algebraic Invariants," in Mundy, J.L and Zisserman, A. (eds.), *Applications of Invariance in computer vision*, MIT press, 1992.
3. w A. Zisserman, D. A. Forsyth, C. A. Rothwell, and J. L. Mundy, "Recognising General Curved Objects Efficiently," in Mundy, J.L and Zisserman, A. (eds.), *Applications of Invariance in computer vision*, MIT press, 1992.
4. C. Coehlo, A. Heller, J.L. Mundy, D.A.Forsyth and A. Zisserman, "An experimental evaluation of projective invariants," in Mundy, J.L and Zisserman, A. (eds.), *Applications of Invariance in computer vision*, MIT press, in print, 1992.
5. Forsyth, D.A., Mundy, J.L., Zisserman, A.P. and Rothwell, C.A. "Applications of invariant theory in vision," In Kapur, D. and Donald, B.R. (eds.), *Integrating Symbolic and Numerical Methods for Artificial Intelligence*, Academic Press, 1992.
6. D.A. Forsyth, "The outline of an algebraic surface yields the surface," *Design and application of curves and surfaces*, R.B. Fisher (ed.), OUP, 1994.
7. F.S. Cho and D.A. Forsyth, "Hidden Feature Removal," *Wiley Encyclopedia of Electrical and Electronics Engineering*, vol. 8, pp. 713-725. New York: John Wiley & Sons, 1999. (invited review).
8. D.A. Forsyth, "Foreword", in H. Aghajan and A. Cavallero, *Multi-Camera Networks*, Elsevier, 2009
9. D.A. Forsyth and J. Malik, " Computer Vision", in S.J. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach* 3e, Pearson, 2009
10. D.A. Forsyth, T. Berg, C. Alm, A. Farhadi, J. Hockenmaier, N. Loeff, G. Wang, "Words and Pictures: Categories, Modifiers, Depiction and Iconography" in *Object Categorization: Computer and Human Vision Perspectives* S. Dickinson, A. Leonardis, B. Schiele, and M. Tarr, (eds), Cambridge University Press, 2009.
11. D.A. Forsyth and J. Malik, " Computer Vision", in S.J. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach* 4e, Pearson, 2020

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1. Forsyth, D.A., "A novel algorithm for colour constancy," *International Journal of Computer Vision*, 5:1, 5-36, July, 1990. Reprinted in *Physics based vision* (3 vols.), edited by S.A. Shafer, G. Healey, and L.B. Wolff, 1992.
2. Forsyth, D.A. and Zisserman, A., "Shape from shading in the light of mutual illumination," *Image and Vision Computing*, 8:1, 42-49, 1990.
3. Forsyth, D.A., Mundy, J.L., Zisserman, A.P. and Brown, C.M., "Projectively Invariant Representations Using Implicit Algebraic Curves," 9:2, 130-136, 1991.
4. Forsyth, D.A., Mundy, J.L., Zisserman, A.P., "Transformational Invariance- a primer," *Image and Vision Computing*, 10:1, 39-45, 1992.
5. s Forsyth, D.A., and Zisserman, A.P., "Reflections on Shading," *IEEE Trans. Pattern Analysis and Machine Intelligence*, Special issue on physical modeling in computer vision, 13:7, 671-679, Jul. 1991.
6. Forsyth, D.A., Mundy, J.L., Zisserman, A.P., Coelho, C., Heller, A. and Rothwell, C.A., "Invariant descriptors for 3D object recognition and pose," *IEEE Trans. Pattern Analysis and Machine Intelligence*, Special issue on 3D object recognition, 13:10, 971-991, Oct. 1991.
7. Rothwell, C.A., Zisserman, A.P., Marinos, C.I., Forsyth, D.A. and Mundy, J.L., "Relative motion and pose from arbitrary plane curves," *Image and Vision Computing*, 10:4, 250-262, 1992.
8. Rothwell, C.A., Zisserman, A., Forsyth, D.A. and Mundy, J.L., "Planar Object Recognition using Projective Shape Representation," *International J. of Computer Vision*, 16:1, 57-99, Sept. 1995.
9. Zisserman, A., Forsyth, D.A., Mundy, J.L., Rothwell, C.A., and Liu, J.S., "3D Object Recognition using Invariance," *Artificial Intelligence*, 78:1-2, 239-288, Oct. 1995.
