

Filed on behalf of Luxottica of America Inc. and Meta Platforms, Inc.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LUXOTTICA OF AMERICA INC. AND META PLATFORMS, INC.,
Petitioners

v.

SOLOS TECHNOLOGY LIMITED,
Patent Owner.

Case No. IPR2026-00376
U.S. Patent No. 12,216,339

**DECLARATION OF JOHN FELAND, PH.D.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 12,216,339**

Luxottica et al. v. Solos IPR2026-00376 Petitioners Ex. 1003

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I. INTRODUCTION

1. I, John Feland, Ph.D., am making this declaration at the request of Luxottica of America Inc. (“Luxottica”) and Meta Platforms, Inc. (“Meta”). I have been asked to analyze the scope and content of U.S. Patent No. 12,216,339 (“the ’339 patent”) relative to the state of the art at the time of the earliest application to which the ’339 patent claims priority. My analysis relates to claims 1-16. I have also been retained to provide analysis regarding what a person of ordinary skill in the art (“POSITA”) would have understood at the time of the earliest application underlying the ’339 patent.

2. This declaration summarizes the opinions I have formed to date. I reserve the right to modify or amend my opinions, if necessary, based on further review and analysis of information that I receive subsequent to the filing of this declaration, including in response to positions taken by Solos Technology Limited (“Solos”) or its experts that I have not yet seen, including any secondary considerations evidence that Solos or its expert may consider and present.

3. It is my opinion that the claims of the ’339 patent are invalid as obvious based on the following grounds:

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Ground 1	Claims 1-16 are obvious in view of Asukai
Ground 2	Claims 11-16 are obvious in view of Asukai and Shan
Ground 3	Claims 1-10 are obvious in view of Liu
Ground 4	Claims 11-16 are obvious in view of Liu and Shan
Ground 5	Claims 1-16 are obvious in view of Asukai and Lisy
Ground 6	Claims 11-16 are obvious in view of Asukai, Shan, and Lisy
Ground 7	Claims 1-10 are obvious in view of Liu and Lisy
Ground 8	Claims 11-16 are obvious in view of Liu, Shan, and Lisy

4. In preparing this declaration, I considered the following materials:

Exhibit No.	Description
1001	U.S. Patent No. 12,216,339 to Villalpando et al. (“’339 patent”)
1002	Excerpts from Prosecution History of the ’339 patent
1005	U.S. Patent App. Publ’n No. 2021/0145340 to Asukai (“Asukai”)
1006	U.S. Patent App. Publ’n No. 2017/0255262 to Liu (“Liu”)
1007	U.S. Patent App. Publ’n No. 2018/0014903 to Shan et al. (“Shan”)
1008	U.S. Patent No. 9,579,060 to Lisy et al. (“Lisy”)
1009	Int’l Patent App. Publ’n No. 2015/127056 to Tanaka et al. (“Tanaka”)

5. I have also relied on my education, training, and experience, and my knowledge of pertinent literature in the field of the ’339 patent.

II. BACKGROUND

A. Experience, Qualifications, and Status as an Independent Expert

6. My curriculum vitae (“CV”) is Exhibit 1004.
7. I am being compensated for my work on this declaration. My fee is not contingent on the outcome of any matter or on any of the technical positions I explain in this declaration.
8. I have been informed that Solos claims ownership of the ’339 patent.
9. I have over 30 years of experience in mechanical engineering, electromechanical engineering, and mechatronics. I graduated from the Massachusetts Institute of Technology with a bachelor of science degree in mechanical engineering in 1994. After graduating from MIT, I attended Stanford University, where I received an M.S. in 1996 and then a Ph.D. in 2005, both also in mechanical engineering. Although my degrees were in mechanical engineering, I completed coursework and research involving electronic circuitry, electromechanical engineering, and mechatronics.
10. Beginning in June 1996, I worked as a mechatronic design engineer for IDEO Product Development. From March 1997 to April 1999, I worked for the National Air Intelligence Center as a Program Manager, Defense Intelligence Systems, managing mission requirements and software development for an \$18 billion missile warning satellite program. From April to July 1999, I served as

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Director, Measurement and Signals Intelligence Systems, for the Joint Analysis Center, supervising classified intelligence support for Operation Allied Force in Kosovo.

11. From August 1999 to July 2001, I was an Assistant Professor of Engineering Mechanics for the United States Air Force Academy. In that time, I launched the Academy's first mechatronics course. From 2002 to 2004, I worked as a design strategy consultant for Trusted Nomad, taught at Stanford, and worked as Senior Mechanical Engineer for Symyx Technologies, developing MEMS industrial sensors.

12. From December 2004 to August 2008, I worked at Synaptics. While at Synaptics, I designed and built several mobile devices and mobile-device accessories. The team I managed retrofitted or designed from scratch hundreds of capacitive touch interfaces for multiple consumer electronic devices. Through this work, I gained deep experience with manufacturing electronic assemblies and integrating them into a wide array of consumer electronics. This work also provided me with significant experience in the path to mass production, including how to deliver technological improvements that could be mass produced, as we recommended these prototypes as potential product features for customers. My work at Synaptics included architecting the Onyx, a working multitouch-controlled mobile phone prototype, which gained international recognition in 2006, winning

the Red Dot Design Concept Award months ahead of Apple's 2007 launch of the iPhone.

13. After Synaptics, I was Chief Technologist at SK Telecom Americas from September 2008 to September 2009. While at SK Telecom Americas, I evaluated several user experience designs across a range of interfaces, including voice, touch, and gesture. From October 2009 to September 2011, I held positions at Stanford, including Executive Director of the Global Design Innovation course that connects graduate students with corporate partners, as well as Consulting Assistant Professor in the Design Group of the Mechanical Engineering department. In 2012, I served as Distinguished Lecturer at Cogswell Polytechnical College, teaching courses in robotics and entrepreneurship.

14. After leaving SK Telecom in September 2009, I founded Argus Insights, a consulting firm that I have run for nearly 15 years. Some of my projects have included analyzing what UX aspects are driving adoption in autonomous vehicles and designing UX for industrial cutting tools to lower training requirements and increase operator effectiveness.

15. I am currently the CEO of Argus Insights, Inc. I founded Argus Insights to commercialize my Ph.D. research exploring the relationship between product design engineering, consumer adoption, and market success. Over the past six years, the company has pivoted to focus on market research and expert-witness consulting.

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During its years of operation, Argus Insights' technology has analyzed end-user responses to tens of thousands of consumer products across hundreds of millions of collected opinions.

16. I most recently served as Principal Solutions Architect, Science for Alembic Technologies, a causal-AI applied-science start-up company in San Francisco, California. In that role, I led the technological aspects of the company's go-to-market efforts while also developing novel applications of causal AI for new target use cases. I also led a team of five Field Scientists charged with bridging the gap between customers' data-science teams and the Alembic causal engine.

17. Prior to my Alembic role, I was a Principal AI Architect at CableLabs, a non-profit think tank for the broadband industry. There, I pursued a mixture of quantitative and qualitative research on consumer behaviors and preferences, and developed methods for applying artificial intelligence to the delivery of broadband services.

18. From April 2017 to September 2018, I served as forum chair and moderator for the IoT (Internet of Things) Forum in Silicon Valley. From August 2018 to January 2022, I also taught engineering at the Nueva School.

19. As shown in my CV, I have authored or co-authored over 30 publications, most of which relate to engineering or design. I am a named inventor on at least six issued patents.

B. Applicable Legal Standards

20. I have been asked to provide my opinion as to whether the claims of U.S. Patent No. 12,216,339 would have been obvious to a POSITA at the time of the alleged invention, in view of the prior art.

21. I am an engineer and product designer by training and profession. The opinions I am expressing in this report involve the application of my training and technical knowledge and experience to the evaluation of certain prior art with respect to the '339 patent.

22. Although I have been involved as a technical expert in patent matters before, I am not an expert in patent law. Therefore, the attorneys from Morgan, Lewis & Bockius LLP have provided me with guidance as to the applicable patent law in this matter. The paragraphs below express my understanding of how I must apply legal principles relating to patent validity in my analysis.

23. It is my understanding that in determining whether a patent claim is obvious in view of the prior art, the Patent Office construes the claim by giving the claim its ordinary and customary meaning ascribed to it by a person of ordinary skill in the art at the time of the invention, consistent with the specification. I also understand that in reading the claim, I must not import limitations from the specification into the claim terms; in other words, I must not narrow the scope of the

claim terms by implicitly adding disclosed limitations that have no express basis in the claims.

24. It is my understanding that a claim is “obvious” if the claimed subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time of the alleged invention. I also understand that an obviousness analysis considers the scope and content of the prior art, the differences between the claimed subject matter and the prior art, and the level of ordinary skill in the art at the time of the invention.

25. In determining the scope and content of the prior art, it is my understanding that a reference is considered appropriate (e.g., analogous) prior art if it falls within the field of the inventor’s endeavor. In addition, a reference is prior art if it is reasonably pertinent to the particular problem with which the inventor was involved. A reference is reasonably pertinent if it logically would have commended itself to an inventor’s attention in considering his problem. If a reference relates to the same problem as the claimed invention, that supports use of the reference as prior art in an obviousness analysis.

26. To assess the differences between prior art and the claimed subject matter, it is my understanding that the law requires the claimed invention to be considered as a whole. This “as a whole” assessment requires showing that one of ordinary skill in the art at the time of invention, confronted by the same problems as

the inventor and with no knowledge of the claimed invention, would have selected the elements from the prior art and combined them in the claimed manner.

27. It is my understanding that something is “inherent in,” and therefore taught by, the prior art, if it necessarily flows from the explicit disclosure of the prior art. I understand that the fact that a certain result or characteristic may be present in the prior art is not sufficient to establish inherency. However, if the result or characteristic is necessarily present based upon the explicit disclosure in the prior art, it is inherent in the prior art and is therefore disclosed.

28. It is my further understanding that the law recognizes several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; a predictable use of prior art elements according to their established functions; applying a known technique to a known device (method or product) ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

29. I understand that a prior art reference may also suggest a limitation of the claims. In that case, even if the prior art reference does not explicitly or inherently disclose the limitation, the motivation to modify the prior art reference to include the limitation may exist within the prior art reference itself. Thus, the limitation would have been obvious over that prior art reference alone. This is the case if a person of ordinary skill in the art would have had a simple design choice or a finite number of identified, predictable solutions, for example, and if the modification furthers the goals of the prior art reference.

30. I further understand that the obviousness analysis must be performed from the perspective of a person of ordinary skill in the art at the time of the alleged invention. This is to avoid using impermissible hindsight in the analysis. The claims of the patent must not be used to provide a road map for obviousness; instead, the claims would have been obvious if a person of ordinary skill in the art would have been motivated to combine the teachings of the prior art to arrive at the claimed invention and had a reasonable expectation of success in doing so.

31. I also understand that an obviousness analysis must consider whether there are additional factors that would indicate that the invention would not have been obvious. These factors include whether there was: (i) a long-felt need in the industry; (ii) any unexpected results; (iii) skepticism of the invention; (iv) a teaching away from the invention; (v) commercial success; (vi) praise by others for the

invention; and (vii) copying by other companies. I am not aware of any evidence that would suggest that the claims of the '339 patent would have been non-obvious. To the extent Patent Owner submits such evidence during the course of the inter partes review, I may provide my opinion on such evidence if asked to do so by counsel.

C. Person of Ordinary Skill in the Art

32. It is my understanding that when interpreting the claims of the '339 patent, I must do so based on the perspective of a POSITA at the relevant priority date. As discussed below, I understand the earliest claimed priority date to be December 12, 2018.

33. I understand that in determining the level of ordinary skill in the art, several factors are considered. Those factors may include: (i) the type of problems encountered in the art; (ii) prior art solutions to those problems; (iii) the rapidity with which innovations are made; (iv) the sophistication of the technology; and (v) the educational level of active workers in the field. A POSITA must have the capability of understanding the scientific and engineering principles applicable to the pertinent art.

34. The '339 patent describes the use of well-known technologies relating to eyewear with electronics. Based on my review of the specification and claims of the '339 patent, it is my opinion that a hypothetical POSITA would have had at least

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a bachelor's degree in mechanical or manufacturing engineering; mechatronics; electrical engineering plus coursework in mechanical engineering, manufacturing engineering, or mechatronics; or a similar technical degree. A POSITA would have also had at least 2 years of experience designing eyewear and/or consumer electronics. Work experience could substitute for formal education and additional formal education could substitute for work experience.

35. However, my opinions do not turn on this specific definition of the level of ordinary skill. The claims would have been obvious from the perspective of a POSITA under any reasonable definition.

36. I can make this assessment because in the 2010s, I was familiar with design and operation principles common in the mechanical, manufacturing, and mechatronic domains as they relate to the design, specification, and manufacturing of consumer electronic components. I, and the engineers that I worked with during the 2010s, had the requisite knowledge to make and use eyewear as described in the claims of the '339 patent. Because I have worked with and supervised designers, engineers, and software developers, I know very well what their capabilities were in the 2010s, how they would interpret and understand the claims of the '339 patent, and how they would understand the disclosures in the prior art discussed herein.

37. Additionally, I have taught in undergraduate and graduate mechanical engineering programs, where I developed novel curricula that integrated

mechatronic course content within existing mechanical engineering curricula. As of May 2007, I had been an assistant professor at the United States Air Force Academy and a graduate teaching assistant at Stanford University, within the departments of Engineering Mechanics and Mechanical Engineering, respectively.

38. In my opinion, as set forth in more detail below, a POSITA at the time of the invention would have considered the methods, mediums, and systems claimed in the '339 patent to be obvious in view of the prior art. My conclusions that the claims of the '339 patent would have been obvious would remain the same even if the invention date, field of endeavor, or level of ordinary skill were slightly different.

III. OVERVIEW OF THE TECHNOLOGY

39. In this section I provide overviews of technologies and prior art pertinent to the '339 patent and to the state of the art as of 2018. In later sections, I address in detail how the prior art discloses and renders obvious the recitations of the challenged claims.

40. The prior art references described below and discussions of what was known to a person of ordinary skill in the art provide a general description of the state of the art at the time of the invention, provide additional motivation to modify the primary references evaluated in the grounds of invalidity with the knowledge of a person of ordinary skill in the art or other references cited herein, and provide support for why a person of ordinary skill in the art would have had a reasonable

expectation of success in combining the teachings of the references. The additional prior art references identified in this section are exemplary in nature and are included to provide factual support for my opinions.

A. Sensors Were Ubiquitous Across Diverse Environments Long Before 2018

41. The foundational sensor technologies described in the '339 patent were each developed and deployed at commercial scale long before any wearable device was contemplated. For example, microelectromechanical systems (MEMS) accelerometers were first developed and commercialized in the late 1980s and 1990s. See <https://electronics360.globalspec.com/article/22999/the-history-of-accelerometers>. The first mass-market application of MEMS accelerometers was in automotive airbag deployment systems, where they achieved high-volume deployment in the late 1980s and early 1990s. <https://www.cmmmagazine.com/cmm-articles/advances-in-mems-based-inertial-sensors/>. By the mid-1990s, MEMS gyroscopes had entered automotive high-volume production, used in vehicle dynamic control and rollover protection systems. See [Advances in MEMS-based inertial sensors - CMM Web Portal](#).

42. As another example, by the early 2000s, GPS receivers had transitioned from military and specialized navigation applications into consumer wrist-worn sports watches. Garmin released the Forerunner 201—the world's first GPS-enabled wrist-worn running watch—in 2003. See <https://www.garmin.com/en->

[US/blog/fitness/twenty-years-of-running-with-garmin/](https://www.garmin.com/en-US/blog/fitness/twenty-years-of-running-with-garmin/). This watch provided athletes with real-time pace, distance, and location data during workouts. *Id.*

43. By 2007, sensors had become standard features of consumer smartphones: when Apple introduced the original iPhone in January 2007, it incorporated an accelerometer (for display orientation), a proximity sensor (to disable touchscreen during calls), and an ambient light sensor (to adjust display brightness)—three sensors working silently to enhance the user experience. *See* <https://www.apple.com/newsroom/2007/01/09Apple-Reinvents-the-Phone-with-iPhone/>. By this point, sensors had spread from industrial machinery and automobiles to medical equipment and consumer electronics, establishing a broad ecosystem of sensor technologies that engineers could draw upon for new applications.

B. Sensors Were Widely Integrated Into Wearable Devices Before 2018

44. Also well before 2018, the industry saw a transition from sensor-equipped electronics generally to wearable sensor systems specifically. One such example was the Nike+iPod Sport Kit—a collaboration between Nike and Apple that launched on July 13, 2006. *See* <https://investors.nike.com/investors/news-events-and-reports/investor-news/investor-news-details/2006/Nike-and-Apple-Launch-Nike--iPod-Sport-Kit/default.aspx>. The Nike+iPod system consisted of a piezoelectric accelerometer sensor embedded in the sole of a Nike+ running shoe

that wirelessly transmitted stride data to an iPod nano receiver clipped to the user's clothing. See <https://electronics.howstuffworks.com/gadgets/fitness/nike-ipod.htm>.

45. In 2009, Fitbit, Inc. launched the Fitbit Tracker—a clip-on wearable device containing a three-axis accelerometer that measured steps taken, distance walked, calories burned, and sleep quality. <https://www.ebsco.com/research-starters/technology/fitbit>. The Fitbit Tracker's three-dimensional accelerometer sensed user movement continuously, and the device used that motion data to calculate and display activity and intensity metrics. https://en.wikipedia.org/wiki/List_of_Fitbit_products. Data was wirelessly synced through a base station to the Fitbit website, where users could view detailed activity trends over time, set and track goals, log food intake, and connect with friends for social accountability. *Id.*

C. Wearable Sensors Were Designed to Analyze the User's State and Provide Assistance

46. By the mid-2010s, the wearable sensor market had matured to the point that multi-sensor wrist-worn devices designed to analyze the user's physical state and provide personalized health guidance had become mainstream consumer products. The Basis B1 smart watch, reviewed and released in 2013, incorporated galvanic skin response sensors, a heart rate sensor using optical photoplethysmography (PPG), an accelerometer, a gyroscope, and an ambient light sensor. [Basis B1 Watch In-Depth Review | DC Rainmaker](#). The Basis companion

applications used data from these sensors to provide statistics about the user's physical activity, conduct stress sensing, and recognize sleep patterns. *Id.*

47. Apple Watch Series 2 (released September 2016) added a built-in GPS sensor, and Apple Watch Series 4 (released September 2018) added an electrical heart sensor enabling ECG readings and an improved accelerometer enabling fall detection—demonstrating that user-protective health assistance from wearable sensors had become a commercial product standard before the '339 patent's priority date. <https://shellsharks.com/apple-watch-hardware>.

48. Garmin's Forerunner watch series, paired with the Garmin Connect platform, analyzed GPS, heart rate, and accelerometry data from the wrist-worn device to assess the user's training load, recovery status, and fitness progression, and delivered personalized guidance recommending when to train hard and when to rest—assistance directed at the user's physical state and well-being. https://en.wikipedia.org/wiki/Garmin_Forerunner. When Garmin added an integrated optical heart rate sensor to the Forerunner 225 in May 2015, users gained the ability to receive training zone guidance and real-time coaching based on heart rate data from the wrist-worn device, extending the scope of the assistance available from a single body-worn sensor package. [Twenty Years of Running with Garmin | Blog](#).

D. Systems Combining Data from Wearable and External Sensors Were Common Before 2018

49. The Nike+iPod Sport Kit—launched in 2006—was itself an early implementation of the multi-source wearable-plus-external-sensor architecture the '339 patent claims. The shoe-embedded accelerometer sensor transmitted data wirelessly to the iPod nano receiver (an external computing device separate from the sensor), which processed the data and delivered real-time audio to the user; workout data was then transmitted via iTunes to the Nike+ cloud platform for post-session analysis and goal tracking. <https://en.wikipedia.org/wiki/Nike%2BiPod>.

50. By 2008 and 2009, Nike extended this multi-source architecture further by enabling the shoe sensor to communicate directly with external gym equipment—treadmills, stationary bicycles, and elliptical—from seven major equipment manufacturers. *Id.* This allowed data from the body-worn shoe sensor to be combined with data from external, non-wearable gym machines to track the user's workout, precisely mirroring the '339 patent's description of combining data from a sensor associated with the user's body with data from external, non-wearable sensors. *Id.*

51. Consumer fitness platforms similarly demonstrated mature multi-source sensor integration years before 2018. The Fitbit platform, by 2012, combined body-worn accelerometer data from the wearable tracker with user-entered food log data, data from the Fitbit Aria smart scale (a separate, non-wearable external sensor),

and sleep tracking data to deliver comprehensive health coaching to the user through the Fitbit website and mobile application. <https://en.wikipedia.org/wiki/Fitbit>. This multi-source architecture—wearable sensor plus external sensors plus cloud analytics plus user feedback—is described in the '339 patent's own specification, which depicts the eyewear communicating via multiple wireless protocols simultaneously with external sensors, user devices, Wi-Fi infrastructure, and remote cloud services. Ex.1001, 13:43-57, Fig.6B, 19:47-67, 20:1-6.

E. Head-Mounted Wearable Systems Were Common Before 2018

52. By the early 2010s, wearable systems had evolved to include head-mounted displays (“HMDs”), which allow a wearer to simultaneously observe the real world and view information overlaid on a display integrated into the device. U.S. Patent No. 8,989,521 (“the '521 patent”), a Google-owned patent with a priority date of November 23, 2011, describes one such system. In this Google system, an HMD takes the form of an eyeglasses-style device equipped with lens frames, optical systems, a front-facing camera, a microphone, a processor, and a touchpad, with lens elements that are at least partially transparent so the wearer can look through them while simultaneously receiving a displayed image. '521 patent, 10:12-41. The practical benefit of this design is that a wearer can receive guidance and information directly in their field of view without interrupting their engagement with the activity around them.

53. The HMD provides assistance to the wearer by using content identification. For example, a user wearing the HMD in an environment where music is playing and dancers are performing can capture audio and video samples through the device's on-board microphone and camera. *Id.*, 11:4-13. The device preprocesses these samples and transmits a content identification query to a remote content analysis server, which identifies the content and returns relevant metadata—such as a song's genre and tempo—to the HMD, which uses it to determine and display appropriate dance steps to the wearer in real time. *Id.*, 5:11-26, 11:22-38. The system may further receive information from onboard or wearable sensors to evaluate the wearer's actual performance of the displayed steps and provide corrective feedback. *Id.*, 6:60-7:15.

54. One other HMD system that similarly provides assistance to the wearer is described in U.S. Patent Application Publication No. 2016/0066847 (“Sales”), which was cited by the examiner in the prosecution history of the '339 patent and has a priority date of September 5, 2014. Sales describes computerized eyewear equipped with one or more sensors configured to monitor the physiological attributes of a wearer, including the wearer's posture, balance, alertness, and physical state. Sales, [0003]-[0004]. The described eyewear comprises at least one processor, a power source, a communication device, and one or more sensors, including an accelerometer, a geomagnetic sensor, a pulse oximeter, a forward-facing camera,

and an eye-facing camera. *Id.* These sensors may be embedded into the eyewear frame or positioned along the temples or lenses of the eyewear. *Id.*, [0037].

55. Sales discloses that the eyewear assists the wearer by establishing a baseline measurement of the wearer's normal physiology against which the system continuously compares current sensor readings. *Id.*, [0038], [0044]. When the wearer's current physiology deviates from the established baseline, the system notifies the wearer of the deviation, for example by displaying a message on the eyewear's lens, communicating through a speaker, or sending a notification to the wearer's mobile device. *Id.*, [0065]-[0066]. In one embodiment, the eyewear monitors driver alertness by tracking the wearer's head position, blink rate, and oxygen level, and alerts the wearer when those readings indicate distraction or drowsiness. *Id.*, [0086]. In the relevant timeframe, it was common for both eyewear and mobile devices to have sensors that provide such data.

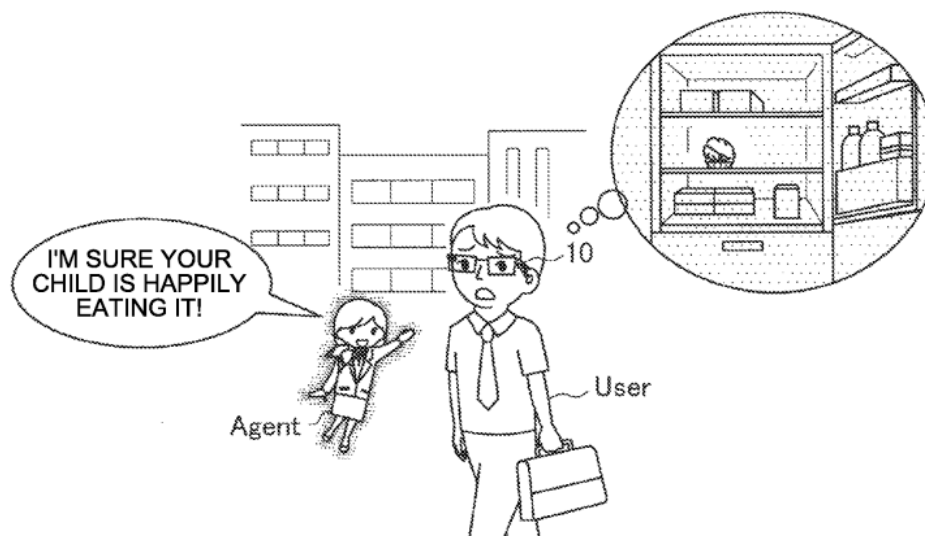
56. Another similar system is described in U.S. Patent Application Publication No. 2011/0214082 ("the '082 publication"), assigned to Microsoft with a priority date of February 28, 2010. This publication describes an interactive head-mounted eyepiece designed to assist the wearer through a broad range of control modalities that allow the system to be operated hands-free or with minimal physical interaction. These include hand and finger gesture recognition, head motion sensing via onboard accelerometers and gyroscopes, eye tracking, voice commands through

integrated microphones, and body-worn control devices such as ring-mounted controllers. '082 publication, [0014]-[0016], [0041]-[0045], [0232], [0247], [0266]-[0267].

