

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.; AND
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner

v.

Power2B Inc.
Patent Owner.

**DECLARATION OF BENJAMIN B. BEDERSON IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,156,931**

Petitioner Samsung Ex. 1002 - Page 1 of 86

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LIST OF EXHIBITS¹

Ex-1001	U.S. Patent No. 10,156,931
Ex-1002	Declaration of Dr. Benjamin Bederson
Ex-1003	Curriculum Vitae of Dr. Benjamin Bederson
Ex-1004	Prosecution History of U.S. Patent No. 10,156,931
Ex-1005	U.S. Patent Publication no. 2003/0156100, published on August 21, 2003 (“Gettemy”)
Ex-1006	U.S. Patent No. 4,879,461, issued on November 7, 1989 (“Philipp”)
Ex-1007	WIPO/PCT Publication no. WO1986000447, published on January 16, 1989 (“Carstedt”)
Ex-1008	[INTENTIONALLY LEFT BLANK]
Ex-1009	[INTENTIONALLY LEFT BLANK]
Ex-1010	[INTENTIONALLY LEFT BLANK]
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Ex-1012	[INTENTIONALLY LEFT BLANK]
Ex-1013	[INTENTIONALLY LEFT BLANK]
Ex-1014	[INTENTIONALLY LEFT BLANK]
Ex-1015	[INTENTIONALLY LEFT BLANK]
Ex-1016	[INTENTIONALLY LEFT BLANK]
Ex-1017	[INTENTIONALLY LEFT BLANK]
Ex-1018	[INTENTIONALLY LEFT BLANK]

¹Four-digit pin citations that begin with 0 are to the page stamps added by Samsung in the bottom right corner of the exhibits. All other pin citations are to original page, column, paragraph, and/or line numbers.

Ex-1019	[INTENTIONALLY LEFT BLANK]
Ex-1020	Summary table showing correspondence between challenged claims and elements
Ex-1021	Email from Jun Zheng, law clerk to the Honorable Alan D Albright, Dated May 4, 2021
Ex-1022	Letter from Ben Haber to Jason A. Wietjes and Adam P. Daniels, Dated June 25, 2021
Ex-1023	Power2B, Inc.’s Preliminary Infringement Contentions, <i>Power2b, Inc. v. Samsung Elecs. Co., Ltd. et al.</i> , Case No. 6:20-cv-01183-ADA (W.D. Tex., May 7, 2021)
Ex-1024	[INTENTIONALLY LEFT BLANK]
Ex-1025	[INTENTIONALLY LEFT BLANK]
Ex-1026	Benjamin B. Bederson, <i>A Miniature Space-Variant Active Vision System: Cortex-I</i> (June 1992) (Ph.D. Dissertation, New York University)
Ex-1027	Benjamin B. Bederson and James D. Hollan, <i>Pad++: A Zooming Graphical Interface for Exploring Alternate Interface Physics</i> , UIST ’94, pp. 19-26 (Nov. 2-4, 1994)
Ex-1028	Benjamin B. Bederson, Audio Augmented Reality: A Prototype Automated Tour Guide, CHI ’95 Mosaic of Creativity, pp. 210-211 (May 7-11, 1995)
Ex-1029	U.S. Patent No. 4,891,630, issued on Jan. 2, 1990 (“Friedman”)
Ex-1030	U.S. Patent No. 5,736,973, issued on Apr. 7, 1998 (“Godfrey”)
Ex-1031	U.S. Patent No. 7,880,732, issued on Feb. 1, 2011 (“Goertz”)
Ex-1032	U.S. Patent No. 5,105,186, issued on Apr. 14, 1992 (“May”)
Ex-1033	Agreed Scheduling Order, <i>Power2b, Inc. v. Samsung Elecs. Co., Ltd. et al.</i> , Case No. 6:20-cv-01183-ADA (W.D. Tex., May 27, 2021), ECF No. 28

I. INTRODUCTION

1. I have been retained by Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Samsung” or “Petitioner”) as an independent expert consultant in this inter partes review (“IPR”) proceeding before the United States Patent and Trademark Office (“PTO”).

2. I have been asked by Samsung Counsel (“Counsel”) to consider whether certain references teach or suggest the features recited in Claims 1, 3, 6-15, and 18-21 of U.S. Patent No. 10,156,931 (“the ’931 Patent”) (Ex-1001) . My opinions and the bases for my opinions are set forth below.

3. I am being compensated at my ordinary and customary consulting rate for my work, which is \$600 per hour. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other financial interest in this proceeding.

II. BACKGROUND AND QUALIFICATIONS

4. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching the technology referenced in this declaration.

5. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I understand that a copy of my current curriculum vitae, which details my education and professional and academic experience, is being submitted as Ex-1003. The following provides a brief overview of some of my experience that is relevant to the matters set forth in this declaration.

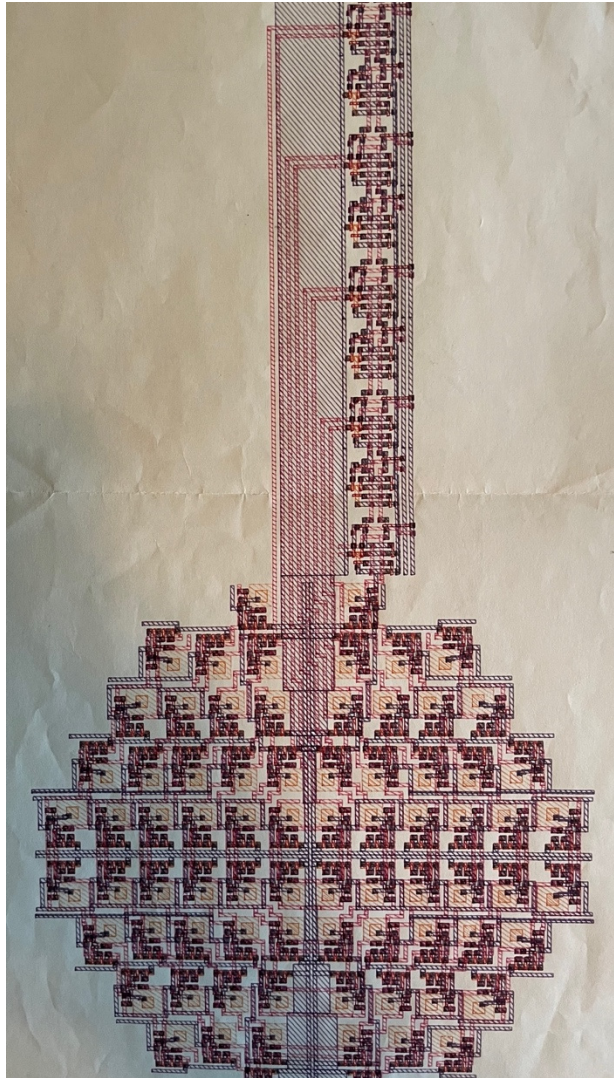
6. I am currently Professor Emeritus of Computer Science at the University of Maryland (“UMD”). From 2014 to 2018, I was the Associate Provost of Learning Initiatives and Executive Director of the Teaching and Learning Transformation Center at the UMD. I am a member and previous director of the Human-Computer Interaction Lab (“HCIL”), the oldest and one of the best known Human-Computer Interaction (“HCI”) research groups in the country. I was also co-founder and Chief Scientist of Zumobi, Inc. from 2006 to 2014, a Seattle-based startup that is a publisher of content applications and advertising platforms for smartphones. I am also co-founder and co-director of the International Children’s Digital Library (“ICDL”), a web site launched in 2002 that provides the world’s largest collection of freely available online children’s books from around the world with an interface aimed to make it easy for children and adults to search and read children’s books online. I am also cofounder and prior Chief Technology Officer of Hazel Analytics, a data analytics company to improve

food safety and better public health whose product sends alerts in warranted circumstances. In addition, I have for more than 25 years consulted for numerous companies in the area of user interfaces, including Hillcrest Labs, Lockheed Martin, Logitech, Microsoft, NASA Goddard Space Flight Center, the Palo Alto Research Center, and Sony.

7. The devices and methods claimed in the '931 Patent generally relate to IR-based technology for detecting objects in proximity to a touchscreen. For more than 30 years, I have studied, designed, and worked in the field of computer science and HCI. My experience includes 30 years of teaching and research, with research interests in HCI and the software and technology underlying today's interactive computing systems. This includes the design and implementation of hardware and software systems including the use of capacitive, resistive, optical and IR, and other sensors, and interactive applications on a range of devices, including embedded systems, controllers, smart phones and PDAs.

8. In 1992, I completed my Ph.D. dissertation at New York University titled "A Miniature Space-Variant Active Vision System: Cortex-I" in which I worked with both CMOS and CCD image sensors and wrote image processing software using those sensors. As depicted in the VLSI circuit layout image below, I designed a custom CMOS image sensor with a radial pixel layout. Figure 2.1 from my dissertation show the result of images taken with a camera I built using that

image sensor. I then built a custom CCD-based camera by manufacturing a lens that I attached directly to a commercially available CCD sensor that is shown in Figure 2.2.



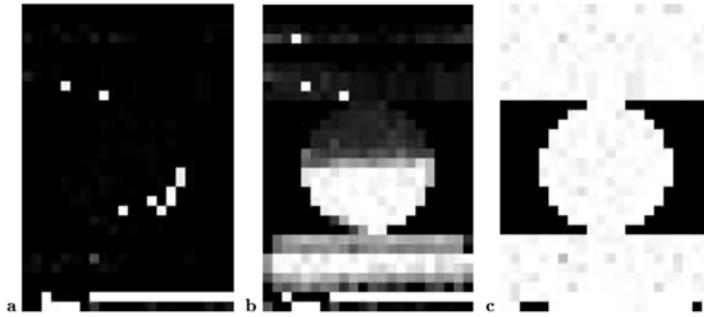


Figure 2.1: Images from our custom logmap sensor chip. They are the logmap images from the chip, and have not been mapped back to scene coordinates. They are scenes of **a)** an all black scene, **b)** a horizontal edge with the top half black and the bottom half white, and **c)** an all white scene. The circle in the center of the images is an artifact of the chip geometry.



Figure 2.2: The fixed field of view camera. It consists of a four element lens assembly attached directly to a CCD sensor.

9. Some of the image processing I performed using the sensor I built included use of a threshold so as to include only pixels that exceeded that threshold. This is described in a section of my dissertation called "Image processing" (p. 80). While not described in my dissertation, I sometimes calculated thresholds dynamically based on the current light conditions. And because sometimes the ambient lighting varied across the field of the image sensor, I sometimes calculated and used different thresholds for different portions of the image.

5.2 Image processing

We have developed several algorithms that are burned into ROM in **Cortex-I**, and are transportable. Some of them use the connectivity graph defined in Section 1.4 of Chapter 1.

Image binarization using the mean pixel value for a threshold runs at 22 frames per second (fps). The mean pixel value is given by

$$\bar{p} \leftarrow \frac{1}{\text{NPIXELS}} \sum_{p \in L} L(p)$$

Then the binarized image, L_B , is defined by

$$L_B(p) \leftarrow \begin{cases} 0 & \text{if } L(p) \leq \bar{p} \\ 255 & \text{otherwise} \end{cases}$$

Image smoothing runs at 3 fps. The smoothed image, L_S , is defined by

$$L_S(p) \leftarrow \frac{1}{|\mathcal{N}(p)|} \sum_{q \in \mathcal{N}(p)} L(q)$$

We defined a simple edge operator that runs at 2 fps. The edge image, L_E , is defined by

$$L_E(p) \leftarrow \frac{1}{|\mathcal{N}(p)|} \sum_{q \in \mathcal{N}(p)} (L(p) - L(q))^2.$$

Finally, a connected components algorithm runs at only 1 fps, illustrating both the generality of the programming model and the limitations of the microcontroller in the current prototype. The connected components problem begins with a given predicate F , for example the foreground-background function

$$F(p, q) = \begin{cases} \text{true} & \text{if } L_B(p) = L_B(q) \\ \text{false} & \text{otherwise} \end{cases} \quad (51)$$

$F(p, q)$ is true in a binary image when the two pixels p and q are either both black or both white. The algorithm to find all connected components of pixels satisfying F is well-known [7,31,44]. We use the familiar graph theoretic algorithm [19]. First we break the graph into subgraphs by removing those edges between pixels where $F(p, q)$ is false. Then, by the connectedness and components algorithm for graphs, our program extracts the connected regions. Figure 5.2 shows the result.

10. In 1995, I built an “audio augmented reality” system² for use in an art museum that identified and announced which piece of art a person was standing in

² Benjamin B. Bederson. 1995. Audio augmented reality: a prototype automated tour guide. In Conference Companion on Human Factors in Computing Systems (CHI '95), I. Katz, R. Mack, and L. Marks (Eds.). ACM, New York, NY, USA, 210-211. DOI=<http://dx.doi.org/10.1145/223355.223526> (Ex. 1016).

front of. This worked by installing infrared (IR) transmitters in the ceiling above each piece of art which was identified by an infrared (IR) receiver controlled by a microcontroller. As depicted in Figure 1 below, a person wearing the receiver walked around, the microcontroller they were carrying would identify the code from the transmitter they were standing under.

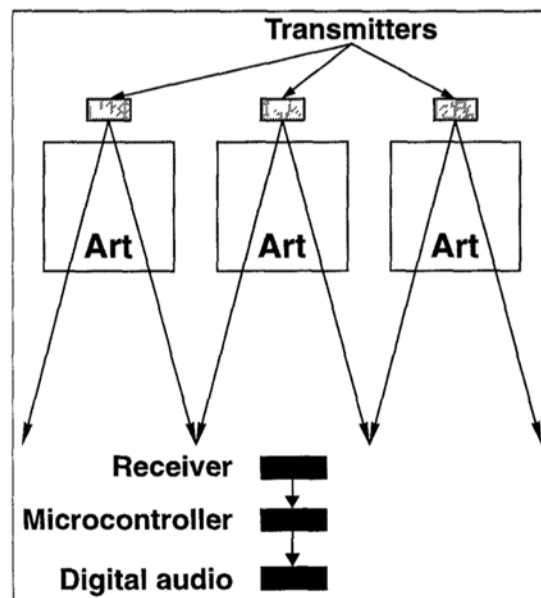


Figure 1: Schematic of automated tour guide prototype.

11. At UMD, I am focused primarily on the area of HCI, a field that relates to the development and understanding of computing systems to serve users' needs. Researchers and practitioners in this field are focused on making universally usable, useful, efficient, and appealing systems to support people in their wide range of activities. My approach is to balance the development of innovative technology that serves people's practical needs. Example systems following this approach that I have built include Cortex-I (1992 embedded

computer vision system that sensed licensed plates with custom motor, camera and controller), Audio Augmented Reality (1995 embedded system for sensing a user's location and playing audio suited to that location), Fisheye Menus (2000 software for sensing movement within and selection of linear list of items in a menu), PhotoMesa (2001 software for end users to browse personal photos), DateLens (2002 software for end users to use their mobile devices to efficiently access their calendar information), SlideBar (2005 linear sensor to control scrolling), LaunchTile (2005 "home screen" software for mobile devices to allow users to navigate apps in a zoomable environment), SpaceTree (2001 software for end users to efficiently browse very large hierarchies), ICDL (as described above), and StoryKit (a 2009 iPhone app for children to create stories).

12. Throughout the 1990s and 2000s, I worked on a range of "zoomable user interfaces" (or "ZUIs"), which are systems that support the multi-scale and spatial organization of and magnification-based navigation among multiple documents or visual objects. I built several different ZUI systems over the years, including Pad++, Jazz and Piccolo. In those systems, I used a range of solutions to allow users to control zooming through the information space. The most common approach for systems with 3 button mice was to use the middle button for zooming in and the right button for zooming out. The user would hold the button down, and the system would smoothly animate zooming in or out – so that the user controlled

how much the system zoomed based on the duration that the button was pressed.³ I also used a commercial off the shelf touch screen for input to a zoomable image browser we built using Pad++ in or about 1998. The touch screen generated standard mouse signals, and I did not have to modify the zoomable image browser or Pad++ at all in order for it to operate with the touch screen.

13. My work has been published extensively in more than 160 technical publications, and I have given about 100 invited talks, including 9 keynote lectures. I have won a number of awards including the Brian Shackel Award for “outstanding contribution with international impact in the field of HCI” in 2007, and the Social Impact Award in 2010 from the Association for Computing Machinery’s (“ACM”) Special Interest Group on Computer Human Interaction (“SIGCHI”). ACM is the primary international professional community of computer scientists, and SIGCHI is the primary international professional HCI community. I have been honored by both professional organizations. I am an “ACM Distinguished Scientist,” which “recognizes those ACM members with at

³ Benjamin B. Bederson & James D. Hollan, *Pad++: A Zooming Graphical Interface for Exploring Alternate Interface Physics*, UIST ‘94 Proceedings of the 7th Annual ACM Symposium on User Interface Software and Technology 17 (1994), DOI: <http://dx.doi.org/10.1145/192426.192435> (Ex-1016).

least 15 years of professional experience and 5 years of continuous Professional Membership who have achieved significant accomplishments or have made a significant impact on the computing field.” I am a member of the “CHI Academy,” which is described as follows: “The CHI Academy is an honorary group of individuals who have made substantial contributions to the field of HCI. These are the principal leaders of the field, whose efforts have shaped the disciplines and/or industry, and led the research and/or innovation in human-computer interaction.” The criteria for election to the CHI Academy are: (1) cumulative contributions to the field; (2) impact on the field through development of new research directions and/or innovations; and (3) influence on the work of others.

14. I have appeared on radio shows numerous times to discuss issues relating to user interface design and people’s use and frustration with common technologies, web sites, and mobile devices. My work has been discussed and I have been quoted by mainstream media around the world over 120 times, including by the New York Times, the Wall Street Journal, the Washington Post, Newsweek, the Seattle Post Intelligencer, the Independent, Le Monde, NPR’s All Things Considered, New Scientist Magazine, and MIT’s Technology Review.

15. I have designed, programmed, and publicly deployed dozens of user-facing software products that have cumulatively had millions of users. My work is

cited by several major companies, including Amazon, Apple, Facebook, Google, and Microsoft. I am a named inventor on 12 U.S. patents and 18 U.S. patent applications. The patents are generally directed to user interfaces and experience.

16. I received a B.S. degree in Computer Science with a minor in Electrical Engineering in 1986 from the Rensselaer Polytechnic Institute. I received M.S. and Ph.D. degrees in Computer Science in 1989 and 1992, both from New York University.

III. INFORMATION CONSIDERED

17. In preparation for this declaration, I have considered the materials discussed in this declaration, including, for example, the '931 Patent, the references cited by the '931 Patent, the prosecution histories of the '931 Patent and applications from which it derives (including the references cited therein), various background articles and materials referenced in this declaration, and the prior art references identified in this declaration. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

IV. RELEVANT LEGAL STANDARDS

18. I am not an attorney and offer no legal opinions. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

19. I have been informed and understand that in an IPR proceeding, claims are to be interpreted according to the Phillips claim construction standard. I have been informed and understand that claim construction is a matter of law and that the final claim constructions for this proceeding will be determined by the Patent Trial and Appeal Board (“PTAB”).

B. Perspective of One of Ordinary Skill in the Art

20. I have been informed and understand that a patent is to be understood from the perspective of a hypothetical “person of ordinary skill in the art” (“POSITA”). Such an individual is considered to possess normal skills and knowledge in a particular technical field (as opposed to being a genius). I understand that in considering what the claims of a patent require, what was known prior to that patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of such a POSITA.

C. Obviousness

21. I have been informed and understand that a patent claim is obvious under 35 U.S.C. § 103, and therefore invalid, if the claimed subject matter, as a whole, would have been obvious to a POSITA as of the priority date of the patent based on one or more prior art references and/or the knowledge of a POSITA.

22. I understand that an obviousness analysis must consider (1) the scope and content of the prior art, (2) the differences between the claims and the prior art,

(3) the level of ordinary skill in the pertinent art, and (4) secondary considerations, if any, of non-obviousness (such as unexpected results, commercial success, long-felt but unmet need, failure of others, copying by others, and skepticism of experts).

