

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

**SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
FOSSIL GROUP, INC.,
FOSSIL STORES I, INC.,
FOSSIL PARTNERS, L.P.,
OURA HEALTH OY, AND
ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD.**

Petitioners,

v.

OMNI MEDSCI, INC.,

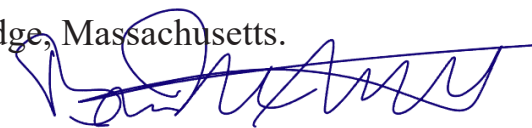
Patent Owner.

Case IPR2025-01249

Patent No. 9,055,868

**DECLARATION OF BRIAN W. ANTHONY IN SUPPORT
OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 9,055,868**

Executed this 5th day of August 2025, in Cambridge, Massachusetts.



Brian W. Anthony

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I. INTRODUCTION

1. My name is Brian W. Anthony and I am a Principal Research Scientist at the Massachusetts Institute of Technology (MIT). I have been retained on behalf of Samsung Electronics Co. Ltd. and Samsung Electronics America Inc. (“Samsung”), to provide my opinions on certain issues related to U.S. Patent No. 9,055,868 (“the ’868 patent”) in connection with the above-captioned *inter partes* review (“IPR”) proceeding. In particular, I have been asked to provide my insights, analysis, and opinions regarding whether claims 7-11, 13-14 of the ’868 patent (“Challenged Claims”) are obvious over the prior art references identified below.

2. I understand that the ’868 patent is titled “System and method for voice control of medical devices,” names as an inventor Mohammed N. Islam, and is currently owned by Omni Medsci Inc. I have considered the ’868 patent. I understand that the ’868 patent has been provided as Ex. 1001.

3. I understand that the file history of the ’868 patent has been provided as Ex. 1002. I have considered this file history, and I will refer to it as “the ’868 Patent File History” or by its exhibit number.

4. I understand that the ’868 patent is a continuation of application No. 14/186,814 filed Feb. 21, 2014, which is a continuation of application No. 13/913,678 filed Jun. 10, 2013, which is a continuation of application No. 13/531,853 filed Jun. 25, 2012, which is a continuation of application No.

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13/349,244 filed Jan. 12, 2012 (now U.S. Pat. No. 8,472,108 issued Jun. 25, 2013), which is a continuation of application No. 13/078,547 filed Apr. 1, 2011, which is a divisional of application No. 12/625,253 filed Nov. 24, 2009 (now U.S. Pat. No. 8,098,423, issued Jan. 17, 2012), which is a divisional of application No. 12/206,432, filed Sep. 8, 2008 (now U.S. Pat. No. 7,633,673, issued Dec. 15, 2009), which is a divisional of application No. 10/812,608, filed Mar. 30, 2004 (now U.S. Pat. No. 7,433,116, issued Oct. 7, 2008), which is a continuation of patent application No. 10/757,341, filed Jan. 13, 2004 (now U.S. Pat. No. 7,259,906, issued Aug. 21, 2007), which is a continuation of application No. 10/652,276 filed Aug. 29, 2003, abandoned. I have considered this file history.

5. I understand that the '868 patent claims a priority date based on the provisional patent application no. 60/408,025, filed on Sep. 3, 2002. For the purposes of this Declaration, I have been asked to assume that the Challenged Claims are entitled to the September 3, 2002 filing date of this provisional application. I have not been asked to opine on whether the Challenged Claims of the '868 patent are entitled to this priority date, and do not provide any opinion on that subject for the purpose of this Declaration.

6. My analysis and conclusions set forth in this declaration are based on my educational background and experiences in the field (Section II). I am qualified to opine concerning what a person of ordinary skill in the art would have known and

understood during that time. Before September 3, 2002, my level of skill in the art was at least that of a person of ordinary skill in the art. I am qualified to opine concerning what a person of ordinary skill in the art would have known and understood at the time of the '868 patent's purported invention. My analysis and conclusions herein are from the perspective of a person of ordinary skill in the art as of September 3, 2002.

7. As part of my independent analysis for this declaration, I have considered the following: the background knowledge/technologies that were commonly known to persons of ordinary skill in the art during the time before the earliest claimed priority date for the '868 patent; my own knowledge and experiences gained from my work experience in the field of the '868 patent and related disciplines; and my experience in working with others involved in this field and related disciplines.

8. I have considered the following non-exhaustive list of references in preparing my declaration. I have been instructed to assume that each of these references qualifies as prior art.

- **U.S. Patent Application Publication No. 2003/0208113 (“Mault”)** to James Mault et al., titled “Closed loop glycemic index system,” filed on July 18, 2001 and published on November 6, 2003. I understand that a copy of this reference has been designated as Exhibit 1004. Throughout my declaration, references to **Mault** are to Exhibit 1004.

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- **Japanese Patent Publication No. JP 2000-74829 (“Mitsui”)** to Shigeki Mochizuki et al., assigned to Mitsui Chemicals Inc., titled “Glucose sensor,” filed on September 2, 1998 and published on March 14, 2000. I understand that a copy of this reference has been designated as Exhibit 1024, and a certified translation of this reference has been designated as Ex. 1005.
- **U.S. Patent No. 5,891,022 (“Pologe”)** to Jonas Pologe, titled “Apparatus for performing multiwavelength photoplethysmography,” filed on September 25, 1996 and granted on April 6, 1999. I understand that a copy of this reference has been designated as Exhibit 1006. Throughout my declaration, references to **Pologe** are to Exhibit 1006.
- **U.S. Patent No. 6,526,300 (“Kiani”)** to Massi Kiani et al., titled “Pulse oximeter probe-off detection system,” filed on June 16, 2000 and granted on February 25, 2003. I understand that a copy of this reference has been designated as Exhibit 1007. Throughout my declaration, references to **Kiani** are to Exhibit 1007.

9. I note that I previously submitted expert declarations in support of a prior IPR challenging limitations of Patent Nos. 9,651,533 (the “’533 patent”) and 10,517,484 (the “’484 patent”), which I understand have been designated as Exhibits 1081 and 1082, respectively, on behalf of Petitioner Apple Inc. in IPR2019-00916 (“the prior ’533 IPR”) and IPR2021-00453 (“the prior ’484 IPR”), which I understand have been designated as Exhibits 1017 and 1030, respectively. *See* Ex. 1017 (Declaration of Brian Anthony, Ph.D. Regarding U.S. Patent No. 9,651,533, herein “’533-Anthony”); 1030 (Declaration of Brian Anthony, Ph.D. Regarding U.S. Patent No. 10,517,484, herein “’484-Anthony”). For purposes of this Declaration, I refer to my declaration submitted in the prior ’533 IPR, as my “Prior ’533 Declaration,” and my declaration submitted in the prior ’484 IPR as my “Prior ’484

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Declaration,” as applicable. Additionally, in this Declaration, I refer to the Board’s Final Written Decision in the prior ’533 IPR as “’533-FWD,” which I understand has been designated as Exhibit 1016, and the Final Written Decision and Final Written Decision on Remand as ’484 IPR “’484-FWD” and “’484-RFWD,” which I understand have been designated as Exhibits 1028 and 1029 respectively. While the ’533 and ’484 patents are from a different patent family than the ’868 patent challenged here, they cover similar claimed subject matter to the Challenged Claims here (e.g., using light-based lens systems to perform physiological measurements). Thus, I reference opinions from my Prior ’533 and/or ’484 Declarations here to the extent the Board relied on them in determining that similar limitations in those prior IPRs were unpatentable.

10. I understand that there are pending district court litigations between Samsung Electronics Co. Ltd., Samsung Electronics America Inc., Fossil Group, Inc., Fossil Stores I, Inc., Fossil Partners, L.P., Oura Health Oy, and OnePlus Technology (Shenzhen) Co., Ltd. (“Petitioners”) and Omni Medsci, Inc. in *Omni Medsci, Inc. v. Samsung Electronics Co., Ltd. et al.*, 2:24-cv-01070-JRG-RSP (E.D. Tex) (“Texas Case”), as well as between Omni MedSci, Inc. and Whoop, Inc. involving the ’868 patent in *Omni MedSci, Inc. v. Whoop, Inc.*, 1:25-cv-00140-JLH (D. Del.).

11. I am being compensated by Samsung at my standard hourly consulting

rate of \$500 for my time on this matter. My compensation is not dependent on the outcome of this proceeding or any other proceeding between the parties.

12. In forming my opinions, I relied on the documents cited in this declaration and the documents identified in the attached **Appendix B**. These documents comprise patents, file histories, printed publications, and other related documents. As discussed below, each document is a type that experts in my field would have reasonably relied upon when forming their opinions. Further, experts in my field would have had access to each document either through the applicable patent offices and/or well-known libraries, conferences, or publications in the field. My opinions are also based upon my personal and professional experience.

II. QUALIFICATIONS

13. A detailed record of my professional qualifications, including a list of publications, awards, and professional activities, is set forth in my curriculum vitae attached to this report as **Appendix A**.

14. I am qualified by education and experience to testify as an expert in the field of physiological measurement system and devices. Additionally, the following overview of my background pertains to my qualifications for providing expert testimony in this matter. I am over the age of 18 and am competent to write this declaration. I have personal knowledge, or have developed knowledge, of these technologies based upon education, training, or experience of the matters set forth

herein.

15. I earned a Bachelor of Science in Engineering from Carnegie Mellon University in 1994 and a Master's degree in Engineering from MIT in 1998. My thesis topic related to anisotropic wave guides and acoustic non-destructive testing. In 2006, I earned my Ph.D. in Engineering from MIT. My research focused on high-performance computation, signal processing, and electro-mechanical system design.

16. In 1997, I co-founded Xcitex Inc., a company that specialized in video-acquisition and motion-analysis software. I served as the Chief Technology Officer and directed and managed product development until 2006. Our first demo product was an optical ring for human motion measurement used to capture user hand motion in order to control the user's interaction with a computer. Many of the structural elements of our optical ring addressed the same system issues as those described and claimed in the patent at issue. For example, our optical ring included multiple light emitting diodes, multiple photodetectors, techniques for modulation and synchronization, noise reduction algorithms, and optical components for light blocking, light redirection, and light capture, and structural components for holding and geometrically arranging the various components. We estimated human hand-motion based on how that motion changed the detected light. In our application we did not try to eliminate motion artifact, we tried to measure it. In developing our ring, we considered well-known problems such as ambient light and noise, which are,

unsurprisingly, also mentioned in the patent at issue. Motion Integrated Data Acquisition System (MiDAS) was our flagship video and data acquisition product which relied upon precise synchronization of multiple clocks for optical sensor and video acquisition, data acquisition, and external illumination.

17. I joined MIT in 2006 and was the Director of the Master of Engineering in Advance Manufacturing and Design Program for over ten years. The degree program covers four main components: Manufacturing Physics, Manufacturing Systems, Product Design, and Business Fundamentals. Many of the courses, projects, and papers my students undertake involve technologies relevant to the patent at issue, for example, sensor devices including non-invasive optical biosensors.

18. In 2011, I co-founded MIT's Medical Electronic Device Realization Center ("MEDRC") and currently serve as co-director. The MEDRC aims to create and deploy revolutionary medical technologies by collaborating with clinicians, the microelectronics, and medical devices industries. We combine expertise in computation; communications; optical, electrical, and ultrasound sensing technologies; and consumer electronics. We focus on the usability and productivity of medical devices using, for example, image and signal processing combined with intelligent computer systems to enhance practitioners' diagnostic intuition. Our research portfolio includes low power integrated circuits and systems, big data, micro electro-mechanical systems, bioelectronics, sensors, and microfluidics.

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Specific areas of innovation include wearable, non-invasive and minimally invasive optical biosensor devices, medical imaging, laboratory instrumentation, and the data communication from these devices and instruments to healthcare providers and caregivers. My experience with these devices is directly applicable to the technology in the patent at issue. For example, in one current project related to this work, we use a patient-mounted mobile near infrared (NIR) camera to image and characterize the surface and subsurface structures of the skin.

19. I am also the Associate Director of MIT.nano, MIT's new 200,000 sq-ft nanofabrication and characterization facility. One of the major research initiatives with MIT.nano focuses on sensors and sensing systems. Our research in sensing science and sensing engineering is targeting innovations in advanced manufacturing, healthcare, environmental remediation, smart infrastructure, and the creation of advanced machines and materials. I also co-founded the Center for Polymer Micro-fabrication at MIT. The Center's research focuses on polymer-based manufacturing processes and the large-scale commercialization of micro fluidic devices for chemical, biomedical, and photonic applications. My experience under these initiatives is directly applicable to the technology in the patent at issue. We develop optical sensors to noninvasively monitor soft flexible materials during the manufacturing process.

20. Furthermore, my research focuses on computational instrumentation,

including the development of instrumentation and measurement solutions for manufacturing systems and medical devices. Additionally, my teaching interests include the design and modeling of large-scale systems in a wide variety of decision-making domains and developing optimization algorithms and software for analyzing and designing such systems. I teach or have taught courses in Electrical Engineering, Controls, Optics, and Signal Processing, all pertinent subject matter to the patent at issue.

21. I have published over 100 papers, and have received a number of best paper and distinguished paper awards. I am a co-author of a number of papers that relate to the technology in the patent at issue.

III. LEGAL UNDERSTANDING

22. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art.

23. I have been informed of certain legal understandings relevant to my opinions. In formulating my opinions, I have relied on the legal understandings I have been provided with as set forth in this declaration.

24. I have been informed that in *inter partes* review proceedings, invalidity must be shown under a preponderance of the evidence standard.

A. My Understanding of Claim Construction

25. I have been informed that patent claims are construed from the viewpoint of a person of ordinary skill in the art of the patent at the time of the invention. I have been informed that patent claims generally should be interpreted consistent with their plain and ordinary meaning as understood by a person of ordinary skill in the art in the relevant time period (i.e., at the time of the purported invention, or the so called “effective filing date” of the patent application), after reviewing the patent claim language, the specification, and the prosecution history (i.e., the intrinsic record).

26. I have further been informed that a person of ordinary skill in the art must read the claim terms in the context of the claim itself, as well as in the context of the entire patent specification. I understand that in the specification and prosecution history, the patentee may specifically define a claim term in a way that differs from the plain and ordinary meaning. I understand that the prosecution history of the patent is a record of the proceedings before the U.S. Patent and Trademark Office and may contain explicit representations or definitions made during prosecution that affect the scope of the patent claims. I understand that an applicant may, during the course of prosecuting the patent application, limit the scope of the claims to overcome prior art or to overcome an examiner’s rejection, by clearly and unambiguously arguing to overcome or distinguish a prior art reference,

or clearly and unambiguously disavowing claim coverage.

27. In interpreting the meaning of the claim language, I understand that a person of ordinary skill in the art may also consider “extrinsic” evidence, including expert testimony, inventor testimony, dictionaries, technical treatises, other patents, and scholarly publications. I understand this evidence is considered to ensure that a claim is construed in a way that is consistent with the understanding of those of ordinary skill in the art at the time of the claimed invention. For example, this can be useful for a technical term whose meaning may differ from its ordinary English meaning. I understand that extrinsic evidence may not be relied on if it contradicts or varies the meaning of claim language provided by the intrinsic evidence, particularly if the applicant has explicitly defined a term in the intrinsic record.

1. Means Plus Function Terms

28. I have been informed and understand that certain claim terms can be means-plus-function terms. I understand that a “means-plus-function” term is one that is expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support of that function in the claim. I understand that a term is presumed not to be a means-plus-function term if it is not drafted using the term means. I also understand that a term that connotes sufficient structure to a person of ordinary skill in the art would not be a means-plus-function term.

29. I understand that for means-plus-function terms, the term is construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof. My understanding of the doctrine of equivalents and equivalent structure is set forth below in Section III.D.

30. If a term is determined to be a means-plus-function claim, I understand that the disclosed structure in the specification is deemed to be corresponding structure if the specification or prosecution history clearly links or associates that structure to the claimed function and the disclosure must be sufficient to achieve the claimed function.

B. My Understanding of Anticipation

31. I understand that a patent claim is invalid as “anticipated” if all the limitations of the claim are present, either expressly or inherently, in a single prior art publication or patent.

32. I also understand that a prior art reference can disclose a claimed feature because the feature is expressly described or because the feature is inherent in the disclosure. I have been informed that something is inherent in a prior art reference if the missing descriptive matter must necessarily be present, not merely probably or possibly present, and it would be so recognized by a person of ordinary skill in the art as of the priority date of the patent. I understand that it is acceptable to examine evidence outside of the prior art reference (i.e., extrinsic evidence) in determining

whether a feature, while not expressly discussed in the reference, is necessarily present in it.

33. I have further been informed that where a reference discloses multiple embodiments, the reference should not be limited to a preferred embodiment. Instead, each disclosed embodiment may anticipate.

34. Moreover, I have been informed that as part of an anticipation analysis, it is proper to take into account not only specific teachings of the reference, but also the inferences that one skilled in the art would reasonably be expected to draw therefrom. A reference can anticipate a claim even if it does not expressly spell out all the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would at once envisage the claimed arrangement or combination.

C. My Understanding of Obviousness

35. I understand that a claim may be invalid if the subject matter described by the claim as a whole would have been obvious to a hypothetical person of ordinary skill in the art in view of a prior art reference or in view of a combination of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a hypothetical person of ordinary skill in the art and that the asserted claims of the patent should be read from the point of view of such a person at the time the claimed invention was made. I

further understand that a hypothetical person of ordinary skill in the art is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent in suit.

36. I have been informed that there are two criteria for determining whether prior art is analogous and thus can be considered prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the patentee's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the patentee is involved. I have also been informed that the field of endeavor of a patent is not limited to the specific point of novelty, the narrowest possible conception of the field, or the particular focus within a given field. I have also been informed that a reference is reasonably pertinent if, even though it may be in a different field from that of the patentee's endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to a patentee's attention in considering their problem.

37. I have also been advised that an analysis of whether a claimed invention would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole.

38. I have also been advised that in considering whether a claimed invention would have been obvious over a combination of prior art references, I may assess whether there are apparent reasons to combine known elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the marketplace, and/or the background knowledge possessed by a person of ordinary skill in the art. I understand that other principles may be relied on in evaluating whether a claimed invention would have been obvious, and that these principles include the following:

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or in a different one, so that if a person of ordinary skill can implement a predictable variation, the variation is likely obvious;
- If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond their skill;
- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine;
- Market demand, rather than scientific literature, can drive design trends and may show obviousness;

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- In determining whether the subject matter of a patent claim would have been obvious, neither the particular motivation nor the avowed purpose of the named inventor controls whether the claim is obvious;
- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;
- Any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed;
- "Common sense" teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle;
- A person of ordinary skill in the art is also a person of ordinary creativity, and is not an automaton;
- A patent claim can be proved obvious by showing that the claimed combination of elements was "obvious to try," particularly when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions such that a person of ordinary skill in the art would have had good reason to pursue the known options within his or her technical grasp; and
- One should be cautious of using hindsight in evaluating whether a claimed invention would have been obvious.

39. I further understand that, in making a determination as to whether the claimed invention would have been obvious to a person of ordinary skill, the Board may consider certain objective factors if they are present, such as: commercial success of products practicing the claimed invention; long-felt but unsolved need; teaching away; unexpected results; copying; and praise by others in the field. These factors are generally referred to as "secondary considerations" or "objective indicia"

of nonobviousness. I understand, however, that for such objective evidence to be relevant to the obviousness of a claim, there must be a causal relationship (called a “nexus”) between the claim and the evidence, and that this nexus must be based on a novel element of the claim rather than something in the prior art. I also understand that even when they are present, secondary considerations may be unable to overcome primary evidence of obviousness (such as motivation to combine with predictable results) that is sufficiently strong.

D. My Understanding of the Doctrine of Equivalents

40. I have been informed that there is a “doctrine of equivalents” in patent law that supports a finding of invalidity if a prior art element is equivalent to a claimed element, even if the prior art element is not identical to the claimed element. Equivalence may be established if the prior art element performs the identical function specified in the claim in substantially the same way and produces substantially the same result.

41. I also understand that insubstantial differences between a prior art element and a claimed element—as understood in light of its specification—will not preclude a finding of invalidity. For example, a difference in a number of parts in a prior art element and the corresponding element disclosed in the patent specification may be an insubstantial difference. Similarly, if a prior art element lacks several components of an overall structure corresponding to a claimed function, that

difference may be insubstantial. And, potential advantages of a structure that do not relate to a claimed function should not be considered in an equivalents determination.

42. I understand that the structures, materials, and acts to be considered equivalent or non-equivalent may be described in a patent's specification. A specification may therefore establish a narrow or broad range of equivalents, although an applicant also need not exhaustively describe the full range of equivalents.

IV. BACKGROUND OF THE TECHNOLOGY

43. As I explain in Section V, the '868 patent's purported invention relates to "a waveguide structure" "implemented in a medical device" that "uses optical signal wavelengths" to "perform surgery and/or spectroscopy on a patient" to detect cancerous tissue. *E.g.*, '868, 17:3-18:41, Figs. 6A, 6B. At a high level, the Challenged Claims (7-11, 13-14) broadly recite a diagnostic system comprising a light source that uses output light beams to perform measurements on a user that are transmitted to and processed by software on a control system and a host. '868, 1:39-2:4, 5:44-55, 9:39-10:13, 24:35-25:20, 25:25-30.

44. But such diagnostic systems were already well known in the art. For example, before the '868, **Mault** disclosed "using at least one semiconductor laser or light emitting diode" to measure a user's "blood glucose levels" and sending these measurements to a "personal digital assistant (PDA) [with] a software program" as

well as a “remote server system” for processing. Mault, [0014]-[0015], [0020]-[0021], [0077], [0079].

45. It is my opinion that the additional limitations in claims 8-11, and 13-14 add nothing new, since they merely recite known features, such as a common spectroscopic technique for performing physiological measurements (“a diagnostics to measure a property of the blood, wherein the diagnostics comprise a spectroscopic procedure” that “is based at least in part on a comparison of amplitudes at a plurality of associated wavelengths transmitted or reflected from the blood,” cl. 9), a multiplexer (“a multiplexer capable of combining the plurality of semiconductor diodes,” cl. 8), a headset (“a headset or a heads-up display,” cl. 10), an audio output device (“an audio output device capable of communicating at least a part of the processed portion of the physiological information,” cl. 14), and using a proximity sensor (“the control system is further coupled to a proximity sensor,” cl. 13) which were already disclosed in **Mault** and/or **Mitsui, Pologe, and/or Kiani**, as I discuss below.

46. Therefore, in my opinion, and as further discussed below, the ’868 patent recites claims that were well-known in the art (Sections IX.A-D).

