

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

OURA HEALTH OY,
Patent Owner.

Case No. IPR2024-01080
U.S. Patent No. 10,842,429

**DECLARATION OF ANDREW WOLFE PH.D.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,842,429**

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I. INTRODUCTION

1. I have been retained by Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Samsung” or “Petitioner”), as an independent expert in this proceeding before the Patent Trial and Appeal Board (“PTAB” or “Board”). I understand that Samsung is requesting that the Board institute an *inter partes* review (“IPR”) proceeding of U.S. Patent No. 10,842,429 (“the ’429 Patent”) (Ex-1001), currently assigned to Oura Health Oy (“Patent Owner” or “PO”).

2. I am not and have never been an employee of Samsung. I am being compensated at my usual and customary rate of \$750 per hour. No part of my compensation depends on the outcome of this proceeding, and I have no other interest in this proceeding.

3. I have been asked to provide my independent analysis of the ’429 Patent in light of the prior art publications cited below. I have also been asked to consider the state of the art and prior art available as of February 26, 2015. Based on the prior art discussed in this declaration, it is my opinion that Claims 1-6 of the ’429 Patent are unpatentable for the reasons provided below.

A. Qualifications

4. I believe that I am well qualified to serve as a technical expert in this matter based upon my educational and work experience, which I summarize below.

I understand that my curriculum vitae, which includes a more detailed summary of my background, experience, and publications, is being submitted as Ex-1003.

5. In 1985, I earned a Bachelor's degree in Electrical Engineering and Computer Science from The Johns Hopkins University. In 1987, I received a Master's degree in Electrical and Computer Engineering from Carnegie Mellon University. In 1992, I received a Ph.D. in Computer Engineering from Carnegie Mellon University. My doctoral dissertation proposed a new approach for the architecture of a computer processor.

6. I have more than 35 years of experience as a computer architect, computer system designer, personal computer component designer, educator, and executive in the electronics industry.

7. In 1983, I began designing touch sensors, microprocessor-based computer systems, and I/O (input/output) cards for personal computers as a senior design engineer for Touch Technology, Inc. During the course of my design projects with Touch Technology, I designed I/O cards for PC-compatible computer systems, including the IBM PC-AT, to interface with interactive touch-based computer terminals that I designed for use in public information systems. I continued designing and developing related technology as a consultant to the Carroll Touch division of AMP, Inc., where in 1986 I designed one of the first custom touch-screen integrated circuits. I designed the touch/pen input system for the Linus WriteTop,

which many believe to be the first commercial tablet computer. From 1983 through 1997 I designed many different sensors and developed signal processing algorithms to record and interpret results from those sensors.

8. From 1986 through 1987, I designed and built a high-performance computer system as a student at Carnegie Mellon University. From 1986 through early 1988, I also developed the curriculum and supervised the teaching laboratory for processor design courses.

9. In the latter part of 1989, I worked as a senior design engineer for ESL-TRW Advanced Technology Division. While at ESL-TRW, I designed and built a bus interface and memory controller for a workstation-based computer system, and also worked on the design of a multiprocessor system.

10. At the end of 1989, I (along with some partners) reacquired the rights to the technology I had developed at Touch Technology and at AMP and founded The Graphics Technology Company. Over the next seven years, as an officer and a consultant for The Graphics Technology Company, I managed the company's engineering development activities and personally developed dozens of touch screen sensors, controllers, and interactive touch-based computer systems. Each of these sensing systems included signal processing, recording, and reporting functionality.

11. I have consulted, formally and informally, for a number of fabless semiconductor companies. In particular, I have served on the technical advisory

boards for two processor design companies: BOPS, Inc., where I chaired the board; and Siroyan Ltd., where I served in a similar role for three networking chip companies—Intellon, Inc., Comsilica, Inc., and Entridia, Inc.—and one 3D game accelerator company, Ageia, Inc. Comsilica developed Wi-Fi components.

12. I have also served as a technology advisor to Motorola and to several venture capital funds in the U.S. and Europe. Currently, I am a director of Turtle Beach Corporation, providing guidance in its development of premium audio peripheral devices for a variety of commercial electronic products including audio headsets and game controllers.

13. From 1991 through 1997, I served on the Faculty of Princeton University as an Assistant Professor of Electrical Engineering. At Princeton, I taught undergraduate- and graduate-level courses in Computer Architecture, Advanced Computer Architecture, Display Technology, and Microprocessor Systems, and conducted sponsored research in the area of computer systems and related topics. From 1999 through 2002, while a Consulting Professor, I taught a Computer Architecture course to both undergraduate and graduate students at Stanford University. At Princeton, I received several teaching awards, both from students and from the School of Engineering. I have also taught advanced microprocessor architecture to industry professionals in seminars sponsored by the Institute of Electrical and Electronics Engineers (“IEEE”) and the Association for Computing

Machinery (“ACM”). I am currently a lecturer at Santa Clara University teaching courses on Microprocessor Systems, Integrated Circuit Design, Real-Time Computing, and Mechatronics. In my classes, I teach about sensors, measurement, signal processing, and control.

14. From 1997 through 2002, I held a variety of executive positions at a publicly held fabless semiconductor company originally called S3, Inc. and later called SonicBlue Inc. I held the positions of Chief Technology Officer, Vice President of Systems Integration Products, Senior Vice President of Business Development, and Director of Technology, among others. At the time I joined S3, the company supplied graphics accelerators for more than 50% of the PCs sold in the United States. At S3 I supervised the design of several PC graphics accelerators. During my time at SonicBlue we launched more than 30 new consumer electronics products, including devices to support streaming audio and video, many of the first commercial products to support internet audio content, and Wi-Fi-based tablet computers. I also worked with Universal Music Group and Sony Entertainment on the development of systems for distribution and management of internet music content and served on the board of RioPort.com, which also developed systems for distribution and management of internet music content.

15. I have published more than 50 peer-reviewed papers on computer architecture and computer systems and IC design. I also have chaired IEEE and

ACM conferences in microarchitecture and integrated circuit design and served as an associate editor for IEEE and ACM journals. I served on the IEEE Computer Society Awards committee. I am an IEEE Fellow, an IEEE Computer Society Distinguished Contributor, and a Member of ACM. I am a named inventor on at least 57 U.S. patents and 37 foreign patents, which are listed in my curriculum vitae. These include several patents on sensing technology including biosensing applications. *See, e.g.*, U.S. Patent No. 8,193,941, U.S. Patent No. 8,836,516, U.S. Patent No. 8,882,677, U.S. Patent No. 8,866,621, U.S. Patent No. 8,628,478. I also developed the technology disclosed in published U.S. Patent Publication Nos. 2010/0286545 and 2010/0286567.

16. In 2002, I was the invited keynote speaker at the ACM/IEEE International Symposium on Microarchitecture and at the International Conference on Multimedia. From 1990 through 2005, I have also been an invited speaker on various aspects of technology and the PC industry at numerous industry events, including the Intel Developer's Forum, Microsoft Windows Hardware Engineering Conference, Microprocessor Forum, Embedded Systems Conference, Comdex, and Consumer Electronics Show, as well as at the Harvard Business School and the University of Illinois Law School. I have been interviewed on subjects related to computer graphics and video technology and the electronics industry by publications such as the *Wall Street Journal*, *New York Times*, *Los Angeles Times*, *Time*,

Newsweek, *Forbes*, and *Fortune* as well as on CNN, NPR, and the BBC. I have also spoken at dozens of universities including MIT, Stanford, University of Texas, Carnegie Mellon University, UCLA, University of Michigan, Rice University, and Duke University.

17. Additional details about my employment history, fields of expertise, and publications are included in my curriculum vitae, which I understand is being submitted as Ex-1003.

B. Materials Considered

18. In forming my opinions, I reviewed the following documents, in addition to others I have cited in my declaration. I also relied on my own knowledge of and experience in the field of electrical engineering, biomedical engineering, and the study and development of sensor system design, signal processing, decision algorithms, and user interfaces.

Ex. No.	Description
Ex-1001	U.S. Patent No. 10,842,429 (“the ’429 Patent”)
Ex-1004	Prosecution History of U.S. Patent No. 10,842,429
Ex-1005	U.S. Patent Publication No. 2015/0250396 to Ahmed (“Ahmed”)
Ex-1006	U.S. Patent Publication No. 2015/0119732 to Wisbey (“Wisbey”)
Ex-1007	U.S. Patent Publication No. 2011/0201902 to Shiga (“Shiga”)
Ex-1020	Claim Mapping Table

Ex. No.	Description
Ex-1021	Claim Construction Order, <i>Oura Health Oy v. Circular SAS</i> , No. 22-cv-00478-ADA (W.D. Tex. Feb. 2, 2024)
Ex-1022	Joint Claim Construction Statement, <i>Oura Health Oy v. Circular SAS</i> , No. 22-cv-00478-ADA (W.D. Tex. Jan. 16, 2024)
Ex-1023	Daniel Siewiorek, <i>Wearable Computing: Retrospectives on the first decade</i> , GetMobile: Mobile Computing and Communications, Vol. 21, Issue 1, 5-10 (Carla Schlatter Ellis ed., Mar. 2017)
Ex-1024	David M. Ewalt, <i>Getting Fitbit</i> , Forbes (June 11, 2010), https://www.forbes.com/2010/06/11/fitbit-tracker-pedometer-lifestyle-health-lifetracking.html (last visited June, 25, 2024)
Ex-1025	Brian Santo, <i>The Consumer Electronics Hall of Fame: Fitbit</i> , IEEE Spectrum (Nov. 7, 2019), https://spectrum.ieee.org/the-consumer-electronics-hall-of-fame-fitbit (last visited June, 25, 2024)
Ex-1026	Garmin Forerunner 920XT Owner's Manual (2014)
Ex-1027	<i>Consumer Reports</i> (Dec. 2014)
Ex-1028	U.S. Patent No. 8,764,651 to Tran ("Tran")
Ex-1029	U.S. Patent No. 9,582,034 to Von Badinski ("Von Badinski")
Ex-1030	Kate Hartman, <i>Make: Wearable Electronics</i> 77, 113-143 (Maker Media, Inc., 2014) (citing Chapters 5 & 7)
Ex-1031	U.S. Patent No. 8,157,731 to Teller ("Teller '731")
Ex-1032	U.S. Patent No. 9,165,117 to Teller ("Teller '117")

II. LEGAL STANDARDS

19. In forming my opinions and considering the subject matter of the '429 Patent and its claims in light of the prior art, I am relying on certain legal principles that counsel in this case explained to me. My understanding of these concepts is

summarized below.

20. I understand that earlier publications and patents may act to render a patent unpatentable for one of two reasons: (1) anticipation, and (2) obviousness.

A. Anticipation

21. It is my understanding that the claims of a patent are anticipated by a prior art reference if each and every element of the claim is found either explicitly or inherently in the reference. I understand that inherency requires a showing that the missing descriptive matter in the claim is necessarily present in the allegedly anticipating reference, and that it would have been so recognized by a person of ordinary skill in the art (“POSITA”).

22. I understand that when a challenged claim covers several structures, either generically or as alternatives, the claim is deemed anticipated if any of the structures within the scope of the claim is found in the prior art reference.

23. Although anticipation typically involves the analysis of a single prior art reference, I understand that additional references may be used to show that the prior art reference has enabling disclosure (i.e., allows a POSITA to make the invention without undue experimentation), to explain the meaning of a term used in the prior art reference, and/or to show that a characteristic is inherent in the prior art reference.

B. Obviousness

24. As explained to me by counsel, I understand that a claim is invalid as obvious if it would have been obvious to a person of ordinary skill in the art at the time the alleged invention was made. This means that even if all of the elements of the claim cannot be found in a single prior art reference that would anticipate the claim, a person of ordinary skill in the art who was aware of the prior art would have been able to come up with the claimed invention. This may be the case, for example, where the missing element represents only an insubstantial difference over the prior art or a reconfiguration of a known system. I understand that in an obviousness determination, the person of ordinary skill in the art is presumed to have knowledge of all material prior art.

25. I understand that an obviousness analysis requires an understanding of the scope and content of the prior art, any differences between the alleged invention and the prior art, and the level of ordinary skill in evaluating the pertinent art.

26. I understand that when a product is available, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill in the art can implement a predictable variation, obviousness likely bars its patentability. For the same reason, if a technique has been used to improve one device and a person of ordinary skill in the art would have recognized that it would improve similar devices in the same way, using the

technique would have been obvious.

27. I understand that whether a prior art reference renders a patent claim unpatentable as obvious is determined from the perspective of a person of ordinary skill in the art at the time of the alleged invention. I have been told that there is not requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention, but a suggestion to combine known elements to achieve the claimed invention may come from the prior art, as filtered through the knowledge of one skilled in the art. In addition, I have been told that the inferences and creative steps a person of ordinary skill in the art would employ are relevant to the determination of obviousness.

28. I understand that one may consider, e.g., whether (1) the change was merely the predictable result of using prior art elements according to their known functions, or whether it was the result of true inventiveness; (2) there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; (3) the claimed innovation applies a known technique that had been used to improve a similar device or method in a similar way; (4) the claimed invention would have been obvious to try, meaning that the claimed innovation was one of a relatively small number of possible approaches to the problem with a reasonable expectation of success by those skilled in the art; (5) the invention merely substituted one known element for another known element in order

to obtain predictable results; (6) the invention merely applies a known technique to a known device, method, or product to yield predictable results; or (7) known work in one field of endeavor may have prompted variations of it for use in either the same field or a different one based on design incentives or other market forces that would have been predictable to a person of ordinary skill in the art.

29. I further understand that certain factors may support or rebut the obviousness of a claim. I understand that such secondary considerations include, among other things, commercial success of the patented invention, skepticism of those having ordinary skill in the art at the time of the invention, unexpected results of the invention, any long-felt but unsolved need in the art that was satisfied by the alleged invention, the failure of others to make the alleged invention, praise of the alleged invention by those having ordinary skill in the art, and copying of the alleged invention by others in the field. I understand that there must be a nexus—that is, a connection—between any such secondary considerations and the alleged invention. I also understand that contemporaneous and independent invention by others is a secondary consideration tending to show obviousness.

30. I am not aware of any allegations by the named inventor of the '429 Patent or any assignee of the '429 Patent that any secondary considerations tend to rebut the obviousness of the '429 Patent.

31. Additionally, I understand that in considering obviousness, it is

important not to use the benefit of hindsight derived from the patent under consideration.

C. Level of Ordinary Skill in the Art

32. When interpreting a patent, I understand that it is important to identify the relevant art pertaining to that patent, as well as the level of ordinary skill in that art at the time of the claimed invention. The “art” is the field of technology to which the patent is related.

33. I am informed and understand that the POSITA is a hypothetical person who is presumed to know the relevant prior art. I understand that the actual inventor’s skill is not determinative of the level of ordinary skill. I further understand that factors that may be considered in determining level of skill include: (i) the types 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. I understand that not all such factors may be present in every case, and one or more of them may predominate.

34. I understand that a POSITA is one who is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity.

35. A person of ordinary skill in the art at the relevant time, which I have

been told to consider as February 26, 2015 (“POSITA”) would have had at least a four-year degree in electrical engineering, biomedical engineering, or related field of study, or equivalent experience, and at least two years’ experience in academia or industry studying or developing, for example, sensor system design, signal processing, decision algorithms, and user interfaces. A higher level of education or skill might make up for less experience, and vice versa.

36. Based on my knowledge, skill, and experience, I have an understanding of the capabilities of a person of ordinary skill in the relevant art. For example, from my industry experience, I am familiar with what an engineer designing non-invasive sensors would have known and found predictable in the art. From teaching and supervising my post-graduate students, I also have an understanding of the knowledge that a person with this academic experience possesses. Furthermore, I possessed the knowledge of a POSITA myself at least as of 1997.

D. Claim Construction

37. I understand that the United States Patent and Trademark Office interprets claim terms in an *inter partes* review proceeding under the same claim construction standard that is used in a United States federal court. I understand that under this standard, the meaning of claim terms is considered from the viewpoint of a POSITA at the time of the alleged invention.

38. I have been informed that claim terms are generally given their ordinary

and customary meaning as understood by one of ordinary skill in the art in light of the specification and the prosecution history pertaining to the patent. I understand, however, that claims terms are generally not limited by the embodiments described in the specification.

39. I understand that in addition to the claims, specification, and prosecution history, other evidence may be considered to ascertain the meaning of claim terms, including textbooks, encyclopedias, articles, and dictionaries. I have been informed that this other evidence is often less significant and less reliable than the claims, specification, and prosecution history.

III. SUMMARY OF GROUNDS

40. I understand that Petitioner challenges the validity of Claims 1-6 of the '429 Patent. It is my opinion that the following grounds demonstrate that the claims of the '429 Patent are invalid.

Ground	Summary
1-2	Claims 1-6 are obvious over Ahmed (Ex-1005) alone or Ahmed in view of Shiga (Ex-1007).
3	Claims 1-6 are obvious over Wisbey (Ex-1006) in view of Shiga.
4	Claims 1-6 are obvious over Wisbey in view of Ahmed.

IV. THE '429 PATENT

A. Overview of the '429 Patent

41. The challenged claims are directed to a method for determining the

readiness of a user by processing and analyzing data related to the user's biological signals and physical activities, and using that data to calculate the user's "readiness score." Ex-1001, 1:6-9. The '429 Patent teaches that a "readiness score is an estimated readiness of the user to perform well at a given day," which "summarizes both physical and mental prerequisites for a good day" and "covers the effects of earlier physical activity, previous night's sleep, and body responses measured lately." Ex-1001, 4:43-48; *see also more generally*, Ex-1001, 4:43-54 ("The readiness score is an estimated readiness of the user to perform well at a given day. It summarized both physical and mental prerequisites for a good day. In essence, it covers the effects of earlier physical activity, previous night's sleep, and body responses measured lately. Body responses can mean for instance temperature, resting heart rates relative to user's own normative values, or how much they have changed as a response to previous day's physical activity. The terms recovery, alertness and readiness can be used interchangeably in this description and are meant to be understood as stated above.").

42. Many of the steps of the method of independent Claim 1 are depicted in the flowchart of Figure 13 below. Ex-1001, Fig. 13.

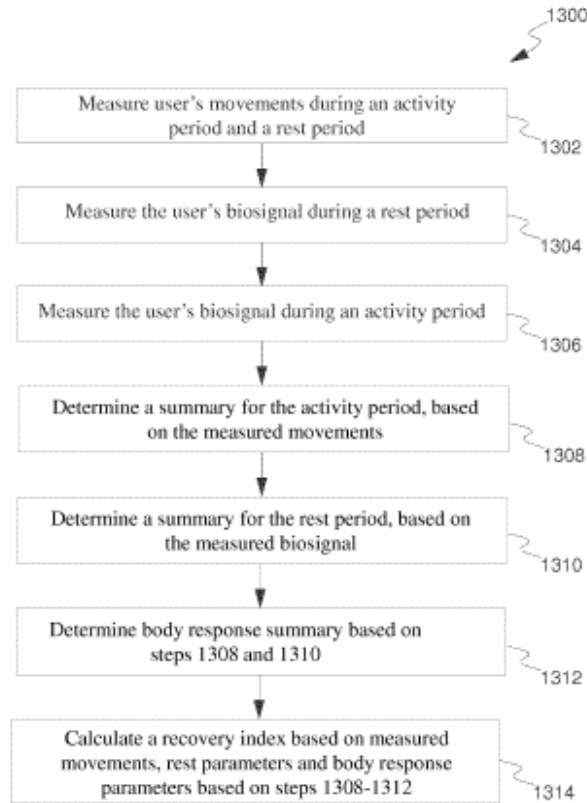
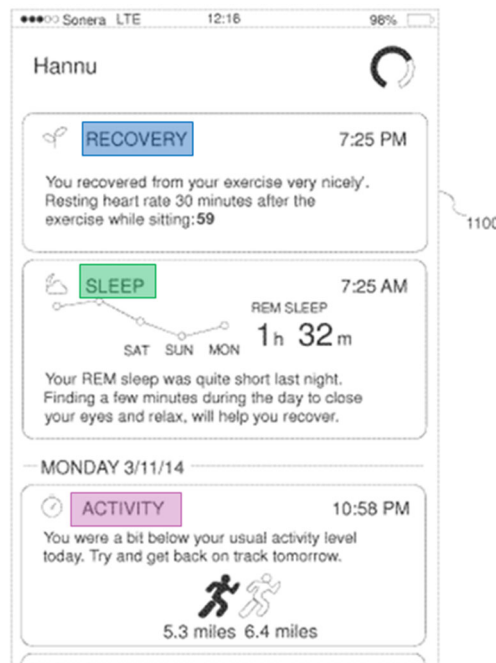


FIG. 13

43. The claimed method collects data regarding the user's movements (step 1302); measures the user's biosignal during the rest period (step 1304); determines a rest summary for the rest period based on the biosignal (step 1310); determines an activity summary for the activity period based on the user's movements from both the present and a previous activity period (step 1308); determines a body response summary based on the rest summary and activity summary (step 1312); and calculates a "readiness score" based on the present and a previous body response summary, which indicates the user's readiness level (step 1314). Ex-1001, Cl. 1, Fig. 13; *see also id.*, 21:57-22:31. The claimed method further requires "showing"

(i.e., displaying) elements contributing to the user's readiness score and instructions relating to physical and mental activity for improving the readiness score using a user interface of the mobile communication device. Ex-1001, Cl. 1. Figure 11 below depicts an exemplary user interface for displaying recovery (blue), sleep (green), and activity (purple) elements and instructions to the user. Ex-1001, Fig. 11.¹



44. The '429 Patent recognizes that methods for “calculat[ing] biological signals” and “monitor[ing] physical activities” of a user were well-known. *Id.*, 1:29-31 (“Conventionally, there are devices that may calculate biological signals of an individual and monitor physical activities of the individual.”). Yet the patent alleges

¹ Throughout, I have added emphasis and annotations unless otherwise specified.

that the claimed method is somehow inventive because it provides information relating to the user's recovery "from mental or physical loads," "a readiness score" that considers historical data, and "suggestions or recommendations that may help the [user] to efficiently recover from such" loads "to increase the readiness score." *Id.*, 1:31-42 ("However, such devices do not provide any information which relates to recovery of the individual from mental or physical loads that the individual is subjected to, neither do they provide any information related to a readiness score of the individual. Further, such devices do not analyse data, associated with health parameters of the individual, in detail. For example, such devices do not consider the individuals' historical data. Also, such devices are not capable of providing appropriate suggestions or recommendations that may help the individual to efficiently recover from such mental and/or physical load and to increase the readiness score."). As explained below, all of these concepts were known and thus the '429 Patent claims are obvious in view of the prior art.

B. Prosecution History of the '429 Patent

45. The '429 Patent was filed August 17, 2017, as the U.S. national stage application of International Patent Application PCT/FI2016/050113 filed February 23, 2016. Ex-1001. The '429 Patent claims priority to three provisional applications, 62/121,425 filed February 26, 2015, 62/205,114 filed August 14, 2015, and 62/260,760 filed November 30, 2015. Ex-1001. I apply the earliest alleged

priority date of the '429 Patent for my analysis herein, which I understand is February 26, 2015.

46. I understand that my Declaration presents opinions related to combinations of art that were not considered during prosecution. *See* Ex-1004. I also understand that the prior art combinations in my Declaration were not before the PTO during prosecution. Ex-1004.

V. TECHNOLOGY BACKGROUND

47. The use of sensors, computer processors, and graphical displays to measure, process, and visualize health data has been a mainstay of the health care field for many decades. The technologies for measuring heart activity, temperature, movement, blood pressure, oxygen levels, and other physiological characteristics are well known.²

² *See* example medical monitor, available at https://commons.wikimedia.org/wiki/File:Hospital_Patient_Monitor_%2817239884329%29.jpg.



48. Wearable computing devices had been in development since at least the early 1990s. *See, e.g.*, Ex-1023 (Siewiorek). Throughout the 1990s through 2014 these devices became smaller, lighter, more capable, and easier to wear. *Id.* at 9, Figs. 3-4. *See also* Ex-1031 (Teller '731), Fig. 7, 20:53-21:44; Ex-1032 (Teller '117), Fig. 7 (same), 20:65-21:56 (same).



FIGURE 3. VuMan 3.



FIGURE 4. AMEC technician selecting
next step in procedure.

49. Around 2009, Fitbit introduced consumer-grade wearable health and fitness monitors that could track motion and calculate user activity levels. Ex-1024 (Forbes Getting Fitbit); *see also* Ex-1025 (Consumer Electronics Hall of Fame).

50. By the earliest possible priority date of the '429 Patent, technologies for monitoring user activity and biological functions had become more sophisticated and more widely available. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to each of these factors. *Id.* at 3, 11.

Activity Tracking

Turning On Activity Tracking

The activity tracking feature records your daily step count, step goal, distance traveled, and calories burned for each recorded day. Your calories burned includes your base metabolism plus activity calories.

Activity tracking can be enabled during the initial device setup, or at any time.

Select **⋮ > Settings > Activity Tracking > Status > On.**

Your step count does not appear until the device locates satellites and sets the time automatically. The device may need a clear view of the sky to locate satellite signals.

Your total number of steps taken during the day appears beneath the time of day **!!**. The step count is updated periodically.

TIP: From the time of day screen, you can select **▼** to view additional activity tracking data.

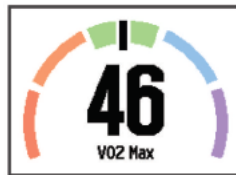
Sleep Tracking

During sleep mode, the device monitors your rest. Sleep statistics include total hours of sleep, sleep levels, and sleep movement.

About VO2 Max. Estimates

VO2 max. is the maximum volume of oxygen (in milliliters) you can consume per minute per kilogram of body weight at your maximum performance. In simple terms, VO2 max. is an indication of athletic performance and should increase as your level of fitness improves. VO2 max. estimates are provided and supported by Firstbeat Technologies Ltd. The Forerunner device has separate VO2 max. estimates for running and cycling. You can use your Garmin device paired with a compatible heart rate monitor and power meter to display your cycling VO2 max. estimate. You can use your Garmin device paired with a compatible heart rate monitor to display your running VO2 max. estimate.

Your VO2 max. estimate appears as a number and position on the color gauge.



 Purple	Superior
 Blue	Excellent
 Green	Good
 Orange	Fair
 Red	Poor

See also Ex-1031 (Teller '731), Figs. 5 (Health Manger 150 displaying summaries

corresponding to each Health Index 155 category and providing information on the user's vital signs), 7 (displaying an Activity Level summary), 9 (displaying a Sleep summary), 19:33-57 ("Health Index 155 is a graphical utility used to measure and provide feedback to member users regarding their performance and the degree to which they have succeeded in reaching a healthy daily routine suggested by central monitoring unit 30. Health Index 155 thus provides an indication for the member user to track his or her progress. Health Index 155 includes six categories relating to the user's health and lifestyle: Nutrition, Activity Level, Mind Centering, Sleep, Daily Activities and How You Feel."), 20:53-21:44 (discussing Activity Level summary), 22:27-23:16 (discussing Sleep summary), 24:26-29 ("Sleep and Activity Level might be simultaneously displayed in order to compare and evaluate Sleep ratings with corresponding Activity Level ratings to determine if any day to-day correlations exist."), 24:41-25:20; Ex-1032 (Teller '117), Figs. 5, 7, 9, 19:46-20:3, 20:65-21:56, 22:39-23:28, 24:39-42, 24:54-25:33.