57. Another exemplary system is described in U.S. Patent Application Publication No. 2012/0105740 (“the ’740 publication”), assigned to Oakley/Luxottica with a priority date of June 2, 2000. This publication describes a detachable adjustable electronics module that may be removably connected to the earstem of an eyeglass frame, consolidating audio and visual electronics into a platform the wearer is already wearing. ’740 publication, [0003], [0010], [0013], [0079]. The module may house MP3 format memory, radio frequency transceivers, cellular telephone hardware, Bluetooth transceivers, and visual display technology. *Id.*, [0011], [0086], [0163]-[0164]. This system provides assistance to the wearer by allowing them to listen to music, take telephone calls, and receive visual information without carrying or interacting with multiple separate devices. *Id.*

F. Asukai Discloses Sensor-Based Head-Mounted Display Feedback Assistance

Asukai describes a wearable feedback system implemented as a “spectacle-type HMD [head mounted display] that includes earphones and a see-through display unit.” Ex.1005, [0072]; *see also id.*, [0068], [0114]-[0117].

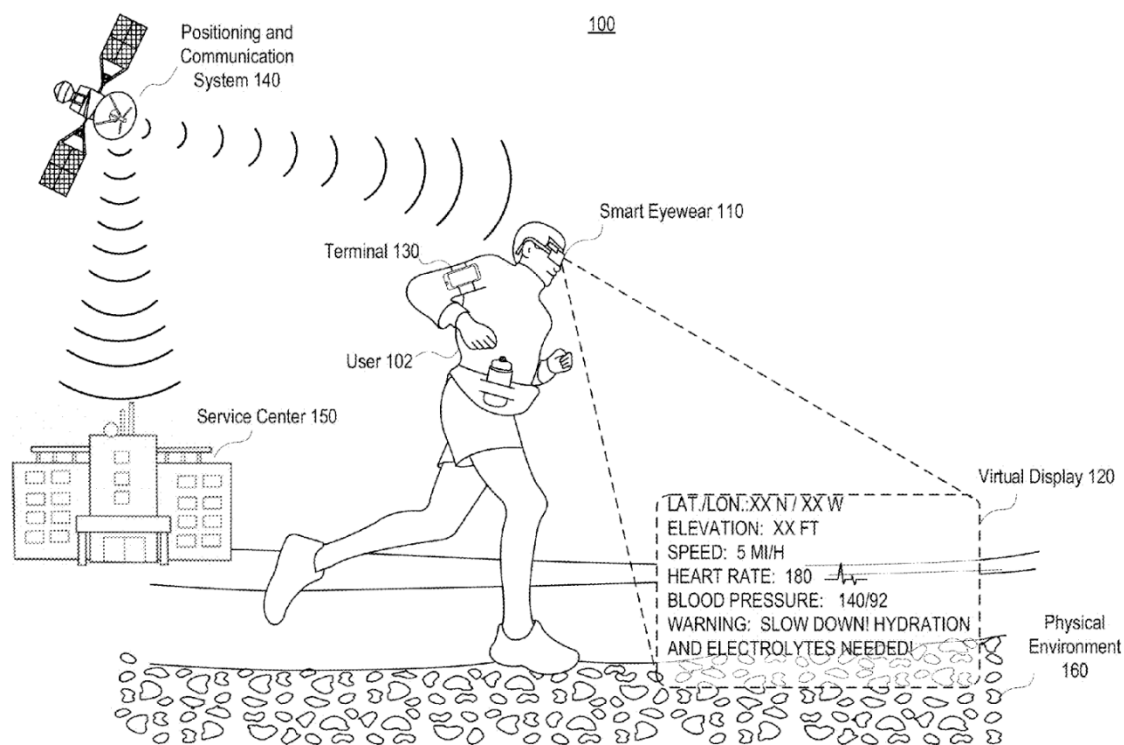


Id., Fig.1(excerpt).

58. The system in Asukai has multiple sensors that collect “various sensing data.” *Id.*, [0069]. The sensors may include cameras, microphones, acceleration sensors, gyro sensors, location-information acquisition units, biological sensors, gaze sensors, and environmental sensors. *Id.* Asukai provides that the sensors are located on the spectacle-type HMD, on an external device, or both. *Id.* (“These sensors may be provided in, for example, the information processing device 10, or may be implemented by another wearable device, smartphone, or the like that is communicatively connected to information processing device 10.”); *see also id.*, [0072]. Asukai’s system uses information obtained from the sensors to recognize the user’s situation and action, identify the user’s emotion, and provide feedback intended to assist the user in view of that state and improve the user’s quality of life. *Id.*, Abstract, [0061]-[0069].

G. Liu Discloses Smart-Eyewear Sensing and Assistance

59. Liu describes a sports-management system centered on smart eyewear 110. Ex.1006, [0016]-[0018]. Liu's eyewear has wearable biosensors, positioning sensors, and imaging sensors, and it operates with a separate terminal 130 (e.g., a smartphone, smart watch, smart bracelet, smart camera, or medical device) that can provide additional biosensor or camera data. *Id.*, [0017], [0021]-[0023].

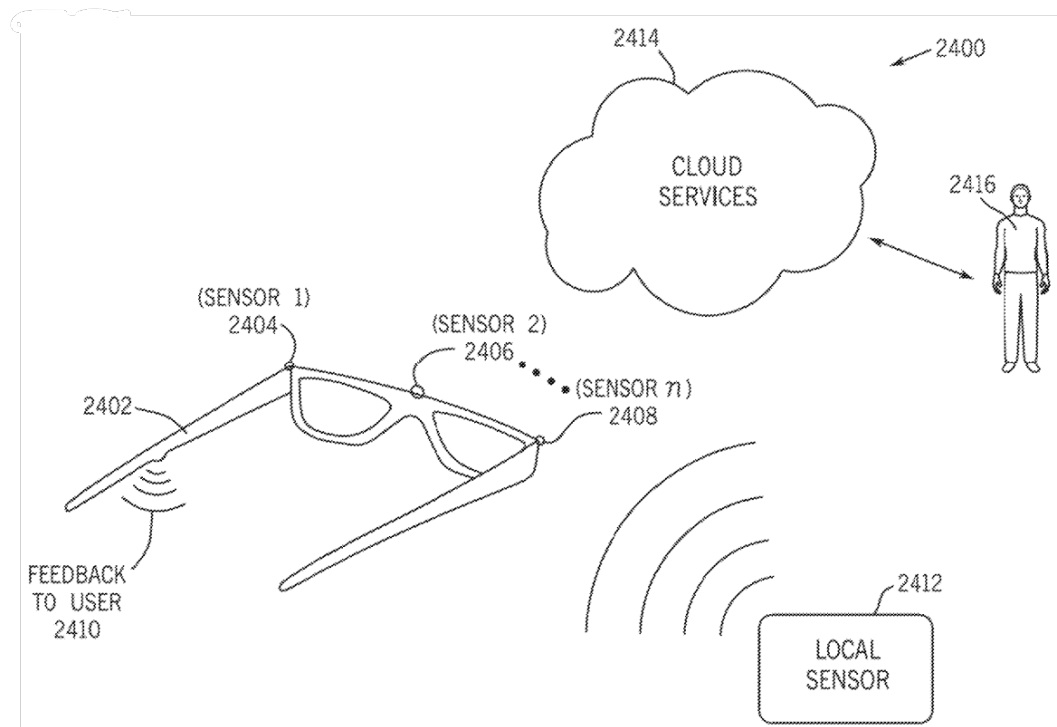


Id., Fig.1. Liu uses those inputs to monitor the user's physiological reactions, movement, position, and surrounding environment, and describes providing exercise and safety advice to the user and issuing alerts or rescue requests when the user's condition is abnormal. *Id.*, [0016]-[0018], [0046], [0050], [0060]-[0062].

IV. THE '339 PATENT

A. Overview

60. The '339 patent is directed to “providing information to a user through a modularized eyewear device.” Ex.1001, 1:43-46. When users are in situations where their hands are occupied, the '339 patent describes using sensor data associated with the eyewear to determine a user's context, analyze the user's state, and provide assistance through the eyewear. *Id.*, 1:49-53, 1:66-2:17.



Id., Fig.24. As the '339 patent further discloses, the user's state includes categories such as health, wellbeing, safety, cognitive, physical, and emotional, and the user's context includes categories such as physical orientation, activity, and environment.

Id., Figs. 18, 21.

B. Prosecution History

61. During prosecution of the application that issued as the '339 patent, the Examiner rejected most claims as anticipated by U.S. Patent App. Publ'n No. 2016/0066847, but indicated that three claims contained allowable subject matter. Ex.1002, 136-143. PO then amended the independent claims to incorporate that allowable subject matter. *Id.*, 119-125. The application issued on February 4, 2025. Ex.1001.

62. Asukai and Liu, the primary references relied on in this Petition, were not before the Examiner. *Id.*

C. Challenged Claims

63. The '339 patent has 16 claims, and I understand that claims 1, 6, and 11 are the only independent claims, where claims 2 and 5 depend upon claim 1, claims 3 and 4 depend upon claim 2, claims 7-10 depend upon claim 6, claims 12-14 and 16 depend upon claim 11, and claim 15 depends upon claim 13. *See* Ex.1001.

V. CLAIM CONSTRUCTION

64. It is my understanding that in determining whether a patent claim is obvious in view of the prior art, the Patent and Trademark Office construes the claim by giving the claim terms their plain and ordinary meaning, as they would have been understood by a POSITA at the time of the invention in view of the intrinsic record (patent claims, patent specification, and file history). For the purposes of this review,

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and to the extent necessary, I have interpreted each claim term in accordance with its plain and ordinary meaning as it would have been understood by a person of ordinary skill in the art at the time of the invention, in view of the intrinsic record.

65. I understand that a patent and its prosecution history are considered “intrinsic evidence” and are the most important sources for interpreting claim language in a patent. I also understand that in reading the claim, I must not import limitations from the specification into the claim terms; in other words, I must not narrow the scope of the claim terms by implicitly adding disclosed limitations that have no express basis in the claims. The prosecution history of related patents and applications can also be relevant.

66. I understand that sources extrinsic to a patent and its prosecution history (such as dictionary definitions and technical publications) may also be used to help interpret the claim language, but that such extrinsic sources cannot be used to contradict the unambiguous meaning of the claim language that is evident from the intrinsic evidence.

67. Unless expressly stated herein, I have applied the plain and ordinary meaning of the claim terms, which I understand is the meaning that a POSITA would have given to terms at the time of the claimed invention based on a review of the intrinsic evidence.

68. I provide my opinions herein on the manner in which the '339 patent describes certain claim elements. First, the patent describes a user's "state" as including categories such as "health," "wellbeing," "safety," "cognitive," "physical," and "emotional," with "no limitation implied thereby." Ex.1001, 23:19-24, Fig.21. For example, the patent describes providing assistance relative to specific states, such as:

- Instructing the user to take medication, as an example of providing assistance relative to the state of Health (*id.*, 23:26-37);
- Notifying the user's son or daughter to call the user after determining the user may be suffering from a physical or mental condition such as a depressive state or flu, or suggesting the user get up and move around, as an example of providing assistance relative to the state of Well Being (*id.*, 23:38-60);
- Alerting an appropriate person that the user has fallen and needs help, as an example of providing assistance relative to the state of Safety (*id.*, 23:61-24:12);
- Testing the user's cognitive state by propounding a number of questions to the user, as an example of providing assistance relative to the Cognitive state (*id.*, 24:13-27);

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- Providing corrective assistance after analyzing the user's posture or providing positive assistance after determining the user has a healthy state, as examples of providing assistance relative to the state of Physical (*id.*, 24:28-42); and
- Analyzing the user's emotional state as part of athletic training or administering a medical procedure, for example to make the user feel calmer and more relaxed based on galvanic skin sensors, as an example of providing assistance relative to the state of Emotional (*id.*, 24:43-63).

69. Second, the patent describes the user's "context" as including "one or more of a physical orientation, an activity, and an environment that the user is in." *Id.*, 20:34-37, Fig.18. According to the patent, "[d]etermining user context can increase the relevance of assistance that the system provides to the user." *Id.*, 26:21-24. For example, if "the user has been inactive for a prolonged period of time," "the system may determine that the user is taking an examination and that this is the reason for the inactivity," and "would not provide the assistance" that may be otherwise provided without such context determination. *Id.*, 26:21-38.

70. I note that the patent's claims recite "analyzing a state" and "determining a context," yet it appears that the patent uses the terms "analyze" and "determine" interchangeably and does not appear to distinguish between these two

terms. For example, despite claiming “analyzing a state,” the patent repeatedly refers to “determin[ing]” a state of the user (*see, e.g., id.*, 22:14-19 (“a state of the user is determined”), 22:48, 23:12-13 (“a state of the user is determined”), 25:36-40 (“a state of the user is determined”), 28:50-51 (“a user’s context and or state are determined”), and does not appear to distinguish between instances in which a user’s state is determined versus when the user’s state is analyzed (*see, e.g., id.*, 2:14-15, 26:4, 27:21-25, 27:65). Similarly, despite claiming “determining a context,” the patent repeatedly refers to “analyz[ing]” a context of the user (*see, e.g., id.*, 21:4 (“analyze context”)), and does not appear to distinguish between instances in which a user’s context is analyzed versus when the user’s context is determined (*see, e.g., id.*, 2:13-14, 20:34-41).

71. I use these descriptions below when explaining how the prior art’s determinations of emotion, physiological status, movement, activity, location, and surroundings fall within the ordinary meaning of the claims.

VI. THE PRIOR ART

72. In this declaration, I rely on several references that are prior art to the ’339 patent’s claims. These references include:

- Asukai (U.S. Patent App. Publ’n No. 2021/0145340) (Ex.1005)
- Liu (U.S. Patent App. Publ’n No. 2017/0255262) (Ex.1006)
- Shan (U.S. Patent App. Publ’n No. 2018/0014903) (Ex.1007)

- Lisy (U.S. Patent No. 9,579,060) (Ex.1008)

73. These references are from the same field as the '339 patent, e.g., wearable systems that sense user condition and provide feedback. *See* Ex.1001, Abstract. These references are further pertinent to a problem the inventors were focused on, e.g., using sensed user state/context to generate assistance to the wearer. *See id.*

VII. OPINIONS ON GROUND 1: CLAIMS 1-16 ARE UNPATENTABLE BASED ON ASUKAI

74. In my opinion, Asukai renders claims 1-16 unpatentable. Like the '339 patent, Asukai describes eyewear (Ex.1005, Fig.1) that amounts to an information processing device 10 as a head mounted display (HMD), and further discloses various embodiments of that information processing device (*e.g.*, 10a, 10b, 10e) incorporating a sensor unit 122. *Id.*, Figs. 1-2, 7, 10, [0068]-[0069], [0072], [0097], [0115]-[0116], [0195]-[0197].

75. There are at least two key embodiments in Asukai: a commuting example and a parenting example. First, Asukai describes its commuting example as using information processing device 10a in Fig. 1, which aggregates data including “location information,” data from an “acceleration sensor on the head” that informs “that the user U2 is walking with his/her head down.” *Id.*, [0115]-[0116]. Essentially, Asukai is determining whether a user is walking and how that user is oriented while walking. Second, Asukai describes its parenting example as using

information processing device 10e (not shown), which aggregates data from a room video camera, pulse rate from a smart band worn by the mother, or uttered voice data from a microphone in the room or on the HMD. *Id.*, [0196]-[0197]. This embodiment focuses on determining how a child has behaved (for example, whether the child has effectively cleaned the room) and how the parent is reacting (either positively by praising or negatively by scolding).

A. Motivation to Combine

76. A POSITA would be motivated to combine Asukai's embodiments to implement certain sensors into the eyewear of Fig. 1.

77. Integrating sensors into the eyewear of Fig. 1 would have been obvious because Asukai already teaches that the disclosed sensors are "on the head" or HMD. A POSITA would have understood the eyewear structure to be a natural and predictable location for the disclosed sensors, including the acceleration sensor, microphones, cameras, and location sensors. Integrating these sensors into the eyewear would have simplified system architecture by consolidating components into the wearable device, improved portability and user comfort, reduced wiring complexity, improved alignment between sensed motion and displayed content.

78. A POSITA would have understood that the combination would improve tracking accuracy and system responsiveness. Locating the acceleration sensor or location sensors directly on the eyewear would ensure that sensed head

orientation and movement, and the user's activity corresponded more precisely to the displayed images, thereby reducing latency and registration errors that could arise if the sensors were separately mounted elsewhere on the user's head. Similarly, locating the microphone and/or camera on the eyewear would ensure that the data picked up by these sensors naturally align with the user's field of view and direction of speech, improving audio acquisition and image capture. These benefits would have been readily appreciated by a POSITA designing head-mounted display systems.

79. At minimum, Asukai provides a small number of identified, predictable locations for the sensors—including on the HMD—and a POSITA would have been motivated to select the eyewear HMD as the mounting location to achieve a more integrated and portable wearable system.

80. A POSITA would also be motivated to implement Asukai's parenting example to combine data from both HMD sensors and sensors external to the HMD.

81. Using multiple sensing sources was a known technique for improving tracking reliability, accuracy, and robustness in wearable systems. Sensors integrated into the HMD provide direct measurement of head position, orientation, audio, or visual information from the user's perspective, while external sensors provide supplemental environmental tracking, reference-point calibration, or verification data. Combining these complementary sensing arrangements would

predictably improve overall system performance by reducing tracking drift, compensating for occlusion or temporary signal degradation, and enabling cross-validation between sensor inputs.

82. A POSITA also would have appreciated that redundant sensing architectures were commonly used in the art to improve accuracy and fault tolerance. By incorporating both HMD-mounted sensors and external sensors, the system continues operating effectively even if one sensor became partially obstructed, misaligned, or noisy. *See* Ex.1008, 4:2-9, Figs.13-14; Ex.1009, [0012], [0045]-[0046]. Additional data allows the system to compare and combine data from multiple perspectives, thereby increasing confidence in positional and environmental determinations.

B. Reasonable Expectation of Success

83. A POSITA would have had a reasonable expectation of success in incorporating Asukai's disclosed sensors, including an acceleration sensor, a camera and/or microphone, into Asukai's eyewear of Fig. 1, and in Asukai's parenting example, combining data from the HMD sensors and external sensors. Each component was already known to operate in wearable and head-mounted computing systems at the relevant time. Asukai itself teaches both an eyewear-based HMD and placing sensors on the head or on an HMD, indicating compatibility between the disclosed components and form factors. A POSITA therefore would have

understood that integrating the sensors into the eyewear embodiment involved only the application of known component-integration techniques to a known wearable platform.

84. The proposed combination would not have required any change to the fundamental operation of Asukai's system. The acceleration sensor, camera, and microphone would continue performing their ordinary and expected functions—capturing orientation, motion, image, and audio information—while the eyewear would continue functioning as an HMD. A POSITA also would have reasonably expected success because the combination merely involves selecting one expressly disclosed mounting location—an HMD—for use with another expressly disclosed embodiment—Asukai's eyewear HMD. Asukai presents the sensor placement options as interchangeable implementation details rather than mutually exclusive designs. Thus, adapting the sensor placement disclosed for one embodiment to the eyewear HMD embodiment would have constituted no more than routine optimization and predictable variation within the skill of an ordinarily skilled artisan.

85. With respect to combining data from HMD sensors and external sensors, the combination involves the use of known sensing components performing their established functions in a predictable manner. In the relevant timeframe, wearable and tracking systems commonly employed multiple sensors positioned at different locations to improve positional tracking, motion detection, and

environmental awareness. A POSITA therefore would have understood that integrating external sensors with existing HMD-mounted sensors involved routine application of known sensor-fusion and synchronization techniques, with predictable benefits in accuracy and reliability, including improved sensor robustness and ability to calibrate and verify the sensed data. Combining these known data streams would not require altering the underlying operation of the individual sensors, but instead would merely aggregate and process additional information using conventional techniques well understood in the art.

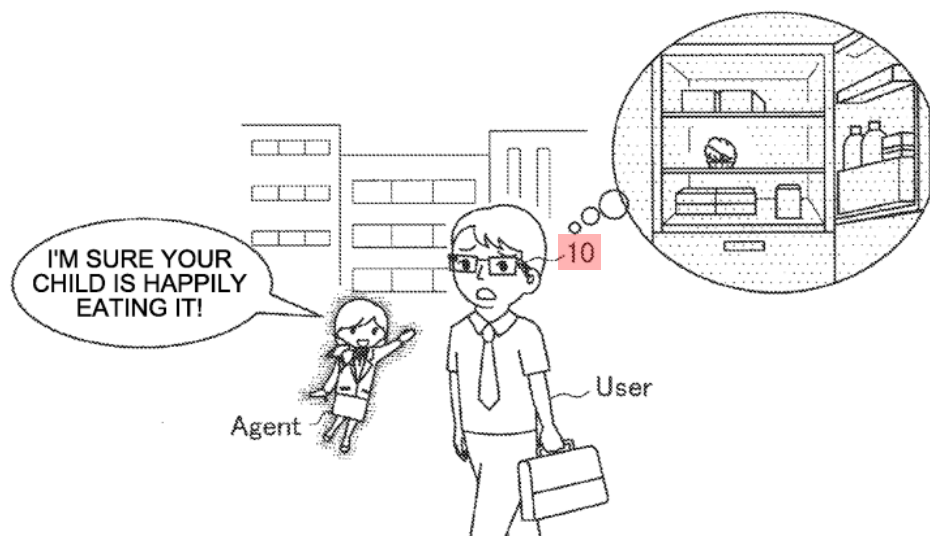
C. Claim 1

1. Preamble 1[pre]: “A method to provide assistance to a user through an eyewear device, comprising;”

86. I have been asked to assume the preamble of claim 1 is limiting. Under that assumption, it is my opinion that Asukai discloses the preamble of claim 1, which recites “[a] method to provide assistance to a user through an eyewear device.”

87. Asukai discloses an information processing system that performs a “method” providing assistance to a user through eyewear. Ex.1005, [0015], [0061] (“[a]n information processing system according to the present embodiment is an agent system that estimates an emotion of a user based on an action of the user or a situation, and gives feedback corresponding to the estimated emotion, thereby

improving quality of life (QOL) of the user”); *see also id.*, Title, Abstract, [0067]-[0068], [0074], Fig.5. Asukai provides feedback by determining whether the user’s emotion is positive or negative based on the user’s situation and action, and then selecting feedback corresponding to that determination. *Id.*, [0061], [0066]-[0068], [0085]-[0090]. This determination takes the form of assessing “whether a user is positive or negative and has any one of a function of promoting an action of the user when it is estimated that the user is positive, [and] a function of suppressing an action of the user when it is estimated that the user is negative.” Ex.1005, Abstract. Therefore, if the user’s action or condition is deemed to be negative, Asukai discloses providing assistance to help the user avoid taking the negative action or suffering from the negative condition. Asukai provides this feedback through “information processing device 10” (red), such as a “spectacle-type HMD [head mounted display] that includes earphones and a see-through display unit.” *Id.*, [0068], [0072]; *see also id.*, [0099], [0114]-[0117].



Id., Fig.1(excerpt) (annotated).