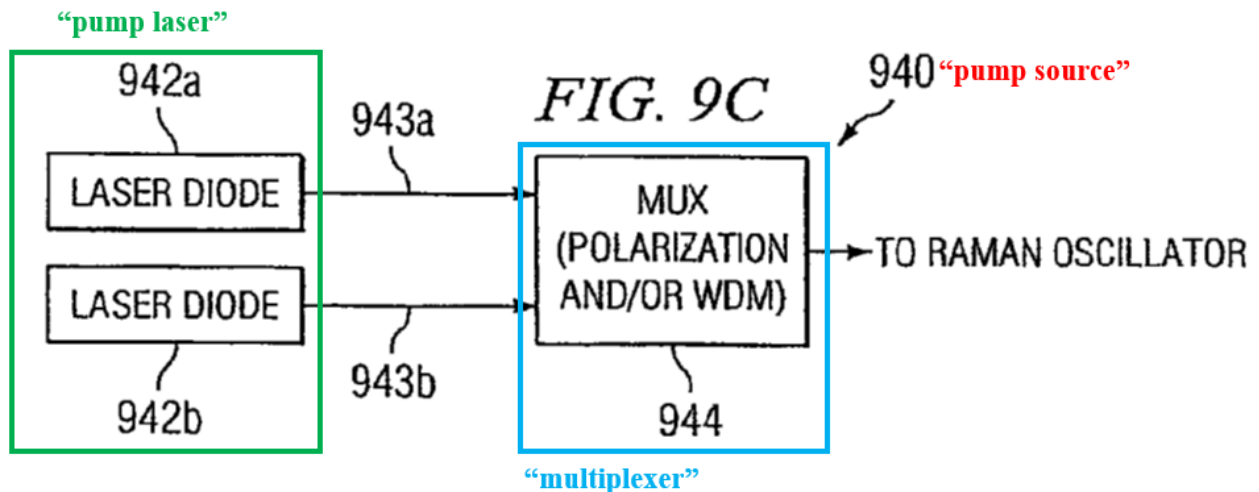
V. THE ’868 PATENT

A. ’868 Patent Overview

47. As I previewed above (Section IV), the Challenged Claims relate to an

embodiment of the '868 patent involving “an optical signal wavelength in the mid-IR range ... used to perform a medical procedure for the early detection of tissue abnormalities such as cancer cells.” '868, 18:24-41; Figs. 9A-9C.

48. For example, Figure 9C of the '868 patent illustrates a laser “**pump source 940**” used for “generating an optical signal wavelength in the mid-IR range” “for the early detection of ... cancer” ('868, 17:34-36, 18:24-41). '868, Fig. 9C.



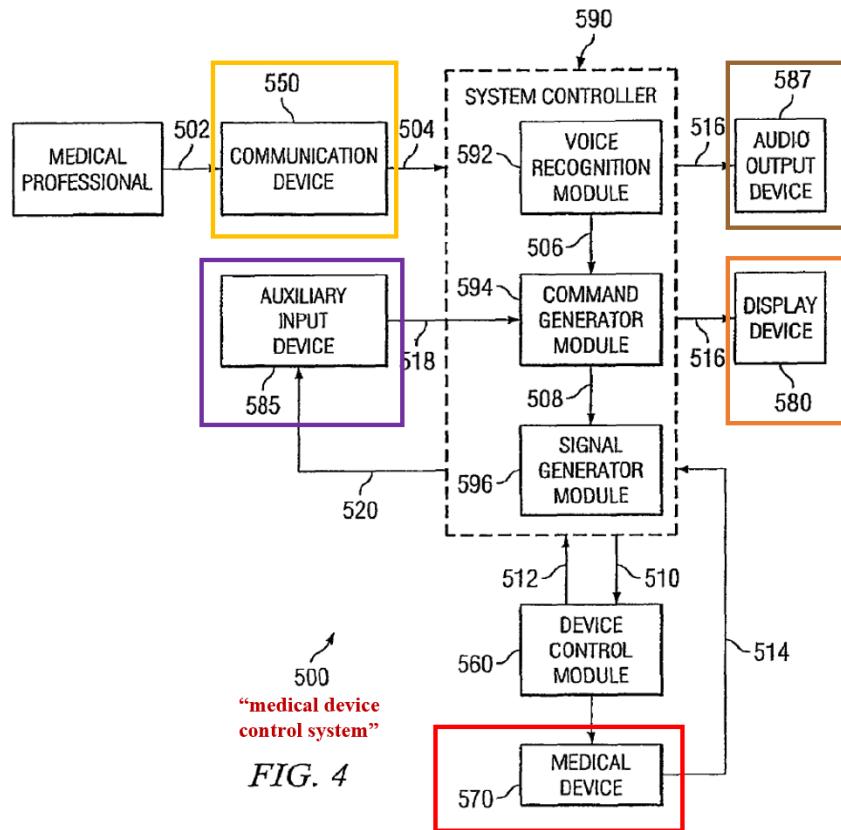
49. The “**pump source 940**” contains a “pump laser 942” with “**two laser diodes,**” 942a and 942b. '868, 22:56-23:9, Fig. 9C. The **laser diodes 942a and 942b** “generat[e] pump signals 943a and 943b,” “each centered at a desired wavelength.” '868, 22:56-23:9.

50. The **pump source 940** also includes a “**multiplexer 944**” (“MUX”). '868, 22:56-23:9, Figs. 9A-9C; Fig. 9C. “**Multiplexer 944** can comprise any device capable of combining pump signals 943, such as a wavelength division multiplexer” (“WDM”). '868, 23:5-7; Fig. 9C. For example, “**multiplexer 944**” is

capable of “wavelength multiplexing pump signals 943a and 943b to form a pump output signal,” which is then sent to a “Raman wavelength shifter and/or a Raman oscillator” which includes a “lens on the delivery fiber for improved focusing of optical signal[s] on the patient” to “perform a medical procedure for the early detection of ... cancer,” such as “spectroscopic measurement[s].” ’868, 18:24-44, 22:56-58, 23:10-25, Fig. 9C. For example, “differential spectroscopy” may be performed, which involves taking “measurements...at several wavelengths” and “compar[ing]” them “to each other.” ’868, 2:34-45, 18:33-48. According to the ’868 patent, “measuring the differential transmission of the tissue at two or more wavelengths, such as 5 microns and 6.1 microns may: improve the signal-to-noise ratio of the cancer cell signature.” ’868, 18:48-51.

51. Separately, the ’868 patent discusses how a medical device may be remotely controlled to perform medical procedures. ’868, 9:39-50. As shown in annotated Figure 2 below, “**medical device control system 300**” includes a “**medical device 210**,” which “communicate[s] data” over “**communication link 305**” to a “**system 150**,” and a “**host 270**,” which is “capable of collecting, entering, processing, storing, retrieving, amending, and/or dispatching medical data.” ’868, 7:22-38, 9:39-50, 9:65-10:13, 10:28-43, Fig. 2. For example, in one embodiment, the “medical device 10 may comprise one or more sensors ... capable of detecting when medical device 10 is in close proximity to and/or in contact with tissue” to

control system 500 can be substantially similar to ... **control system 300** of FIG. 2” and includes an “**auxiliary input device 585** ... substantially similar to the structure and function of **auxiliary input devices 165**,” a “**communication device 550**” (like “**communication device 155**”), and a “**display device 580**” (like “**display device 160**”). ’868, 14:22-38, 15:38-42, 15:67-16:3. Additionally, the ’868 patent also describes an “**audio output device 587** capable of communicating data associated with **medical device 570**.... such as a speaker.” ’868, 15:49-61, Fig. 4.



’868, Fig. 4.

B. The Prosecution History

54. In formulating my opinions, I considered the contents of the

prosecution history of the '868 patent, a copy of which I understand has been designated as Exhibit 1002.

55. The '868 patent issued from U.S. Pat. App. 14/476,082 ("082-App."), filed 9/3/2014 which claims priority through a series of continuations to provisional application U.S. Prov. Pat. App. 60/408,025, filed 9/3/2002. The claims were allowed as filed, and the Examiner issued no prior art rejections during prosecution. '868FH, 1-278.

56. In issuing the Notice of Allowance, the Examiner noted that the prior art did not teach or suggest the combination of the following two limitations recited in then-pending independent claim 21 (issued claim 1, not challenged here).

57. Specifically, in its "Reasons For Allowance," the Examiner stated: "The cited prior art does not teach or suggest the whole combination of elements set forth by [then-pending] claims 21-28 and 30-41. For example, there is no teaching or suggestion in the prior art for combining:

a plurality of semiconductor diodes with light beams; a multiplexer capable of combining the plurality of semiconductor diode light beams and generating at least a multiplexed light beam comprising one or more wavelengths; one or more waveguide structures configured to receive at least a portion of the one or more wavelengths and to communicate at least the portion of the one or more wavelengths to an output end of the one or more

waveguide structures to form an output beam; and a lens system configured to receive at least a portion of the output beam and to communicate at least the portion of the output beam onto a part of a user's body comprising blood to perform a measurement on a use;

Wherein the combination above used with:

a software application capable of generating data based at least in part on the measurement on the user, wherein the data represents at least in part physiological information associated with the user; the software application capable of operating on a control system adapted to receive, store and process at least a portion of the physiological information, the control system having a touch-screen, a proximity sensor, and a wireless transceiver to transmit wireless data over a wireless link, the wireless data comprising at least a part of the physiological information, wherein the control system is further capable of receiving voice input signals and manually entered input signals; and a host comprising: a digital file for receiving and storing at least a portion of the wireless data; control logic at the host to process at least the portion of the wireless data to generate a status of the user; a memory storage device for recording the status; and an output for communicating at least a portion of the status or associated information over a communication link to one or more

display output devices, wherein the one or more display output devices are located remotely from the host.”

’868FH, 182-183 (emphasis added).

58. The combination of these two groups of limitations that appeared to overcome the prior art of record was not recited in Challenged Claim 7 (then-pending independent claim 27), which is broader than independent claim 1 explicitly addressed by the Examiner. Rather, Challenged Claim 7 only recited the second group of limitations, but not the first group of limitations.

59. Thus, it appears that in allowing all claims, the Examiner did not properly examine whether Challenged Claim 7 actually disclosed the purportedly distinguishing feature in independent claim 1. And indeed, for the reasons set forth below, these concepts were already well known as demonstrated by the art cited herein, and Challenged Claim 7 and its challenged dependent claims (8-11, 13-14) should be found unpatentable. See my analysis in Section IX.

VI. LEVEL OF ORDINARY SKILL IN THE ART

60. In rendering the opinions set forth in this declaration, I was asked to consider the patent claims and the prior art through the eyes of a person having ordinary skill in the art at the time of the alleged invention. I understand that the factors considered in determining the ordinary level of skill in a field of art include the level of education and experience of persons working in the field; the types of

problems encountered in the field, the teachings of the prior art, and the sophistication of the technology at the time of the alleged invention. I understand that a person having ordinary skill in the art is not a specific real individual, but rather is a hypothetical individual having the qualities reflected by the factors above. I understand that a person having ordinary skill in the art would also have knowledge from the teachings of the prior art including the art cited below.

61. I have been asked to assume the Challenged Claims are entitled to the September 3, 2002 priority date for the purposes of this declaration only. Upon consideration of the relevant factors listed above, in my opinion, on or before the priority date, a person of ordinary skill in the art, at the time the application that matured into the '868 patent was filed, would have had a good working knowledge of optical sensing techniques and their applications, and some familiarity with optical system design and signal processing techniques. That knowledge would have been gained via an undergraduate education in engineering (electrical, mechanical, biomedical or optical) or a related field of study, along with relevant experience in studying or developing physiological monitoring devices (e.g., non-invasive optical biosensors) in industry or academia. This description is approximate; varying combinations of education and practical experience also would be sufficient.

62. This is the same level of ordinary skill in the art as I opined for the '484 and '533 patents in IPR2019-00916 and IPR2021-00453, and the Board

adopted. '484-Anthony, ¶35; '533-Anthony, ¶35; '533-FWD, at 8-9; '484-Inst., at 7-8; '484-FWD, at 11 n.7.

63. Well before September 3, 2002, my level of skill in the art was at least that of a person having ordinary skill. I am qualified to opine concerning what a person having ordinary skill in the art would have known and understood at the time of the '868 patent's purported invention. My analysis and conclusions herein are from the perspective of a person having ordinary skill in the art as of September 3, 2002. A different priority date would not change my opinions as long as the identified prior art were still prior art.

VII. CLAIM CONSTRUCTION

64. I have been instructed that the Challenged Claims of the '868 patent are to be given their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the alleged invention in light of the specification and the prosecution history pertaining to the patent, except as provided below. I have followed these principles in my analysis set forth in this document. I reserve the right to supplement my opinions in this declaration to the extent that any parties later propose claim constructions for any claim terms in the '868 patent.

A. Means-Plus-Function

65. For purposes of this Declaration, I was asked to consider a means-plus-function construction for the term “voice recognition module” in claim 11, and

whether that construction would affect my opinions. Specifically, I was instructed to consider the construed function to be “voice recognition,” and the construed corresponding structure to be “any hardware, software, firmware, or any combination thereof that is capable of converting a voice command signal into a control signal.” ’868 patent, 14:48-51, 9:24-30.

66. I have not adopted the above constructions as my own, and I express no opinions on whether this construction should be adopted. Regardless of whether the term is considered as a means-plus-function claim term or is subject to the plain and ordinary meaning, the prior art disclosed herein meets the limitation.

67. For example, as set forth below in Section IX.A.2.[11], “voice recognition module” (claim 11) is disclosed and rendered obvious by the prior art cited herein even when the term is considered as means-plus-function claim term, literally and/or under the doctrine of equivalents by **Mault (optionally in view of Pologe and/or Kiani)**, by performing substantially the same functions in substantially the same way to achieve substantially the same result.

B. Terms at Issue in Texas Case

68. I understand that in their Supplemental Invalidity and Subject Matter Eligibility Contentions served in the Texas Case between Petitioners and Patent Owner, which I understand has been designated as Exhibit 1013, Petitioners identified the following limitations of Challenged Claims as potentially indefinite:

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- “a part of a user’s body comprising blood” (cl. 7),
- “physiological information associated with the user” (cl. 7),
- “wireless data” (cl. 7),
- “voice input signals and manually entered input signals” (cl. 7),
- “at least a portion of the status or associated information” (cl. 7),
- “a multiplexer capable of combining the plurality of semiconductor diodes” (cl. 8),
- “generating the input light beam comprising one or more wavelengths” (cl. 8),
- “adapted for use in a diagnostics” (cl. 9), and
- “a plurality of associated wavelengths transmitted or reflected from the blood” (cl. 9).

Ex. 1013, at 227-228.

69. For the purposes of this Declaration, I do not take a position on whether these terms are indefinite. And, regardless of the outer bounds of these limitations, for the reasons discussed below in Section IX, these limitations are still disclosed or rendered obvious by the prior art because the prior art discloses or renders obvious embodiments within the indisputable scope of these limitations.

VIII. GROUNDS OF UNPATENTABILITY

70. As I explain above in Section IV, physiological measurement systems were well-known in the art.

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71. In this section, I will explain why the teachings or combinations of teachings from the following references render obvious each of the Challenged Claims:

Name	Ex.	Publication	Filed	Published/ Issued
Mault	1004	US 2003/0208113	7/18/2001	11/6/2003
Mitsui	1005	JP 2000074829A	9/2/1998	3/14/2000
Pologe	1006	US 5,891,022	9/25/1996	4/6/1999
Kiani	1007	US 6,526,300	6/16/2000	2/25/2003

I have been instructed to assume that each of these references qualifies as prior art.

72. As I explain below, the Challenged Claims are invalid based upon the following prior art grounds:

- **Ground 1:** Challenged Claims 7, 10-11, and 14 of the '868 patent are rendered obvious by **Mault**.
- **Ground 2:** Challenged Claim 9 of the '868 patent is rendered obvious by **Mault** in view of **Mitsui**.
- **Grounds 3-4:** Challenged Claims 7-11 and 14 of the '868 patent are rendered obvious by Grounds 1-2 in view of **Pologe**.
- **Grounds 5-8:** Challenged Claims 7-11 and 13-14 of the '868 patent are rendered obvious by Grounds 1-4 in view of **Kiani**.

IX. SPECIFIC GROUNDS FOR CHALLENGE

73. It is my opinion that Challenged Claims of the '868 patent are unpatentable as explained below. As I explain above in Section IV, although the '868 patent purports to have invented a physiological measurement system, such

devices were well-known in the art. As described below, the cited prior art provides these teachings.

74. In this section, I explain why claims 7-11 and 13-14 of the '868 patent are rendered obvious by the teachings of **Mault**, **Mitsui**, **Pologe**, and **Kiani**. Regarding all Grounds, **Mault** teaches a diagnostic system with a light source which generates beams to take measurements of users for use with a control system and a host, which processes these measurements and provides feedback to the user. Regarding Ground 2, **Mitsui** further teaches a spectroscopic procedure that performs these measurements by comparing the amplitudes of different wavelengths reflected by the user's tissue. Regarding Grounds 3 and 4, **Pologe** further teaches combining the light source with a lens system and multiplexer. Regarding Grounds 5-8, **Kiani** further teaches adding a proximity sensor to the physiological sensor of the diagnostic system.

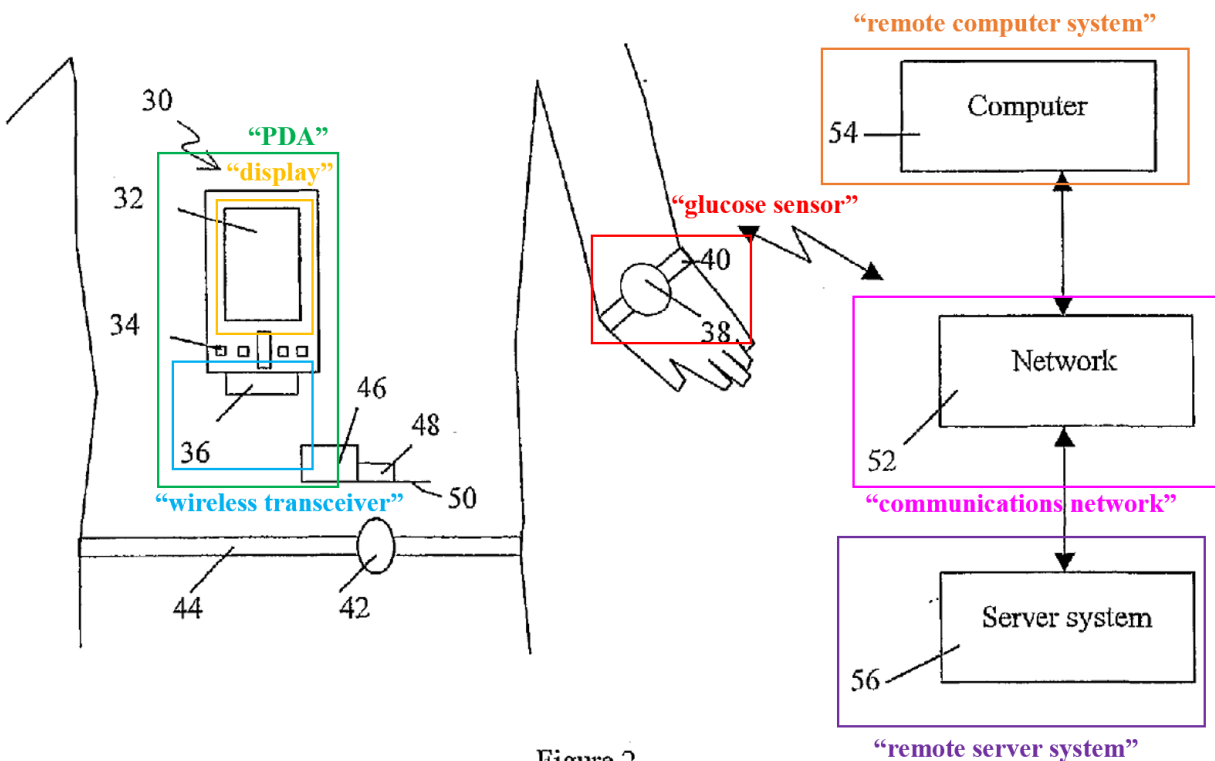
75. I note that in this discussion, I may focus on the particular language in the specific claims, but it should be understood that my analysis applies to the corresponding elements of all Challenged Claims containing identical or substantially identical language.

A. GROUND 1: Mault (Claims 7, 10-11, and 14)

1. Overview of Mault

76. **Mault** discloses "blood glucose management systems" for

“controlling...blood glucose levels,” which allow users to “keep blood glucose levels within a predetermined range” using “blood glucose measurements” and calculations based on a “glycemic response model.” Mault, Abstract, [0013], [0037], [0073]. For example, as illustrated in exemplary Figure 2 below, the system uses a **“glucose sensor 38”** with “at least one semiconductor laser or light emitting diode to emit wavelengths in the near-IR” that is “placed against part of the body” and detects “wavelengths ... transmitted through or reflected by blood-containing tissue” through procedures including “spectroscopic techniques.” Mault, [0013], [0020], [0073], Fig. 2 (including my annotations).



Mault, Fig. 2 (including my annotations).

77. The measurements from the **glucose sensor** are then sent to a “portable electronic device,” such as a “headset” or “**personal digital assistant (PDA)**, having a software program” which uses the “glycemic response model” to “calculate the change in blood glucose level for the person over time.” Mault, [0014]-[0015], [0020]-[0021], [0070]. For example, the **PDA, such as a “Palm Pilot,”** includes a “**display 32,**” “sensors” for “determining location ... from GPS,” and a “**wireless transceiver 36,**” to transmit data such as the “blood glucose reading[s].” Mault, [0070], [0077], [0079], [0198], [0208], Fig. 2. The PDA is also “used as a diet log ... to store blood glucose readings” and further includes “voice recognition software” and a “restricted voice recognition capability” that allows it to process “voice entr[ies]” from the user to the diet log. Mault, [0106], [0118], [0133], [0193].

78. **Mault’s** blood glucose management system further includes a “**remote server system 56**” which receives the blood glucose data from the **PDA** over a wireless “**communications network 52.**” [0079], Fig. 2. The **remote server system 56** “store[s] a database” of data such as the “blood glucose reading[s].” [0074], [0079], [0201]. Additionally, “**remote computer system 54**” performs “computer expert system analysis” on the blood glucose readings and generates “feedback” indicating whether the person’s current blood glucose level “exceeds the upper recommended blood glucose level” and projecting future levels over time, including whether the glucose level will rise above an upper recommended limit, in

which case the user would receive “an alert regarding the glucose level excursion.” [0079], [0136], Fig. 15. This feedback is then transmitted to the PDA and “other display device[s] such as an interactive television” for display to the user. [0077], [0079], [0180].