23. I understand that a prior art reference may be combined with other references to disclose each element of the invention under 35 U.S.C. § 103. I understand that a reference may also be combined with the knowledge of a POSITA, and that this knowledge may be used to combine multiple references. I further understand that a POSITA is presumed to know the relevant prior art. I understand that the obviousness analysis may take into account the inferences and creative steps that a POSITA would employ.

24. In determining whether a prior art reference would have been combined with other prior art or other information known to a POSITA, I understand that the following principles may be considered:

- whether the references to be combined involve non-analogous art;
- whether the references to be combined are in different fields of endeavor than the alleged invention in the Patent;
- whether the references to be combined are reasonably pertinent to the problems to which the inventions of the Patent are directed;

- whether the combination is of familiar elements according to known methods that yields predictable results;
- whether a combination involves the substitution of one known element for another that yields predictable results;
- whether the combination involves the use of a known technique to improve similar items or methods in the same way that yields predictable results;
- whether the combination involves the application of a known technique to a prior art reference that is ready for improvement, to yield predictable results;
- whether the combination is “obvious to try”;
- whether the combination involves the known work in one field of endeavor prompting variations of it for use in either the same field or a different one based on design incentives or other market forces, where the variations are predictable to a POSITA;
- whether there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;

- whether the combination requires modifications that render the prior art unsatisfactory for its intended use;
- whether the combination requires modifications that change the principle of operation of the reference;
- whether the combination is reasonably expected to be a success; and
- whether the combination possesses the requisite degree of predictability at the time the invention was made.

25. I understand that in determining whether a combination of prior art references renders a claim obvious, it is helpful to consider whether there is some teaching, suggestion, or motivation to combine the references and a reasonable expectation of success in doing so. I understand, however, that a teaching, suggestion, or motivation to combine is not required.

V. SUMMARY OF OPINIONS

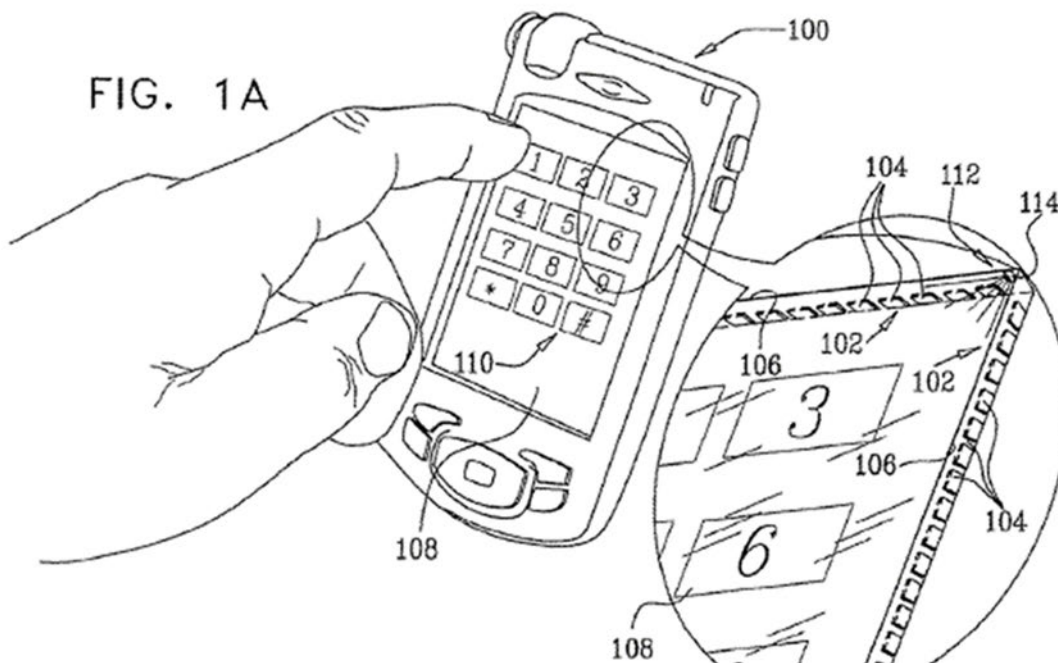
26. It is my opinion that Claims 1-3, 6-15, and 18-21 of the '931 Patent are unpatentable under 35 U.S.C. §§ 103 on the following grounds:

- **Grounds 1 and 2:** Claims 1, 3, 6-13, 15, and 18-21 are rendered obvious by U.S. Pub. No. 2003/0156100 ("Gettemy") alone or Gettemy in view of U.S. Pat. No. 4,879,461 ("Philipp");

- **Ground 3 and 4:** Claims 2 and 14 are rendered obvious by Gettemy in view of WIPO/PCT WO1986000447 (“Carstedt”) or Gettemy and Philipp in view of Carstedt;

VI. THE CHALLENGED PATENT

27. The ‘931 Patent generally “relates to displays and input devices.” Ex-1001, 1:20. As shown in Figure 1A, the ‘931 Patent describes “a mobile telephone 100 having a touch responsive input functionality employing light reflection in accordance with a preferred embodiment of the present disclosure.” Ex-1001, 7:58-60.



28. For the reasons set forth below, however, the claims are directed to well-known and predictable prior art elements in touchscreen devices as reflected, for example, in Claim 1. The other independent claims are substantially the same,

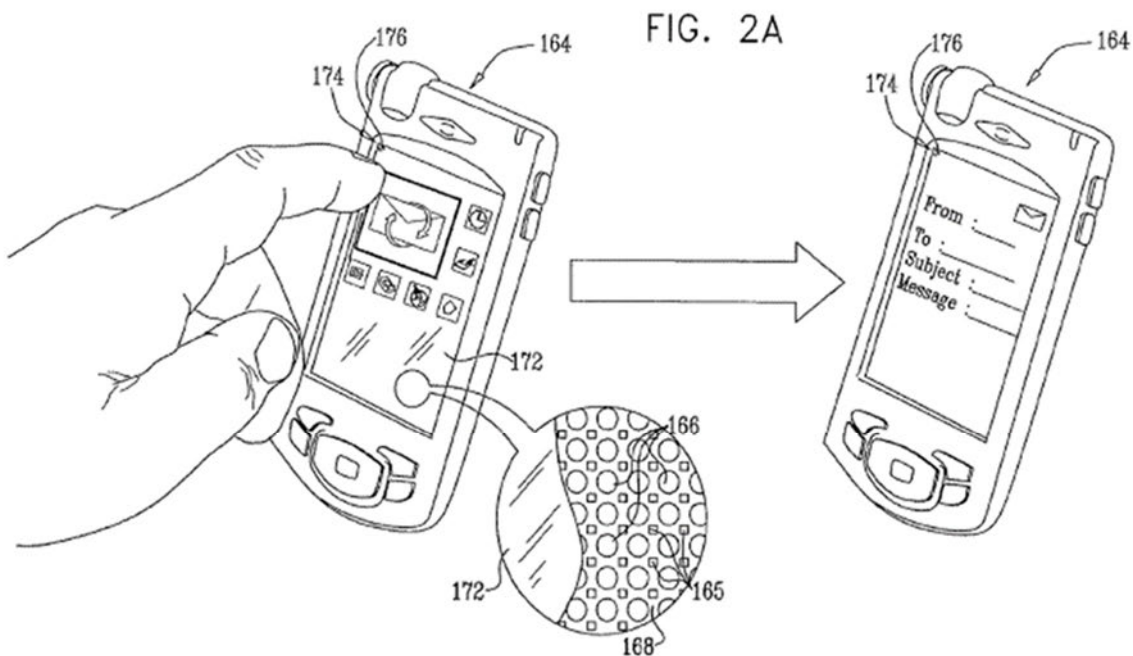
and the dependent claims simply add minor, well-known functional or structural variations.

1. A device comprising:

- a display panel having a pixel array that defines a display area, the pixel array is configured to visually present digital content;
- an Infra-Red (IR) emitter positioned proximate to the display area, the IR emitter illuminating one or more objects in proximity to the device;
- a position sensing array positioned proximate to at least one edge of the display area, the position sensing array is configured to receive, through at least one layer of the display panel, at least a portion of light reflected by an object in proximity to the device and generate an output signal that represents an amount of the portion of light; and
- a processing unit configured to:
 - receive the output signal from the position sensing array;
 - determine the output signal exceeds a predetermined threshold;
 - calculate, based on the output signal, a position of the object relative to the device when the output signal exceeds the predetermined threshold; and
 - execute input functionality corresponding to the position of the object.

29. As described in claim 1, the combined device is straightforward. It includes a display made up of a number of pixels. There is an emitter and corresponding detector used to illuminate and detect light reflected from a nearby object. The light from the emitter must pass through the display to the detector. Then, a processing unit compares the detected signal to a predetermined threshold, and, if it exceeds the threshold, executes some input functionality on the device based on the detected position of the nearby object.

30. An example of this configuration is shown in Figure 2A below. “FIG. 2A illustrates launching an application, such as an e-mail application, on a mobile telephone 164.” Ex-1001, 9:32-33. “A multiplicity of light detector elements 165 are interspersed among light emitters 166 arranged in a plane 168.” Ex-1001, 9:39-40. “Light, preferably including light in the IR band, reflected by the user’s finger, propagates through at least one cover layer 172 and is detected by one or more of detector elements 165.” Ex-1001, 9:45-48. “The outputs of detector elements 165 are processed to indicate one or more of the X, Y, or Z positions and/or angular orientation of the user’s finger. This detected position is utilized ... to launch an application or control any of the other functionalities.” Ex-1001, 48-55.



31. As explained in detail below, the '931 Patent's claims would have been obvious in view of the prior art.

VII. PATENT PROSECUTION HISTORY

32. The '931 Patent file history is submitted as Ex-1004. The application leading to the '931 Patent application, 15/343018, was filed on November 3, 2016. It purports to be a continuation of application 12/066,238, filed on Sept 3, 2008, now US Patent 9,949,972. The '931 Patent also claims priority to two provisional applications: 60/715,546, filed on September 8, 2005; and 60/734,027, filed on November 3, 2005.

33. On December 30, 2016, the examiner issued a final rejection, stating that the only then-pending claim was not patentably distinct from an issued claim in the parent 9,494,972 Patent. Ex-1004, 0474. The examiner also rejected the claim as anticipated over a prior art reference. Ex-1004, 0474.

34. On March 29, 2017, Applicant filed an RCE and claim amendment. Ex-1004, 0497. The claim amendment included a set of 20 new claims to overcome the examiner's prior rejection. Ex-1004, 0501. On May 19, 2017, the examiner issued a non-final rejection of the new claims, rejecting them all as anticipated and obvious over the prior art. Ex-1004, 0514. On November 17, 2017, Applicant further amended the claims and presented argument that the amended claims distinguished the prior art. Ex-1004, 0550. On March 2, 2018, the examiner issued

another final rejection again rejecting the claims as obvious over the prior art. Ex-1004, 0575.

35. On August 31, 2018, Applicant submitted another RCE and claim amendment. Ex-1004, 0593. This amendment added, among other things, the requirement that the light go through the display and that the device execute input functionality based on the position of the nearby object. Ex-1004, 0597. On September 10, 2018, the applicant submitted an IDS that identified 47 new references not previously submitted to the examiner during prosecution. Ex-1004, 0616-619. The examiner did not issue any office actions discussing any of these 47 new references before allowing the claims. Instead, about two weeks later, on September 26, 2018, the examiner signed the applicant's IDS, added a footer stating "all references considered except where lined through," and did not line through any of the references. Ex-1004, 0950. On October 11, 2018, the examiner issued a notice of allowance. Ex-1004, 0928.

36. Gettemy was submitted as item 16 of 47 in the IDS submitted at the end of prosecution. However, the other prior art references submitted with this petition (Phillip and Carstedt) were not before the examiner, either via the examiner's own search or submitted by the applicant in an IDS. While Gettemy was listed in the late-stage IDS, the examiner did not substantively address its teachings or disclosures in any office action. Nor did the examiner address any of

the combinations of art presented in this petition. This prior art makes clear that none of the claims, including those claims with elements added to avoid different prior art references, are non-obvious.

37. Two of the three references relied upon in this petition were never before the Examiner. Nor were any similar disclosures or teachings discussed by the Examiner. For example, the Applicant submitted a number of claim amendments in its last submission to the examiner on August 31, 2018. Ex-1004, 0597-601. The examiner did not apply any prior art to these added elements or in response to the arguments presented by the applicant. The primary reference asserted by the examiner, Omura, is a very different system than any of the references included in this petition. As the applicant explained, “Omura teaches a complicated system for manipulating light into parallel rays relative to the writing surface.” Ex-1004, 0605. The applicant distinguished Omura’s complex light manipulation from a more simple “position sensing array.” *Id.* But such a simple position sensing array and associated algorithms is disclosed in the prior art references I discuss in my declaration that were not previously before the examiner at all. For example, as to the independent claims, no prior art reference that was before the examiner discloses the IR LED emitter/photodiode pair along with the various thresholding algorithms of Philipp. Nor do any prior art references that were before the examiner make disclosures similar to those for which Carstedt is

cited. Accordingly, none of the arguments directly relating to patentability based on these disclosures were previously presented to the examiner.

38. Additionally, the Examiner should not have overlooked the clear and unambiguous teachings of Gettemy. Gettemy was included along with 46 other references towards the end of prosecution, but the examiner did not make any statements about any one of the references submitted in the IDS, other than stating that they were “considered except where lined through.” Ex-1004, 0950. As explained in detail in Section XIII, Gettemy alone or in combination with other prior art renders obvious all of the challenged claims. As just one example, the applicant’s final claim amendment added the limitation: “receive, through at least one layer of the display panel, at least a portion of light reflected by an object in proximity to the device.” Ex-1004, 0597. This limitation, which resulted in allowance, was added to avoid the Omura prior art, but is plainly disclosed by Gettemy, *e.g.*, in Figure 2. *See* Ex-1005, Fig. 2; *Supra* Section XIII.A.2.e, below. Gettemy also teaches the remainder of the independent claims. Because Gettemy at least renders obvious all elements of the independent claims, including elements added to distinguish the prior art, the Examiner should not have overlooked Gettemy’s teachings in my opinion.

39. The examiner’s unexplained statement that all 47 references in a late-filed IDS were “considered” should not have much weight considering the clear

and unambiguous disclosures of Gettemy demonstrating the obviousness of the challenged claims as set out in detail in my declaration. In my opinion, it was a mistake for the examiner not to even discuss Gettemy during prosecution. Further, the sections of Gettemy that I rely on could never have been considered in view of the other references in this petition not presented to the Office. The prosecution record as it stands now contains no such discussion of the merits of these strong prior art references and disclosures, which disclose and teach elements specifically added to overcome rejections.

VIII. TECHNOLOGY BACKGROUND

A. Combined image display and sensing including backlight and transmissive layers

40. A wide range of integrated image display and sensing technology has been broadly available for decades. These have commonly taken the form of “touch screens” which combine multiple layers into what, from a user’s perspective, is a single integrated device. These layers may include a backlight, a display, and a touch sensitive surface. A variety of touch sensing technologies have been used over the years, including resistive, optical, capacitive, and acoustic technologies. These were all very well-known technologies to system designers by at least 1990. For example, U.S. Pat. No. 5,105,186, filed May 25, 1990 expressly states these technologies were well known:

With a touch screen, a user can select from options displayed on the display's viewing surface by touching the surface adjacent to the desired option, or, in some designs, touching the option directly. **Common techniques employed in these devices for detecting the location of a touch include mechanical buttons, crossed beams of infrared light, acoustic surface waves, capacitance sensing, and resistive membranes.** (US 5,105,186 at 1:10-20 (emphasis added).)

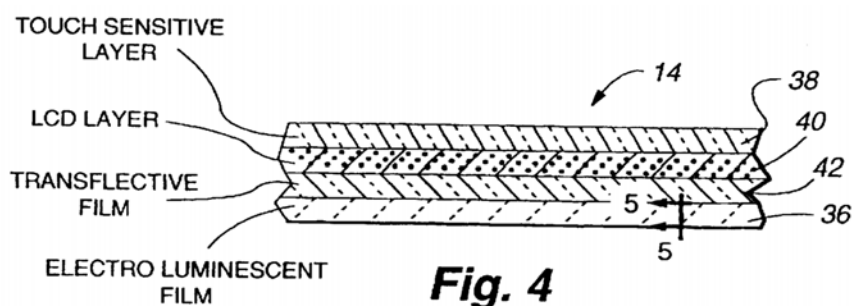
41. These touch screens also included backlights that were designed to emit light that would be transmitted through the display and touch sensitive surface. For example, US Pat. No. 5,736,973, filed November 1, 1995 shows all of these elements. As Figure 4 shows, these layers are described as follows:

The source of light is a conventional **electroluminescent film 36** which is added as a lowermost or **last layer** of the elements of the screen 14, as shown in FIG. 4. (US 5,736,973 at 5:21-24 (emphasis added).)

A top layer 38 of the screen 14 is the **touch-sensitive layer** of the screen 14 which, when pressed, supplies input commands or signals to the computer of the PDA. The top touch-sensitive layer 38 functions in the conventional manner. Transparent electrodes within the layer 38 form a grid-work. Pressure on the screen causes an electrical connection between two or more of the electrodes, and the resulting signal(s) from the connection is interpreted as the input signal to the computer.

A **conventional LCD layer 40** is located beneath the touch sensitive layer 38. The LCD layer 40 comprises groups of segments or pixels (not shown) which are physically oriented to form individual alphabetical or numerical characters. Each pixel consists of a quantity of **normally transparent** anisotropic liquid sandwiched between two transparent electrodes (not specifically

shown). Application of an electric field across the anisotropic liquid causes its light absorptive characteristics to change from transparent to opaque, and the darkened pixel becomes a component of a alphabetical letter or number. Combinations of individual pixels are therefore selectively darkened to form characters and Words. (*Id* at 5:32-54 (emphasis added).)



B. Sensing with infrared (IR), including positioning proximate to an edge

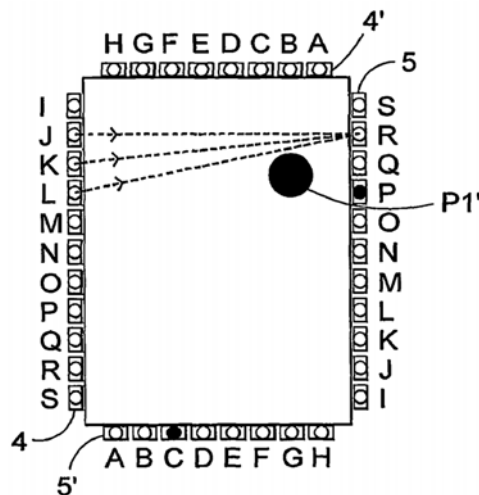
42. While many touch sensitive sensors overlay the entire display, and thus may also be considered proximate to the edges of the device in certain areas (such as described in the previous section), other touch sensitive sensors are implemented with light emitters (including infrared light) from one edge that are received by sensors on the opposite edges of the display. Such a touch sensitive sensor is described in US Pat. No. 7,880,732, filed November 4, 2002.

FIG. 8 shows that a plurality of **light pulse emitting units**, referenced 4J, 4K and 4L, are adapted to send light pulses during a chosen time duration and during respective time slots, and that only one **light pulse receiving unit 5R** is adapted to be activated in this respect, so as to allow anticipated or expected light pulses to be received during said chosen time duration and within said time slots, and therewith allow occurring light pulses and shadowed light pulses to be registered so

as to enable the geographical position of a more diffuse point, such as the point P1", to be evaluated. (*Id.* at 14:19-29 (emphasis added).)

A further technical problem resides in the ability to realise the significance of enabling a substrate to support not only said display unit but also said light pulse emitting and light pulse receiving units, where said **light pulses have a frequency within the infrared range (IR range)**. (*Id.* at 4:47-52 (emphasis added).)