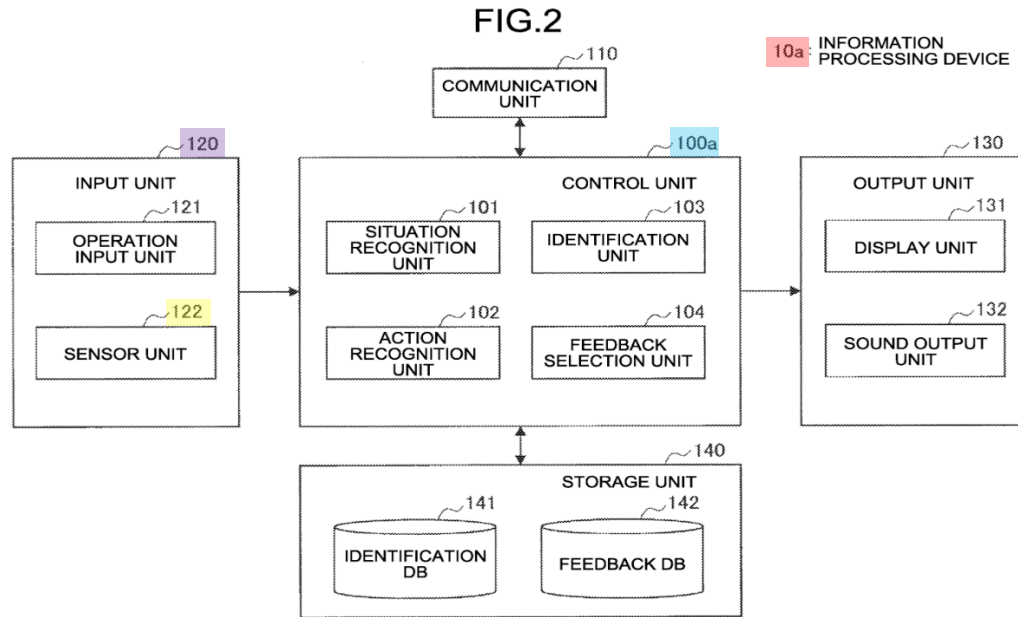
2. Limitation 1[a]: “receiving first data from a first sensor, the first sensor is incorporated into the eyewear device, the first sensor measures a parameter related to the user;”

88. In my opinion, Asukai renders obvious 1[a]: “receiving first data from a first sensor, the first sensor is incorporated into the eyewear device, the first sensor measures a parameter related to the user.”

89. The information processing device 10a (red) in Asukai includes input unit 120 (purple) and sensor unit 122 (yellow), where sensor unit 122 “senses various types of sensing data for recognizing a user situation or a user action.” Ex.1005, [0095], [0097], Fig.2 (I reproduced this figure below with annotations); *see also id.*, [0069], [0072], [0075]-[0076], [0095], [0103], [0075]-[0076] (explaining that “the information processing system [including information processing device 10] according to the present embodiment will be described in detail by using a plurality

of exemplary embodiments [including information processing device 10a]”). Asukai’s sensor unit 122 has sensors such as a camera, microphone, acceleration sensor, gyro sensor, location-information acquisition unit, and biological sensor; these sensors measure user-related parameters including motion, voice, gaze, blink, eye movement, brain waves, body movement, body position, heartbeat, pulse, respiration, and SpO2. *Id.*, [0068]-[0069], [0079]-[0084], [0097]. These sensors “sense[] data” and measure parameters related to the user, because they are measuring a range of physical qualities of the user. *See id.*, [0068]-[0069], [0079]-[0084] (disclosing that Asukai’s situation recognition unit 101 recognizes “an environment,” “an action of the user,” and “a situation” that the user is in based on the user’s perception, user-inputted information, and social networks/virtual reality worlds), [0097] (“sensor unit 122 is a sensor that senses various types of sensing data for recognizing a user situation or a user action”).

90. Asukai discloses that the sensors may be provided in the information processing device. *Id.*, [0069] (“These sensors may be provided in, for example, the information processing device 10.”); *see also id.*, [0160] (“...location information of a GPS of the HMD (information processing device 10e) worn by the user...”). Therefore, when that device is implemented as a spectacle-type HMD, Asukai discloses a sensor incorporated into eyewear.



Ex.1005, Fig.2 (annotated).

91. Asukai's input unit 120 "acquires input information for the information processing device 10a and outputs the input information to the control unit 100a [blue]." Ex.1005, [0095]. In turn, control unit 100a uses sensor data to perform situation recognition and action recognition. *Id.*, [0078]-[0084]. As a result, Asukai discloses receiving first data from a sensor, such as an acceleration sensor, gyro sensor, or microphone, incorporated into the eyewear device (information processing device implemented as eyewear-type HMD).

92. Even if a particular Asukai example does not expressly repeat that the sensor is incorporated into the spectacle-type HMD, a POSITA would have been motivated to implement that arrangement. Asukai describes various HMD-associated sensors and sensing arrangements, including a camera provided in the

HMD, a microphone positioned near the user's ear, acceleration and GPS sensing associated with an HMD worn by a user, and a microphone of an HMD worn by a parent. Ex.1005, [0080], [0157], [0160], [0197]. These disclosures would have informed a POSITA that sensors used to collect user-perspective or user-worn information could be implemented in the spectacle-type HMD described by Asukai. At minimum, a POSITA would have been motivated to implement the claimed first sensor in Asukai's spectacle-type HMD. A POSITA would have been motivated to do so because locating the sensor in the spectacle-type HMD would provide user-perspective or user-worn data from a stable location associated with the user's head, viewpoint, and direction of speech, which would be useful for Asukai's situation recognition, action recognition, and emotion estimation. This placement also would reduce ambiguity about whether the sensed information corresponds to the HMD wearer; align the sensed data with the wearer's field of view, head orientation, and speech direction; improve tracking accuracy and system responsiveness; simplify the device architecture by reducing the need for separate externally mounted sensors or inter-device wiring; and improve portability and user convenience. A POSITA would have had a reasonable expectation of success in doing so because placing the sensor in the spectacle-type HMD would use one of Asukai's disclosed, predictable sensor locations and would not require any material change to Asukai's overall data flow, processing, or feedback architecture.

93. This is supported by the fact that Asukai's HMD is seen by the eye, and could either be traditional eyewear or a system similar to Google Glass or those pioneered by Steve Mann. [Google Glass Review: The Good, The Bad and The Ugly](#); [Steve Mann: Pioneer of Wearables and Extended Reality - IEEE Spectrum](#). Dr. Steve Mann filed for a patent in 1999 for his lab's Eye Tap wearable platform that includes multiple eyewear-mounted sensors and includes provisions to aid the user, such as journalists, in maintaining their state of Safety¹. Integrating these sensors into the eyewear simplified system architecture by consolidating components into the wearable device, improved portability and user comfort, reduced wiring complexity, improved alignment between sensed motion and displayed content. Years later, when Google Glass was announced in 2013², the same eyewear mounted wearable technology architecture was used but with the benefit of improved processing, communications, sensing and battery technology.

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<https://patentimages.storage.googleapis.com/ff/22/62/f805d27b81ab21/WO1999049655A1.pdf> last accessed 19 May 2026

² <https://www.cnet.com/culture/confirmed-google-glass-arrives-in-2013-and-under-1500/> last accessed 19 May 2026

94. These sensors further had been used on eyewear by this time, as evidenced in Google's '521 patent, as I discussed above. Asukai itself teaches both an eyewear-based HMD and placing sensors on the head or on an HMD, indicating compatibility between the disclosed components and form factors. This would have encouraged a POSITA based not only on known industry principles but also on the reference itself. Specifically, such a person would therefore have understood that integrating the sensors into the eyewear involved only the application of known component-integration techniques to a known wearable platform. I discuss examples of these wearable platforms above in Section III.E.

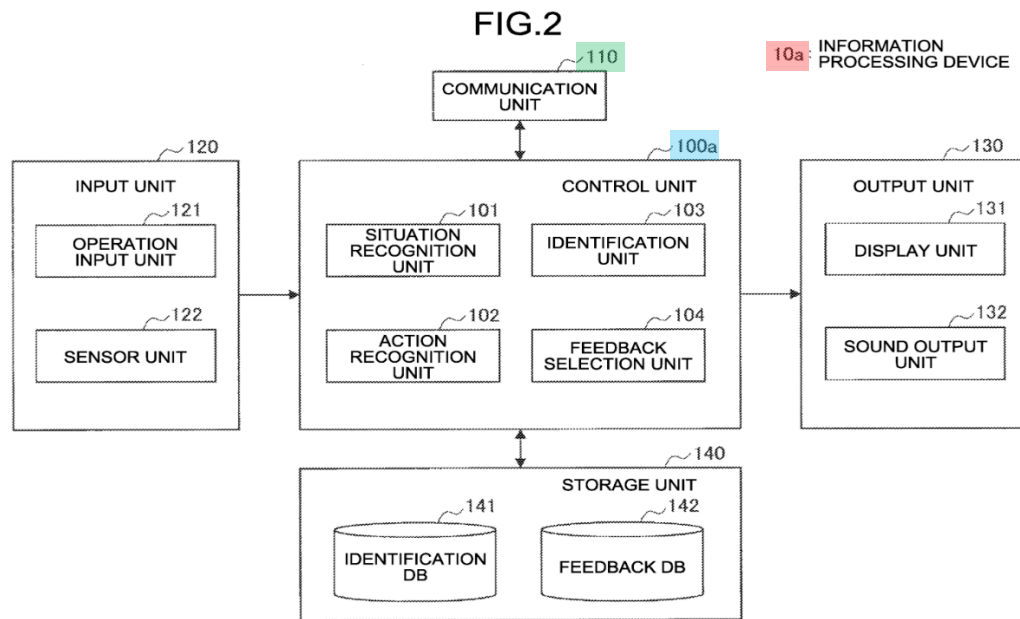
95. I also understand Asukai's exemplary-embodiment structure to support this reading. Asukai explains that components having substantially the same functional configuration are identified using the same reference signs and are not repeatedly described, and Asukai identifies information processing devices 10 and 10a-10f as sharing common components, including sensor unit 122. Ex.1005, [0036], [0258]-[0269]. Asukai further states that later embodiments may use previously described information processing devices and may be combined with earlier embodiments. *Id.*, [0140], [0147], [0161], [0187]. In view of these disclosures, a POSITA would have understood Asukai's HMD implementation, sensor unit 122, connected-device sensor disclosure, and use-case examples as compatible implementations within the same overall architecture.

3. Limitation 1[b]: “receiving second data from a second sensor, wherein the second sensor is an external sensor;”

96. In my opinion, Asukai discloses 1[b]: “receiving second data from a second sensor, wherein the second sensor is an external sensor.”

97. It is my opinion that Asukai discloses an external sensor separate from the eyewear, because Asukai discloses separate sensors. Asukai discloses that its sensors “may be implemented by another wearable device, a smartphone, or the like that is communicatively connected to the information processing device 10.” Ex.1005, [0069]. Specifically, the sensors in “the sensor unit 122 may be provided in the external device, or may be provided in both the information processing device 10a and the external device,” and “[t]he number of respective sensors may be plural.” *Id.*, [0097], [0103]; *see also id.*, [0072]. Therefore, there may be multiple sensors that are located on a device, which is separate from the eyewear. Asukai’s external sensor, located on, for example, a smartphone, includes a global navigation satellite system (GNSS), video camera in the room providing video data, wearable smart band providing pulse data, or a room microphone providing audio data (*id.*, [0197]), or the sensor leverages the native smartphone tools to provide location information (*id.*, [0097]). Thus, Asukai discloses first data that comes from a sensor incorporated into the eyewear and second data that comes from a different sensor external to the eyewear.

98. In my opinion, Asukai discloses receiving second data from the external sensor. Specifically, Asukai's communication unit 110 (green) "is connected to an external device in a wired or wirelessly [sic] manner, and transmits and receives data to and from the external device" (Ex.1005, [0093]), where that external device includes sensors from the sensor unit 122 (*id.*, [0103]).



Id., Fig.2 (annotated). Asukai's situation recognition unit 101 of control unit 100a (blue) uses "sensing data acquired from a sensor device (surveillance camera, surveillance microphone, or the like) installed in the vicinity...acquired by the information processing device 10a," "in addition to the sensing data sensed by the sensor unit 122." *Id.*, [0081]; *see also id.*, [0196]-[0197]. Because the external sensor device is installed in the vicinity, it is not located on the HMD with the first sensor and is separate. Next, the external-sensor-device data is received by

information processing device 10a. Therefore, Asukai discloses receiving second data from an external sensor.

4. Limitation 1[c]: “analyzing a state of the user, wherein the analyzing uses the first data and the second data;”

99. In my opinion, Asukai discloses or renders obvious 1[c]: “analyzing a state of the user, wherein the analyzing uses the first data and the second data.” I discussed this above in Section V, where I explained that a state includes health, wellbeing, safety, cognitive, physical, and emotional. The patent itself also describes a user’s “state” as including categories such as “health,” “wellbeing,” “safety,” “cognitive,” “physical,” and “emotional,” with “no limitation implied thereby.” Ex.1001, 23:19-24, Fig.21.

100. Asukai describes that “recognition of the situation or action of the user, and the emotion estimation” is performed with “various sensing data,” such as camera, microphone, acceleration, gyro, location, biological, gaze, and environmental-sensor data. Ex.1005, [0069]; *see also id.*, [0079], [0081]. Asukai explains that those sensors are provided in information processing device 10 or in another wearable device, smartphone, or the like communicatively connected to it. *Id.*, [0069], [0103]. That understanding is consistent with Asukai’s described architecture. Asukai states that situation recognition unit 101 uses nearby external-sensor data “in addition to” sensor-unit data, action recognition unit 102 recognizes

user action from sensor-unit data, and identification unit 103 “identifies a user emotion based on” the recognized situation and action. *Id.*, [0081], [0084]-[0085]. The emotion-recognition embodiment in Asukai also recognizes “user emotion” based on sensing data. *Id.*, [0120], [0124]-[0126]. In view of the ’339 patent’s broad use of “state” to include emotional state, a POSITA would have understood Asukai’s identification or recognition of emotion as corresponding to analysis of the user’s state. Asukai thus describes analyzing the user’s emotional state using both the first and second data.

101. Even if one were to read a particular Asukai embodiment as not expressly stating that the emotion analysis uses both eyewear-sensor data and external-sensor data, a POSITA would have been motivated to implement Asukai in that manner. The two categories of information were known, complementary sensor inputs for assessing a user’s emotional state, and using them together would have predictably increased the reliability of the analysis by allowing user-specific cues to be corroborated against surrounding contextual cues and by reducing ambiguity that could arise from either source alone. For example, user-worn data can reflect information associated with the user, such as motion, speech, gaze, biological signals, or head orientation, while external data can provide contextual information, such as location, room-camera information, or room-audio information. *See* Ex.1005, [0079]-[0085], [0097], [0124], [0196]-[0197]; *see also* Ex.1009, [0012],

[0045]-[0046]. Asukai's disclosed processing arrangement also points toward that implementation: situation recognition may account for external-sensor data in addition to sensor-unit data, action recognition uses sensor-unit data, and emotion identification is performed based on the recognized situation and action. Ex.1005, [0081], [0084]-[0085]. A POSITA would have reasonably expected success in implementing the analysis in this way because it would have used Asukai's disclosed sensor information with Asukai's existing recognition and emotion-identification units for their intended purposes, without requiring any material change to the control-unit architecture.

102. Moreover, using multiple sensing sources was a known technique for improving tracking reliability, accuracy, and robustness in wearable systems. *See, e.g.,* Ex.1008, 4:2-9. As discussed in Lisy, receiving data from multiple sensors provides for a more robust data set for analysis. *Id.* Sensors integrated into the HMD provide direct measurement of head position, orientation, audio, or visual information from the user's perspective, while external sensors provide additional environmental tracking, reference-point calibration, or verification data. External sensors can provide information that may be costly to integrate into the HMD from a weight and a power standpoint, such as GPS off a mobile phone or extensive GPU computational tasks. Combining these complementary sensing data would predictably improve overall system performance by reducing tracking drift,

compensating for occlusion or temporary signal degradation, and enabling cross-validation between sensor inputs. The combination would also integrate information from the environment to provide extra context to the experience being delivered to the user.

103. A POSITA also would have appreciated that redundant sensing architectures were commonly used in the art to improve accuracy and fault tolerance. References such as Tanaka discuss the benefits of redundant sensor data, pointing to the fact that multiple readings can provide more precise measurements. Ex.1009, [0012]. Incorporating both HMD-mounted sensors and external sensors means that the system would continue operating effectively even if one sensor became partially obstructed, misaligned, or noisy. *See* Ex.1008, 4:2-9, Figs.13-14; Ex.1009, [0012], [0045]-[0046]. The extra data also allows the system to compare and combine data from multiple perspectives, which increases confidence in positional and environmental determinations. This can be desirable in achieving the stated outcomes of both Asukai's and the '339 patent's embodiments. False positives and false negatives would ill serve users and degrade trust in, and acceptance of, the device.

104. Asukai's commuting and parenting examples are consistent with this understanding.

i. Commuting example

105. In my opinion, Asukai's commuting example discloses or renders obvious this limitation. This embodiment focuses on analyzing the user's state while they are walking or commuting. Specifically, Asukai describes "identification unit 103 [part of information processing device 10a] identifies that the user emotion is positive" (Ex.1005, [0114]) or "negative," for example, when "walking with his/her head down during commuting" (*id.*, [0115]-[0116]). The user's emotion falls within the claimed user "state," as I discussed above in Section V.

106. Asukai analyzes that emotion based on a combination of situation and action information derived from location information and acceleration-sensor information. Ex.1005, [0115]. As discussed for limitations 1[a]-1[b], the acceleration-sensor data corresponds to first data from the eyewear-incorporated sensor, and the location information corresponds to second data from an external sensor or device. §§VII.C.2-VII.C.3. Even if one were to read the commuting example as not expressly requiring that precise sensor placement, a POSITA would have understood Asukai to at least suggest that implementation because Asukai teaches providing sensors in the spectacle-type HMD and in communicatively connected external devices. A POSITA would have been motivated to use those data together because the location information identifies the commuting context, the acceleration-sensor information identifies the walking/head-down action, and

Asukai associates that combined situation/action information with a negative emotion. *See* Ex.1005, [0115]-[0116].

ii. Parenting example

107. In my opinion, Asukai's parenting example also renders this limitation obvious. Asukai's information processing system "recognize[s] [user emotion] based on sensing data of the user" (Ex.1005, [0120]) using an "emotion recognition unit 105 [that] recognizes a user emotion based on sensing data acquired by a sensor unit 122 and the like" (*id.*, [0124], Fig.7), which falls within the claimed user "state," as I discussed above in Section V.

108. Asukai analyzes a parent's negative emotion based on facial expression analysis from the room camera (external sensor), pulse-rate data from a smart band (external sensor), and voice data from a room microphone (external sensor) and/or the microphone of the HMD worn by the parent (eyewear sensor). Asukai explains:

Further, the action recognition unit 102 of the information processing device 10e can analyze an uttered voice of the parent collected from a microphone and recognize that the parent is scolding the child. Further, the emotion recognition unit 105 of the information processing device 10e can identify that the emotion of the parent is negative based on a facial expression of the parent analyzed from a video of a camera installed in the room, a pulse rate acquired from a smart band worn by the mother, or a voice recognition result of uttered voice data acquired from a microphone installed in the room or a microphone of an HMD worn by the parent.

Id., [0196]-[0197]; *see also id.*, [0077]-[0078]. Given Asukai's disclosure that sensor unit 122 may be provided in both the information processing device and an

external device, a POSITA would have been motivated to analyze the parent's negative emotion using HMD microphone data together with external room-camera, smart-band, and/or room-microphone data. Those inputs would provide complementary information about the same parenting episode, such as the parent's utterance, facial expression and room context, physiological arousal, and/or ambient speech or audio. *See id.*, [0103], [0196]-[0197]. Those complementary inputs would be useful because they allow the system to correlate the parent's speech with visual, physiological, and environmental context, thereby providing a more complete basis for identifying the parent's emotion.

5. Limitation 1[d]: “determining a context of the user, wherein determining uses the first data and the second data;”

109. In my opinion, Asukai discloses or renders obvious 1[d]: “determining a context of the user, wherein determining uses the first data and the second data.” I discussed this above in Section V, where I explained that context includes physical orientation, activity, or environment. The patent itself also describes the user's “context” as including “one or more of a physical orientation, an activity, and an environment that the user is in.” Ex.1001, 20:34-37, Fig.18.

110. In my opinion, Asukai's information processing device relies on both first data and second data to determine the user's context. Information processing device 10a includes situation recognition unit 101 and action recognition unit 102.

Situation recognition unit 101 “recognizes an environment in which the user is placed as a situation,” such as a “train, bus, car, bicycle, or the like,” or in a particular room or other surrounding environment, and uses nearby external-sensor data “in addition to” sensor unit 122 data. Ex.1005, [0079], [0081]. Action recognition unit 102 “recognizes the action of the user,” including actions such as “stand, sit, walk, run, lie, fall, or talk.” *Id.*, [0084]. Therefore, both of these recognition units are being used to determine the user’s environment, physical orientation, and activity, which are each qualities of the user’s context.

111. Even if one were to read a particular Asukai example as not expressly using first data from the eyewear-incorporated sensor and second data from the external sensor for context determination, a POSITA would have understood Asukai to at least suggest, and would have been motivated to use, that implementation because Asukai teaches using sensor data from both information processing device 10 and external devices. Ex.1005, [0069], [0081], [0103]. Those were known categories of sensor inputs that provided complementary information, and using them together would have predictably increased confidence in the context determination and reduced ambiguity that could result from relying on either source alone. User-worn data provides information specific to the user, such as motion, orientation, speech, or activity information, while external data provides complementary location, room, or environmental information. *See also* Ex.1009,

[0012], [0045]-[0046]. Asukai's own functional division further supports that implementation: situation recognition may take into account external-sensor data in addition to sensor-unit data, while action recognition uses sensor-unit data, such that the resulting context determination reflects both environmental/situation information and user action/activity information. Ex.1005, [0081], [0084]. A POSITA would have reasonably expected success because this would use Asukai's disclosed sensor inputs with Asukai's situation- and action-recognition units for their intended functions, without requiring a material change to Asukai's architecture.

112. Moreover, as discussed for limitation 1[c], using multiple sensing sources was a known technique for improving tracking reliability, accuracy, and robustness in wearable systems, and redundant sensing architectures were commonly used to improve accuracy and fault tolerance. §VII.C.4. A POSITA would have applied that same reasoning when determining context because eyewear-incorporated sensors and external sensors supply different but complementary perspectives on the user and the user's surroundings. Combining those inputs would predictably improve the reliability of Asukai's context determination by allowing the system to correlate user-specific activity information with external environmental information, thereby increasing confidence in the recognized context and reducing the risk that an ambiguous cue from one source would be misinterpreted.

i. Commuting example

113. In my opinion, Asukai's commuting example discloses or renders obvious this limitation. In the commuting example, the situation recognition unit 101 and action recognition unit 102 determine the user's context by recognizing first, from location information (Ex.1005, [0097]), that the user is "commuting" and second, from acceleration-sensor information (*id.*, [0069], [0115]), that "the user U2 is walking with his/her head down." *Id.*, [0115]; *see also id.*, [0077]-[0078]. The user's activity (walking), environment (commuting situation), and physical orientation (head down) each meets the claimed "context," as I discussed above in Section V. Thus, it is my opinion that Asukai uses first and second data to determine the user's context.

114. Even if one were to read the commuting example as not expressly requiring first data from an eyewear-incorporated sensor and second data from an external sensor, a POSITA would have been motivated to adopt such a sensor placement and data use because Asukai teaches providing sensors in the spectacle-type HMD and in communicatively connected external devices. *See* Ex.1005, [0069], [0072], [0103]. A POSITA would have been motivated to use those data together because location information identifies the commuting environment, while head-mounted acceleration information identifies the user's walking activity and downward head orientation. *See id.*, [0115]. Using those data together would

provide a more complete basis for recognizing the situation/action combination Asukai associates with the user's emotion.

ii. Parenting example

115. In my opinion, Asukai's parenting example also renders this limitation obvious. In the parenting example, the context being determined is the child's room and whether it is messy. *See* Ex.1001, 21:38-44 ("Context analysis 1802 includes...an environment that the user is in."). Asukai discloses a situation recognition unit 101 that helps a parent analyze that environment, such as whether a child's room was messy to begin with, and whether the child effectively cleaned the room. The situation recognition unit "analyze[s] a video of a camera provided in the child's room to recognize a degree of messiness... before cleaning (such as a state where things are scattered) and a state of the room after cleaning" and "compare[s] videos before and after cleaning by the child" to "calculate a degree of achievement of cleaning." Ex.1005, [0196]. If the result is that the child did not clean their room effectively, the parent may scold the child. At this point, action recognition unit 102 may "analyze an uttered voice of the parent collected from a microphone and recognize that the parent is scolding the child." *Id.*, [0197]. This processing is equivalent to determining the user's environment (*e.g.*, child's room), activity (*e.g.*, scolding), and physical orientation (*e.g.*, parent physically oriented toward child while scolding).

116. Because Asukai uses video-based analysis of the parent/child scene, voice-based recognition that the parent is scolding, and facial-expression or other sensor data to characterize the parent's conduct in the same scene (*see, e.g., id.*, [0197]), a POSITA would understand Asukai's information processing device to determine, or at least suggest determining, that the parent is physically oriented toward the child while scolding. A POSITA would have been motivated to make that determination because the parent's orientation toward the child would help confirm that the detected speech, facial expression, and conduct correspond to the parent-child interaction being analyzed, and would have had a reasonable expectation of success because that determination could be made using Asukai's video-based scene analysis and sensor inputs. By 2018, pose detection and You Only Look Once (YOLO) methods were open-source and being implemented. Carnegie Mellon University released OpenPose for human pose detection from cameras in 2017. *See* github.com-CMU-Perceptual-Computing-Lab-openpose_-2017-05-31_21-12-32 : CMU-Perceptual-Computing-Lab : Free Download, Borrow, and Streaming : Internet Archive.