10. Forsyth, D.A., "Recognizing Algebraic Surfaces from their Outlines," *International J. Computer Vision*, 18:1, 21-40, 1996.
11. Forsyth, D.A. and Fleck, M. M., "Automatic Detection of Human Nudes," *International J. Computer Vision*, 32:1, 63-77, Aug. 1999.
12. Chenney, S., Ichnowski, J. and Forsyth, D.A., "Dynamics modeling and culling," *IEEE Computer Graphics and Applications*, 19:2, 78-87, 1999.
13. Cho, F.S. and Forsyth, D.A., "Interactive Ray Tracing with the Visibility Complex," *Computers and Graphics*, Special Issue on Visibility - Techniques and Applications, 23:5, 703-717, 1999.
14. Forsyth, D.A., "Computer Vision Tools for Finding Images," *Library Trends, Topic: Progress in Visual Information Access and Retrieval*, 48:2, Fall 1999.
15. Stephen Chenney and D. A. Forsyth. "Sampling Plausible Solutions to Multi-Body Constraint Problems," *Proceedings of SIGGRAPH 2000*, p.219-28, 2000
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17. Forsyth, D.A., Haddon, J., and Ioffe, S., "The Joy of Sampling," *International J. Computer Vision*, 41:1-2, 109-134, Jan. 2001.
18. O. Arikan and D.A. Forsyth, "Interactive Motion Generation from Examples," *Proc. SIGGRAPH*, 2002
19. O. Arikan, Forsyth, D.A., and J. O'Brien "Motion Synthesis from Annotations," *SIGGRAPH 2003*, San Diego, CA, Jul. 2003, in *ACM Transactions on Graphics*, vol. 33:3, 402-408, 2003
20. Barnard, K., Duygulu, P., Forsyth, D., de Freitas, N., Blei, D.M, Jordan, M. I., "Matching Words and Pictures," *Journal of Machine Learning Research*, 3(Feb):1107-1135, 2003.
21. Okan Arikan, David A. Forsyth, James F. O' Brien, "Fast and detailed approximate global illumination by irradiance decomposition," *ACM Transactions on Graphics (TOG) (SIGGRAPH 05)* Volume 24 , Issue 3 (July 2005)
22. A. Lobay and D.A. Forsyth, "Shape from Texture without Boundaries," *Int. J. Computer Vision*, 67, 1, 71-91, 2006
23. David A. Forsyth, Okan Arikan, Leslie Ikemoto, James O' Brien, Deva Ramanan, "Computational Studies of Human Motion: Part 1, Tracking and Motion Synthesis," *Foundations and Trends in Computer Graphics and Vision* Volume 1 Issue 2/3 (255pp), 2006 (also published in book form).
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26. Ryan White, Keenan Crane, David Forsyth, "Capturing and Animating Occluded Cloth," *ACM Transaction on Graphics (SIGGRAPH)*, 2007.
27. T. Berg, A. Berg, R. White, E. Learned Miller, Y.W. The and D.A. Forsyth, "Names and Faces," accepted for publication, *IJCV* 2008
28. L. Ikemoto, O.Arikan and D.A. Forsyth, "Generalizing motion edits with Gaussian processes," *ACM Transactions on Graphics*, 2009
29. N. Ikizler and D.A. Forsyth, "Searching for Complex Human Activities with No Visual Examples," *Int. J. Computer Vision*, 2008.

30. Tamara L. Berg and Alexander Sorokin and Gang Wang and David A. Forsyth and Derek Hoiem and Ali Farhadi and Ian Endres, It's all about the data, *Proceedings of IEEE*, 2010
31. D. Forsyth, "Variable Source Shading Analysis", *Int J. Computer Vision*, Volume 91 Issue 3, February 2011
32. Anna Paviotti, David A. Forsyth and Guido M. Cortelazzo, "Lightness Recovery for Pictorial Surfaces", *Int J Computer Vision*, Vol 94, Issue 1, 2011
33. Kevin Karsch, Varsha Hedau, Derek Hoiem and D.A. Forsyth, "Rendering Synthetic objects into Legacy Photographs", *ACM Transactions on Graphics (Proc SIGGRAPH Asia)*, V 30, Issue 6, 2011
34. Gang Wang, Derek Hoiem, David Forsyth, "Learning Image Similarity from Flickr Groups Using Fast Kernel Machines," *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, Nov. 2012.