Fig. 8



C. Image processing to determine object attributes (including 3D and orientation)

43. While the above touch sensitive displays focus on measuring the position of an object touching the screen, other sensors were able to determine additional attributes of an object touching or approaching a display – including orientation of the object as well as three dimensional attributes of the object.

44. For example, US Pat. No. 4,891,630, filed April 22, 1988 uses an image sensor to determine the orientation and position of an object including the 3D position and orientation.

In order to **determine the 3D orientation and position of a user's head** (generalizing to a plane surface) with a single view and with an inexpensive 8 bit microprocessor, a reflective patch 20 is attached to the user's face with double stick tape. (US 4,891,630 at 5:49-53 (emphasis added).)

IX. LEVEL OF ORDINARY SKILL IN THE ART

45. One of ordinary skill in the art would have had a bachelor's degree in electrical engineering, computer engineering, computer science, or a related field, and at least two years of experience in the research, design, development, and/or testing of touch and/or proximity sensors, human-machine interaction and interfaces, and related firmware and software, or the equivalent, with additional education substituting for experience and vice versa.

X. PRIORITY DATE

46. The earliest possible priority for the '931 Patent is provisional patent application 60/734,027 filed September 8, 2005. All prior art references asserted in this petition are U.S. patents or patent publications that were published more than one year before the earliest possible priority date of the '931 Patent. I understand, therefore, that it is unnecessary for me to take a position on the proper priority date for each claim of the '931 Patent, because such prior art as I rely on in the petition cannot be antedated.

XI. CLAIM CONSTRUCTION

47. I do not believe that any term requires explicit construction to resolve the issues presented in this Petition. I ascribe the plain meaning to each claim term, as that plain meaning would have been understood by a POSITA.

XII. OVERVIEW OF THE PRIOR ART REFERENCES

A. Gettemy (Ex-1005)

48. Gettemy, titled “Display system,” is U.S. Patent Publication no. 2003/0156100, published on August 21, 2003. I understand that Gettemy qualifies as prior art under at least pre-AIA 35 U.S.C. §102(b), based on its publication date.

49. Gettemy “relates generally to the field of displays. The present invention more specifically relates to the field of interactive displays such as touch screens and touch panels.” Ex-1005, [0001].

50. Gettemy discloses a mobile device having a touch screen display, such as the one shown in Figure 7:

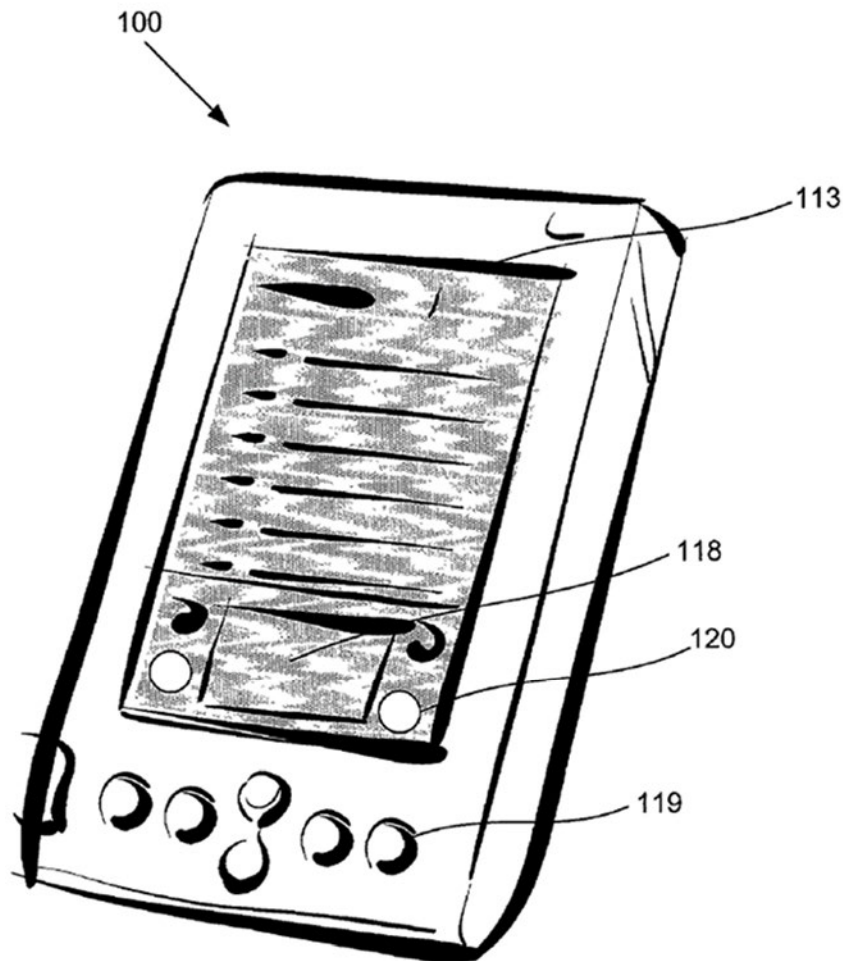


FIGURE 7

51. Handheld device 100 in Figure 7 may include, for example, a Palm-style computer, Windows CE, or other well-known PDA. Ex-1005, [0044].

52. As explained at Ex-1005, [0025]-[0028], Gettemy's touch screen display discloses an array of pixels 20 and an array 40 of individual photodetectors 42, as shown in Figures 1 and 2. Light travels through the display panel and is received by the photodetectors.

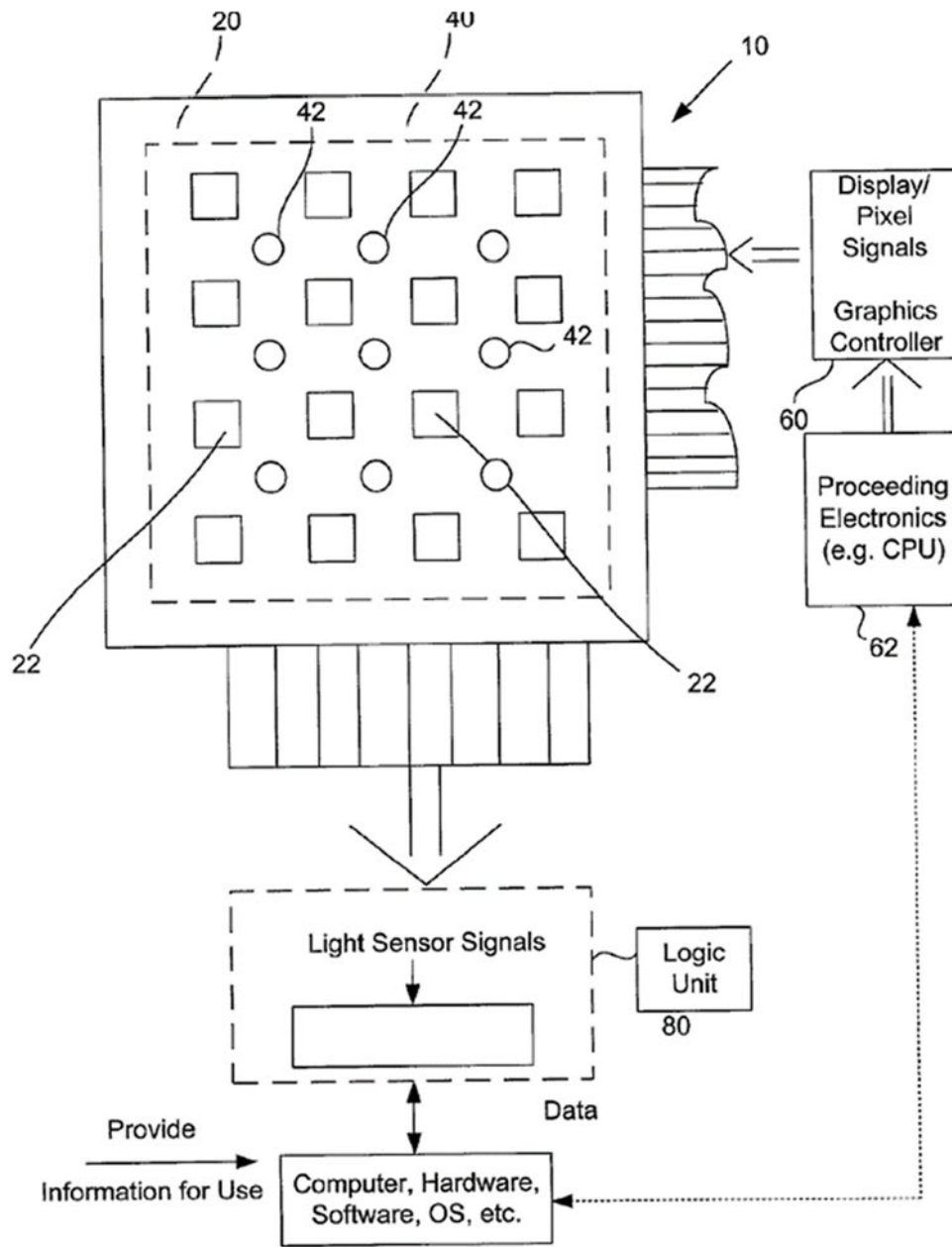
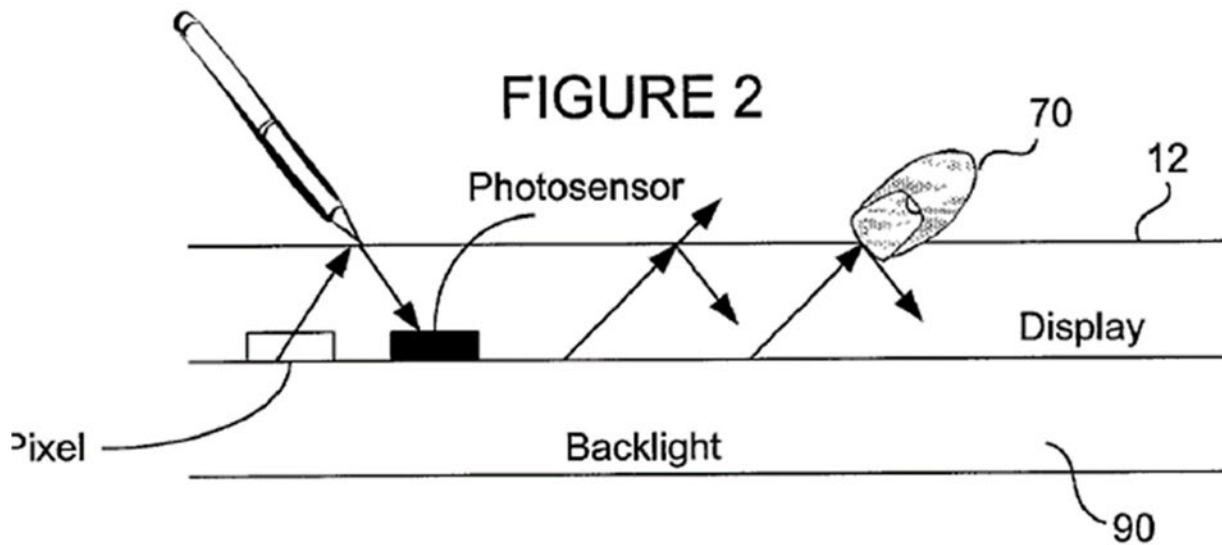


FIGURE 1



As shown in Figure 2:

When an object 70 is near display 10, object 70 reflects or refracts a certain amount of light which has passed through display surface 12, back toward display 10. By detecting the additional amount of light that is reflected or refracted from object 70, the position of object 70 relative to display 10 may be determined, as will be discussed in greater detail below.

Id. ¶ [0024].

53. Gettemy discloses a number of exemplary embodiments for determining the position or location of object 70 relative to the display, including by providing an array of sensors in a grid coordinate system, as shown in Figure 3. The state of the light sensors, e.g., A1, C3, etc., is passed to correlation step 82, where it is compared with maximum and minimum value to determine position.

Id. ¶ [0039], Fig. 3A-3B; *see also id.* ¶ [0043], Fig. 4.

54. The information relating to the position of object 70 may be provided to data processing electronics, such as CPU 62, “to determine the or interpret the motion of object 70 into alpha-numeric characters (e.g., Graffiti™, etc.).” *Id.* ¶ [0043]

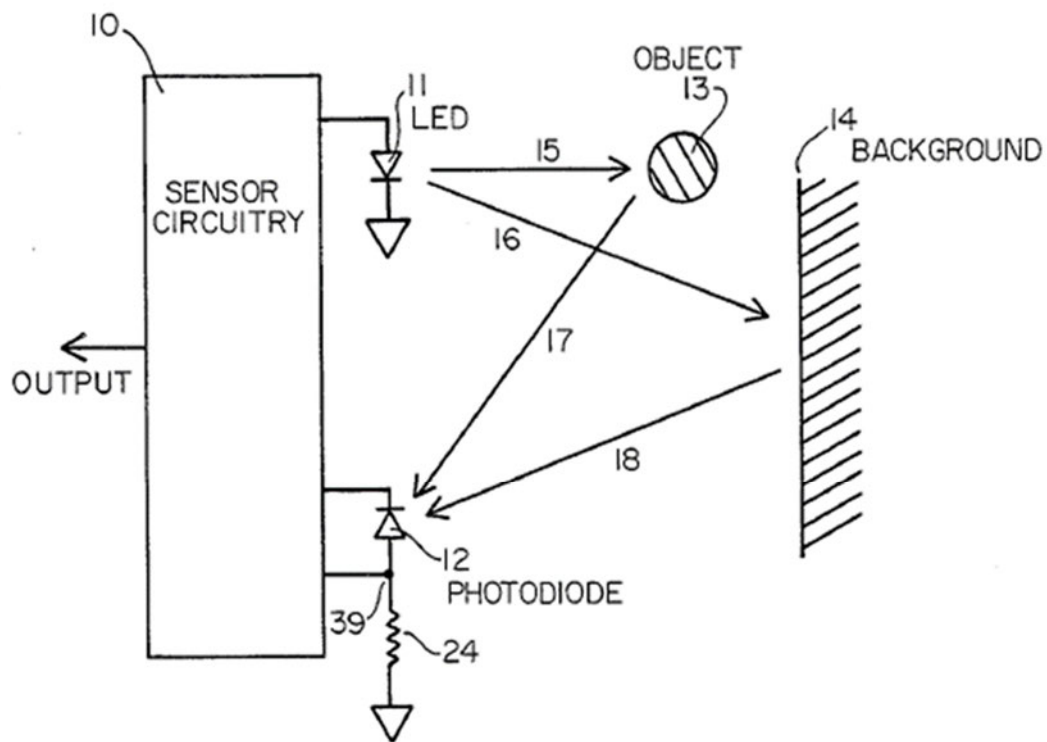
B. Philipp (Ex-1006)

55. Philipp, titled “Energy field sensor using summing means,” is U.S. Patent No. 4,879,461, issued on November 7, 1989. I understand that Philipp qualifies as prior art under at least pre-AIA 35 U.S.C. §102(b), based on its issue date.

56. Philipp “relates to sensing apparatus for the emission and subsequent detection of energy fields and disturbances within such fields, and more particularly to an optical sensor for sensing object motion, presence, or other disturbance within a sensing region.” Ex-1006, 1:5-11.

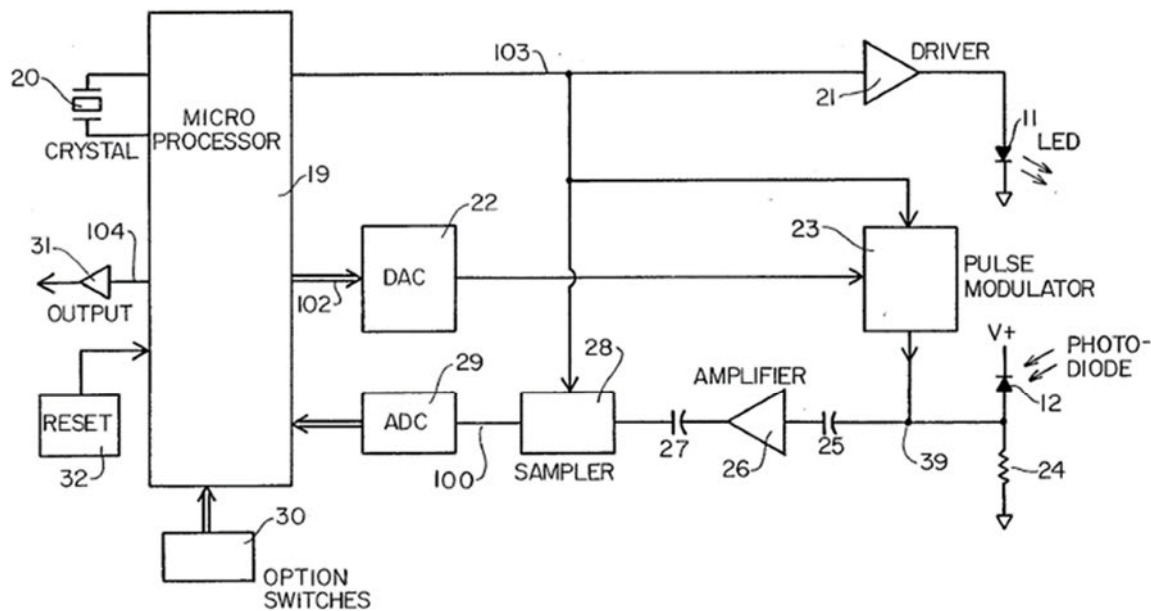
57. Philipp discloses an IR emitter (LED 11) and sensor (Photodiode 12) pair that is used to detect a nearby object (13), in its Figure 1:

FIG. 1



58. Philipp also discloses a number of “thresholding” algorithms that are implemented in software running, e.g., on microprocessor 19, of Figure 2:

FIG. 2



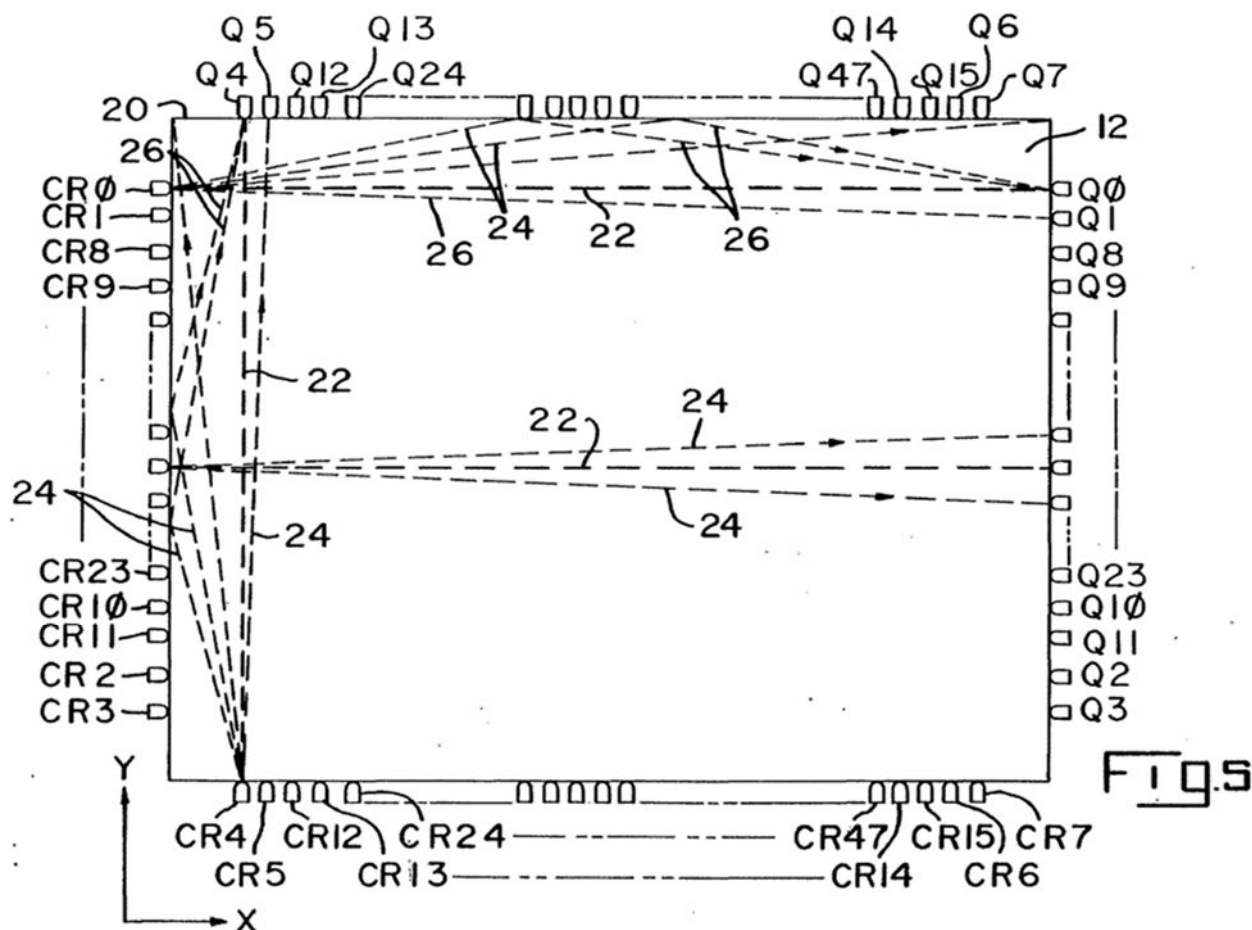
59. “The microprocessor 19 contains software that performs various algorithmic operations on the data recovered from signal 100.” Ex-1006, 10:1-5. “Algorithms that operate on the signal 100 typically include ADC 29 operation, signal averaging, polarity detection and thresholding, and threshold limit timing. ...” *Id.* at 10:6-8. “Thresholding occurs when the signal rises above or falls below a specific set level.” *Id.* at 11:21-22. “The result of these algorithms may be used in further processing to determine the operating mode.” *Id.* 10:6-16.