117. Asukai determines the user's context based on video data from the room camera (external sensor) and voice data from the microphone of the HMD worn by the parent (eyewear sensor) and/or the room microphone (external sensor). Asukai explains:

Further, the action recognition unit 102 of the information processing device 10e can analyze an uttered voice of the parent collected from a microphone and recognize that the parent is scolding the child. Further, the emotion recognition unit 105 of the information processing device 10e can identify that the emotion of the parent is negative based on a facial expression of the parent analyzed from a video of a camera installed in the room,...or a voice recognition result of uttered voice data acquired from a microphone installed in the room or a microphone of an HMD worn by the parent.

Ex.1005, [0196]-[0197]. Given Asukai's disclosure that sensor unit 122 may be provided in both the information processing device and an external device, a POSITA would have been motivated to determine the parent's context using HMD microphone data together with external room-camera and/or room-microphone data. Those inputs would provide complementary information about the same parenting episode, including the parent's utterance or activity, the room condition and visual scene, and/or ambient speech or audio. *See id.*, [0103], [0196]-[0197]. Using those inputs together would be useful because it would allow the system to evaluate both the parent's own conduct and the surrounding room context when determining the parenting situation being analyzed. Accordingly, Asukai discloses determining the user's context (situation/action) using both the first data from the eyewear sensor and the second data from the external sensor.

6. Limitation 1[e]: “providing assistance to the user, wherein the assistance is in a form of feedback, and wherein the feedback is related to the state and the context.”

118. In my opinion, Asukai discloses or renders obvious 1[e]: “providing assistance to the user, wherein the assistance is in a form of feedback, and wherein the feedback is related to the state and the context.”

119. As I discussed for limitations 1[c]-1[d], Asukai analyzes the user’s state by identifying emotion and determines the user’s context by recognizing situation and action. §§VII.C.4-VII.C.5. Those analyses and determinations are used in Asukai to select and provide feedback. For example, Asukai’s processing flow recognizes situation and action, identifies positive or negative emotion, selects feedback, and provides the selected feedback. Ex.1005, Fig.5; *see also id.*, [0066]-[0067], [0085]-[0089]. Asukai further explains that feedback selection unit 104 selects feedback based on the result from identification unit 103, and Asukai’s feedback databases associate feedback with situation, action, positive or negative state, feedback type, and feedback content. *Id.*, [0089], Figs.4, 14, 17.

120. Asukai explains that through feedback “it is possible to make a state of a user better and improve quality of life,” by promoting an action, suppressing an action, or presenting a positive interpretation. Ex.1005, [0066]-[0067], Fig.5 (“PROVIDE FEEDBACK”). Asukai describes providing feedback in forms including sound, image, text, and tactile stimulation, such as through a user-worn

HMD. *Id.*, [0068], [0074], [0099]. In my opinion, Asukai therefore discloses providing assistance, in the form of feedback, related to the user's state and context.

i. Commuting example

121. It is my opinion that limitation 1[e] is satisfied in Asukai's commuting example. Before providing feedback to the user, Asukai must determine what kind of feedback to provide. When Asukai's user "takes the action of 'facing down & walking' in the situation of 'commuting' [the claimed context] and it is identified that the user emotion is negative [the claimed state]," the feedback selection unit 104 (part of the information processing device 10a) "presents a video in which a generally disliked insect is moving on the display unit 131 of the see-through HMD worn by the user U2, or plays an uncomfortable sound from the sound output unit 132 of the HMD." Ex.1005, [0116]; *see also id.*, [0115], [0117], [0099], [0085]-[0086] (discussing identification unit 103 includes emotion), [0089] (discussing feedback based on result from identification unit 103), Fig.14 (organizing different examples of feedback based on the emotion and context of the wearer). Presenting a generally disliked image like the insect would be an example of discouraging a negative action or state of the user. The feedback in that way is dependent on the state and context determinations of the disclosed system. When the system detects the negative state of walking with the user's head down and provides

discouragement to get the user to stop doing this, this feedback is related to the user's state (emotion) and context (commuting/walking/head down).

ii. Parenting example

122. It is also my opinion that limitation 1[e] is rendered obvious based on Asukai's parenting example. Before providing feedback to the parent, Asukai determines what kind of feedback to provide. In this example, based on recognizing the parent is scolding a child for not cleaning a room (context) and has a negative emotion (state), Asukai "presents, as reframing, an objective evaluation like 'although XX didn't clean the room perfectly, it's XX% cleaner than before cleaning.'"

By doing so, a parent's anger subsides, and a result of cleaning can be objectively grasped, such that it is possible to praise the child and teach areas to be improved. Further, the child does not remain scolded for cleaning, and thus it is possible to prevent the cleaning action from being suppressed.

Ex.1005, [0198]; *see also id.*, [0099], [0085]-[0086], [0089], Fig.14. That feedback is dependent on the determinations that are being made, because the parent is being given advice that is aimed at minimizing their negative condition/emotion and that is directly related to the context of the child's room. Therefore, this corresponds to presenting feedback related to the user's state (emotion) and context (child's room/scolding/parent physically oriented toward child while scolding) and assists

by presenting a positive interpretation of the situation or action to improve the parent's state or quality of life.

123. Even if one were to read the parenting example as not expressly delivering the reframing feedback through the parent's HMD, a POSITA would have understood Asukai to at least suggest that implementation. Asukai discloses providing sound, image, or text feedback through an HMD, and the parenting example describes both an HMD worn by the parent and reframing feedback that would be suitable for those feedback forms. *Id.*, [0068], [0074], [0099], [0197]-[0198]. A POSITA would have been motivated to provide the feedback through the parent's HMD because that device is already worn by the parent during the episode and provides a direct, user-specific interface for presenting the selected feedback.

124. Thus, it is my opinion that claim 1 is unpatentable based on Asukai.

D. Dependent Claim 2: “The method of claim 1, wherein a first element of the context is a physical orientation of the user.”

125. In my opinion, Asukai renders claim 2 unpatentable for the same reasons I discussed for limitation 1[d], where I explained that Asukai discloses or renders obvious the claimed determination of user context including physical orientation—such as a user lying or facing downward—and that a POSITA also would have found it obvious, in the parenting example, to configure Asukai's system to determine the parent's orientation toward the child. §VII.C.5.

E. Dependent Claim 3: “The method of claim 2, wherein a second element of the context is an activity that the user is doing.”

126. In my opinion, Asukai renders claim 3 unpatentable for the same reasons I discussed for limitation 1[d], where I explained that Asukai discloses the claimed determination of user context including an activity that the user is doing, including, for example, general action examples such as standing, sitting, walking, running, lying, falling, or talking, as well as the commuting example in which the user is walking and the parenting example in which the parent is scolding the child. §VII.C.5.

F. Dependent Claim 4: “The method of claim 2, wherein a third element of the context is the user’s environment.”

127. In my opinion, Asukai renders claim 4 unpatentable for the same reasons I discussed for limitation 1[d], where I explained that Asukai discloses the claimed determination of user context including the user’s environment, including, for example, the environment in which the user is placed, the commuting situation, and the child’s room in the parenting example. §VII.C.5.

G. Dependent Claim 5: “The method of claim 1, wherein the assistance is in a form of audio communication for the user.”

128. In my opinion, Asukai renders claim 5 unpatentable.

129. As I discussed for limitation 1[e], Asukai discloses providing assistance to the user in the form of feedback, such as “in a form of sound output.” §VII.C.6;

Ex.1005, [0074]. Asukai discloses sound output from a speaker. In Asukai, output unit 130 of information processing device 10a includes sound output unit 132, which “outputs an agent voice, music, a melody, a sound effect, and the like.” Ex.1005, [0099]. Asukai explains that “a sound may be presented from an earphone of a [HMD] ...worn by the user.” *Id.*, [0068]. Sound output from the earphones would be a form of audio communication for the user. Because information processing device 10a determines which feedback to provide, the feedback would be output from information processing device 10a through an earphone, thereby providing audio communication to the user. *Id.*, [0116].

H. Claim 6

1. Preamble 6[pre]: “A computer readable storage medium storing program code for causing a data processing system to perform steps comprising:”

130. I have been asked to assume the preamble of claim 6 is limiting. Under that assumption, in my opinion, Asukai discloses preamble 6[pre], which recites “[a] computer readable storage medium storing program code for causing a data processing system to perform steps comprising.”

131. Asukai discloses a computer program that can be used for data processing. Asukai discloses “a computer program can also be created for causing hardware such as a CPU, a ROM, and a RAM built in the information processing device 10 to function as the information processing device 10.” Ex.1005, [0201];

see also id., [0076]-[0078] (“Further, the control unit 100a may include a read only memory (ROM) that stores programs, arithmetic operation parameters, or the like to use, and a random access memory (RAM) that temporarily stores parameters varying as appropriate, or the like.”), [0101] (“The storage unit 140 is implemented by a read only memory (ROM) that stores programs, arithmetic operation parameters, or the like to be used in processing performed by the control unit 100a, and a random access memory (RAM) that temporarily stores parameters varying as appropriate, or the like.”). Asukai further states that “a computer-readable storage medium storing the computer program is also provided.” *Id.* Asukai likewise discloses that “a recording medium recording a program is provided that causes a computer to function as a control unit,” providing further proof that the recording medium stores program code for causing a data processing system to perform the recited steps. *Id.*, [0016]; *see also id.*, claim 15.

2. Limitations 6[a]-[b]: “receiving first data from a first sensor, the first sensor is incorporated into an eyewear device, the first sensor measures a parameter related to a user; receiving second data from a second sensor, wherein the second sensor is an external sensor;”

132. For the same reasons I discussed for limitations 1[a]-1[b], it is my opinion that Asukai discloses or renders obvious limitations 6[a]-6[b]. §§VII.C.2-VII.C.3.

3. Limitations 6[c]-[d]: “determining a context of the user, wherein the determining uses the first data and the second data; and providing assistance to the user, wherein the assistance is related to the context, and wherein the assistance is in a form of audio communication to the user.”

133. For the same reasons I discussed for limitations 1[d]-1[e] and claim 5, it is my opinion that Asukai renders obvious limitations 6[c]-6[d]. §§VII.C.5-VII.C.6, VII.G.

134. Thus, in my opinion, claim 6 is unpatentable based on Asukai.

I. Dependent Claims 7-9: “The computer readable storage medium of claim 6, wherein a first element of the context is a physical orientation of the user. The computer readable storage medium of claim 6, wherein a second element of the context is an activity that the user is doing. The computer readable storage medium of claim 6, wherein a third element of the context is the user’s environment.”

135. For the same reasons I discussed for claims 2-4, respectively, it is my opinion that Asukai renders claims 7-9 unpatentable. §§VII.D-VII.F.

J. Dependent Claim 10: “The computer readable storage medium of claim 6, further comprising: analyzing a state of the user, wherein the analyzing uses the first data and the assistance is related to both the state and the context.”

136. For the same reasons I discussed for claims 1 and 5, it is my opinion that Asukai renders claim 10 unpatentable. §§VII.C, VII.G.

K. Claim 11

1. Preamble 11[pre]: “A system for execution by a data processing system to provide assistance to a user through an eyewear device, comprising:”

137. I have been asked to assume the preamble of claim 11 is limiting. Under that assumption, in my opinion, Asukai discloses preamble 11[pre]: “[a] system for execution by a data processing system to provide assistance to a user through an eyewear device.”

138. As I discussed for preamble 1[pre], Asukai’s information processing device 10a provides assistance to a user through an eyewear device. §VII.C.1. Information processing device 10a executes data processing systems. Information processing device 10a is made up of input unit 120, output unit 130, storage unit 140, and control unit 100a that controls the overall operation of the information processing device 10a according to various programs. Control unit 100a therefore executes the disclosed assistance functions. Ex.1005, [0076]-[0078]; *see also id.*, [0073] (“Further, the agent system according to the present embodiment is an application executed on these output devices or a server, and may be implemented by a plurality of devices.”), [0101].

2. Limitation 11[a]: “a voice interface, the voice interface has a microphone and a speaker, the voice interface to receive user commands and to provide assistance to the user;”

139. In my opinion, Asukai discloses or renders obvious limitation 11[a]: “a voice interface, the voice interface has a microphone and a speaker, the voice interface to receive user commands and to provide assistance to the user.”

140. Asukai discloses a voice interface with a microphone and a speaker. In Asukai, “input unit 120 acquires input information for the information processing device 10a” and includes sensor unit 122 including a “microphone.” Ex.1005, [0095], [0097]. Therefore, Asukai discloses one side of a voice interface: a mode for accepting sound input through a microphone. “[O]utput unit 130 has a function of outputting feedback to the user” and includes sound output unit 132, such as a speaker. *Id.*, [0099]. “[S]ound output unit 132 outputs an agent voice, music, a melody, a sound effect, and the like,” and that “sound output unit 132 may be a directional speaker.” *Id.*; *see also id.*, [0068], [0072]. Asukai thus also discloses the other side of a voice interface: a mode for projecting sound output through a speaker. The fact that this system includes both a microphone and a speaker that can receive and output audio data, respectively, amounts to a voice interface.

141. Asukai discloses receiving user commands under the broad usage of the term in the '339 patent. According to the '339 patent, the voice interface “provides command and control of the telephone call by converting the user’s voice signals to

commands that the device uses,” including commands such as “select caller,” “place call,” “volume up,” “volume down,” and “end call.” Ex.1001, 14:18-24. Limitation 11[a] recites a voice interface “to receive user commands,” but does not require a particular command syntax, specific command, or particular downstream operation performed in response to the command. Asukai similarly receives user voice signals and uses them to drive system action. For example, in Asukai’s parenting example, action recognition unit 102 analyzes the parent’s uttered voice collected from a microphone to recognize that the parent is scolding the child, and the system uses that recognized voice-based action to select and provide reframing feedback. Ex.1005, [0197]-[0198]. In my opinion, under limitation 11[a]’s breadth, Asukai’s microphone-based interface—which collects user utterances that are used by the system to trigger responsive assistance—corresponds to the claimed voice interface configured to receive user commands.

142. Further, even if Asukai does not expressly disclose the voice interface receiving user commands, it is my opinion that a POSITA would have been motivated to implement Asukai’s microphone/speaker interface to receive spoken user commands and provide assistance. Asukai identifies known voice-agent functionality where an agent “recognizes an uttered voice of the user” and responds to a user “question or request,” and Asukai improves that agent framework by selecting feedback based on the user’s situation, action, and emotion. *Id.*, [0061]-

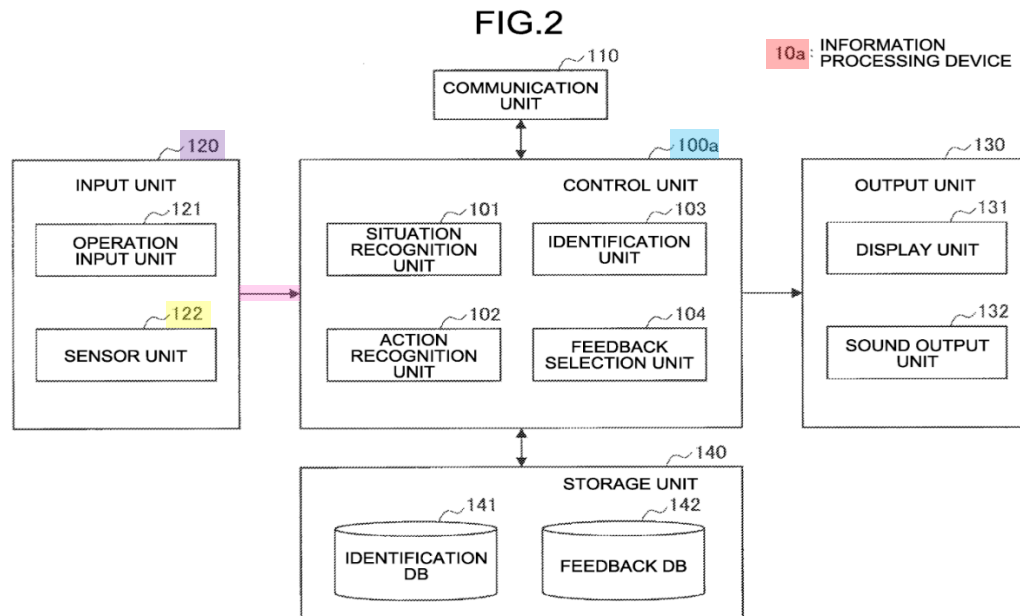
[0068]. Asukai further teaches that feedback processing may be terminated by “an explicit termination instruction from the user.” *Id.*, [0111], [0144]. In my opinion, a POSITA would have understood such user questions, requests, and instructions to be user commands. A POSITA also would have been motivated to receive those commands through Asukai’s disclosed HMD microphone and provide responsive assistance through Asukai’s disclosed sound output unit, including “agent voice” output, because spoken commands provide a natural hands-free way for a user to interact with a spectacle-type HMD that already includes audio-input and auditory-feedback components. *See id.*, [0068], [0072], [0097], [0099]. A POSITA would have had a reasonable expectation of success because the implementation would use Asukai’s disclosed microphone, HMD, and sound-output/feedback components for their ordinary purposes, without requiring any material change to Asukai’s feedback-assistance architecture. Voice assistants such as Siri and Google Assistant were already well known and understood by the priority date. In my opinion, implementing spoken user-command interaction in Asukai’s HMD agent system would have been no more than applying known voice-agent functionality to a similar HMD assistance system to obtain the predictable benefit of hands-free user control.

3. Limitation 11[b]: “a sensor data input, the sensor data input to receive sensor data;”

143. In my opinion, Asukai discloses limitation 11[b]: “a sensor data input, the sensor data input to receive sensor data.”

144. As I discussed for limitation 1[a], Asukai's input unit 120 includes sensor unit 122, which acquires input information for information processing device 10a and outputs that input information to control unit 100a. §VII.C.2. Asukai further explains that "sensor unit 122 is a sensor that senses various types of sensing data for recognizing a user situation or a user action," such as sensing data from a camera, microphone, acceleration sensor, biological sensor, location information acquisition unit, and an environment sensor. Ex.1005, [0097]; *see also* §VII.C.2.

145. Figure 2 illustrates input unit 120 (purple), including sensor unit 122 (yellow), providing such sensing data (pink) to control unit 100a (blue):



Id., Fig.2 (annotated); *see also id.*, [0095] ("The input unit 120 acquires information for the information processing device 10a and outputs the input information to the

control unit 100a. The input unit 120 includes, for example, an operation input unit 121 and the sensor unit 122.”).

4. Limitation 11[c]: “a processor, the processor is in electrical communication with the voice interface and the sensor data;”

146. In my opinion, Asukai discloses or renders obvious limitation 11[c]: “a processor, the processor is in electrical communication with the voice interface and the sensor data.”

147. Asukai’s control unit 100a contains the claimed processor. Asukai discloses that “control unit 100a functions as an arithmetic processing device and a control device, and controls an overall operation in [information processing device] 10a according to various programs.” Ex.1005, [0077]. Asukai further explains that “control unit 100a is implemented by an electronic circuit such as a central processing unit (CPU) or a microprocessor.” *Id.* Therefore, Asukai discloses that its control unit 100a includes a processor, in the form of either a CPU or a microprocessor.

148. Asukai also discloses that control unit 100a, which contains either a CPU or a microprocessor, is in communication with the claimed sensor-data input and the audio-input/output components. As I explained for limitations 11[a]-11[b], Asukai’s input unit 120 includes sensor unit 122, which may include a microphone and which acquires input information and outputs the input information to control

unit 100a. §§VII.K.2-VII.K.3. Control unit 100a uses information obtained from the sensors to perform functions including situation recognition, action recognition, and emotion identification. Ex.1005, [0078]-[0085]. Asukai further discloses that output unit 130 includes sound output unit 132 and “output[s] feedback to the user under the control of the control unit 100a.” *Id.*, [0099]. Figure 2 depicts input unit 120 and output unit 130 connected to control unit 100a within information processing device 10a. *Id.*, Fig.2.

149. A POSITA would understand Figure 2 to depict the functional units and sub-units of an information processing device as operatively connected to one another. In that context, the depicted relationships between the units and their constituent sub-units, together with Asukai’s disclosure that input information is output to control unit 100a and that output unit 130 operates under the control of control unit 100a, would be understood to include electrical or electronic signal, data, and control connections. Thus, a POSITA would understand Asukai’s processor to be in electrical communication with the sensor-data input and audio-input/output components.

150. Even if Asukai does not expressly use the words “electrical communication” to describe the connections between control unit 100a, input unit 120, and output unit 130, a POSITA would have understood those connections to include electrical or electronic communication, or at minimum would have found

such communication obvious. Asukai discloses that control unit 100a includes either a CPU or a microprocessor and performs recognition and feedback functions based on input information acquired by input unit 120, including sensor unit 122. Asukai further discloses that control unit 100a controls output unit 130, including sound output unit 132, to output feedback to the user. *Id.*, [0077]-[0085], [0095], [0097], [0099], Fig.2. A POSITA would have understood that the CPU or microprocessor in control unit 100a would receive electrical signals or data representing sensor and/or microphone input and would provide electrical signals or data/control information to the sound output unit and/or speaker to generate the disclosed feedback. Without such electrical or electronic signal, data, and control communication between the processor, the sensor/microphone input components, and the audio output components, Asukai's disclosed recognition and feedback functions could not operate. In my opinion, implementing those ordinary electrical, electronic, signal, data, and control connections between a processor, sensor inputs, and audio input/output components would have been a predictable use of known processor-interface connections for their ordinary functions.

5. Limitation 11[d]: “a computer program for processing the sensor data, the computer program and the processor to cause the data processing system to perform steps comprising:”

151. In my opinion, Asukai discloses limitation 11[d]: “a computer program for processing the sensor data, the computer program and the processor to cause the data processing system to perform steps comprising.”

152. As I discussed for preamble 6[pre], Asukai discloses a computer program that causes a computer to function as the disclosed control unit, and, as I discussed for limitation 11[c], control unit 100a includes a CPU or microprocessor that controls the overall operation of information processing device 10a according to various programs. §§VII.H.1, VII.K.4. For the same reasons I discussed for limitations 1[c]-1[d], Asukai’s computer program and processor cause the data processing system to perform the recited processing steps. §§VII.C.4-VII.C.5.

- 6. Limitations 11[e]-11[i]: “receiving first data from a first sensor, the first sensor is incorporated into the eyewear device, the first sensor measures a parameter related to the user; receiving second data from a second sensor, wherein the second sensor is an external sensor; determining a context for the user, wherein the determining uses the first data and the second data; analyzing a state of the user, wherein the analyzing uses the first data and the second data; and providing assistance to the user, the assistance is related to the context and the state.”**

153. For the same reasons I discussed for limitations 1[a]-1[e], Asukai discloses or renders obvious limitations 11[e]-11[i]. §§VII.C.2-VII.C.6.

154. Thus, in my opinion, claim 11 is unpatentable based on Asukai.

- L. Dependent Claim 12: “The system of claim 11, wherein the analyzing considers a category selected from the group consisting of health, wellbeing, safety, cognitive, physical, and emotional.”**

155. In my opinion, Asukai renders claim 12 unpatentable.

156. As I discussed for limitation 1[c], and incorporated through claim 11, it is my opinion that Asukai renders obvious analyzing the user’s emotional state. §§VII.C.4, VII.K. Asukai discloses identifying the user’s emotion as positive or negative. Ex.1005, [0021], [0135] (“Note that the identification unit 103 may perform the P/N identification based on the emotion recognition result obtained by the emotion recognition unit 105.”).

157. Further, in Asukai's commuting and parenting examples, the analyzed state includes the user's state (emotion), as I explained for limitation 1[c]. §VII.C.4; *see also* Ex.1005, [0081], [0103], [0105], [0115]-[0117]. In the commuting example, the user's emotion is determined at least based on the angle of the head (whether it is down). Ex.1005, [0116] ("Since it is easy to feel depressed when walking with his/her head down..."), [0197] ("the emotion recognition unit 105 of the information processing device 10e can identify that the emotion of the parent is negative based on a facial expression of the parent analyzed from a video of a camera installed in the room...").

M. Dependent Claim 13: "The system of claim 11, wherein the assistance is designed to help the user correct a negative condition."

158. In my opinion, Asukai renders claim 13 unpatentable.

159. As I discussed for claim 12, Asukai discloses analyzing the user's emotional state and identifying it as negative. §VII.L. Asukai also explains that "an excessive negative emotion leads to stress and may adversely affect an immune system or the like." Ex.1005, [0061]. That is a negative condition within the meaning of claim 13. According to the '339 patent:

Negative conditions are conditions in which some detriment to the user might result either imminently or at some future time, such as, but not limited to, lack of sufficient frequency of movement or maintaining a stationary position of the head for too long a period of time. In this example, the detriment is an impairment to the user's biomechanical function.

Ex.1001, 20:57-61.