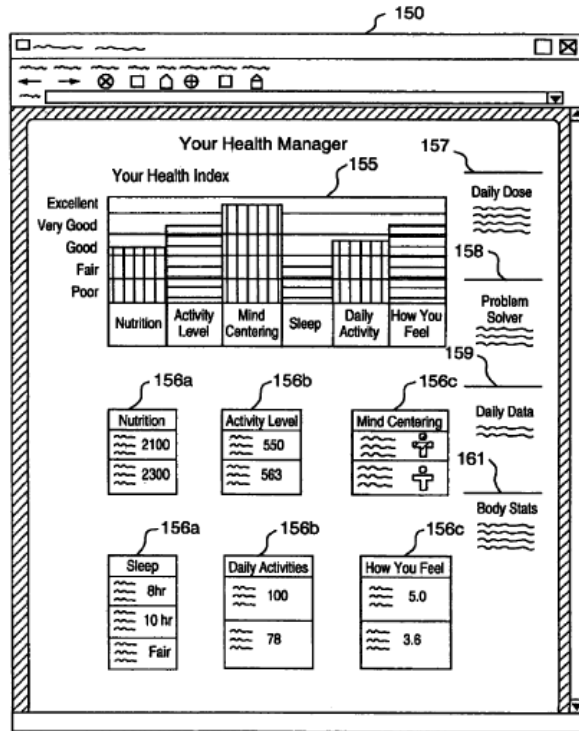


FIG. 5

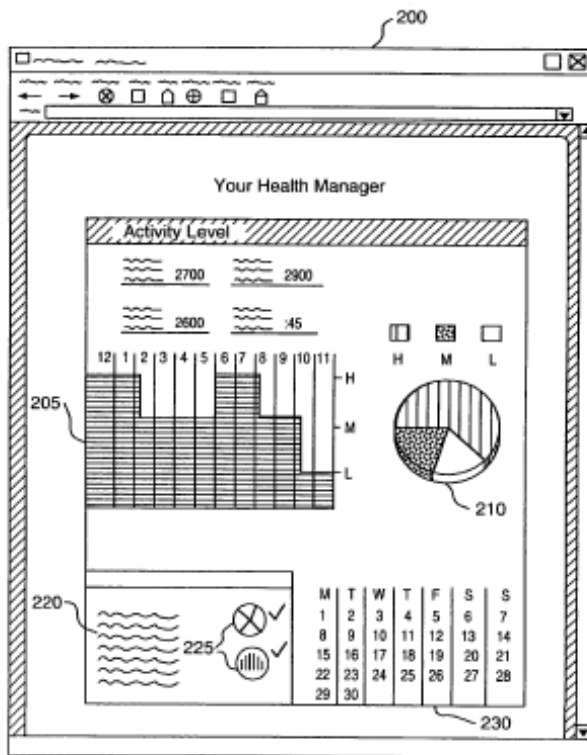
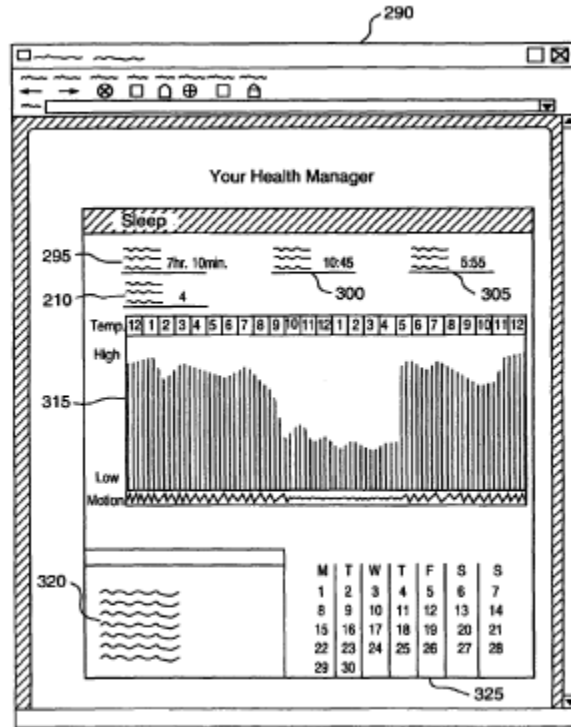


FIG. 7

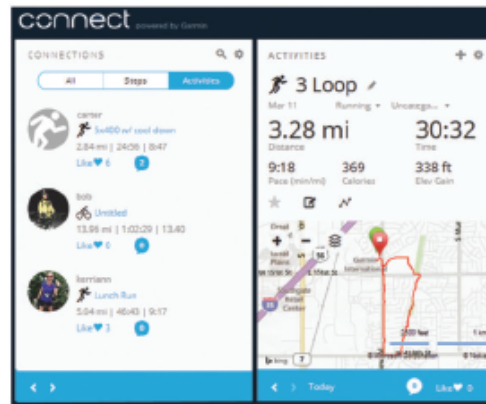


51. The Garmin product also included software to store historical data about the health measurements and to perform analysis and provide graphical visualizations. Ex-1026, 5-6, 8.

Store your activities: After you complete and save an activity with your device, you can upload that activity to Garmin Connect and keep it as long as you want.

Analyze your data: You can view more detailed information about your activity, including time, distance, elevation, heart rate, calories burned, cadence, VO2 max., running dynamics, an overhead map view, pace and speed charts, and customizable reports.

NOTE: Some data requires an optional accessory such as a heart rate monitor.



Similar teachings appear in, *e.g.*, Ex-1031 (Teller '731), Figs. 7 (Activity level calendar 230 allows the user to select among views having variable and selected time periods such that the user can view previous day summaries), 9 (providing the same data for Sleep), 20:53-21:44, 22:27-23:16; Ex-1032 (Teller '117), Figs. 7, 9, 20:65-21:56, 22:39-23:28.

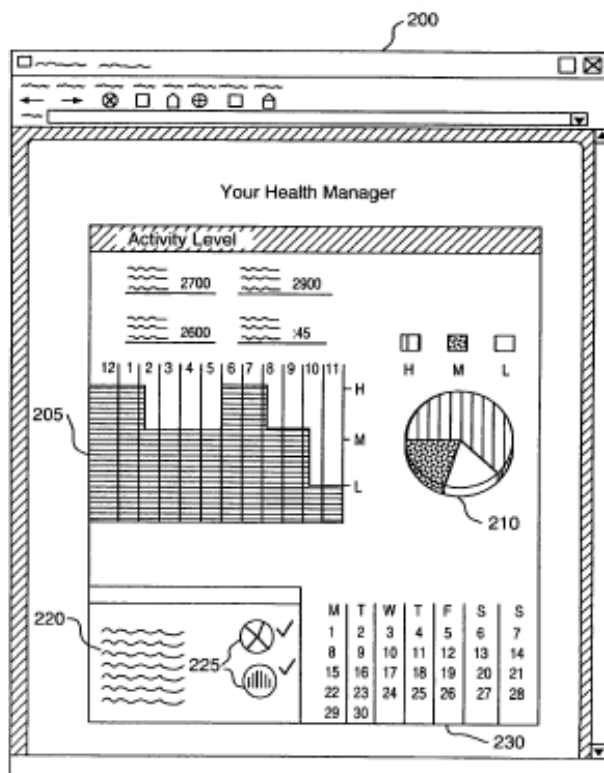


FIG. 7

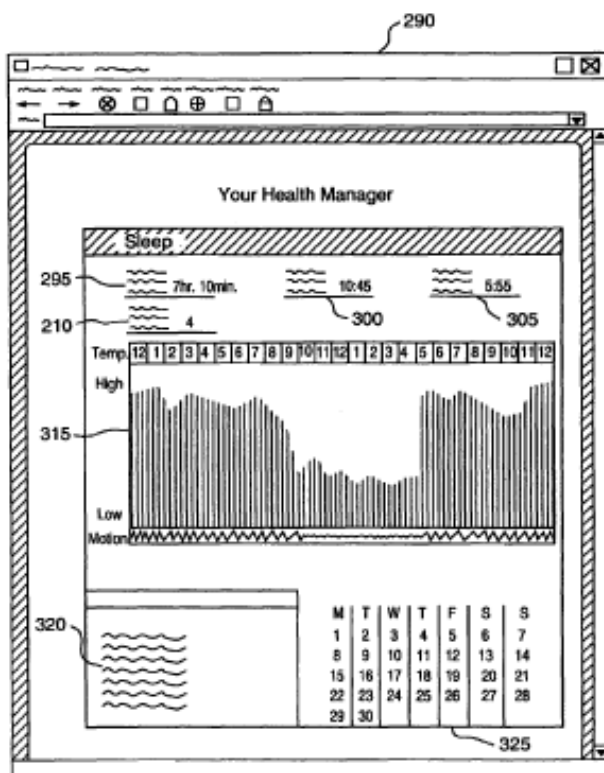


FIG. 9

52. The Garmin product also included a “Recovery Advisor,” which provided feedback by “display[ing] how much time remains before [the user] is fully recovered and ready for the next hard workout.” Ex-1026, 12. This included “Recovery check,” which “provides a real-time indication of [the user’s] state of recovery within the first several minutes of an activity” and “Recovery time,” which counts down [time] until it is optimal for [the user] to attempt another hard workout.” *Id.* Similar teachings appear in, e.g., Ex-1031 (Teller ’731), Table 3 (one of the things continually measured is “readiness”); Ex-1032 (Teller ’117), Table 3 (same).

53. By the end of 2014, many wearable health and fitness monitoring devices were available on the market. Consumers Report noted that “[s]ome also serve as health and fitness devices tracking your physical activity and sleep patterns.” Ex-1027 (Consumer Reports) at 46. The same article notes that “[t]he Apple Watch will measure changes in atmospheric pressure to calculate altitude and use infrared and visible-light LEDs on the back of the case to shine into the wrist’s blood vessels to determine your heart rate.” *Id.*

54. Books targeted to engineers at the time extolled the opportunities for wearable electronics. For example, Make Magazine published a compendium on Wearable Electronics in 2014. Ex-1030. Chapter 5, “Making Electronics Wearable” asks the question “Why does this need to be wearable?” and provides several possible reasons:

“There are many possible answers to this question, but it’s important that you have at least one in mind. Here are a few:

- You are sensing the body in such a way that the sensor needs to be placed on the body.
- You have a display or feedback mechanism that needs to stay with a person at all times.
- Your project needs to travel with the user and not stay in one place.
- You want to create a particularly intimate or immersive experience for the wearer.
- Your project is specifically clothing-oriented, such as a costume or fashion piece.
- You’re interested in the future of wearable electronics and want to use making as a way to think about what’s next.”

Ex-1030 at 77.

55. The same book explains the capabilities of various sensors in measuring physical phenomena and techniques for processing sensor data in Chapter 7, “Sensors”:

“A sensor is an electronic component that measures some aspect of the physical world and converts that measurement into varying electrical characteristics, namely voltage or resistance. Sensors can sense things like light, movement, temperature, and touch. They are exciting because they make the physical world perceivable by computers—even tiny computers like microcontrollers.” *Id.* at 113.

“In this chapter, you’ll take a moment to consider how you can best listen to what’s happening in, on, and around the body through technological means. You’ll encounter an assortment of body-centric sensors and look at some simple ways to work with the data they produce.” *Id.*

“Once you’re able to get access to the sensor data, you then need

to figure out what to do with it. In this section, I explore some concepts for making sense of sensor data, including thresholds, mapping, calibration, constraining, and smoothing.” *Id.* at 117.

“When working with a range of sensor values, sometimes it’s helpful to indicate what different ranges within those values mean. Thresholds are a good way to get started.” *Id.*

“Mapping is a way to translate a value from one range of numbers to another. It can be used to create a direct relationship between an input and an output.” *Id.* at 119.

“Calibration is a way to fine-tune your code so that it is responsive to a specific set of conditions. The range of what a sensor senses will differ based on its environment and context.” *Id.* at 120.

“Smoothing can help turn an erratic datastream into something cleaner and easier to work with.” *Id.* at 122.

56. This book explains that sensors can measure “Movement, Orientation, and Location.” *Id.* at 128. Examples are provided including instructions for the use of multi-axis accelerometers and compasses. *Id.* at 128-130.

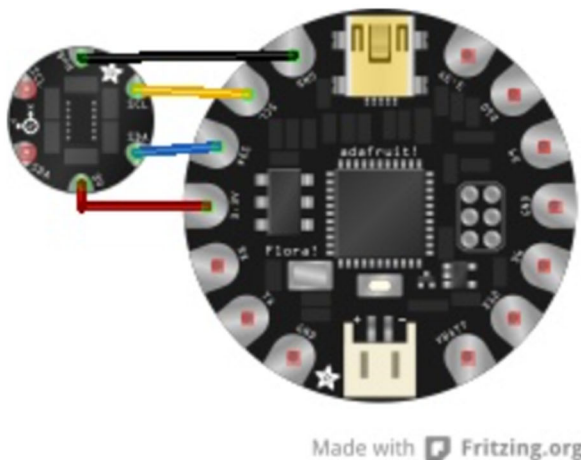


Figure 7-40. Flora accelerometer/compass circuit diagram

57. Specific instructions are also provided for the use of biosensors including heart rate sensors. *Id.* at 131. These clearly place the capability for biosensor measurements within the capabilities of an ordinary artisan.

“Your heart beats faster when you’re excited, and your skin gets clammy when you’re nervous. Besides sensing your environment and your movements, you can also use sensors to learn more about what is happening within someone’s body. A great place to start sensing these biometrics is pulse or heart rate.” *Id.* at 131.

“Optical heart rate sensors (Figure 7-43), such as the Pulse Sensor Amped (AF 1093, SF SEN-11574), are a small, lower-cost solution for measuring pulse. This type of sensor measures the mechanical flow of blood, usually in a finger or earlobe. It contains an LED that shines light into the capillary tissue and a light sensor that reads what is reflected back.” *Id.* at 131.

“Chest strap heart monitors are a more expensive but more accurate solution for measuring heart rate. They measure the actual electrical frequency of the heart through two conductive electrodes (oftentimes made of conductive fabric) that must be pressed firmly against the skin.” *Id.* at 132.

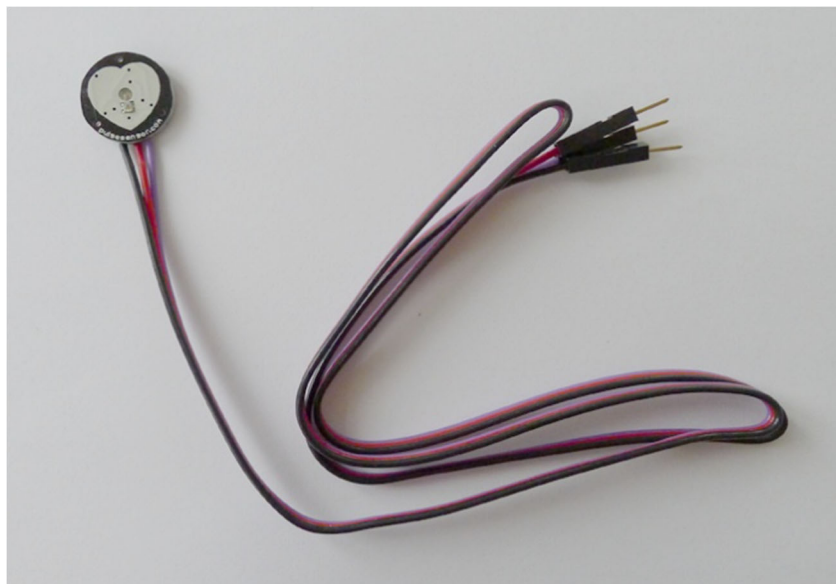


Figure 7-43. Pulse sensor

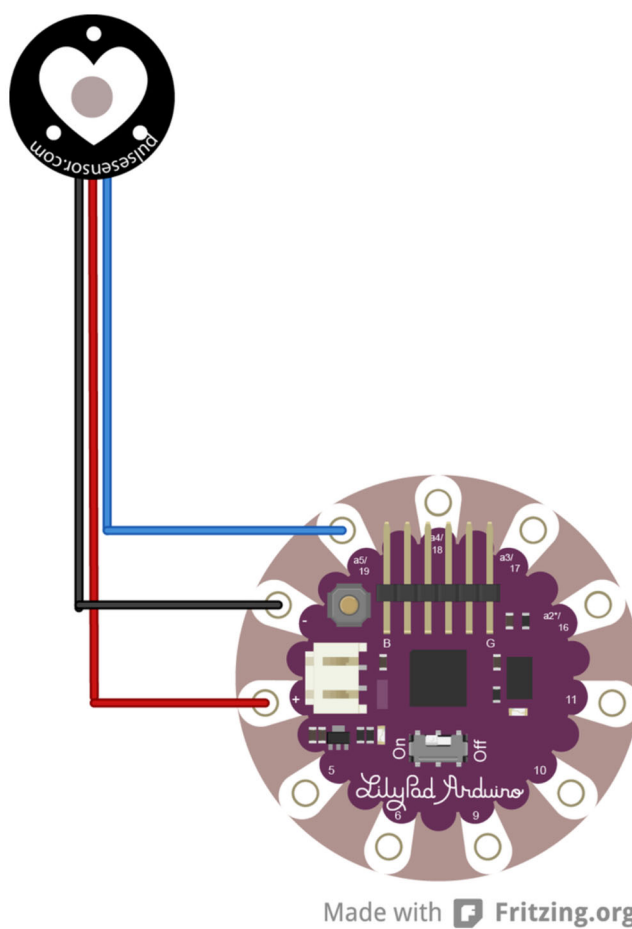


Figure 7-44. Pulse sensor circuit diagram

58. It is also explained that there are numerous other biosensor

measurements that are within the capabilities of an ordinary artisan. *Id.* at 132-133.

Color and temperature measurements are also discussed. *Id.* at 136-141.

“Beyond heart rate, there are many other biological signals you might want to measure. Here are a few:

Galvanic skin response (GSR)

A method of measuring the conductivity of the skin. Changes in this conductivity can indicate a response to physical or psychological stimulus. GSR sensors are used in classic lie detectors. A GSR sensor can be built with some basic inexpensive electronic components.

Electromyography (EMG)

A method of measuring of muscle activity by detecting its electrical potential. The Muscle V3 Sensor Kit (SF SEN-11776) provides varying analog voltage so you can easily read muscle activity with an Arduino analog input pin.

Electroencephalography (EEG)

A method of measuring electrical activity in the scalp. EEG headsets are often used in thought-controlled computing applications.” *Id.* at 132-133.

59. The most popular wearable designs in 2014 were in the form of a watch, but by the earliest possible priority date of the '429 Patent, a POSITA would also have been familiar with various designs that incorporate the requisite sensors and processing capabilities into a ring form factor or otherwise suited to measuring a finger. U.S. Patent Publication No. 2015/0119732 to Wisbey (Ex. 1006) teaches a wristband for monitoring biological signals but also teaches the use of a finger sensor.

“FIG. 1 illustrates a cross-sectional view of the wristband and

electronic modules of an example activity monitoring device.” [0018], “In one embodiment, the attachable device is a wristband that includes an activity monitoring device.” [0035]. “In some embodiments, finger biosensor 220 and wrist biosensor 210 are replaced or supplemented by a single biosensor. The single biosensor, in an embodiment, is an optical biosensor such as a pulse oximeter configured to detect blood oxygen saturation levels. The pulse oximeter may then output a signal to logic circuits 240 indicating detected a cardiac cycle phase, and the logic circuits may use cardiac cycle phase data to calculate a HRV value.” Ex-1006 ¶40.

“Wristband 100 comprises material 110 configured to encircle a human wrist. In one embodiment, wristband 100 is adjustable”. [0041] “Measuring HRV, in one embodiment, involves the combination of wrist biosensor 210 and finger biosensor 220. Wrist biosensor 210 may measure the heartbeat in the wrist of one arm while finger sensor 220 measures the heartbeat in a finger of the hand of the other arm.” Ex-1006 ¶101.

60. U.S. Patent No. 8,764,651 to Tran issued on July 1, 2014 (Tran) teaches a ring for health and wellness monitoring that uses biosensors. Ex-1028 (Tran). “Turning now to FIGS. 8-13, various exemplary monitoring devices are shown. In FIG. 8, a ring 130 has an opening 132 for transmitting and receiving acoustic energy to and from the sensor 84 in an acoustic implementation. In an optical implementation, a second opening (not shown) is provided to emit an optical signal from an LED, for example, and an optical detector can be located at the opening 132 to receive the optical signal passing through the finger wearing the ring 130. In another implementation, the ring has an electrically movable portion 134 and rigid portions 136-138 connected thereto. The electrically movable portion 134 can

squeeze the finger as directed by the CPU during an applanation sweep to determine the arterial blood pressure.” Ex-1028 (Tran), 54:5-17, Fig. 8.

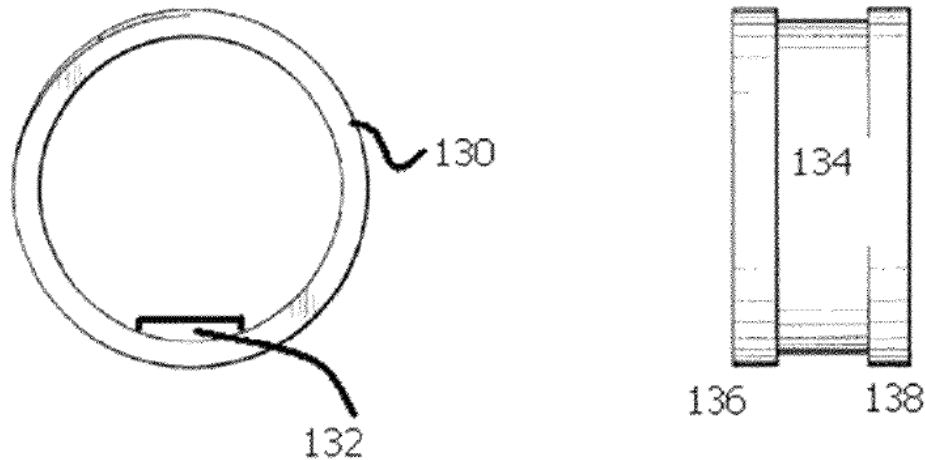


FIG. 8

61. Tran teaches the use of biosensor information to determine qualitative and quantitative aspects of both a user’s physical activities and mental activities and to create appropriate notifications and warnings:

“A module 54 monitors patient or wearer activity and generates a warning if the patient or wearer has fallen. In one implementation, the system detects the speed of center of mass movement. If the center of mass movement is zero for a predetermined period, the patient or wearer is either sleeping or unconscious. The system then attempts to signal the patient or wearer and receive confirmatory signals indicating that the

patient or wearer is conscious. If patient or wearer does not confirm, then the system generates an alarm. For example, if the patient or wearer has fallen, the system would generate an alarm signal that can be sent to friends, relatives or neighbors of the patient or wearer. Alternatively, a third party such as a call center can monitor the alarm signal. Besides monitoring for falls, the system performs video analysis of the patient or wearer. For example, during a particular day, the system can determine the amount of time for exercise, sleep, and entertainment, among others. The network of sensors in a patient or wearer's home can recognize ordinary patterns—such as eating, sleeping, and greeting visitors—and to alert caretakers to out-of-the-ordinary ones—such as prolonged inactivity or absence. For instance, if the patient or wearer goes into the bathroom then disappears off the sensor for 13 minutes and don't show up anywhere else in the house, the system infers that patient or wearer had taken a bath or a shower.” Ex-1028 (Tran), 11:41-67.

“In another embodiment, the patch includes a Galvanic Skin Response (GSR) sensor. In this sensor, a small current is passed through one of the electrodes into the user’s body such as the fingers and the CPU calculates how long it takes for a capacitor to fill up. The length of time the capacitor takes to fill up allows us to calculate the skin resistance: a short time means low resistance while a long time means high resistance. The GSR reflects sweat gland activity and changes in the sympathetic nervous system and measurement variables. Measured from the palm or fingertips, there are changes in the relative conductance of a small electrical current between the electrodes. The activity of the sweat glands in response to sympathetic nervous stimulation (Increased sympathetic activation) results in an increase in the level of conductance. Fear, anger, startle response, orienting response and sexual feelings are all among the emotions which may produce similar GSR responses.”

Ex-1028 (Tran), 38:43-59; *see also similar teachings in*: Ex-1031 (Teller ’731), Figs. 7-9, 21:43-47 (“[A]ctivity level web page 200 may include at least one hyperlink 220 to allow a user to directly access relevant news items and articles,

suggestions for refining or improving daily routine with respect to activity level and affiliate advertising elsewhere on the network.”), 22:28-34 (“The preferred mind centering web page may also include an indication of the total time spent on mind centering activities, shown at 275, hyperlinks 280 which allow the user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to mind centering and affiliate advertising, and a calendar 285 for choosing among views having variable and selectable time periods.”), 23:19-25 (“The sleep web page 290 may also include hyperlinks 320 which allow the user to directly access sleep related news items and articles, suggestions for refining or improving daily routine with respect to sleep and affiliate advertising available elsewhere on the network, and a sleep calendar 325 for choosing a relevant time interval.”); Ex-1032 (Teller ’117), Figs. 7-9, 21:43-47, 22:28-34, 23:19-25.

62. Similarly, U.S. Patent No. 9,582,034 to Von Badinski was filed on November 28, 2014 (Von Badinski) and teaches a ring for health and wellness monitoring that uses biosensors. Ex-1029 (Von Badinski). “The present disclosure describes a wearable computing device (WCD) in the form of a ring that can be worn on the finger of a human user.” Ex-1029 (Von Badinski), Abstract. Von Badinski illustrates the physical construction of such a ring, explains the health and fitness functionality it can embody, and describes the various components including sensors, computing resources, power supplies, and wireless communications:

“Accordingly, the present embodiments of the WCD 110 can function as fitness monitors/computer which is suitable for prolonged usage so as to create accurate results. In addition or as an alternative to fitness monitoring, as will be discussed in more detail below, the WCD 110 can function as a remote input device through, for example, gesture recognition. In some embodiments, the WCD 110 can further function as a sleep monitor, a heart rate sensor, a cardiac monitor a body temperature detector, or the like. It is noted that, for those embodiments which can function as a cardiac monitor (e.g., that measures electrocardiogram (EKG)), it may be necessary to establish a closed loop (e.g., for the electrical measurement of EKG) across the heart. As such, in some of those embodiments, a separate conductive pad can be coupled to the WCD 110 so that a user can pinch the pad with fingers on an opposite hand.

Specifically, in some embodiments of the present disclosure, the WCD 110 can be worn by the user (e.g., on a finger) for fitness, physical activity, biological data monitoring as well as for gestural input or other suitable purposes. As shown in FIGS. 1A and 1B, the WCD 110 can include the exterior window 120 on its exterior wall for input/output data transmission and reception, battery recharge, or status indication. The WCD 110 can also include the interior window 130 on its interior wall for various monitoring or sensing activities. The form factor of the WCD 110 allows it to be worn for prolonged hours with constant and consistent contact with the skin area, thereby creating a more reliable and extended recording (e.g., as compared to aforementioned conventional fitness monitors) of the user's fitness activity, physical exercise, as well as health information such as heart rates and body temperature.” Ex-1029 (Von Badinski), 9:20-51, Figs. 2, 3A.