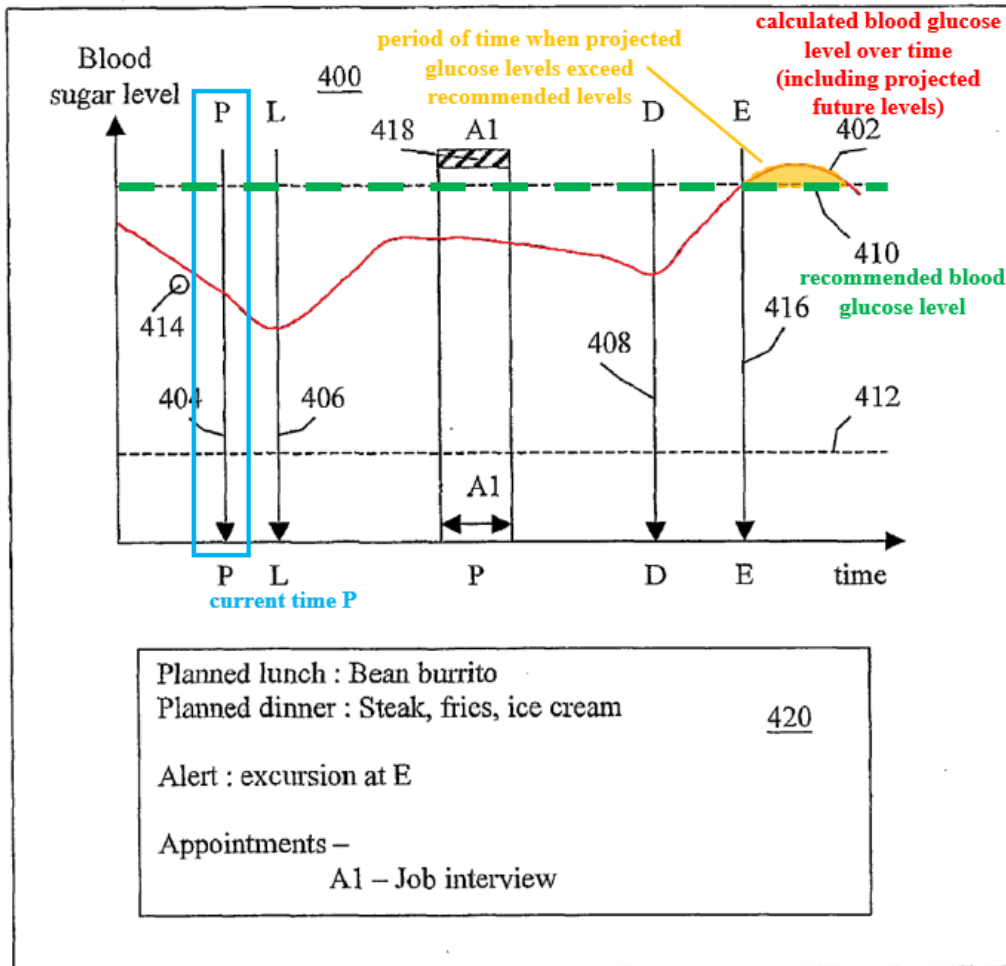


Figure 15

Mault, Fig. 15 (including my annotations).

2. Invalidity of Claims 7, 10-11, and 14 Over Mault

79. As I discuss below, Claims 7, 10-11, and 14 are rendered obvious by **Mault**. In addition to my discussion in Section IX.A.1, the following discussion identifies example disclosures that each disclose Challenged Claims 7, 10-11, and 14.

a. Element [7.pre]

80. Element [7.pre] recites: “**A diagnostic system comprising.**” This element is met by **Mault**.

81. **To the extent that the preamble is limiting, Mault discloses a diagnostic system (e.g., “blood glucose management system[.]”).**

- **Abstract:** “*A system for assisting a person to maintain a blood glucose level between predetermined limits* comprises: an electronic device, comprising a display, a clock, a memory, and a processor; and a software program executable by the processor of the electronic device, adapted to receive nutritional data of food consumed by the person, adapted to calculate the blood glucose level for the person using the nutritional data and a glycemic response model for the person, and further adapted to present the blood glucose level to the person on the display of the electronic device.”
- **[0013]:** “Embodiments of the present invention provide methods of *blood glucose management systems* that allow a person to view projected future levels of blood glucose, so as to assist the person to *keep blood glucose levels within a predetermined range, such as a medically advisable healthy range.*”
- **See also** [0037], [0068], [0073], [0105].

82. **Mault** discloses “blood glucose management systems,” which allow

users to “keep blood glucose levels within a predetermined range.” [0013]. A person of ordinary skill in the art would have recognized that **Mault’s** disclosed system as a “diagnostic system,” as understood in the relevant art at the time. Consistent with a person of ordinary skill in the art’s understanding of a “diagnostic system” at the time, **Mault** specifically describes its system as being intended to measure, project, and manage blood glucose levels, activities unmistakably aligned with diagnostic functions. A person of ordinary skill in the art would readily have understood that diagnostic systems were commonly utilized to monitor and assess medical conditions, and classify **Mault’s** described system as diagnostic. Furthermore, given that **Mault** expressly characterizes its system in terms of maintaining blood glucose within medically advisable limits, a person of ordinary skill in the art further have understood **Mault’s** blood glucose management system as a “diagnostic system.”

b. Element [7.a]

83. Element [7.a] recites: “**a light source comprising: one or more semiconductor diodes generating an input light beam; and.**” This element is met by **Mault**.

84. **Mault** discloses a light source comprising one or more semiconductor diodes (*e.g.*, “blood glucose sensor” that “us[es] at least one semiconductor laser or light emitting diode”) **generating an input light beam** (*e.g.*, “emit wavelengths”).

- [0013]: “Embodiments of the present invention provide methods of ***blood glucose management systems*** that allow a person to view projected future levels of blood glucose, so as to assist the person to ***keep blood glucose levels within a predetermined range, such as a medically advisable healthy range.***”
- [0020]: “The person carries a portable computing device, such as a PDA, which receives blood glucose levels from a blood glucose sensor. The ***blood glucose sensor*** may be a device clipped on to the earlobe of the person, using ***at least one semiconductor laser or light emitting diode*** to ***emit wavelengths*** in the near-IR. These wavelengths are ***transmitted through or reflected by blood-containing tissue, and then detected by a near-IR detector.***”
- *See also* [0087], [0105].

85. **Mault’s** blood glucose management system includes a “blood glucose sensor” that “us[es] at least one semiconductor laser or light emitting diode to emit wavelengths in the near-IR,” which are “transmitted through...blood-containing tissue.” [0013], [0020].

c. Element [7.b]

86. Element [7.b] recites: “**a lens system configured to receive at least a portion of the input light beam and to communicate at least the portion of the input light beam onto a part of a user’s body comprising blood, wherein at least the portion of the input light beam is used in a measurement on a user.**” This element is met by **Mault**.

87. **Mault discloses the light source** (“blood glucose sensor,” *see* [7.a]) **comprising a lens system** (e.g., “at least one light emitting diode” in the “blood

glucose sensor” is covered by an encapsulating lens) **configured to receive at least a portion of the input light beam** (*e.g.*, encapsulating lens(es) of the “at least one light emitting diode” receive(s) the wavelengths of light emitted from the diode, *see* [7.a]) **and to communicate at least the portion of the input light beam onto a part of a user's body comprising blood** (*e.g.*, “emit wavelengths” through “blood-containing tissue”), wherein **at least the portion of the input light beam is used in a measurement on a user** (*e.g.*, “wavelengths ... transmitted through or reflected by blood-containing tissue” are “used to compute the blood glucose level of the person” using the “blood glucose sensor” that is “wrist-mounted” or clipped to the person’s “earlobe”).

• **Fig. 2:**

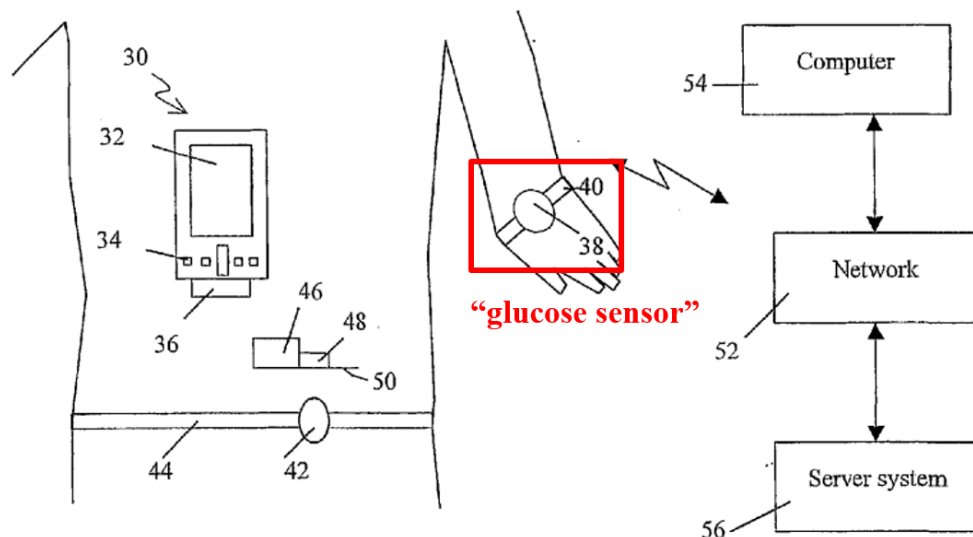


Figure 2

- **Fig. 9:**

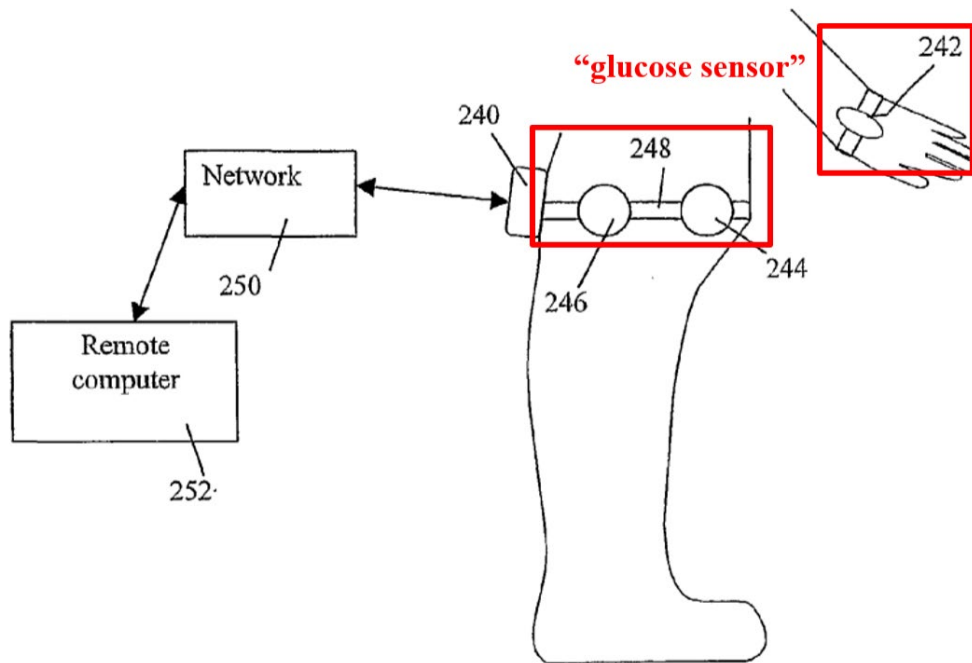


Figure 9

- [0020]: “The person carries a portable computing device, such as a PDA, which receives blood glucose levels from a blood glucose sensor. The *blood glucose sensor may be a device clipped on to the earlobe of the person, using at least one semiconductor laser or light emitting diode to emit wavelengths in the near-IR. These wavelengths are transmitted through or reflected by blood-containing tissue....* For example, two wavelengths may be chosen, one absorbed and one not absorbed by blood glucose, *the absorption ratio then being used to compute the blood glucose level of the person.*”
- [0073]: “... Sensor 12 may also use in-vivo spectroscopy techniques to measure blood glucose For example, *IR absorption or reflection* properties of skin or tissues For example, using a *non-invasive spectroscopic technique*, the PDA/module combination may be *placed against part of the body to obtain a blood glucose reading.*”
- [0079]: “*FIG. 2 shows a system embodiment, comprising portable computing device 30 having a display 32, data entry mechanism 34, and wireless transceiver 36; a wrist-mounted glucose sensor 38 having a strap 40....*”

- **[0105]:** “FIG. 9 shows a glycemic control system integrated with a fetal monitoring system for pregnant women. ... The electronic device 240 receives data from a *blood glucose sensor 242 which is illustrated as a wrist mounted device but can be any convenient location, such as mounted on belt 248. The belt 248 can be placed around the waist of the woman.*” ...*Other physiologic sensors can be added to the system.*”
- *See also* [0085], [0089], [0094], [0122].

88. See my analysis in [7.a]. The “at least one light emitting diode” (LED) in **Mault**’s blood glucose sensor is part of a lens system. In particular, a person of ordinary skill in the art would have understood, and at minimum found obvious, that the light emitting diode(s) are covered by lensing encapsulants to help direct light emitted by the LED(s) to the tissue. Mault, [0020]. For example, as the Board previously found in its final written decisions in the prior ’533 and ’484 IPRs, “a [person of ordinary skill in the art] would have known that LEDs are often covered by lensing encapsulants, and would have selected such LEDs for wireless sensor 102/312 in order to ‘direct more of the light produced by the LED outward toward the tissue,’ thereby improving the efficiency of wireless, battery-powered, sensor 102/312” (’533-FWD, 36 (citing ’533-Pet. 39-40)) and “a [person of ordinary skill in the art] would have understood that glass encapsulating LEDs serves as a lens, i.e., a basic building block of an optical sensor, to receive the LED’s light and transmit that light to a particular location” (’484-FWD, 23, citing ’484-Pet, 29-30). Additionally, the Board explained that “a [person of ordinary skill in the art], knowing a lens is a basic building block of an optical sensor, would have included

lenses in Lisogurski's wireless sensor 102/312." '533-FWD, 36 (citing '533-Pet. 41); *see also* '484-FWD, 23.

89. This is consistent with my opinions provided in my Prior '533 and '484 Declarations, which I incorporate by reference as if fully set forth herein. '533-Anthony, ¶¶124-127; '484-Anthony, ¶¶104-107 (citing Ex. 1033, 97-98, 191-99, 266-67; Ex. 1034, 765). Though I understand that the '533 and '484 have a later claimed priority date (in 2012) than the earliest claimed priority date of the challenged '868 patent here (in 2002), my opinions in the Prior '533 and '484 Declarations regarding lensing encapsulants of LEDs apply equally to the '868 patent. For example, it was well understood by those skilled in the art that a conventional LED package typically includes a light-emitting semiconductor encapsulated in a medium, such as glass, which often serves both to protect the semiconductor and to act as a lens focusing the emitted light, as illustrated by e.g., U.S. Patent Nos. 5,122,943 and 6,661,167, which I understand have been designated as Exhibits 1035 and 1036, as further discussed below. *See, e.g.*, Ex. 1035 (Pugh), 3:1-14 ("The LED 10 includes an LED chip or active light emitting element 22 ... encapsulated in or covered by an epoxy resin envelope ... [which] functions as a magnifying lens for the rays of light emitted from the active light emitting element 22"); Ex. 1036 (Eliasehevich), 4:28-31 ("The encapsulant 22 is preferably an epoxy, plastic, low temperature glass, polymer, thermoplastic, thermoset material, resin or

other type of LED encapsulating material as is known in the art”). Many commercially available LEDs were designed with such encapsulants, and a person of ordinary skill would recognize that selecting an LED with a lens-like encapsulant—known as a primary optic—was a common and obvious choice, especially for applications like those described in Mault, as illustrated by e.g., U.S. Patent No. 7,001,058, which I understand has been designated as Exhibit 1037, as further discussed below. Ex. 1035, 3:1-14; Ex. 1036, 4:28-31; Ex. 1037 (Inditsky), 4:61-65 (“LEDs with conventional primary optics (lens-like or flat shaped epoxy encapsulants in direct optical contact with the LED emitter and/or reflector cup”). Thus, incorporating a lens into the LED package increases the directional intensity of the emitted light, efficiently directing more light toward the intended target while conserving power, which is particularly important for battery-powered, wireless devices. *Id.*

90. Thus, a person of ordinary skill in the art reading **Mault** would have understood that the lensing encapsulants would then “emit [the] wavelengths in the near-IR,” which “are transmitted through or reflected by blood-containing tissue” of a person’s body.” Mault, [0020]. The body’s absorption levels of the wavelengths (e.g., “absorption ratio” comparing absorption of one wavelength to another) are then “used to compute the blood glucose level of the person” “to obtain a blood glucose reading” where the blood glucose sensor is “wrist-mounted,” “mounted on

a belt,” or clipped to the person’s “earlobe.” Mault, [0020], [0073], [0079], [0105]; Figs. 2, 9.

91. I understand that Defendants identified a portion of this limitation—“**a part of a user’s body comprising blood**”—as potentially indefinite in the Texas Case. Ex. 1013, 228. Regardless of the outer bounds of this term (e.g., the extent of the user’s body comprising blood), however, and without opining on whether or not it has adequate written description support, **Mault** meets this term because **Mault** discloses the indisputable scope of this term. For example, the ’868 patent discusses embodiments where a lens system communicates an optical beam “onto a part of a patient’s body comprising a patient’s blood,” and a person of ordinary skill in the art would have understood this term at least includes these embodiments. *See, e.g.,* 868 patent, 3:17-21 (“A lens system is configured to receive at least the portion of the output beam and to communicate at least the portion of the output beam through a patient’s mouth onto a part of a patient’s body comprising a patient’s blood.”). A person of ordinary skill in the art would thus have understood that the term encompasses at least a tissue containing blood. Consistent with these embodiments, as discussed above, **Mault** discloses a lens system that “emit[s] wavelengths in the near-IR” through “blood-containing tissue” of a person to “compute the blood glucose level of the person.” *See, e.g.,* Mault, [0020].

d. Element [7.c]

92. Element [7.c] recites: **“a software application capable of generating data based at least in part on the measurement on the user, wherein the data represents at least in part physiological information associated with the user.”**

This element is met by **Mault**.

93. **Mault discloses a software application** (e.g., “software program” of PDA) **capable of generating data** (e.g. “predict[s] future blood glucose levels”) **based at least in part on the measurement on the user** (e.g., “two wavelengths ... one absorbed and one not absorbed” sensed by the “blood glucose sensor” that is “wrist-mounted,” “mounted on a belt,” or clipped to the person’s “earlobe”) **wherein the data represents at least in part physiological information associated with the user** (e.g., person’s blood glucose levels).

• **Fig. 2:**

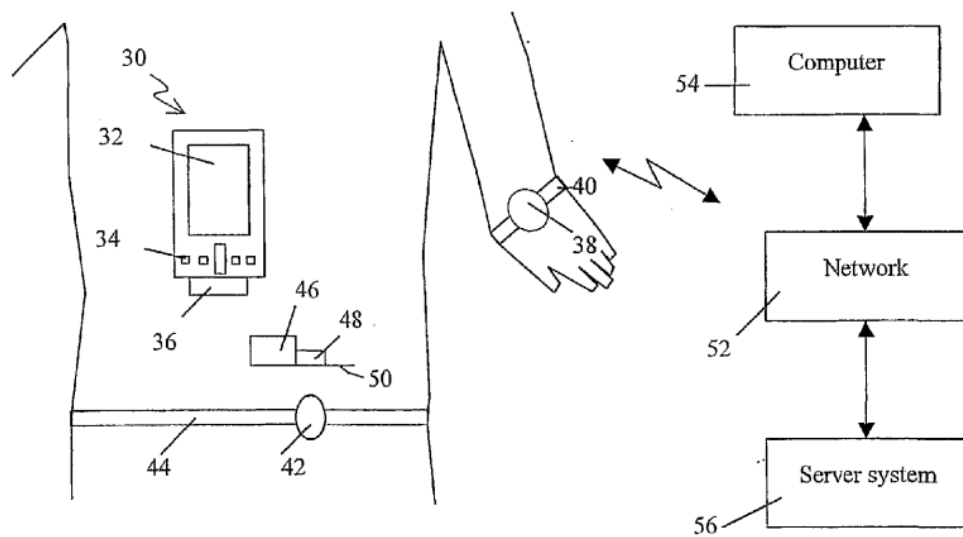


Figure 2

- **Fig. 9:**

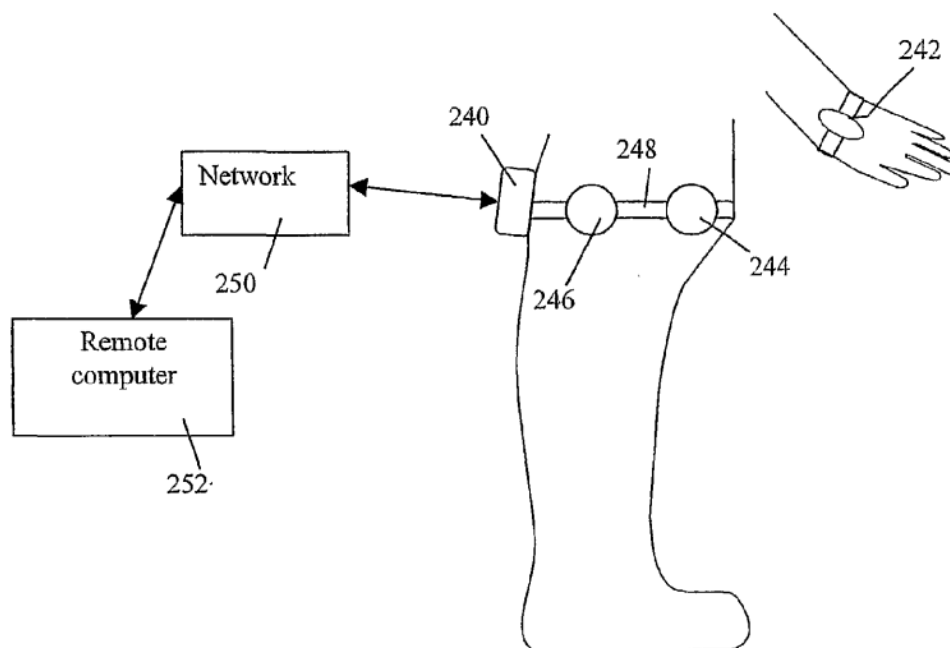


Figure 9

- [0014]: “In one embodiment, the system comprises a portable computing device such as a personal digital assistant (PDA), having a ***software program*** (such as a calorie management program or other health maintenance program) having a ***glycemic modeling capability, such as a glycemic response algorithm***.... The software program can be adapted to ***receive blood glucose measurements of the person***. ...The software program can be advantageously modified...to access a component response database by which the ***blood glucose response of a person to a meal can be determined by identifying meal components and determining the glycemic response of the person to the components***. Diet logging methods are described in more detail later.”
- [0015]: “... The ***software program receives food data, and uses a glycemic response model to calculate the change in blood glucose level for the person over time, projecting future values*** and presenting the future values to the person on a display....***The projected blood glucose levels, as determined by the software program, can be compared with measurements of blood glucose*** performed by the person at intervals....”
- [0020]: “The person carries a portable computing device, such as a PDA, ***which receives blood glucose levels from a blood glucose sensor. The***

blood glucose sensor may be a device clipped on to the earlobe of the person, using at least one semiconductor laser or light emitting diode to emit wavelengths in the near-IR. These wavelengths are transmitted through or reflected by blood-containing tissue, and then detected by a near-IR detector. ...For example, two wavelengths may be chosen, one absorbed and one not absorbed by blood glucose, the absorption ratio then being used to compute the blood glucose level of the person...."