160. In my opinion, Asukai further discloses providing assistance that is designed to correct a negative condition. One of Asukai's purposes is "to make a state of a user better and improve quality of life by providing feedback corresponding to an emotion of the user." Ex.1005, [0066]. When Asukai determines that the user's emotion is negative, feedback selection unit 104 selects feedback to "make [the] state of a user better" by "suppress[ing] the action" of the user. *Id.*, [0066], [0090]. Therefore, Asukai seeks to correct a negative condition by limiting that condition and providing feedback that will help a user avoid the negative condition, and thus, correct the condition. Asukai further discloses providing "reframing" feedback that "presents a positive interpretation with respect to a situation or action that the user perceives as negative." *Id.*, [0067]-[0068]. In both situations, Asukai provides helpful guidance to change a user's state for the better and improve the user's emotional state. Therefore, Asukai discloses feedback that is expressly designed to improve the user's negative emotional state and thereby help correct the underlying negative condition.

161. In Asukai's commuting example, the control unit provides assistance to suppress the action of commuting while walking with his/her head down. Asukai provides:

As such, as the negative reinforcer FB, an unpleasant sound is played, an unpleasant vibration is applied, a video of a disliked animal is

played, or a favorite character says a negative word, such that the action of “walking with his/her head down” of the user U2 can be weakened, that is, suppressed.

Id., [0115]-[0117]; *see also id.*, [0099], [0081], [0103], [0105], [0115]-[0117].

162. In Asukai’s parenting example, the control unit provides assistance such as reframing feedback to correct the negative condition, as I discussed above in Section VII.C.6. Ex.1005, [0197]-[0198]; *see also id.*, [0099].

N. Dependent Claim 14: “The system of claim 11, wherein the assistance is designed to help the user by encouraging a positive condition.”

163. In my opinion, Asukai renders claim 14 unpatentable.

164. As I discussed for claim 12, Asukai discloses analyzing the user’s emotional state and identifying it as positive. §VII.L. Asukai explains that “having a positive emotion has a good influence on the immune system or the like, and can be said as a more favorable state.” Ex.1005, [0061]. That is a positive condition within the meaning of claim 14. *See also* Ex.1001, 20:63-66 (“Assistance can also be assistance that affirms a positive condition, such as acknowledgment that sufficient head movement is occurring, or that sufficient physical activity is occurring.”). Therefore, Asukai identifies a positive condition.

165. It is my opinion that Asukai further discloses providing assistance designed to encourage a positive condition. According to Asukai, “it is possible to make a state of a user better and improve quality of life by providing feedback

corresponding to an emotion of the user.” Ex.1005, [0066]. When the user’s emotion is positive, feedback selection unit 104 selects feedback to “reinforce the action” of the user. *Id.*, [0090]. This will encourage the user to maintain that action. Asukai likewise discloses positive feedback promoting a user’s action. *Id.*, [0014], [0067]. This feedback is expressly designed to encourage and reinforce the positive state of the user.

166. In the commuting example, when the user is walking with his/her head up and in a positive emotional state, Asukai’s control unit provides assistance by reinforcing that action by playing favorite music. *Id.*, [0114], [0116]-[0117]; *see also id.*, [0099], [0081], [0103], [0105], [0115]-[0117] (“In addition, when walking while keeping his/her head up, reinforcement such as playing a favorite music is performed as feedback, the action of walking while keeping his/her head up is promoted, and the action of walking with his/her head down can be further suppressed.”). The user will want to continue hearing the music, so they will continue walking with their head up, thereby encouraging the positive condition.

167. In the parenting example, Asukai’s control unit provides assistance including reframing feedback to encourage a positive condition. *Id.*, [0197]-[0198]; *see also id.*, [0099]. Asukai explains that this reframing “presents a positive interpretation with respect to a situation or action that the user perceives as

negative,” as I discussed above in Section VII.C.6. Ex.1005, [0067]-[0068].

Specifically, Asukai discloses:

As illustrated in FIG. 1, for example, when the user forgot to eat a dessert (for example, a food with a short shelf life such as cream puff) before going out, and thus has a negative emotion, the agent presents a positive interpretation such as “I’m sure your child is happily eating it!” or “I’m sure your child will find it and eat it, thinking dad left it for me!”, thereby making it possible to turn a state of the user into a positive state without changing the situation or action.

Id.

O. Dependent Claim 15: “The system of claim 13, the system further comprising: a device, the device is external to the eyewear device, the device is in electrical communication with the eyewear device and the device is used to provide the assistance to the user.”

168. In my opinion, Asukai renders claim 15 unpatentable.

169. As I discussed for preamble 11[pre], Asukai’s information processing device may be implemented by an eyewear-type HMD. §VII.K.1. Asukai also discloses its system “may be implemented by a plurality of devices” and that “an arbitrary output device may provide feedback as appropriate.” Ex.1005, [0073]. For example, “while the user is at home, a speaker device or display device...in the room mainly provides the feedback, but while the user is outside the home, a smartphone, a smart band, a smart earphone, or the like mainly provides the feedback.” *Id.* The speaker device, display device, smartphone, smart band, and smart earphone are all examples of the arbitrary output devices. As I explained for limitation 1[e], the

feedback provided through those output devices is the claimed assistance because Asukai selects and presents feedback based on the user's recognized situation/action and emotion, which correspond to the user's context and state. §VII.C.6. All of these devices are separate from the eyewear-type HMD. Therefore, Asukai discloses an external device. Asukai also discloses that communication unit 110 "is connected to an external device in a wired...manner" and "transmits and receives data to and from the external device." Ex.1005, [0093]. Because communication unit 110 is located on the eyewear, the external devices are in electrical communication with the eyewear. *Id.*, [0076]. Therefore, Asukai discloses an external device, external to the eyewear device, that is in electrical communication with the eyewear device and used to provide the assistance to the user.

P. Dependent Claim 16: "The system of claim 11, the steps further comprising: receiving third data from a plurality of embedded sensors, the determining uses both the first data and the third data and the analyzing uses both the first data and the third data."

170. In my opinion, Asukai renders claim 16 obvious.

171. As I discussed for limitations 11[b] and 1[a], "[t]he number of respective sensors [in sensor unit 122] may be plural." §§VII.K.3, VII.C.2. Asukai describes that information processing device 10 may be implemented as a spectacle-type HMD, that sensor unit 122 may be included in information processing device 10, and that "[t]he number of respective sensors may be plural." Ex.1005, [0069],

[0072], [0097], [0103]. Asukai further explains sensor unit 122 as having multiple types of sensors, such as a camera, microphone, acceleration sensor, gyro sensor, gaze sensor, location-information acquisition unit, biological sensor, and environmental sensor. *Id.*, [0069], [0097]. As a result, when information processing device 10 is implemented as the spectacle-type HMD, Asukai teaches receiving data from multiple sensors incorporated in the HMD.³

172. Asukai also teaches using data obtained from the embedded sensors to determine context and analyze state. As I discussed for limitation 1[d], Asukai's situation recognition unit 101 and action recognition unit 102 use sensor information to recognize the user's situation and action, which correspond to determining context. §VII.C.5. Asukai's identification unit 103 then identifies the user's emotion based on the recognized situation and action, which corresponds to analyzing the user's state. §VII.C.4. Asukai's emotion-recognition embodiment is consistent with that understanding because it recognizes user emotion based on sensing data acquired by sensor unit 122 "and the like." Ex.1005, [0120], [0124]-[0126]. In this arrangement, the first data may be data from one embedded HMD sensor, such as an acceleration sensor or HMD microphone, while the third data may

³ The '339 patent discloses that "embedded" sensors are "embedded in **an eyewear device.**" Ex.1001, 23:13-14(emphasis added).

be data from other embedded HMD sensors, such as camera, gaze, gyro, and/or biological sensors.

173. Even if one were to read Asukai as not expressly stating in each example that the same first and third data are used for both context determination and state analysis, a POSITA would have been motivated to adopt that implementation. Asukai describes a multi-sensor HMD architecture in which sensing data is used to recognize situation, action, and emotion. A POSITA would have been motivated to use multiple embedded HMD sensors together because those sensors provide complementary information about the user, including motion, orientation, gaze, speech, visual environment, and biological condition. *See id.*, [0069], [0079]-[0085], [0097], [0124]-[0126]. Using the same sensor data for both context determination and state analysis also would have been technically sensible because Asukai's state analysis depends on the recognized situation and action, so the same user-specific sensor information would be relevant to both operations. A POSITA would have reasonably expected success because the implementation would use Asukai's embedded sensors and recognition units for their intended purposes, and would predictably improve the accuracy and reliability of both context determination and state analysis.

174. Asukai's commuting example illustrates this point. In that example, the first data may be acceleration-sensor data, and the third data may include data

from additional embedded HMD sensors, such as gaze, camera, gyro, and biological sensors. A POSITA would have been motivated to use that same first and third data for both determining context and analyzing state. For context, acceleration data together with gaze, camera, and/or gyro data would identify or confirm the user's walking activity and downward head or eye orientation while commuting. *See id.*, [0115]. For state, that same data would support identifying a negative emotion because Asukai associates walking with the head down during commuting with negative emotion and also teaches emotion recognition from sensing data, including biological, gaze/eye-movement, and brain-wave data. *See id.*, [0097], [0115]-[0116], [0124]-[0126].

175. In my opinion, a POSITA would also understand that using camera and biological-sensor data, in addition to the acceleration-sensor data, to confirm the user's gaze would lead to more precise determinations of whether the user is looking down while walking (context) and experiencing a negative emotion (state). Using multiple data points to create a fuller picture was a known concept at the time of the priority date, as evidenced by references such as Lisy and Tanaka. *See, e.g.*, Ex.1008, 4:2-9; Ex.1009, [0012].

176. Asukai's parenting example supports the same understanding. In that example, the first data may be voice data from the HMD microphone worn by the parent, and the third data may include data from additional embedded HMD sensors,

such as biological, gaze, camera, gyro, and/or orientation sensors. *See* Ex.1005, [0069], [0097], [0103]. A POSITA would have been motivated to use those data together for both context determination and state analysis. For context, the HMD microphone data would help recognize that the parent is scolding, while embedded camera, gaze, gyro, and/or orientation data would help determine the parent's conduct, physical orientation, and surrounding child-room scene. *See id.*, [0196]-[0197]. For state, the same HMD microphone data and embedded biological, gaze, and/or other sensor data would help identify the parent's negative emotion, consistent with Asukai's use of uttered-voice data, facial-expression analysis, and pulse-rate data. *See id.*, [0197]. For example, it is my opinion that a POSITA would understand that biological data such as the parent's heartbeat or sweating (third data) would similarly help determine whether the parent is experiencing a negative emotion while scolding. If a person is scolding, it is likely that their heartbeat and sweating would increase. Using data from both a microphone and biological sensors would make the context (scolding) and state (emotion) determinations more precise. Further, data that takes different forms such as voice data as opposed to heartbeat data would provide a fuller picture of the parent's condition, which can only improve this determination process.

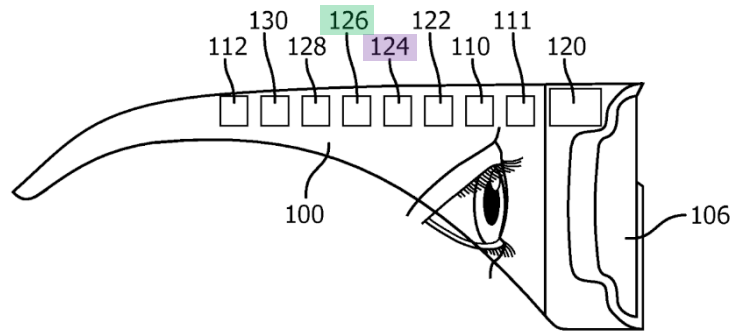
177. As a result, in my opinion, Asukai discloses, or at minimum would have suggested, receiving third data from a plurality of embedded sensors and using both

the first data and the same third data to determine the user's context and analyze the user's state.

**VIII. OPINIONS ON GROUND 2: CLAIMS 11-16 ARE UNPATENTABLE
BASED ON ASUKAI AND SHAN**

178. As I discussed for Ground 1, Asukai itself discloses or renders obvious the limitations of claims 11-16. §§VII.K-VII.P. Even if one were to read Asukai as not expressly disclosing a “voice interface to receive user commands,” a POSITA would have been motivated to implement Asukai's HMD-based microphone/speaker voice interface so that it receives user commands in view of Shan.

179. Shan describes “a head-mountable computing device comprising at least one display module and a processor for controlling the at least one display module to display information on the display module in response to an identified wearer's activity.” Ex.1007, [0001]. Shan's head-mountable computing device also includes “a microphone 124 [purple] for capturing the wearer's spoken instruction or the conversations...[and] a speaker 126 [green] for allowing the wearer to hear the audio information generated by the head-mountable computing device 100.” *Id.*, [0037]; *see also id.*, Abstract, [0007]-[0014], [0031]-[0039].



Id., Fig.2 (annotated). According to Shan, the wearer may control the head-mountable device through spoken or audio commands. For example, Shan explains that a starting command may be triggered by “spoken instruction via the microphone 124,” and the wearer may choose assistance information by “sending audio commands to the head-mountable computing device 100.” *Id.*, [0041], [0051].

A. Motivation to Combine

180. In my opinion, a POSITA would have been motivated to configure Asukai’s HMD-based microphone/speaker voice interface to receive spoken user commands, as described by Shan. Both Asukai and Shan describe head-mounted devices that provide assistance to the user based on the user’s activity or context, and spoken commands would provide a natural, hands-free way for the user to interact with that type of HMD assistance system. *See* Ex.1005, [0068], [0072], [0097], [0099]; Ex.1007, [0001], [0010]-[0014], [0037], [0041], [0051]. A POSITA would have viewed Shan’s spoken-instruction functionality as compatible with Asukai’s system because Asukai already includes voice input/output capabilities in an HMD environment, and Shan uses similar voice-based control in a head-mounted

assistance device. From a technical perspective, adding Shan's spoken-command functionality to Asukai would have been a predictable way to make Asukai's HMD easier to operate by permitting the wearer to issue instructions without using a separate manual input mechanism, which is particularly advantageous in a portable, hands-free eyewear system. A POSITA would have appreciated that spoken instructions reduce manual input, which in turn improves portability, safety, and user experience. The proposed combination would be viewed as no more than the application of a known speech-input feature to a known voice-enabled eyewear system, to achieve the predictable benefit of improved voice-command functionality.

B. Reasonable Expectation of Success

181. A POSITA would have had a reasonable expectation of success because the combination would use Shan's known spoken-command functionality with Asukai's disclosed HMD microphone, speaker, or sound-output unit, and feedback-assistance architecture for their ordinary purposes. These are well-understood and widely used technologies operating according to their established functions. By 2018, spoken-command capture techniques and speech-recognition systems were commonly implemented in portable consumer electronics and wearable computing devices. Because both systems rely upon conventional audio acquisition and speech-processing functionality, a POSITA would have reasonably expected that Shan's

spoken-instruction capture features could be incorporated into Asukai using routine engineering methods.

182. In my opinion, adding Shan's spoken-instruction functionality would not have required a substantial redesign of Asukai's system or altered how Asukai's HMD provides user assistance. Asukai already provides an eyewear HMD that contains voice-interface components and processing architecture, so a POSITA would have incorporated Shan's spoken-command functionality using ordinary audio-capture, speech-processing, and command-interpretation techniques. The resulting system would have operated in the expected manner: receiving the wearer's spoken instructions through the HMD voice interface and processing those instructions as user commands. A POSITA would have known how to integrate such components using conventional interfaces, including audio processing circuitry, speech-recognition modules, and command interpretation algorithms. The combination would have represented nothing more than the predictable use of prior-art elements according to their established functions to obtain the expected result of an eyewear HMD capable of capturing and processing the wearer's spoken instructions through its existing voice interface.

183. For these reasons, the combination of Asukai and Shan renders claim 11 obvious. I also understand claims 12-16 to be obvious for the same reasons I discussed for Ground 1 because Shan is relied on for the "voice interface to receive

user commands” limitation of 11[a], and the combination does not materially change the Asukai-based analysis of the remaining limitations. §§VII.L-VII.P.

**IX. OPINIONS ON GROUND 3: CLAIMS 1-10 ARE UNPATENTABLE
BASED ON LIU**

184. In my opinion, Liu renders claims 1-10 unpatentable. Liu describes combining data collected from sensors on smart eyewear 110 (first sensor) and from sensors on a terminal 130 (second sensor). Liu goes on to describe determining the user’s status, safety, and emergency state (any of which meets the claimed state) as well as the user’s activity, environment, and physical orientation (any of which meets the claimed context).

A. Motivation to Combine

185. A POSITA would be motivated to implement Liu’s determination of state and context from data collected from sensors on both the eyewear (first sensor) and terminal (second sensor), because combining multiple streams of sensor data from different sources improves the accuracy, reliability, and completeness of user-state and contextual determinations. Liu already teaches that both the eyewear device and the external terminal collect relevant user-related information, including biosensor data, motion and position data, physiological data, environmental data, and location data, and further teaches determining a user’s state and context from such information. Liu also already states that the terminal “form[s] a binding relationship with smart eyewear 110” and “serve[s] to extend and expand the

functions of smart eyewear 110” by “shar[ing] the burden of collecting, storing, and/or processing data.” Ex.1006, [0023]. A POSITA would have understood that the data generated by the eyewear and terminal are complementary because by virtue of each device’s different physical location, even if the eyewear and terminal collect the same type of data (*e.g.*, physical orientation, physiological information, location), the devices possess different sensing capabilities, perspectives, and processing resources. Accordingly, it would have been obvious to utilize data collected from both the eyewear and the external terminal together when determining the user’s state and context in order to obtain a more robust and accurate assessment than could be achieved using either device alone.

186. Further, at the relevant timeframe, multimodal sensor fusion between eyewear and companion terminals was a known and predictable design approach for improving contextual awareness and user monitoring systems. A POSITA would have recognized that combining sensor data from the eyewear and terminal would reduce ambiguity, compensate for missing or noisy measurements from one device, and improve confidence in inferred user conditions or contextual determinations. For example, a POSITA would have known to corroborate motion data captured by the eyewear with positional or environmental information from the terminal, while physiological or biosensor information from one device could be interpreted in light of similar data from the other. Because Liu already contemplates both devices

participating in the collection of relevant data and in determining user state and context, using data from both devices together would have been nothing more than the predictable use of known sensor-fusion techniques to improve system performance.

B. Reasonable Expectation of Success

187. A POSITA also would have had a reasonable expectation of success in combining data from the eyewear and terminal for determining the user's state and context. Liu discloses that both the eyewear and the external terminal are part of the same interconnected sports management system 100 (*see, e.g.*, Ex.1006, [0023]), and both are configured to obtain, process, and communicate user-related information. Liu's references to collecting similar categories of information across both devices (*see, e.g.*, Ex.1006, [0024] (both eyewear and terminal determine position and location), [0022] and [0034] (both eyewear and terminal have biosensors to detect physiological conditions and reactions), [0022] and [0036] (both eyewear and terminal have cameras for filming the physical environment)) demonstrate that the system architecture already supported interoperable data acquisition and exchange. Because the eyewear and terminal were already designed to communicate and participate in user state monitoring and contextual evaluation, a POSITA would have reasonably expected that jointly processing the respective

datasets would operate successfully using conventional communication and data-processing techniques.

188. Moreover, the proposed combination would not have required any unpredictable modification to Liu's system or any departure from known technological principles. Sensor fusion and aggregation of data from multiple connected devices were routine and widely used techniques in wearable computing and mobile-device ecosystems at the time. The combination merely involves using known data inputs from known devices for their established purpose of improving contextual and state determination. A POSITA therefore would have expected the combined use of eyewear-derived data and terminal-derived data to predictably yield improved analysis of user state and determination of user context.

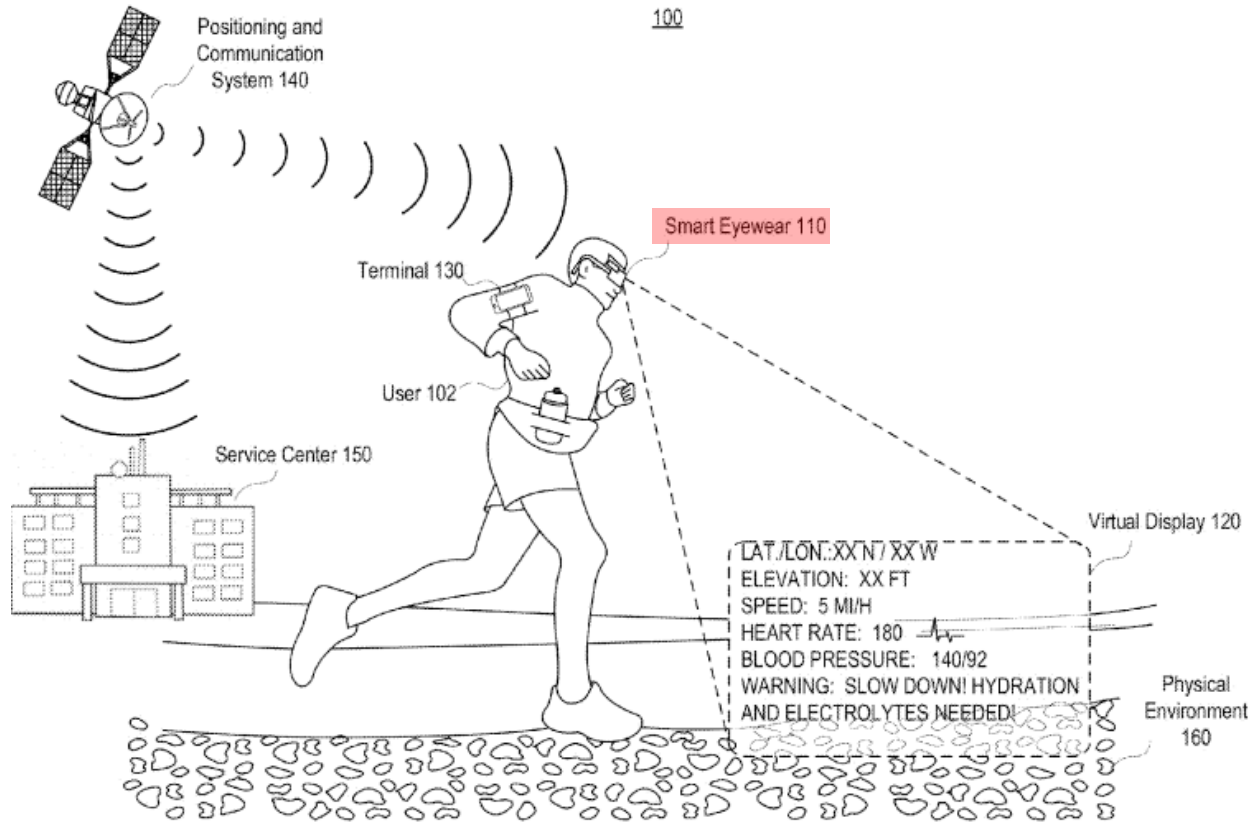
C. Claim 1

1. Preamble 1[pre]: "A method to provide assistance to a user through an eyewear device, comprising;"

189. I have been asked to assume the preamble of claim 1 is limiting. Under that assumption, in my opinion, Liu discloses preamble 1[pre].

190. Liu discloses "a sports management system 100" where "smart eyewear 110" (red) is worn by "user 102" and performs a sports management method. Ex.1006, [0016], [0007]; *see also id.*, [0014], [0017]-[0018], [0058], Title,

Fig.5(showing flowchart of sports management method performed by smart eyewear 110).



Id., Fig.1 (annotated).