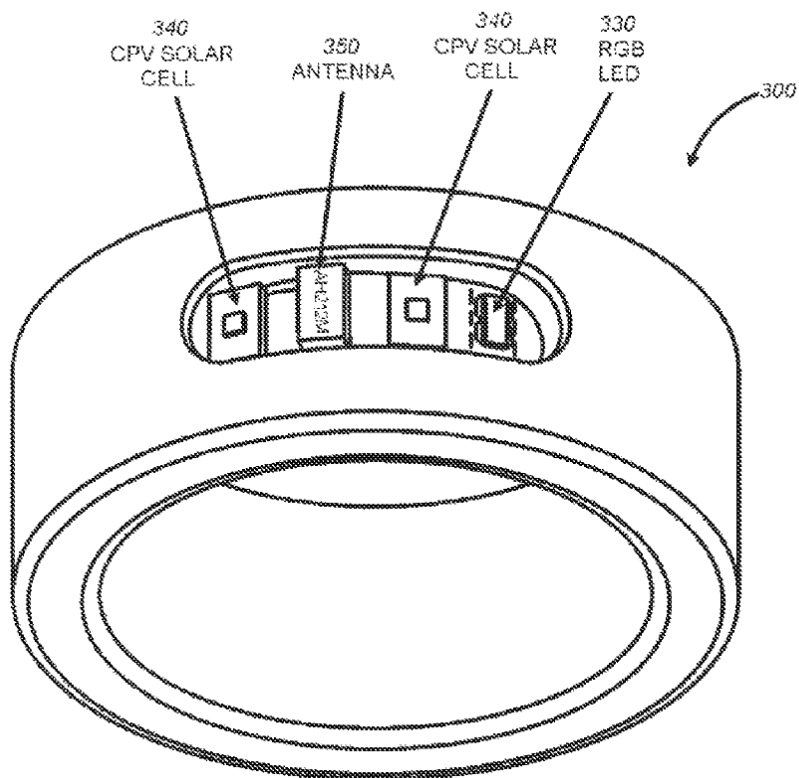


FIG. 3A

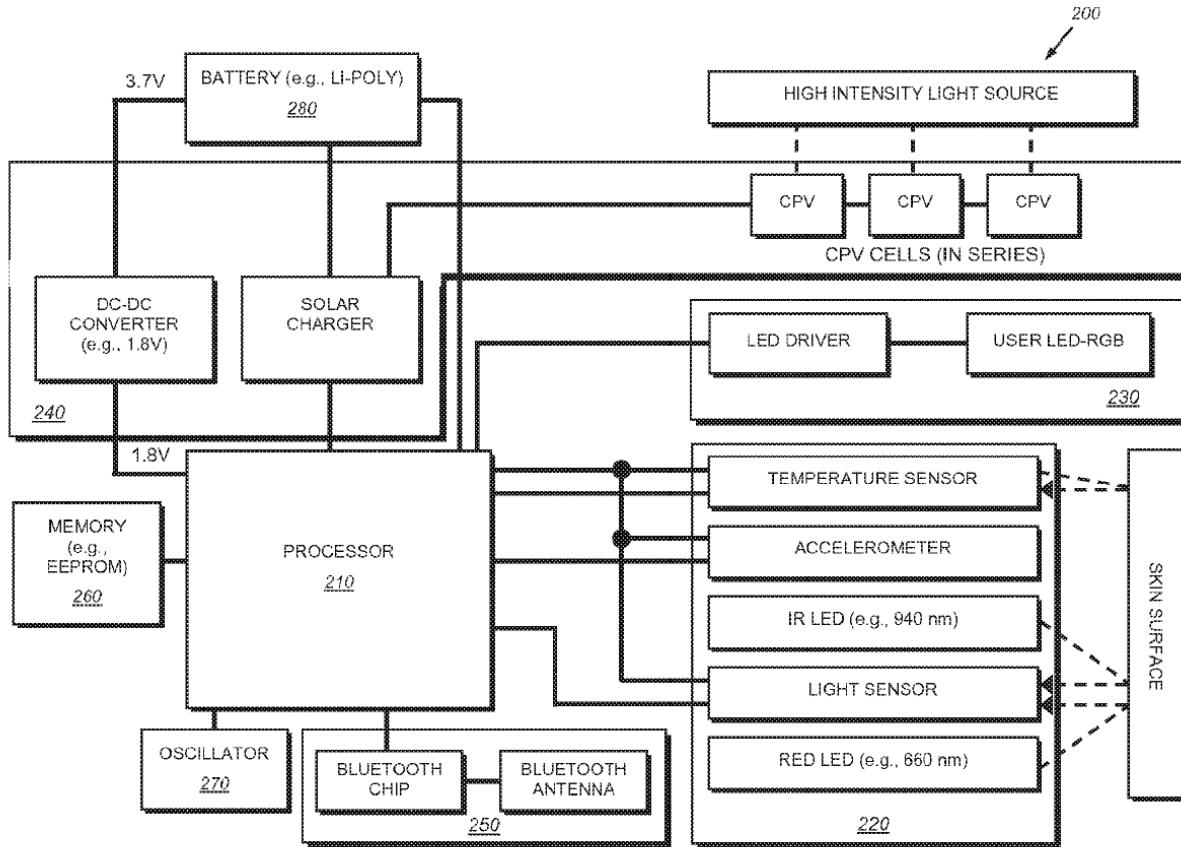


FIG. 2

63. Von Badinski also teaches the processing of biosensor information and its comparison to reference data to determine how and when to alert a user:

“Another aspect of the disclosure provides a method of generating an alert, comprising: authenticating a first wearer of a first wearable computing device as a first authenticated user; transmitting first biometric data associated with the first wearer; associating the first biometric data with a first profile associated with the first wearer of the first wearable computing device; comparing the first biometric data with a group profile comprising aggregated biometric data from a plurality of distinct wearers of a plurality of distinct wearable computing devices; and generating an alert if the first biometric data falls outside of a predetermined threshold set by the aggregated biometric data.

In one example, the biometric data comprises at least one of heart rate; ECG profile; blood sugar, and blood pressure.” Ex-1029 (Von Badinski), 4:16-29.

64. Von Badinski also teaches a user interface on a mobile device for reporting current and historical health and fitness information to a user. Ex-1029 (Von Badinski) at 13:21-24, 28:39-41 (“fitness activities, exercise histories, as well as recorded biological signs such as heart rate and body temperature, can be stored onboard in the memory 260 of the WCD 110”; “The WCD can also use historic temperature data to develop trend temperature data.”). *See also*:

“FIG. 10 is an example screenshot illustrating a user interface of a mobile application coupled to the WCD and displaying fitness monitoring readings in accordance with some embodiments[.]

FIG. 11 is an example screenshot illustrating a user interface of a mobile application coupled to the WCD and displaying sensor readings (e.g., for calibration purposes) in accordance with some embodiments.” Ex-1029 (Von Badinski), 5:26-33.

“As previously mentioned, the WCD 110 can be used with a software application (e.g., a mobile phone application for the Apple iOS or the Google Android OS) which can run on the user's computing device (e.g., a mobile device such as a smart phone). Specifically, the software application can facilitate the mobile device of the user to couple to the WCD 110 (e.g., via the communication module 250) for data communication, such as downloading activity logs, changing configuration and preferences, training the WCD. The software application can also generate a user interface showing the results or readings from the health and fitness tracking performed by the WCD 110. FIG. 10 is an example screenshot illustrating such user interface 1000 displaying fitness monitoring readings in accordance with some embodiments.” Ex-1029 (Von Badinski), 15:9-23.

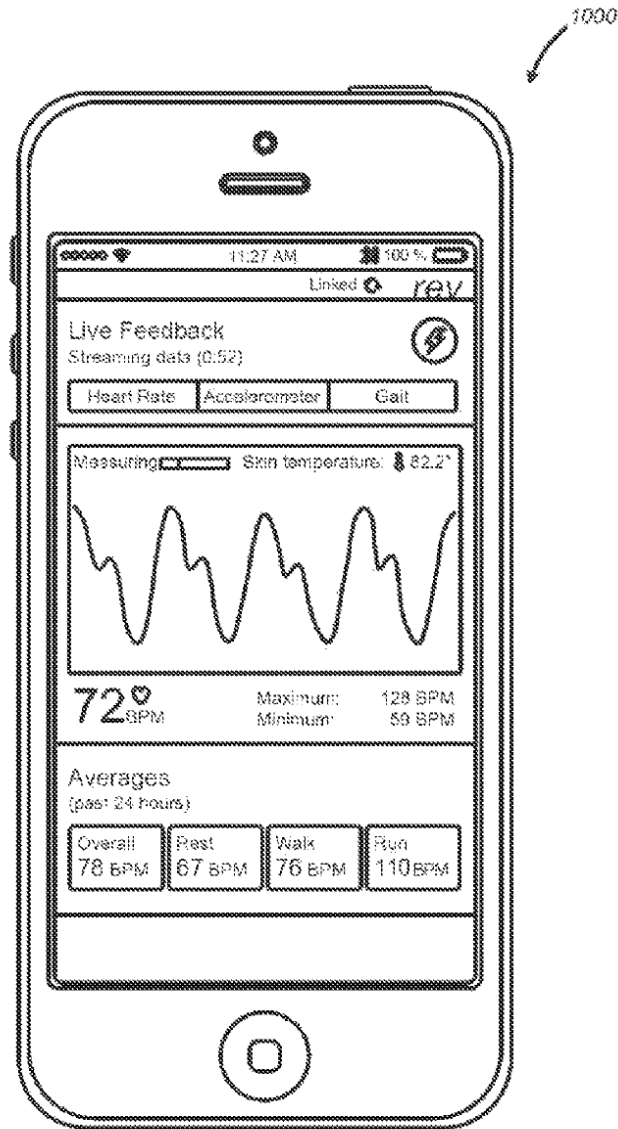


FIG. 10

65. Von Badinski measures a number of indicators of activity and draws conclusions about activity types and activity periods from current and historical measurements:

“In accordance with one or more embodiments, the sensor modules 220 can include various sub-modules for the WCD 110 to perform different monitoring or sensing activities. A view 302 of the interior window (e.g., window 130) of a WCD (e.g., WCD

110) with example components exposed is shown in FIG. 3B. As shown in the example of FIG. 3B, the sensor modules 220 can include a temperature sensor 320 a, a red light emitting diode (LED) 320 b, a light sensor 320 c, and an infra-red LED 320 d. Among the sensors in the sensor modules 220, those sensors (e.g., sensors 320 a-320 d) which are directly related to biological sign monitoring can be configured and positioned in a way that is close to the skin (e.g., facing the interior window 130 of the WCD 110). Although not shown in FIG. 3B for simplicity, the sensor modules 220 can further include sensors that are not directly related to biological sign monitoring; some examples of these sensors include accelerometers, gyroscopes, vibration, sensors (e.g., a magnetometer or a digital compass), or other suitable sensors (e.g., for gesture recognition). The magnetometer can measure the strength and/or direction of a prevailing magnetic field. In this regard, the magnetometer can be used during global positioning and/or navigation. In particular, the magnetometer can be used to measure a directional heading when the WCD is in motion and can supplement position data where the WCD is out of communication range. In one or more embodiments, the accelerometers in the sensor modules 220 can detect movements in multiple (e.g., 3) dimensions or axes. The accelerometer can measure force of acceleration of the WCD and can measure gestures performed by a user while wearing the WCD. In other examples, the accelerometer can detect acceleration of the user while wearing the WCD. This can permit tracking of activity level, such as steps taken or number of laps swum in a pool.

The temperature sensor can be any type of sensor that detects temperature, such as a thermistor, PTC, NTC, etc. In another example, the temperature sensor can use IR light emitted from an object to calculate a surface temperature of the object in a manner clear to those of ordinary skill in the art.

Together, the processor module 210 and the sensor modules 220 can enable the WCD 110 to perform multiple functions including, for example, pedometer, sleep monitor (e.g., which monitors sleep quality), heart rate sensor, pulse oximetry, skin (and in select embodiments, ambient) temperature. In addition,

some embodiments of the WCD 110 can further function as a gesture input device. In particular, the present embodiments recognize that the WCD 110 can detect finger motions or gestures which may be difficult for conventional fitness sensors to detect, such as a tap, a snap, a knock on the table, and the like. In some embodiments, the WCD 110 can utilize the accelerometer to measure the activity level (e.g., arm movement) in conjunction with the measured heart rate to determine if the user is walking horizontally, running, swimming, or climbing stairs. Other activities can be identified by the WCD 110 may include biking or sleeping.” Ex-1029 (Von Badinski), 10:58-11:47.

66. Von Badinski also teaches maintaining a log of daily activities. Ex-1029 (Von Badinski), Fig. 42.

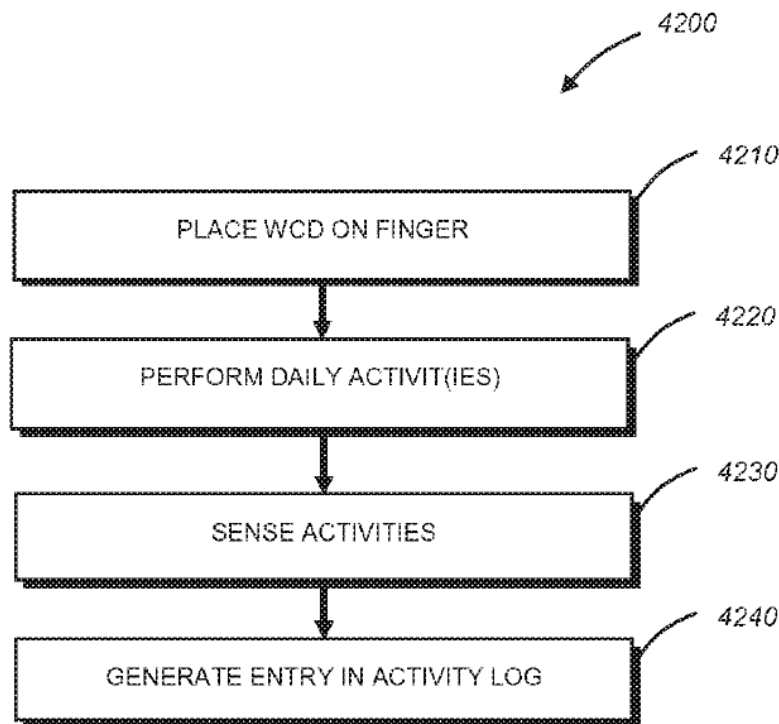


FIG. 42

67. By the earliest possible priority date of the '429 Patent, thus, a POSITA would have been very familiar with the intended operation of a wearable health and fitness monitoring device as well as the hardware and software components required to construct one. Specific biosensors were well-known. The use of multiple measurements, over time and from multiple sensors, to reach determinations about the type, duration, and quality of various activities was common. Assessment of both physical and mental conditions was well understood. Watch and ring form factors were available. User interfaces on the sensor device or on a separate mobile device were used. The understanding of a POSITA at the time should incorporate this context.

VI. THE PRIOR ART IN THE APPLIED INVALIDITY GROUNDS

A. Ahmed (U.S. Patent Publication No. 2015/0250396) (Ex-1005)

68. Ahmed (U.S. Patent Publication No. 2015/0250396) was filed March 5, 2013, and published September 10, 2015. As explained to me by counsel, I understand that Ahmed qualifies as prior art under 35 U.S.C. §102(a)(2).

69. Ahmed teaches a method for determining a “user’s recovery after physical exertion or daily stress given sleep and other forms of rest” by analyzing data related to the user’s biological signals during physical and sleep activities and using that data to calculate the user’s “recovery score.” Ex-1005 ¶47. Specifically, Ahmed determines a “sleep score,” which summarizes the user’s “sleep efficiency”

and “sleep duration” based on “a combination of physiological parameters,” such as the user’s heart rate during sleep. Ex-1005 ¶166 (“The sleep score indicates and is a measure of sleep efficiency (how good the user’s sleep was) and sleep duration (if the user had sufficient sleep). Each of these measures is determined by a combination of physiological parameters, personal habits and daily stress/strain (intensity) inputs. ... [The sleep score] thus takes advantage of the continuous monitoring nature of the exemplary physiological measurement systems disclosed herein by considering each sleep period in the context of biologically-determined sleep needs, pattern-determined sleep needs and historically-determined sleep debt.”). Ahmed further teaches determining an “intensity score,” which is calculated based on the user’s heart rate reserve (HRR) (Ex-1005 ¶144) and provides a summary of “the cardiovascular intensities experienced by the user during a portion of a day, during the entire day or during any desired period of time (e.g., during a week or month).” Ex-1005 ¶142 (“The intensity score is customized and adapted for the unique physiological properties of the user and takes into account, for example, the user’s age, gender, anaerobic threshold, resting heart rate, maximum heart rate, and the like.”). Ahmed’s feedback panel, depicted below in Figure 15A, presents a qualitative summary to the user regarding the user’s sleep (green) and physical (purple) activities. Ex-1005, Fig. 15A.

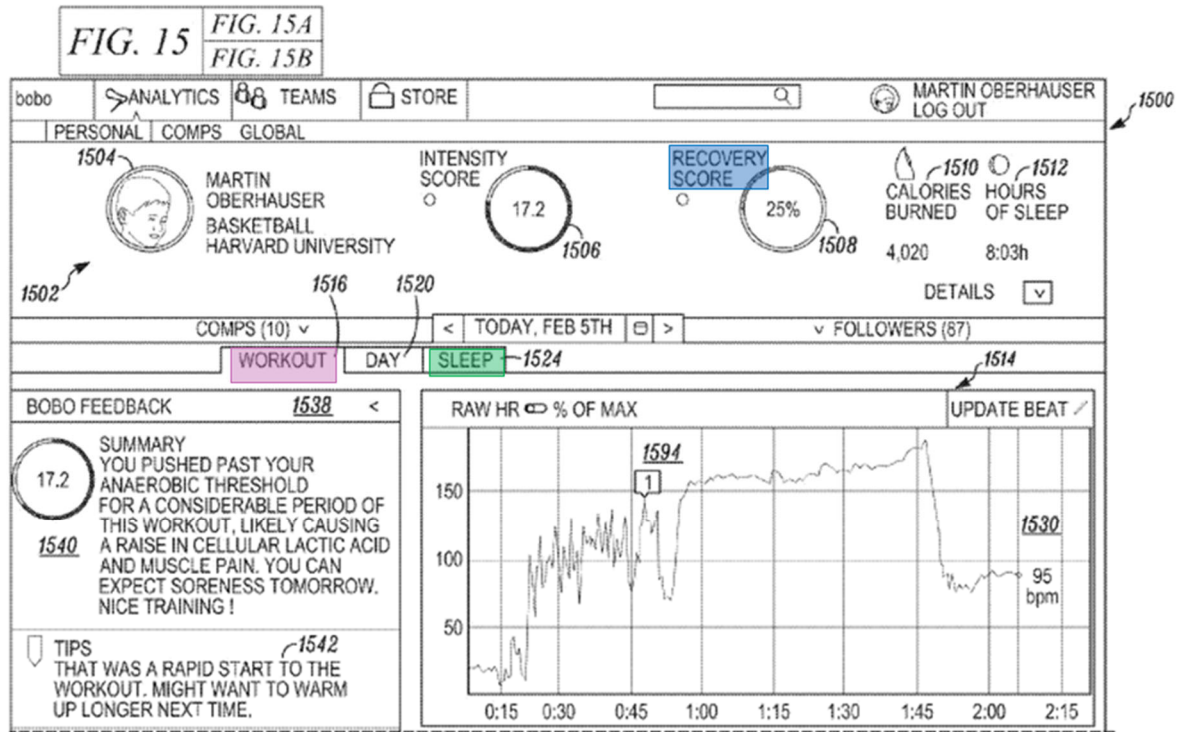


FIG. 15A

70. Ahmed further teaches a recovery score, which indicates the “level of recovery of a user’s body and health after a period of physical exertion.” Ex-1005 ¶¶160-161. The recovery score indicates the user’s readiness level by, for example, helping the user understand “how exercise-ready he/she is each day” and “how he/she arrived at the exercise-readiness score each day.” Ex-1005 ¶161 (“[A] low readiness score is a predictor of poor recovery habits or an inappropriate training schedule. This insight aids the user in adjusting his/her daily activities, exercise regimen and sleeping schedule [to] therefore obtain the most out of his/her training.”). Ahmed’s exemplary user interface, depicted in Figures 14A-14C below, shows elements contributing to the recovery score including, for example, heart rate

variability, resting heart rate, sleep quality, and recent physical and psychological strain. Ex-1005 ¶172 (“FIGS. 14A-14C illustrate the recovery score graphic component with exemplary recovery scores and qualitative information corresponding to the recovery scores.”), Figs. 14A-14C. It also gives instructions to the user such as the user “may need rest” or “is well prepared for intense activity.” Ex-1005, Figs. 14A-14C.

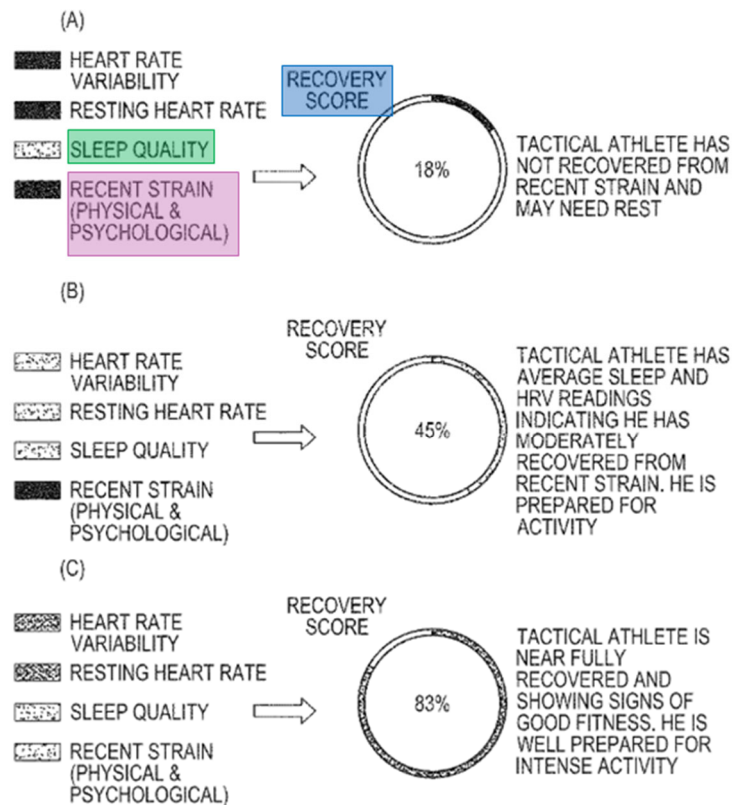


FIG. 14

B. Wisbey (U.S. Patent Publication No. 2015/0119732) (Ex-1006)

71. Wisbey (U.S. Patent Publication No. 2015/0119732) was filed December 20, 2013, and published April 30, 2015. As explained to me by counsel, I understand that Wisbey qualifies as prior art under 35 U.S.C. §102(a)(2).

72. Wisbey teaches a method for “providing a recovery status” to a user based on an “interpreted recovery score” (Ex-1006 ¶12), which is a measurement that “accurately reflects the user’s physical condition and performance capabilities.” Ex-1006 ¶¶57 (The interpreted recovery score “aids in providing a personalized metric by which the user can attain peak performance.”), 12 (“The recovery status, in one instance, is one of the following: fatigued, recovered, and optimal. In another example, the method includes performing a comparison of the interpreted recovery score to the fatigue level, and the method includes tracking the comparison over time.”). Wisbey teaches that logic circuits detect “the amount of physical activity and the amount of sleep a user experienced over the last 48 hours” and combine that metric with the user’s HRV (Heart Rate Variability Value) to calculate a fatigue level, which indicates “the user’s physical condition and aptitude for further physical activity that day.” Ex-1006 ¶¶38-39; *see also id.* ¶91 (the user’s physical activity is also summarized using a “metabolic activity score”). The fatigue level may be based, for example, “on the amount of sleep that is measured for the previous night, the duration and type of user activity, and the intensity of the activity determined for a previous time period (e.g., exercise activity level in the last twenty-four hours).” Ex-1006 ¶102 (“[T]hese factors may also include stress-related activities such as work and driving in traffic, which may generally cause a user to become fatigued.”). Wisbey further teaches determining an “interpreted recovery score,” which is “based

on a user's personalized fatigue levels, as recorded over time.” Ex-1006 ¶57.

73. Figure 10D below depicts an archive table that may be part of the user's “dynamic recovery profile,” which shows the parameters that contribute to the user's interpreted recovery score. Ex-1006 ¶107 (“The dynamic recovery profile ... is implemented in conjunction with an archive table that represents data and relationships of parameters relative to that data. Archive table 1020 includes the parameters of date 1022, MAS 1024, average UAI 1026, sleep time 1028, and fatigue level 1030.”), Fig. 10D. Wisbey also teaches that the dynamic recovery profile includes instructions for improving the recovery score.

Date	MAS	Avg. UAI	Sleep Time (hours)	Fatigue Level
1 Nov. 2013	2,500	7	6	HIGH
2 Nov. 2013	2,000	5	8	NORMAL
3 Nov. 2013	1,500	3	9	LOW

For example, if “the user has a mean fatigue level of 7 following a day when sleep to MAS ratio is 6 to 2,000” and the system has determined that “the user typically achieves a below average MAS on days when the fatigue level is 7 or higher,” then “the dynamic recovery profile may indicate that the user should get more sleep, or should strive for a lower MAS, to avoid becoming overly fatigued.” Ex-1006 ¶109.

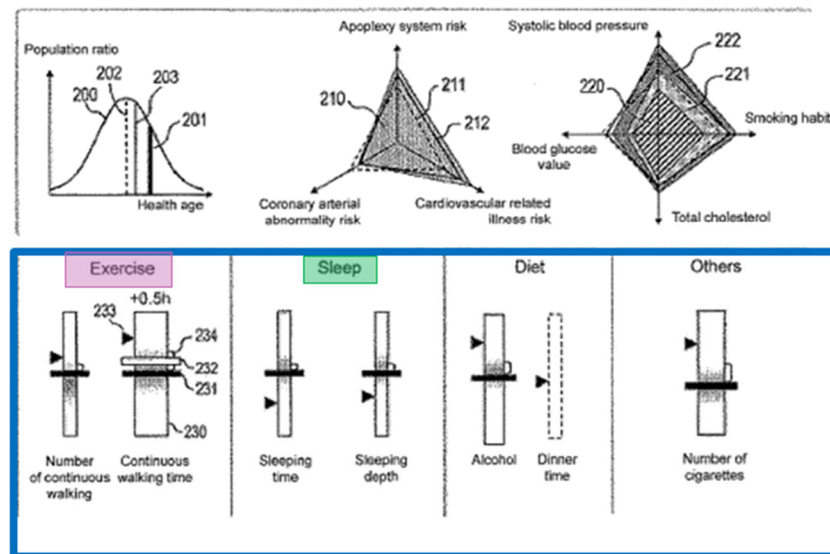
C. Shiga (U.S. Patent Publication No. 2011/0201902) (Ex-1007)

74. Shiga (U.S. Patent Publication No. 2011/0201902) was filed April 21, 2011, and published August 18, 2011. As explained to me by counsel, I understand that Shiga qualifies as prior art under 35 U.S.C. §102(a)(1).