35. Zicheng Liao, Hugues Hoppe, David Forsyth, Yizhou Yu, A subdivision-based representation for vector image editing. *IEEE Trans. Vis. Comput. Graphics*, 18(11), Nov. 2012. (Spotlight Paper)
36. Yang Wang, Duan Tran, Zicheng Liao, D.A. Forsyth, Discriminative Hierarchical Part-based Models for Human Parsing and Action Recognition, *J. Machine Learning Research* 13 (Oct) 2012, 3075-3102
37. G. Wang, D. Hoiem, D.A. Forsyth, "Improved object categorization and detection using comparative object similarity", *IEEE TPAMI* 2013, Vol. 99
38. Recognizing activities in multiple views with fusion of frame judgments Selen Pehlivan, David A. Forsyth, *Image and Vision Computing* 32 (2014) 237-249
39. Karsch, K.; Golparvar-Fard M.; Forsyth, D., "ConstructAide: Analyzing and visualizing construction sites through photographs and building models" *ACM Transactions on Graphics* (to be presented at SIGGRAPH Asia), 2014.
40. Karsch, K.; Sunkavalli, K. Hadap, S.; Carr, N.; Jin, H.; Fonte, R.; Sittig, M.; Forsyth, D. "Automatic scene inference for 3D object compositing," *ACM Transactions on Graphics* (presented at SIGGRAPH), 33, 3, 2014.
41. Du Tran, Junsong Yuan, and David Forsyth, Video Event Detection: from Subvolume Localization to Spatio-Temporal Path Search, *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, 2014
42. Zicheng Liao, Kevin Karsch, Hongyi Zhang, D.A. Forsyth, "An Approximate Shading Model with Detail Decomposition for Object Relighting" *Int. J. Computer Vision*, 2018
43. D.A. Forsyth and Jason Rock, "Intrinsic Image Decomposition using Paradigms", *IEEE TPAMI*, November, 2022
44. Xiaoyang Bai, Zhongmin Zhu, Alexander Schwing, David Forsyth, Viktor Gruev, "Angle of polarization calibration for omnidirectional polarization cameras" *Opt Express*. 2023 Feb 13;31(4):6759-6769.
45. Kedan Li, Jeffrey Zhang, David Forsyth, "POVNet: Image-Based Virtual Try-On Through Accurate Warping and Residual" *IEEE Trans Pattern Anal Mach Intell*, accepted for publication Jun 2023
46. Xiaoyang Bai, Zuodong Liang, Zhongmin Zhu, Alexander Schwing, David Forsyth & Viktor Gruev, "Polarization-based underwater geolocalization with deep learning", *eLight* volume 3, Article number: 15 (2023)
47. Y. Shen, B. Chandaka, Z-H. Lin, A. Zhai, H. Cui, D.A. Forsyth, S. Wang, "Sim-on-Wheels: Physical World in the Loop Simulation for Self-Driving", *IEEE Robotics and Automation Letters*, Accepted for publication, 2023

Conference papers

1. s Forsyth, D.A., "Finding Changes in Colour," *Proc. 1987 Alvey Vision Conference*.
2. s Brady, J.M., Cameron, S.A., Durrant-Whyte, H., Fleck, M.M., Forsyth, D.A., Noble, J.A., and Page, I., "Progress towards a system that can acquire pallets and clean warehouses," *Proc. ISRR*, 1987.
3. s Forsyth, D.A., "A novel approach to colour constancy," *Proc. 2nd International Conference on Computer Vision*, 9-18, 1988.
4. s Forsyth, D.A. and Zisserman, A., "Mutual illumination," *Proc. IEEE conference on Computer Vision and Pattern Recognition*, 466-473, 1989.
5. s Forsyth, D.A. and Zisserman, A., "Shape from shading in the light of mutual illumination," *Proc. 5th Alvey Vision Conference*, 193-198, 1989.
6. Forsyth, D.A., Mundy, J.L., Zisserman, A.P. and Brown, C.M., "Projectively Invariant Representations Using Implicit Algebraic Curves," *1st European Conference on Machine Vision*, 427-436, 1990. (also OU Internal report no: 1829/90).