191. The method in Liu provides assistance to the user through the smart eyewear 110 (claimed eyewear device) by “provid[ing] alert, advice, navigation, and rescue assistance to the user, so as to ensure the exercise safety for the user.” *Id.*, [0062]. Specifically, Liu provides this assistance by “monitor[ing] and collect[ing] information regarding the physiological reactions of a user 102” and “analyz[ing] the physiological reactions in real time and provid[ing] health and safety-related advice to user 102.” *Id.*, [0016]. Liu also describes “collect[ing] information

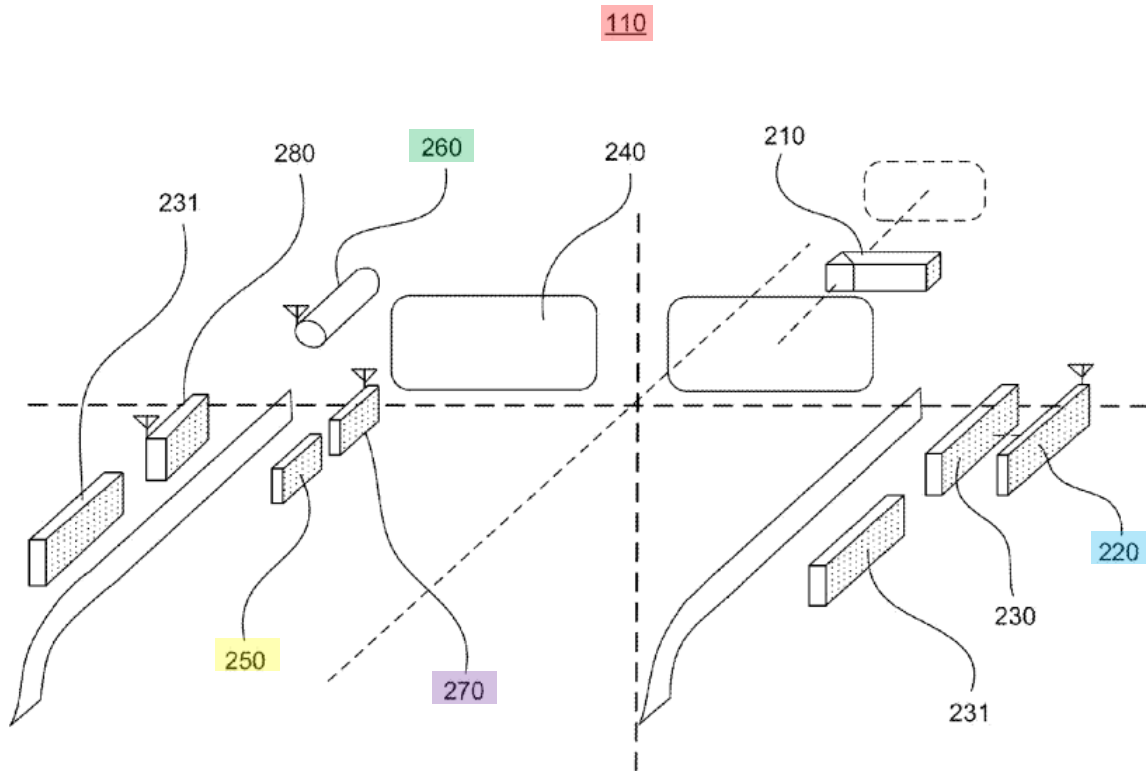
regarding the surrounding physical environment and the position of user 102, and provid[ing] navigation for user 102,” as well as “enabl[ing] the communication between user 102 and a third party, such as a rescue team or a doctor, so as to facilitate the search, rescue, and medical treatment of user 102 during an emergency.” *Id.* These examples demonstrate assistance tailored to the user’s specific circumstances. Liu uses the eyewear 110 to communicate this assistance to the user by “display[ing] a combination of graphics and texts to describe user 102’s real-time physiological conditions, to provide exercise advices [sic], to indicate user 102’s location, etc.” and when the user has over exercised and is dehydrated, “display[ing] a warning message alerting user 102 to slow down and take water and electrolytes.” *Id.*, [0018]. Therefore, Liu uses the eyewear’s display to communicate messages to the user to keep them safe and healthy, thus providing assistance.

2. Limitation 1[a]: “receiving first data from a first sensor, the first sensor is incorporated into the eyewear device, the first sensor measures a parameter related to the user;”

192. In my opinion, Liu discloses limitation 1[a].

193. Liu discloses a first sensor and first data. Liu’s smart eyewear 110 (red) includes a sensor module 250 (yellow) that includes “one or more biosensors configured to generate various signals quantitatively indicative of the [user’s] physiological conditions” (Ex.1006, [0034]) and “one or more sensors to provide

status assessments of the [user's] movement” including the eyewear's position, orientation, acceleration, or velocity (*id.*, [0035]). *Id.*, Fig.2(reproduced below), [0026]. Any of these sensors in sensor module 250 would, in my opinion, serve as a first sensor. Liu's smart eyewear 110 further includes an imaging module 260 (green), which includes an “outward-facing camera/image sensor to generate image data about physical environment 160” or “user-facing eye tracking sensors configured to monitor and/or track a viewing direction of user 102 based on the position of one or both of user 102's eyes.” *Id.*, [0036]-[0037]. In my opinion, any of these sensors in imaging module 260, the camera/image sensors or eye tracking sensors, would also serve as a first sensor. Liu's smart eyewear 110 further includes a locating module 270 (purple), which “include[s] any device capable of providing a signal that indicates the location of smart eyewear 110,” such as a GNSS receiver or a GPS device, and provides data to improve accuracy of position and velocity computations. *Id.*, [0038]. In my opinion, locating module 270 could also serve as a first sensor.



Id., Fig.2 (annotated).

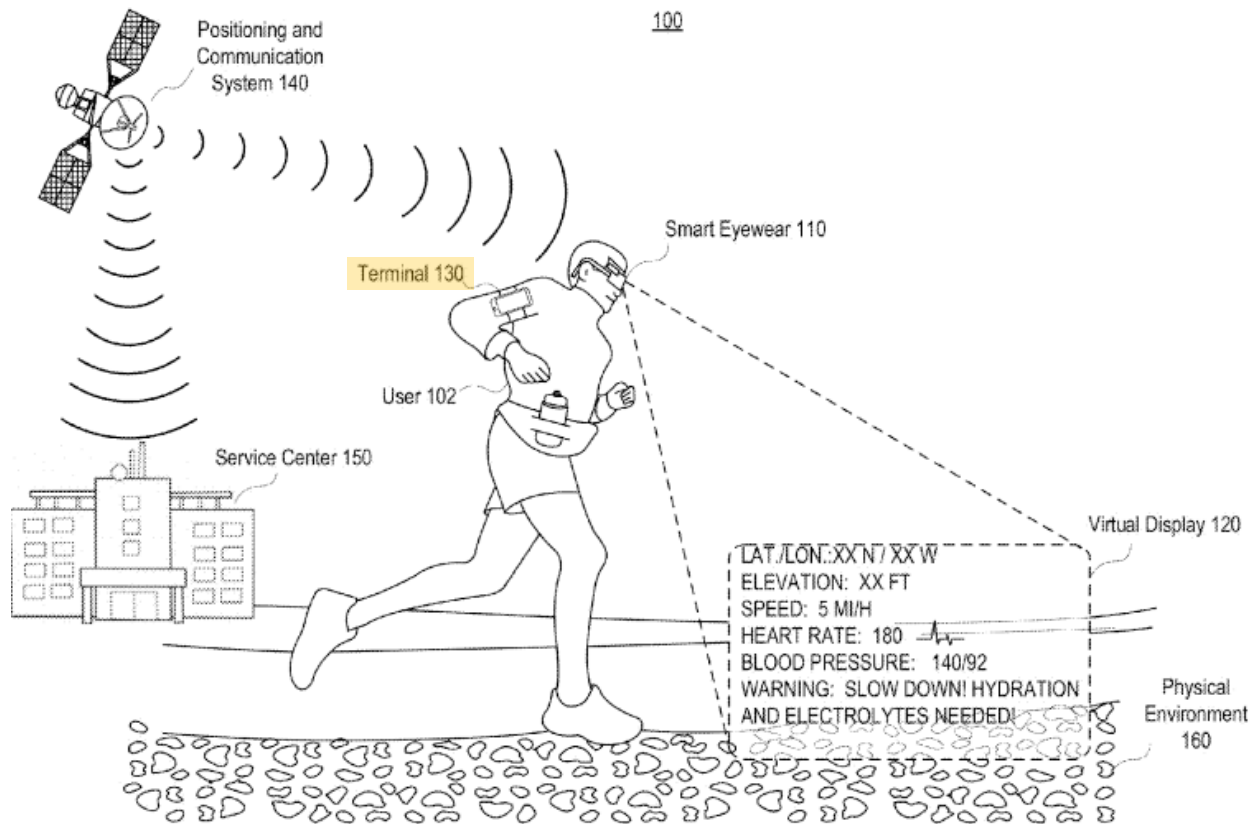
194. Thus, it is my opinion that any of these biosensors, status assessment sensors, cameras/image sensors, or locating devices meet the claimed first sensor and measure a parameter related to the user. These parameters include the user's physiological parameters, status assessments, location, and eye tracking. These sensors are incorporated into eyewear 110 because they are “attached, for example, to a temple or brow bar of the frame” (*id.*, [0028]), or positioned in the smart eyewear's “slots, ports, and/or interfaces” for “allow[ing] convenient installation and uninstallation” (*id.*, [0040]). *See id.*, [0062] (“[S]mart eyewear is integrated with multiple sensors.”).

195. In turn, Liu's controller 220 receives data from the first sensor (e.g., sensor module 250, imaging module 260, or locating module 270) by "establish[ing] wireless or wired communication" and "exchang[ing] data, signals, and commands with these components and/or devices." *Id.*, [0030]; *see also id.*, [0059] ("Controller 320 may receive, filter, analyze, process, and store the data and signals generated by sensor module 350, imaging module 360, and locating module 370."), [0044]-[0045] ("Processing component 326 may be configured to receive and process the data generated by sensor module 350, imaging module 360, and locating module 370.").

3. Limitation 1[b]: "receiving second data from a second sensor, wherein the second sensor is an external sensor;"

196. In my opinion, Liu discloses limitation 1[b].

197. It is my opinion that Liu discloses an external sensor in the form of terminal 130 (orange), within the sports management system 100. Terminal 130 is a separate device, such as "a smart phone..., a smart watch, a smart bracelet, a smart camera,...a medical device" (Ex.1006, [0021]) and includes "various biosensors configured to detect physiological reactions of user 102 during exercise," and "high-resolution cameras configured to film physical environment 160" (*id.*, [0022]).



Id., Fig.1 (annotated). It is my further opinion that any of the sensors on terminal 130 (including the camera and biosensors) would be the claimed second sensor and would be separate from the smart eyewear 110 and therefore meet an external sensor.

198. Liu describes receiving second data from the external sensor. Liu's terminal 130 communicates with smart eyewear 110, including "in a wired or wireless manner" to "transmit[] various information, such as the detected physiological reactions." *Id.*, [0023]; *see also id.*, [0024]. The fact that the terminal 130 transmits detected physiological reactions indicates that both processed event data and raw sensor data are communicated. Liu's controller 220 receives data from the external sensors by "establish[ing] wireless or wired communication with...(for

example, terminal 130), and exchange[ing] data, signals, and commands with these components and/or devices.” *Id.*, [0030]; *see also, e.g., id.*, Fig. 3, [0041]-[0043] (“The above components may be connected to each other via a bus 390. While a bus architecture is shown in FIG. 3, any suitable architecture may be used, including any combination of wired and/or wireless networks.”). Further, Liu discloses:

Memory 328 may store the data received from other components of smart eyewear 110 and/or terminal 130. Memory 328 may also store instructions used by the processing component 326 to process the received data. These instructions may include various applications used to drive each of AR display module 310, sensor module 350, imaging module 360, locating module 370, and telecommunication module 380.

Id., [0053].

4. Limitation 1[c]: “analyzing a state of the user, wherein the analyzing uses the first data and the second data;”

199. In my opinion, Liu discloses or renders obvious 1[c]. To begin, the ’339 patent describes a user’s “state” as including categories such as “health,” “wellbeing,” “safety,” “cognitive,” “physical,” and “emotional,” with “no limitation implied thereby.” Ex.1001, 23:19-24, Fig.21.

200. Liu analyzes the user’s state by evaluating the user’s physiological condition and exercise status. Liu describes a sports-management system that monitors and collects information regarding the user’s physiological reactions during indoor or outdoor sports activities and analyzes those physiological reactions

in real time. Ex.1006, [0016]. Liu's smart eyewear "is integrated with multiple sensors and devices to provide a comprehensive evaluation of a user's status during exercises." *Id.*, [0062]. This "status" maps to the claimed user "state" and, in part, determines whether "an emergency" has occurred (*id.*, [0016], [0050], [0061], Fig.5, claims 14, 22), such as that the user is "over exercised" and "dehydrated" (*id.*, [0018]), that the user suffered from "an injury or adverse reaction" or "adverse event" (*id.*, [0025]), or that the user's physiological conditions are "abnormal" (*id.*, [0060], Fig.5). Therefore, Liu's user status matches the types of "state" identified by the '339 patent, including "health," "well being," "safety," and "physical." Specifically, the '339 patent provides:

FIG. 21 illustrates, generally at 2100, different user states, according to embodiments of the invention. With reference to FIG. 21, given for illustration, with no limitation implied thereby a user state analysis 2102 can have subcategories of Health 2104, Well Being 2106, Safety 2108, Cognitive 2110, Physical 2112, and Emotion 2114.

Ex.1001, 23:19-24, Fig.21.

201. Liu analyzes the user's state using sensor-derived information, including physiological, movement, position or location, and image or environmental information. For example, Liu describes determining whether an emergency has occurred based on the user's physiological conditions, movement, and position, and/or images of the user's physical environment. Ex.1006, [0061]; *see also id.*, [0050], Fig.5. Liu collects these types of information using both smart

eyewear 110 and terminal 130. The smart eyewear includes biosensors, positioning or movement sensors, imaging sensors, and locating functionality, while terminal 130 may include additional biosensors, high-resolution cameras, and GPS or navigation functionality. *Id.*, [0017], [0022]-[0024], [0034]-[0038]. Liu further explains that terminal 130 forms a “binding relationship” with smart eyewear 110, communicates with the smart eyewear, and extends its functions by sharing the burden of “collecting, storing, and/or processing data.” *Id.*, [0023]. In view of these disclosures, I understand Liu to disclose analyzing the user’s state using first data from the eyewear sensors together with second data from the external sensors in terminal 130.

202. Even if one were to read Liu as not expressly stating that eyewear-sensor data and terminal-sensor data are jointly used in the same state analysis, a POSITA would have been motivated to adopt that implementation. Liu already describes a coupled eyewear-and-terminal system in which the terminal communicates with and extends the functionality of the smart eyewear, including by sharing data-collection, storage, and processing functions. Ex.1006, [0023], [0030], [0053]. Liu also teaches using multiple sensors and devices to provide a “comprehensive evaluation” of the user’s exercise status, and it discloses overlapping and complementary sensor categories across the eyewear and terminal, including physiological, movement, position or location, and image or

environmental information. *Id.*, [0017], [0022]-[0024], [0034]-[0038], [0061]-[0062]. A POSITA would have been motivated to configure Liu's smart eyewear to use the eyewear-derived and terminal-derived sensor data together when analyzing the user's state because those data streams provide complementary information about the same exercise event from different device locations and sensing perspectives. For example, data from one device would allow Liu's system to confirm, contextualize, or supplement data from the other, such as by considering eyewear-based motion information together with terminal-based location or environmental information, or by evaluating physiological information from one device in view of related information collected by the other. Using those data together would improve the accuracy, reliability, and completeness of Liu's physiological or status determination, as evidenced by references such as Lisy and Tanaka. *See, e.g.*, Ex.1008, 4:2-9; Ex.1009, [0012]. Using both sources also would reduce the risk that the analysis depends on incomplete, noisy, or device-limited measurements from a single device. *See also* Ex.1009, [0012], [0045]-[0046].

203. Further, at the relevant timeframe, multimodal sensor fusion between eyewear and companion terminals was a known and predictable design approach for improving contextual awareness and user monitoring systems. By 2018, Bluetooth GATT (General Attribute Profile) supported sharing of data from multiple fitness and health devices, including heart-rate monitors, glucose monitors, bicycle-cadence

sensors, and more. In my opinion, a POSITA would have recognized that combining sensor data from the eyewear and terminal would reduce ambiguity, compensate for missing or noisy measurements from one device, and improve confidence in inferred user conditions or contextual determinations. For example, a POSITA would have known to corroborate motion data captured by the eyewear with positional or environmental information from the terminal, while physiological or biosensor information from one device could be interpreted in light of similar data from the other. Because Liu already contemplates both devices participating in the collection of relevant data and in determining user state and context, using data from both devices together would have been nothing more than the predictable use of known sensor-fusion techniques to improve system performance.

204. A POSITA would have had a reasonable expectation of success because Liu's eyewear and terminal are components of the same sports-management system, are already configured to communicate and exchange data, and both participate in the collecting, processing, and communicating user-related information. *See* Ex.1006, [0023], [0030], [0053]. Liu also discloses overlapping sensor categories across the eyewear and terminal, including position or location information, physiological information, and image or environmental information. *See id.*, [0022]-[0024], [0034], [0036]. This would have indicated to a POSITA that Liu's system was designed to support interoperable data acquisition and processing between the

two devices. In my opinion, using the eyewear and terminal data together would have involved conventional processing of known sensor inputs from known, communicatively connected devices for their ordinary purpose—improving Liu’s analysis of the user’s physiological condition and exercise status. Because the eyewear and terminal were already designed to communicate and exchange user-related information, a POSITA would have reasonably expected that jointly processing their respective datasets would operate successfully using conventional communication and data-processing techniques.

205. Such joint processing was also known and implemented at the time. Systems using accelerometers and gyroscopes at the time already incorporated data from multiple sensors. [The history of accelerometers | Electronics360](#). For example, a three-axis accelerometer has three distinct acceleration sensors, one for each axis, that are processed together. *Id.* Because the eyewear and terminal were already designed to communicate, a POSITA would have reasonably expected that jointly processing the respective datasets would operate successfully using conventional communication and data-processing techniques.

206. Moreover, the implementation would not have required any unpredictable modification to Liu’s system or any departure from known technological principles. Combining or aggregating data from multiple connected devices were routine and widely used techniques in wearable computing and mobile-

device ecosystems at the time. This concept is further supported by references such as Lisy and Tanaka that discuss the use of multiple data sources to provide a fuller, more robust set of data. Ex.1008, 4:2-9; Ex.1009, [0012]. The implementation merely involves using known data inputs from known devices for their established purpose of improving state analysis.

207. Accordingly, in my opinion, Liu discloses, or at minimum would have suggested, analyzing the user's state using both the first data and the second data.

5. Limitation 1[d]: “determining a context of the user, wherein determining uses the first data and the second data;”

208. In my opinion, Liu discloses 1[d]. To begin, the '339 patent describes the user's “context” as including “one or more of a physical orientation, an activity, and an environment that the user is in.” Ex.1001, 20:34-37, Fig.18.

209. Liu determines the user's “context” by determining information such as the user's movement or activity, physical orientation, location, and surrounding environment. Liu describes its sports-management system as “collect[ing] information regarding the surrounding physical environment and the position of the user 102” and providing navigation to the user. Ex.1006, [0016]. Liu also determines the user's “physiological conditions, movement, and location” during exercise and whether the user is in an outdoor environment. *Id.*, [0059]; *see also id.*, [0061]. A POSITA would consider those determinations to correspond to context,

including the user's activity, location or environment, and surrounding physical environment.

210. Liu further determines the user's physical orientation. For example, Liu's smart eyewear 110 has positioning sensors or devices that detect the user's "position and movement," and sensor module 250 may include an IMU that measures information such as "a position, an orientation, an acceleration, a velocity, a heading, or an angular rate of smart eyewear 110." *Id.*, [0017], [0035]. According to Liu, processing component 326 uses IMU signals for determining the user's movement and angular orientation, such as "roll, heading, and pitch." *Id.*, [0047]. A POSITA would understand these orientation, heading, pitch, roll, position, movement, and activity determinations to correspond to determining the claimed "context."

211. Liu describes determining that context using first data from the eyewear sensors together with second data from the external sensors in terminal 130. Liu's context-related inputs include movement, position, angular-orientation, location, and physical-environment data from the eyewear sensors, in addition to image, location/GPS, and physical-environment data from terminal 130. *Id.*, [0017], [0022]-[0023], [0034]-[0038], [0047]-[0049], [0059], [0061]. For instance, Liu's emergency analysis considers "movement," "position," and "images of the physical environment," and Liu also describes collecting those categories of information

through smart eyewear 110 and terminal 130 where smart eyewear 110 has positioning or movement sensors and imaging sensors and terminal 130 has high-resolution cameras and GPS or navigation functionality. *Id.*, [0017], [0022], [0024], [0035]-[0038], [0061]. According to Liu, terminal 130 forms a “binding relationship” with smart eyewear 110, communicates with the smart eyewear, and extends its functions through sharing the burden of “collecting, storing, and/or processing data.” *Id.*, [0023]. In view of these disclosures, I understand Liu to disclose determining the user’s context using both the first data and the second data.

212. Even if one were to read Liu as not expressly stating that eyewear-sensor data and terminal-sensor data are jointly used in the same context determination, a POSITA would have been motivated to adopt that implementation for similar reasons to those discussed above for limitation 1[c]. §IX.C.4. Liu describes a coupled eyewear-and-terminal system in which terminal 130 communicates with smart eyewear 110, exchanges data with it, and shares data-collection, storage, and processing functions. Ex.1006, [0023], [0030], [0053]. Further, Liu discloses overlapping and complementary context-related sensor categories across the eyewear and terminal, such as movement, orientation, position or location, image, and environment data. *Id.*, [0017], [0022]-[0024], [0034]-[0038], [0047]-[0049], [0059], [0061]. A POSITA would have been motivated to configure Liu’s smart eyewear to evaluate the eyewear-derived and terminal-derived sensor

data together when determining context because those data streams provide complementary information about the same exercise event from different device locations and sensing perspectives. For instance, eyewear-based movement or orientation information would be evaluated together with terminal-based position or location, image, or environmental information to determine the user's context more accurately and reliably. Using those inputs together would have predictably increased confidence in Liu's context determination and reduced ambiguity that could arise from relying on incomplete, noisy, or device-limited measurements from a single device. *See also* Ex.1009, [0012], [0045]-[0046]. This would have been a predictable way to use Liu's coupled eyewear-and-terminal system to combine complementary sensor information for context determination.

213. A POSITA would have had a reasonable expectation of success for similar reasons discussed above for limitation 1[c]. §IX.C.4. Liu's eyewear and terminal are components of the same sports-management system, are already configured to communicate and exchange data, and Liu contemplates both devices participating in the collection, processing, and communication of user-related information. *See* Ex.1006, [0023], [0030], [0053]. Liu also discloses overlapping context-related sensor categories across the eyewear and terminal, including movement, orientation, position or location, image, and environment information. *See id.*, [0022]-[0024], [0034]-[0038], [0047]-[0049], [0059], [0061]. Those

disclosures would have indicated to a POSITA that Liu's system was designed to support interoperable data acquisition and processing between the two devices. Jointly processing the eyewear and terminal data for context determination would have involved conventional processing of known sensor inputs from known, communicatively connected devices. *See* Ex.1008, 4:2-9; Ex.1009, [0012]. In my opinion, that implementation would not have required any unpredictable modification to Liu's system or departure from known technological principles, and would have used the disclosed data inputs for their ordinary purpose of improving Liu's determination of the user's movement, orientation, location, and surrounding environment during exercise.

214. Accordingly, in my opinion, Liu discloses, or at minimum would have rendered obvious, determining the user's context using both the first data and the second data.

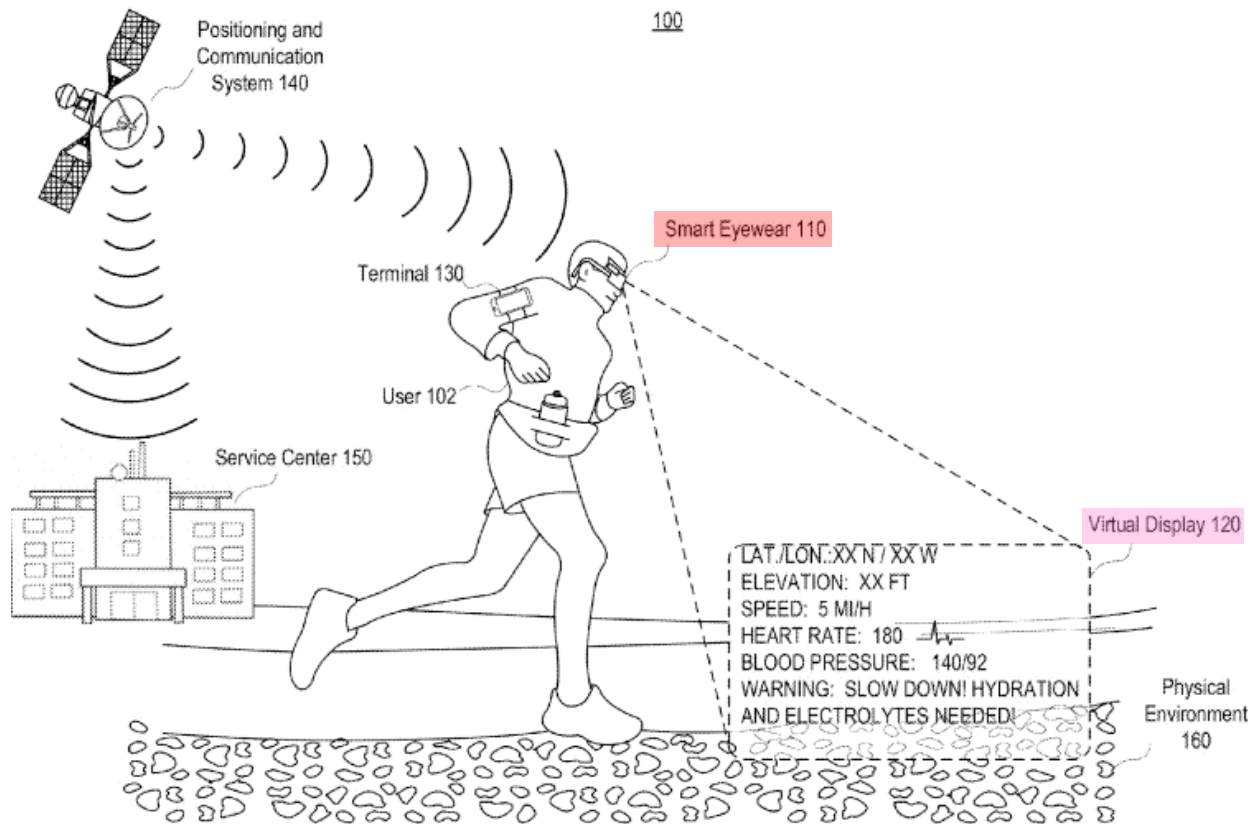
6. Limitation 1[e]: “providing assistance to the user, wherein the assistance is in a form of feedback, and wherein the feedback is related to the state and the context.”