C. Carstedt (Ex-1007)

60. Carstedt, titled “Touch input device having digital ambient light sampling” is a WIPO/PCT Publication no. WO1986000447, published on January 16, 1989. I understand that Carstedt qualifies as prior art under at least pre-AIA 35 U.S.C. §102(b), based on its publication date.

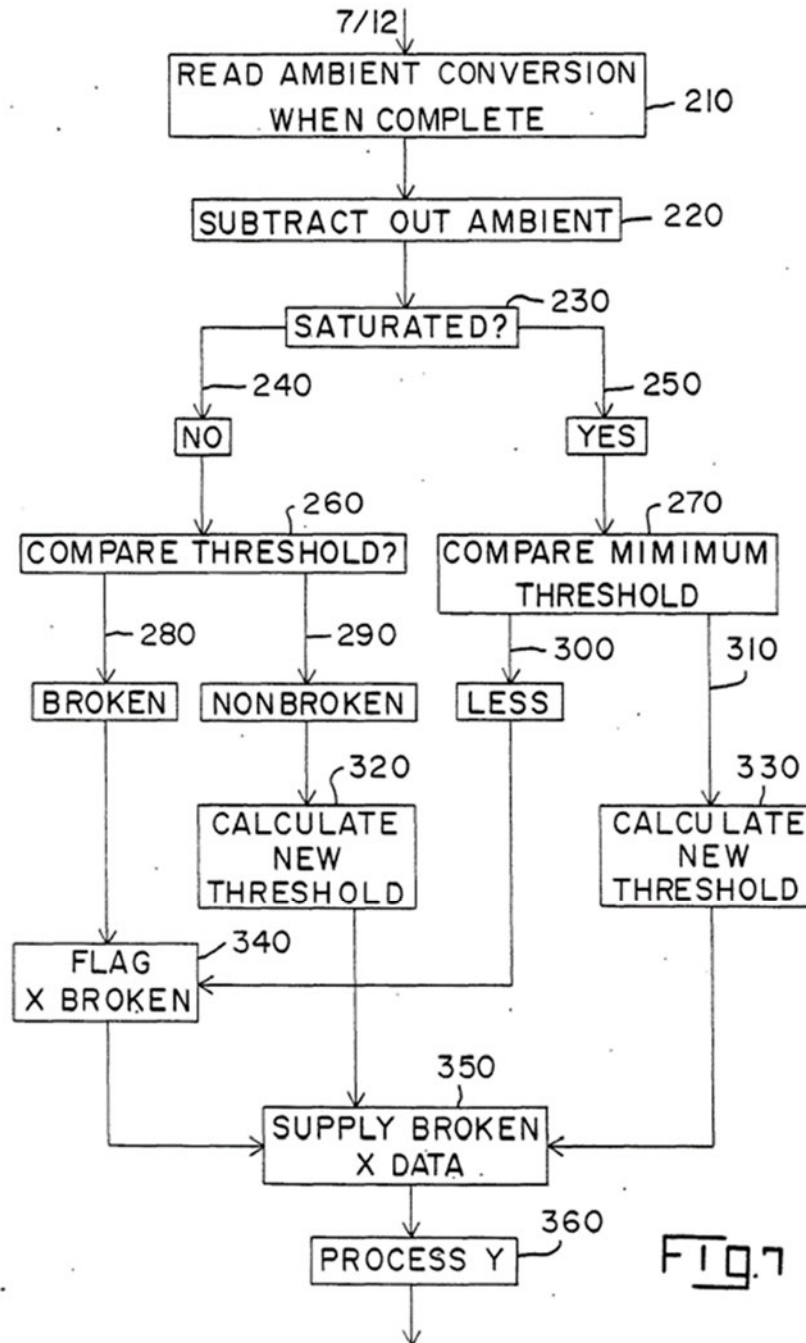
61. Carstedt relates “generally, to a touch input device and, more particularly, to an opto-matrix frame having automatic corner glare compensation.” Ex-1007, 1:7-9.

62. Carstedt discloses, for example in its Figure 5, a number of optical emitters (CR0 - CR47) and detectors (Q0 - Q47) around the edge of a display area:



63. Carstedt explains that “it is also desirable to have a device which dynamically compensates for ambient light and for variations in emitter output and detector sensitivity.” Ex-1007, 2:17-19. To accomplish this ambient light compensation, Carstedt proposes to use ambient light sampling and to update

detection thresholds based on the ambient light, for example as shown in Figure 7, at 330:



64. Using this approach, Carstedt explains “a continuous and dynamic sampling of ambient light is utilized and taken into account.” Ex-1007, 15:15-16.

XIII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

65. The '931 Patent contains 21 claims, of which three are independent. Independent claims 1, 13, 21, challenged here, contain substantially similar limitations, with claim 1 directed to an apparatus, claim 13 directed to a method, and claim 21 directed to a system. Similarly, most of the challenged dependent apparatus claim limitations have corresponding dependent method claim limitations that are substantively the same. Substantially similar claim elements are discussed together in the below element-by-element analysis. Exhibit 1020 is a summary table showing correspondence between challenged claims and elements. To the extent there are any meaningful differences between the claims or elements, such differences are individually identified and discussed. As explained below, the challenged claims are disclosed or taught by the prior art.

A. Grounds 1 and 2: Claims 1, 3, 6-13, 15, and 18-21 are rendered obvious by Gettemy (Ex-1005) alone or by Gettemy in view of Philipp (Ex-1006).

1. A POSITA would have been motivated to combine the teachings of Gettemy and Philipp, and would have had a reasonable expectation of success in doing so.

66. In addition to the reasons set out below with respect to specific claim elements, a POSITA would have been motivated to combine the teachings of Gettemy and Philipp, and would have a reasonable expectation of success in doing so, because each relates to the same well-known issues on sensing objects near a

touch display. Specifically, Gettemy's teachings "provide for user interaction (such as by touching, pointing, placement of objects proximate to the display, etc.)" Ex-1005, [0023]. Gettemy discloses using pixels and other light sources and sensors to detect the presence of an object. *Id.* at [0024]. Additionally, Philipp teaches "the use of light emitters such as light emitting diodes to illuminate a sensing area; the light energy from such emitters is detected and processed to determine the introduction of objects into the sense field, or the motion of objects already in the sense field." Ex-1006, 1:15-20.

67. Gettemy also discloses embodiments for comparing light sensor values to an expected value, then determining the object's position and tracking it as it moves. Ex-1005, [0039]-[0040], [0042]-[0043]. Philipp discloses various thresholding techniques for adding increased robustness in determining when an object comes into the sense field and how long it remains there. Ex-1006, 10:6-16, 10:33-41.

68. A POSITA seeking to solve well-known position and motion detection problems would have known of and consulted each of the proposed solutions of these references. A POSITA would have been motivated to combine the teachings of Gettemy and Philipp at least because Gettemy expressly envisions IR detectors, Ex-1005, [0032], and would have understood that IR detectors should be paired with IR emitters, as exemplified by Philipp, which proposes using IR

detectors and corresponding IR emitters, Ex-1006, Fig 1, to detect objects within the sense field, *id.* at 1:15-20, using thresholding techniques to increase robustness, *id.* at 10:33-41.

69. A POSITA would have had a reasonable expectation of success in combining the teaching of Gettemy and Phillip. Each purports to solve these problems in similar and predictable ways, such as by using well-known IR detectors and processors to execute software algorithms that determine a nearby object's position based thereon. Both recognize these issues and propose solutions using the same types of hardware and software. Accordingly, a POSITA would have understood that these references disclose interrelated teachings based on routine hardware and software technology and they would be quite amenable to various well-understood and predictable combinations.

2. Independent claims 1, 13, and 21

a. Element 1[pre]: A device comprising:

Element 13[pre]: A method for determining a position of an object relative to a device, the method comprising:

Element 21[pre]: A system for determining a position of an object relative to a device, the system comprising:

70. Gettemy alone, or Gettemy and Philipp, disclose and teach the preambles of Claims 1, 13, and 21, to the extent these are determined to be limiting.

71. Gettemy discloses devices, methods, and systems for determining position of an object relative to the device. For example, Gettemy discloses “A display for providing information relating to an object relative to the display.” Ex-1005, Abstract. The device may be a portable device, such as Palm or Windows CE PDA, as shown in Figure 7:

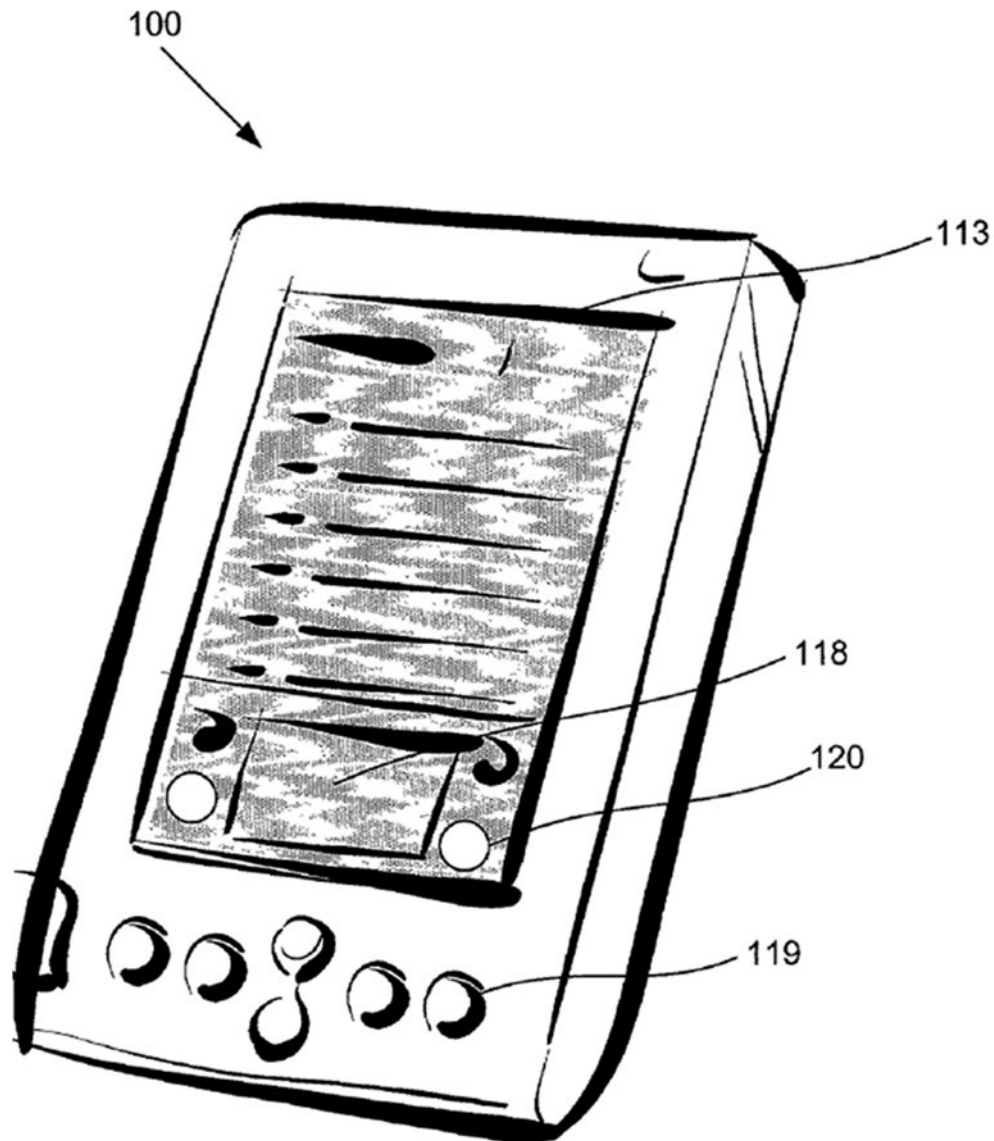
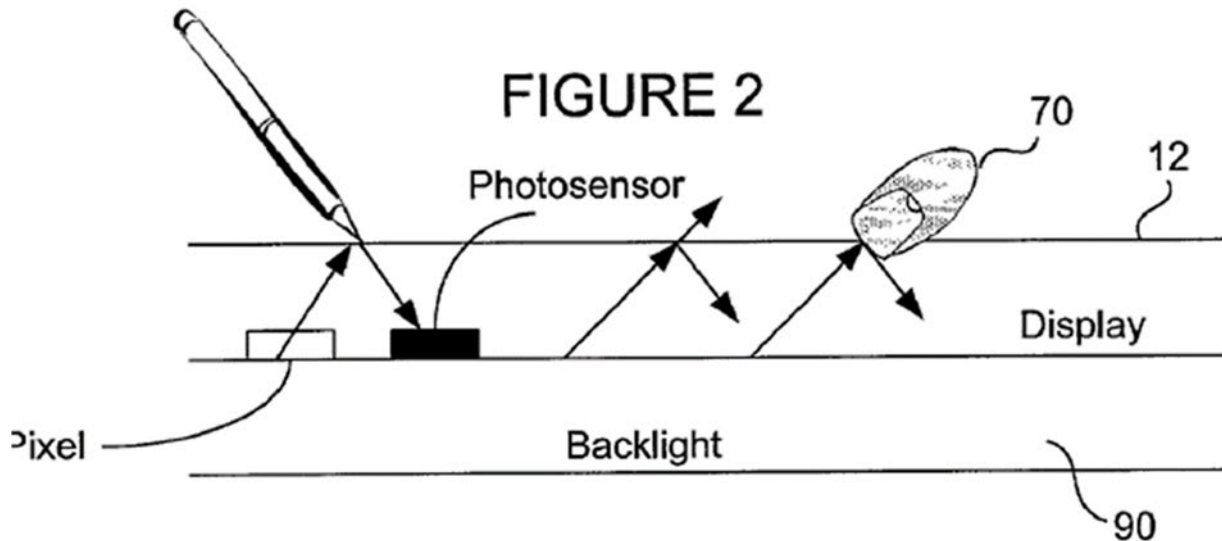


FIGURE 7

72. And the device may include a touch sensitive screen that detects position of nearby objects, as shown in Figure 2:

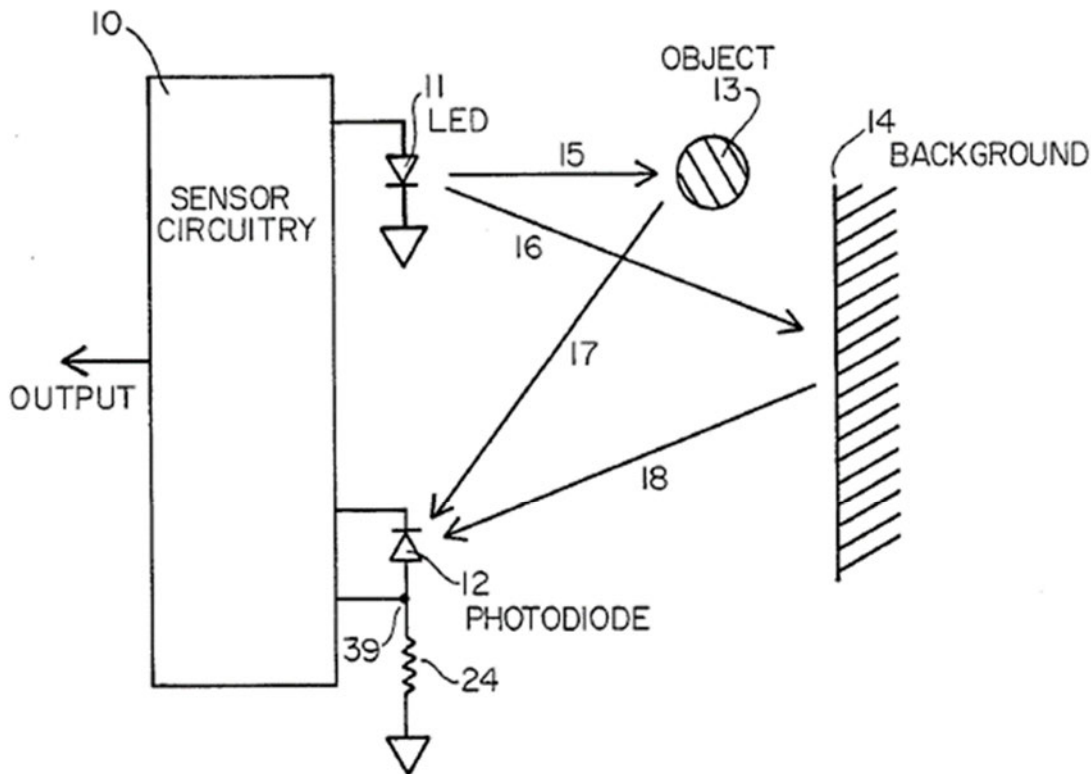


73. Gettemy further discloses methods of using such devices, such as in claim 33, and its dependents. Ex-1005, Claims 33-39.

74. Philipp also discloses like devices, methods, and systems.⁴ For example, Philipp discloses an IR sensor device in its Figure 1:

⁴ Although Phillip is relied upon in Ground 2 for specific limitations discussed below, it is included in the element-by-element analysis to provide context and the interrelated teachings of both references, which would have been well-known to a POSITA. As to Ground 1, Gettemy alone renders obvious the challenged claims.