75. Shiga teaches a “health condition determining device” that accumulates measured data relating to certain physiological indexes of the user and determines an “improvable factor” to present “along with the evaluation of the health condition” to the user. Ex-1007, Abstract. Shiga teaches determining a “lifestyle index” for the user, which is a numerical value generated by combining an “exercise related index” and a “sleep related index” (along with a diet related index) relating to the “daily body activity and lifestyle habit[s]” of the user. Ex-1007 ¶50 (“The ‘lifestyle index’ is the criterion indicating the daily body activity and lifestyle habit (exercise, sleep, diet, etc.) and the numerical value thereof. The lifestyle index includes exercise related index (intermittent walking time per unit time, continuous walking time, number of continuous walking, regularity of walking pattern, etc.), sleep related index (sleeping time, number of times of roll-over, number of times of breathing, etc.), diet related index (consumed).”). Shiga uses the user’s past and present lifestyle indices to determine an “improvable factor” for the user, which is an action or habit that the user can take to improve the user’s health. Ex-1007 ¶¶109 (“The improvable factor extracting function 172 evaluates which factor is effective

to improve in order to improve the health condition of the user, and extracts the factor in which the improvement effect can be expected.”), 119. Shiga further teaches a user interface that shows elements contributing to the “improvable factor” and instructions relating to physical and mental activities for improving it. For example, the “lower level of the screen” in Figure 7 below gives an example of the “improvable factor” (blue), which shows the user their present exercise (purple) and sleep (green) progress compared to past exercise and sleep progress and the average user’s values for the same. Ex-1007 ¶¶118-120, Fig. 7.

Fig. 7



VII. CLAIM CONSTRUCTION

76. I do not believe that any term requires express construction to resolve

the issues presented in my Declaration.³ I understand that there is a pending litigation, which I will refer to as the “*Circular* litigation,” where Patent Owner asserted the ’429 Patent against an unrelated party and certain terms of the ’429 Patent were construed by the Court or agreed upon by the parties. To the extent that terms were construed or agreed upon by the parties in the *Circular* litigation,⁴ as set forth below, I apply these constructions for purposes of my Declaration. The constructions adopted below are consistent with plain and ordinary meaning.

A. “obtaining the user’s movements” (Claim 1)

77. I understand from counsel that in the *Circular* litigation, the parties agreed that this claim term should be given the following construction: “collecting data regarding the user’s movements.” Ex-1022, 4; Ex-1021, 1. I apply this construction for purposes of my Declaration. As I explain in detail below, it is my opinion that the prior art invalidates the challenged claims under this construction.

³ I understand from counsel that there is a pending declaratory judgment action between Patent Owner and Petitioner. I further understand from counsel that there are no invalidity claims in that action and therefore no overlap with my Declaration. I respectfully reserve all rights to raise claim construction and other arguments in district court and to supplement my Declaration, if necessary, when the district court’s claim construction becomes available. Additionally, should Patent Owner raise express or implied claim construction arguments in its Preliminary Response, I respectfully reserve the right to supplement my Declaration to respond.

⁴ I have adopted these constructions only for purposes of my Declaration and reserve the right to propose and/or adopt any construction in any pending litigation.

B. “instructions related to physical activity and mental activity for improving the readiness score” (Claim 1)

78. I understand from counsel that in the *Circular* litigation, the parties agreed that this claim term should be given the following construction: “instructions related to at least one physical activity and at least one mental activity for improving the readiness score.” Ex-1022, 4; Ex-1021, 1. I apply this construction for purposes of my Declaration. As I explain in detail below, it is my opinion that the prior art invalidates the challenged claims under this construction.

VIII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

A. Grounds 1-2: Claims 1-6 are obvious over Ahmed alone or Ahmed in view of Shiga.

1. A POSITA would have been motivated to combine Ahmed’s teachings with Shiga’s teachings and would have had a reasonable expectation of success.

79. A POSITA would have been motivated to combine the teachings of Ahmed and Shiga and would have had a reasonable expectation of success in doing so because each relates to the same well-known technologies. Both are directed to physiological monitoring devices that collect biometric data from the user relating to the user’s sleep and physical activity and use that data to evaluate the user’s health state and provide recommendations for improving it. *See, e.g.*, Ex-1005, Abstract (“Disclosed herein is a device for continuous physiological monitoring as well as systems and methods for interpreting data from such a device. ... In addition, the

acquisition of continuous physiological data facilitates automated recommendations concerning changes to sleep, recovery time, exercise routines and the like.”), ¶4 (same), Figs. 14-18; Ex-1007, Abstract (“A health conditioning device accumulates data measured or input by an evaluation subject for each index of a plurality of items including a lifestyle index, which is an index related to body activity or lifestyle habit, and a biomarker, which is an index related to physiological state of the body” and “displays the improvable factor along with the evaluation of the health condition of the evaluation subject.”), Fig. 7.

80. Ahmed teaches a feedback panel, shown in Figure 15A below, that presents a summary of the user’s sleep and workout activity to the user (i.e., a body response summary). Ex-1005, Fig. 15A. For example, Ahmed’s feedback panel “present[s] the intensity score along with a qualitative summary 1540 of the score indicating, for example, whether the user pushed past his anaerobic threshold for a considerable period of the exercise.” Ex-1005 ¶182 (“A feedback panel 1538 associated with the workout panel 1514 may present information on the intensity score and the exercise routines performed by the user during a selected period of time including, but not limited to, quantitative information, qualitative information, feedback, recommendations on future exercise routines, and the like. The feedback panel 1538 may present the intensity score along with a qualitative summary 1540 of the score indicating, for example, whether the user pushed past his anaerobic

threshold for a considerable period of the exercise, whether the exercise is likely to cause muscle pain and soreness, and the like. Based on analysis of the quantitative health parameters monitored during the exercise routine, the feedback panel 1538 may present one or more tips 1542 on adjusting the exercise routine, for example, that the exercise routine started too rapidly and that the user should warm up for longer. In some cases, upon selection of the tips sub-panel 1542, a corresponding indicator 1544 may be provided in the heart rate graph 1530.”). The panel also presents, for example, a summary of “the number of hours of sleep 1512 obtained by the user the previous night.” Ex-1005 ¶¶179, 188 (“The sleep panel 1522 may include information on health parameters of the user during sleep including, but not limited to, an overlaid graph 1573 of heart rate and movement during sleep, statistics 1574 on the maximum heart rate, minimum heart rate, number of times the user awoke during sleep, average movement during sleep, a sleep cycle indicator 1576 showing durations spent awake, in light sleep, in deep sleep and in REM sleep, and a sleep duration graph 1578 showing the number of hours slept over a period of time.”).

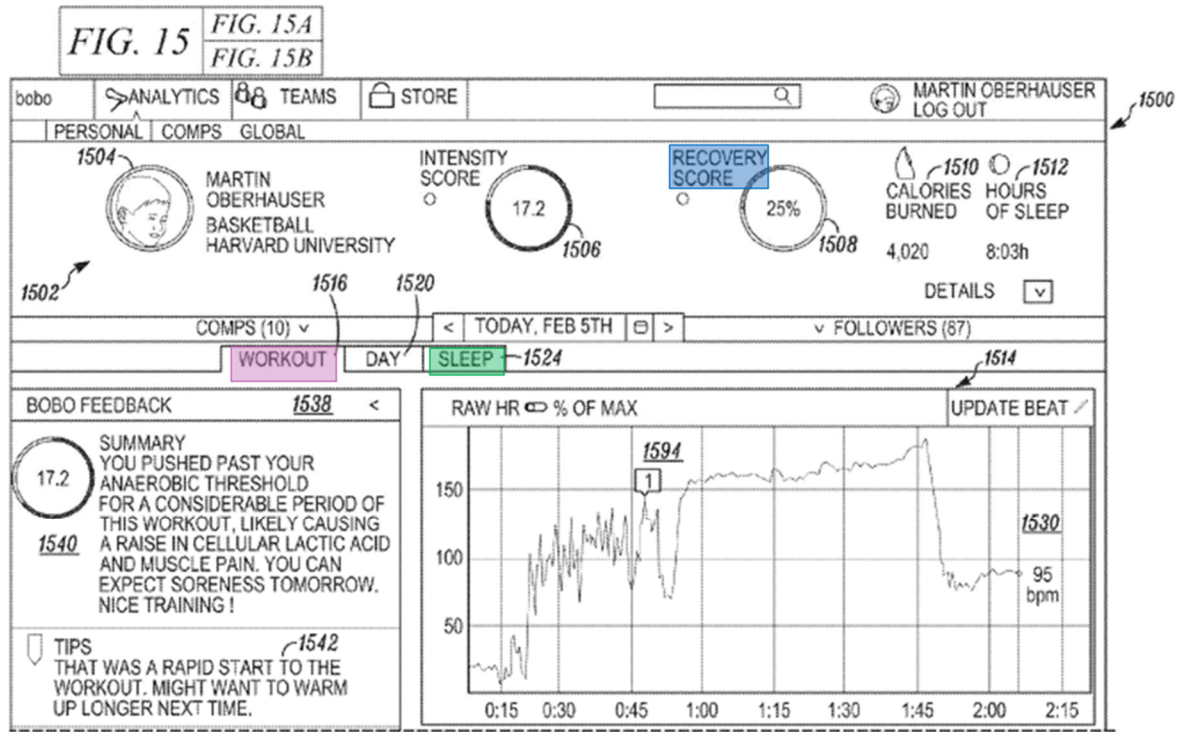


FIG. 15A

81. Ahmed calculates a recovery (i.e., readiness) score, taking into account the user's sleep and physical activity summaries, to determine the user's "readiness for physical and psychological exertion." Ex-1005 ¶¶70, 160-161. Shiga teaches a "lifestyle index" (i.e., body response summary), which is a numerical value generated by combining an "exercise related index" and a "sleep related index" (along with a diet related index). Ex-1007 ¶50 ("The 'lifestyle index' is the criterion indicating the daily body activity and lifestyle habit (exercise, sleep, diet, etc.) and the numerical value thereof. The lifestyle index includes exercise related index (intermittent walking time per unit time, continuous walking time, number of continuous walking, regularity of walking pattern, etc.)[,], sleep related index

(sleeping time, number of times of roll-over, number of times of breathing, etc.), diet related index (consumed).”). Shiga uses the user’s past and present lifestyle indices to determine an “improvable factor” (i.e., readiness score), which is an action the user can take to improve the user’s health. Ex-1007 ¶¶109 (“The improvable factor extracting function 172 evaluates which factor is effective to improve in order to improve the health condition of the user, and extracts the factor in which the improvement effect can be expected.”), 119.

82. To the extent it is determined that the claimed “body response summary” must be a discrete data point that is calculated by the system before calculating the claimed “readiness score,” it would have been obvious to a POSITA that Ahmed’s algorithm does this because it uses the combined sleep score and intensity score data (i.e., body response summary) to calculate the recovery score. For example, Ahmed’s Figures 15-18 show examples of the qualitative body response summaries that are presented to the user by words and narratives, which summarize the user’s sleep and workout activity. Ex-1005, Figs. 15-18.

83. A POSITA interested in additional implementation details for a “body response summary” would have understood that another way a summary could be communicated to a user would be using a discrete data point such as a numerical value, as Shiga teaches with its “lifestyle index,” to capture the same information. Ex-1007 ¶50 (“The ‘lifestyle index’ is the criterion indicating the daily body activity

and lifestyle habit (exercise, sleep, diet, etc.) and the numerical value thereof.”). A POSITA would have been motivated to implement Shiga’s teachings to create a body response summary in the form of a numerical value with Ahmed’s system because this would have been a simple, efficient, tangible, and user-friendly alternative to presenting a summary of combined rest and activity information to the user by narratives and words.

84. A user can easily tell from looking at a numerical value whether the user’s combined sleep and fitness summary (body response summary) for the day has improved or worsened since the previous reading. Ahmed already uses a numerical value to communicate its recovery, sleep, and intensity scores to the user. Ex-1005 ¶70 (“using the physiological readouts of the device and the analytics described herein, an ‘Intensity Score’ (e.g., 0-21) (e.g., that measures a user’s recent exertion), a ‘Recovery Score’ (e.g., 0-100%), and ‘Sleep Score’ (e.g., 0-100) may together measure readiness for physical and psychological exertion”). And both Ahmed and Shiga provide recommendations to the user for improving their respective scores or indexes using narratives. Ex-1005 ¶167 (displaying, for example, “whether the user has recovered sufficiently, what level of activity the user is prepared to perform, whether the user is prepared to perform an exercise routine [of] a particular desired intensity, whether the user should rest and the duration of recommended rest, whether the exercise regimen of the user should be automatically

adjusted (e.g., made easier if the recovery score is low), and the like”), Figs. 14A-14C (“tactical athlete has not recovered from recent strain and may need rest”; “tactical athlete has average sleep and HRV readings indicating he has moderately recovered from recent strain” and “is prepared for activity”; “tactical athlete is near fully recovered and showing signs of good fitness” and “is well prepared for intense activity”); Ex-1007 ¶¶118-120 (teaching that the information provided with bar 230 in Figure 7 relating to exercise, sleep, diet, and other categories instructs the user on how to improve the user’s improvable factor), Fig. 7. Therefore, a POSITA would have understood that providing the body response summary in the form of a numerical value before providing the narrative recommendation would improve the system. Thus, design incentives and consumer preferences would have motivated a POSITA to apply the teachings of Shiga to Ahmed.

85. A POSITA would have had a reasonable expectation of success in combining Ahmed and Shiga. Ahmed and Shiga are analogous prior art as they both involve physiological monitoring devices that measure the same physiological parameters (such as the user’s heart rate), during the same activities (for example, sleep and exercise activities), and with the same goal—to provide recommendations to the user for improving the user’s health condition and fitness state. *See, e.g.*, Ex-1005, Abstract, ¶¶4, 70 (“using the physiological readouts of the device and the analytics described herein, an ‘Intensity Score’ (e.g., 0-21) (e.g., that measures a

user's recent exertion), a 'Recovery Score' (e.g., 0-100%), and 'Sleep Score' (e.g., 0-100) may together measure readiness for physical and psychological exertion"), Figs. 14-18; Ex-1007, Abstract, ¶55 ("The measurement device of the lifestyle index includes the activity amount meter for measuring the body activity amount and the exercise intensity, the passometer for measuring the number of steps, the sleep sensor for measuring the state of sleeping, and the calorie meter for carrying out calorie calculation of the diet."), Fig. 7. Moreover, a POSITA would have understood that Ahmed and Shiga's devices are similar such that they are programmable using standard processors and are interchangeable regardless of whether they use narratives or numerical values to communicate information to the user. A POSITA would have understood, therefore, that these references disclose interrelated teachings based on routine technologies that would have been amenable to various well-understood and predictable combinations to provide more features and enhance user interest.

2. Independent Claim 1

a. Element 1[pre]: A method for assessing readiness of a user, the method comprising:

86. Ahmed alone teaches⁵ the preamble, to the extent it is limiting.

87. Ahmed teaches a method for computing a "recovery" score, which is

⁵ I use the term teaches, which I understand from counsel includes both express teachings or those fairly suggested to a person of ordinary skill in the art.

an assessment of the user's readiness to exercise, from data obtained by a wearable device. Ex-1005 ¶¶4-5. Ahmed teaches computer-executable instructions, which "enable automatic interpretation of one or more physiological parameters to assess ... the user's recovery after physical exertion or daily stress given sleep and other forms of rest (embodied in a recovery score)." Ex-1005 ¶47. The recovery score presents "an accurate indication" of the readiness level of the user's "body and health after a period of physical exertion." Ex-1005 ¶160.

b. Element 1[a]: obtaining the user's movements;

88. Ahmed alone teaches Element 1[a]. As discussed in Section VII.A, I interpret "obtaining the user's movements" to mean "collecting data regarding the user's movements." *See, e.g.*, Ex-1022, 4; Ex-1021, 1.

89. Ahmed teaches collecting data regarding the user's movements via accelerometers and gyroscopes. For example, Ahmed teaches that the wearable device records physiological parameters including, for example, "motion (using one or more multi-axes accelerometers and/or gyroscope[s])." Ex-1005 ¶70. Ahmed teaches that its device includes "one or more sensors for activity measurement" such as "one or more multi-axes accelerometers and/or gyroscope[s] to provide a measurement of activity." Ex-1005 ¶77. While accelerometers directly measure changes in velocity and/or movement with respect to gravity, a POSITA would have understood that they are commonly used to measure general movement using

common mathematical formulae. Gyroscopes directly measure rotational speed. These are commonly used together to measure motion.

90. Additionally, as I explained in my Technology Background Section (see Section V), Make Magazine published a compendium on Wearable Electronics in 2014, which explains that sensors can measure “Movement, Orientation, and Location.” Ex-1030 at 128. Examples are provided including instructions for the use of multi-axis accelerometers and compasses. *Id.* at 128-130.

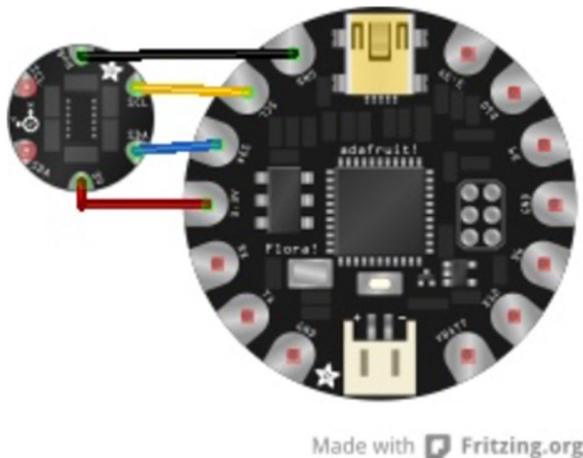


Figure 7-40. Flora accelerometer/compass circuit diagram

Moreover, Von Badinski teaches using accelerometers to measure movement. Ex-1029 (Von Badinski), 10:58-11:47 (“[S]ensor modules 220 can further include sensors that are not directly related to biological sign monitoring; some examples of these sensors include accelerometers, gyroscopes, vibration, sensors (e.g., a magnetometer or a digital compass), or other suitable sensors (e.g., for gesture recognition). ... In one or more embodiments, the accelerometers in the sensor

modules 220 can detect movements in multiple (e.g., 3) dimensions or axes. The accelerometer can measure force of acceleration of the WCD and can measure gestures performed by a user while wearing the WCD.”).

c. Element 1[b]: using the obtained user’s movements to determine a nature of the period, wherein the nature of the period is selected from an activity period and a rest period;

91. Ahmed alone teaches Element 1[b].

92. Ahmed uses the data collected regarding the user’s movements, among other information, to determine whether the user is in an active, rest, or sleep state.⁶ Ahmed teaches a processing module that processes “the motion data to determine a motion status of the user which indicates the level of motion of the user,” for example, light motion (e.g., walking), exercise, no motion or rest, and sleep. Ex-1005 ¶126. For example, Ahmed may determine that the user is asleep based on “movement input, skin temperature and heart rate” that correlate to a user sleeping. Ex-1005 ¶135. “[P]eriods of no movement or small bursts of movement (such as shifting in bed), lower skin temperature (although it is not a dramatic drop from normal), drastic GSR⁷ changes, and heart rate that is below the typical resting heart

⁶ I note that the ’429 Patent defines “rest period” as “primarily relat[ing] to a sleep period of the user in a day,” but also “includ[ing the] time period when the user is sitting or lying down to relax.” Ex-1001, 5:23-26. Thus, a POSITA would have understood that Ahmed’s teachings regarding sleep and rest periods both meet the claimed “rest period” and related “rest summary” limitation discussed below.

⁷ GSR stands for galvanic skin response, a measure of skin conductivity.

rate when the user is awake” are common indicators that correlate to a user being asleep. Ex-1005 ¶135. Because these variables depend on each user’s physiology, Ahmed teaches a “machine learning algorithm” that is “trained with user-specific input” to assess when the user is awake or asleep. *Id.*

d. Element 1[c]: measuring at least one biosignal of the user during the rest period;

93. Ahmed alone teaches Element 1[c].

94. Ahmed teaches measuring the user’s biosignals while the user sleeps, including the user’s heart rate and skin conductivity. Ahmed teaches that continuous data is collected by the “physiological measurement system regarding the user’s heart rate, skin conductivity, ambient temperature and accelerometer/gyroscope data throughout the user’s sleep.” Ex-1005 ¶166.

95. Additionally, as I explained in my Technology Background Section (see Section V), measuring a biosignal of a user during sleep was well known by 2015. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin) at 3 (“During sleep mode, the device monitors your rest. Sleep statistics include total hours of sleep, sleep levels, and sleep movement.”); *see also* Ex-1027 (Consumer Reports) at 46 (“Some [wearable health and fitness monitoring devices] also serve as health and fitness devices tracking your physical activity and sleep patterns.”); Ex-1028 (Tran), 11:41-67 (“[D]uring a

particular day, the system can determine the amount of time for exercise, sleep, and entertainment, among others.”); Ex-1029 (Von Badinski), 10:58-11:47 (“Together, the processor module 210 and the sensor modules 220 can enable the WCD 110 to perform multiple functions including, for example, pedometer, sleep monitor (e.g., which monitors sleep quality), heart rate sensor, pulse oximetry, skin (and in select embodiments, ambient) temperature.”); Ex-1031 (Teller ’731), Figs. 5, 9, 22:27-23:16; Ex-1032 (Teller ’117), Figs. 5, 9, 22:39-23:28.

e. Element 1[d]: determining a rest summary for the rest period, based on the measured at least one biosignal and at least one biosignal of a previous rest period;

96. Ahmed alone teaches Element 1[d].

97. Ahmed teaches determining a “sleep score” (i.e., rest summary) for the user’s sleep period, which is based on the user’s most recent sleep biometric data and the user’s past sleep biometric data. Ahmed’s “sleep score” measures and indicates “sleep efficiency (how good the user’s sleep was) and sleep duration (if the user had sufficient sleep)” based on “a combination of physiological parameters, personal habits and daily stress/strain (intensity) inputs.” Ex-1005 ¶166. Ahmed teaches that “[t]he *actual data* measuring the time spent in various stages of sleep may be *combined with the wearer’s recent daily history* and a longer-term data set describing the wearer’s personal habits *to assess the level of sleep sufficiency achieved by the user.*” Ex-1005 ¶166; *see also id.* ¶188 (“The sleep panel 1522 may

include information on health parameters of the user during sleep including, but not limited to, an overlaid graph 1573 of heart rate and movement during sleep, statistics 1574 on the maximum heart rate, minimum heart rate, number of times the user awoke during sleep, average movement during sleep, a sleep cycle indicator 1576 showing durations spent awake, in light sleep, in deep sleep and in REM sleep, and a sleep duration graph 1578 showing the number of hours slept over a period of time.”). The sleep score therefore “model[s] sleep quality in the context of sleep duration and history” and “consider[s] each sleep period in the context of biologically-determined sleep needs, pattern-determined sleep needs and historically-determined sleep debt.” Ex-1005 ¶166. As explained in the previous section, the continuous data that is collected by the physiological measurement system includes “the user’s heart rate, skin conductivity, ambient temperature and accelerometer/gyroscope data throughout the user’s sleep.” Ex-1005 ¶166.

98. Additionally, as I explained in my Technology Background Section (*see* Section V), determining a rest summary for a rest period, based on the measured biosignal and at least one biosignal of a previous rest period was well known by 2015. For example, the Garmin product included software to store historical data about the health measurements and this feature was also taught by Von Badinski. Ex-1026 (Garmin) at 8 (“You can review your heart rate data in the device history and on your Garmin Connect account.”); Ex-1029 (Von Badinski) at 28:39-41 (“The

WCD can also use historic temperature data to develop trend temperature data.”); *see also, e.g.*, Ex-1026 (Garmin) at 3 (“During sleep mode, the device monitors your rest. Sleep statistics include total hours of sleep, sleep levels, and sleep movement.”); Ex-1028 (Tran), 11:41-67 (“[D]uring a particular day, the system can determine the amount of time for exercise, sleep, and entertainment, among others.”); Ex-1029 (Von Badinski), 10:58-11:47 (“Together, the processor module 210 and the sensor modules 220 can enable the WCD 110 to perform multiple functions including, for example, pedometer, sleep monitor (e.g., which monitors sleep quality), heart rate sensor, pulse oximetry, skin (and in select embodiments, ambient) temperature.”); Ex-1031 (Teller ’731), Figs. 5, 9, 22:27-23:16; Ex-1032 (Teller ’117), Figs. 5, 9, 22:39-23:28.

f. Element 1[e]: determining an activity summary for the activity period, based on the obtained movements of an activity period and obtained movements of at least one previous activity period;

99. Ahmed alone teaches Element 1[e].

100. As explained for Element 1[a], Ahmed obtains the user’s movements using accelerometers and gyroscopes. Ex-1005 ¶77. Ahmed further teaches determining an “intensity score” (i.e., activity summary) for the user’s activity period, which is based on the user’s most recent activity biometric data. Ahmed’s intensity score “may be determined in real-time or after a workout routine or for an entire day.” Ex-1005 ¶140. The intensity score, which is calculated based on the

user's heart rate reserve (HRR) (Ex-1005 ¶144), “provides an accurate indication of the cardiovascular intensities experienced by the user during a portion of a day, during the entire day or during any desired period of time (e.g., during a week or month).” Ex-1005 ¶142; *see also id.* ¶181 (“The workout panel 1514 may present quantitative information on the user's health and exercise routines, for example, a graph 1530 of the user's continuous heart rate during the exercise, statistics 1532 on the maximum heart rate, average heart rate, duration of exercise, number of steps taken and calories expended, Zones 1534 in which the maximum heart rate fell during the exercise, and a graph 1536 of the intensity scores over a period of time (e.g., seven days).”), Fig. 15. The intensity score is adapted and customized for the user's “unique physiological properties” and also considers, for example, the user's gender, age, resting heart rate, anaerobic threshold, and maximum heart rate. Ex-1005 ¶142. If the intensity score is determined based on an exercise routine period and beyond, it indicates “the cardiovascular intensities experienced by the user during the routine and also the activities the user performed after the routine (e.g., resting on the couch, active day of shopping) that may affect their recovery or exercise readiness.” Ex-1005 ¶142.

101. Ahmed also teaches tracking past intensity scores, using the user's past activity biometric data to both calibrate measurements and provide a summary with feedback to the user, and using past activity biometric data in the weighting scheme

that is used to determine the intensity score. For example, Ahmed teaches that the user's intensity score values may be displayed to the user along with quantitative or qualitative information such as, for example, "how difficult an exercise routine was *in the context of the user's training*" and "whether the exercise regimen of the user should be automatically adjusted (e.g., made easier *if the intensity scores are consistently high*).” Ex-1005 ¶152. Moreover, as shown in Figure 10 below, Ahmed teaches that one of the steps in generating the intensity score is the weighting of heart rate reserve (HRR) values (step 1004). Ex-1005, Fig. 10.