215. In my opinion, Liu discloses 1[e].

216. As I discussed for limitations 1[c]-1[d], Liu analyzes the user's state by evaluating the user's physiological condition or status and determines the user's context by evaluating information such as movement or activity, physical orientation, location, and surrounding environment. §§IX.C.4-IX.C.5. In turn, Liu

provides user assistance in the form of feedback related to that state analysis and context determination. For example, the sports management system in Liu “analyze[s] the physiological reactions in real time and provide[s] health and safety-related advice to user 102,” collects information regarding “the surrounding physical environment and the position of the user 102,” and “provide[s] navigation for user 102.” Ex.1006, [0016]. In addition, Liu describes smart eyewear 110 providing “alert, advice, navigation, and rescue assistance to the user.” *Id.*, [0062]. Liu’s feedback is therefore generated from and related to the user’s physiological condition or status as well as movement, activity, orientation, location, and surrounding-environment information.

217. Liu describes providing its assistance as feedback through smart eyewear 110. Virtual display 120 in Liu “display[s] a combination of graphics and texts to describe user 102’s real-time physiological conditions, to provide exercise advices [sic], to indicate user 102’s location, etc.” *Id.*, [0018]; *see also id.*, [0030] (“[c]ontroller 220 may filter, analyze, process, and store these data and signals, and generate exercise advice and navigation information for user 102.”). Liu’s virtual display 120 overlays content on the physical environment so that the user can view physiological and/or navigation information while also viewing the surrounding environment. *Id.*, [0020].



Id., Fig.1 (annotated). Liu also discloses feedback in forms such as warning messages, exercise advice, audible alarms, and vibration. *Id.*, [0046], [0060]. These disclosures teach providing assistance to the user, through feedback, that is related to the user's state and context.

218. One example is Liu's running scenario. When the user is running, virtual display 120 displays information like the user's "speed, heart rate, blood pressure, and location information, such as the latitude, the longitude, and the elevation." *Id.*, [0018]. If it is then determined that the user's "physiological condition suggests that user 102 probably has over exercised and is in a dehydrated state," virtual display 120 displays a warning message instructing the user "to slow

down and take water and electrolytes.” *Id.* That feedback is related to the user’s state, such as over-exercise, dehydration, or abnormal physiological condition, and to the user’s context, such as running speed, location, elevation, exercise activity, and surrounding environment. *See id.*, [0020], [0059]-[0060].

219. Liu further describes providing assistance in emergency scenarios. For example, controller 320 determines whether an emergency has occurred “based on the physiological conditions, movement, and position of user 102, and/or images of physical environment 160.” *Id.*, [0061]; *see also id.*, [0041], [0050], Fig.3. If an emergency is detected, smart eyewear 110 sends a rescue request and the user’s status to service center 150, which may include “the physiological conditions and position of user 102 and images of physical environment 160,” so that assistance can respond quickly. *Id.*, [0061]. According to Liu, smart eyewear 110 may also “establish a telephone call with service center 150 so that user 102 may receive advice and guidance from service center 150 to properly react to the adverse event.” *Id.*, [0025]. Establishing a connection with service center 150 so that the user can get the needed help provides assistance to the user. The provided status and navigation information, warnings, advice, audible alarms, vibration, and telephone-call guidance are forms of user feedback. In turn, that feedback is tied to the user’s state, such as physical condition, injury or adverse reaction, or emergency status, and to the user’s context, such as movement, physical orientation, position, location,

and surrounding physical environment. As a result, Liu describes providing user assistance in the form of feedback related to the user's state and context.

220. Accordingly, it is my opinion that claim 1 is unpatentable based on Liu.

D. Dependent Claim 2: “The method of claim 1, wherein a first element of the context is a physical orientation of the user.”

221. In my opinion, Liu renders claim 2 unpatentable.

222. As I discussed for limitation 1[d], it is my opinion that Liu discloses determining the user's context, including physical orientation. §IX.C.5. Liu describes smart eyewear 110 as including positioning sensors or devices that detect the user's “position and movement.” Ex.1006, [0017]. Liu also explains that sensor module 250 may include an IMU that measures information such as “a position, an orientation, an acceleration, a velocity, a heading, or an angular rate of smart eyewear 110.” *Id.*, [0035]. In turn, processing component 326 uses IMU signals to determine position and angular-orientation information, including “roll, heading, and pitch.” *Id.*, [0047]. Given that smart eyewear 110 is worn by user 102, a POSITA would have understood measurements of the eyewear's orientation, heading, roll, and pitch as corresponding to the user's physical orientation. *See also id.*, [0037] (user-facing eye-tracking sensors monitor the user's viewing direction based on eye position), [0061] (“user 102 has fainted, fallen down, or had a collision”).

E. Dependent Claim 3: “The method of claim 2, wherein a second element of the context is an activity that the user is doing.”

223. In my opinion, Liu renders claim 3 unpatentable.

224. As I discussed for limitation 1[d], it is my opinion that Liu discloses determining the user’s context, including activity such as movement during exercise.

§IX.C.5.

F. Dependent Claim 4: “The method of claim 2, wherein a third element of the context is the user’s environment.”

225. In my opinion, Liu renders claim 4 unpatentable.

226. As I discussed for limitation 1[d], it is my opinion that Liu discloses determining the user’s context, including the user’s environment, such as whether the user is outdoors or the user’s physical environment. §IX.C.5.

G. Dependent Claim 5: “The method of claim 1, wherein the assistance is in a form of audio communication for the user.”

227. In my opinion, Liu renders claim 5 unpatentable.

228. As I discussed for limitation 1[e], it is my opinion that Liu discloses providing assistance to the user through smart eyewear 110, including through an audible alarm or communication. §IX.C.6. In an adverse-event or emergency situation, Liu’s smart eyewear 110 “establish[es] a telephone call with service center 150 so that user 102 may receive advice and guidance from service center 150 to properly react to the adverse event.” Ex.1006, [0025]. This provides assistance in

the form of audio communication for the user, because the user can receive the necessary information for them to mitigate their circumstances and correct a negative condition or maintain a positive condition. *See also* Ex.1006, [0016] (disclosing communication between user 102 and third party during emergency), [0046] (smart eyewear 110 may generate “an alarm”).

H. Claim 6

1. Preamble 6[pre]: “A computer readable storage medium storing program code for causing a data processing system to perform steps comprising:”

229. I have been asked to assume the preamble of claim 6 is limiting. Under that assumption, in my opinion, Liu discloses preamble 6[pre].

230. It is my opinion that Liu discloses a computer readable storage medium. Liu discloses memory 328, which includes “any type of computer-readable medium, such as flash memory, random access memory, or firmware, configured to store data and/or instructions to support the operation of smart eyewear 110.” Ex.1006, [0053]; *see also id.*, [0041] (“FIG. 3 is a block diagram of an exemplary smart eyewear 110, consistent with smart eyewear 110 depicted in FIG. 2.”). Liu further discloses that controller 320 includes processing component 326 and memory 328. *Id.*, [0042], Fig.3.

231. Liu further discloses a storage medium that can cause data processing. Liu discloses that memory 328 “store[s] instructions used by the processing

component 326 to process the received data,” and that those instructions “include various applications used to drive each of AR display module 310, sensor module 350, imaging module 360, locating module 370, and telecommunication module 380.” *Id.*, [0053]. Those instructions thus cause a data processing system to take action.

232. As a result, Liu discloses a computer readable storage medium storing program code for causing a data processing system to perform the steps recited in claim 6, which I address below.

2. **Limitations 6[a]-[b]: “receiving first data from a first sensor, the first sensor is incorporated into an eyewear device, the first sensor measures a parameter related to a user; receiving second data from a second sensor, wherein the second sensor is an external sensor;”**

233. For the same reasons I discussed for limitations 1[a]-1[b], it is my opinion that Liu discloses limitations 6[a]-6[b]. §§IX.C.2-IX.C.3.

3. **Limitations 6[c]-[d]: “determining a context of the user, wherein the determining uses the first data and the second data; and providing assistance to the user, wherein the assistance is related to the context, and wherein the assistance is in a form of audio communication to the user.”**

234. For the same reasons I discussed for limitations 1[d]-1[e] and claim 5, it is my opinion that Liu discloses or renders obvious limitations 6[c]-6[d]. §§IX.C.5-IX.C.6, IX.G.

235. Thus, in my opinion, claim 6 is unpatentable based on Liu.

I. Dependent Claims 7-9: “The computer readable storage medium of claim 6, wherein a first element of the context is a physical orientation of the user. The computer readable storage medium of claim 6, wherein a second element of the context is an activity that the user is doing. The computer readable storage medium of claim 6, wherein a third element of the context is the user’s environment.”

236. For the same reasons I discussed for claims 2-4, respectively, it is my opinion that Liu renders claims 7-9 unpatentable. §§IX.D-IX.F.

J. Dependent Claim 10: “The computer readable storage medium of claim 6, further comprising: analyzing a state of the user, wherein the analyzing uses the first data and the assistance is related to both the state and the context.”

237. For the same reasons I discussed for claims 1 and 5, it is my opinion that Liu renders claim 10 unpatentable. §§IX.C, IX.G.

X. OPINIONS ON GROUND 4: CLAIMS 11-16 ARE UNPATENTABLE BASED ON LIU AND SHAN

238. In my opinion, Liu and Shan render claims 11-16 unpatentable. Liu describes a smart-eyewear assistance architecture, including sensors, processing, feedback, display, and communication functions. Ex.1006, [0016]-[0018], [0025], [0039], [0060]-[0062]. I understand Shan to provide an additional express teaching of a head-mountable device having a microphone-and-speaker interface for receiving spoken instructions and providing audio assistance. As discussed below,

a POSITA would have found it obvious to incorporate that voice-interface functionality into Liu's smart eyewear.

A. Motivation to Combine

239. It would have been obvious to incorporate a microphone-and-speaker voice interface such as Shan's into Liu's eyewear because Shan discloses a straightforward hands-free way for an eyewear user to speak commands and receive device-generated responses via audio. A POSITA would have been motivated to implement this microphone and speaker in Liu's eyewear, because both Liu and Shan are in the same field of head-mountable wearable computing devices providing real-time assistance to a user through an eyewear-based interface.

240. Liu's smart eyewear 110 also already includes a telecommunication module configured to establish voice communication between the user and third parties such as service center 150, through telephone calls. Ex.1006, [0039]. Liu's controller 220 is also described as exchanging "data, signals, and commands" with other components and devices (Ex.1006, [0030]), confirming that Liu supports bidirectional communication. A POSITA would recognize that adding a microphone and speaker, such as Shan's microphone 124 which captures "the wearer's spoken instruction" (Ex.1007, [0037]) and Shan's speaker 126, to Liu's existing eyewear platform would be a straightforward enhancement that leverages hardware that Liu already contemplates.

B. Reasonable Expectation of Success

241. A POSITA would have had a reasonable expectation of success in incorporating a microphone and speaker such as Shan's into Liu's smart sports eyewear platform because the combination requires only the integration of well-known commercially mature audio components into a device that already has the architecture to support them. Shan already describes its microphone and speaker as standard components of an HMD (Ex.1007, [0037]), and Shan confirms their successful integration into a similar head-mountable eyewear platform. *Id.*, [0034], [0037]. Liu's telecommunication module 280 is also already configured to support voice communication with third parties. Ex.1006, [0039]. Combining a microphone and speaker such as Shan's and Liu's eyewear system would have predictably enabled Liu's eyewear to accept spoken user commands and output audio assistance, improving usability and safety when the user's hands and visual attention are occupied. *Id.* Therefore, the combination would have been the use of known elements according to their established functions, yielding the predictable result of a voice interface that receives user commands and provides assistance to the user. *Id.*; *see also* Ex.1007, [0004], [0037], [0047].

C. Claim 11

1. Preamble 11[pre]: “A system for execution by a data processing system to provide assistance to a user through an eyewear device, comprising:”

242. I have been asked to assume the preamble of claim 11 is limiting. Under that assumption, in my opinion, Liu discloses preamble 11[pre].

243. As I discussed for preamble 1[pre], it is my opinion that Liu’s sports management system 100 includes smart eyewear 110 (claimed eyewear device) and terminal 130, and provides assistance to the user through the eyewear device. §IX.C.1. Figure 3 in Liu illustrates “an exemplary smart eyewear 110” with controller 320 that includes processing component 326 and memory 328, which stores “instructions used by the processing component 326 to process the received data,” confirming that Liu’s system is executed by a data processing system. *Id.*, [0041]-[0042], [0053].

2. Limitation 11[a]: “a voice interface, the voice interface has a microphone and a speaker, the voice interface to receive user commands and to provide assistance to the user;”

244. In my opinion, Liu and Shan render obvious limitation 11[a].

245. Liu’s smart eyewear 110 provides real-time user assistance, including alerts, advice, navigation, rescue assistance, and emergency-related communications. Ex.1006, [0016]-[0018], [0025], [0060]-[0062]. Liu’s telecommunication module 280 establishes communication between the user and a

third party, such as service center 150, “to enable user 102 to speak to a member of service center 150.” *Id.*, [0039]; *see also id.*, [0025]. Liu’s controller 220 is also described as exchanging “data, signals, and commands” with other components and devices (*id.*, [0030]), confirming that Liu supports bidirectional communication. These disclosures thus show that Liu already provides eyewear-based assistance and user interaction through smart eyewear 110.

246. Shan provides an express teaching of the claimed microphone-and-speaker voice interface for receiving user commands. Shan describes a head-mountable computing device that includes “a microphone 124 for capturing the wearer’s spoken instruction or conversations” and “a speaker 126 for allowing the wearer to hear the audio information generated by the head-mountable computing device.” Ex.1007, [0037]. Shan further explains that the device may be triggered by a “spoken instruction via the microphone 124,” and that the wearer may select assistance information by “sending audio commands to the head-mountable computing device 100.” *Id.*, [0041], [0051]. The spoken instructions and audio commands in Shan correspond to user commands, and the speaker in Shan provides audio information or assistance to the wearer.

247. A POSITA would have been motivated to incorporate a microphone-and-speaker interface such as Shan’s into Liu’s smart eyewear 110 or terminal 130. Both Liu and Shan describe smart devices, such as eyewear-based computing

devices, providing real-time assistance to a wearer. Ex.1006, [0016]-[0018], [0062]; Ex.1007, [0004], [0010]-[0014], [0037]. A voice interface would have enabled the user of Liu's system to issue spoken commands and receive audible assistance while exercising, navigating, or responding to an emergency, including in situations where the user's hands are occupied or the user's visual attention is directed to the activity or surrounding environment. Liu already provides advice, alerts, navigation, rescue assistance, and service-center communication through smart eyewear 110; adding a microphone-and-speaker interface would have been a predictable way to provide hands-free input and output for those same assistance functions. *See* Ex.1006, [0025], [0039], [0060]-[0062]; Ex.1007, [0037], [0041], [0051].

248. Liu specifically discloses implementing terminal 130 as a smart phone and using smart eyewear 110 for making a telephone call, which a POSITA would have understood as involving microphone-and-speaker voice functionality. Ex.1006, [0021], [0039]. Incorporating these conventional audio components into Liu's smart eyewear or terminal would have supported the telecommunication functionality disclosed in Liu. During the relevant timeframe, microphones and speakers were standard and ubiquitous components in smartphones, wearable electronics, and smart-eyewear systems, particularly in devices configured for voice communications or voice-controlled interaction. In my opinion, a POSITA would have understood that once such audio hardware was included to support telephone

or telecommunication operations, the same hardware could also predictably be used to receive spoken user commands and provide audio feedback. That use would have improved the usability of Liu's system in hands-free or mobile environments by allowing the user to interact with the system without relying on manual input, furthering Liu's objective of providing assistance to the user. Voice-controlled interaction (e.g., Siri or Google Assistant) was also well known by December 2018, reinforcing that a POSITA would have viewed spoken-command functionality as a predictable use of microphone-and-speaker hardware in Liu's system. Thus, configuring Liu's smart eyewear or terminal to include a microphone and a speaker for receiving user commands and providing audio output would have represented no more than the predictable use of known components according to their established functions.

249. A POSITA also would have reasonably expected success in the combination. Shan's microphone and speaker are disclosed components of a head-mountable computing device, and Liu's smart eyewear already includes a controller, telecommunication module, display and feedback architecture, and communication links. *See* Ex.1006, [0030], [0039], [0041]-[0043]; Ex.1007, [0037]. Incorporating audio input/output components such as Shan's into Liu's eyewear would have used known components for their ordinary functions without requiring any material change to Liu's sports-management or assistance architecture. The expected result

would have been a voice interface in Liu's eyewear that receives spoken user commands through a microphone and provides assistance through a speaker, such as audible alerts, advice, navigation, emergency guidance, or service-center communication. *See* Ex.1006, [0025], [0039], [0046], [0060]-[0062]; Ex.1007, [0037], [0041], [0051]. Further, Liu and Shan concern similar smart devices or eyewear-based assistance systems, and Shan confirms that a microphone and speaker could be successfully integrated into that type of platform. Ex.1007, [0034], [0037]; *see also id.*, [0004] ("Such head-mountable computing device can generate video and/or audio user assistance information"), [0037] ("The head-mountable computing device 100 may further comprise a ... microphone 124 for capturing the wearer's spoken instruction ... [and] a speaker 126 for allowing the wearer to hear the audio information generated"), [0047] ("If it is confirmed that the identified activity may need assistance information, then the method may be triggered to step 210, namely providing assistance information to the wearer[.]").

250. A POSITA also would have reasonably expected success implementing a microphone-and-speaker interface in Liu's terminal 130. Liu expressly discloses that terminal 130 may be a smart phone, and smartphones conventionally included integrated microphones and speakers for voice calling and audio interaction. Ex.1006, [0021]. Liu also discloses telecommunication functionality involving spoken interaction with a service center, which further confirms that the audio

hardware and associated processing functionality was either already present or readily implementable using routine techniques. *See id.*, [0039], [0062]. Smart wearable devices also commonly used microphones and speakers for communication and voice-based interaction. Thus, whether implemented in Liu's eyewear or terminal, a POSITA would have understood that the interface used conventional components and processing techniques in a predictable manner.

251. Adapting such known audio interfaces to receive user commands would also have involved applying established voice-input and signal-processing techniques. As I discussed, voice assistant systems such as Siri and Google Assistant were well known at the time, so a POSITA would have known how to adapt Liu's system. The implementation would not have required any unconventional redesign or experimentation, and instead would have relied on audio components and processing functionality already used in smartphones and wearable computing devices. In fact, Liu itself contemplates telecommunication functionality, and Shan discloses the same type of microphone-and-speaker components in a head-mountable computing device. Accordingly, it is my opinion that a POSITA would have reasonably expected that incorporating a microphone and a speaker into Liu's eyewear, and using those components to receive user commands, would function successfully and predictably for their intended purpose.

3. Limitation 11[b]: “a sensor data input, the sensor data input to receive sensor data;”

252. In my opinion, Liu and Shan render obvious limitation 11[b].

253. As I discussed for limitations 1[a]-1[b], it is my opinion that Liu discloses sensor data generated by sensor module 250 and other smart-eyewear components, as well as sensor data from external terminal 130. §§IX.C.2-IX.C.3. Liu further discloses that smart eyewear 110 includes a controller 320 that “include[s] a communication component” and “an input/output (I/O) interface 324” that may be used to communicate that sensor data. Ex.1006, [0041]-[0042], Fig.3. “Communication component 322 [such as Bluetooth, (*id.*, [0043])] may be configured to facilitate communication, wired or wirelessly, between controller 320 and other components of smart eyewear 110 or devices other than smart eyewear 110 (for example, terminal 130).” *Id.*, [0043]. Liu’s “I/O interface 324 may include one or more digital and/or analog devices configured to consolidate data/signals it received from communication component 322 and relay the data/signals to processing component 326,” and Liu’s “I/O interface 324 may send the signals generated by the sensor module 350 to processing component 326 for further processing.” *Id.*, [0044]. Liu describes processing component 326 as configured to receive and process data generated by sensor module 350, imaging module 360, and locating module 370, and further explains that controller 320 receives, filters,

analyzes, processes, and stores data or signals generated by those modules. *Id.*, [0045], [0059].

254. As a result, I/O interface 324 and communication component 322 in Liu would be configured to receive and relay sensor data generated by sensor module 250, other smart-eyewear components, and external terminal 130, for processing by controller 320/processing component 326.

4. Limitation 11[c]: “a processor, the processor is in electrical communication with the voice interface and the sensor data;”

255. In my opinion, Liu and Shan render obvious limitation 11[c].

256. Liu’s “controller 220... process[es]... various types of information” including “exchang[ing] data, signals, and commands” with components in smart eyewear 110, including “sensor module 250, imaging module 260, and locating module 270.” Ex.1006, [0030]; *see also id.*, [0034] (stating controller 220 processes electronic signals converted from a detected physiological parameter from the biosensors), [0036] (stating controller 220 processes image data). Therefore, it is my opinion that Liu discloses a processor, namely controller 220.

257. Liu further discloses that “[c]ontroller 320 may include a communication component 322, an input/output (I/O) interface 324, [and] a processing component 326...” Ex.1006, [0042]. Liu explains that “[c]ommunication component 322 may be configured to facilitate...wired”

communication (*i.e.*, electrical communication) “between controller 320 and other components of smart eyewear 110 or devices other than smart eyewear 110 (for example, terminal 130).” *Id.*, [0043]. Processing component 326 relies on I/O interface 324, which “may...consolidate...and relay the data/signals to processing component 326.” *Id.*, [0044]. Liu further discloses that controller 320, sensor module 350, imaging module 360, and telecommunication module 380 “may be connected to each other via a bus 390” (*id.*, [0041]), which facilitates electrical communication between the components. Therefore, Liu discloses a processor that is in electrical communication.

258. As such, in my opinion, in the Liu-Shan combination, a POSITA would have been motivated to configure the processor in electrical communication with the voice interface. As I discussed for limitation 11[a], a microphone-and-speaker such as Shan’s would have been incorporated into Liu’s smart eyewear, thereby satisfying the voice interface limitation. §X.C.2. A POSITA would have coupled those audio input/output components to Liu’s controller 320 or processing component 326 using Liu’s existing communication, input/output, and/or bus architecture, allowing the processor to receive spoken-command input from the microphone and control audible assistance provided through the speaker. *See* Ex.1006, [0041]-[0044]; Ex.1007, [0037]. That implementation would have been a predictable application

of known electrical and data connections between a processor and audio input/output components in a head-mounted computing device.

259. As a result, in my opinion, the Liu-Shan combination renders obvious a processor in electrical communication with the voice interface and the sensor-data input.

5. Limitation 11[d]: “a computer program for processing the sensor data, the computer program and the processor to cause the data processing system to perform steps comprising:”

260. In my opinion, Liu and Shan render obvious limitation 11[d].

261. As I discussed for preamble 6[pre], Liu’s memory 328 stores instructions that are used by processing component 326 to process received data, where the instructions include various applications used to drive the connected modules. §IX.H.1. Therefore, it is my opinion that Liu discloses a computer program for processing the sensor data, the computer program and the processor to cause the data processing system to perform steps, including those of limitations in 11[e]-11[i].

- 6. Limitations 11[e]-11[i]: “receiving first data from a first sensor, the first sensor is incorporated into the eyewear device, the first sensor measures a parameter related to the user; receiving second data from a second sensor, wherein the second sensor is an external sensor; determining a context for the user, wherein the determining uses the first data and the second data; analyzing a state of the user, wherein the analyzing uses the first data and the second data; and providing assistance to the user, the assistance is related to the context and the state.”**

262. For the same reasons I discussed for limitations 1[a]-1[e], it is my opinion that Liu discloses or renders obvious limitations 11[e]-11[i]. §§IX.C.2-IX.C.6.

263. Thus, in my opinion, claim 11 is unpatentable based on Liu and Shan.

D. Dependent Claim 12: “The system of claim 11, wherein the analyzing considers a category selected from the group consisting of health, wellbeing, safety, cognitive, physical, and emotional.”