FIG. 1



75. Philipp also discloses numerous methods of using its device and software, such as in claim 14, and its dependents. Ex-1006, Claims 14-20.

b. **Element 1[a]/21[a]: a display panel having a pixel array that defines a display area, the pixel array is configured to visually present digital content;**

Element 13[a]: displaying digital content by a pixel array that defines a display area on a portion of a display panel;

76. Gettemy alone, or Gettemy and Philipp, disclose and teach elements 1[a], 13[a], and 21[a].

77. Gettemy discloses a display panel (10) having a pixel array (20) defining its display area, in its Figure 1:

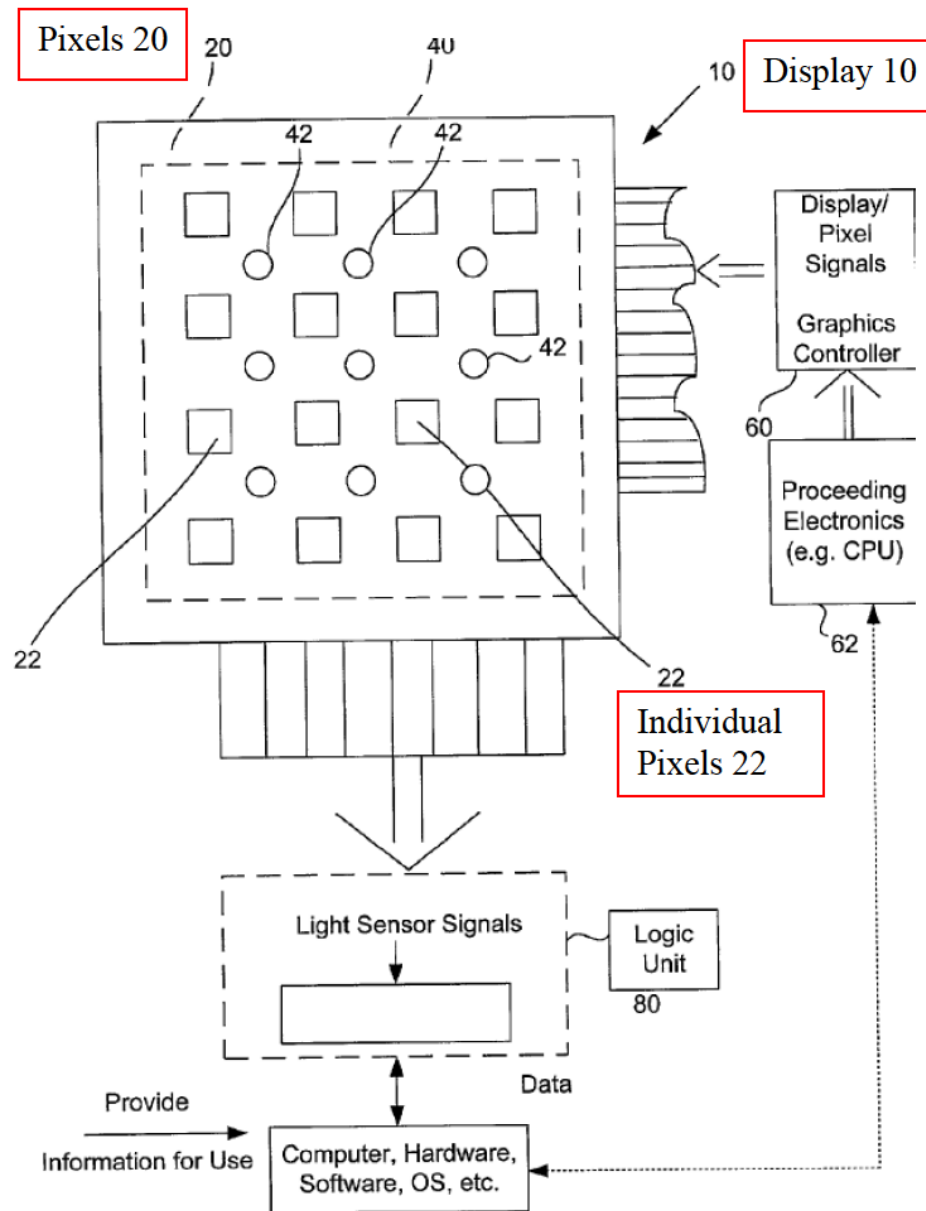


FIGURE 1

78. “Display (10) includes a plurality of pixels (20).” Ex-1005, [0024].

Gettemy discloses controlling “individual pixel 22 of pixels 20” so that “the combination of individual pixels 22 results in the array of pixels 20 displaying information on display 10.” Ex-1005, [0026]. The pixel array is configured to visually display digital content in the form of “text, graphics, images, pictures, and other visual information.” *Id.* at [0025].

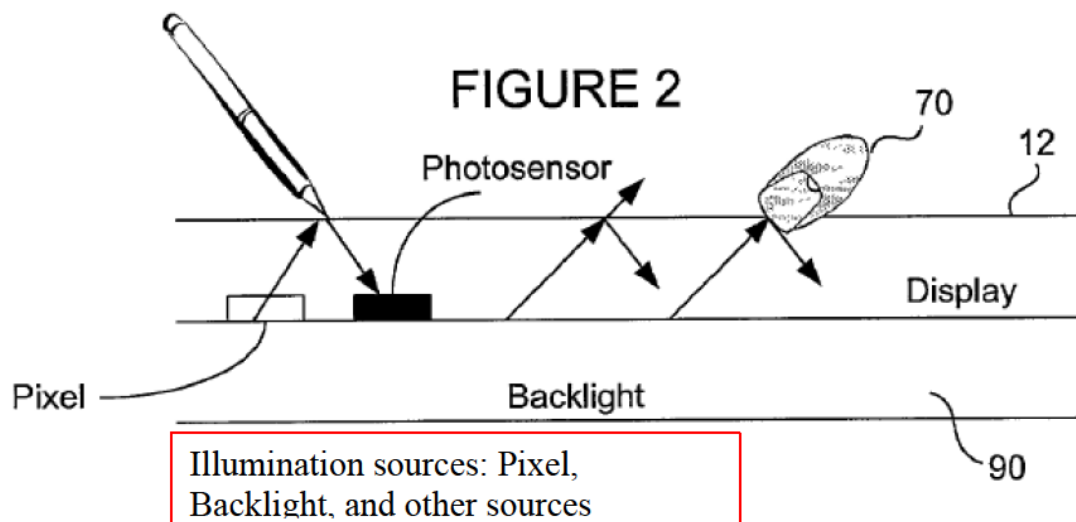
c. **Element 1[b]/21[b]: an Infra-Red (IR) emitter positioned proximate to the display area, the IR emitter illuminating one or more objects in proximity to the device;**

Element 13[b]: illuminating one or more objects in proximity to the device by an Infra-Red (IR) emitter positioned proximate to the display area;

79. Gettemy alone, or Gettemy and Philipp, disclose and teach elements 1[b], 13[b], and 21[b].

80. Gettemy discloses an emitter in the display area that illuminates nearby objects. For example, Gettemy discloses that light may be emitted from a pixel, a backlight, or “other sources.” “As shown in FIG. 2, when light is emitted from a display (either emanating from pixels 20, from a backlight 90, or from other sources), a certain amount of light will pass through a display surface 12, and a certain amount of light will be reflected or refracted back from display surface 12.” Ex-1005, [0024]. Light from the display also illuminates the object 70 in

proximity to the device. *Id.* (“[O]bject 70 reflects or refracts a certain amount of light, which has passed through display surface 12.”).



81. Gettemy does not expressly disclose that the emitter is an infrared (IR) emitter, but does suggest using sensors “configured to detect light in the infrared wavelength.” Ex-1005 , [0032]. A POSITA would have found it obvious to use an IR emitter in either the pixel, the backlight, or one of the “other sources” discussed by Gettemy, based on Gettemy’s disclosure that “Light sensor 42 may be tuned to be responsive to certain types of light (i.e. infrared, visible, ultra-violet, other types of electromagnetic radiation, etc.).” *Id.* “For example, in one exemplary embodiment, light sensor 42 is configured to detect light in the infrared wavelength.” *Id.*

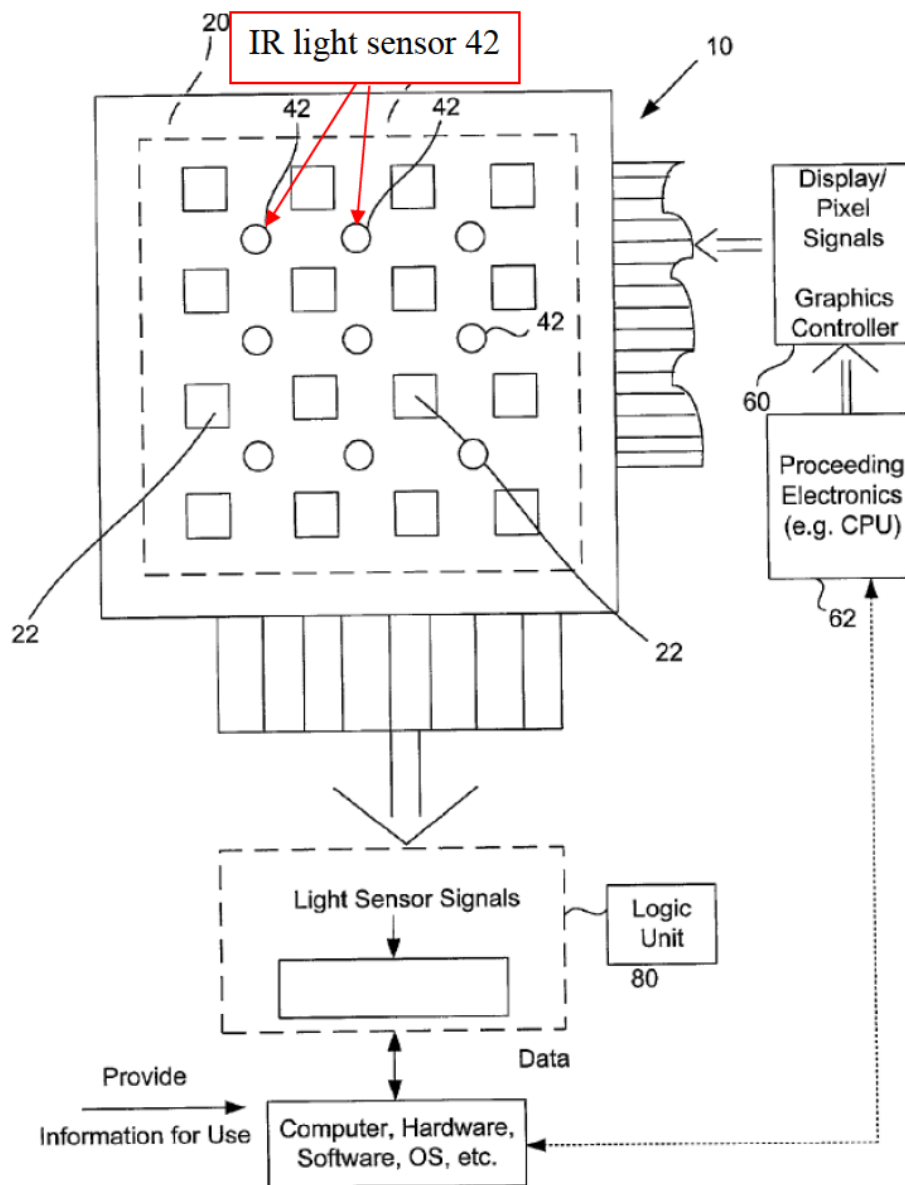


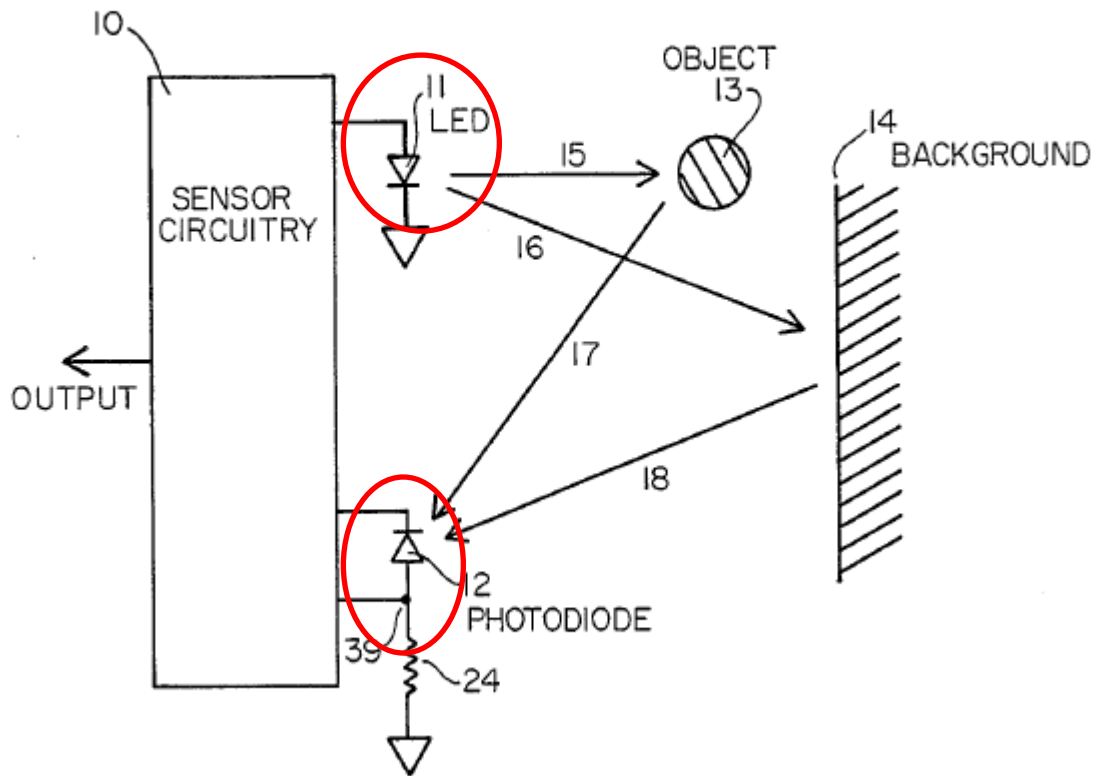
FIGURE 1

Gettemy further teaches that the light “wavelength may be chosen as the wavelength of light which will be reflected by object 70.” Ex-1005, [0032]. Furthermore, Gettemy teaches that the “panel may be designed to allow light (including non-visible light) through the panel for detection.” Ex-1005, [0047]. A

POSITA would understand that an obvious kind of non-visible light is IR light (especially since Gettemy discloses that it can sense IR light.) Based on these teachings, a POSITA would have understood that IR light sensor 42, is configured to detect reflected light in the IR wavelength, and thus would have chosen a corresponding emitter in the IR wavelength. This would, therefore, provide the IR emitted light that is reflected and detected by IR detector 42. Moreover, the '931 Patent makes clear that IR emitters were well-understood prior art devices at the time. *See, e.g.*, Ex-1001, 10:15-35.

82. To the extent that using an IR light emitter with Gettemy's IR light sensor 42 is not obvious in view of Gettemy alone (Ground 1), it would have been obvious in further view of Philipp (Ground 2). Philipp discloses LED 11 emitting light that is reflected and received by Photodiode 12, as shown in Figure 1:

FIG. 1



83. Philipp explains, “The sensor includes an emitting means such as an infrared light emitting diode (LED) 11. LED 11 emits rays of a beam of energy represented by lines 15 and 16 into a sensing region of space. The beam reflects off objects in the region, such as a stationary background 14 which one desires to discriminate against, and an object 13 which one desires to sense. Light energy reflected from these objects is received by a PIN photodiode 12 sensitive to the emitted light energy.” Ex-1006, 5:13-22. Philipp thus teaches to use an IR emitter when detecting light with an IR detector. As explained by Gettemy, a POSITA

would have been motivated to use the same wavelength of light for the emitter and the detector to ensure that the signals are properly “tuned” to each other. Ex-1005, [0030].

84. Moreover, a POSITA would have had a reasonable expectation of success in implementing an IR emitter in Gettemy, as any of the disclosed illumination sources. Because Gettemy contemplates using IR detectors, it also contemplates using IR emitters, although it is silent on the implementation details, which would have been known to a POSITA.

85. For example, Gettemy explicitly discloses using “other sources” of IR light. A POSITA would have understood that one of the well-known “other sources” of IR light would have been an IR LED such as the one disclosed by Philipp, placed in the display screen.

86. As another example, Gettemy discloses using a “backlight” to illuminate the screen and nearby objects. A POSITA would have also been able to implement Gettemy’s backlight 90 “to provide a light source which will be reflected by object 70” with an IR LED as disclosed by Philip. Ex-1005, [0027].

87. As another example, Gettemy discloses that its pixels may be made up of subpixels emitting light in different wavelengths. Ex-1005, [0029]. This is shown in Figure 5:

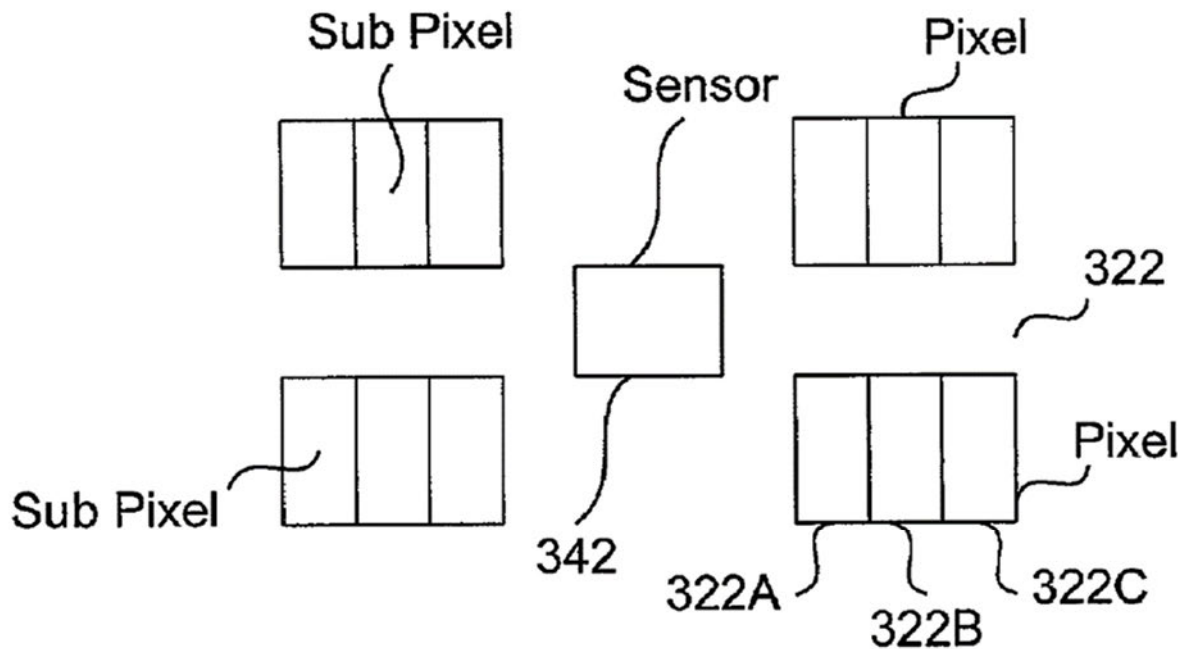


FIGURE 5

88. A POSITA would have been successful in adding an IR emitting sub-pixel, such as an IR LED as is disclosed by Philipp or other well-known IR source, in this pixel array because the electrical circuitry and control software were well-understood and predictable. Indeed, both Gettemy and Philipp include simple and predictable circuits and software for these devices. Gettemy already discloses 3 different colored subpixels, and there would be no impediment to adding a fourth tuned to emit IR light. LED pixels, regardless of wavelength were well-known, understood, and predictable to implement.

89. A POSITA would have had a reasonable expectation of success in implementing any of Gettemy's three identified emitters as IR emitters, whether it

was the “Pixels,” “the Backlight” or the “other sources” of illumination for the same reasons. For example, a POSITA would have also been able to implement Gettemy’s backlight 90 “to provide a light source which will be reflected by object 70” with an IR LED as discussed above. Ex-1005, [0027]; Additionally, Gettemy’s “other sources” of light would have been understood as easily implementable as an additional, separate IR LEDs for the same reasons.