7. Forsyth, D.A., Mundy, J.L., Zisserman, A.P. and Brown, C.M., "Invariance-a neFramework for vision," *3rd International Conference on Computer Vision*, Osaka, Japan, 598-605, 1990. (also OU Internal report no: 1830/90)
8. Forsyth, D.A., Mundy, J.L., Zisserman, A.P. and Brown, C.M., "Transformational Invariance - a primer," *British Machine Vision Association Conference*, 1-6, 1990.
9. Zisserman, A.P., Marinos, C.I., Forsyth, D.A., Mundy, J.L. and Rothwell, C.A., "Relative motion and pose from invariants," *British Machine Vision Association Conference*, 7-12, 1990.
10. Rothwell, C.A., Zisserman, A.P., Forsyth, D.A. and Mundy, J.L., "Using Projective Invariants for constant time

- library indexing in model based vision," Proc. British Machine Vision Conference, 1991.
11. Rothwell, C.A., Zisserman, A., Forsyth, D.A., and Mundy, J.L., "Canonical Frames for Planar Object Recognition," 2nd European Conference on Computer Vision, Springer Verlag Lecture Notes in Computer Science, 757-772, 1992.
 12. Rothwell, C.A., Zisserman, A., Mundy, J.L., and Forsyth, D.A., "Efficient Model Library Access by Projectively Invariant Indexing Functions," Computer Vision and Pattern Recognition 92, 109-114, 1992.
 13. Forsyth, D.A., Mundy, J.L., Zisserman, A.P., and Rothwell, C.A., "Recognising rotationally symmetric surfaces from their outlines," Proc. 2nd European Conference on Computer Vision, Santa Margherita Ligure, Italy, May 1992, 639-648, 1992.
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 15. Forsyth, D.A., "Recognizing Algebraic Surfaces from their Outlines," International Conference on Computer Vision, Berlin, Germany, 476-480, 1993.
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 17. Forsyth, D.A. and Rothwell, C.A., "Recognising extruded surfaces from their outlines," Proc. Allerton Conference on communication, computing and control, 1993.
 18. Forsyth, D.A., Mundy, J.L., Rothwell, C.A., and Zisserman, A., "Using global consistency to recognize Euclidean objects with an uncalibrated camera," Proc CVPR-94, Seattle, WA, 1994.
 19. Forsyth, D.A., Yang, C.K., and Teo, K.B., "Efficient radiosity in dynamic environments," Proc. 5th Eurographics workshop on rendering, 1994.
 20. Zisserman, A., Mundy, J.L., Forsyth, D.A., Liu, J.S., Pillow, N., Rothwell, C.A. and Uteke, S., "Class-based grouping in perspective images," Proc. 5th International Conference on Computer Vision, Boston, MA., June 20-23, 1995.
 21. M.M. Fleck, D.A. Forsyth, and C. Bregler, "Finding naked people," Fourth European Conf. on Computer Vision, Cambridge, UK, Apr. 1996, in Buxton, B. and Cipolla, R. (eds.), Computer Vision -- ECCV'96, Vol. II, Lecture Notes in Computer Science, vol. 1065, 593-602, Berlin, Germany: Springer-Verlag.
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 25. Forsyth, D.A. and Fleck, M.M., "Finding People and Animals by guided Assembly," Proc. Imagina Conference, 70-77, 1997 (invited paper).
 26. Kim, S-K and Forsyth, D.A., "A New Approach for Road Sign Detection and Recognition Algorithm," Proc. 30th ISATA Conference, 1997.
 27. Cheney, S.J. and Forsyth, D.A., "View Dependent Culling of Dynamic Systems in Virtual Environment," ACM Symposium on Interactive 3D Graphics, 1997.
 28. Forsyth, D.A. and Fleck, M.M., "Body Plans," Proc. CVPR '97, San Juan, Puerto Rico, Jun. 1997, 678-683, 1997.
 29. Forsyth, D.A. and Fleck, M.M., "Finding people and animals by guided assembly," Proc. International Conference on Image Processing, Washington, DC, Oct. 1997, vol. 3, 5-8, 1997 (invited paper).
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