264. In my opinion, Liu and Shan render claim 12 unpatentable.

265. As I discussed for claim 11 and limitation 1[c], it is my opinion that Liu analyzes the user’s status (the claimed state) during exercise, which is based on the user’s health, wellbeing, safety, and physical conditions. §§X.C, IX.C.4. Examples of the analyzed status include whether the user is “over exercised” and “in a dehydrated state” (Ex.1006, [0018]), whether the user’s physical conditions are “abnormal” (*id.*, [0060]), whether the user has suffered “an injury or adverse

reaction” or an “adverse event” (*id.*, [0025]), and whether “an emergency” has occurred (*id.*, [0061]). All of these user statuses have an impact on the user’s health, wellbeing, physical, and safety conditions during exercise. As a result, Liu’s state analysis includes health, wellbeing, and physical (such as physical conditions, dehydration, over-exercising) and safety (such as injury, adverse reaction, adverse event, emergency).

E. Dependent Claim 13: “The system of claim 11, wherein the assistance is designed to help the user correct a negative condition.”

266. In my opinion, Liu and Shan render claim 13 unpatentable.

267. As I discussed for claim 11 and limitation 1[e], it is my opinion that Liu provides assistance to user 102 in the form of warnings and advice directed to the user’s condition. §§X.C, IX.C.6. The assistance in Liu is designed to help the user correct a negative condition, such as over-exercise, dehydration, or other abnormal physiological conditions. *See* Ex.1006, [0025] (User may receive “advice and guidance” from service center 150 “to properly react to the adverse event.”). According to Liu, when “the physiological condition suggests that user 102 probably has over exercised and is in a dehydrated state, virtual display 120 may further display a warning message alerting user 102 to slow down and take water and electrolytes.” *Id.*, [0018]. This is just one example of the Liu system helping the user to correct a negative condition. Liu also discloses that, when user 102’s

“physiological conditions are abnormal,” “smart eyewear 110 may alert user 102 to adjust the current exercise mode and generate an advice for user 102.” *Id.*, [0060].

Both of these examples demonstrate that Liu provides assistance to the user, in an attempt to correct a negative condition.

F. Dependent Claim 14: “The system of claim 11, wherein the assistance is designed to help the user by encouraging a positive condition.”

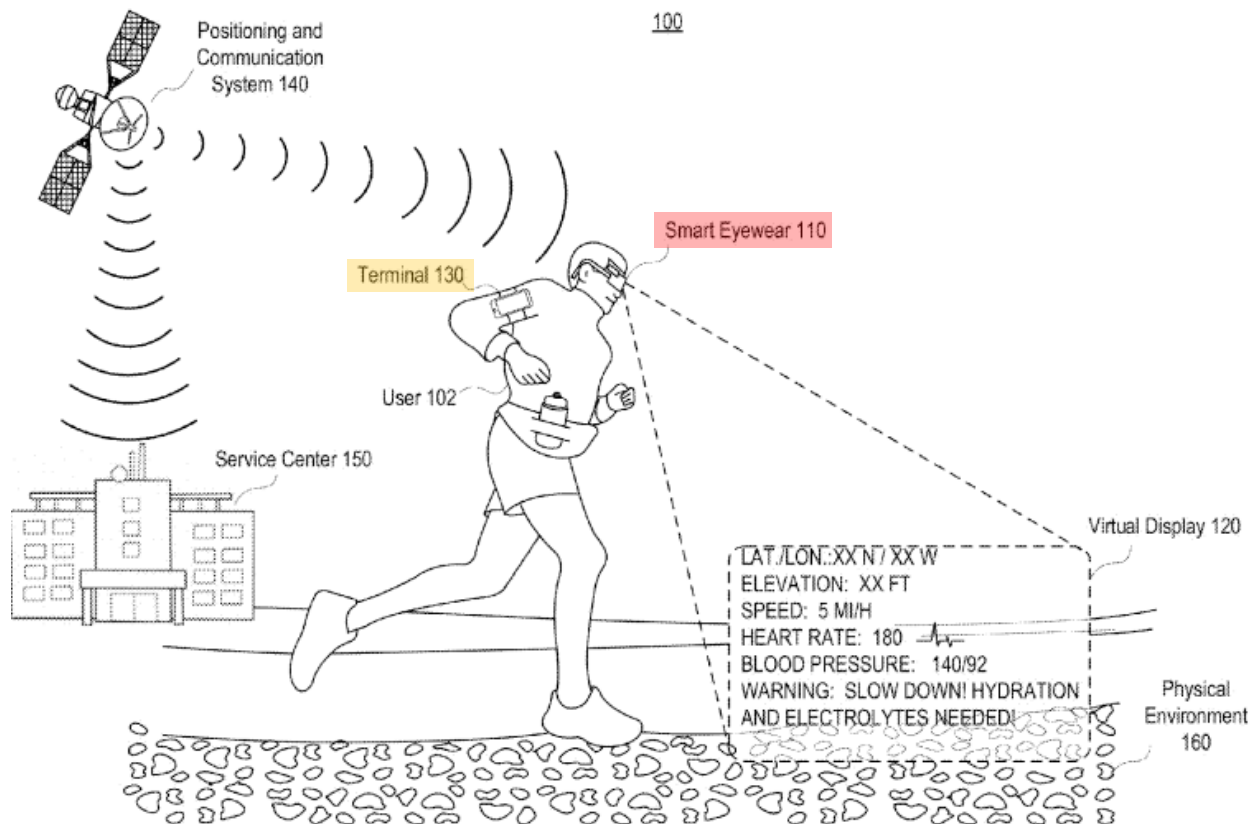
268. In my opinion, Liu and Shan render claim 14 unpatentable.

269. As I discussed for claim 11 and limitation 1[e], it is my opinion that Liu’s smart-eyewear assistance system provides exercise-related feedback and advice to the user based on the user’s condition. §§X.C, IX.C.6. According to Liu, its sports-management system supports “a healthy and active lifestyle” (Ex.1006, [0003]), and provides user assistance in the form of “health and safety-related advice,” “navigation,” and “exercise advices” (*id.*, [0016], [0018], [0062]). Such condition-based exercise advice and feedback are designed to encourage positive conditions, such as continued safe activity, appropriate exertion, hydration, health, and a healthy and active lifestyle. *See id.*, [0018], [0060]. Without the ability to encourage positive conditions, the system would only be geared towards correcting negative conditions. That approach, on its own, would not support a healthy and active lifestyle, including maintaining safe activity levels and avoiding over-exercise or dehydration.

G. Dependent Claim 15: “The system of claim 13, the system further comprising: a device, the device is external to the eyewear device, the device is in electrical communication with the eyewear device and the device is used to provide the assistance to the user.”

270. In my opinion, Liu and Shan render claim 15 unpatentable.

271. It is my opinion that Liu discloses a device that is external to the eyewear. This is based on the fact that Liu discloses that “sports management system 100 may include terminal 130 configured to collaborate with smart eyewear 110 to provide various sports management functions.” Ex.1006, [0021]. According to Liu, terminal 130 is a separate electronic device wearable by user 102, such as “a smart watch, a smart bracelet, a smart camera...[or] a medical device....” *Id.*



Id., Fig.1 (annotated). Because terminal 130 is separate, it is external to smart eyewear 110.

272. Liu explains that “[t]erminal 130 may form a binding relationship with smart eyewear 110 and communicate with smart eyewear 110 in a wired...manner, such as through a connection cable” (*id.*, [0023]; *see also id.*, [0030]), which involves electrical communication. Therefore, it is also my opinion that Liu discloses a device that is external to the eyewear, that is in electrical communication with the eyewear device. Liu also discloses that terminal 130 provides assistance to the user, explaining that “[t]erminal 130 may transmits [sic] various information, such as the detected physiological reactions” or “the generated exercise advice...to smart eyewear 110 for displaying on virtual display 120.” Ex.1006, [0023]. Moreover, Liu discloses that “[t]erminal 130 can also conduct a telephone call with a third party device” and “provide communication service to user 102.” *Id.*, [0022], [0024]. Therefore, it is my opinion that Liu discloses a device that is external to the eyewear, is in electrical communication with the eyewear, and provides assistance to the user.

H. Dependent Claim 16: “The system of claim 11, the steps further comprising: receiving third data from a plurality of embedded sensors, the determining uses both the first data and the third data and the analyzing uses both the first data and the third data.”

273. In my opinion, Liu and Shan render claim 16 unpatentable.

274. As I discussed for limitations 11[b] and 1[a], it is my opinion that Liu discloses first data from a sensor integrated within smart eyewear 110, including biosensors, eyewear position, orientation, acceleration, or velocity sensors, eye-tracking sensors, and imaging and location modules. §§X.C.3, IX.C.2. All of these sensors are part of the eyewear 110 and therefore are embedded sensors. For example, when Liu's movement sensor is the claimed first sensor, any of the remaining sensors, including the physiological, eye-tracking, imaging, or location sensors, in my opinion, meet the claimed plurality of embedded sensors that provide third data.

275. It is also my opinion that Liu further discloses that the third data is used to determine context and analyze state. For context, Liu describes determining the user's movement or activity, position or location, physical orientation, and surrounding environment using eyewear-sensor data. That data includes movement, location, outdoor-environment, image or physical-environment, and IMU-derived roll, heading, and pitch information. Ex.1006, [0017], [0035]-[0038], [0047], [0059], [0061]. Thus, first data, such as movement or orientation data, together with third data, such as camera/image and locating data from additional embedded sensors, is used to determine the user's context.

276. For state, Liu describes analyzing the user's physiological condition or status during exercise using those same categories of embedded-sensor data. For

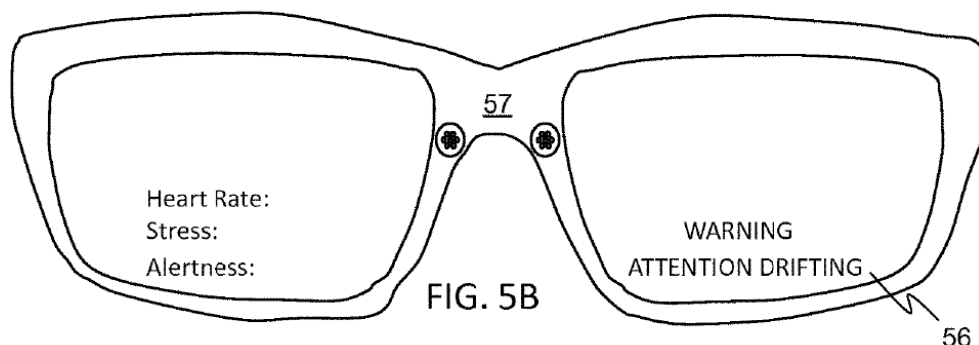
example, Liu determines whether an emergency has occurred based on “the physiological conditions, movement, and position of user 102, and/or images of physical environment 160,” and Liu also analyzes conditions such as over-exercise, dehydration, injury or adverse reaction, and abnormal physiological conditions. *Id.*, [0018], [0025], [0060]-[0061], Fig.5. Thus, Liu uses first data, such as movement, position, or orientation data, together with the same third data, such as biosensor data, image/environment data, and locating data, to analyze the user’s state.

277. Even if one were to read Liu as not expressly stating that the same first and third data are used for both context determination and state analysis, a POSITA would have been motivated to adopt that implementation. The smart eyewear in Liu integrates “multiple sensors and devices” for a “comprehensive evaluation” of exercise status, and Liu’s controller receives and processes data from sensor, imaging, and locating modules. *Id.*, [0045], [0059], [0062]. In my opinion, a POSITA would have been motivated to use the same embedded multi-sensor data set for both context determination and state analysis because that data provides complementary information about the same exercise event. A POSITA also would have reasonably expected success because Liu already integrates and processes that data for exercise-status, emergency, movement, position, location, and environment determinations.

**XI. OPINIONS ON GROUNDS 5-8: CLAIMS 1-16 ARE UNPATENTABLE
BASED ON GROUNDS 1-4 AND LISY**

278. As explained above, Grounds 1-4 independently render claims 1-16 unpatentable. §§VII-X. Grounds 5-8 further combine Lisy with Grounds 1-4. In my opinion, Lisy reinforces why a POSITA would have found it obvious to jointly use sensor-derived data for state analysis and context determination, including eyewear-sensor first data with external-sensor second data and, for claim 16, first data with third data from a plurality of embedded sensors. Lisy confirms that it was known to fuse data from head-mounted sensors and other worn or connected sensors for user monitoring, feedback, recommendations, alerts, and warnings.

279. Lisy describes head-mounted systems, such as “eyewear,” that collect physiological and ambient or environmental information and that may pair with other user-worn sensor systems, including a smart watch or phone. Ex.1008, 2:58-3:14, 4:2-9.



According to Lisy, its system may “fuse[] data” from sensors on the various devices to provide a “more complete and robust set of data,” recommendations, and

warnings. *Id.*, 4:2-9; *see also id.*, Figs.13-14. In addition, Lisy describes using physiological and secondary or environmental sensors to derive user-condition metrics, including stress, alertness, concentration, focus, and preparedness, and to provide feedback, alerts, or messages to the user. *Id.*, Figs.13-14.

A. Ground 5: Claims 1-16 are Obvious Based on Asukai and Lisy

1. Motivation to Combine

280. In my opinion, a POSITA would have been motivated to incorporate Lisy's multi-sensor fusion into the eyewear of Asukai so that the eyewear-sensor data and external-sensor data were jointly used in analyzing user state and determining user context. This is because Lisy discloses that combining sensor data from multiple devices yields a more complete and robust data set for analysis and user recommendations. A POSITA would have viewed incorporating data from multiple sensors to form a more thorough analysis as beneficial.

281. Asukai describes using "various sensing data" for recognizing the user's situation or action and estimating emotion, such as data from cameras, microphones, acceleration sensors, gyro sensors, location-information acquisition units, biological sensors, gaze sensors, and environmental sensors. Ex.1005, [0069]. Specifically, Asukai discloses that an information processing device 10a (eyewear-type HMD) can include "sensor unit 122," which "is a sensor that senses various types of sensing data for recognizing a user situation or a user action." *Id.*, [0097];

see also *id.*, [0072], [0076]-[0077] (“As illustrated in FIG. 2, the information processing device 10a includes a control unit 100a, a communication unit 110, an input unit 120, an output unit 130, and a storage unit 140.”). These sensors include biological sensors that detect “heartbeat, body temperature, sweating, blood pressure, pulse, respiration, gaze, blink,...skin temperature,” etc. *Id.*, [0097]. In addition, Asukai describes that those sensors are provided in information processing device 10 or in another wearable device, smartphone, or the like communicatively connected to information processing device 10. *See id.*, [0097], [0103].

282. Like Asukai, Lisy discloses a head-mounted sensor platform that includes temperature sensors, galvanic skin response sensors, and pulse oximetry sensors. Ex.1008, 3:33-44; *see also id.*, 25:26-26:55. It is my opinion that a person of ordinary skill in the art would have been motivated to combine Lisy’s multi-sensor integration with Asukai’s sensors and processing because Lisy provides the architecture to implement this integration in an eyewear device. Such a person would know that because both references disclose the same kinds of sensors, used for similar purposes, the teachings of Lisy could be applied to the sensors in Asukai.

283. It is also my opinion that a POSITA would be motivated to use Lisy’s fusion approach to predictably enhance Asukai’s situation/action recognition, emotion/state analysis, context determination, and feedback selection by jointly using complementary sensor inputs, including eyewear/HMD sensor data, external-

sensor data, and, for claim 16, data from multiple embedded HMD sensors. *See id.*, 4:2-9, Figs.13-14. Asukai discloses emotion recognition that is determined using a situation recognition unit 101 that recognizes a situation by referring to sensing data, where this sensing data covers biological parameters that inform the system about the state of the user. Ex.1005, [0069]. Lisy also discloses sensor-fusion teachings and biological measurements relevant to stress indicators, including heart-rate variability and galvanic skin response. Ex.1008, 4:2-9, 37:1-38:38, 25:26-67, Figs.13-14. In view of these similar sensor types, it is my opinion that a POSITA would know that the use of Lisy's multi-sensor fusion would improve the performance of Asukai's recognition by enhancing the sensor quality and quantity, as the more data points that are provided about the user's emotional state, the more precise the determination will be and the more effective the overall system will be.

2. Reasonable Expectation of Success

284. A POSITA would have had a reasonable expectation of success because Asukai already provides an architecture for communicating and processing sensor data from the information processing device and connected external devices, and Lisy's data-fusion teachings rely on known sensors and conventional data-processing techniques used for their ordinary purposes. *See* Ex.1005, [0069], [0093], [0097], [0103]; Ex.1008, 4:2-9, Figs.13-14. A POSITA would have recognized that applying Lisy's sensor-fusion architecture to the eyewear of Asukai

was a straightforward use of known data-processing techniques according to their established functions, with the predictable result of improved accuracy, better contextual disambiguation, and more useful user feedback. Incorporating data from multiple sensors, rather than just one, in Asukai would merely expand the use of sensors already disclosed in Asukai; therefore, a POSITA would have reasonably expected that expansion to benefit the system and operate successfully.

B. Ground 6: Claims 11-16 are Obvious Based on Asukai, Shan, and Lisy

1. Motivation to Combine

285. For the same reasons I discussed for Grounds 2 and 5, a POSITA would have been motivated to combine Asukai, Shan, and Lisy and would have had a reasonable expectation of success in doing so. §§VIII, XI.A. Shan teaches a known HMD voice-command interface for interacting with an assistance system, and Lisy teaches sensor-fusion techniques that would support the multi-sensor analysis underlying Asukai's situation and action recognition, emotion or state analysis, context determination, and feedback selection. Ex.1005, [0069], [0072], [0097], [0099], [0103]; Ex.1007, [0037], [0041], [0051]; Ex.1008, 4:2-9, Figs. 13-14. Asukai already describes an HMD-based agent system with sensors, microphone/speaker components, processing, connected-device inputs, and feedback functionality. As a result, incorporating Shan's spoken-command functionality and Lisy's sensor-fusion teachings into Asukai would have involved

the predictable use of known components and data-processing techniques for their ordinary purposes.

2. Reasonable Expectation of Success

286. A POSITA also would have had a reasonable expectation of success. Asukai teaches situation and action recognition, emotion or state analysis, context determination, and feedback selection. Ex.1005, [0069], [0072], [0097], [0099], [0103]. Applying Lisy's sensor-fusion approach and Shan's command interface to Asukai therefore would have been a straightforward use of known components and known data-processing techniques, with the predictable result of improved accuracy, better contextual disambiguation, and more useful user feedback. The combination would not have required a departure from Asukai's spectacle-type assistance architecture; rather, it would have expanded Asukai's use of sensor data and assistance outputs in a manner consistent with the functions already disclosed in Asukai.

C. Ground 7: Claims 1-10 are Obvious Based on Liu and Lisy

1. Motivation to Combine

287. In my opinion, a POSITA would have been motivated to incorporate Lisy's multi-sensor fusion into the eyewear of Liu so that the eyewear-sensor data and external-sensor data were jointly used in analyzing user state and determining context. Liu describes smart eyewear 110 as including biosensors, positioning or

movement sensors, imaging sensors or cameras, locating components, and computing functionality, as well as terminal 130 as including additional biosensors, high-resolution cameras, GPS or navigation functionality, exercise-advice generation, and wired or wireless communication with the eyewear. Ex.1006, [0016]-[0023], [0034]-[0038], [0059]-[0062]. Liu also discloses a smart eyewear system that displays individual physiological parameters, including a user's "speed, heart rate, blood pressure, and location information." *Id.*, [0018]. Lisy's multi-sensor integration encourages the use of data from multiple streams, such as from multiple physiological, secondary, and environmental sensors, because it affords a more complete and robust data set, feedback, warnings, alerts, and recommendations. *See* Ex.1008, 4:2-9, Figs.13-14. In my opinion, a POSITA would understand that integrating Lisy's multi-sensor fusion would enhance the quality of individual physiological parameters that Liu can display, because combining the data would lead to better state analysis and context determinations.

288. Further, a POSITA would combine Lisy's multi-sensor fusion with Liu's eyewear because Liu provides a well-suited mechanical structure to implement Lisy's sensor placement strategy. Lisy discloses that the "head provides a variety of unique natural anchor points for sensors...including...around the ears, on the bridge of the nose, and around the circumference of the head." Ex.1008, 2:27-44. Further, Liu discloses an eyewear system, including sensor module 250, that "may be

attached, for example, to a temple or brow bar of the frame.” Ex.1006, [0029].

Therefore, a POSITA would understand that Lisy’s sensor placement around the circumference of the head could be integrated into eyewear near a temple or brow bar of the frame because those are both around the circumference of the head.

2. Reasonable Expectation of Success

289. In my opinion, applying Lisy’s fusion approach to Liu would have predictably improved Liu’s user-state analysis and user-context determinations, including determinations of physiological condition or status, over-exercise, dehydration, abnormal conditions, emergencies, movement, position or location, and surrounding environment, as well as the corresponding warnings, advice, navigation, and rescue assistance. *See* Ex.1006, [0016]-[0018], [0023], [0059]-[0062]. A POSITA would have had a reasonable expectation of success because Liu already provides an eyewear-and-terminal communication and processing architecture for exchanging data and sharing collection, storage, and processing functions, while Lisy uses known sensors and processing steps for their ordinary purposes. *See* Ex.1006, [0023], [0030], [0041]-[0044], [0053]; Ex.1008, 4:2-9, Figs.13-14. Applying Lisy’s sensor-fusion approach to Liu therefore would have been a straightforward use of known data-processing techniques with the predictable result of improved accuracy, contextual disambiguation, and more useful user feedback, using sensor inputs of the type Liu already discloses.

290. Liu's eyewear also would have provided a suitable mechanical platform for implementing Lisy's sensor-placement teachings. Lisy explains that the head provides "a variety of unique natural anchor points for sensors," including locations around the ears, on the bridge of the nose, and around the circumference of the head. Ex.1008, 2:27-44. Liu likewise describes eyewear structure suitable for sensor placement, including sensor module 250, which "may be attached, for example, to a temple or brow bar of the frame." Ex.1006, [0028]. A POSITA would have understood those temple and brow-bar locations to be consistent with Lisy's head-mounted sensor-placement approach, including placement around the head and near the ears or bridge of the nose, and would have expected Liu's eyewear frame to support integration of such sensors using ordinary eyewear-mounted sensor design techniques.

D. Ground 8: Claims 11-16 are Obvious Based on Liu, Shan, and Lisy

1. Motivation to Combine

291. For the reasons I discussed for Grounds 4 and 7, a POSITA would have been motivated to combine Liu, Shan, and Lisy and would have had a reasonable expectation of success in doing so. §§X.C, XI.C. Shan provides a known hands-free voice-command interface for interacting with an eyewear-based assistance system, while Lisy provides sensor-fusion teachings that would enhance the sensor-data analysis underlying Liu's user-status, context, warning, recommendation, and

assistance determinations. Ex.1006, [0016]-[0023], [0059]-[0062]; Ex.1007, [0037], [0041], [0051]; Ex.1008, 4:2-9, Figs. 13-14. Using Lisy's multi-sensor fusion with Liu's eyewear would allow eyewear-sensor data and external-sensor data to be used jointly in analyzing user state and determining user context, while a microphone and speaker such as Shan's would provide a hands-free input/output interface for user commands and audible assistance. That combination would have been useful because the additional sensor information would improve user-state analysis and user-context determinations, and the interface would provide another way for the user to interact with, and receive assistance from, the eyewear system.

2. Reasonable Expectation of Success

292. A POSITA also would have had a reasonable expectation of success. Liu already provides smart-eyewear processing, communication, sensor-data, and feedback architecture, Shan's microphone and speaker are known audio input/output components for head-mounted devices, and Lisy's fusion teachings use known sensors and data-processing techniques for their ordinary purposes. Applying Lisy's sensor-fusion approach and Shan's command interface to Liu therefore would have been a straightforward use of known components and known data-processing techniques, with the predictable result of improved accuracy, better contextual disambiguation, and more useful user feedback. The combination would not have required a departure from Liu's eyewear-based assistance architecture; rather, it

would have expanded Liu's use of sensor data and assistance outputs in a manner consistent with the functions already disclosed in Liu.

XII. SECONDARY CONSIDERATIONS

293. I am not aware of any secondary-considerations evidence that would support a finding of non-obviousness for the '339 patent. I am not aware of any products sold by Patent Owner in the United States that would be covered by the '339 patent.

294. Given that the eyewear features claimed in the '339 patent are not new and were invented long before December 2018, I am not aware of any long-felt need in the industry, unexpected results, skepticism of the claimed inventions, or teaching away from the claimed inventions. I am also not aware of any praise for the alleged inventions or copying of the alleged inventions by other companies. If Patent Owner identifies any alleged evidence of secondary considerations in the future, I reserve the right to respond to that information.

XIII. CONCLUSION

295. For all the reasons stated above, it is my opinion that the challenged claims of the '339 patent are unpatentable.

296. This declaration and my opinions are made to the best of my knowledge and understanding, and based on the material available to me at the time of signing this declaration. All statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true. Further, I am aware that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001. I declare under penalty of perjury that the foregoing is true and correct.

Dated: 18 Jun 2026

By: /

A handwritten signature in black ink, appearing to read 'John Feland', is written over a horizontal line.

John Feland, Ph.D.