- d. **Element 1[c]/21[c]: a position sensing array positioned proximate to at least one edge of the display area, the position sensing array is configured to receive, through at least one layer of the display panel, at least a portion of light reflected by an object in proximity to the device and generate an output signal that represents an amount of the portion of light; and**

Element 13[c]: receiving, by a position sensing array, at least a portion of light reflected by an object in proximity to the device and through at least one layer of the display panel; and generating an output signal by the position sensing array, the output signal representing an amount of the portion of light reflected by the object;

90. Gettemy alone, or Gettemy and Philipp, disclose and teach elements 1[c], 13[c], and 21[c].

91. Gettemy discloses that its position-sensing features may be positioned on display 10, including at least in positions proximate to the edge of the display, as shown in Figure 1 below (throughout, all red annotations and text added unless otherwise noted):

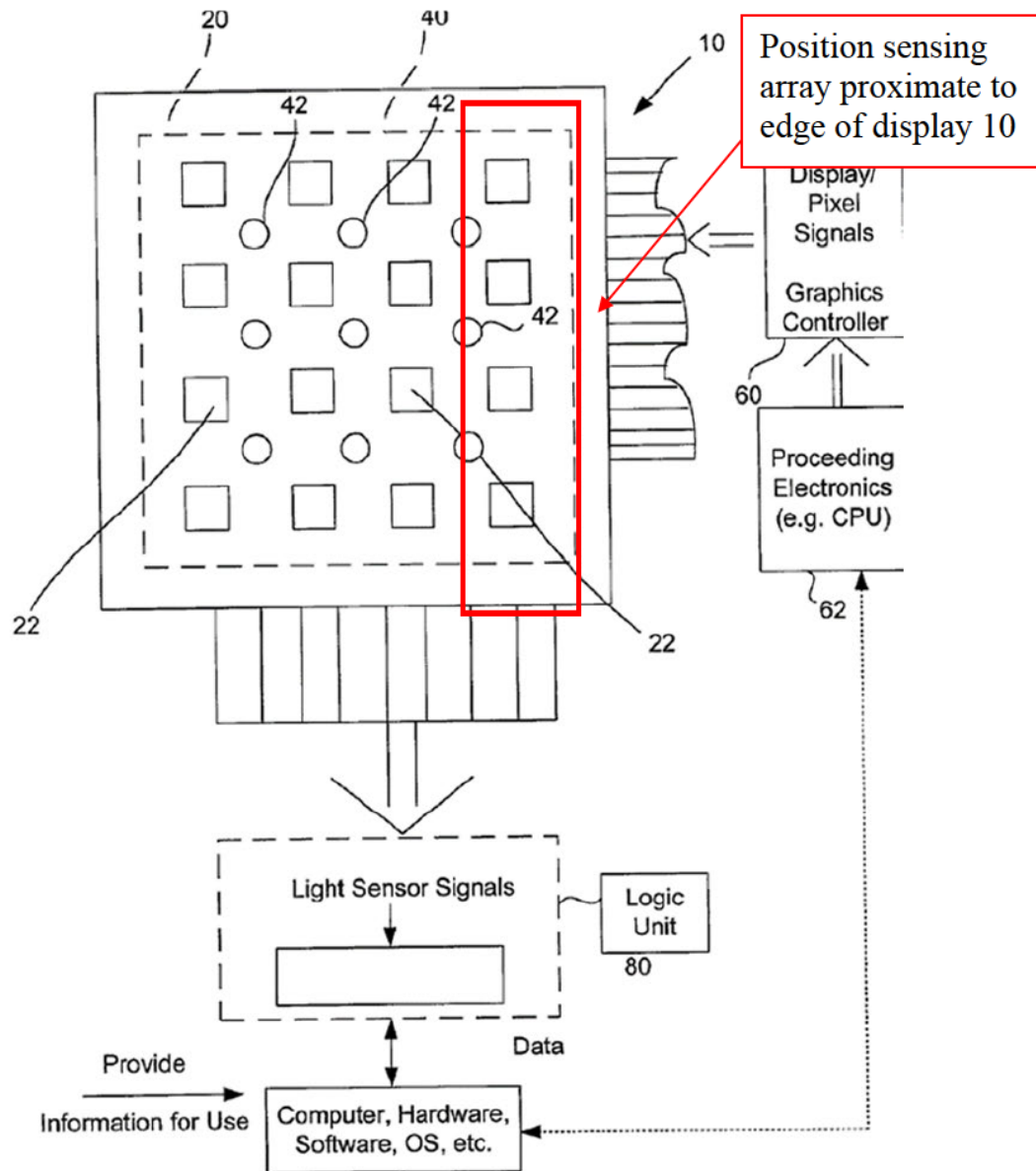
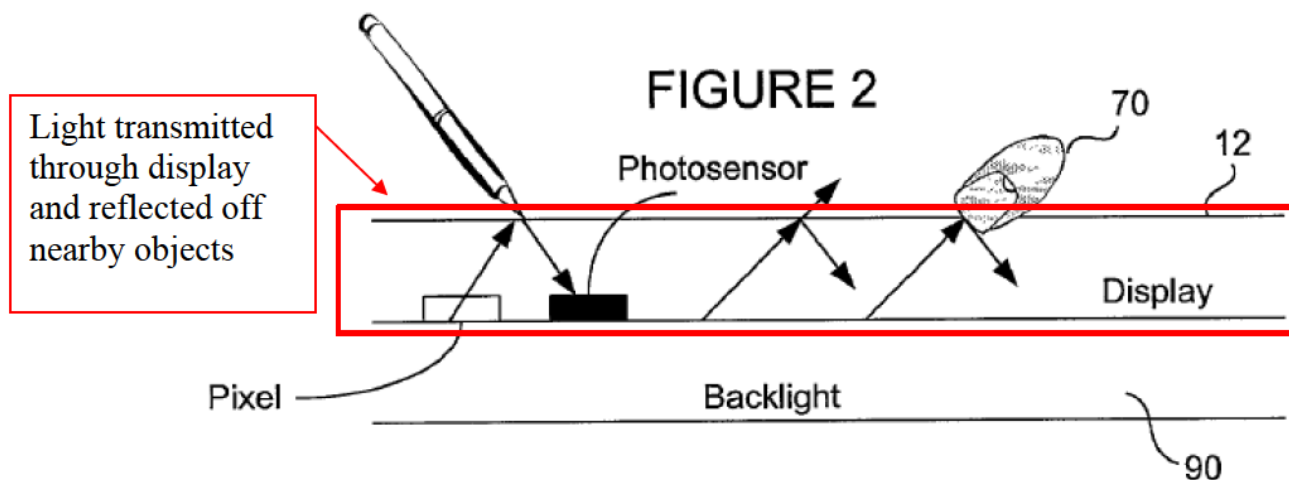


FIGURE 1

Specifically, each individual light sensor 42 may be located proximate to individual pixels 22, and the array of pixels 20 constitutes the display area 10. *Id.* at [0025], [0028]. Accordingly, as shown in the annotated portion of Figure 1, the array of sensors 42 among the pixels 20 along the rightmost edge of display 10, is a

position sensing array positioned proximate to at least one edge of the display area.

92. Gettemy further discloses that the position sensor detects, through at least one layer of the display panel, light reflected from a nearby object. This is shown in Figure 2:



93. Gettemy explains that three layer touch screens with layers for touch sensing, display, and backlight were well known. Ex-1005, [0004]. A POSITA would understand that it wouldn't make sense to have such multi-layer screens unless light could pass through at least some of those layers. And in fact, Gettemy goes further to explain that the touch layer is partially transparent. Ex-1005, [0008]. And that the display "panel may be designed to allow light (including non-visible light) through the panel for detection." Ex-1005, [0047]. Additionally, "a certain amount of light will pass through a display surface 12, and a certain amount of light will be reflected or refracted back from display surface 12. When an object

70 is near display 10, object 70 reflects or refracts a certain amount of light which has passed through display surface 12, back toward display 10.” Ex-1005, [0024].

94. Gettemy discloses generating an output signal indicative of the reflected light received. For example, “according to one exemplary embodiment, light sensor 42 provides an output (such as an electrical signal) in response to an amount of detected light.” Ex-1005, [0032]. Specifically, as shown in Figure 1, these signals are provided to the logic unit 80 configured to translate the output data from the light sensors to information such as position or motion. *Id.* at [0038]

95. Additionally, Philipp also discloses generating an output signal indicative of the reflected light received. Philipp explains: “The diode 12 generates in response a signal current proportional to the intensity of the light received, which when passed through a passive element such as a resistor 24 will create a voltage according to Ohm’s Law. This voltage is proportional to the total light energy received at a given moment in time from reflections from both background 14 and object 13.” Ex-1006, 5:22-30.

**e. Element 1[d]/21[d]: a processing unit configured to:
receive the output signal from the position sensing
array;**

96. Gettemy alone, or Gettemy and Philipp, disclose and teach elements 1[d], and 21[d]. Claim 13 does not separately require “a processing unit” as claims 1 and 21 do, but other elements of claim 13, discussed below, require method steps

to be performed “by a processor.” The disclosures and teachings discussed here are also applicable to the “processor” elements of claim 13.

97. Gettemy discloses a processing unit that may include a Graphics Controller, 62, CPU 62, and Logic Unit 80. Gettemy further explains that “Logic unit 80 may be in communication with the CPU or graphics controller.” Ex-1005, [0040]. Additionally, “The signals from light sensors 40 are passed to logic unit 80, so that logic unit 80 can determine the position of object 70 relative to display 10. Once the position of object 70 is determined, the position may then be passed to CPU 62 (or other functional unit such as a memory unit, storage unit, software, operating system (OS), buffer, or other components of the device) for use.” Ex-1005, [0038]. Features of a processing unit are depicted in annotated Figure 1, below.

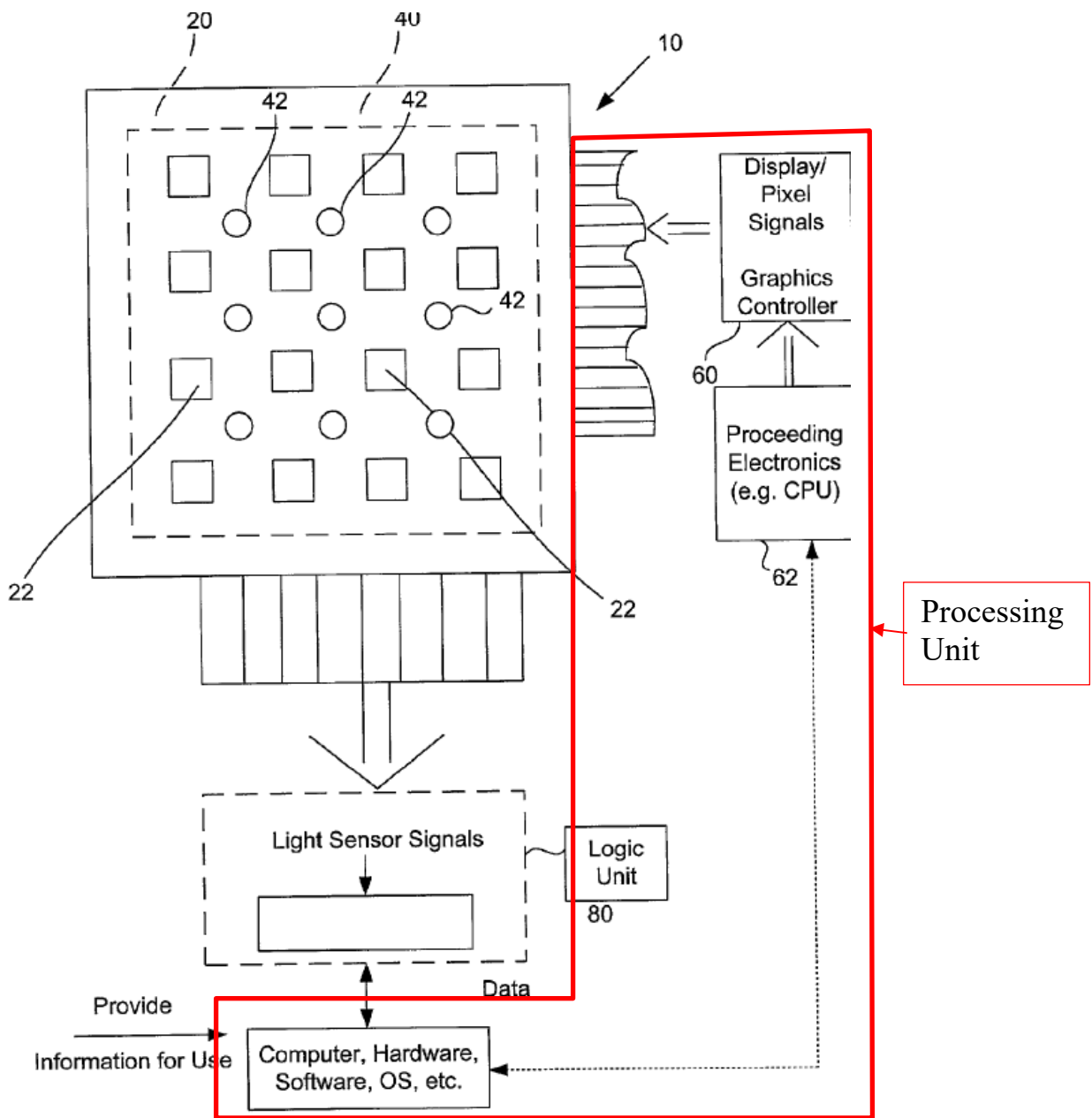
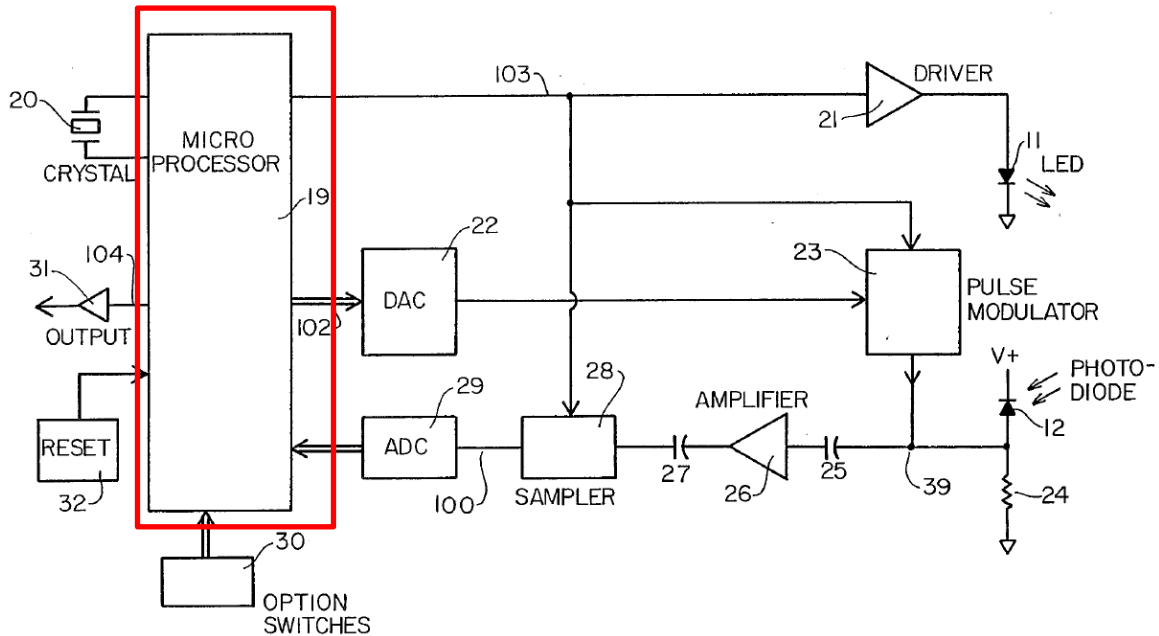


FIGURE 1

98. Philipp also discloses a processing unit, such as microprocessor 19 in Figures 2 and 4. Figure 2 is below:

FIG. 2



99. Philipp's sensor is operated using "software incorporated into microprocessor 19." Ex-1006, 5:42-43. Specifically, "the microprocessor 19 contains software that performs various algorithmic operations on the data recovered from signal 100." Ex-1006, 10:1-5. Additionally, Philipp teaches that "it is understood that although this specific implementation makes use of a microprocessor, random logic or other digital means may be employed to achieve the same result of a microprocessor." Ex-1006, 6:8-10. As such, to the extent a processing unit is limited to a single integrated circuit, a POSITA would have understood that the components identified in Gettemy Figure 1 could have, as a standard design choice that was well-understood at the time, been implemented solely in a microprocessor, such as the one disclosed by Philipp. A POSITA would have been motivated to make such a predicable variation on Gettemy's

implementation to minimize the number of physical components in a device and reduce size, weight, and hardware complexity.

f. Element 1[e]/21[e]: determine the output signal exceeds a predetermined threshold;

Element 13[d]: determining, by a processor, the output signal exceeds a predetermined threshold; and

100. Gettemy alone, or Gettemy and Philipp, disclose and teach elements 1[e], 13[d], and 21[e].

101. Gettemy discloses comparing the signal to a predetermined threshold. For example, “logic unit 80 may be configured to compare the light sensor signals with an expected readout value.” Ex-1005, [0040]. These expected values may be provided by a “calibration chart” or “comparison table,” or provided by the CPU based on the “effect of the displayed data.” *Id.* The “expected readout value” is a threshold against which the “light sensor signals” are compared. And this threshold is predetermined because they involve either a static prediction in the form of values or tables, or a prediction that is updated based on the displayed image. In either case, logic unit 80 is, in advance, “provided with an expected value for the light sensors” so that it can “compare those values with the actual detected light.” Ex-1005, [0040].

102. To the extent that Gettemy does not disclose this element, it would have been obvious to a POSITA in view of the foregoing disclosures of Gettemy

alone or in further view of Philipp. For example, Philipp discloses that “if software so chooses, it may elect to set the output driver 31 to a triggered state in response to this net signal, provided it is large enough (i.e. exceeds a threshold level).” Ex-1006, 6:54-68. Philipp describes multiple example of using thresholds. Ex-1006, 10:1-11:37. E.g., “As long as the new object 13 remains in the sense field, the threshold will remain exceeded and a trigger output will occur.” Ex-1006, 10:35-38. Additionally, Philipp’s threshold is predetermined because it relies upon a specific level set in advance: “Thresholding occurs when the signal rises above or falls below a specific set level.” Ex-1006, 11:20-21.

103. A POSITA would have been motivated to include a determination of whether the signal exceeds a predetermined threshold for a number of reasons. As an initial matter, to the extent that the “expected readout value” is not necessarily a predetermined threshold, a POSITA would have been motivated to treat it as one. That is, a POSITA would have been motivated to implement a predetermined threshold based on the expected readout value and determine when the signal exceeds this value. This would allow for a consistent, known benchmark against which to measure the signal, and ensure a consistent and reliable response. Gettemy itself explains “unwanted registrations” may be caused by dust or smudges, and the adjustments to a “sensitivity level” can be used to correct for such unwanted effects. Ex-1005, [0049]. A POSITA would have been motivated to

use a pre-determined threshold setting the sensitivity level high enough to avoid such unwanted registrations. To the extent that Gettemy alone is insufficient, Philipp would have further motivated a POSITA to include a predetermined threshold because Philipp teaches that “thresholding of the detected signal could benefit from a greater degree of flexibility.” Ex-1006, 2:34-35. Philipp explains that thresholding can be used to determine whether “a valid trigger state exists.” Ex-1006, 11:17-20. Philipp provides algorithms with such flexibility (e.g., *id.*, 10:1-11:37) that a POSITA would have been motivated to include in Gettemy to improve system reliability and flexibility. And a POSITA would have had a reasonable expectation of success in implementing such a determination in Gettemy because the threshold settings and algorithms are simple software or firmware routines that were well-understood to implement by a POSITA with predictable results.

g. Element 1[f]/21[f]: calculate, based on the output signal, a position of the object relative to the device when the output signal exceeds the predetermined threshold; and

Element 13[e]: calculating, by the processor, a position of the object relative to the device when the output signal exceeds the predetermined threshold.

104. Gettemy alone, or Gettemy and Philipp, disclose and teach elements 1[f], 13[e], and 21[f]. *See* section XIII.A.2.e regarding the “predetermined threshold.”

105. Gettemy discloses calculating the position of the object relative to the device. For example, “Shown in FIG. 3 is one exemplary embodiment of a method used by logic unit 80 to determine the location or position of object 70 relative to display 10.” Ex-1005, [0039].