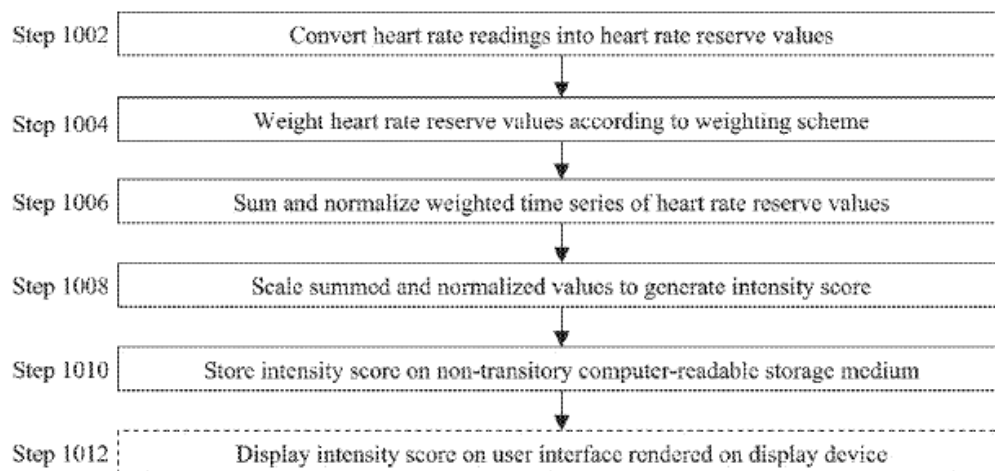


FIG. 10

102. Ahmed further teaches that in an exemplary weighting scheme, “the HRR time series is weighted iteratively *based on the intensity scores determined thus far* (e.g., the intensity score accrued thus far) and the path taken by the HRR values to get to the present intensity score” such that the “*path may be detected*

automatically based on the historical HRR values.” Ex-1005 ¶156. A POSITA would thus have understood that Ahmed’s intensity score is “based on the obtained movements of an activity period and obtained movements of at least one previous activity period.” Ahmed clearly discloses that activity scores may be calculated using a variety of time periods up to and including an entire day which a POSITA would have understood to include measurements from multiple activity periods. *See, e.g.*, Ex-1005 ¶¶ 140-149. This teaches the calculation of activity scores using a weighted sum of multiple activity periods using a time series of heart rate measurements. For example, Ahmed teaches “[i]n exemplary embodiments, the intensity score is calculated based on the user's heart rate reserve (HRR) as detected continuously throughout the desired time period, for example, throughout the entire day. In one embodiment, the intensity score is an integral sum of the weighted HRR detected continuously throughout the desired time period.” Ex-1005 ¶143. To the extent that Ahmed does not explicitly state that an entire day includes both a current activity period and at least one previous activity period, a POSITA would have understood that this is the ordinary case where, as Ahmed explains, activity periods can include periods of intense workouts at elevated heart rates. *See, e.g.*, Ex-1005, Figs. 12, 19B, ¶152. Ahmed teaches that its “analytics system may consider the magnitude of the differences between 7-day moving averages and 3-day moving averages of” the user’s HRV “readings for a given day.” Ex-1005 ¶163. And “[t]he

recovery score algorithm may take into account [resting heart rate] RHR along with history of past intensity and recovery scores.” Ex-1005 ¶164.

103. Additionally, as I explained in my Technology Background Section (*see* Section V), determining an activity summary for an activity period, based on the obtained movements of an activity period and obtained movements of at least one previous activity period was well known by 2015. For example, around 2009, Fitbit introduced consumer-grade wearable health and fitness monitors that could track motion and calculate user activity levels. Ex-1024 (Forbes Getting Fitbit); *see also* Ex-1025 (Consumer Electronics Hall of Fame). By the earliest possible priority date of the '429 Patent, technologies for monitoring user activity and biological functions had become more sophisticated and more widely available. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to each of these factors. *Id.* at 3, 11. By the end of 2014, many wearable health and fitness monitoring devices were available on the market. Consumers Report noted that “[s]ome also serve as health and fitness devices tracking your physical activity and sleep patterns.” Ex-1027 (Consumer Reports) at 46. Tran also teaches the use of biosensor information to determine qualitative and quantitative aspects of both a user’s physical activities and mental activities and to create appropriate notifications and

warnings. Ex-1028, 11:41-67, 38:43-59. Von Badinski also taught measuring a number of indicators of activity and draws conclusions about activity types and activity periods from current and historical measurements. Ex-1029 at 10:58-11:47; Ex-1031 (Teller '731), Figs. 5, 7, 20:53-21:44; Ex-1032 (Teller '117), Figs. 5, 7, 20:65-21:56.

104. Moreover, the Garmin product included software to store historical data about the health measurements and this feature was also taught by Von Badinski. Ex-1026 (Garmin) at 5-6 (“History includes time, distance, calories, average pace or speed, lap data, and optional ANT+ sensor information. NOTE: When the device memory is full, your oldest data is overwritten.”); Ex-1029 (Von Badinski) at 13:21-24, 28:39-41 (“fitness activities, exercise histories, as well as recorded biological signs such as heart rate and body temperature, can be stored onboard in the memory 260 of the WCD 110”); Ex-1031 (Teller '731), Figs. 5, 7, 20:53-21:44; Ex-1032 (Teller '117), Figs. 5, 7, 20:65-21:56.

g. Element 1[f]: determining a body response summary based on the rest summary and the activity summary;

105. Ahmed alone or in view of Shiga (“Ahmed-Shiga”) teaches Element 1[f].

106. The '429 Patent does not define a “body response summary” other than to state that it is determined based on the rest summary and the activity summary and used to calculate the readiness score. *See, e.g.*, Ex-1001, Fig. 13 (step 1312:

“Determine body response summary based on steps 1308 [summary for the activity period] and 1310 [summary for the rest period]”; step 1314: “Calculate a recovery index based on measured movements, rest parameters and body response parameters based on steps 1308-1312”). The ’429 Patent states that a body response summary can be determined “for day to night, or activity period to rest period.” Ex-1001, 23:26-28. And it gives examples of “body response parameters” including, for example, “training impact vs. heart rate recovery speed, daily physical activity parameter vs. amount of deep sleep or lowest heart rate of the night,” and “changes in body signal as a response from rest to stand-up at rise time.” Ex-1001, 23:28-33.

107. If the “body response summary” is simply the combination of past and present biosignal measurements during the user’s sleep and activity periods that is used to generate the readiness score (discussed in Element 1[g]), this limitation is met by Ahmed. Ahmed teaches that the recovery score (i.e., readiness score) takes into account similar body response parameters as the ’429 Patent including, for example, the user’s HRV, “resting heart rate, sleep quality,” “recent physiological strain (indicated, in one example, by the intensity score of the user),” and “the sleep score combined with performance readiness measures (such as, morning heart rate and morning heart rate variability).” Ex-1005 ¶161.

108. Moreover, as shown in Figure 15 below, Ahmed’s feedback panel presents a body response summary to the user, which includes both an activity

summary (purple) and a rest summary (green). Ex-1005, Fig. 15A.

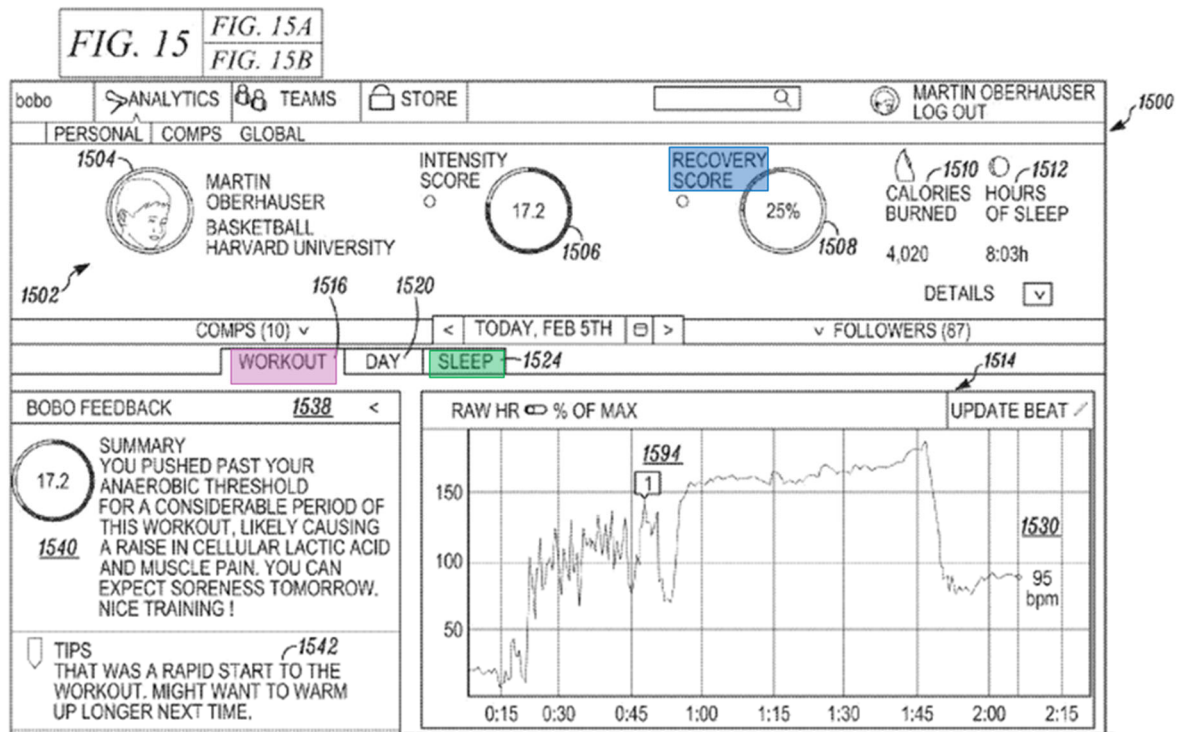


FIG. 15A

109. Ahmed’s panel “present[s] the intensity score along with a qualitative summary 1540 of the score indicating, for example, whether the user pushed past his anaerobic threshold for a considerable period of the exercise, whether the exercise is likely to cause muscle pain and soreness, and the like.” Ex-1005 ¶182. The panel also presents, for example, “the number of hours of sleep 1512 obtained by the user the previous night.” Ex-1005 ¶179. Ahmed further teaches that the user interface may “include panels for presenting information on the user’s workouts—a workout panel 1514 accessible using tab 1516...and sleep-a sleep panel 1522 accessible using tab 1524.” Ex-1005 ¶180. A POSITA would thus have understood that Ahmed

teaches the claimed body response summary. To the extent that Ahmed is interpreted to compute the body response summary based on raw measurement data rather than from intermediate summaries, a POSITA would have understood that these is a minor calculation detail that is insubstantially different in this situation. Moreover, Ahmed already teaches that intermediate calculations, which are activity and rest summaries, are utilized. *See, e.g.,* Ex-1005 ¶¶148, 179, 189, 239. Ahmed specifically teaches using the intensity score and sleep score to calculate a recovery score. Ex-1005 ¶161. It would have been obvious to a POSITA that the measure of sleep quality, sleep score, and/or resting heart rate could be a rest summary and the intensity score could be an activity summary. *Id.*

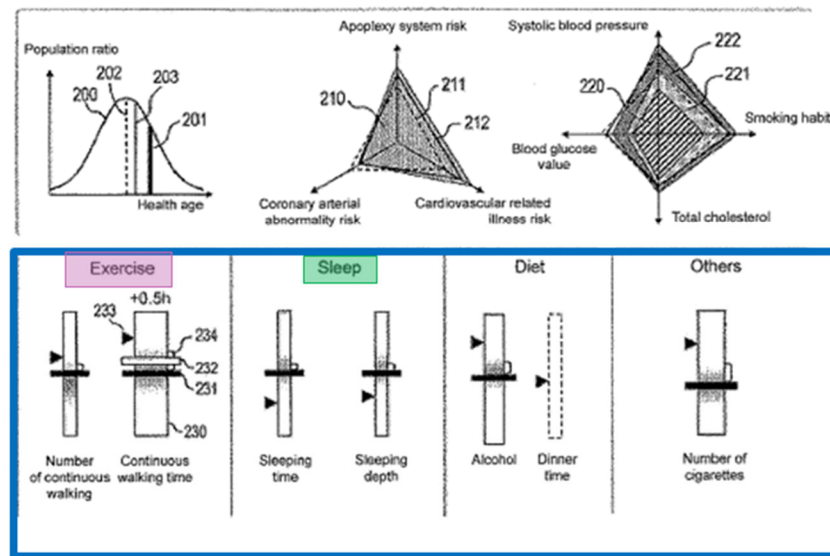
110. To the extent that the body response summary must be a discrete data point that is determined by the system before the claimed “readiness score” is calculated, it would have been obvious to a POSITA that Ahmed teaches this limitation because its algorithm uses the combined rest summary (i.e., sleep score) and the activity summary (i.e., intensity score) data (i.e., the claimed body response summary) to calculate the readiness (i.e., recovery) score. Ex-1005 ¶161.

111. **Ground 2:** This limitation is also taught by Shiga. Shiga teaches a “lifestyle index” (i.e., body response summary), which is a value generated by combining an “exercise related index” and a “sleep related index” (along with a diet related index). Ex-1007 ¶50. Shiga’s “lifestyle index” is defined as “the criterion

indicating the daily body activity and lifestyle habit (exercise, sleep, diet, etc.) ***and the numerical value thereof.***” Ex-1007 ¶50. It includes the exercise related index, which takes into account the user’s body activity amount and exercise intensity including, for example, “intermittent walking time per unit time, continuous walking time, number of continuous walking, regularity of walking pattern, etc.”; and the sleep related index, which is a measure of the user’s sleep, e.g., “sleeping time, number of times of roll-over, number of times of breathing, etc.” Ex-1007 ¶¶50, 55.

112. Shiga uses the user’s past and present lifestyle indices (i.e., body response summaries) to determine an “improvable factor,” similar to the claimed “readiness score,” which is an action or habit the user can take to improve the user’s health. Ex-1007 ¶119. It would have been obvious to a POSITA to implement Shiga’s teachings to combine a rest summary (i.e., sleep related index shown in lower level of Figure 7) and an activity summary (i.e., exercise related index shown in lower level of Figure 7) to generate a numerical summary value. Ex-1007, Fig. 7. The combined data (i.e., lifestyle index or body response summary) could then be used to improve Ahmed to determine the overall health and readiness of the user in Ahmed, in the same manner that Shiga uses this data to determine Shiga’s “improvable factor.” It would have been obvious to a POSITA that one purpose of providing activity and rest scores to a user in a numerical format is to educate the user on historical trends and improvements in health and wellness.

Fig. 7



113. A POSITA would have been motivated to combine Ahmed's teachings with Shiga's teachings and had a reasonable expectation of success in doing so, for the same reasons discussed in Section VIII.A.1.

114. Additionally, as I explained in my Technology Background Section (see Section V), determining a body response summary based on the rest summary and the activity summary was well known by 2015. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to each of these factors. *Id.* at 3, 11; see also Ex-1031 (Teller '731), Figs. 5, 7, 9, 24:26-29 ("Sleep and Activity Level might be simultaneously displayed in order to compare and evaluate Sleep ratings with corresponding Activity Level ratings to determine if any day to-day correlations

exist.”); Ex-1032 (Teller ’117), Figs. 5, 7, 9, 24:39-42.

h. Element 1[g]: calculating a readiness score based on the body response summary and a previous body response summary, whereby the readiness score indicates a level of readiness of the user; and

115. Ahmed alone or Ahmed-Shiga teaches Element 1[g].

116. The ’429 Patent does not expressly define the term “level” but defines “readiness” as “a return to the normal state of mental and physical strength (or energy level) after the mental and physical load.” Ex-1001, 10:5-7. Thus, for example, “*the readiness score may be good or high (such as about 90%)*, if the heart rate, [HRV] and stress level of the user have returned to the normal state after the exercise.” Ex-1001, 10:11-14.

117. Ahmed teaches calculating a recovery (i.e., readiness) score, which “provides an accurate indication of the level of recovery of a user’s body and health after a period of physical exertion.” Ex-1005 ¶160. The “recovery score” is adapted and customized for the user’s “unique physiological properties.” Ex-1005 ¶161. It is a weighted combination of, for example, the user’s resting heart rate, heart rate variability (HRV), “sleep quality indicated by a sleep score” (i.e., rest summary), and “recent physiological strain (indicated, in one example, by the intensity score [i.e., activity summary] of the user).” Ex-1005 ¶161.

118. Ahmed teaches that its “analytics system may consider the magnitude of the differences between 7-day moving averages and 3-day moving averages of”

the user's HRV "readings for a given day." Ex-1005 ¶163. And "[t]he recovery score algorithm may take into account [resting heart rate] RHR along with history of past intensity and recovery scores." Ex-1005 ¶164. Ahmed's recovery score indicates a level of readiness of the user by, for example, helping the user understand "how exercise-ready he/she is each day" and "how he/she arrived at the exercise-readiness score each day." Ex-1005 ¶161.

119. A POSITA would have understood that Ahmed's recovery (i.e., readiness) score is calculated by combining a variety of present biometric data and past biometric data, including, for example, a "history of past and present intensity and recovery scores." Ahmed teaches "[i]n exemplary embodiments, the intensity score is calculated based on the user's heart rate reserve (HRR) as detected continuously throughout the desired time period, for example, throughout the entire day. In one embodiment, the intensity score is an integral sum of the weighted HRR detected continuously throughout the desired time period." Ex-1005 ¶143. Moreover, Ahmed teaches that the recovery (i.e., readiness) score takes into account similar body response parameters as the '429 Patent. Ex-1005 ¶161. Thus, as discussed for Element 1[f], if the "body response summary" is simply the combination of past and present biosignal measurements during the user's sleep and activity periods that is used to generate the readiness score, a POSITA would have understood that Ahmed teaches "calculating a readiness score based on the body

response summary and a previous body response summary.” Ahmed specifically teaches using the intensity score and sleep score to calculate a recovery score. Ex-1005 ¶161. It would have been obvious to a POSITA that the measure of sleep quality, sleep score, and/or resting heart rate could be a rest summary and the intensity score could be an activity summary. *Id.*

120. To the extent that the past and present body response summaries must be discrete data points that are determined by the system before the claimed “readiness score” is calculated, it would have been obvious to a POSITA that Ahmed teaches this limitation because its algorithm uses the combined past and present rest summary (i.e., sleep score) and past and present activity summary (i.e., intensity score) to calculate the readiness (i.e., recovery) score. Ex-1005 ¶161.

121. **Ground 2:** This limitation is also taught by Shiga. Shiga uses the user’s past and present lifestyle indices (i.e., body response summaries) to determine an “improvable factor,” similar to the claimed “readiness score,” which is an action or habit that the user can take to improve the user’s health. Ex-1007 ¶119. It would have been obvious to a POSITA to implement Shiga’s teachings to combine past and present body response summaries and use the combined data to determine the overall health and readiness of the user in Ahmed, in the same manner that Shiga uses it to determine Shiga’s “improvable factor.”

122. A POSITA would have been motivated to combine Ahmed’s teachings

with Shiga’s teachings and had a reasonable expectation of success in doing so, for the same reasons discussed in Section VIII.A.1.

123. Additionally, as I explained in my Technology Background Section (see Section V), determining the recovery level of a user was well known by 2015. For example, the Garmin product included a “Recovery Advisor,” which provided feedback by “display[ing] how much time remains before [the user] is fully recovered and ready for the next hard workout.” Ex-1026 at 12. This feature included “Recovery check,” which “provides a real-time indication of [the user’s] state of recovery within the first several minutes of an activity” and “Recovery time,” which counts down [time] until it is optimal for [the user] to attempt another hard workout.” *Id.*; see also Ex-1031 (Teller ’731), Table 3 (one of the things continually measured is “readiness”); Ex-1032 (Teller ’117), Table 3 (same).

- i. **Element 1[h]: using a user interface of the mobile communication device⁸ to show elements contributing to the readiness score and instructions related to physical activity and mental activity for improving the readiness score.**

124. Ahmed alone teaches Element 1[h]. As discussed in Section VII.B., I interpret “instructions related to physical activity and mental activity for improving

⁸ The term “*the* mobile communication device” in Claim 1 appears to lack antecedent basis. I reserve the right to provide an indefiniteness opinion for the term “user interface of *the* mobile communication device” in other proceedings. The prior art describes this term as it is described in the ’429 Patent, so it is my opinion that this limitation is met by the prior art regardless of how it is interpreted.

the readiness score” to mean “instructions related to at least one physical activity and at least one mental activity for improving the readiness score.” Ex-1022, 4; Ex-1021, 1.

125. Ahmed teaches “using a user interface of the mobile communication device to show elements contributing to the readiness score.” Ahmed teaches that “data collected by a wearable system may be transmitted via a mobile communication device application to a cloud-based data storage, from which data may be downloaded for display and analysis on a website.” Ex-1005 ¶49; *see also id.* ¶175 (“Exemplary systems have the ability to stream the physiological information wirelessly, directly or through a mobile device application, to an online website”). Ahmed further teaches that “the website may be displayed using a mobile website or a mobile application.” Ex-1005 ¶50. Ahmed’s Figures 14A-14C, shown below, depict the “recovery score graphic component with exemplary recovery scores and qualitative information corresponding to the recovery scores” that are shown on the user interface of the mobile communication device. Ex-1005 ¶172, Figs. 14A-14C. The user interface shows elements contributing to the recovery (i.e., readiness) score including, for example, heart rate variability, resting heart rate, sleep quality, and recent strain (physical and psychological). *Id.*

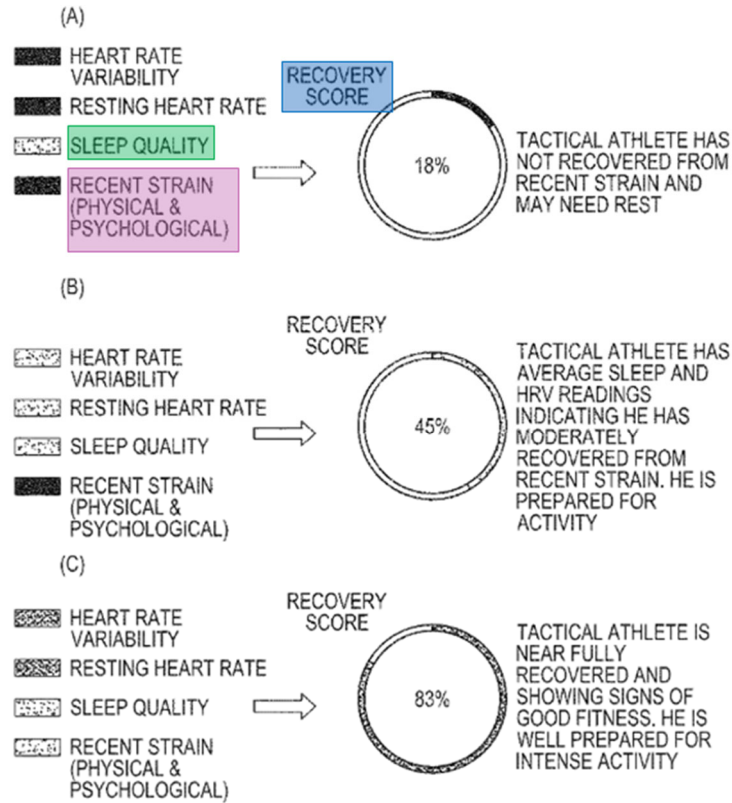


FIG. 14

126. Ahmed's user interface shows instructions related to at least one physical activity for improving the readiness score. Ahmed teaches that the recovery score is displayed with other qualitative or quantitative information regarding the user including, for example, "whether the user has recovered sufficiently, what level of activity the user is prepared to perform, whether the user is prepared to perform an exercise routine [of] a particular desired intensity, whether the user should rest and the duration of recommended rest, whether the exercise regimen of the user should be automatically adjusted (e.g., made easier if the recovery score is low), and the like." Ex-1005 ¶167, Figs. 14A-14C ("tactical athlete has not recovered from

recent strain and may need rest”; “tactical athlete has average sleep and HRV readings indicating he has moderately recovered from recent strain” and “is prepared for activity”; “tactical athlete is near fully recovered and showing signs of good fitness” and “is well prepared for intense activity”). Moreover, Ahmed teaches that the “analytics system may automatically generate, store and display an exercise regimen customized based on the recovery scores of the user alone or in combination with the intensity scores.” Ex-1005 ¶167; *see also id.* ¶¶170, 172-173.

127. Ahmed’s user interface also shows instructions related to at least one mental activity for improving the readiness score. For example, Ahmed teaches that the “recovery score may take into account perceived psychological strain experienced by the user” either from user input or by automatically “detecting changes in sympathetic activation based on one or more parameters including, but not limited to, heart rate variability, heart rate, galvanic skin response, and the like.” Ex-1005 ¶162; *see also id.* ¶73 (the device may “include a user input component for enabling additional contextual data, e.g., emotional (e.g., the user’s feelings), perceived intensity, and the like”).

128. Ahmed further teaches that the feedback panel may display qualitative information regarding, for example, whether “the user was stressed at a certain point in the day (e.g., if there was a high level of sweat with little activity).” Ex-1005 ¶186. For example, Figure 17B below shows the user interface displaying “at 230pm

you had high levels of sweat although little movement” and “this appears to be a stressful movement⁹ in your day.” Ex-1005, Figs. 17B, 18B (“Consider rest,” “Get a good night’s sleep tonight!”), ¶¶181 (feedback panel 1538 presents “tips 1542 on adjusting the exercise routine”), 189 (feedback panel 1580 presents “tips 1584 on adjusting sleep”), Fig. 15A. A POSITA would have understood that this meets the claim requirement that instructions be displayed “related to at least one mental activity for improving the readiness score” because informing the user that a stressful moment was detected during the day that contributed to a low recovery score implicitly instructs the user that reducing psychological strain could improve the score. *See also* Ex-1005 ¶¶70 (“For example, as explained herein, using the physiological readouts of the device and the analytics described herein, an ‘Intensity Score’ (e.g., 0-21) (e.g., that measures a user’s recent exertion), a ‘Recovery Score’ (e.g., 0-100%), and ‘Sleep Score’ (e.g., 0-100) may together measure readiness for physical and psychological exertion.”), 162. Additionally, it would have been obvious, in light of Ahmed’s extensive discussion of providing feedback and recommendations regarding physiological activities based on physiological measurements and activity scores, to also provide feedback and recommendations regarding psychological activities based on stress indicators and sleep scores.

⁹ Sic – this appears to be a typo and intended to be a “stressful moment.” *See* Ex-1005 at ¶186.