- [0021]: "The person enters meals consumed (in terms of food content and time of meal), and planned meals, into the PDA using the diet log functionality of a software program running on the PDA. *The software program further uses a glycemic response model for the person to predict future blood glucose levels, based on the planned meals and possible insulin injections.*"
- [0079]: "*FIG. 2 shows a system embodiment, comprising portable computing device 30 having a display 32, data entry mechanism 34, and wireless transceiver 36; a wrist-mounted glucose sensor 38 having a strap 40....*"
- [0105]: "FIG. 9 shows a glycemic control system integrated with a fetal monitoring system for pregnant women. ...The electronic device 240 receives data from a *blood glucose sensor 242 which is illustrated as a wrist mounted device but can be any convenient location, such as mounted on belt 248. The belt 248 can be placed around the waist of the woman.*" ... *Other physiologic sensors can be added to the system.*"
- *See also [0028], [0037], [0038], [0042], [0134], [0151].*

94. **Mault's** blood glucose management system further includes a "personal digital assistant (PDA), having a software program," which "uses a glycemic response model" to generate data that "predict[s] future blood glucose levels" of the person based on the measured glucose levels of the person and further input regarding the person's dietary habits. [0014]-[0015], [0021].

95. For example, **Mault** discloses that "[t]he software program can be

adapted to receive blood glucose measurements of the person.” [0014]. For example, the blood glucose level is measured using a “blood glucose sensor” worn on the user (e.g., “clipped on to the earlobe of the person,” “wrist-mounted”). [0020], [0079], Figs. 2, 9. For example, the “blood glucose sensor” uses “at least one semiconductor laser or light emitting diode to emit wavelengths in the near-IR. These wavelengths are transmitted through or reflected by blood-containing tissue, and then detected by a near-IR detector.” [0020]. As such, Mault teaches “two wavelengths may be chosen, one absorbed and one not absorbed by blood glucose, the absorption ratio then being used to compute the blood glucose level of the person.” [0020], [0079], [0105]; Figs. 2, 9.

96. The predicted blood glucose levels generated by the software program represent how the person’s measured “[b]lood glucose levels” are predicted to change over time based on various input data from the person (e.g., consumed meals). [0014]-[0015], [0020]-[0021]. For example, **Mault** states that “[t]he software program can be advantageously modified from the program described in U.S. Provisional Application 60/240,185 to James R. Mault and others, so as to have a glycemic response algorithm, to record blood glucose levels, and to access a component response database by which the blood glucose response of a person to a meal can be determined by identifying meal components and determining the glycemic response of the person to the components.” [0014].

97. The software program accepts input data in various forms, including through voice entries that are processed by a “voice recognition software” regarding, for example, what food the person consumed. *Mault*, [0109] (“PDA” has “data entry means in the form of a keypad” or “[o]ther data entry mechanisms,” such as “voice recognition, and the like”), [0100] (“voice recognition capability for data input”), [0118] (“[T]he person records food consumed using a software program running on a PDA, having a diet log function, for example as described in U.S. Provisional App. 60/240,185 (filed Oct. 13, 2000). Data entry can be made using any convenient method such as stylus entry, keyboard...making voice records, voice recognition software...Meal data can be entered as food consumed, food about to be consumed, or food planned to be consumed.”).

98. I understand that Defendants identified a portion of this limitation—**“physiological information associated with the user”**—as potentially indefinite in the Texas Case. Ex. 1013, 228. Regardless of the outer bounds of this term (e.g., what constitutes physiological information “associated with” the user), however, and without opining on whether or not it has adequate written description support, **Mault** meets this term because **Mault** discloses the indisputable scope of this term. For example, the ’868 patent discusses embodiments where a “patient’s physiological parameters” includes blood constituents, and a person of ordinary skill in the art would have understood that the term at least includes these embodiments. *See, e.g.,*

868 patent, 7:66-8:2 (“System controller 90 may be operable to provide data associated with a patient's medical status during a medical procedure to the medical professional...”), 8:3-15 (“In this embodiment, host 70 also includes an auxiliary input device 80 coupled to system controller 90...the medical professional may use auxiliary device 80 to input data into system controller 90, such as the patient’s physiological parameters, for example, blood pressure, heart rate, blood oxygen level, or to retrieve data stored in a memory device associated with host 70.”). Consistent with these embodiments, as discussed above, **Mault** discloses a “software program” that generates a prediction of a person’s “blood glucose levels,” a type of blood constituent, based on a measurement of the person’s glucose level obtained using a “blood glucose sensor.” *See, e.g.,* Mault, [0014]-[0015], [0020]-[0021], [0079].

e. Element [7.d]

99. Element [7.d] recites: “**the software application capable of operating on a control system adapted to receive, store and process at least a portion of the physiological information.**” This element is met by **Mault**.

100. **Mault discloses the software application** (*e.g.*, “software program,” *see* [7.c]) **capable of operating on a control system** (*e.g.*, “PDA”) **adapted to receive** (*e.g.*, “adapted to receive blood glucose measurements”), **store** (*e.g.*, “store blood glucose readings”) **and process at least a portion of the physiological**

information (e.g., “glycemic response of the person” is “calculated from the blood glucose readings” using a “glycemic response algorithm”).

- **Fig. 9:**

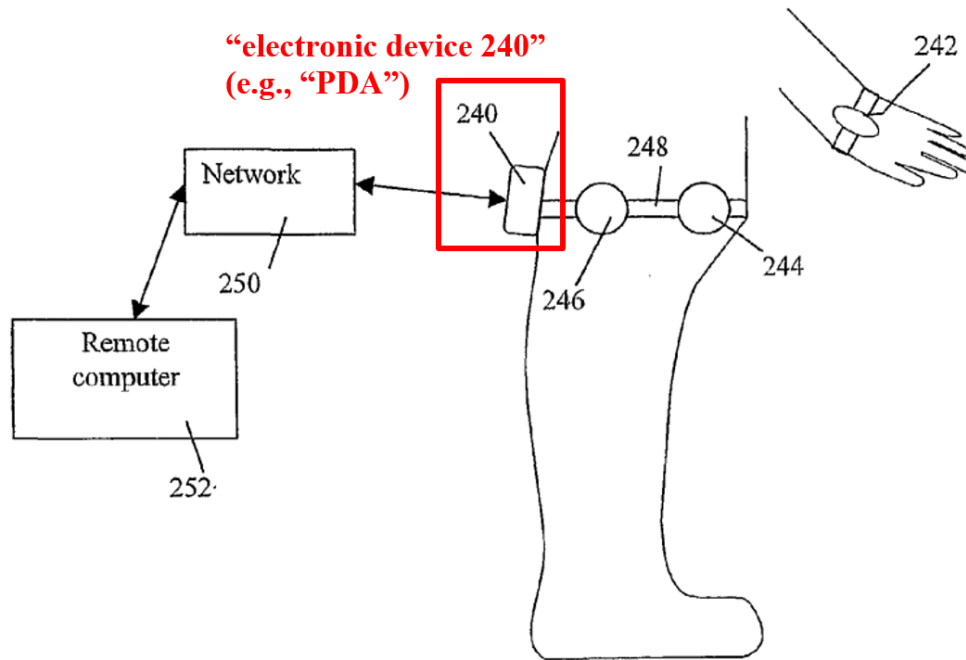


Figure 9

- [0014]: “In one embodiment, the system comprises a *portable computing device such as a personal digital assistant (PDA), having a software program...having a glycemic modeling capability, such as a glycemic response algorithm....* The *software program can be adapted to receive blood glucose measurements of the person. Blood glucose levels can be determined* by any convenient technique for comparison with the glycemic response predictions of the software program.”
- [0042]: “A system for assisting a person to maintain a blood glucose level between predetermined limits comprises an *electronic device, for example a portable computing device such as a PDA....*”
- [0074]: “In one embodiment, the *glucose sensor transmits the blood glucose level data to the PDA* using a wireless communication protocol such as Bluetooth (Ericsson Components AB).”

- [0105]: “... *Electronic device 240* is shown mounted on a belt 248 but can be *any portable electronic device* such as a *PDA*...”
- [0106]: “The *electronic device 240* is used as a *diet log* and to *store blood glucose readings*....”
- [0129]: “The *PDA* may also be used to keep a *diet log* for the person *over an extended period of time*, for example one month, during which *blood glucose readings* are made at appropriate intervals, for example every half-hour, perhaps more frequently just after a meal. The *glycemic response of the person can then be calculated from the blood glucose readings*”
- See also [0069], [0070], [0079], Figs. 1-2.

101. **Mault** further discloses the “electronic device 240,” such as a “PDA,” has “a software program” that is “adapted to receive blood glucose measurements of the person.” [0014], [0042], [0105], Fig. 9. The PDA “store[s]” the “blood glucose readings” to keep a “diet log” for the person, and uses a “glycemic response algorithm” to “calculate” the person’s “glycemic response...from the blood glucose readings.” [0014], [0042], [0069], [0106], [0129]. As such, a person of ordinary skill in the art would have understood that **Mault’s** PDA-based software application received physiological data, stored that data, and subsequently processed that data through algorithms or computational models.

f. Element [7.e]

102. Element [7.e] recites: “**the control system having a touch-screen, circuitry for obtaining position information from a location sensor, and a wireless transceiver to transmit wireless data over a wireless link, the wireless**

data comprising at least a part of the physiological information, wherein the control system is further capable of receiving voice input signals and manually entered input signals; and.” This element is met by **Mault**.

103. **Mault discloses the control system (e.g., “PDA,” see [7.d]) having a touch-screen (e.g., “display 32” of the PDA, such as a “Palm Pilot”), circuitry for obtaining position information from a location sensor (e.g., “global positioning system (GPS)” on PDA includes circuitry to obtain location information from sensors used for “determining location”), and a wireless transceiver to transmit wireless data over a wireless link (e.g., “wireless transceiver[s]” that “transmit[s] physiologic data”), the wireless data comprising at least a part of the physiological information (e.g., “physiologic data” includes “blood glucose reading[s]”, see [7.c]), wherein the control system is further capable of receiving voice input signals and manually entered input signals (e.g., PDA receives “voice entry, manual entry”).**

- [0079]: “FIG. 2 shows a system embodiment, comprising *portable computing device 30 having a display 32, data entry mechanism 34, and wireless transceiver 36....*”
- [0105]: “FIG. 9 shows a glycemic control system integrated with a fetal monitoring system for pregnant women. Electronic device 240 is shown mounted on a belt 248 but can be any portable electronic device such as a PDA. The *electronic device 240 receives data from a blood glucose sensor 242*”
- [0198]: “...The PDA can be used for monitoring the physical activity of the person. The PDA is used to receive and store activity-related data, for example the *PDA may be used for:...receiving positional and/or altitude data, using a global positioning system (GPS), triangulation method, or other positioning scheme, to obtain data such as speed, distance traveled, distance climbed....*”
- [0199]: “Data may be received by the *PDA* using any convenient method, for example ... *voice entry, manual entry* (for example using keys or stylus), etc....”
- [0201]: “A *PDA* can also be used to monitor the *physiological state of the person*. It may *communicate or otherwise receive data from physiological sensors* or monitors carried by the person.... The following methods or devices may be used: ... *transmitting physiologic data* to a physician, nutritionist, dietician, fitness consultant, or other professional, *using for example a wireless internet connection*, for example *transmitting data* at periodic intervals or on demand *from the PDA to a database on a remote (i.e. not carried by the person) computer....*”
- [0208]: “*Appropriate sensors may be part of the PDA*, carried with the person by some other method, or otherwise be *appropriately located for transmission of useful information to the PDA*. The following methods may be useful either individually or in combination: ... *determining location (from GPS or other positioning method) ... manual entry of data* from diverse sources....”
- *See also* [0037], [0042], [0078], [0106], [0109], [0148], Figs. 9-10.

104. **Mault** further discloses the PDA has a “display 32.” Mault, [0079],

Fig. 9. For example, **Mault** discloses that the PDA is, e.g., a “Palm Pilot,” which a person of ordinary skill in the art would have understood has a touch-screen, as illustrated by e.g., U.S. Patent Nos. 6,757,001 and 6,597,345, which I understand have been designated as Exhibits 1018 and 1025, respectively, as further discussed below. Mault, [0070], [0079], Fig. 2; Ex. 1018 (Allport), 3:60-65 (“The Palm Pilot, by 3-Com, Corporation, has a small touch-screen and a small number of physical buttons.”); Ex. 1025 (Hirshberg), 9:3-5 (“Referring now to FIG. 3, a preferred embodiment for Palm pilot touch screen is shown.”).

105. At minimum, a person of ordinary skill in the art would have found it obvious to include a touch-screen in Mault’s PDA because it was well-known for PDAs to have touch-screens as a data entry mechanism to provide a convenient and intuitive way for a user to control a device by interacting with the display of the device itself, as illustrated by e.g., U.S. Patent Nos. 6,641,533 and 6,727,930, which I understand have been designated as Exhibits 1019 and 1021, respectively, as further discussed below. *See, e.g.*, Ex. 1019 (Causey), 18:24-28 (“The display 102 of the PDA 10 is a touch screen LCD that allows the display of various icons 110 representative of different programs available on the PDA 10. The icons 110 on the display 102 may be activated by finger pressure or the touch of a stylus 112”); Ex. 1021 (Currans), 2:46-49 (“Symbol recognition software within the PDA detects and ‘reads’ the movement of a stylus on a touch sensitive screen and transforms the

stylus movements into text or symbols or other key stroke actions.”).

106. **Mault’s** PDA further includes “sensors” for “determining location (from GPS or other positioning method)” of the person, as well as “positional and/or altitude data.” Mault, [0208], [0198]. To “facilitate medical rescue in an emergency,” the “global positioning system (GPS)...added to the PDA” includes circuitry to obtain location information from the PDA’s “sensors” for “determining location,” or at minimum it would have been obvious to do so. Mault, [0077], [0208].

107. **Mault’s** PDA further includes “wireless transceiver 36,” which wirelessly “transmit[s] physiologic data,” such as the “blood glucose reading[s]” (*see* [7.c], [7.d]) “using...a wireless internet connection” “to a physician, nutritionist, dietician, fitness consultant” for assessment. Mault, [0074], [0077], [0079], [0105], [0201], Fig. 2.

108. **Mault’s** PDA also receives input though “voice entry [and] manual entry.” Mault, [0199].

109. I understand that Defendants identified portions of this limitation—**“wireless data”** and **“voice input signals and manually entered input signals”**—as potentially indefinite in the Texas Case. Ex. 1013, 228. Regardless of the outer bounds of the term **“wireless data”** (e.g., how the data is wireless), however, and without opining on whether or not it has adequate written description support, **Mault** meets this term because **Mault** discloses the indisputable scope of this term. For

example, the '868 patent discusses embodiments where a “communication device 50” (e.g., “wireless device”) that “enable[s] a medical professional to communicate with host 70” over one or more “communication links,” such as “a wireless link...or any other suitable interface operable to assist in the communication of information to and/or from network 104,” such that the data is wirelessly communicable. *See, e.g.,* 868 patent, 8:35-9:3. A person of ordinary skill in the art would have understood that the term “wireless data” at least includes these embodiments. Consistent with these embodiments, as discussed above, **Mault** discloses a wireless communications device (e.g., PDA) that communicates physiological information to a physician over a wireless link such as a “wireless internet connection.” *See, e.g.,* Mault, [0201].

110. Regardless of the outer bounds of “**voice input signals and manually entered input signals**” (e.g., the extent of and means for voice and manual input), however, and without opining on whether or not it has adequate written description support, **Mault** meets this term because **Mault** discloses the indisputable scope of this term. For example, the '868 patent discusses an embodiment where “an auxiliary input device 80” is capable of receiving input commands through a “keyboard” or “voice commands,” and a person of ordinary skill in the art would have understood that this term at least includes this embodiment. *See, e.g.,* 868 patent, 8:3-10 (“In this embodiment, host 70 also includes an auxiliary input

device 80 coupled to system controller 90. Although a keyboard is depicted in this example, any other device capable of inputting commands and/or data may be used without departing from the scope of this disclosure. In this example, auxiliary device 80 is operable to facilitate manual entry of manipulation commands to supplement and/or replace voice commands”). Consistent with this embodiment, as discussed above, **Mault** discloses that its “PDA” receives data using “any convenient method” such as “voice entry” or “manual entry (for example using keys or stylus).” *See, e.g.,* Mault, [0199].

g. Element [7.f]

111. Element [7.f] recites: “**a host comprising: a digital file for receiving and storing at least a portion of the wireless data; control logic at the host to process at least the portion of the wireless data to generate a status of the user; a memory storage device for recording the status; and an output for communicating at least a portion of the status or associated information over a communication link to one or more display output devices, wherein the one or more display output devices are located remotely from the host.**” This element is met by **Mault**.

112. **Mault discloses a host** (*e.g.*, “remote server system 56”) **comprising: a digital file for receiving** (*e.g.*, “a database” on “remote server system 56” for receiving data “through the communications network 52”) **and storing at least a**

portion of the wireless data (*e.g.*, “stor[ing] ... physiological parameters, activity, and diet,” including “physiologic data,” such as the “blood glucose reading[s],” *see* [7.e]); **control logic at the host to process at least the portion of the wireless data** (*e.g.*, “computer expert system” to perform “computer expert system analysis” on “physiologic data,” such as the “blood glucose reading[s],” *see* [7.e]) **to generate a status of the user** (*e.g.*, “feedback generated by a ... computer expert system,” which indicates whether the person’s blood glucose measurement “exceeds the upper recommended blood glucose level”); **a memory storage device for recording the status** (*e.g.*, a memory on remote computer system that stores the feedback); **and an output for communicating at least a portion of the status or associated information over a communication link to one or more display output devices** (*e.g.*, network interface of remote computer server for “transmitt[ing] to the PDA” “or other display device such as an interactive television” “[f]eedback... over the communications network 52”), **wherein the one or more display output devices are located remotely from the host** (*e.g.*, PDA with “display 32” or “other display device” separate from the remote server system).

- **Fig. 1:**

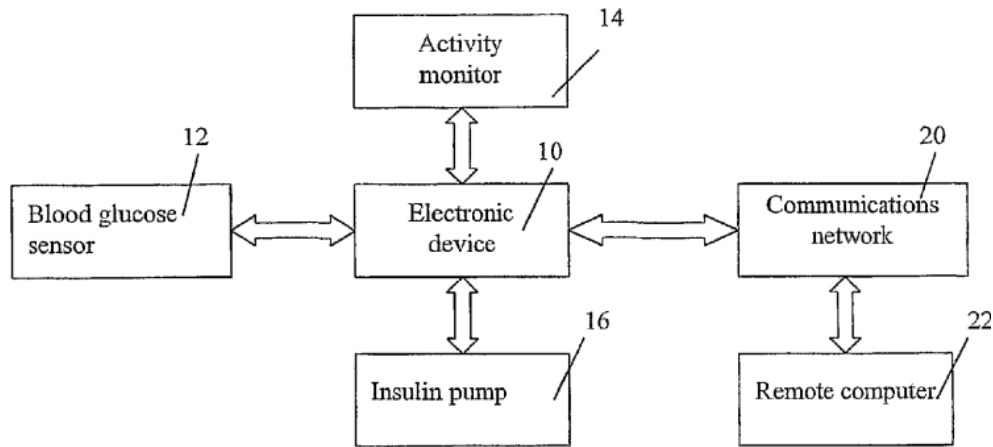


Figure 1

- **Fig. 2:**

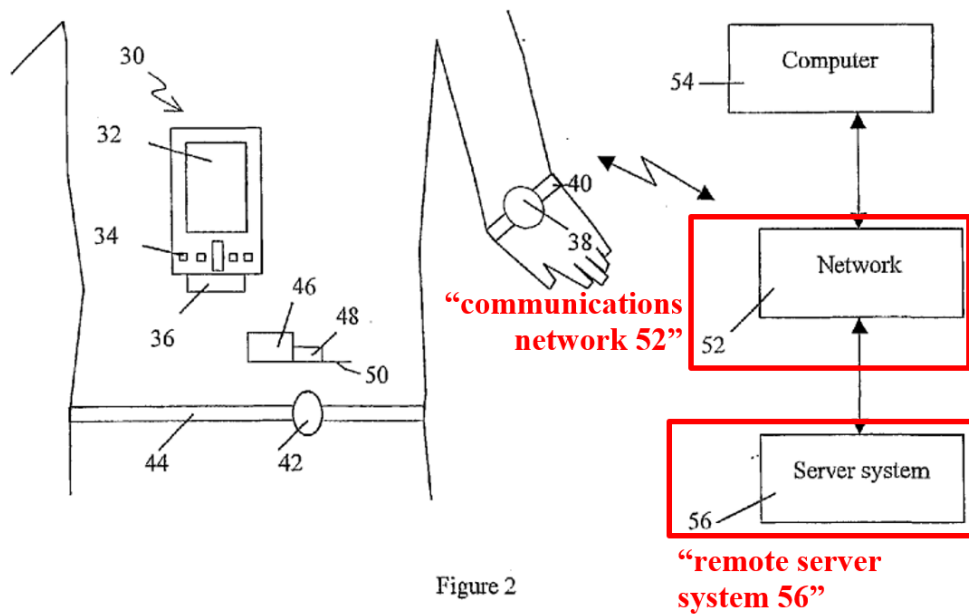


Figure 2

- [0079]: “**FIG. 2 shows a system embodiment...** The portable computing device 30 is in linked to a communications network 52, allowing communication a remote computer system 54, which may be located at the person's home, doctor's office, or other remote location. A **remote server system 56** is also accessible through the **communications network 52**, and **can be used to store a database of physiological parameters, activity, and diet** relating to the person, for **medical, nutritional, or computer expert system analysis.**”
- [0136]: “**FIG. 15 shows a possible presentation on a screen or display of a computing device used to provide feedback to the person.** Within the top half of the screen, a graph or chart 400 shows a curve 402, which **represents the calculated blood glucose level for the person as a function of time.** The **current present time[] P** is indicated by arrow 404.... **As a result of the entered meals, the curve exceeds the upper recommended blood glucose level, shown by dotted line 410**, after the planned dinner at a time E, shown by arrow 416. The **previous accuracy of the model's predictions has been checked using a data point (414)** which represents an actual blood glucose measurement for the person.... **If discrepancies are present, the curve can be shifted, the predictive algorithm modified, or the person recommended to perform more frequent blood glucose measurements.**”
- [0180]: “The PDA may also be in communication with a remote computer system, for example the Internet. Advice from a computer expert system, physician, *web site*, etc. **may be displayed to the person as text, graphics, video, etc., on the PDA or other display device such as an interactive television.**”
- [0201]: “A **PDA** can also be used to monitor the **physiological state of the person**.... The following methods or devices may be used: ... **transmitting physiologic data** to a physician, nutritionist, dietician, fitness consultant, or other professional, **using for example a wireless Internet connection**, for example transmitting data at periodic intervals or on demand **from the PDA to a database on a remote (i.e. not carried by the person) computer**....”
- **See also [0069], [0112], [0134], [0190], Fig. 14.**

113. **Mault** discloses a “remote server system 56,” such as a “remote server,”

which receives “data ...transferred” from the user’s PDA over a wireless “communications network 52.” Mault, [0079], Fig. 2. The remote server “store[s] a database of physiological parameters,” which includes “physiologic data” such as the “blood glucose reading[s]” (*see* [7.e]) that was “transmitt[ed]” by the PDA to the remote server. Mault, [0074], [0079], [0105], [0201]. For example, the PDA uses “a wireless internet connection,” to “transmit[] physiologic data” “from the PDA to a database on a remote ... computer.” Mault, [0201].