FIGURE 3

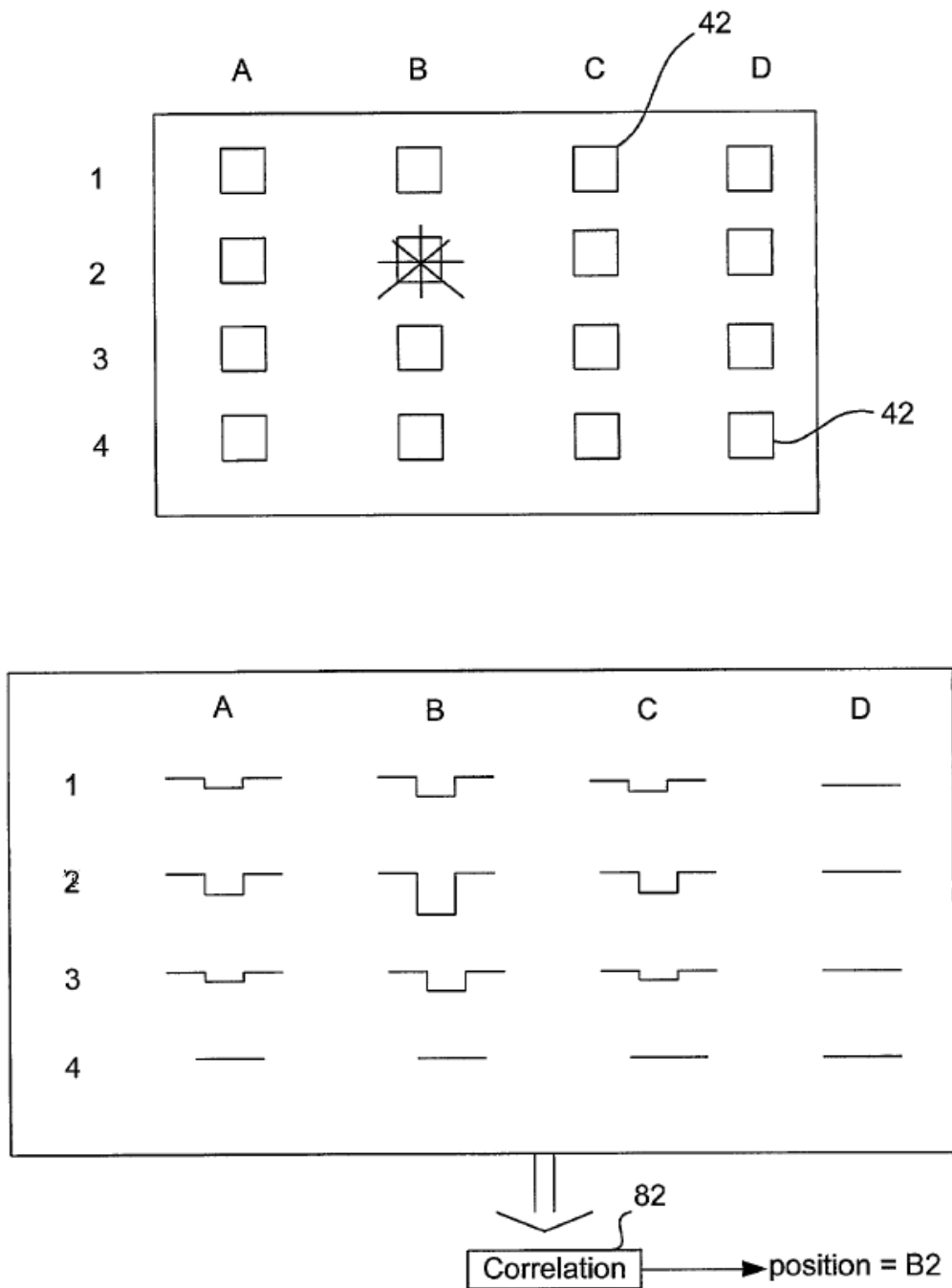


Figure 3 shows a simplified grid of light sensors. A user's finger is positioned over element B2, which results in the maximum signal return over that sensor. *Id.* "The state of each light sensor is then passed to a correlation step 82. Correlation step 82

may search the light detector data for a maximum or minimum value in order to determine a position.” *Id.* “[T]he position coordinate may be correlated to a pixel, a group of pixels, an area on the screen, etc.” *Id.*

A POSITA would have understood that the positioning calculation is done when the detected signal exceeds the pre-determined threshold, as exceeding a threshold is known by a POSITA to be a triggering event. To the extent not obvious in view of Gettemy alone, this is obvious in further view of Philipp. Philipp explicitly discloses using “a triggered state in response to this net signal, provided it is large enough (i.e. exceeds a threshold level).” Ex-1006, 6:54-68; *see also id.*, 11:21-22.

h. Element 1[g]/21[g]: execute input functionality [for the device] corresponding to the position of the object.

106. Gettemy alone, or Gettemy and Philipp, disclose and teach elements 1[g], and 21[g]. Claim 13 does not include this element, unlike claims 1 and 21.

107. Gettemy discloses executing a number of input functionalities corresponding to the position of the object. For example, “the information relating to the object is provided to data processing electronics (such as a CPU 62) to determine or interpret the motion of object 70 into an alpha-numeric text characters (e.g. Graffiti”, etc.) for use with text processing programs, user programs, operating systems, etc.” Ex-1005, [0042]. As another example, “Handheld device 100, depicted in FIG. 7 includes a plurality of input functions, keys 119 and a

display 113 having graphical user interface features according to the present invention.” *Id.*, [0045]. “A plurality of input buttons 120 for performing automated or preprogrammed functions may be provided on a portion of display 113. In a particular embodiment, display 113 is a touch screen display that is electronically responsive to movements of a stylus (or other pointing device, such as but not limited to a fingertip or pen tip) on or near the surface of display 113.” *Id.* These functions may be shown on the screen of the device as depicted in Figure 7, including handwriting recognition area 118, and input buttons 120.

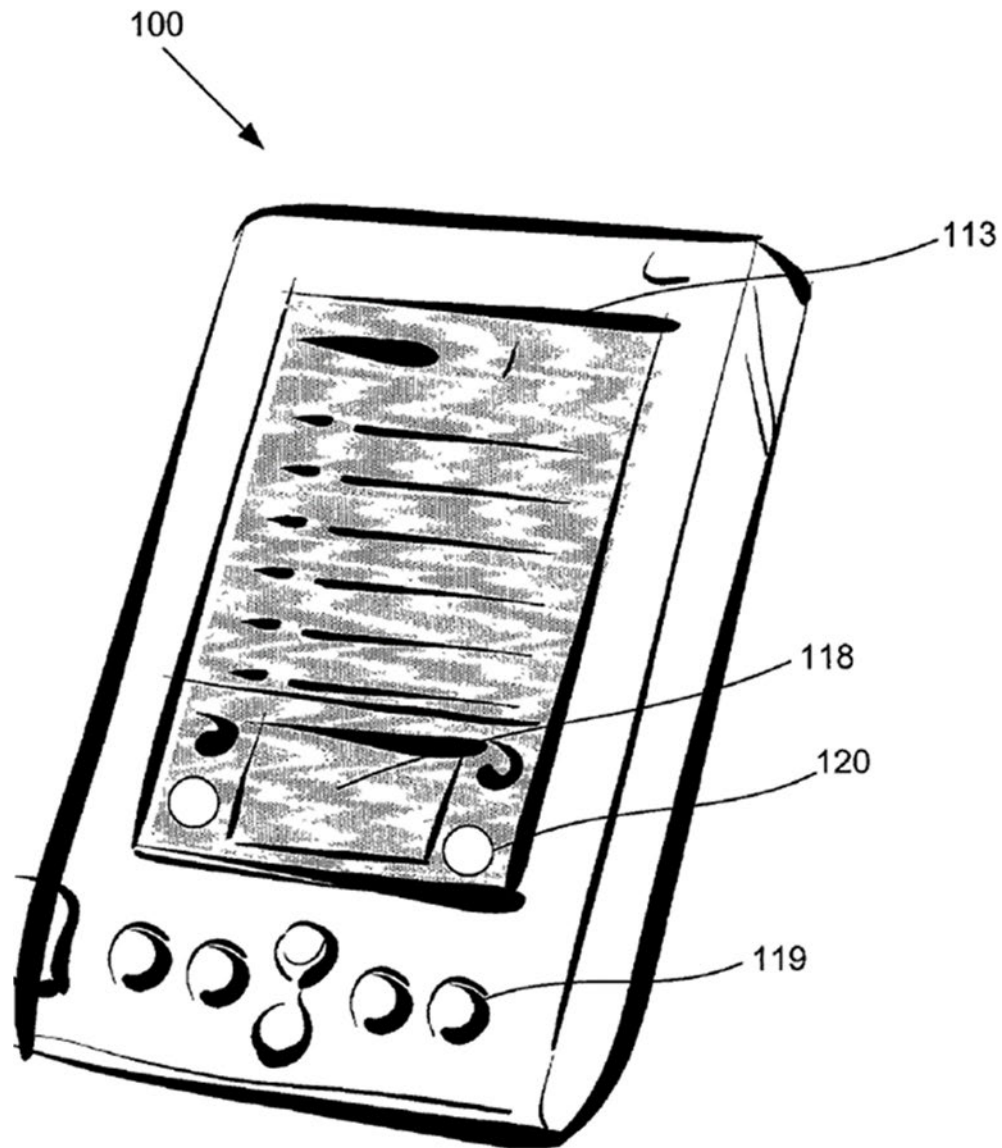


FIGURE 7

3. Dependent claims 3, 6-12, 15, and 18-20

- a. Claim 3:** The device of claim 1, wherein the processing unit is further configured to: determine a change in the output signal; and calculate movement of the object relative to the display panel based on the output signal.

Claim 15: The method of claim 13, further comprising: determining, by the processor, a change

in the output signal; and calculating, by the processor, movement of the object relative to the display panel based on the change in the output signal.

108. Gettemy alone, or Gettemy and Philipp, disclose and teach claims 3 and 15.

109. As explained above with respect to claim limitation 1[f]/21[f], Gettemy calculates at the correlation step, based on the output signal, a position of the object relative to the device. Gettemy translates signals “from light Sensors 40 into more useable information such as position, *motion*, acceleration, shape etc. for use by the device.” Ex-1005, [0038] (emphasis added); *see also* Fig. 4 (correlation step 210 determining motion).

110. In an exemplary embodiment, “the information relating to the object is provided to data processing electronics (such as CPU 62) to determine the motion of object 70 into alpha-numeric text characters (e.g., Graffiti, etc.).” Ex-1005 ¶ [0042]. “Graffiti ... or other hand recognition software, [is] for tracing alpha numeric characters as input.” *Id.*, ¶ [0045]. Translating motion into specific alpha-numeric characters discloses or teaches “determining movement by the object relative to the display panel based on the change in output signal.”

b. Claim 6: The device of claim 1, wherein the processing unit is further configured to: determine, based on the output signal, a two-dimensional position of the object relative to the display area.

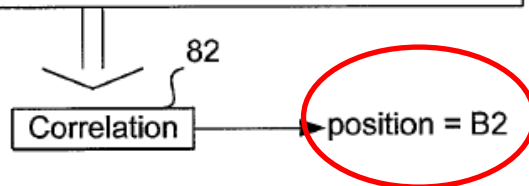
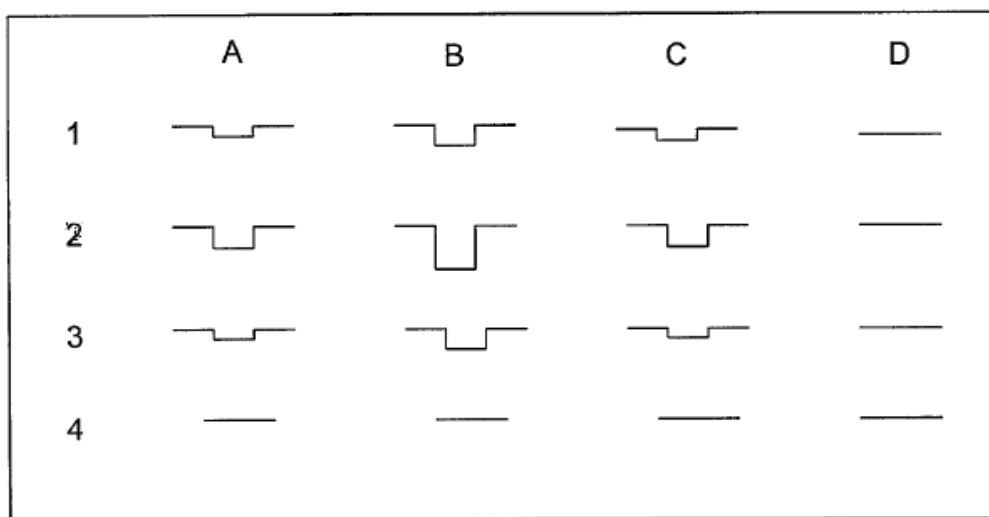
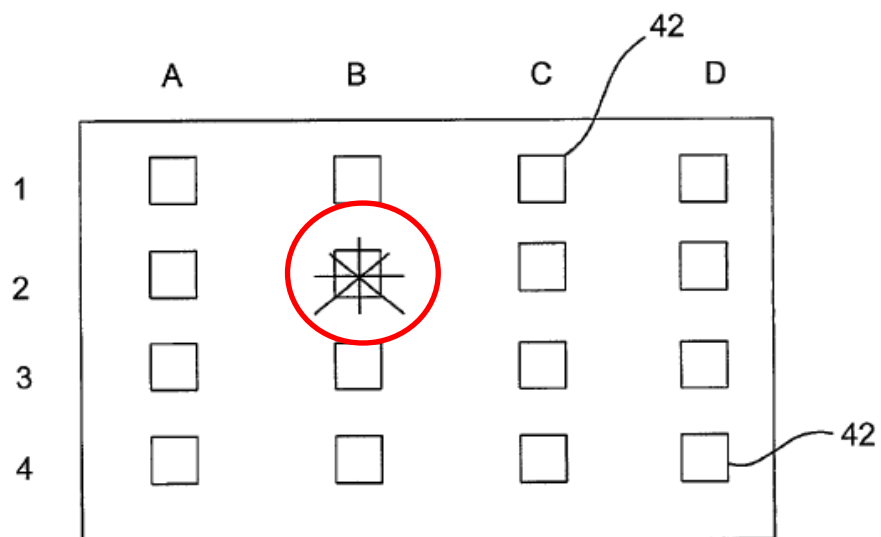
Claim 18: The method of claim 13, further

comprising: determining, based on the output signal, a two-dimensional position of the object relative to the display area.

111. Gettemy alone, or Gettemy and Philipp, disclose and teach claims 6 and 18.

112. Gettemy discloses, in its Figure 3, determining a two-dimensional position of the object. For example, in the simplified example depicted, “letters A-D represent[] columns of display 10, and the numbers 1-4 represent[] rows of display 10.” *See* Ex-1005, ¶ [0039]. *Id.* Gettemy uses its device and algorithms to calculate the two-dimensional position of the object as B2. *Id.*

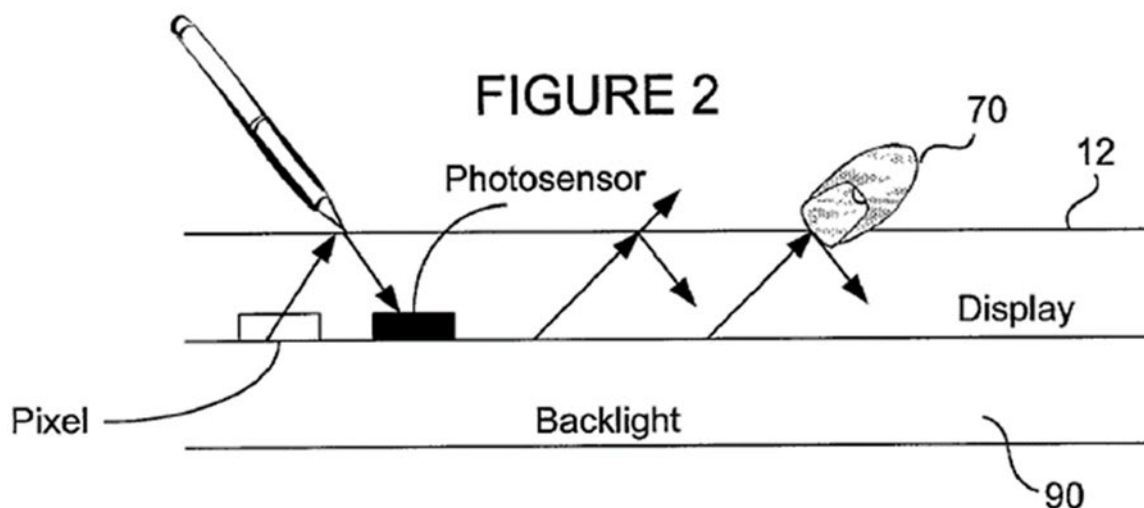
FIGURE 3



- c. **Claim 7/19: The device of claim 1 [the method of claim 13], wherein the display panel comprises at least one of an infra-red (IR) transmissive display layer, a liquid crystal display (LCD) layer, or an organic light emitting diode (OLED) layer.**

113. Gettemy alone, or Gettemy and Philipp, disclose and teach claims 7 and 19.

114. Gettemy discloses that the display includes an IR transmissive layer. For example, Gettemy explains that “a certain amount of light will pass through a display Surface 12” and be detected by the IR photosensor. Ex-1005, [0024], [0032]. Gettemy teaches that the “panel may be designed to allow light (including non-visible light) through the panel for detection.” Ex-1005, [0047]. A POSITA would understand that an obvious kind of non-visible light is IR light (especially since Gettemy discloses that it can sense IR light.)

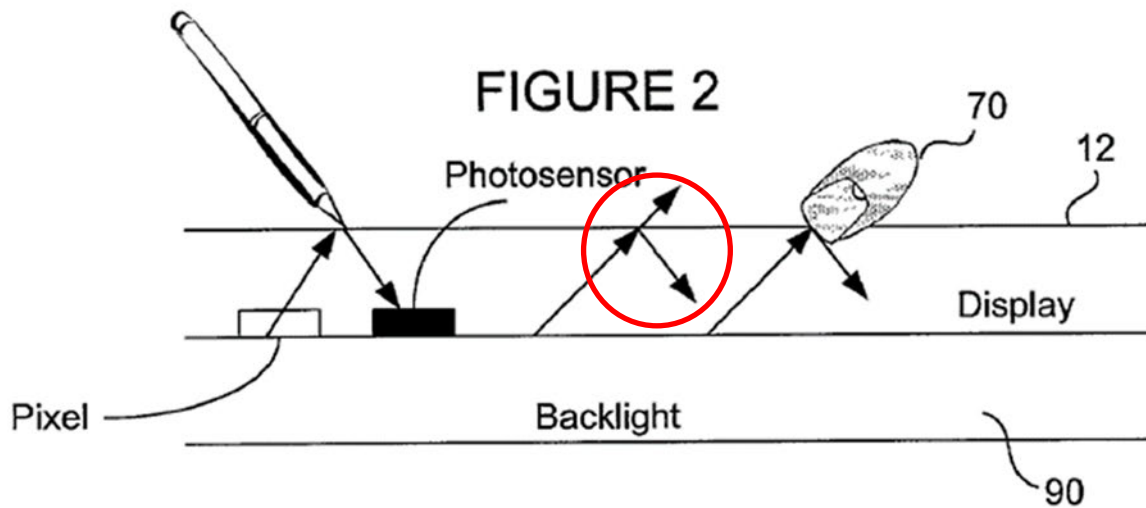


115. Additionally, Gettemy discloses an LCD layer on the display: “Display 113 may include a liquid crystal display (LCD), a thin film transistor (TFT) display, a micro machine mirror display, and other back lit, side lit, refractive or reflective displays.” Ex-1005, [0045].

d. Claim 8: The device of claim 1, wherein the display panel comprises at least one of a diffusing layer, a reflector layer, or a collimating layer.