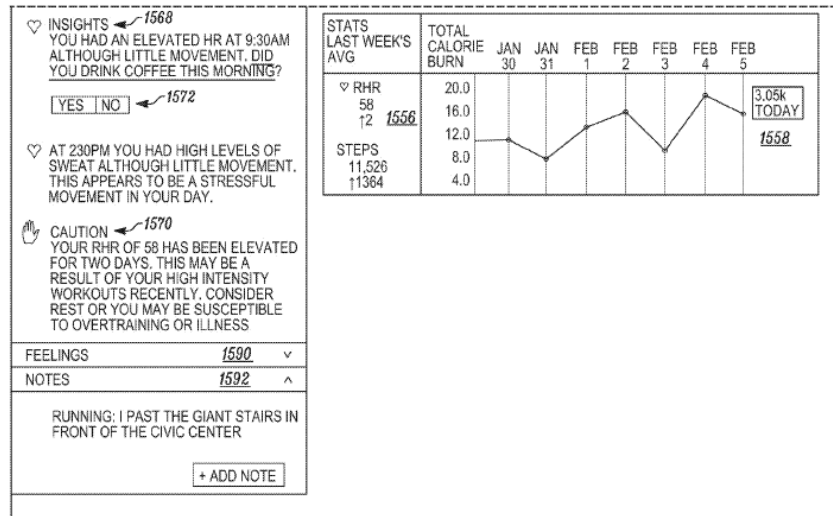


FIG. 17B

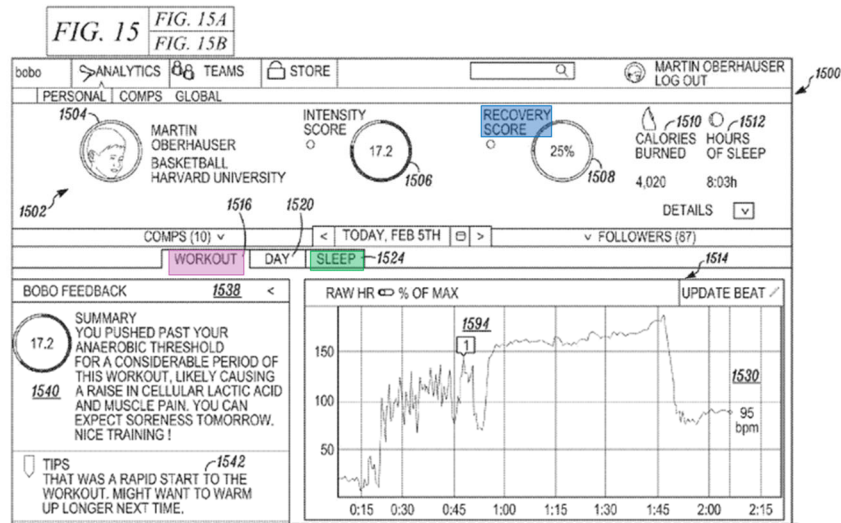
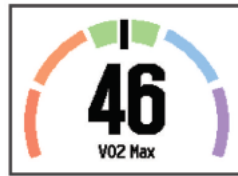


FIG. 15A

129. Additionally, as I explained in my Technology Background Section (see Section V), using a user interface of the mobile communication device to show instructions related to physical activity and mental activity was well known by 2015. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to

each of these factors. *Id.* at 3, 11.

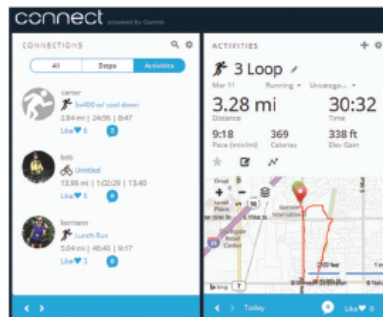


Purple	Superior
Blue	Excellent
Green	Good
Orange	Fair
Red	Poor

Store your activities: After you complete and save an activity with your device, you can upload that activity to Garmin Connect and keep it as long as you want.

Analyze your data: You can view more detailed information about your activity, including time, distance, elevation, heart rate, calories burned, cadence, VO2 max., running dynamics, an overhead map view, pace and speed charts, and customizable reports.

NOTE: Some data requires an optional accessory such as a heart rate monitor.



The Garmin product also included software to store historical data about the health measurements and to perform analysis and provide graphical visualizations. *Id.* at 5-6. The Garmin product included a “Recovery Advisor,” which provided feedback by “display[ing] how much time remains before [the user] is fully recovered and ready for the next hard workout.” *Id.* at 12. This included “Recovery check,” which “provides a real-time indication of [the user’s] state of recovery within the first

several minutes of an activity” and “Recovery time,” which counts down [time] until it is optimal for [the user] to attempt another hard workout.” *Id.* Tran also teaches the use of biosensor information to determine qualitative and quantitative aspects of both a user’s physical activities and mental activities and to create appropriate notifications and warnings. Ex-1028 (Tran), 11:41-67, 38:43-59. Von Badinski also teaches the processing of biosensor information and its comparison to reference data to determine how and when to alert a user and a user interface on a mobile device for reporting current and historical health and fitness information to a user. Ex-1029 (Von Badinski) at 4:16-29, 5:26-33, 15:9-23, Figs. 10-11.

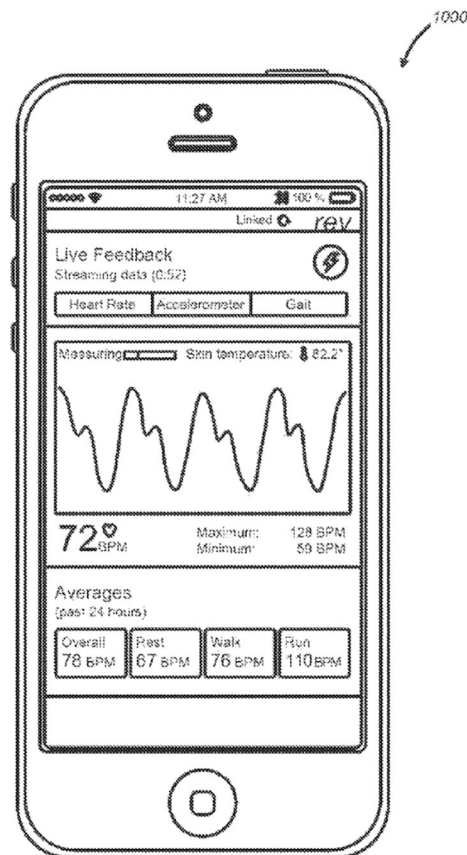


FIG. 10

See also Ex-1031 (Teller '731), Figs. 7-9, 21:43-47 (“[A]ctivity level web page 200 may include at least one hyperlink 220 to allow a user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to activity level and affiliate advertising elsewhere on the network.”), 21:45-22:26 (discussing mental activities measured), 22:28-34 (“The preferred mind centering web page may also include an indication of the total time spent on mind centering activities, shown at 275, hyperlinks 280 which allow the user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to mind centering and affiliate advertising, and a calendar 285 for choosing among views having variable and selectable time periods.”), 23:19-25 (“The sleep web page 290 may also include hyperlinks 320 which allow the user to directly access sleep related news items and articles, suggestions for refining or improving daily routine with respect to sleep and affiliate advertising available elsewhere on the network, and a sleep calendar 325 for choosing a relevant time interval.”), Table 3 (one of the things continually measured is “readiness”); Ex-1032 (Teller '117), Figs. 7-9, 21:43-47, 22:28-34, 23:19-25, Table 3.

3. Dependent Claims 2-6

- a. Claim 2: A method according to claim 1, wherein obtaining the user's movements is performed by measuring the user's movements or by retrieving the user's movement data from a separate device.**

130. Ahmed alone or Ahmed-Shiga teaches Claim 2.

131. Ahmed obtains the user's movements by measuring the user's movements using a wearable device, such as a bracelet. Ex-1005 ¶65 (“[T]he wearable system may include components configured to provide various functions such as data collection and streaming functions of the bracelet.”). For example, Ahmed's wearable device includes “one or more sensors for activity measurement” such as “one or more multi-axes accelerometers and/or gyroscope to provide a measurement of activity.” Ex-1005 ¶77.

b. Claim 3: A method according to claim 1, further comprising measuring at least one biosignal during the activity period.

132. Ahmed alone or Ahmed-Shiga teaches Claim 3.

133. Ahmed teaches measuring at least one biosignal during the activity period, including as part of determining an intensity score (i.e., activity summary). Ahmed teaches that “the intensity score is calculated based on the user's heart rate reserve (HRR) as detected continuously throughout the desired time period.” Ex-1005 ¶143; *see also id.* ¶144 (“continuous heart rate readings are converted to HRR values”). Ahmed also teaches measuring GSR, skin temperature, and other biosignal measurements. Ex-1005 ¶70.

- c. **Claim 4: A method according to claim 1, wherein the at least one biosignal is selected from the group consisting of an electrocardiogram, a photoplethysmogram, an electromyogram, an electrooculogram, a heart rate, a heart rate variability, a body temperature, a resting heart rate, an average heart rate and signals related to breathing.**

134. Ahmed alone or Ahmed-Shiga teaches Claim 4.

135. Ahmed teaches measuring at least the user's heart rate and body temperature during sleep when generating a sleep score (i.e., rest summary). Ex-1005 ¶166 (“[T]he analytics system generates a sleep score using continuous data collected by an exemplary physiological measurement system regarding the *user's heart rate*, skin conductivity, *ambient temperature* and accelerometer/gyroscope data *throughout the user's sleep*.”); *see also* Ex-1005 ¶70.

136. Additionally, as I explained in my Technology Background Section (*see* Section V), measuring a biosignal such as an electrocardiogram, a photoplethysmogram, an electromyogram, a heart rate, a heart rate variability, a body temperature, a resting heart rate, an average heart rate and signals related to breathing was well known by 2015. For example, Make Magazine published a compendium on Wearable Electronics in 2014 explains the capabilities of various sensors in measuring physical phenomena and techniques for processing sensor data in Chapter 7, “Sensors.” Ex-1030, 113, 117, 119-120, 122. Specific instructions are also provided for the use of biosensors including heart rate sensors. *Id.* at 131. These

clearly place the capability for biosensor measurements within the capabilities of an ordinary artisan. It is also explained that there are numerous other biosensor measurements that are within the capabilities of an ordinary artisan. *Id.* at 132-133. Color and temperature measurements are also discussed. *Id.* at 136-141.

“Beyond heart rate, there are many other biological signals you might want to measure. Here are a few:

Galvanic skin response (GSR)

A method of measuring the conductivity of the skin. Changes in this conductivity can indicate a response to physical or psychological stimulus. GSR sensors are used in classic lie detectors. A GSR sensor can be built with some basic inexpensive electronic components.

Electromyography (EMG)

A method of measuring of muscle activity by detecting its electrical potential. The Muscle V3 Sensor Kit (SF SEN-11776) provides varying analog voltage so you can easily read muscle activity with an Arduino analog input pin.

Electroencephalography (EEG)

A method of measuring electrical activity in the scalp. EEG headsets are often used in thought-controlled computing applications.” *Id.* at 132-133.

- d. Claim 5: A method according to claim 1, wherein determining the rest summary comprises at least one of determining a sleep factor, determining a sleep balance, determining lowest body temperature during rest and determining a resting heart rate.**

137. Ahmed alone or Ahmed-Shiga teaches Claim 5.

138. Ahmed teaches determining at least the user’s lowest body temperature during rest as part of the sleep score (i.e., rest summary). Ahmed states that its

“sensors may be used to recognize sleep based on a temperature drop.” Ex-1005

¶78. Moreover, Ahmed teaches that the user’s “body temperature, in conjunction with heart rate monitoring and motion, may be used to interpret whether a user is sleeping or just resting, as body temperature drops significantly when an individual is about to fall asleep[.]” Ex-1005 ¶78; *see also id.* ¶166 (using the user’s ambient temperature throughout the user’s sleep in generating the sleep score).

- e. **Claim 6: A method according to claim 1, further comprising providing the user with appropriate instructions, related to at least one of physical activity, mental activity and rest, for improving the user's readiness score.**

139. Ahmed alone or Ahmed-Shiga teaches Claim 6.

140. As explained for Element 1[h], Ahmed teaches displaying on a user interface elements contributing to the recovery (i.e., readiness) score and instructions related to physical and mental activity and rest for improving the readiness score. For example, Ahmed teaches that the system may “automatically generate or adjust an exercise routine or regimen based on the user’s actual recovery scores (e.g., *to recommend lighter exercise for days during which the user has not recovered sufficiently*).” Ex-1005 ¶173; *see also id.*, Figs. 15A, 17B (“this appears to be a stressful movement in your day”), 18B (“Consider rest,” “Get a good night’s sleep tonight!”), ¶¶181 (feedback panel 1538 presents “tips 1542 on adjusting the exercise routine”), 189 (feedback panel 1580 presents “tips 1584 on adjusting sleep”).

B. Ground 3: Claim 1-6 are obvious over Wisbey in view of Shiga.

- 1. A POSITA would have been motivated to combine Wisbey's teachings with Shiga's teachings and would have had a reasonable expectation of success.**

141. A POSITA would have been motivated to combine the teachings of Wisbey and Shiga and would have had a reasonable expectation of success in doing so because each relates to the same well-known technologies. Both are directed to physiological monitoring devices that collect biometric data from the user relating to the user's sleep activity and physical activity and use that data to evaluate the user's health state and provide recommendations for improving it. *See, e.g.*, Ex-1006, Abstract, ¶¶39 (“Logic circuits 240 may detect, for example, the amount of physical activity and the amount of sleep a user experienced over the last 48 hours, combine those metrics with the user's HRV, and calculate a fatigue level of between 1 and 10, wherein the fatigue level could indicate the user's physical condition and aptitude for further physical activity that day.”), 57; Ex-1007, Abstract (“A health conditioning device accumulates data measured or input by an evaluation subject for each index of a plurality of items including a lifestyle index, which is an index related to body activity or lifestyle habit, and a biomarker, which is an index related to physiological state of the body” and “displays the improvable factor along with the evaluation of the health condition of the evaluation subject.”), Fig. 7. Both references evaluate measures of metabolic activity and fatigue and present

summaries and recommendations to a user. *See, e.g.*, Ex-1006 ¶¶14, 24, Fig. 5; Ex-1007 ¶¶123-124.

142. Wisbey displays elements contributing to the interpreted recovery (i.e., readiness) score. For example, Wisbey teaches archive table 1020 (shown below), which may be part of the user's dynamic recovery profile and shows parameters contributing to the interpreted recovery score such as metabolic activity score (MAS) 1024, "sleep time 1028, and fatigue level 1030." Ex-1006 ¶¶107 ("The dynamic recovery profile, in one embodiment, is implemented in conjunction with an archive table that represents data and relationships of parameters relative to that data."), 109, Fig. 10D. Wisbey further teaches that the dynamic recovery profile includes instructions related to at least one physical activity and at least one mental activity for improving the recovery score. For example, Wisbey teaches that "the dynamic recovery profile may indicate that the user should get more sleep, or should strive for a lower MAS, to avoid becoming overly fatigued." Ex-1006 ¶109.

Diagram illustrating an archive table (1020) with columns and rows. The columns are labeled: Date (1022), MAS (1024), Avg. UAI (1026), Sleep Time (hours) (1028), and Fatigue Level (1030). The rows represent data entries for three dates in November 2013.

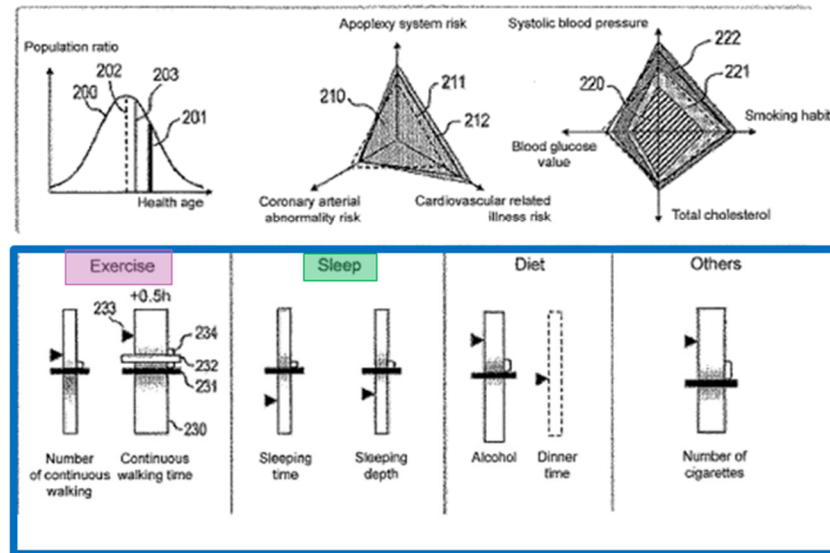
Date	MAS	Avg. UAI	Sleep Time (hours)	Fatigue Level
1 Nov. 2013	2,500	7	6	HIGH
2 Nov. 2013	2,000	5	8	NORMAL
3 Nov. 2013	1,500	3	9	LOW

143. Shiga teaches a *user interface of the mobile communication device* for showing elements contributing to Shiga's "improvable factor" and instructions relating to physical and mental activities for improving it. *See, e.g.*, Ex-1007 ¶¶56, 59 ("As shown in FIG. 4, the comprehensive health condition determining device 1 includes ... a user I/F (interface) control unit 103, a communication connector 104 and a device communication control unit 105 ... and a display control unit 109."), 61 ("The communication method may be a wired communication including USB and IEEE1394, or a wireless communication including Bluetooth, ZigBee, IrDA, and wireless LAN."). Shiga's Figure 7 shows an exemplary user interface. On the "lower level of the screen," the interface gives an example of the "improvable factor" by showing the user their present exercise and sleep progress compared to past exercise and sleep progress. The interface also shows the average user's values for the same, and implicit instructions for improving the "improvable factor" using bars and triangles on the display. Ex-1007 ¶¶118 ("The lower level of the screen of FIG. 7 is the display example of the improvable factor. In this example, the 'number of continuous walking' and the 'continuous walking time' are displayed for the lifestyle index of the exercise category; the 'sleeping time' and the 'sleeping depth' are displayed for the lifestyle index of the sleep category, and the 'alcohol ingestion frequency' is displayed for the lifestyle index of the diet category. ... The 'number of cigarettes' is not a factor selected by the improvable factor extracting function

172, but is selected as a default improvable factor as it is known to have great influence on the illness risk.”), 119 (“In the example of FIG. 7, the individual improvable factor is bar displayed. Each part configuring the bar 230 will be described taking the ‘continuous walking time’ by way of example. The vertical axis of the bar 230 represents the value of the lifestyle index, where the value becomes more satisfactory towards the upper side. The color (shading) of the bar 230 shows the variation in the value of the lifestyle index for a certain period (e.g., few weeks) in the past. That is, the portion of darkest color in the bar 230 represents the average μ of a certain period in the past. The width of the bar 230 represents the intensity of the influence the respective improvable factor has on the biomarker (problematic index). That is, the more the improvement effect can be expected, the wider the width of the improvable factor becomes. A black line 231 arranged overlapping the bar 230 shows the immediate measurement value (may be the latest measurement value or average of a plurality of immediate measurement values). A white line 232 on the black line 231 shows the improvement target set by the user. The numerical value ‘+0.5h’ displayed at the upper part of the bar 230 shows the value of the improvement target. A black triangle 233 arranged on the left side of the bar 230 represents the average value in a group of the same age and the same gender as the user.”), 120 (“A second bar 234 arranged on the right side of the bar 230 shows the range that can be set for the improvement target (movable range of

the line 232). ... [T]he user himself/herself can grasp the improvement amount of the realistic health condition at the current time point by looking at the length of the second bar 234.”), Fig. 7.

Fig. 7

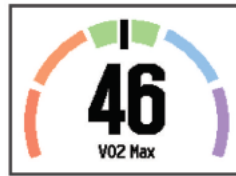


144. A POSITA would have been motivated to implement Shiga’s user interface teachings for displaying elements contributing to the readiness score and instructions for improving it in order to enhance Wisbey’s system because this was a well-known and user-friendly way to present information to the user. Wisbey does not explicitly teach that the elements contributing to the recovery score and the instructions for improving it are shown *on a user interface of the mobile communication device*. But it would have been obvious to a POSITA to do so based on Wisbey’s teachings that the user interacts with a user interface to input information relating to the user’s lifestyle and physical activity types. *See, e.g., Ex-*

1006 ¶¶59 (“The user may provide the user information by, for example, a user interface of computing device 708, or of electronic capsule 200.”), 60, 84 (“[A] user interface is provided such that the user can confirm whether the displayed user activity type is correct, or select the user activity type from a group of activity types.”), 85, 124 (“the past interpreted recovery score is *displayed on a graph* (e.g., a line or bar graph) as a function of time (e.g., comparing against other past interpreted recovery scores from past measuring periods)”).

145. A POSITA would thus have been motivated to display all related recovery score information on a user interface of the user’s mobile communication device, as taught by Shiga. In the Wisbey-Shiga combination, the dynamic recovery profile, which shows the elements contributing to the recovery score and the instructions on physical and mental activities that can improve the score, would have been displayed on the user interface.

146. Additionally, as I explained in my Technology Background Section (see Section V), using a user interface of the mobile communication device to show instructions related to physical activity and mental activity was well known by 2015. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to each of these factors. *Id.* at 3, 11.

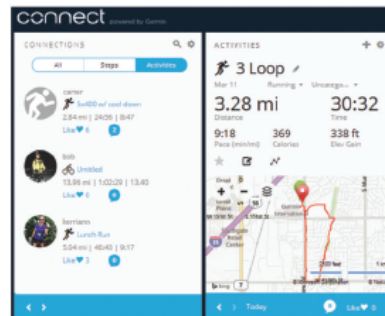


Purple	Superior
Blue	Excellent
Green	Good
Orange	Fair
Red	Poor

Store your activities: After you complete and save an activity with your device, you can upload that activity to Garmin Connect and keep it as long as you want.

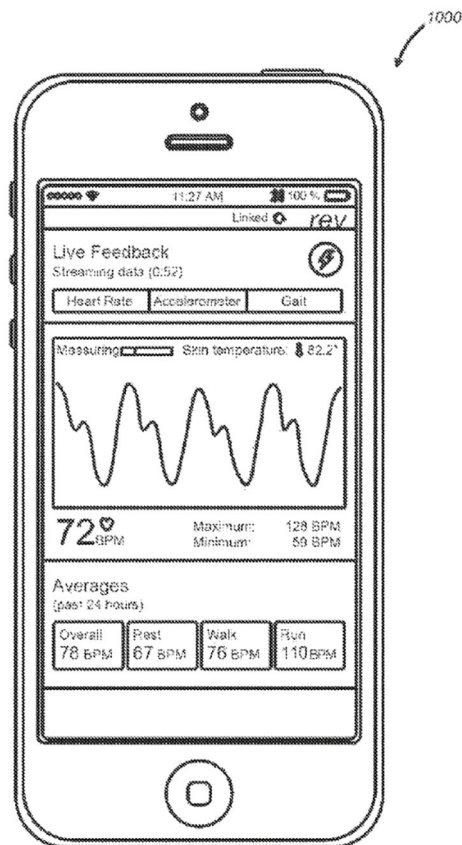
Analyze your data: You can view more detailed information about your activity, including time, distance, elevation, heart rate, calories burned, cadence, VO2 max., running dynamics, an overhead map view, pace and speed charts, and customizable reports.

NOTE: Some data requires an optional accessory such as a heart rate monitor.



The Garmin product also included software to store historical data about the health measurements and to perform analysis and provide graphical visualizations. *Id.* at 5-6. The Garmin product included a “Recovery Advisor,” which provided feedback by “display[ing] how much time remains before [the user] is fully recovered and ready for the next hard workout.” *Id.* at 12. This included “Recovery check,” which “provides a real-time indication of [the user’s] state of recovery within the first several minutes of an activity” and “Recovery time,” which counts down [time] until

it is optimal for [the user] to attempt another hard workout.” *Id.* Tran also teaches the use of biosensor information to determine qualitative and quantitative aspects of both a user’s physical activities and mental activities and to create appropriate notifications and warnings. Ex-1028 (Tran), 11:41-67, 38:43-59. Von Badinski also teaches the processing of biosensor information and its comparison to reference data to determine how and when to alert a user and a user interface on a mobile device for reporting current and historical health and fitness information to a user. Ex-1029 (Von Badinski) at 4:16-29, 5:26-33, 15:9-23, Figs. 10-11.



See also Ex-1031 (Teller '731), Figs. 7-9, 21:43-47 (“[A]ctivity level web page 200

may include at least one hyperlink 220 to allow a user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to activity level and affiliate advertising elsewhere on the network.”), 21:45-22:26 (discussing mental activities measured), 22:28-34 (“The preferred mind centering web page may also include an indication of the total time spent on mind centering activities, shown at 275, hyperlinks 280 which allow the user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to mind centering and affiliate advertising, and a calendar 285 for choosing among views having variable and selectable time periods.”), 23:19-25 (“The sleep web page 290 may also include hyperlinks 320 which allow the user to directly access sleep related news items and articles, suggestions for refining or improving daily routine with respect to sleep and affiliate advertising available elsewhere on the network, and a sleep calendar 325 for choosing a relevant time interval.”), Table 3 (one of the things continually measured is “readiness”); Ex-1032 (Teller ’117), Figs. 7-9, 21:43-47, 22:28-34, 23:19-25, Table 3.

147. A POSITA would have had a reasonable expectation of success in combining Wisbey and Shiga. Wisbey and Shiga are analogous prior art as they both involve physiological monitoring devices that measure the same biological markers (such as the user’s heart rate), during the same activities (for example, sleep and exercise activities), and with the same goal—to provide recommendations to the

user for improving the user's health condition and/or fitness state. *See, e.g.*, Ex-1006, Abstract, ¶¶39, 57 (“The operations of method 1000 take into account not only the user's current fatigue level, but also the relationship between current and past fatigue levels to create an interpreted recovery score that accurately reflects the user's physical condition and performance capabilities.”); Ex-1007, Abstract, ¶55 (“The measurement device of the lifestyle index includes the activity amount meter for measuring the body activity amount and the exercise intensity, the passometer for measuring the number of steps, the sleep sensor for measuring the state of sleeping, and the calorie meter for carrying out calorie calculation of the diet.”), Fig. 7. Moreover, a POSITA would have understood that Wisbey and Shiga's devices are similar such that they are programmable using standard processors and are interchangeable regardless of how they display information to the user. A POSITA would have understood, therefore, that these references disclose interrelated teachings based on routine technologies that would have been amenable to various well-understood and predictable combinations to provide more features and enhance user interest.

2. Independent Claim 1

a. Element 1[pre]: A method for assessing readiness of a user, the method comprising:

148. Wisbey in view of Shiga (“Wisbey-Shiga”) teaches the preamble, to the extent it is limiting.

149. Wisbey teaches a method for “providing a recovery status” to a user based on an “interpreted recovery score” (Ex-1006 ¶12), which is a measurement that “accurately reflects the user’s physical condition and performance capabilities.” Ex-1006 ¶57. Figure 10A shows Wisbey’s exemplary “method 1000 for providing an interpreted recovery score.” Ex-1006 ¶57, Fig. 10A. The interpreted recovery score “take[s] into account not only the user’s current fatigue level, but also the relationship between current and past fatigue levels,” based on data obtained from a wearable device (e.g., worn on the user’s wrist or finger). Ex-1006 ¶57.

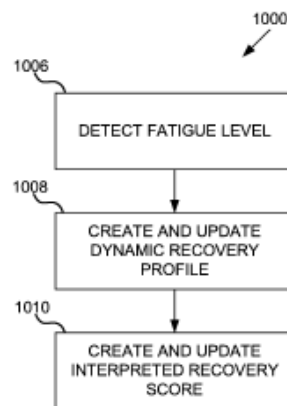


Fig. 10A

b. Element 1[a]: obtaining the user’s movements;

150. Wisbey-Shiga teaches Element 1[a]. As discussed in Section VII.A., I interpret “obtaining the user’s movements” to mean “collecting data regarding the user’s movements.” *See, e.g.*, Ex-1022, 4; Ex-1021, 1.

151. Wisbey teaches collecting data regarding the user's movements using accelerometers and gyroscopes. For example, Wisbey teaches that "the movement of the user's leg in x, y, and z directions may be monitored (e.g., by an accelerometer or gyroscope)." Ex-1006 ¶¶72. Moreover, Wisbey teaches monitoring the user's movement using sensors attached to the user's body such as "a gyroscope or accelerometer to detect movement, and a heart-rate sensor, each of which may be embedded in a wristband that a user can wear on the user's wrist or ankle, such as wristband 100." Ex-1006 ¶¶78.