114. A person of ordinary skill in the art would have known, or at minimum found obvious, that the remote server’s database is a digital file that stores the “physiologic data,” including the “blood glucose reading[s]” because databases are stored in files in a server or system’s storage. Since system information is stored in files and a database is a structured collection of information, a database would also be stored on the system as one or more files—and at minimum it would have been obvious to do so, as illustrated by e.g., U.S. Patent Nos. 5,544,357 and 4,817,050, which I understand have been designated as Exhibits 1031 and 1032, as further discussed below. For example, Huei and Komatsu taught that it was common to store database information in a “database file.” *See, e.g.*, Ex. 1031 (Huei), 1:37-43 (“a database engine maintains the structure of the database, that is, the relationship between the logical keys and the physical data actually stored in the database file”); Ex. 1032 (Komatsu), 5:60-64 (“The data of type portion 52 represents the type of

data stored in the database file.”).

115. A “computer expert system” of the remote computer system performs “computer expert system analysis” to process the stored “physiologic data,” such as the “blood glucose reading[s]” to generate “feedback” indicating whether the person’s measured blood glucose level “exceeds the upper recommended blood glucose level.” Mault, [0074], [0077], [0136], [0180], [0201], Fig. 15. As such, the person’s status—whether his/her blood glucose level is too high—is generated by the “remote computer system” as part of the feedback and then “displayed to the person ... on the PDA.” [0180]. For example, as shown in Fig. 15, the feedback is illustrated using a chart that shows the status of the person’s blood glucose levels over time by visually depicting whether the blood glucose level (depicted by curve 402) rises above the upper recommended limit (dotted line 410). Mault, Fig. 15, [0136].

116. A person of ordinary skill in the art would have understood, or at minimum found it obvious, that in order to display the status of the person’s calculated blood glucose level, the status information would have been recorded in a memory storage device because the processed information must be held in a storage in order to be transmitted as a visual output to a display device when the user wants to view the information. Indeed, as **Mault** explains, the remote computer system performs accuracy checks on its computed glucose models in order to display

the person's glucose status, such that the computed glucose models would be stored in the internal memory of the remote computer system. Mault, [0136].

117. **Mault** discloses that the “feedback” generated by the “computer expert system” of the remote computer system is “transmitted to the PDA” “or other display device such as an interactive television” “from the remote computer over the communications network” “such as the Internet.” [0077], [0078], [0079], [0180]. Thus, a person of ordinary skill in the art would have understood, or at minimum found it obvious, that the remote computer system has a network interface to connect to the “communication network” to transmit the blood glucose level “feedback” to “display device[s]” such as the “display 32” of the person's PDA or an “interactive television,” which is remote from the remote server. Mault, [0079], [0180], [0201].

118. I understand that Defendants identified portions of this limitation—“**at least a portion of the status or associated information**”—are potentially indefinite in the Texas Case. Ex. 1013, 228. Regardless of the outer bounds of this term (e.g., extent of status or associated information that must be communicated to one or more display output devices), however, and without opining on whether or not it has adequate written description support, **Mault** meets this term because **Mault** discloses communicating at least a portion of the status of the user (which I understand is enough to meet this limitation, since “associated information” is recited as an alternative to “status” information). For example, the '868 patent

discusses embodiments where the “current state” of “the patient’s physiological parameters” are displayed as needed to “assist a medical professional during a medical procedure.” *See, e.g.*, 868 patent, 8:24-31 (“display 60 and GUI 72 may display ... information about a patient’s medical status, such as the current state of any number of the patient’s physiological parameters, information about the particular device 10 being used, or any other information that may assist a medical professional during a medical procedure.”). Consistent with these embodiments, as discussed above, **Mault** discloses and renders obvious communicating and displaying “feedback” regarding whether a person’s measured blood glucose level “exceeds the upper recommended blood glucose level,” a “state of [the user’s] physiological parameters.” *See, e.g.*, Mault, [0136], Fig. 15.

h. Claim [10]

119. Claim 10 recites: “**The diagnostic system of claim 7, wherein the control system is further coupled to a headset or a heads-up display.**” This additional limitation is met by **Mault**. *See* my analysis in connection with claim 7 (Sections IX.A.2.[7.pre]-[7.f]).

120. **Mault discloses that the control system** (*e.g.*, “PDA, *see* [7.d]) **is further coupled to a headset or a heads-up display** (*e.g.*, “a headset”).

- **[0070]:** “The electronic device can be a portable electronic device or system carried by the person, or *a device or system combining multiple*

functionalities, such as: a personal digital assistant (PDA)... a headset, providing for example visual and audio communication to the person"

121. See my analysis in [7.d]. **Mault** further discloses “combining” the functionality of a “PDA” with the functionality of a “headset” that provides “visual and audio communication to the person.” Mault, [0070]. Thus, **Mault** discloses, or at minimum renders obvious, that its PDA is coupled to a headset.

i. Claim [11]

122. Claim 11 recites: “**The diagnostic system of claim 7, wherein the control logic includes voice recognition software to process at least a portion of the voice input signals, and wherein the control system further comprises a voice recognition module.**” This additional limitation is met by **Mault**. See my analysis in connection with claim 7 (Sections IX.A.2.[7.pre]-[7.f]).

123. **Mault discloses that the control logic includes voice recognition software (e.g., “voice recognition software”) to process at least a portion of the voice input signals (e.g., process “voice entry...of food consumed”), and wherein the control system further comprises a voice recognition module (e.g., “voice recognition capability”).**

- [0118]: “In use, *the person records food consumed using a software program running on a PDA Data entry can be made using any convenient method, such as ... making voice records, voice recognition software*, using a roller jog entry (as used on Sony devices), or using any convenient method.”

- [0133]: “... *Data entry methods can include keystroke entry, voice entry (using voice recognition software)....*”
- [0190]: “As part of a physiological monitoring system, a *portable computing device* can be used to monitor a number of factors influencing the physiological state of the person.... *Electrical, electromagnetic, and manual data entry may also be used, along with the transfer of non-volatile memory media, voice recognition software, etc.* The person may enter data manually into the PDA. Optical character recognition may be used for entry of numbers and text into the PDA. Certain sensors may be incorporated directly into the PDA.”
- [0193]: “*Food consumed can be entered into the PDA* using a menu entry system, for example using key presses, stylus entry, *voice entry*, eye motion detection, hand motion (gesticulation) detection, etc.—for *voice entry, a restricted voice recognition capability*... The name, code, number, other identifier, time of consumption, nutritional data, portion size, *or other information concerning food consumed can be entered into the PDA, for example using...voice entry...recording voice records of food consumed.*”
- *See also* [0074], [0100], [0121], [0193], [0199], Fig. 13.

124. Mault discloses that the PDA has a “voice recognition software” to support “voice entry” of food consumed as a method of manual data entry “entered into the PDA.” Mault, [0070], [0118], [0133], [0190]. For example, “a restricted voice recognition capability may be adopted for computational simplicity, for example on which recognizes only numbers or letters associated with menu choices, such as disclosed in co-pending provisional application serial No. 60/212,319 filed Jun. 16, 2000, to James R. Mault.” Mault, [0193]. For example, the referenced provisional application, which I understand has been designated as Exhibit 1026, discusses receiving and processing various simple voice commands to control a PDA

(e.g., “up” and “down” to control navigation of a “PDA”). Ex. 1026, 5:18-21 (the PDA “may also recognize the commands ‘up’ and ‘down.’ Commands could also be recognized for a few of the most commonly used functions of the PDA, such as ‘date’ for date book, ‘to do’ for the to do list, and ‘address’ or ‘phone’ for the address list”). As such, the PDA uses the “voice recognition software” to process a user’s voice entry to determine what food the user has consumed.

125. Based on the construction I was instructed to consider for “voice recognition module”, which I have not adopted as my own, I have been asked whether the “voice recognition module” term (recited in claim 11) would be met if it was considered to be a means-plus-function limitation. As discussed in the Claim Construction Section above (Section VII.A), assuming this term is construed under means-plus-function, **the function would include** voice recognition, and the **corresponding structure would include** “hardware, software, firmware, or any combination thereof that is capable of converting a voice command signal [] into a control signal.” See, e.g., ’868, 14:39-51 (“[S]ystem controller 590 comprises a voice recognition module 592 capable of at least partially contributing to one or more functions of system controller 590....In this example, voice recognition module 592 at least partially contributes to the conversion of voice command signal 504 to a control signal 506. Voice recognition module 592 may include any hardware, software, firmware, or any combination thereof that is capable of converting voice

command signal 504 into control signal 506.”).

126. Under this means-plus-function construction, **Mault** discloses and renders obvious “voice recognition module.” As discussed above, **Mault** discloses “voice recognition software” that receives “voice entr[ies]” as entry data regarding what food a user has consumed or plans to consume. Mault, [0133], [0190]. The entered meals and mealtimes are then incorporated into “feedback” in the form of display charts for the user, showing mealtimes and “blood glucose levels ... projected at times beyond the consumption of a meal.” Mault, [0133]-[0137], Figs. 14, 15. Further, as discussed above, **Mault** discloses that its “voice recognition software” is capable of operating according to the disclosure in “co-pending provisional application serial No. 60/212,319” (Mault, [0193]), which discusses a voice recognition capability that uses voice commands for controlling the use of a PDA (Ex. 1026, 5:18-21). Thus, a person of ordinary skill in the art would have understood, or at minimum found obvious, that the voice recognition software converts the user’s voice entries, which are command signals into control signals that control the display of voice-entered data (e.g., food consumed).

127. To the extent **Mault** does not literally meet “voice recognition module” under the means-plus-function construction discussed above, the term is met by **Mault** under the doctrine of equivalents. For example, as discussed above (*see* Section IX.A.2.[11]), **Mault’s** “voice recognition software” performs the function

of voice recognition in substantially the same way as the '868 patent (e.g., “voice recognition module,” which can be “software,” receives a “voice command signal” from a user and converts it into a “control signal” that instructs a system to display information based on the voice input). '868, 14:39-15:28 (“...voice recognition module 592 may include any hardware, software, firmware, or any combination thereof that is capable of converting voice command signal 504 into control signal 506,” such as an “actuation signal” that is communicated to a “device control module” to control the “system controller” with “data” for “a live video feed associated with a camera coupled to medical device 570”). Both the '868 and **Mault** discuss software that receives a person’s spoken input converts the input into an electronic form that is processed by the system to display further information based on the spoken input. **Mault**, [0118], [0133], [0190], [0193].

j. Claim [14]

128. Claim 14 recites: **“The diagnostic system of claim 7, wherein the control system is further coupled to an audio output device capable of communicating at least a part of the processed portion of the physiological information.”** This additional limitation is met by **Mault**. See my analysis in connection with claim 7 (Sections IX.A.2.[7.pre]-[7.f]).

129. **Mault discloses that the control system (e.g., “PDA, see [7.d]) is further coupled to (e.g., in “Bluetooth wireless communication with”) an audio**

output device capable of communicating (e.g., an “earring-like device ... to give audible feedback to the person”) **at least a part of the processed portion of the physiological information** (e.g., “feedback” indicates whether the person’s blood glucose levels measured by the PDA (*see* [7.c]) “exceeds the upper recommended blood glucose level”).

- [0080]: “*Functionalities of system elements can be combined.... An earring-like device could combine the functionality of a glucose sensor and a device to give audible feedback to the person, perhaps as an extension of the PDA, and in for example Bluetooth wireless communication with it.* The PDA may have a plug in module which analyzes blood. Other combinations are possible.”
- *See also* [0074], [0077], [0079], [0112], [0129], [0136], [0175].

130. **Mault** further discloses that the “PDA” is in “Bluetooth wireless communication with” an “earring-like device,” which “combine[s] the functionality of a glucose sensor and a device to give audible feedback to the person.” Mault, [0080]. The “earring-like device” functions “as an extension of the PDA” and thus provides feedback from the PDA in an audible form, such as “[f]eedback, generated by a specialist or computer expert system” that was “transmitted to the PDA.” Mault, [0077], [0080]. For example, this feedback includes whether the person’s blood glucose level measured by the PDA “exceeds the upper recommended blood glucose level.” Mault, [0074], [0077], [0079]-[0080], [0136]. A person of ordinary skill in the art would have recognized the practical advantage and relevance of **Mault’s** audio output capabilities within physiological monitoring devices, particularly those

intended for continuous use and health monitoring applications like blood glucose management. A person of ordinary skill in the art would thus have recognized **Mault's** disclosure of an earring-like device that integrates both glucose-sensing functionality and audible feedback as offering convenience, immediacy, and improved user experience.

B. GROUND 2: Mault in view of Mitsui (Claim 9):

131. Claim 9 recites: **“The diagnostic system of claim 7, wherein at least the portion of the input light beam is adapted for use in a diagnostics to measure a property of the blood, wherein the diagnostics comprise a spectroscopic procedure, wherein the spectroscopic procedure is based at least in part on a comparison of amplitudes at a plurality of associated wavelengths transmitted or reflected from the blood.”** As I explained above (Sections IX.A.2.[7.pre]-[7.f]), **Mault** discloses the limitations of claim 7. The additional limitation in claim 9 is met by **Mault** in view of **Mitsui**.

132. **Mault discloses that at least the portion of the input light beam (e.g., “wavelengths...transmitted through...blood-containing tissue,” see [7.a]) is adapted for use in a diagnostics to measure a property of the blood (e.g., “wavelengths ... transmitted through or reflected by blood-containing tissue” are “used to compute the blood glucose level of the person,” see [7.b]), wherein the diagnostics comprise a spectroscopic procedure (e.g., “non-invasive**

spectroscopic technique[s]” used to “measure blood glucose”). Mault, [0013], [0020], [0073].

133. **Mitsui further discloses a procedure** (*e.g.*, analyzing light wavelength intensities to “determine the amount of glucose” in a person’s blood) **that is based at least in part on a comparison of amplitudes** (*e.g.*, “determining the ratio of the light intensities of λ_1 and λ_2 ”) **at a plurality of associated wavelengths** (*e.g.*, “wavelength λ_1 ,” “wavelength λ_2 ,” and “wavelength λ_3 ”) **transmitted or reflected from the blood** (*e.g.*, “transmitted or reflected by a living body,” including the “blood flow at the light irradiation site”). Mitsui, [0007].

134. **Mault** discloses a “blood analysis sensor” 12 that is “built into a module which plugs into the PDA” that “us[es] non-invasive spectroscopic technique[s] to measure blood glucose.” [0073]. Mault states that “sensor 12” may use “spectroscopy techniques to measure blood glucose, for example, as described in U.S. Pat. Nos. 6,067,463 (Jeng), 6,049,727 (Crothall[1]), 5,660,163 (S[c]hulman), and others.” [0073]; *see also* Ex.1011 (Crothall), 7:31-44, 8:48-52; Ex.1010 (Jeng), 5:66-6:10, 13:60-14:3; Ex.1012 (Schulman), 6:51-7:32, 7:66-8:12. I understand U.S. Patent Nos. 6,067,463 (Jeng), 6,049,727 (Crothall), and 5,660,163 (Schulman) have been designated as Exhibits 1010, 1011, and 1012, respectively. For example, as Crothall explains, the spectroscopy techniques involve “directing electromagnetic radiation or light energy (hereafter, ‘light’) containing a plurality of different

infrared wavelengths ... through the body fluid” and “detect[ing] relative differences in absorptivity ... from one wavelength to the next in order to measure relatively dilute substances in a body fluid, such as glucose in blood.” Crothall, 7:31-44, 8:48-52.

135. **Mitsui** discloses a sensor for detecting and measuring glucose levels in a person’s blood. Mitsui, [0001], [0006], [0007], [0009], [0015]. **Mitsui** discloses a “glucose sensor” with a “light emitting means” and a “detecting means for detecting the intensity of the light ... transmitted or reflected by a living body” such as a “photodetector.” Mitsui, [0007], [0009]. For example, **Mitsui** discloses “determining the ratio of the light intensities” of multiple wavelengths (e.g., “wavelength λ_1 ,” “wavelength λ_2 ,” and “wavelength λ_3 ”), which involves a comparison of amplitudes because the amplitude of light waves determines intensity and intensity is directly correlated to the amplitude of a light wave. Mitsui, [0007].

136. **Mault** and **Mitsui** are thus analogous art, in the same field as the ’868, which includes diagnostic medical devices, and are reasonably pertinent to the problems addressed by the ’868, e.g., using light-based procedures to perform medical diagnostics. ’868, Abstract (“A diagnostic system includes a plurality of semiconductor diodes, a multiplexer, and one or more waveguide structures to form an output beam. A lens system communicates some of the output beam onto a part of a user’s body comprising blood to perform a measurement.”), 1:39-51, 1:58-63,

2:25-45, 2:64-3:2, 3:21-28, 4:37-62, 5:44-55, 6:14-31, 10:28-43, 17:18-23 (“...For light-based surgery and spectroscopy, it can be particularly advantageous to use an optical signal wavelength in the range between approximately 5 microns to approximately 7 microns to minimize tissue damage or collateral damage. In a particular embodiment, an optical signal having a wavelength of approximately 6.45 microns may be advantageously used for light-based surgery and/or spectroscopy.”); Figs. 1, 2; Mault, Abstract, [0003], [0008], [0013] (“Embodiments of the present invention provide methods of blood glucose management systems that allow a person to view projected future levels of blood glucose, so as to assist the person to keep blood glucose levels.”), [0020] (“The person carries a portable computing device, such as a PDA, which receives blood glucose levels from a blood glucose sensor. The blood glucose sensor may be a device clipped on to the earlobe of the person, using at least one semiconductor laser or light emitting diode to emit wavelengths in the near-IR. These wavelengths are transmitted through or reflected by blood-containing tissue, and then detected by a near-IR detector.”), [0022], [0073], [0089], [0144], [0146], [0199], [0201], [0208]; Mitsui, [0001] (“The present invention relates to a sensor device for detecting the glucose concentration in the blood of a living body such as the human body.”), [0002], [0005], [0006], [0007], [0009], [0015].

137. A person of ordinary skill in the art would have been motivated to apply

Mitsui's teachings of comparing a plurality of wavelength intensities for determining glucose levels to **Mault's** blood glucose management system. **Mitsui** teaches comparing the detected intensities of multiple wavelengths to perform a "non-invasive measurement of glucose concentrations" that are advantageously "less susceptible to variations in the measurement device and environmental conditions, enabling accurate measurements." Mitsui, [0006], [0007]; Mault, [0073], [0089]. A person of ordinary skill in the art would thus have been motivated to apply **Mitsui's** teachings of light intensity, or amplitude, comparison of multiple wavelengths for increased accuracy and reliability of **Mault's** blood glucose measurement system. A person of ordinary skill in the art would further have understood that applying **Mitsui's** teachings of a comparative method to **Mault's** system would directly address known challenges of optical glucose sensing (such as variability due to ambient light, temperature fluctuations, and physiological differences between individuals) by providing stable, comparative reference points. This comparative method provides inherent calibration and significantly enhances reliability and reproducibility in optical glucose measurements.

138. Both **Mault** and **Mitsui** teach performing optical physiological measurements utilizing multiple wavelengths of light, and comparing detected light intensities as a means for measuring glucose in the blood was well known in the art, as illustrated by e.g., U.S. Patent No. 5,377,674, which I understand has been

designated as Exhibit 1008, as further discussed below. *See, e.g.*, Ex. 1008 (Kuestner), Abstract, 5:32–47, 6:16–39 (disclosing a “measurement [that] consists of a combination of ordinary absorbance data at multiple wavelengths in the form of a ratio or of a ratio of derivative absorbance data” for blood oxygen, glucose, or cholesterol). Accordingly, a person of ordinary skill in the art would have had a reasonable expectation of success applying **Mitsui’s** teachings to **Mault’s** spectroscopic detection, and a person of ordinary skill in the art would have known that the combination (yielding the claimed limitations) would predictably work and provide the expected functionality.

139. Thus, a person of ordinary skill in the art would have found it routine, straightforward and advantageous to apply **Mitsui’s** teaching of wavelength intensity comparison to **Mault’s** spectroscopic techniques, and would have known such a combination (yielding the claimed limitations) would predictably work and provide the expected functionality.