116. Gettemy alone, or Gettemy and Philipp, disclose and teach claim 8.

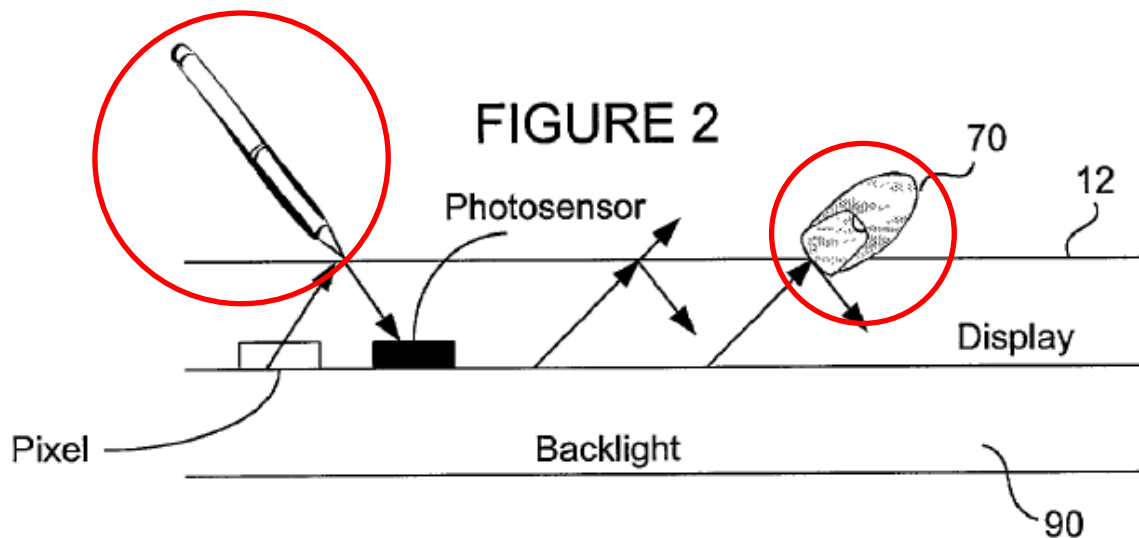
117. Gettemy discloses a reflective layer. “As shown in Fig. 2, when light is emitted from a display (either emanating from pixels 20, from a backlight 90, or from other sources), a certain amount of light will pass through display surface 12, and a certain amount of light will be reflected or refracted back from display surface 12.” Ex-1005, ¶ [0024]. Additionally, a certain amount of light will be reflected at the “glass/air” transition of the display surface: “For example, a glass to air transition may cause roughly a 5 percent reflection due to the change in the index of refraction. However, a glass to another material (such as a polymer or elastomer) transition may cause a greater than 5 percent reflection due to the change in the index of refraction. Light sensors 40 may be configured to detect such changes.” Ex-1005, [0034]. The surface of the display is thus a reflector layer. Gettemy also explains: “Display 113 may include ... refractive or reflective displays” Ex-1005, [0045]; *See also id.* [0047].



- e. **Claim 9/20:** The device of claim 1 [the method of claim 13], wherein the object comprises at least one of a stylus, a portion of a hand, or a finger.

118. Gettemy alone, or Gettemy and Philipp, disclose and teach claims 9 and 21.

119. Gettemy discloses, in Figure 2 for example, using a stylus or a finger as the touch object 70. *See* Ex-1005, ¶ [0024]. Referring to the device of Figure 7, “[d]isplay 113 may be provided with an interface that allows a user to select an altered display content using a pointer, such as, but not limited to, a stylus.” *Id.*, ¶ [0045]. The other example object depicted in Figure 2 is the tip of a finger.

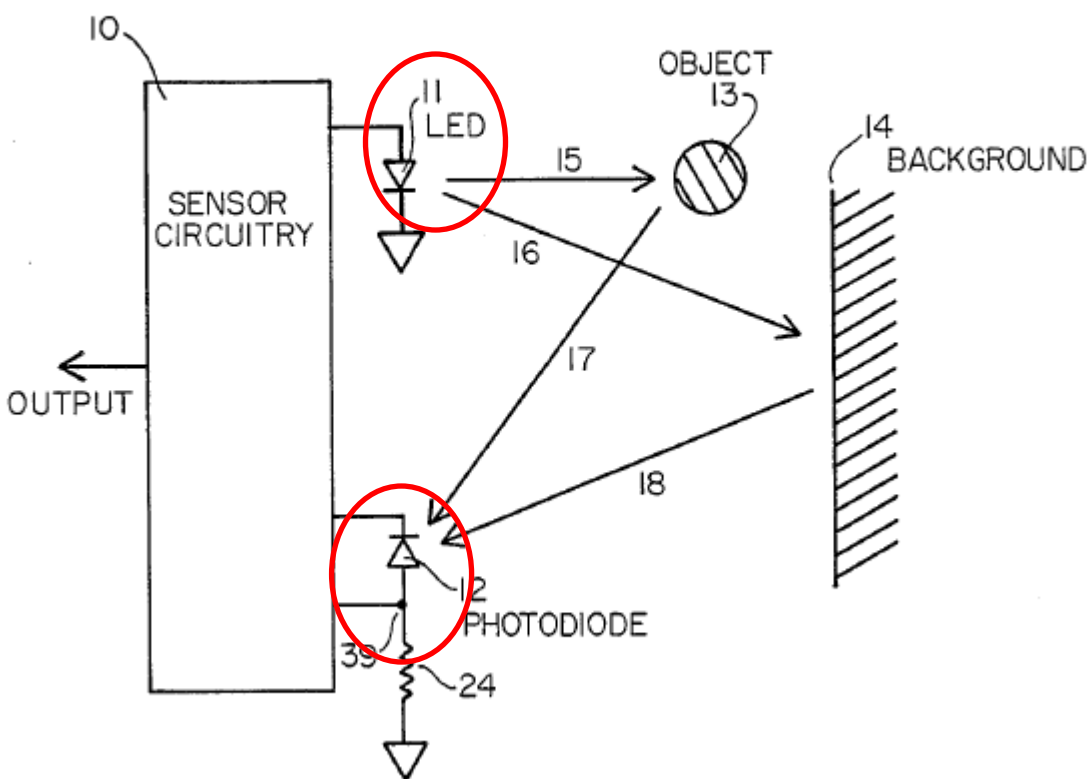


- f. **Claim 10: The device of claim 1, wherein the IR emitter comprises an IR light-emitting diode (LED).**

120. Gettemy alone, or Gettemy and Philipp, disclose and teach claim 10.

121. Gettemy does not explicitly disclose an IR LED emitter. But, as explained in connection with claim elements 1[b]/21[b]/13[b], Gettemy teaches an IR photosensor, Ex-1005 ¶ [0032], which would, for the reasons explained above, require an IR emitter. Moreover, as explained above, Philipp discloses IR LED 11 emitting light that is reflected and then received by Photodiode 12. This is shown in Figure 1:

FIG. 1

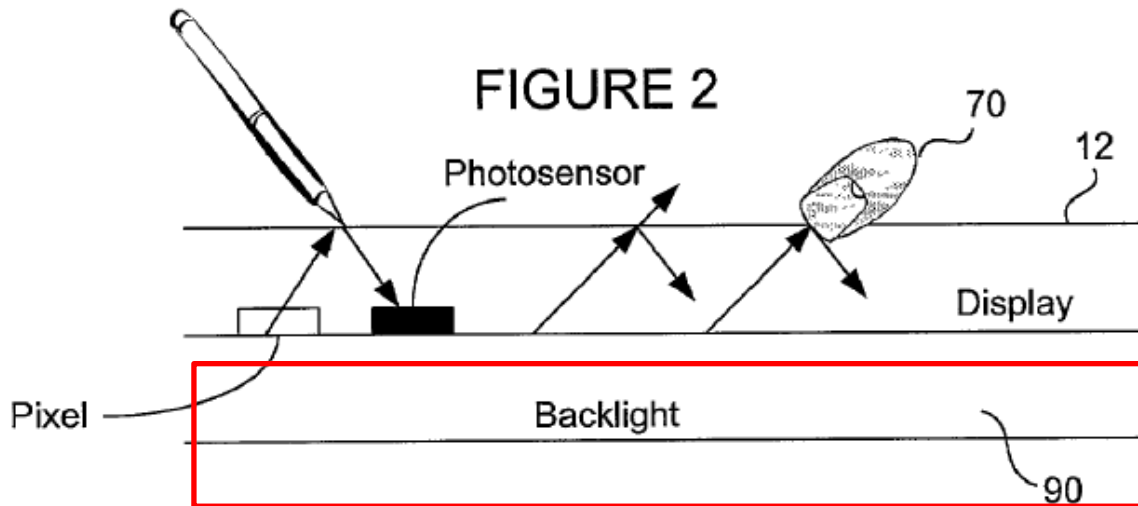


122. Philipp explains, “The sensor includes an emitting means such as an infrared light emitting diode (LED) 11.” It would have been obvious to implement Gettemy’s “other sources,” “pixels,” or “backlight” with IR LED emitters for the reasons discussed above in connection with claim elements 1[b]/21[b]/13[b].

g. Claim 11: The device of claim 1, wherein the display panel includes a backlight layer for illuminating at least a portion of the display area.

123. Gettemy alone, or Gettemy and Philipp, disclose and teach claim 11.

124. Gettemy discloses using a backlight layer, for example in its Figure 2.



125. Gettemy explains: “According to an alternative embodiment (as shown in FIG. 2), display 10 may further include a backlight 90. Backlight 90 may provide illumination of display 10 in low lighting conditions. Backlight 90 may also be used to provide a light source which will be reflected by object 70, and which light will be detected by light sensors 40.” Ex-1005, [0027]. Additionally, Gettemy explains that “Touch screens typically include three layers: a touch panel layer, a display layer below the touch panel layer, and a *backlight layer* below the display layer.” Ex-1005, [0004]

**h. Claim 12: The device of claim 1, further comprising:
a backlight for illuminating at least a portion of the
display area.**

126. Gettemy alone, or Gettemy and Philipp, disclose and teach claim 12.

127. *See* Claim 11, above. Additionally: “Backlight 90 may provide illumination of display 10 in low lighting conditions.” Ex-1005, [0027].

B. Ground 3 and 4: Claims 2 and 14 are rendered obvious by Gettemy (Ex-1005), or Gettemy and Philipp (Ex-1006), in view of Carstedt (Ex-1007).

1. A POSITA would be motivated to combine the teachings of Gettemy, Philipp, and Carstedt and would have a reasonable expectation of success in doing so.

128. In addition to the reasons set out below with respect to specific claim elements, a POSITA would have been motivated to combine the teachings of Gettemy alone, or Gettemy and Philipp, (for the reasons discussed above in Section XIII.A.1) and Carstedt, and would have a reasonable expectation of success in doing so, because each relates to the same well-known issues. Specifically, like Gettemy and Philipp, Carstedt teaches the use of optical sensors, including IR sensors to detect the position of objects near a computer screen. Ex-1007, 2:10-35. A POSITA seeking to solve well-known optical touch detection problems, such as problems with changing ambient light conditions, would have known of and consulted each of these proposed solutions. A POSITA would have been motivated to combine the teachings of Gettemy, Philipp, and Carstedt, at least because Gettemy discloses both ambient light sensors and potential problems with “unwanted registrations.” Ex-1005, [0035], [0049]. Carstedt similarly teaches “digital ambient light sampling.” Ex-1008, Title.

129. A POSITA would have had a reasonable expectation of success in combining the teachings of Carstedt, Gettemy, and Philipp. Each purports to solve

these problems in similar and predictable ways, such as by using ambient light sampling. Each recognizes these issues and proposes solutions using the same types of hardware and software. Accordingly, a POSITA would have understood that these references disclose interrelated teachings based on routine hardware and software technology and they would be quite amenable to various well-understood and predictable combinations.

2. Dependent claims 2 and 14.

- a. Claim 2: The device of claim 1, wherein the processing unit is further configured to: determine a baseline level of ambient light proximate to the device; and set the predetermined threshold above the baseline level of ambient light.**

Claim 14: The method of claim 13, further comprising: determining, by the processor, a baseline level of ambient light proximate to the display panel; and setting the predetermined threshold above the baseline level of ambient light.

130. Gettemy and Carstedt, or Gettemy, Philipp, and Carstedt, disclose and teach claims 2 and 14. As set forth above in section XIII.A, Gettemy alone, or Gettemy and Philipp, disclose and teach claims 1 and 13. More specifically, Gettemy and Philipp each disclose and teach determining a predetermined threshold. *See, supra*, section XIII.A.f.

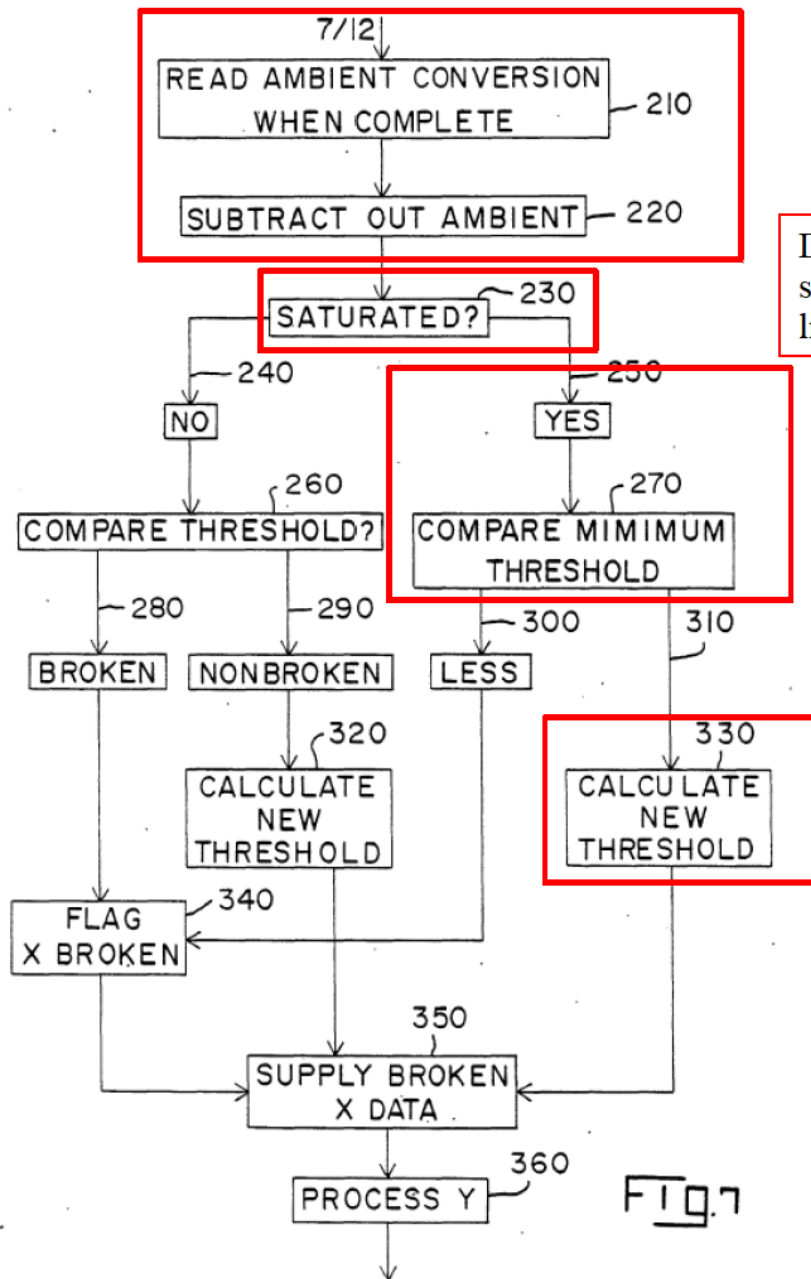
131. Further, Gettemy discloses that “unwanted registrations” may be caused by dust or smudges, and the adjustments to a “sensitivity level” can be used to correct for such effects. Ex-1005, [0049]. Gettemy further discloses detection of

changes to ambient light: “light sensors 40 may be configured to detect an amount of ambient light present (or absent) due to object 70 from the surrounding environment.” Ex-1005, [0035]. Gettemy does not expressly disclose detecting a “baseline” of ambient light and updating the threshold based on it, but this feature would have been an obvious design choice for ensuring correct registration of nearby objects in changing ambient light conditions.

132. Carstedt expressly discloses that “it is also desirable to have a device which dynamically compensates for ambient light and for variations in emitter output and detector sensitivity.” Ex-1007, 2:17-19. The method disclosed by Carstedt “produces a device which accommodates for changing ambient light levels, emitter and/or detector degradation and which has few components.” Ex-1007, 18:21-23.

133. Carstedt discloses, for example, the flow chart in Figure 7 (reproduced below). Step 210 determines the “baseline” ambient light level proximate to the device. Ex-1007, 14:20. In step 220, the ambient light level determined at step 210 is subtracted from the level read from the detector. *Id.* The process then determines whether the detector is saturated at step 230. *Id.* 14:25. When the signal is “saturated,” it has received a large amount of light. If it is determined at step 230 that the detector is saturated with ambient light, at step 270 the sensed signal value “is compared against a predetermined fixed minimum threshold value.” *Id.* 15:1-5.

If this ambient saturated value is greater than the first predetermined threshold, then, at step 330, a new threshold, above the “baseline level,” is calculated to account for the ambient lighting conditions, and used for future comparisons. *Id.* 15:10-15 “In this manner a continuous and dynamic sampling of ambient light is utilized and taken into account. Further, device degradation which generally occurs over a considerable period of time and which results in decreased sensitivity by the phototransistor or decreased light output by the emitter is automatically taken into account since, within predetermined absolute minimums and maximums, new thresholds are continuously calculated and utilized.” *Id.* 15:15-23.



Determine baseline level of ambient light

Determine if sensor saturated with ambient light

Compare signal to threshold

Raise threshold above the ambient baseline level

Fig. 7

134. A POSITA would have been motivated to include this type of ambient baseline processing for a number of reasons. Gettemy itself explains that a “level of sensitivity” may be updated to ensure correct registration of nearby objects. Ex-

1005, ¶ [0049]. A POSITA would have understood that a variable “level of sensitivity” would have been implemented with a variable threshold. POSITA further would have understood that, since the level of ambient light changes, the sensitivity level or threshold should change as well, otherwise the system will not be properly sensitive to nearby objects that are too strongly or weakly lit. A POSITA would have been motivated to determine and update thresholds to accommodate for ambient light to ensure an appropriate “level of sensitivity” for the then present lighting conditions. Carstedt would have further motivated a POSITA to include setting thresholds over an ambient baseline because Carstedt teaches that using a threshold that does not change “dynamically” in response to ambient lighting conditions is problematic. Ex-1007, 2:4-7. Additionally Carstedt’s software solution is proposed to ensure that a detection threshold is sensitive enough to not be saturated by a strong ambient light, all without having to add physical components Ex-1007, 1:33-35.

135. Gettemy already includes logic or programming to detect ambient lighting conditions. Ex-1005, [0035], [0040]. Carstedt provides algorithms that a POSITA would have been motivated to include in Gettemy to improve system responsiveness in the presence of changing ambient lighting conditions. A POSITA would have had a reasonable expectation of success in implementing such a determination in Gettemy because the ambient lighting and threshold settings and

algorithms are simple software routines that were well-understood and predictable to implement.

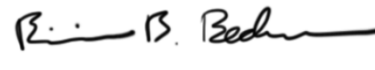
XIV. SECONDARY CONSIDERATIONS

136. I have considered and evaluated the impact of all secondary indicia of non-obviousness of which I am aware. I am not aware of any such considerations raised by the Patent Owner. Should Patent Owner raise any such issues, I reserve the right to respond. With respect to the claims at issue and the prior art discussed herein, no secondary considerations have tipped my opinion one way or another in terms of the obviousness of these claims in light of the art discussed.

XV. CONCLUSION

137. Claims 1-3, 6-15, and 18-21 are obvious over the prior art.

DATED: 6/24/2021

A handwritten signature in black ink, appearing to read "B. B. Bederson", written over a horizontal line.

Benjamin B. Bederson