152. Additionally, as I explained in my Technology Background Section (see Section V), Make Magazine published a compendium on Wearable Electronics in 2014, which explains that sensors can measure "Movement, Orientation, and Location." Ex-1030 at 128. Examples are provided including instructions for the use of multi-axis accelerometers and compasses. *Id.* at 128-130.

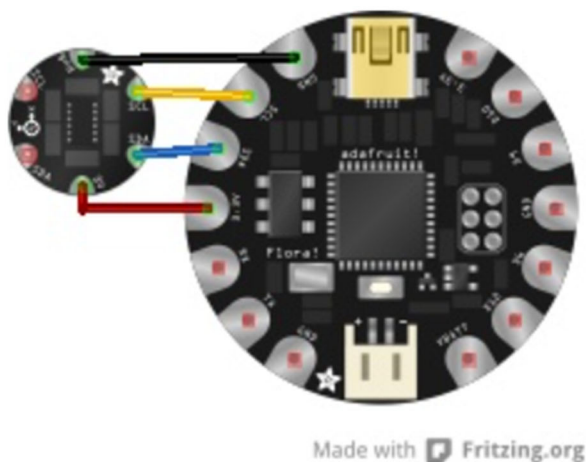


Figure 7-40. Flora accelerometer/compass circuit diagram

Moreover, Von Badinski teaches using accelerometers to measure movement. Ex-1029 (Von Badinski), 10:58-11:47 (“[S]ensor modules 220 can further include sensors that are not directly related to biological sign monitoring; some examples of these sensors include accelerometers, gyroscopes, vibration, sensors (e.g., a magnetometer or a digital compass), or other suitable sensors (e.g., for gesture recognition). ... In one or more embodiments, the accelerometers in the sensor modules 220 can detect movements in multiple (e.g., 3) dimensions or axes. The accelerometer can measure force of acceleration of the WCD and can measure gestures performed by a user while wearing the WCD.”).

c. Element 1[b]: using the obtained user’s movements to determine a nature of the period, wherein the nature of the period is selected from an activity period and a rest period;

153. Wisbey-Shiga teaches Element 1[b].

154. Wisbey uses the data collected regarding the user’s movements, among other information, to determine whether the user is in an active, rest, or sleep state.¹⁰ Wisbey teaches determining “the user activity type and the user activity intensity by using sensors configured to be attached to the user’s body.” Ex-1006 ¶90. Wisbey determines the activity type from a “set of reference activity types,” with each type

¹⁰ A POSITA would have understood that Wisbey’s teachings regarding sleep and rest periods both meet the claimed “rest period” and related “rest summary” limitation discussed below, for the same reasons explained in Ground 1. See Ex-1001, 5:23-26 (“rest period” and “rest summary” include both sleep and rest).

being “associated with a reference activity type pattern.” Ex-1006 ¶79. Examples of reference activity types “include typical activities, such as *running*, walking, *sleeping*, swimming, bicycling, skiing, surfing, *resting*, working.” Ex-1006 ¶67. Wisbey then determines based on, for example, a pattern, pattern frequency, and temperature “that there is an 80% chance the user activity type is running, a 15% chance the user activity type is walking, and a 5% chance the user activity is dancing,” and so on. Ex-1006 ¶85; *see also id.* ¶39 (logic circuits “detect and store metrics such as the amount of physical activity, sleep, or rest over a recent period of time, or the amount of time without physical activity over a recent period of time”).

d. Element 1[c]: measuring at least one biosignal of the user during the rest period;

155. Wisbey-Shiga teaches Element 1[c].

156. Wisbey teaches measuring the user’s biosignals, including the user’s heart rate and heart rate variability (HRV). For example, Wisbey teaches logic circuits that “receive and process a plurality of electric signals” from the wrist and finger biosensors including, for example, “electro-cardio signals from a heart” detected by a heart rate sensor or oximeter, which “may be used to calculate and store a heart rate variability (HRV) value.” Ex-1006 ¶¶38, 45. The logic circuits “detect and store metrics” such as the amount of sleep, rest, or physical activity “over a recent period of time, or the amount of time without physical activity over a recent period of time” and “combine those metrics with the user’s HRV.” Ex-1006 ¶39;

see also id. ¶40 (pulse oximeter may also detect blood oxygen saturation levels, which may be used to calculate the user's HRV).

157. Wisbey teaches that the user's biosignals are measured while the user sleeps. For example, Wisbey teaches that "if the user slept poorly, but for some reason this ***lack of sleep*** is not captured in the fatigue level measurement (e.g., ***if the HRV is consistent rather than sporadic***), the interpreted recovery score may be adjusted to account for the user's lack of sleep." Ex-1006 ¶111.

158. Additionally, as I explained in my Technology Background Section (*see* Section V), measuring a biosignal of a user during sleep was well known by 2015. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin) at 3 ("During sleep mode, the device monitors your rest. Sleep statistics include total hours of sleep, sleep levels, and sleep movement."); *see also* Ex-1027 (Consumer Reports) at 46 ("Some [wearable health and fitness monitoring devices] also serve as health and fitness devices tracking your physical activity and sleep patterns."); Ex-1028 (Tran), 11:41-67 ("[D]uring a particular day, the system can determine the amount of time for exercise, sleep, and entertainment, among others."); Ex-1029 (Von Badinski), 10:58-11:47 ("Together, the processor module 210 and the sensor modules 220 can enable the WCD 110 to perform multiple functions including, for example, pedometer, sleep monitor (e.g.,

which monitors sleep quality), heart rate sensor, pulse oximetry, skin (and in select embodiments, ambient) temperature.”); Ex-1031 (Teller ’731), Figs. 5, 9, 22:27-23:16; Ex-1032 (Teller ’117), Figs. 5, 9, 22:39-23:28.

e. Element 1[d]: determining a rest summary for the rest period, based on the measured at least one biosignal and at least one biosignal of a previous rest period;

159. Wisbey-Shiga teaches Element 1[d].

160. The ’429 Patent teaches that a rest summary includes “one or more of the following: bedtime, rise time, total sleep duration, sleep disturbances, hypnogram, lowest hear[t] rate, average heart rate, biosignal amplitude variation, heart rate variability, restlessness etc.” Ex-1001, 23:20-25. Thus, a POSITA would have understood that a calculation or evaluation based, at least in part, on one or more of these factors would satisfy the claimed “rest summary.” In fact, a rest summary could be any metric related to the quantity and/or quality of rest (including sleep) that a user experienced.

161. Wisbey’s logic circuits “detect and store metrics” such as the amount of sleep or rest (i.e., total sleep duration) the user experienced “over a recent period of time.” Ex-1006 ¶39. Specifically, the logic circuits detect “the amount of sleep a user experienced over the last 48 hours” and combine that metric with the user’s HRV and amount of physical activity to calculate a fatigue level (i.e., the claimed body response summary, discussed for Element 1[f]). Ex-1006 ¶39. The fatigue

level is also “based on the amount of sleep that is measured for the previous night.”

Ex-1006 ¶102. As discussed in the previous section, Wisbey teaches that the user’s biosignals are measured while the user sleeps. For example, “if the user slept poorly, but for some reason this *lack of sleep* is not captured in the fatigue level measurement (e.g., *if the HRV is consistent rather than sporadic*), the interpreted recovery score may be adjusted to account for the user’s lack of sleep.” Ex-1006 ¶111. A POSITA would thus have understood that Wisbey determines a sleep (i.e., rest) summary for the user’s sleep period, which is based on the user’s most recent sleep biometric data (previous night) and the user’s past sleep biometric data (last 48 hours). Logic circuits, in some disclosed embodiments, detect and store metrics such as the amount of physical activity, sleep, or rest over a recent period of time, or the amount of time without physical activity over a recent period of time. Ex-1006 ¶39. Wisbey classifies activities based on a variety of measurements and other factors. One classification includes sleeping while another includes resting. Ex-1006 ¶67. Sleep and/or rest measurements can be used as a factor in calculating a high fatigue level. Ex-1006 ¶¶102, 105. Sleep measurements can also be used in the calculation of analytics or stored in an archive for future evaluation. Ex-1006 ¶¶108- 111.

162. Additionally, as I explained in my Technology Background Section (see Section V), determining a rest summary for a rest period, based on the measured

biosignal and at least one biosignal of a previous rest period was well known by 2015. For example, the Garmin product included software to store historical data about the health measurements and this feature was also taught by Von Badinski. Ex-1026 (Garmin) at 8 (“You can review your heart rate data in the device history and on your Garmin Connect account.”); Ex-1029 (Von Badinski) at 28:39-41 (“The WCD can also use historic temperature data to develop trend temperature data.”); *see also, e.g.*, Ex-1026 (Garmin) at 3 (“During sleep mode, the device monitors your rest. Sleep statistics include total hours of sleep, sleep levels, and sleep movement.”); Ex-1028 (Tran), 11:41-67 (“[D]uring a particular day, the system can determine the amount of time for exercise, sleep, and entertainment, among others.”); Ex-1029 (Von Badinski), 10:58-11:47 (“Together, the processor module 210 and the sensor modules 220 can enable the WCD 110 to perform multiple functions including, for example, pedometer, sleep monitor (e.g., which monitors sleep quality), heart rate sensor, pulse oximetry, skin (and in select embodiments, ambient) temperature.”); Ex-1031 (Teller ’731), Figs. 5, 9, 22:27-23:16; Ex-1032 (Teller ’117), Figs. 5, 9, 22:39-23:28.

f. Element 1[e]: determining an activity summary for the activity period, based on the obtained movements of an activity period and obtained movements of at least one previous activity period;

163. Wisbey-Shiga teaches Element 1[e].

164. As explained for Element 1[a], Wisbey obtains the user’s movements

using accelerometers and gyroscopes. Ex-1005 ¶72. Wisbey further teaches determining an “metabolic activity score” (i.e., activity summary) for the user’s activity period. Wisbey’s metabolic activity score, which may be “represented as a numerical value,” is created and updated by “multiplying the metabolic loading by the duration of the user activity type at a particular user activity intensity.” Ex-1006 ¶91.

165. Wisbey’s “metabolic activity score” is based on the user’s past and present activity biometric data. Wisbey’s logic circuits “detect and store metrics” such as the amount of physical activity the user experienced “over *a recent period of time*.” Ex-1006 ¶39; *see also id.* ¶51 (“movement monitoring module” monitors the user’s “movement to create a metabolic activity score”). Moreover, the logic circuits detect “the amount of physical activity ... a user experienced *over the last 48 hours*” and combine that metric with the user’s HRV and amount of physical activity to calculate a fatigue level (i.e., the claimed body response summary, discussed for Element 1[f]). Ex-1006 ¶39. Wisbey teaches that “the metabolic activity score may be updated by *continually supplementing* the metabolic activity score *as new activities are undertaken* by the user” such that the “score continually increases as the user participates in more and more activities.” Ex-1006 ¶91. Moreover, Wisbey teaches that “the metabolic activity score is created and *updated as an aggregate of period activity scores*, and the metabolic activity score may represent a running sum

total of the period activity scores.” Ex-1006 ¶93; *see also id.* ¶98 (“the activity score may be continually updated over the period of one week, or one month”). Wisbey also teaches an archive, which “includes *historical* information about the movement and the *metabolic activity score*.” Ex-1006 ¶53. A POSITA would thus have understood that Wisbey’s metabolic activity score is “based on the obtained movements of an activity period and obtained movements of at least one previous activity period.” Wisbey specifically explains that “the metabolic activity score is based on score periods.” Ex-1006 ¶92. Since only a single score period can be current and Wisbey is incapable of scoring future time periods, this must include at least one prior score period.

166. Additionally, as I explained in my Technology Background Section (*see* Section V), determining an activity summary for an activity period, based on the obtained movements of an activity period and obtained movements of at least one previous activity period was well known by 2015. For example, around 2009, Fitbit introduced consumer-grade wearable health and fitness monitors that could track motion and calculate user activity levels. Ex-1024 (Forbes Getting Fitbit); *see also* Ex-1025 (Consumer Electronics Hall of Fame). By the earliest possible priority date of the ’429 Patent, technologies for monitoring user activity and biological functions had become more sophisticated and more widely available. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking,

sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to each of these factors. *Id.* at 3, 11. By the end of 2014, many wearable health and fitness monitoring devices were available on the market. Consumers Report noted that “[s]ome also serve as health and fitness devices tracking your physical activity and sleep patterns.” Ex-1027 (Consumer Reports) at 46. Tran also teaches the use of biosensor information to determine qualitative and quantitative aspects of both a user’s physical activities and mental activities and to create appropriate notifications and warnings. Ex-1028, 11:41-67, 38:43-59. Von Badinski also taught measuring a number of indicators of activity and draws conclusions about activity types and activity periods from current and historical measurements. Ex-1029 at 10:58-11:47; Ex-1031 (Teller ’731), Figs. 5, 7, 20:53-21:44; Ex-1032 (Teller ’117), Figs. 5, 7, 20:65-21:56.

167. Moreover, the Garmin product included software to store historical data about the health measurements and this feature was also taught by Von Badinski. Ex-1026 (Garmin) at 5-6 (“History includes time, distance, calories, average pace or speed, lap data, and optional ANT+ sensor information. NOTE: When the device memory is full, your oldest data is overwritten.”); Ex-1029 (Von Badinski) at 13:21-24, 28:39-41 (“fitness activities, exercise histories, as well as recorded biological signs such as heart rate and body temperature, can be stored onboard in the memory

260 of the WCD 110”); Ex-1031 (Teller ’731), Figs. 5, 7, 20:53-21:44; Ex-1032 (Teller ’117), Figs. 5, 7, 20:65-21:56.

g. Element 1[f]: determining a body response summary based on the rest summary and the activity summary;

168. Wisbey-Shiga teaches Element 1[f].

169. Wisbey teaches determining a “fatigue level” (i.e., body response summary), which is based on the sleep summary and metabolic activity score. Wisbey’s logic circuits “detect and store metrics” such as the amount of rest, sleep, or physical activity “over a recent period of time” and use the user’s HRV, or HRV in combination with those metrics, to determine a fatigue level. Ex-1006 ¶39. For example, the logic circuits detect the amount of sleep and physical activity “a user experienced over the last 48 hours, combine those metrics with the user’s HRV, and calculate a fatigue level of between 1 and 10,” which indicates “the user’s physical condition and aptitude for further physical activity that day.” Ex-1006 ¶39. The fatigue level is based, for example, “on the amount of sleep that is measured for the previous night, the duration and type of user activity, and the intensity of the activity determined for a previous time period (e.g., exercise activity level in the last twenty-four hours).” Ex-1006 ¶102. Wisbey further teaches an archive, which includes, for example, “information about past user activity types, past user activity intensities, and past fatigue levels, as well as the *relationships between* each of these (e.g., if *fatigue levels* are particularly high after a certain user activity type or after a user

achieve a particular *metabolic activity score*)." Ex-1006 ¶104; *see also id.* ¶53 ("archive includes historical information about the fatigue level," including "historical information about the movement and the metabolic activity score").

170. Additionally, as I explained in my Technology Background Section (*see* Section V), determining a body response summary based on the rest summary and the activity summary was well known by 2015. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to each of these factors. *Id.* at 3, 11; *see also* Ex-1031 (Teller '731), Figs. 5, 7, 9, 24:26-29 ("Sleep and Activity Level might be simultaneously displayed in order to compare and evaluate Sleep ratings with corresponding Activity Level ratings to determine if any day to-day correlations exist."); Ex-1032 (Teller '117), Figs. 5, 7, 9, 24:39-42.

h. Element 1[g]: calculating a readiness score based on the body response summary and a previous body response summary, whereby the readiness score indicates a level of readiness of the user¹¹; and

171. Wisbey-Shiga teaches Element 1[g].

172. Wisbey teaches calculating an "interpreted recovery score" (i.e.,

¹¹ As explained in Ground 1, the '429 Patent does not expressly define "level" but defines "readiness" and provides an example of a readiness score indicating the level of readiness of the user. Ex-1001, 10:5-14.

readiness score), which is based on past and present “fatigue levels” (i.e., body response summaries) and indicates the readiness level of the user. Specifically, Wisbey teaches that the interpreted recovery score is “based on a user’s personalized fatigue levels, as recorded over time” and therefore considers “not only the user’s current fatigue level, but also the relationship between current and past fatigue levels to create” a score “that accurately reflects the user’s physical condition and performance capabilities.” Ex-1006 ¶57. Wisbey’s method takes into account current and past fatigue levels by, for example, “creating and updating a dynamic recovery profile based on an archive,” which includes “historical information about the fatigue level.” Ex-1006 ¶104. Because the interpreted recovery score “is based on both the fatigue level detected and on actual, historical results (as incorporated into the dynamic recovery profile),” Wisbey teaches that it is able to “provide[] higher resolution and additional perspective into the user’s current performance state” and “capacity for activity.” Ex-1006 ¶¶110-111; *see also id.* ¶¶110 (“The interpreted recovery score may be, for example, a number selected from a range of numbers.”), 122 (the interpreted recovery score itself may be further compared to past interpreted recovery scores “to inform the user’s current activity”).

173. Additionally, as I explained in my Technology Background Section (*see* Section V), determining the recovery level of a user was well known by 2015. For example, the Garmin product included a “Recovery Advisor,” which provided

feedback by “display[ing] how much time remains before [the user] is fully recovered and ready for the next hard workout.” Ex-1026 at 12. This feature included “Recovery check,” which “provides a real-time indication of [the user’s] state of recovery within the first several minutes of an activity” and “Recovery time,” which counts down [time] until it is optimal for [the user] to attempt another hard workout.” *Id.*; *see also* Ex-1031 (Teller ’731), Table 3 (one of the things continually measured is “readiness”); Ex-1032 (Teller ’117), Table 3 (same).

- i. Element 1[h]: using a user interface of the mobile communication device to show elements contributing to the readiness score and instructions related to physical activity and mental activity for improving the readiness score.**

174. Wisbey-Shiga teaches Element 1[h].

175. Wisbey teaches showing elements contributing to the interpreted recovery score (i.e., readiness score). For example, Figure 10D shows an archive table 1020 that may be part of the user’s dynamic recovery profile, which includes the parameters that contribute to the interpreted recovery score, for example, “date 1022, [metabolic activity score] MAS 1024, average [user activity intensity] UAI 1026, sleep time 1028, and fatigue level 1030.” Ex-1006 ¶107.

1020

1022

1024

1026

1028

1030

Date	MAS	Avg. UAI	Sleep Time (hours)	Fatigue Level
1 Nov. 2013	2,500	7	6	HIGH
2 Nov. 2013	2,000	5	8	NORMAL
3 Nov. 2013	1,500	3	9	LOW

176. Wisbey further teaches that the dynamic recovery profile includes instructions related to at least one physical activity and at least one mental activity for improving the recovery score. For example, Wisbey teaches that if “the user has a mean fatigue level of 7 following a day when sleep to MAS ratio is 6 to 2,000” and the system has determined that “the user typically achieves a below average MAS on days when the fatigue level is 7 or higher,” then “the dynamic recovery profile may indicate that *the user should get more sleep, or should strive for a lower MAS*, to avoid becoming overly fatigued.” Ex-1006 ¶109; *see also id.* ¶¶9 (“in one embodiment, ... a recovery recommendation module ... provides an activity recommendation based on the interpreted recovery score”), 121. A POSITA would have understood that the instruction for the user to “get more sleep” is related to a mental activity and the instruction to strive for a lower metabolic activity score is related to a physical activity. Moreover, it would have been obvious to a POSITA that Wisbey’s purpose in collecting, aggregating, storing, and assessing biometric

data representative of physical and mental activity is to be able to provide constructive feedback to a user. Wisbey explains that “[t]he present disclosure relates generally to fitness monitoring devices, and more particularly to a system and method for providing an interpreted recovery score.” Ex-1006 ¶2. Wisbey also explains that “[i]n a further embodiment, the apparatus includes a recovery status module that provides a recovery status based on the interpreted recovery score. The recovery status, in one instance, is one of the following: fatigued, recovered, and optimal. In another example, the interpreted recovery score module performs a comparison of the interpreted recovery score to the fatigue level, and tracks the comparison over time.” Ex-1006 ¶8. A POSITA would also have understood that the instructions provided by Wisbey are examples and that an instruction related to another mental activity such as stress or rest could instead be given as an obvious matter of design choice, given that Wisbey teaches considering factors including “stress-related activities such as work and driving in traffic” in determining the fatigue level. Ex-1006 ¶102.

177. Wisbey does not explicitly teach that the elements contributing to the recovery score and the instructions for improving it are shown *on a user interface of the mobile communication device* but it would have been obvious to a POSITA to do so based on Wisbey’s teachings that the user interacts with a user interface. For example, Wisbey teaches that “[t]he user may provide the user information by,

for example, a user interface of computing device 708, or of electronic capsule 200.”

Ex-1006 ¶59; *see also id.* ¶60 (“apparatus 702 may prompt the user for information about the user’s lifestyle (e.g., via a user interface”), 67 (“user defines a user-defined activity by programming computing device 708 (e.g., by an interface on electronic capsule 200) with information about the user-defined activity, such as pattern of movement, frequency of pattern, and intensity of movement”), 84, (“user interface is provided such that the user can confirm whether a displayed user activity type is correct, or select the user activity type from a group of activity types”), 85 (“Via a user interface, a list of these possible user activities may be provided such that the user may select the activity type the user is performing.”). Moreover, Wisbey teaches that “the past interpreted recovery score is *displayed* on a graph (e.g., a line or bar graph) as a function of time (e.g., comparing against other past interpreted recovery scores from past measuring periods).” Ex-1006 ¶124. A POSITA would have understood that the dynamic recovery profile, which shows the elements contributing to the recovery score and the instructions on physical and mental activities that can improve the score, would also have been displayed on a user interface because this would have been the most efficient and user-friendly way to communicate such information to the user. A POSITA would have also understood that one motivation for including computing device 708 in at least some embodiments, in addition to apparatus for providing interpreted recovery score 702,

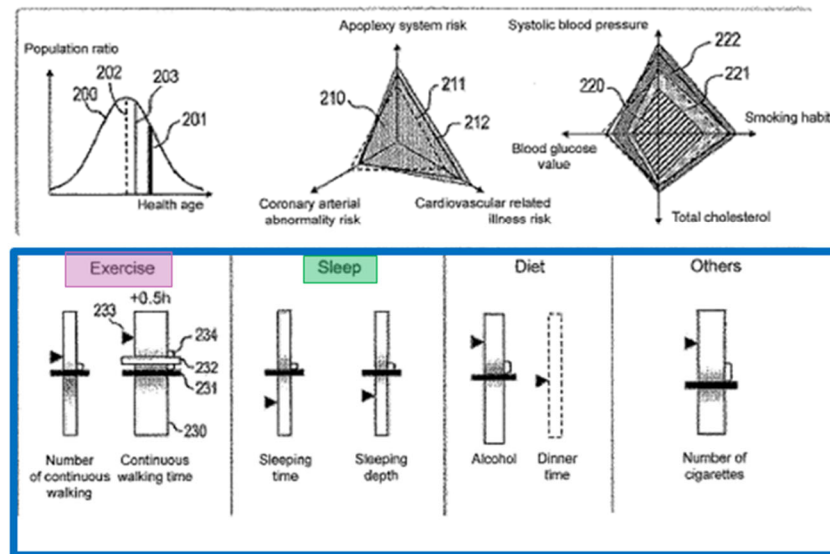
is to provide the claimed user interface for a user. Computing device 708 may take a variety of forms, such as a desktop or laptop computer, a smartphone, a tablet, a processor, a module, or the like. Ex-1006 ¶¶46, 49.

178. This limitation is also taught by Shiga. As described above, Shiga uses the user's past and present lifestyle indices (i.e., body response summaries) to determine an "improvable factor," similar to the claimed "readiness score," which is an action or habit that the user can take to improve the user's health. Ex-1007 ¶119. One of Shiga's goals is to give the user "specific guideline[s] such as what actions" the user can "take to maintain his/her condition ... or to improve his/her condition." Ex-1007 ¶5. Shiga proposes a "technology for presenting to the user a specific improvement action that is effective in improving the health condition of the user," "visualizing how the improvement in body activity and lifestyle habit in daily life influences the [user's] comprehensive health condition," and "assisting the setting of an appropriate improvement target that can be realized at a reasonable level for the user." Ex-1007 ¶13. To that end, Shiga teaches a user interface of the mobile communication device for showing elements contributing to Shiga's "improvable factor" and instructions relating to physical and mental activities for improving it.

179. Shiga's Figure 7 shows an exemplary user interface display. Ex-1007 ¶97, Fig. 7. Shiga teaches that the "lower level of the screen" gives an example of the "improvable factor" by showing the user their present exercise and sleep progress

compared to past exercise and sleep progress and the average user's values for the same. Ex-1007 ¶¶118-120. For example, the exercise category of the lifestyle index shows “number of continuous walking” and “continuous walking time”; the sleep category shows “sleeping time” and “sleeping depth”; the diet category shows “alcohol ingestion frequency”; and the “other” category shows the number of cigarettes smoked by the user. Ex-1007 ¶118.

Fig. 7



180. In the example of Figure 7, the individual improvable factor bar is displayed. The components of bar 230 will be described using the “continuous walking time” example. Shiga teaches that “[t]he vertical axis of the bar 230 represents the value of the lifestyle index, where the value becomes more satisfactory towards the upper side”; “[t]he color (shading) of the bar 230 shows the variation in the value of the lifestyle index for a certain period (e.g., few weeks) in

the past”; “[t]he width of the bar 230 represents the intensity of the influence the respective improvable factor has on the biomarker (problematic index)”; “black line 231 arranged overlapping the bar 230 shows the immediate measurement value (may be the latest measurement value or average of a plurality of immediate measurement values)”; “white line 232 on the black line 231 shows the improvement target set by the user”; “numerical value ‘+0.5h’ displayed at the upper part of the bar 230 shows the value of the improvement target”; “black triangle 233 arranged on the left side of the bar 230 represents the average value in a group of the same age and the same gender as the user”; and “[a] second bar 234 arranged on the right side of the bar 230 shows the range that can be set for the improvement target (movable range of the line 232).” Ex-1007 ¶¶119-120. A POSITA would have understood that the information provided with bar 230 in Figure 7 relating to exercise, sleep, diet, and other categories implicitly instructs the user on how to improve the user’s improvable factor. A POSITA would have thus understood that Shiga teaches a user interface on the mobile communication device that shows elements contributing to the readiness score (i.e., improvable factor) and instructions relating to physical activity (e.g., exercise) and mental activity (e.g., sleep and smoking habit) to improve it. Ex-1007 ¶¶56 (“The comprehensive health condition determining device 1 and each measurement device 2 to 6 are data communicable by wire or wirelessly.”), 59 (“As shown in FIG. 4, the comprehensive health condition

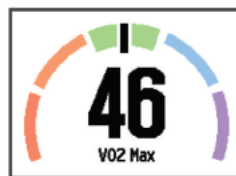
determining device 1 includes a CPU (Central Processing Unit) 101, a button 102 and a user I/F (interface) control unit 103, a communication connector 104 and a device communication control unit 105, an RTC (Real Time Clock) 106 and a RTC control unit 107, a panel 108 and a display control unit 109, a sound source device 110 and a sound control unit 111, a ROM (Read Only Memory) 112/RAM (Random Access Memory) 113 and a storage medium control unit 114, a power supply 115 and a power supply control unit 116.”), 61 (“The communication connector 104 and the device communication control unit 105 are communication means for realizing data communication between various types of measurement devices. The communication method may be a wired communication including USB and IEEE1394, or a wireless communication including Bluetooth, ZigBee, IrDA, and wireless LAN.”). Moreover, Wisbey expresses a motivation to educate the user about these very factors.