140. I also understand that Defendants identified portions of this limitation—“**adapted for use in a diagnostics**” and “**a plurality of associated wavelengths transmitted or reflected from the blood**”—as potentially indefinite in the Texas Case. Ex. 1013, 228. Regarding the term “**adapted for use in a diagnostics,**” regardless of its outer bounds (e.g., what constitutes “a diagnostics”), and without opining on whether or not it has adequate written description support,

Mault meets this term because **Mault** discloses the indisputable scope of this term. For example, the '868 patent discusses embodiments where an optical beam “is adapted for use in medical diagnostics to measure a property of the patient’s blood,” and a person of ordinary skill in the art would have understood that this term would at least include these embodiments. *See, e.g.*, 868 patent, 3:21-28, 3:46-54 (“In various embodiments, at least the portion of the output beam is adapted for use in medical diagnostics to measure a property of the patient's blood, wherein the medical diagnostics comprise a spectroscopic procedure...”). Consistent with these embodiments, **Mault** discloses “using a non-invasive spectroscopic technique...to obtain a blood glucose reading,” which is used to diagnose medical conditions like “diabetes.” *See, e.g.*, Mault, [0073]. [0151], [0003], [0008]-[0009], [0018]-[0019], [0022]-[0023].

141. Regarding the term “**a plurality of associated wavelengths transmitted or reflected from the blood**,” regardless of its outer bounds (e.g., what it means for “a plurality of associated wavelengths” to be “transmitted...from the blood”), and without opining on whether or not it has adequate written description support, **Mault** in view of **Mitsui** meets this term because the proposed combination meets a plurality of associated wavelengths reflected from the blood (which I understand is enough to meet this limitation, since “reflected from the blood” is recited as an alternative to “transmitted”). For example, as discussed above,

Mitsui discloses a “glucose sensor” that emits multiple wavelengths of light and uses “detecting means for detecting the intensity of the light...reflected by a living body.” Mitsui, [0007], [0009]. Thus, as discussed above, **Mault’s** blood glucose management system, as modified by these teachings from **Mistui**, renders obvious “a plurality of associated wavelengths...reflected from the blood.”

C. GROUNDS 3-4: Grounds 1-2 in view of Pologe (Claims 7-11 and 14):

1. Overview of Pologe

142. **Pologe** discloses a “photoplethysmographic measurement system”—a system that measures changes in volume in a part of the body using optically obtained data—“that utilizes wavelength division multiplexing” to “noninvasively measure various blood analytes in a test subject.” Pologe, 1:11-17, 2:8-11, 4:20-22, 4:32-36. Multiplexing combines multiple signals into a single signal, which increases the efficiency of transmission by requiring only one transmission channel. The wavelength division multiplexing is performed by a “wavelength division multiplexing (WDM) coupler” “such as those using lenses” to “produc[e] a wavelength multiplexed pulse on a single light guide.” Pologe, 3:38-55, 3:65-4:4.

143. Figure 1 illustrates an embodiment of **Pologe’s** measurement system. Pologe, 4:33-34. The measurement system includes an “optical coupler 22,” which can be “any of a number of different types of wavelength division multiplexing (WDM) couplers ... such as WDM couplers using lenses.” Pologe, 5:44-59. The

measurement system also includes a main test unit with an “input device 34, such as ... a touch screen.” Pologe, 4:63-5:9.

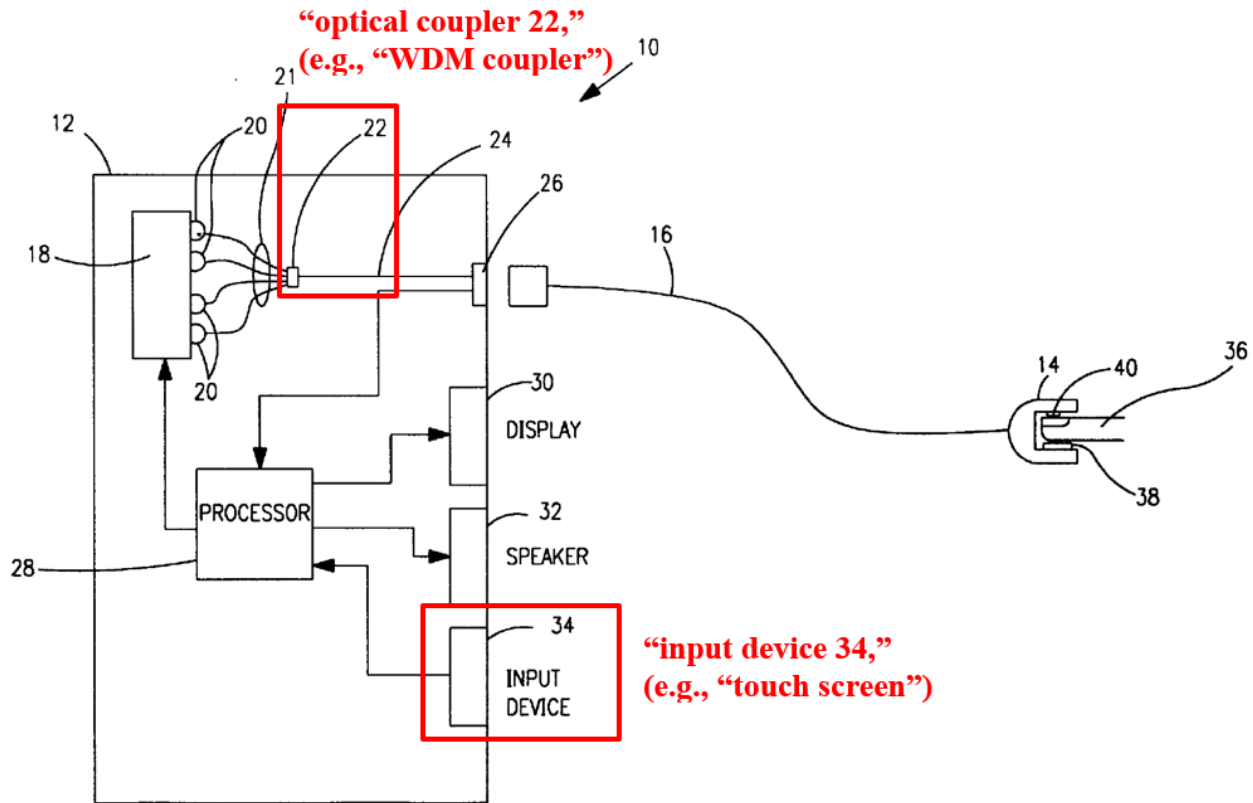


FIG. 1

Pologe, Fig. 1 (including my annotations).

2. Motivation to Combine Mault with Pologe

144. **Mault** and **Pologe** are analogous art, in the same field as the '868, which includes diagnostic medical devices, and are reasonably pertinent to the problems addressed by the '868, e.g., using light-based procedures to perform medical diagnostics. '868, Abstract, 1:39-51, 1:58-63, 2:25-45, 2:64-3:2, 4:37-62, 5:44-55, 6:14-31, 8:17-34, 10:28-43, Figs. 1, 2; Mault, Abstract, [0003], [0008],

[0013], [0020], [0022], [0073], [0089], [0144], [0146], [0199], [0201], [0208];
Pologe, Abstract, 1:63-2:6, 2:8-15, 2:28-44, 3:38-56, 4:1-4:4, 4:20-54, 4:63-5:18.

145. Regarding **Pologe**'s multiplexer teachings, a person of ordinary skill in the art would have been motivated to apply **Pologe**'s teaching of wavelength division multiplexing (WDM) couplers to **Mault**'s "blood glucose sensor" with "at least one semiconductor laser or light emitting diode" to combine multiple light signals into a single multiplexed signal, which "reduce[s] system implementation cost and increase[s] flexibility" of signal transmission means used. Pologe, Abstract, 1:63-2:6, 3:65-4:4; Mault, [0020], [0073], [0089]. A person of ordinary skill in the art would have understood that employing WDM couplers, as taught by **Pologe**, would address common and practical challenges in developing optical physiological sensors, particularly the need for minimizing system complexity, reducing production and maintenance costs, and simplifying component replacement and maintenance procedures. In particular, **Pologe** teaches using WDM couplers to combine multiple light signals into a single signal because "it is advantageous to reduce the number of signal carriers in the signal transmission means" to keep "the signal transmission means [] as lightweight and flexible as possible" and reduce cost of making the signal transmission means, which "must be replaced periodically" and thus should be "relatively inexpensive to produce." Pologe, 1:63-2:6. A person of ordinary skill in the art would also have recognized that applying **Pologe**'s WDM

coupler teachings to **Mault's** "blood glucose sensor" would minimize system complexity, allowing decreased production and maintenance costs and simplified maintenance procedures.

146. Regarding **Pologe's** lens system teachings employed by **Pologe's** WDM coupler, a person of ordinary skill in the art would have been motivated to apply **Pologe's** lens teachings to the LED(s) in **Mault's** "blood glucose sensor" to advantageously improve the accuracy of **Mault's** blood glucose measurements. Pologe, 1:55-58, 3:38-55, 3:65-4:4, 4:24-31, 5:44-59; Mault, [0020], [0073], [0089]. As **Pologe** teaches, "the path a light signal takes through the tissue under test can affect the accuracy of the measurement," so "it is important that all light pulses be directed into the tissue from essentially a single point" by using the lens to help focus and direct the light into the target tissue of the subject. Pologe, 1:55-58, 3:38-55.

147. A person of ordinary skill in the art would have had a reasonable expectation of success in applying **Pologe's** teachings of a multiplexer with a lens, such as a wavelength division multiplexing (WDM) coupler, to **Mault's** sensor with LEDs. Both **Mault** and **Pologe** teach optical physiological monitoring systems utilizing LEDs as light sources. Mault, [0020], [0073], [0089]; Pologe 1:63-2:6, 3:38-55, 3:65-4:4, 4:24-31, 5:44-59. A person of ordinary skill in the art would have found it routine and straightforward to apply **Pologe's** WDM coupler with lenses to the LEDs in **Mault's** sensor because using multiplexers with lenses to generate

multiplexed emissions from LEDs was well-known in the art, as illustrated by e.g., U.S. Patent No. 4,244,045, which I understand has been designated as Exhibit 1009, as further discussed below. Pologe, 3:38-55, 5:44-59; Ex. 1009 (Nosu), 1:6-11, 1:38-39, 6:4-20. For example, like Pologe, Nosu taught the use of a “multiplexer” which uses “lenses” to direct and couple beams of light from “light sources” like “light emitting diode[s] (LED)” with “wavelengths λ_1 , λ_2 , λ_3 , λ_4 , λ_5 respectively.” See, e.g., Ex. 1009 (Nosu), 1:6-11, 1:38-39, 6:4-20 (disclosing an “optical multiplexer” that uses a “multiplexer” that combines “signals of the wavelengths λ_1 , λ_2 , λ_3 , λ_4 , λ_5 respectively” from “light source[s]” such as “light emitting diode[s] (LED)” using “collimating lenses”). A person of ordinary skill in the art would thus have understood and expected that applying **Pologe’s** teachings of a WDM coupler with lenses to **Mault’s** LED-based blood glucose sensor would predictably enhance device performance, efficiency, and overall system reliability, with well-known and proven technology. Thus, a person of ordinary skill in the art would have known such a combination (yielding the claimed limitations) would predictably work and provide the expected functionality.

148. Regarding **Pologe’s** touch screen teachings, a person of ordinary skill in the art would also have been motivated to apply **Pologe’s** teaching of a touch screen in the display to receive user input commands to **Mault’s** electronic device

240. **Mault** teaches a “manual entry of data into the PDA using any input

mechanism, such as keys, a stylus, voice recognition, and the like,” and a person of ordinary skill in the art would have looked to other input mechanisms. **Mault**, [0074]. Like **Mault**, **Pologe** teaches that a “touch screen” is a means “for allowing the user to input commands and other information to the processor unit.” **Pologe**, 4:63-5:9. Thus, a person of ordinary skill in the art would have been motivated to apply **Pologe’s** teachings of using a touch screen as a mechanism for accepting user input to **Mault’s** electronic device 240, such as a PDA, as one of the many input mechanisms contemplated by **Mault** to provide for additional convenience and ease of use. **Pologe**, 4:63-5:9; **Mault**, [0074]. For example, Causey and Currans taught using PDA touchscreens to provide a convenient and intuitive way for a user to control a device by interacting with the display of the device itself. *See, e.g.*, Ex. 1019 (Causey), 18:24-28 (“the display 102 of the PDA 10 is a touch screen LCD ... icons 110 on the display 102 may be activated by finger pressure”); Ex. 1021 (Currans) 2:46-49 (“Symbol recognition software within the PDA detects and “reads” the movement of a stylus on a touch-sensitive screen”).

149. A person of ordinary skill in the art would have had a reasonable expectation of success in applying **Pologe’s** teachings of a touch screen to **Mault’s** electronic device 240. Both **Mault** and **Pologe** teach devices capable of performing processing, having a display function, and receiving inputs from users. **Mault**, [0074]; **Pologe** 4:63-5:9. Indeed, using touch screens as a means through which

users can input data or commands was well known in the art, such that a person of ordinary skill in the art would have found it straightforward to apply **Pologe**'s touch screen to **Mault**'s electronic device 240, such as a PDA. For example, Cause and Currans taught that it was well-known for PDAs to include touch screen displays to receive user inputs. *See, e.g.*, Ex. 1019 (Causey), 18:24-28 ("the display 102 of the PDA 10 is a touch screen LCD ... icons 110 on the display 102 may be activated by finger pressure"); Ex. 1021 (Currans), 2:46-49 ("Symbol recognition software within the PDA detects and "reads" the movement of a stylus on a touch-sensitive screen"). Thus, a person of ordinary skill in the art would have known such a combination (yielding the claimed limitations) would predictably work and provide the expected functionality.

150. **Pologe**'s teachings concern using WDM coupler to direct the output light and input mechanisms and incorporating a touch screen into the display of **Mault**'s electronic device and **Mitsui**'s teaching concerns a wavelength amplitude comparison technique (Section IX.B) such that the above-discussed motivations and reasonable expectation of success would remain the same for **Mault**'s system alone or in view of **Mitsui**.

3. Claim Mappings

151. As I discussed above in Ground 1, **Mault** discloses and at least renders obvious all limitations of claim 7. *See* my discussion in Sections IX.A.2.[7.pre]-

[7.f]. To the extent further disclosure is required for “a lens system” of [7.b] and “touch-screen” of [7.e], **Pologe** discloses those limitations, as discussed further below.

a. Claim 7

(i) Elements [7.b]

152. Element [7.b] recites: **“a lens system configured to receive at least a portion of the input light beam and to communicate at least the portion of the input light beam onto a part of a user’s body comprising blood, wherein at least the portion of the input light beam is used in a measurement on a user.”**

153. As discussed in Section IX.A.2.[7.b], **Mault’s** “blood glucose sensor” with “at least one light emitting diode” (LED) teaches and at least renders obvious the **“lens system configured to receive at least a portion of the input light beam.”**

154. **To the extent additional disclosure is required, Pologe discloses a “lens system” (e.g., “lenses” within “WDM coupler”) configured to receive at least a portion of the input light beam (e.g., “light pulses” from “light sources, such as light emitting diodes”).** Pologe, 3:57-4:4.

155. **Pologe** discloses that a “WDM coupler is capable of producing a wavelength multiplexed pulse” from the “light pulses” of “multiple separate light sources, such as light emitting diodes (LEDs)” and that these WDM couplers “can include any of a number of coupler types, such as those using lenses.” Pologe, 3:57-

59, 3:63-4:4. The WDM coupler then directs the light onto an “appendage of a person being tested, such as a finger” and “the received light pulses” that travel through the finger are “processed to determine the level of one or more blood analytes in the person's arterial blood.” Pologe, 4:40-46.

156. As I discussed in Section IX.C.2, a person of ordinary skill in the art would have been motivated to apply **Pologe**’s teaching of WDM coupler with “lenses” to the LED(s) in **Mault**’s “blood glucose sensor” to more efficiently direct wavelength multiplexed light outputs onto a sample for blood glucose measurements and improve the accuracy of those measurements. This would apply to **Mault** alone, or in view of **Mitsui**. See my discussion in Sections IX.A-B.

(ii) **Element [7.e]**

157. Element [7.e] recites: “**the control system having a touch-screen, circuitry for obtaining position information from a location sensor, and a wireless transceiver to transmit wireless data over a wireless link, the wireless data comprising at least a part of the physiological information, wherein the control system is further capable of receiving voice input signals and manually entered input signals; and.**”

158. As I discussed in Section IX.A.2.[7.e], **Mault** teaches and at least renders obvious the “**touch-screen**” limitation.

159. **To the extent additional disclosure is required, Pologe discloses a**

“touch-screen” (e.g., “an input device 34 such as...a touch screen”). Pologe 4:63-5:9.

160. **Pologe** discloses that a “main test unit 12” that includes “an input device 34, such as a keypad or a touch screen, for allowing the user to input commands and other information to the processor unit.” Pologe, 4:63-5:9.

161. As I discussed in Section IX.C.2, a person of ordinary skill in the art would have been motivated to apply **Pologe’s** teaching of a touch screen to **Mault’s** electronic device (e.g., PDA) as a straightforward and convenient means through which users can input data or commands to a display. This would apply to **Mault** alone, or in view of **Mitsui**. See my discussion in Sections IX.A-B.

b. Claim 8

162. Claim 8 recites: “**The diagnostic system of claim 7, wherein the light source comprises a plurality of semiconductor diodes that are further coupled to a multiplexer capable of combining the plurality of semiconductor diodes and generating the input light beam comprising one or more wavelengths.**”

163. As I discussed in Sections IX.A.2.[7.pre]-[7.f], **Mault** discloses and at least renders obvious the diagnostic system of claim 7.

164. **Mault further discloses the light source comprises a plurality of semiconductor diodes** (e.g., “at least one semiconductor laser or light emitting diode,” see [7.a]). Mault, [0020]. As I discussed in [7.pre]-[7.a] above (Sections

IX.A.2.a-b), **Mault** discloses the “blood glucose management system[]” includes a “blood glucose sensor” that “us[es] at least one semiconductor laser or light emitting diode to emit wavelengths in the near-IR.” Mault, [0013]. A light emitting diode is a semiconductor diode, as illustrated by e.g., U.S. Patent No. 3,609,475, which I understand has been designated as Exhibit 1022, as further discussed below. Ex. 1022 (Kaposhilin), 1:5-7 (“A light-emitting diode (LED) is a semiconductor device”).

165. **Pologe discloses a multiplexer capable of combining the plurality of semiconductor diodes** (e.g., “a wavelength division multiplexing (WDM) coupler for combining the light signals from the plurality of emitters into a single light signal”) **and generating the input light beam comprising one or more wavelengths** (e.g., “producing a wavelength multiplexed pulse on the single light guide”). Pologe, 3:38-55, 3:65-4:4.

166. **Pologe** further discloses “a wavelength division multiplexing (WDM) coupler for combining the light signals from the plurality of emitters into a single light signal, wherein the WDM coupler is capable of simultaneously receiving multiple light pulses ... and simultaneously coupling the multiple light pulses [into] ... a single light pulse.” Pologe, 3:38-55, 5:44-59. The WDM coupler thus “is capable of producing a wavelength multiplexed pulse on the single light guide.” Pologe, 3:65-4:4. Additionally, **Pologe** further discloses “active WDM couplers[,]”

such as those including cascaded or parallel emitters on a single substrate” such that emitters (i.e., light sources such as semiconductor diodes) are grouped together. 5:51-53.

167. As I discussed in Section IX.C.2, a person of ordinary skill in the art would have been motivated to apply **Pologe**’s teaching of a multiplexer, such as a WDM coupler, to **Mault**’s blood glucose sensor as an efficient and straightforward means for producing wavelength multiplexed light outputs for blood glucose measurements. This would apply to **Mault** alone, or in view of **Mitsui**. Sections IX.A-B.

168. I understand that Defendants identified a portion of this limitation—“**a multiplexer capable of combining the plurality of semiconductor diodes**”—as potentially indefinite in the Texas Case. Ex. 1013, 228. Regardless of its interpretation (*e.g.*, (1) grouping semiconductor diodes; or (2) combining light outputs from semiconductor diodes), however, and without opining on whether or not it has adequate written description support, **Pologe** meets this term under either interpretation. Under the first interpretation, **Pologe** discloses using “active WDM couplers[,] such as those including cascaded or parallel emitters on a single substrate” such that emitters (i.e., light sources such as semiconductor diodes) are grouped together. Pologe, 5:51-53. Under the second interpretation, **Pologe** discloses a “wavelength division multiplexing (WDM) coupler” that “combin[es] the light

signals from the plurality of emitters into a single light signal” by “receiving multiple light pulses” and “coupling the multiple light pulses” into “a single light pulse.” Pologe, 3:38-55, 5:44-59.

169. I also understand that Defendants identified another portion of this limitation—“**generating the input light beam comprising one or more wavelengths**”—as potentially indefinite in the Texas Case. Ex. 1013, 228. Regardless of the interpretation of this term (e.g., whether (1) *each* input light beam from each individual semiconductor diodes comprises one or more wavelengths, or (2) *together*, the single input light beam combining those from one or more semiconductors comprises one or more wavelengths, however, and without opining on whether or not it has adequate written description support, **Mault** alone or in view of **Pologe** meets this term under either interpretation. Under the first interpretation, as discussed above in connection with Section IX.A.2.[7.a], **Mault** discloses a “blood glucose sensor” that uses at least one semiconductor “light emitting diode to emit wavelengths in the near-IR.” *See, e.g.,* Mault, [0020]. LEDs were known to have a bandwidth such that a single-colored LED emits light having more than one wavelength. Ex. 1011 (Crothall), 6:15-18, 14:20-22 (“The sensor system includes a source of light which emits at a plurality of different wavelengths” “[l]ight emitting diodes (LEDs) are one suitable light source which may be used”); Ex. 1036 (Eliashevich), 4:5-17 (“The produced light may be of any desired wavelength or

wavelengths depending upon the type of LED die 10 employed.”). A person of ordinary skill in the art would thus have understood, or at least found it obvious, that **Mault’s** light emitting diode would emit a range of wavelengths in the near-IR spectrum. Mault, [0020]; Ex. 1011 (Crothall), 6:15-18, 14:20-22; Ex. 1036 4:5-17. Under the second interpretation, as discussed above, **Pologe** teaches a “wavelength division multiplexing (WDM) coupler” that “combin[es] the light signals from a plurality of emitters into a single light signal,” thus “producing a wavelength multiplexed pulse on the single light guide.” *See, e.g.*, Pologe, 3:65-4:4, 3:38-55, 5:44-59. Thus, as discussed above, **Mault’s** blood glucose sensor, as modified by **Pologe’s** multiplexer teachings, renders obvious a multiplexer that combines the collective input light beams generated by one or more semiconductor diodes to produce a single light pulse comprising one or more wavelengths. *See, e.g.*, Section IX.C; Mault, [0013], [0020]; Pologe, 3:38-55, 3:65-4:4, 5:44-59.

D. GROUNDS 5-8: Grounds 1-4 in view of Kiani (Claims 7-11 and 13-14):

170. As I discussed above in Ground 1, **Mault** discloses and at least renders obvious all limitations of claim 7. *See* my analysis in connection with claim 7 in Sections IX.A.2.[7.pre]-[7.f].

1. “circuitry for obtaining position information from a location sensor” ([7.e])

171. As discussed in connection with [7.e], **Mault discloses and at least**

renders obvious the “circuitry for obtaining position information from a location sensor” (e.g., “global positioning system (GPS)” on PDA includes circuitry to obtain location information from sensors used for “determining location”). See my analysis in Section IX.A.2.[7.e]. For example, **Mault** discusses that the PDA “may communicate or other receive data from physiological sensors or monitors carried by the person.” Mault, [0210].

172. To the extent further disclosure is required for “location sensor” (recited in [7.e]), **Kiani** discloses a “location sensor” (e.g., “contact sensor 343” indicating whether the “optical probe” of the “pulse oximeter” has been “partially or completely dislodged from the patient”). Kiani, Abstract, 1:10-14, 1:52-67, 4:28-51, 5:37-62, Fig. 3A, 3D, 3E.

173. **Kiani** discloses a pulse oximeter 140 with an “optical probe 202” worn over a person’s finger to detect blood oxygen levels in a person’s blood. 2:65-3:2, 3:50-55. As shown in Figure 3E (as I annotated below), the pulse oximeter includes a “probe-off detector module 138,” which receives position information from “contact sensor 343” to reduce measurement inaccuracies from when a “probe-off condition occurs” and “the probe detector receiv[es] light directly from the emitters.” Kiani, 4:38-51, 5:50-62, Fig. 3E (including my annotations below), 3A.

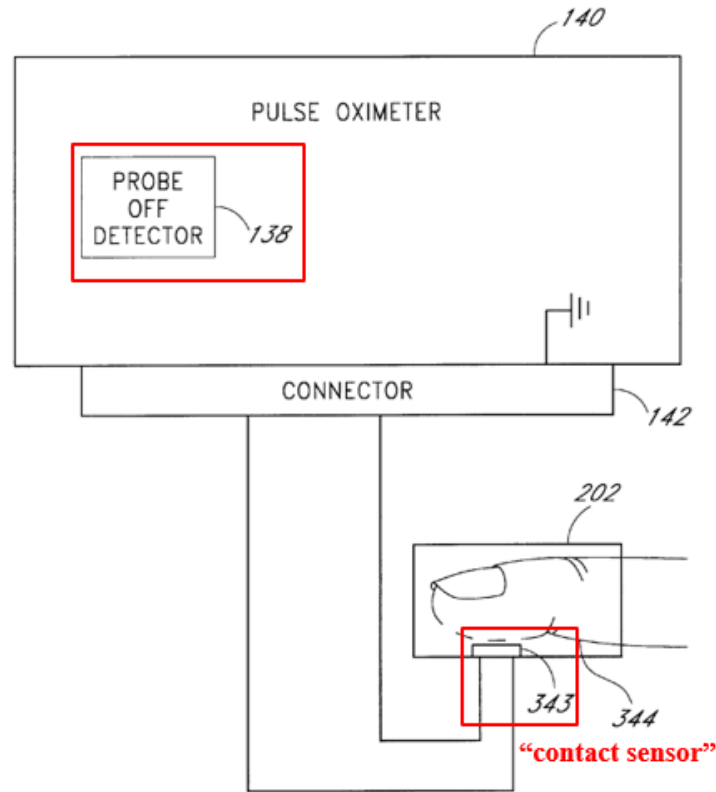


FIG. 3E

174. In particular, the detector module 138 uses contact sensor 343 to determine “when the optical probe becomes partially or completely dislodged from the patient,” thus leading to errors in the measurements. Kiani, Abstract, 1:10-14, 1:52-67, 4:28-51, 5:50-62, Fig. 3A, 3D. Kiani, 4:28-51, 4:56-65, 5:50-62. Thus, **Kiani’s** contact sensor is a location sensor that provides information about the optical probe’s relative position to the patient’s finger in order for the “probe-off condition” to be detected.

175. As **Kiani** teaches, the detector module determines when the pulse oximeter probe is detecting light “directly from the emitters without transmission

through the patient's tissue,” such that these signals are not “processed as a physiological signal” and interfere with the accuracy of the measurements. Kiani, 4:28-38, 5:37-49. As **Kiani** explains, “[p]robe-off errors are serious because the pulse oximeter may display a normal saturation when, in fact, the probe is not properly attached to the patient, potentially leading to missed desaturation events.” Kiani, 4:29-38.

176. **Mault** and **Kiani** are analogous art, in the same field as the '868, which includes diagnostic medical devices, and are reasonably pertinent to the problems addressed by the '868 patent, *e.g.*, using light-based procedures to perform medical diagnostics. '868, Abstract, 1:39-51, 1:58-63, 2:25-45, 2:64-3:2, 3:21-28, 4:37-62, 5:44-55, 6:14-31, 10:28-43, Figs. 1, 2; Mault, Abstract, [0003], [0008], [0013], [0020], [0022], [0073], [0089], [0144], [0146], [0199], [0201], [0208]; Kiani, Abstract, 1:10-14, 1:52-67, 2:65-3:15, 3:20-49, 4:28-51, 5:37-49.

177. A person of ordinary skill in the art would have been motivated to apply **Kiani**'s teachings of a contact sensor to **Mault**'s physiological sensor to detect when the physiological sensor worn on the person is dislodged, to advantageously improve the accuracy of physiological measurements caused by dislodged physiological sensors, as taught by **Kiani**. For example, **Mault** discloses that its PDA “may communicate or otherwise receive data from physiological sensors or monitors carried by the person,” and that “sensors” are “appropriately located for transmission

of useful information to the PDA.” Mault, [0208], [0201]. Like the pulse oximeter in **Kiani**, **Mault** discloses that an example of the “physiological sensor” is a “pulse rate sensor.” Mault, [0111]. Additionally, **Mault** discloses that the “PDA is used to receive and store activity-related data,” such as “receiving signals from a body mounted accelerometer...a similar device (or devices) which provides a signal (or signals) related to the activity level of the person.” [0198]. For example, **Mault** discloses that its “PDA...receive[s] positional” data and “data from physiological monitors which obtain information related to physical activity.” [0198]. **Mault** is also interested in “improv[ing] the accuracy of [its] glycemic response model.” [0044].

178. In light of these disclosures, to improve the accuracy of **Mault’s** physiological measurements, a person of ordinary skill in the art would have been motivated to modify **Mault’s** “physiological sensor” according to **Kiani’s** contact sensor teachings to detect when the physiological sensor is dislodged from the user’s body. To apply this modification, a person of ordinary skill in the art would have further modified **Mault’s** PDA to receive data from the modified physiological sensor mounted on the patient’s body, which would include information regarding the position of the physiological sensor relative to the patient’s skin to indicate whether the sensor is dislodged, thereby reducing erroneous readings and improving the accuracy of the measurements. Kiani, 4:28-38, 5:37-49; Mault, [0042], [0073],

[0208].

179. A person of ordinary skill in the art would have had a reasonable expectation of success in applying **Kiani**'s teachings of a contact sensor to **Mault**'s physiological sensor. Indeed, **Mault** already discloses that its PDA includes "sensors" for "determining location" using a "positioning method." Mault, [0208], [0198]. Mault, [0208], [0198]. Both **Mault** and **Kiani** also teach physiological sensors, such as pulse rate oximeters, which take measurements by being placed on a user's skin. *See, e.g.*, Mault, [0073], [0089], [0201], [0111]; Kiani, 2:65-3:2, 3:50-55, 4:28-51 5:50-62. Using contact sensors to determine if a sensor is in contact with a user's body was well known in the art, as illustrated by e.g., U.S. Patent Nos. 7,020,508 and 6,424,851, which I understand have been designated as Exhibits 1023 and 1038, as further discussed below. For example, like **Kiani**'s "contact sensor," Stivoric taught the use of a "proximity sensor" in a wearable physiological measurement device to determine when the device is in contact with a person to perform physiological measurements, including "heart rate, pulse rate,... blood pressure, body fat, hydration level, activity level, oxygen consumption, glucose or blood sugar level" and Berman taught the use of a "pressure sensor" in a spectroscopy measurement device to determine when the device is adequately in contact with a person's body "to determine the level of a selected analyte, preferably blood glucose, in the human body." Ex. 1023 (Stivoric), 6:45-53, 37:47-56

(disclosing a proximity sensor that detects when a measurement device is being worn); Ex. 1038 (Berman), 6:34-37, 9:33-63 (disclosing a pressure sensor for “maintain[ing] a minimum threshold pressure on the body part ... to be measured” “which would provide a ‘no-go/go’ type of signal to the user”). Thus, a person of ordinary skill in the art would have found it routine and straightforward to modify **Mault’s** physiological sensor according to **Kiani’s** contact sensor teachings to provide positional information to **Mault’s** PDA indicating if the physiological sensor has been dislodged from the user’s skin.

180. **Kiani’s** teachings concern a contact sensor to be applied to **Mault’s** physiological sensor while **Mitsui’s** teaching concerns a wavelength amplitude comparison technique for **Mault’s** spectroscopic procedure (Section IX.B), and **Pologe’s** teachings concern using WDM coupler to direct the output light and input mechanisms and incorporating a touch screen into the display of **Mault’s** electronic device (Section IX.C), such that the above-discussed motivations and reasonable expectation of success would remain the same for **Mault’s** system alone or in view of **Mitsui** and/or **Pologe**.

181. Thus, a person of ordinary skill in the art would have found it routine, straightforward and advantageous to apply **Kiani’s** teaching of a contact sensor to **Mault’s** (alone or in view of **Mitsui** and/or **Pologe**) measurement system, and would have known such a combination (yielding the claimed limitations) would predictably

work and provide the expected functionality.

2. Claim 13: The diagnostic system of claim 7, wherein the control system is further coupled to a proximity sensor.

182. Claim 13 recites: “**The diagnostic system of claim 7, wherein the control system is further coupled to a proximity sensor.**”

183. As I explained above in connection with claim 7, **Mault discloses and at least renders obvious claim 7.** See my discussion in Sections IX.A.2.[7.pre]-[7.f].

184. As I discussed in connection with [7.e] above, **Mault in view of Kiani render obvious the control system** (*e.g.*, Mault’s “PDA”) **is further coupled to a proximity sensor** (*e.g.*, **Mault’s** “physiological sensor” modified to detect when it is dislodged from the user’s skin based on **Kiani’s** contact sensor teachings). See my analysis in Section IX.D.[7.e].

185. As I discussed above in connection with my analysis of [7.e] based on **Mault** in view of **Kiani** (*see* Section IX.D.[7.e]), the proposed modification of **Mault** based on **Kiani’s** teachings yields a system where **Mault’s** “PDA” is coupled to a “physiological sensor,” which is modified according to **Kiani’s** contact sensor teachings to detect when the physiological sensor is dislodged from the user’s skin. As such, the modified physiological sensor is a proximity sensor because it provides information about the sensor’s relative position to a person’s skin a target skin.

186. Indeed, other art referred to sensors like the “contact sensor” taught by **Kiani** as a “proximity sensor.” For example, Stivorice discloses a “proximity sensor” coupled to a “processing unit” (like Mault’s PDA) that detects when a physiological sensor has fallen off the body, like Kiani’s “contact sensor.” Ex. 1023 (Stivorice), 6:45-53, 37:47-56 (“proximity sensor 1000 which is coupled to processing unit 900 for sensing whether sensor device 800, which measures various physiological indicators including “heart rate, pulse rate,... blood pressure, body fat, hydration level, activity level, oxygen consumption, glucose or blood sugar level,” is being worn on the body. Proximity sensor 1000 may also be used as a way to automatically power on and off sensor device 800. Proximity sensor preferably comprises a capacitor, the electrical capacitance of which changes as sensor device 800 gets closer to the body.”).

187. Thus, for the same reasons I discussed above in relation to [7.e], a person of ordinary skill in the art would have been motivated to apply **Kiani**’s teaching of a contact sensor, which is a proximity sensor, to **Mault**’s physiological sensor to advantageously detect when the physiological sensor worn on the person in **Mault** is dislodged and thus mitigate any resulting measurement distortions, and would have had a reasonable expectation in doing so. *See* my discussion in Section IX.D.[7.e].

X. SECONDARY CONSIDERATIONS

188. I have found no evidence in either the '868 patent's prosecution history or elsewhere that supports any secondary considerations arguments, or evidence of nexus to any challenged Claim. *See generally* '868FH. Indeed, as I have discussed in connection to the prior art referenced herein, any purported solutions to problems or unexpected results in the '868 patent were already well-known in the art.

189. To the extent the patent owner asserts the existence of any additional secondary considerations in its responses, or presents any additional evidence or arguments, I reserve my right to address any such evidence.

XI. CONCLUSION

190. In summary, I have concluded that the Challenged Claims are rendered obvious over the prior art references as discussed above. Specifically, in my opinion, for at least the reasons above, the Challenged Claims of the '868 patent obvious.

191. To the extent it is argued that any further disclosure is required for an element in the Challenged Claims that I have identified as being disclosed, a person of ordinary skill in the art would certainly have found that element obvious to include based on the sample explicit disclosure or inherent disclosures and analysis I have identified above.

192. I reserve the right to supplement my opinions in the future to respond to any arguments that Patent Owner or its expert(s) may raise and to take into account

Declaration of Brian W. Anthony in Support of
Petition for *Inter Partes* Review, U.S. Patent No. 9,055,868

new information as it becomes available to me.

193. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

194. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

APPENDIX A

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
School of Engineering Faculty Personnel Record

Date: November 20, 2024

Name:

Brian W. Anthony

Department: Mechanical Engineering / Institute of Medical Engineering and Science

1. Date of Birth: July 1972

2. Citizenship: USA

3. Education:

<u>School</u>	<u>Degree</u>	<u>Date</u>
Carnegie Mellon University	BS	1994
MIT	SM	1998
MIT	PhD	2006

4. Title of Thesis for Most Advanced Degree:
Video Based System Monitoring

5. Principal Fields of Interest:

Biomedical Imaging, Ambient and Wearable Instruments and Sensors, Computational Instrumentation, Optics, Applied ML and AI, Device Design and Manufacturing, Innovation and Product Realization, Imaging.

6. Name and Rank of Other Department Faculty in the Same Field:

Harry Asada, Professor

Ian Hunter, Professor

Kamal Youcef-Toumi, Professor

7. Non-MIT Experience (including military service):

<u>Employer</u>	<u>Position</u>	<u>Beginning</u>	<u>Ending</u>
LANL	Scientist	1992	1994
Independent Consultant	Consultant	1994	1998
Xcitex	CoFounder / CTO	1998	2005
Cooper Perkins	CTO	2005	2007
dRNome	CoFounder	2011	2016

8. History of MIT Appointments:

<u>Rank</u>	<u>Beginning</u>	<u>Ending</u>
Lecturer, Sloan	2006	2009
Lecturer, MechE	2006	(present)
Research Scientist	2006	2013
Principal Research Scientist	2013	(present)
Director Singapore MIT Alliance – Manufacturing Systems and Technology Program (SMA-MST)	2006	2010
Director Advanced Manufacturing and Design Program	2006	(present)

Faculty Lead for Education, MIT Skoltech Initiative	2011	2016
Deputy Director, MIT Skoltech Initiative	2014	2016
Associate Director, AIM Academy	2016	2017
Faculty Lead for Industry Engagement, MechE	2018	2022
Associate Director, MIT.nano	2017	(present)
Director, Clinical Technology, Center for Clinical and Translational Research	2017	(present)
Director, Immersion Lab	2017	(present)

9. Consulting Record:

Engagements greater than 3 months.

<u>Firm</u>	<u>Beginning</u>	<u>Ending</u>
Los Alamos National Labs		2000
Textron		2000
Federal Trade Commission		2000
FAA		2004
Kodak		2004
Redlake		2005
Olympus		2006
TIS	2009	2012
Photron	2009	2011
Cooper Perkins	2010	2012
IDEO	2012	---
Alcon	2012	---
Ximedica	2013	2014
Herman Miller	2014	2014
Novartis	2015	2015
Lenze	2015	2016
Baxter	2019	2019
Apple	2017	2025
Samsung	2024	2025

10. Professional Service

<u>Activity</u>	<u>Beginning</u>	<u>Ending</u>
MEngM Admissions Committee	2006	present
CDO Admissions Committee	2007	2008
Career Fair – SMA in Singapore, Org Chair	2007	2007
Career Fair – SMA/MIT in Singapore, Org Chair	2008	2008
Mfg. microFluidics Symp, Chair	2009	2010
SMART Proposal Lead on Med Devices	3/2010	9/2010
LMP Summit Co-Chair	2011	2011
MEDRC Workshop, Chair	2012	2012
Pilot IMI Proposal, MIT Lead	5/2012	6/2012
Additive mfg working group, Lead	6/2012	8/2012
Co-Chair Education Workstream, AMP 2.0	2013	2014
MIT's role in reducing the cost of health care	2014	2015

AIM Photonics Workforce Committee	2017	2017
Nextflex Collaboration Lead PI	2016	2017
Campus and Community Health Management	2020	2021
MIT-Skoltech Steering Committee	2017	2022
SPIE Conference Committee	2011	2022
MIT / Tufts CTSI TAP Committee	2020	
MIT. nano Leadership Council	2017	

11. Awards Received:

<u>Award</u>	<u>Date</u>
National Television Academy, Emmy for Innovative Technical Achievement. "Golf on CBS, SwingVision."	2005
BPLA Invented Here, Featured Honoree	2014

12. Current Organization Membership:

<u>Organization</u>	<u>Offices Held</u>
ASME	
IEEE	
SPIE	
AIUM (American Institute of Ultrasound in Medicine)	
Sigma Xi	
RSNA	

13. Patents and Patent Applications Pending:

1. US Patent 5606130 "Method for determining the octane rating of gasoline samples by observing corresponding acoustic resonances therein."
2. US Patent 6393384 "Apparatus and method for remote ultrasonic determination of thin material properties using signal correlation."
3. US Patent 6226081 "Optical height of fill detection system and associated methods."
4. US Patent 8,333,704, B. Anthony and M. Gilbertson, "Handheld Force-Controlled Ultrasound Probe," Dec 11, 2012
5. US Patent 8,328,725, B. Anthony and M. Gilbertson, "Ultrasound Probe," Dec 18, 2012
6. US Patent 8,382,671, B. Anthony and M. Gilbertson, "Handheld Ultrasound Probe," Feb 26, 2013
7. US Patent 9,121,705, B. Anthony and D. Ljubicic, "Sensor for Simultaneous Measurement of Thickness and Lateral Position of a transparent object," Sept 1, 2015
8. US Patent 9,456,800, Brian W. Anthony, Matthew W. Gilbertson, "Ultrasound scanning system", Oct 4, 2016
9. US Patent 10353191, Circular scanning technique for large area inspection, July 16, 2019.
10. MIT Case 14088, Force Controlled Ultrasound Probe, 16-Dec-09
11. MIT Case 14387, Deformation Estimation and Correction in Elastography with a Handheld Force Controlled Ultrasound Probe, 16-Jul-10
12. MIT Case 14422, High-Speed Profilometer for Manufacturing Inspection, 30-Jul-10
13. MIT Case 14966J, Force Measurement Ultrasound Probe for Sonographer Fatigue Monitoring, 10-Jun-11
14. MIT Case 15012, A 6-DOF Optical System for Freehand 3D Ultrasound, 05-Jul-11

15. MIT Case 15681J, Local Actuation and Control of Stamp Deformation in Microcontact Printing, 06-Jun-12
16. MIT Case 15782, Usability Improvements to a Handheld Force-Controlled Ultrasound Probe, 03-Aug-12
17. MIT Case 15884, Computer-Guided Restoration of Ultrasound Scan Poses by Optical Tracking, 01-Oct-12
18. MIT Case 16160, Quick-Release Mechanism for a Force-Measuring Ultrasound Probe, 22-Feb-13
19. MIT Case 16447, Force-correlated Quantitative Ultrasound Image Analysis, 02-Jul-13
20. MIT Case 17106J, Acoustic Characterization of Superficial Body Fluids, 07-May-14
21. MIT Case 17211J, Wireless Capsule Endoscopic Ultrasound, 24-Jun-14
22. MIT Case 17259K, A Concentric Circle Scanning Technique for Large Area Inspection, 09-Jul-14
23. MIT Case 17260K, Grid-Based Matching for Full-Field Large-Area Deformation Measurement, 09-Jul-14
24. MIT Case 17344, Recovery and Computer-Guided Restoration of Ultrasound Scan Poses Based on Human Skin Features, 21-Aug-14
25. MIT Case 17864J, Ultrasound-Based Individual Scatterer Detection Method Using Scatterer Motion Induced by Acoustic Radiation Force, 21-Apr-15
26. MIT Case 17865, Ultrasound-Based Absolute Scatterer Concentration Measurement Technique: Image Volume Estimation from Scatter Spread Function Extracted From the Image, 21-Apr-15
27. MIT Case 17990, Hydrogel Ultrasound Angle Wedge, 04-Jun-15
28. MIT Case 18074, Joint Camera-Ultrasound Data Acquisition for Limb Scanning, 13-Jul-15
29. MIT Case 18544, An Iterative RTM with a Priori Data to Estimate Bone Thickness Using a Cylindrically Scanning Ultrasound Tomography Scanner, 22-Feb-16
30. MIT Case 18545K, Block-Wise Inversion for the Soundspeed of Human Soft Tissue and Bone Using Ray Based Travel Time Tomographic Techniques, 22-Feb-16
31. MIT Case 18636, Concentric Ring-Based Point Pattern Matching of Skin Features, 05-Apr-16
32. MIT Case, Physical and Chemical Characterization of Aerosols with Photonic Waveguides, United States Patent Application 20190234850
33. MIT Case 19192QJ, Non-Invasive Assessment of Venous Pressure via Actuation of Reciprocal Surface Forces for Vessel Collapse Using Single-Crystal Ultrasound in Vertebrates
34. MIT Case 19409, Medical Ultrasound Device with Integrated Force Measurement and Methods for Data Synchronization
35. MIT Case 19460, Shear Wave Elastography Imaging with External Mechanical Vibration
36. MIT Case 19516, Source and Receiver Tracking for Non-Contact Ultrasound
37. MIT Case 19618, Real Time Imaging of Invisible Micron-Scale Monolayer Patterns on a Moving Web Using Condensation Figures
38. MIT Case 19626TE, Apparatus and Methods for Ultrasound Limb Scanning Under Load
39. MIT Case 19710, A Technique for Imaging Cortical Bone and Soft Tissue Using the Level-Set Method to Regularize Travel-Time and Full Waveform Tomography Techniques
40. MIT Case 19791, On chip Photonic Aerosol Spectrometer
41. MIT Case 19921, Equity Disbursement for Bionic Skins LLC (4914743)
42. MIT Case 20289, Miniaturization of External Mechanical Vibration for Ultrasound Shear Wave Elastography Imaging

43. MIT Case 20506L, Systems and Methods for Enabling Non-Contact Laser Ultrasound
44. MIT Case 21078, Microscale Photoacoustic Spectroscopy and Microscopy
45. MIT Case 21123, Tunable Filler Assembly in Multi-material Polymer Extrusions Using Direct Injection and Acoustic Radiation Forces
46. MIT Case 21145, 3D Organ and Tissue Property Mapping using Superficial Vasculature-Based RGBD-SLAM and Deep Vasculature Alignment
47. MIT Case 22420, Integrated Optofluidic Sensor for Thromboembolic and Coagulation Risk Monitoring in COVID-19 Patients at Point-of-Care
48. MIT Case 22432, High Sensitivity and Specificity, Rapid, Low Cost, On-Chip Covid-19 Virus (and Other Virus) Detection using Integrated Photonic Sensors
49. MIT Case 22652, Dynamic Control of a Fiber Manufacturing Process using Deep Reinforcement Learning
50. MIT Case 23256, Privacy-Preserving Health Diagnosis of Manufacturing Machines
51. Circular scanning technique for large area imaging (US Patent 10,735,674)
52. Method for detecting circulating cells in superficial body fluids (US Patent 10,639,012)
53. Physical and Chemical Characterization of Aerosols with Photonic Waveguides (US Patent 11,181,454)

14. Professional Registration:

N/A.

15. Major New Products, Processes Designs, or Systems:

See next.

1. Books:

Smart Manufacturing On-line course, deployed 2019 and 2020

2. Papers in Referred Journals:

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- 3.61. Singh R, Agarwal A, Anthony BW. Ultra-high sensitive all-optical photoacoustic transducers. In: Oraevsky AA, Wang L V., editors. Photons Plus Ultrasound: Imaging and Sensing 2020. SPIE; 2020. p. 35.
- 3.62. Singh R, Agarwal A, Anthony BW. Leveraging Integrated Photonics for Ultrasound Sensing Applications. In: Imaging and Applied Optics Congress. Washington, D.C.: OSA; 2020. p. JW5A.7.
- 3.63. Singh R, Su P, Agarwal A, Anthony BW. Integrated Mid-IR Photonics for Gas and Aerosol Sensors. In: Imaging and Applied Optics Congress. Washington, D.C.: OSA; 2020. p. JW5C.7.
- 3.64. Ely G, Fincke J, Zhang X, Anthony BW. Optimizing Transducer Acquisition Scheme for Rapid Ultrasound Tomography of Limbs. In: 2020 IEEE International Ultrasonics Symposium (IUS). IEEE; 2020. p. 1–4.
- 3.65. Cuiffi JD, Wang H, Heim J, Anthony BW, Kim S, Kim DD. Factory 4.0 Toolkit for Smart Manufacturing Training. In: 2021 ASEE Virtual Annual Conference Content Access. 2021.
- 3.66. Hahm KS, Chase AS, Dwyer B, Anthony BW. Indoor Human Localization and Gait Analysis using Machine Learning for In-home Health Monitoring. In: 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC). IEEE; 2021. p. 6859–62
- 3.67. Hong MS. Teaching Process Data Analytics and Machine Learning at MIT. Chem Eng Educ. 2022;56(4).
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Theses Supervised by Brian W. Anthony

Summary:

	<u>Total</u>	<u>Completed</u>	<u>In Progress</u>
Bachelor's	5	5	0
Master's	42	35	7
MEng	29	17	12
Engineer's			
<u>Doctoral</u>			
As Supervisor	26	15	11
As Reader	4	3	1

Last	First	Title	Department	Year	
Bachelor's Theses					
Syverud	Brian	<i>Robotic ultrasound manipulator: calibration of position and orientation measurement system</i>	MechE	2009	
Johnson	Michael	<i>Design of a precise X-Y-Theta nanopositioning optical sensor</i>	MechE	2009	
Chai	Lauren	<i>Design of mechanical arterial simulator</i>	MechE	2012	
Ramos	Javier	<i>Design of Force Measurement Probe</i>	MechE	2012	
Mireault	Alfred Norman	<i>Mechanical design of an ultrasonic tomographic imaging system</i>	MechE	2016	

Master's Theses					
Fitriani		<i>Multiscale Dynamic Time and Space Warping</i>	CDO	2008	
Zarrouati	Nadège	<i>A precision manipulation system for polymer microdevice production</i>	MechE	2010	
Gilbertson	Matthew Wright	<i>Handheld force-controlled ultrasound probe</i>	MechE	2010	
Sun	Shih-Yu	<i>Deformation correction in ultrasound imaging in an elastography framework</i>	EECS	2010	
Zakrzewski	Aaron	<i>Multi-scale quantitative elastography and its application to blood pressure estimation</i>	MechE	2013	
Koppaka	Sisir	<i>Imaging Biomarkers for Duchenne Muscular Dystrophy</i>	CDO	2015	
Zhang	Xiang (Shawn)	<i>Design of a single element 3D ultrasound scanner</i>	MechE	2015	
Primack	Willow	<i>Analysis and Productivity Improvement of an Automated Material Handling System through Simulation</i>	LGO	2015	

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Churchill	Hugh E.	<i>Cycle-time Analysis and Improvement Using Lean Methods within a Retail Distribution Center</i>	LGO	2015	
Sazdanoff	Nicholas	<i>Evaluation of postponement in the Drug Product supply chain</i>	LGO	2015	
Kojimoto	Nigel Costello	<i>Ultrasonic inspection methods for defect detection and process control in roll-to-roll flexible electronics manufacturing</i>	MechE	2015	
Kundu	Ina Annesha	<i>Imaging platforms for detecting and analyzing skin features and Its stability : with applications in skin health and in using the skin as a body-relative position-encoding system</i>	MechE	2015	
Conover	Susan	<i>Imaging platforms for detecting and analyzing skin features and Its stability : with applications in skin health and in using the skin as a body-relative position-encoding system</i>	SDM	2015	
Hess	Tylor	<i>Algorithm deployment platform</i>	MechE	2016	
Lee	Kang Qi lan	<i>Computational tools for enabling longitudinal skin image analysis</i>	CDO	2016	
Huang	Athena Yeh	<i>May the force be with you : a medical ultrasound system with integrated force measurement</i>	MechE	2017	
Benjamin	Alex	<i>The (travel) times they are a changing : a computational framework for the diagnosis of non-alcoholic fatty liver disease (NAFLD)</i>	CDO	2017	
Yang	Heng	<i>Ultrasound shear wave elastography imaging with external mechanical vibration</i>	MechE	2017	
Zubajlo	Rebecca	<i>Quantitative biomarkers for tissue characterization</i>	MechE	2017	
Benjamin	Rishon Robert	<i>Silence of the lamb waves</i>	CDO	2017	
Haidar	Samer	<i>Supply chain network strategy for consumer medical device introduction</i>	LGO	2016	
Al-Meer	Mariam	<i>Reducing heart failure admissions through improved care systems and processes</i>	LGO	2017	
Sandford	Michael	<i>Application of 3D printing in medical devices New Product Development</i>	LGO	2017	

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Graule	Moritz Alexander	<i>Towards force-correlated ultrasound volume elastography</i>	MechE	2017	
Sun	Mingxiu	<i>Education and practice factory : from factory design to first product delivery</i>	MechE	2018	
Singh	Robin	<i>Whispering photons : on-chip biophotonic integrated circuits for point-of-care diagnostics</i>	MechE	2018	
Beaudoin	Judy	<i>Quantifying dermatology : method and device for user-independent ultrasound measurement of skin thickness</i>	MechE	2018	
DiAndreth	Chris	<i>Optimization of Downstream Supply Chain Product Flow based on an Integrated Cost-to-Deliver Perspective</i>	LGO	2019	
Puppo	Manuel Martinez	<i>Replenishment in an integrated stock world</i>	LGO	2019	
Lu	Shirley Suet-Ning	<i>Design of dynamically controlled desktop fiber accumulator with tension feedback as part of smart manufacturing educational kit</i>	MechE	2020	
Kim	Sangwoon	<i>Model-free tracking control of an optical fiber drawing process using deep reinforcement learning</i>	MechE	2020	
Chen	Hongling (Holly)	<i>Vascular Imaging System for Longitudinal Registration and Mapping of Superficial Vessels with Quantitative Analysis</i>	IDM	2020	
Chavez	Yasmin	<i>System identification and control of a miniature external mechanical vibration device towards clinical ultrasound shear wave elastography</i>	MechE	2020	
Koeppen	Ryan	<i>Design of Electromechanical Attachments for Improved Ultrasound Imaging Repeatability</i>	MechE	2021	
Goryachev	Ivan	<i>Kiosks for Non-Contact Vital Sign Detection</i>	MechE	2021	
Adiwijaya	Zenia	<i>Tenative: ML for Process control</i>	SDM	2023	expected
Chen	George	<i>Tenative: ML for Process control</i>	MechE	2022	expected
Deshpande	Aniruddha	<i>Tenative: Food manufacturing - ML models</i>	EECS	2023	expected
Dhar	Shreya	<i>Tenative: Education Kit</i>	MechE	2023	expected
Espinoza	Victor Reyes	<i>Tenative: ML for Process control</i>	EECS	2022	expected
Justiniano	Eugenio Caraballo	<i>Tenative: Sound and Light on Cells</i>	MechE	2023	expected

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Magana-Salgado	Uriel	<i>Tenative: Muscle Health monitoring</i>	MechE	2023	expected
Master Eng. Theses					
Su	Xiangyong	<i>Optimization of labor allocation at a syringe production facility : design proposals</i>	MechE	2008	
Liaw	Sze Sen	<i>Optimization of labor allocation at a syringe production facility using computer simulation</i>	MechE	2008	
Ng	Gar Yan	<i>Optimization of labor allocation at a syringe production facility : work study</i>	MechE	2008	
Linares	Rodrigo	<i>Manufacturability of lab on a chip devices: tolerance analysis and requirements establishment</i>	MechE	2010	
Selvakumar	Sivesh	<i>Manufacturing of Lab-On-a-Chip devices : variation analysis of liquid delivery using blister packs</i>	MechE	2010	
Namvari	Kasra	<i>Manufacturability of lab-on-chip devices : dimensional variation analysis of electrode foils using visual technology</i>	MechE	2011	
Donoghue	Linda	<i>Design of a micro-interdigitated electrode for impedance measurement performance in a biochemical assay</i>	MechE	2011	
Holmes	Jacklyn	<i>Robustness and repeatability of interdigitated electrodes on a substrate tested in an aqueous environment</i>	MechE	2011	
Judge	Benjamin	<i>Thermoplastic bonding of microfluidic substrates</i>	MechE	2012	
Jain	Nikhil	<i>A comprehensive study and validation of high-throughput microscale electrode production using thermal transfer printing techniques</i>	MechE	2012	
Inamdar	Tejas Satish	<i>Manufacturing of lab-on-a-chip devices : characterizing seals for on-board reagent delivery</i>	MechE	2013	
Saber	Aabed Saud	<i>Manufacturability of lab on chip devices : reagent-filled reservoirs bonding process and its effect on reagents flow pattern</i>	MechE	2013	

Theses Supervised by Brian W. Anthony

Nguyen	Khanh Huy	<i>Hot embossing as a method for rapid prototyping microfluidic devices</i>	MechE	2013	
Ragosta	Nicholas Hiroshi	<i>Design and measurement analysis of hot embossing system for high aspect ratio microfluidics</i>	MechE	2013	
Kalsekar	Viren Sunil	<i>Design and process optimization of a hot embossing machine for microfluidics with high aspect ratios</i>	MechE	2013	
Xue	Elise	<i>Sensorless ultrasound probe 6DoF pose estimation through the use of CNNs on image data</i>	EECS	2018	
DiAndreth	Christopher	<i>Optimization of downstream supply chain product flow based on an integrated cost-to-deliver perspective</i>	LGO	2019	
Cherna	Samuel	<i>External virbarion on Butterfly Probes</i>	EECS	2022	expected
Sawant	Nilay Sanjay	<i>Tenative: ML for Process Control</i>	MechE	2022	expected
Othman	Mohamed Ayman Mohamed	<i>Tenative: ML for Process Control</i>	MechE	2022	expected
Sardet	Maelle Jade	<i>Tenative: ML for Process Control</i>	MechE	2022	expected
Li	Rui	<i>Tenative: Design and Manufacture of Education Kit</i>	MechE	2022	expected
Rojrungrasathorn	Tanach	<i>Tenative: Design and Manufacture of Education Kit</i>	MechE	2022	expected
Levi	Aviva Jesse	<i>Tenative: Design and Manufacture of Education Kit</i>	MechE	2022	expected
Bradley	Russel	<i>Tenative: Design and Manufacture of Education Kit</i>	MechE	2022	expected
Smith	Carly Madeleine	<i>Tenative: Clinical Trial Monitoring Kit Design</i>	MechE	2022	expected
Aitmbiriq	Imane	<i>Tenative: Clinical Trial Monitoring Kit Design</i>	MechE	2022	expected
Noh	Joyce	<i>Tenative: Clinical Trial Monitoring Kit Design</i>	MechE	2022	expected
Lin	Ryan Shao-Wei	<i>Tenative: Clinical Trial Monitoring Kit Design</i>	MechE	2022	expected

Doctoral Theses, Supervisor					
Ljubicic	Dean	<i>High Speed Instrumentation for Inspection of transparent parts</i>	MechE	2013	
Gilbertson	Matthew Wright	<i>Electromechanical systems to enhance the usability and diagnostic capabilities of ultrasound imaging</i>	MechE	2014	
Sun	Shih-Yu	<i>Ultrasound probe localization by tracking skin features</i>	EECS	2014	

Theses Supervised by Brian W. Anthony

Zakrzewski	Aaron	<i>Arterial blood pressure estimation using ultrasound</i>	MechE	2017	
Roberts	Megan	<i>Design and fabrication of a flexible membrane ultrasound transducer</i>	MechE	2018	
Lee	John Haeseon	<i>Measuring the absolute concentration of particles in suspension using high frequency B-mode ultrasound imaging</i>	EECS	2015	
Fincke	Jonathan Randall	<i>Non-contact quantitative imaging of limbs, bone and tissue, using ultrasound tomographic techniques</i>	MechE	2018	
Ranger	Bryan	<i>Ultrasonic imaging methods for quantitative musculoskeletal tissue assessment and improved prosthetic interface design</i>	HST	2018	
Kundu	Ina Annesha Kundu	<i>Imaging skin structures for health, body mapping, and identification (under the Tucson Skin)</i>	MechE	2018	
Kim	David Donghyun Kim	<i>Design and development of desktop fiber and fabric manufacturing system for advanced materials</i>	MechE	2020	
Wang	Jenny Wang	<i>Formation Process of Acoustophoretic Patterns</i>	MechE	2022	
Pigula	Anne Pigula	<i>Statistical analysis of ultrasound signals for tissue characterization : the Homodyned K Distribution</i>	HST	2020	
Zhang	Xiang Zhang	<i>Non-contact ultrasound</i>	MechE	2019	
Benjamin	Alex Benjamin	<i>3D organ property mapping using freehand ultrasound scans</i>	MechE	2020	
Singh	Robin Singh	<i>Integrated bio-photonic devices : sensors, imagers, and beyond</i>	MechE	2021	
Chen	Melinda Chen	<i>Liver Vascular Health Imaging</i>	HST	2022	
Jaffe	Alex	<i>Venous and Blood Pressure in the extremities</i>	EECS	2022	
Hahm	Katie	<i>Ambient Gait Analysis</i>	MechE	2022	
Chai	Lauren	<i>Tentative: Radiation Force Manufacturing</i>	MechE	2022	expected
Zubajlo	Rebecca Zubajlo	<i>Tentative: Physical Measurement of Cells</i>	MechE	2022	expected
Lange	April	<i>Tentative: Volume US - Squishy slam</i>	MechE	2023	expected
Zhang	Zhuorui	<i>Tentative: Large Aperture Wearable</i>	MechE	2024	expected
Gao	Mingye	<i>Tentative: Integrated Photonics for Biosensing</i>	EECS	2024	expected

Theses Supervised by Brian W. Anthony

Lin	QiAn	<i>Tenative: US Path Planning</i>	MechE	2024	expected
Kang	David Ha Eun	<i>Tenative: Homomorphic Encryption and ML</i>	MechE	2023	expected
Tripathy	Soumya	<i>Tenative: Integrated Photonics for US</i>	Media	2024	expected

Doctoral Theses, Reader

Shi	Chuan	<i>Efficient buffer design algorithms for production line profit maximization</i>	MechE	2011	
Petrzelka	Joe	<i>Contact region fidelity, sensitivity, and control in roll-based soft lithography</i>	MechE	2012	
Smyth	Katherine	<i>Piezoelectric micro-machined ultrasonic transducers for medical imaging</i>	EECS	2016	
Athanassiadis	Athanasios G.	<i>Optical breakdown acoustics : transduction and sensing underwater</i>	MechE	2019	

Postdoctoral Associates and Fellows Supervised by Brian W. Anthony

Current Postdocs

<i>Name</i>	<i>Dates of Appointment</i>	<i>PhD Granting Institution</i>
Jenny Wang	2022 -	MIT
Melinda Chen	2022 -	MIT
David Lee	2024-	

Previous Postdocs

<i>Name</i>	<i>Current Title</i>	<i>Current Employer</i>
Vannah, Bill	Scientist	Mary Free Bed Rehabilitation Hospital
Victor Lempitsky	Head of AI	Samsung
Javier J. Gonzalez	May 2013 – 2015	University of Madrid
Matthew Gilbertson	Senior Electro-Optical Engineer	Lockheed Martin
Xian, Du	Professor	UMass (2018)
David Ibarra	Professor	Monterery Tec
Micha Feigin	Research Scientist	MIT
Ian Butterworth	Biomedical Research Engineer	MIT
Carlos Castro-Gonzalez		
	Co-Founder and CEO	Leuko
Berta Martí Fuster	Head of Communications	Oncoheroes Biosciences
Bonghun (Bruce) Shin	Senior Scientist	University Waterloo
Megan Roberts	Director of Product Development	Med Tech Co.
Greg Ely	Senior Algorithm Engineer	Imaging Co.
David Kim	Scientist	Sandia Labs
Shawn Zhang	Scientist	MIT
Praneeth Namburi	Scientist	MIT

APPENDIX B (LIST OF MATERIALS CONSIDERED)

Exhibit No.	Description
1001	U.S. Patent No. 9,055,868 (“’868”)
1002	File History of U.S. Application No. 17/078,771 (“’868FH”)
1004	U.S. Patent Pub. No. 2003/0208113 (“Mault”)
1005	JP Publication No. 2000074829A (Certified English Translation) (“Mitsui”)
1006	U.S. Patent No. 5,891,022 (“Pologe”)
1007	U.S. Patent No. 6,526,300 (“Kiani”)
1008	U.S. Patent No. 5,377,674 (“Kuestner”)
1009	U.S. Patent No. 4,244,045 (“Nosu”)
1010	U.S. Patent No. 6,067,463 (“Jeng”)
1011	U.S. Patent No. 6,049,727 (“Crothall”)
1012	U.S. Patent No. 5,660,163 (“Schulman”)
1013	Defendants’ Supplemental Invalidity and Subject Matter Eligibility Contentions, July 18, 2025. <i>Omni MedSci, Inc. v. Samsung Electronics Co., Ltd. et al.</i> , No. 2:24-cv-01070-JRG-RSP (E.D. Tex.)
1015	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2019-00916, Paper 1 (P.T.A.B. Apr. 10, 2019) (“’533-Pet.”)
1016	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2019-00916, Paper 39 (P.T.A.B. Oct. 14, 2020) (“’533-FWD”)
1017	Declaration of Brian Anthony in Support of Apple Inc.’s Petition for <i>Inter Partes</i> Review of U.S. Patent No. 9,651,533 submitted in IPR2019-00916, Ex. 1003 (“’533-Anthony”)
1018	U.S. Patent No. 6,757,001 (“Allport”)
1019	U.S. Patent No. 6,641,533 (“Causey”)

Exhibit No.	Description
1021	U.S. Patent No. 6,727,930 (“Currans”)
1022	U.S. Patent No. 3,609,475 (“Kaposhilin”)
1023	U.S. Patent No. 7,020,508 (“Stivorice”)
1024	JP Publication No. 2000074829A (Original Japanese Publication)
1025	U.S. Patent No. 6,597,345 (“Hirshberg”)
1026	U.S. Provisional Patent App. No. 60/212,319
1027	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 1 (P.T.A.B. Jan. 22, 2021) (“’484-Pet.”)
1028	<i>Apple Inc. v. Omni Medsci, Inc.</i> , No. IPR2021-00453, Paper 22 (P.T.A.B. Aug. 3, 2022) (“’484-FWD”)
1030	Declaration of Brian Anthony in Support of Petition for <i>Inter Partes</i> Review of U.S. Patent No. 10,517,484 submitted in IPR2021-00453, Ex. 1003 (“’484-Anthony”)
1031	U.S. Patent No. 5,544,357 (“Huei”)
1032	U.S. Patent No. 4,817,050 (“Komatsu”)
1033	E.F. Schubert, <i>Light-Emitting Diodes</i> (Cambridge Univ. Press, 2nd ed. reprinted 2014)
1034	“The Biomedical Engineering Handbook,” by Joseph D. Bronzino (1995)
1035	U.S. Patent No. 5,122,943 (“Pugh”)
1036	U.S. Patent No. 6,661,167 (“Eliashevich”)
1037	U.S. Patent No. 7,001,058 (“Inditsky”)
1038	U.S. Patent No. 6,424,851 (“Berman”)
1039	U.S. Patent No. 9,651,533 (“’533”)
1040	U.S. Patent No. 10,517,484 (“’484”)

*I also considered any additional materials referenced in my declaration.