181. A POSITA would have been motivated to combine Wisbey’s teachings with Shiga’s teachings and had a reasonable expectation of success in doing so, for the same reasons discussed in Section VIII.B.1. Wisbey discloses collecting the data required for Shiga’s user interface and providing a computing and display apparatus usable to implement Shiga’s user interface.

182. Additionally, as I explained in my Technology Background Section (*see* Section V), using a user interface of the mobile communication device to show

instructions related to physical activity and mental activity was well known by 2015.

For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to each of these factors. *Id.* at 3, 11.

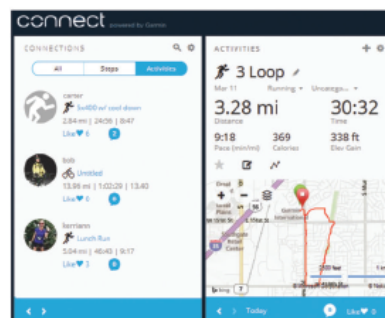


Purple	Superior
Blue	Excellent
Green	Good
Orange	Fair
Red	Poor

Store your activities: After you complete and save an activity with your device, you can upload that activity to Garmin Connect and keep it as long as you want.

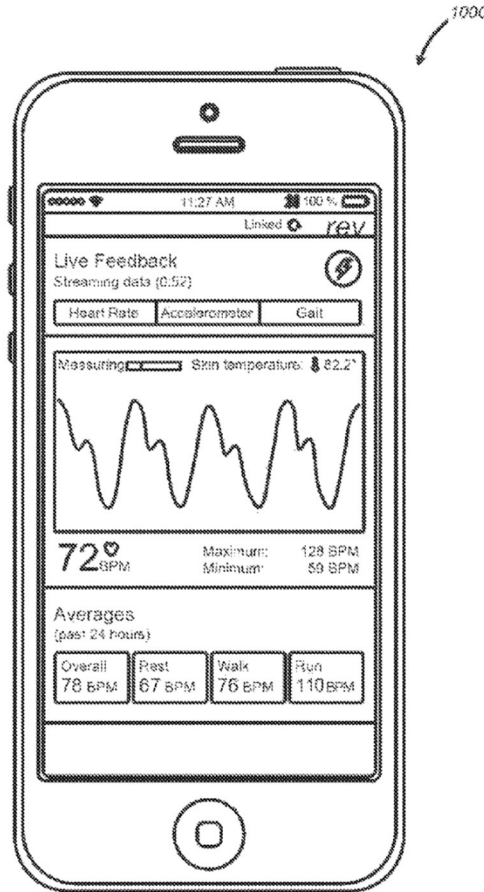
Analyze your data: You can view more detailed information about your activity, including time, distance, elevation, heart rate, calories burned, cadence, VO2 max., running dynamics, an overhead map view, pace and speed charts, and customizable reports.

NOTE: Some data requires an optional accessory such as a heart rate monitor.



The Garmin product also included software to store historical data about the health measurements and to perform analysis and provide graphical visualizations. *Id.* at

5-6. The Garmin product included a “Recovery Advisor,” which provided feedback by “display[ing] how much time remains before [the user] is fully recovered and ready for the next hard workout.” *Id.* at 12. This included “Recovery check,” which “provides a real-time indication of [the user’s] state of recovery within the first several minutes of an activity” and “Recovery time,” which counts down [time] until it is optimal for [the user] to attempt another hard workout.” *Id.* Tran also teaches the use of biosensor information to determine qualitative and quantitative aspects of both a user’s physical activities and mental activities and to create appropriate notifications and warnings. Ex-1028 (Tran), 11:41-67, 38:43-59. Von Badinski also teaches the processing of biosensor information and its comparison to reference data to determine how and when to alert a user and a user interface on a mobile device for reporting current and historical health and fitness information to a user. Ex-1029 (Von Badinski) at 4:16-29, 5:26-33, 15:9-23, Figs. 10-11.



See also Ex-1031 (Teller '731), Figs. 7-9, 21:43-47 (“[A]ctivity level web page 200 may include at least one hyperlink 220 to allow a user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to activity level and affiliate advertising elsewhere on the network.”), 21:45-22:26 (discussing mental activities measured), 22:28-34 (“The preferred mind centering web page may also include an indication of the total time spent on mind centering activities, shown at 275, hyperlinks 280 which allow the user to directly access relevant news items and articles, suggestions for refining or improving daily

routine with respect to mind centering and affiliate advertising, and a calendar 285 for choosing among views having variable and selectable time periods.”), 23:19-25 (“The sleep web page 290 may also include hyperlinks 320 which allow the user to directly access sleep related news items and articles, suggestions for refining or improving daily routine with respect to sleep and affiliate advertising available elsewhere on the network, and a sleep calendar 325 for choosing a relevant time interval.”), Table 3 (one of the things continually measured is “readiness”); Ex-1032 (Teller ’117), Figs. 7-9, 21:43-47, 22:28-34, 23:19-25, Table 3.

3. Dependent Claims 2-6

- a. Claim 2: A method according to claim 1, wherein obtaining the user’s movements is performed by measuring the user’s movements or by retrieving the user’s movement data from a separate device.**

183. Wisbey-Shiga teaches Claim 2.

184. Wisbey obtains the user’s movements by measuring the user’s movements using a wearable device, such as a wrist biosensor or a finger biosensor. Ex-1006 ¶¶38, 45. Specifically, Wisbey teaches monitoring the user’s movement using sensors attached to the user’s body such as “a gyroscope or accelerometer to detect movement, and a heart-rate sensor, each of which may be embedded in a wristband that a user can wear on the user’s wrist or ankle, such as wristband 100.” Ex-1006 ¶129. For example, Wisbey monitors “movement of the user’s leg ... (e.g., by an accelerometer or gyroscope).” Ex-1006 ¶72.

b. Claim 3: A method according to claim 1, further comprising measuring at least one biosignal during the activity period.

185. Wisbey-Shiga teaches Claim 3.

186. Wisbey teaches measuring at least one biosignal during the activity period. For example, Wisbey teaches that its logic circuits “receive and process a plurality of electric signals” from the wrist and finger biosensors including, for example, “electro-cardio signals from a heart” detected by a heart rate sensor or oximeter, which “may be used to calculate and store a heart rate variability (HRV) value.” Ex-1006 ¶¶38, 45. Wisbey further teaches that “the user’s heart rate, and other indicators (e.g., breathing rate) may be monitored to determine how hard the user is working during the activity.” Ex-1006 ¶89.

c. Claim 4: A method according to claim 1, wherein the at least one biosignal is selected from the group consisting of an electrocardiogram, a photoplethysmogram, an electromyogram, an electrooculogram, a heart rate, a heart rate variability, a body temperature, a resting heart rate, an average heart rate and signals related to breathing.

187. Wisbey-Shiga teaches Claim 4.

188. Wisbey teaches measuring at least the user’s heart rate when the user is sleeping. For example, Wisbey teaches logic circuits that “receive and process a plurality of electric signals” from the wrist and finger biosensors including, for example, “electro-cardio signals from a heart” detected by a heart rate sensor or

oximeter, which “may be used to calculate and store a heart rate variability (HRV) value.” Ex-1006 ¶¶38, 45. Wisbey further teaches that “if the user slept poorly, but for some reason this *lack of sleep* is not captured in the fatigue level measurement (e.g., *if the HRV is consistent rather than sporadic*), the interpreted recovery score may be adjusted to account for the user’s lack of sleep.” Ex-1006 ¶111.

189. Additionally, as I explained in my Technology Background Section (see Section V), measuring a biosignal such as an electrocardiogram, a photoplethysmogram, an electromyogram, a heart rate, a heart rate variability, a body temperature, a resting heart rate, an average heart rate and signals related to breathing was well known by 2015. For example, Make Magazine published a compendium on Wearable Electronics in 2014 explains the capabilities of various sensors in measuring physical phenomena and techniques for processing sensor data in Chapter 7, “Sensors.” Ex-1030, 113, 117, 119-120, 122. Specific instructions are also provided for the use of biosensors including heart rate sensors. *Id.* at 131. These clearly place the capability for biosensor measurements within the capabilities of an ordinary artisan. It is also explained that there are numerous other biosensor measurements that are within the capabilities of an ordinary artisan. *Id.* at 132-133. Color and temperature measurements are also discussed. *Id.* at 136-141.

“Beyond heart rate, there are many other biological signals you might want to measure. Here are a few:

Galvanic skin response (GSR)

A method of measuring the conductivity of the skin. Changes in this conductivity can indicate a response to physical or psychological stimulus. GSR sensors are used in classic lie detectors. A GSR sensor can be built with some basic inexpensive electronic components.

Electromyography (EMG)

A method of measuring of muscle activity by detecting its electrical potential. The Muscle V3 Sensor Kit (SF SEN-11776) provides varying analog voltage so you can easily read muscle activity with an Arduino analog input pin.

Electroencephalography (EEG)

A method of measuring electrical activity in the scalp. EEG headsets are often used in thought-controlled computing applications.” *Id.* at 132-133.

- d. Claim 5: A method according to claim 1, wherein determining the rest summary comprises at least one of determining a sleep factor, determining a sleep balance, determining lowest body temperature during rest and determining a resting heart rate.**

190. Wisbey-Shiga teaches Claim 5.

191. Wisbey teaches that determining the rest summary includes at least determining a sleep balance. The '429 Patent defines “sleep balance” at least as “sleep debt.” Ex-1001, 12:1 (“Sleep balance (sleep debt)”), 11:24-26 (“sleep debt (i.e., if the user did not sleep enough, the difference between the user’s optimal amount of sleep and the amount of sleep the previous night or nights)”). Wisbey’s logic circuits detect “the amount of sleep a user experienced over the last 48 hours.” Ex-1006 ¶39. Wisbey teaches that the user’s dynamic recovery profile “may reflect information indicating that the user typically has a very high fatigue level *when the*

user gets less than six hours of sleep.” Ex-1006 ¶105. Wisbey further teaches calculating analytics such as the mean ratio of sleep to the metabolic activity score. Ex-1006 ¶108. Wisbey uses these analytics to make recommendations to the user, including regarding the user’s sleep debt. For example, if “the user has a mean fatigue level of 7 following a day when sleep to MAS ratio is 6 to 2,000,” the user’s “dynamic recovery profile may indicate that *the user should get more sleep.*” Ex-1006 ¶109. The user’s “lack of sleep information” is “available via archived activity type detection and movement monitoring.” Ex-1006 ¶111.

- e. **Claim 6: A method according to claim 1, further comprising providing the user with appropriate instructions, related to at least one of physical activity, mental activity and rest, for improving the user's readiness score.**

192. Wisbey-Shiga teaches Claim 6.

193. As explained for Element 1[h], the Wisbey-Shiga combination teaches displaying on a user interface, elements contributing to the readiness score and instructions related to physical and mental activities and rest for improving the readiness score. Wisbey further teaches providing the user with appropriate instructions related to at least the user’s physical activity and rest to improve the user’s readiness score. For example, Wisbey teaches that “the dynamic recovery profile may indicate that *the user should get more sleep, or should strive for a lower MAS*, to avoid becoming overly fatigued.” Ex-1006 ¶109; *see also id.* ¶¶9 (“in one

embodiment, ... a recovery recommendation module ... provides an activity recommendation based on the interpreted recovery score”), 102, 121.

C. Ground 4: Claims 1-6 are obvious over Wisbey in view of Ahmed.

1. A POSITA would have been motivated to combine Wisbey’s teachings with Ahmed’s teachings and would have had a reasonable expectation of success.

194. A POSITA would have been motivated to combine the teachings of Wisbey and Ahmed and would have had a reasonable expectation of success in doing so because each relates to the same well-known technologies. Both are directed to physiological monitoring devices that collect biometric data from the user relating to the user’s sleep activity and physical activity and use that data to evaluate the user’s health state and provide recommendations for improving it. *See, e.g.*, Ex-1006, Abstract, ¶¶39 (“Logic circuits 240 may detect, for example, the amount of physical activity and the amount of sleep a user experienced over the last 48 hours, combine those metrics with the user’s HRV, and calculate a fatigue level of between 1 and 10, wherein the fatigue level could indicate the user’s physical condition and aptitude for further physical activity that day.”), 57; Ex-1005, Abstract (“Disclosed herein is a device for continuous physiological monitoring as well as systems and methods for interpreting data from such a device. ... In addition, the acquisition of continuous physiological data facilitates automated recommendations concerning changes to sleep, recovery time, exercise routines and the like.”), ¶4 (same), Figs.

14-18.

195. As explained in Section VIII.B.1., Wisbey teaches showing elements contributing to the interpreted recovery score and providing instructions related to at least one physical activity and at least one mental activity for improving the recovery score. Ex-1006 ¶¶107 (“The dynamic recovery profile, in one embodiment, is implemented in conjunction with an archive table that represents data and relationships of parameters relative to that data.”), 109, Fig. 10D.

Date	MAS	Avg. UAI	Sleep Time (hours)	Fatigue Level
1 Nov. 2013	2,500	7	6	HIGH
2 Nov. 2013	2,000	5	8	NORMAL
3 Nov. 2013	1,500	3	9	LOW

196. Ahmed teaches a *user interface of the mobile communication device* for showing elements contributing to Ahmed’s recovery score and instructions for improving it. For example, Ahmed’s Figures 14A-14C, shown below, depict the “recovery score graphic component” of the user interface, which includes “qualitative information corresponding to the recovery scores” such as “sleep quality” and “recent strain (physical and psychological)” elements and an instruction that the “tactical athlete has not recovered from recent strain and may need rest.”

Ex-1005 ¶¶167 (displaying, for example, “whether the user has recovered sufficiently, what level of activity the user is prepared to perform, whether the user is prepared to perform an exercise routine [of] a particular desired intensity, whether the user should rest and the duration of recommended rest, whether the exercise regimen of the user should be automatically adjusted (e.g., made easier if the recovery score is low), and the like”), 170 (“the analytics system may recommend a second different exercise routine that is typically associated with higher intensity scores than the first exercise routine (e.g., running)”), 172-173, Figs. 14A-14C (“tactical athlete has not recovered from recent strain and may need rest”; “tactical athlete has average sleep and HRV readings indicating he has moderately recovered from recent strain” and “is prepared for activity”; “tactical athlete is near fully recovered and showing signs of good fitness” and “is well prepared for intense activity”); *see also id.*, Figs. 15A, 17B (“this appears to be a stressful movement in your day”), 18B (“Consider rest,” “Get a good night’s sleep tonight!”), ¶¶181, 189.

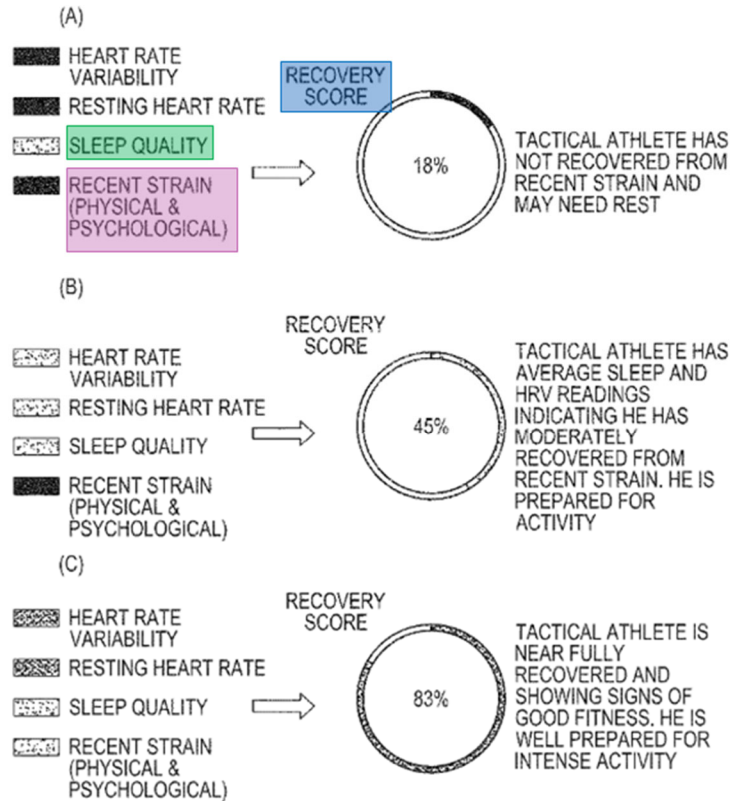
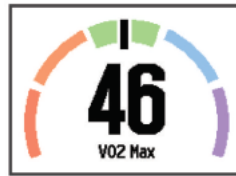


FIG. 14

197. A POSITA would have been motivated to implement Ahmed's user interface teachings for displaying elements contributing to the readiness score and instructions for improving it, with Wisbey's system, for the same reasons described in Ground 3 (Section VIII.B.1.), namely because this was a well-known and user-friendly way to present information to the user. Wisbey does not explicitly teach that the elements contributing to the recovery score and the instructions for improving it are shown *on a user interface of the mobile communication device* but it would have been obvious to a POSITA to do so based on Wisbey's teachings that the user interacts with a user interface to input information relating to the user's

lifestyle and physical activity types. *See, e.g.*, Ex-1006 ¶¶59 (“The user may provide the user information by, for example, a user interface of computing device 708, or of electronic capsule 200.”), 60, 84 (“[A] user interface is provided such that the user can confirm whether the displayed user activity type is correct, or select the user activity type from a group of activity types.”), 85, 124 (“the past interpreted recovery score is ***displayed on a graph*** (e.g., a line or bar graph) as a function of time (e.g., comparing against other past interpreted recovery scores from past measuring periods)”). A POSITA would thus have been motivated to display the graph and all related recovery score information on a user interface of the user’s mobile communication device, as taught by Ahmed. In the Wisbey-Ahmed combination, the dynamic recovery profile, which shows the elements contributing to the recovery score and the instructions on physical and mental activities that can improve the score, would have been displayed on the user interface.

198. Additionally, as I explained in my Technology Background Section (*see* Section V), using a user interface of the mobile communication device to show instructions related to physical activity and mental activity was well known by 2015. For example, the Garmin Forerunner 920XT, which I tested at the time included activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to each of these factors. *Id.* at 3, 11.

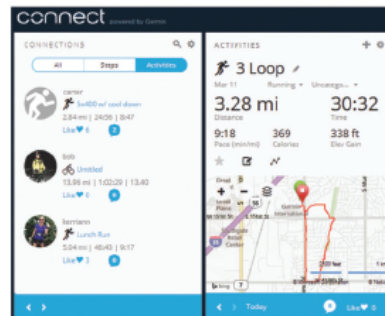


Purple	Superior
Blue	Excellent
Green	Good
Orange	Fair
Red	Poor

Store your activities: After you complete and save an activity with your device, you can upload that activity to Garmin Connect and keep it as long as you want.

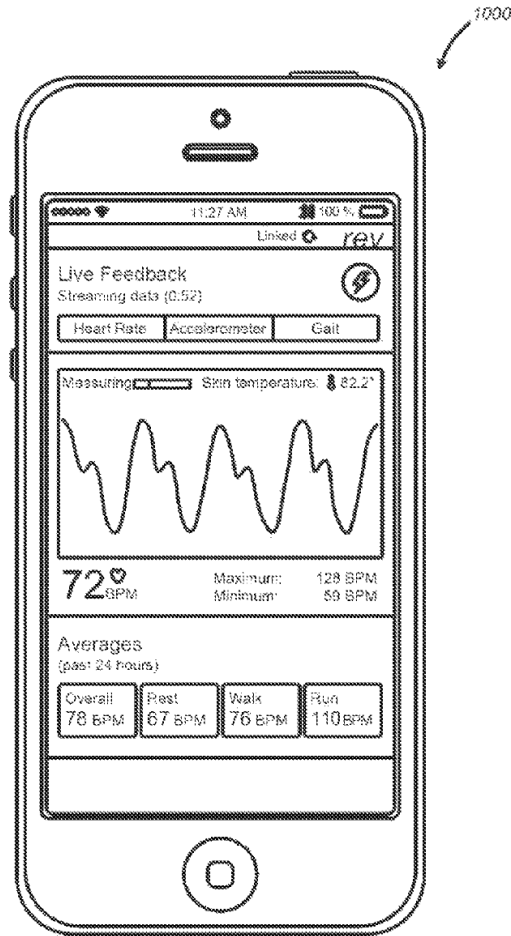
Analyze your data: You can view more detailed information about your activity, including time, distance, elevation, heart rate, calories burned, cadence, VO2 max., running dynamics, an overhead map view, pace and speed charts, and customizable reports.

NOTE: Some data requires an optional accessory such as a heart rate monitor.



The Garmin product also included software to store historical data about the health measurements and to perform analysis and provide graphical visualizations. *Id.* at 5-6. The Garmin product included a “Recovery Advisor,” which provided feedback by “display[ing] how much time remains before [the user] is fully recovered and ready for the next hard workout.” *Id.* at 12. This included “Recovery check,” which “provides a real-time indication of [the user’s] state of recovery within the first several minutes of an activity” and “Recovery time,” which counts down [time] until

it is optimal for [the user] to attempt another hard workout.” *Id.* Tran also teaches the use of biosensor information to determine qualitative and quantitative aspects of both a user’s physical activities and mental activities and to create appropriate notifications and warnings. Ex-1028 (Tran), 11:41-67, 38:43-59. Von Badinski also teaches the processing of biosensor information and its comparison to reference data to determine how and when to alert a user and a user interface on a mobile device for reporting current and historical health and fitness information to a user. Ex-1029 (Von Badinski) at 4:16-29, 5:26-33, 15:9-23, Figs. 10-11.



See also Ex-1031 (Teller '731), Figs. 7-9, 21:43-47 (“[A]ctivity level web page 200 may include at least one hyperlink 220 to allow a user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to activity level and affiliate advertising elsewhere on the network.”), 21:45-22:26 (discussing mental activities measured), 22:28-34 (“The preferred mind centering web page may also include an indication of the total time spent on mind centering activities, shown at 275, hyperlinks 280 which allow the user to directly

access relevant news items and articles, suggestions for refining or improving daily routine with respect to mind centering and affiliate advertising, and a calendar 285 for choosing among views having variable and selectable time periods.”), 23:19-25 (“The sleep web page 290 may also include hyperlinks 320 which allow the user to directly access sleep related news items and articles, suggestions for refining or improving daily routine with respect to sleep and affiliate advertising available elsewhere on the network, and a sleep calendar 325 for choosing a relevant time interval.”), Table 3 (one of the things continually measured is “readiness”); Ex-1032 (Teller ’117), Figs. 7-9, 21:43-47, 22:28-34, 23:19-25, Table 3.

199. A POSITA would have had a reasonable expectation of success in combining Wisbey and Ahmed. Wisbey and Ahmed are analogous prior art as they both involve physiological monitoring devices that measure the same biological markers (such as the user’s heart rate), during the same activities (for example, sleep and exercise activities), and with the same goal—to provide recommendations to the user for improving the user’s health condition and/or fitness state. *See, e.g.*, Ex-1006, Abstract, ¶¶39, 57 (“The operations of method 1000 take into account not only the user’s current fatigue level, but also the relationship between current and past fatigue levels to create an interpreted recovery score that accurately reflects the user’s physical condition and performance capabilities.”); Ex-1005, Abstract, ¶¶4, 70 (“using the physiological readouts of the device and the analytics described

herein, an ‘Intensity Score’ (e.g., 0-21) (e.g., that measures a user’s recent exertion), a ‘Recovery Score’ (e.g., 0-100%), and ‘Sleep Score’ (e.g., 0-100) may together measure readiness for physical and psychological exertion”), Figs. 14-18. Moreover, a POSITA would have understood that Wisbey and Ahmed’s devices are similar such that they are programmable using standard processors and are interchangeable regardless of how they display information to the user. A POSITA would have understood, therefore, that these references disclose interrelated teachings based on routine technologies that would have been amenable to various well-understood and predictable combinations to provide more features and enhance user interest.

2. Independent Claim 1

a. Element 1[pre]: A method for assessing readiness of a user, the method comprising:

200. Wisbey in view of Ahmed (“Wisbey-Ahmed”) teaches the preamble, to the extent it is limiting, for the same reasons described in Section VIII.B.2.a.

b. Element 1[a]: obtaining the user's movements;

201. Wisbey-Ahmed teaches Element 1[a], for the same reasons described in Section VIII.B.2.b.

c. Element 1[b]: using the obtained user's movements to determine a nature of the period, wherein the nature of the period is selected from an activity period and a rest period;

202. Wisbey-Ahmed teaches Element 1[b], for the same reasons described

in Section VIII.B.2.c.

- d. Element 1[c]: measuring at least one biosignal of the user during the rest period;**

203. Wisbey-Ahmed teaches Element 1[c], for the same reasons described in Section VIII.B.2.d.

- e. Element 1[d]: determining a rest summary for the rest period, based on the measured at least one biosignal and at least one biosignal of a previous rest period;**

204. Wisbey-Ahmed teaches Element 1[d], for the same reasons described in Section VIII.B.2.e.

- f. Element 1[e]: determining an activity summary for the activity period, based on the obtained movements of an activity period and obtained movements of at least one previous activity period;**

205. Wisbey-Ahmed teaches Element 1[e], for the same reasons described in Section VIII.B.2.f.

- g. Element 1[f]: determining a body response summary based on the rest summary and the activity summary;**

206. Wisbey-Ahmed teaches Element 1[f], for the same reasons described in Section VIII.B.2.g.

- h. Element 1[g]: calculating a readiness score based on the body response summary and a previous body response summary, whereby the readiness score indicates a level of readiness of the user; and**

207. Wisbey-Ahmed teaches Element 1[g], for the same reasons described in Section VIII.B.2.h.

- i. **Element 1[h]: using a user interface of the mobile communication device to show elements contributing to the readiness score and instructions related to physical activity and mental activity for improving the readiness score.**

208. Wisbey-Ahmed teaches Element 1[h].

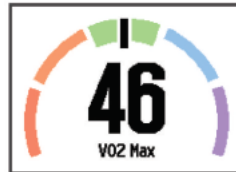
209. As discussed in Section VIII.B.2.i, while not explicitly disclosed by Wisbey, it would have been obvious to a POSITA that Wisbey's dynamic recovery profile, which shows elements contributing to the recovery score and instructions on physical and mental activities that can improve the score, would have been shown on Wisbey's user interface that is already used to display other information to the user, because this would have been the most user-friendly and efficient way to communicate the recovery score information to the user.

210. Ahmed also teaches this limitation for the same reasons described in Section VIII.A.2.i.

211. A POSITA would have been motivated to combine Wisbey's teachings with Ahmed's teachings and had a reasonable expectation of success in doing so, for the same reasons discussed in Section VIII.C.1.

212. Additionally, as I explained in my Technology Background Section (*see* Section V), using a user interface of the mobile communication device to show instructions related to physical activity and mental activity was well known by 2015. For example, the Garmin Forerunner 920XT, which I tested at the time included

activity tracking, sleep monitoring, and with a wearable sensor, heart-rate monitoring. Ex-1026 (Garmin). A display could provide feedback with respect to each of these factors. *Id.* at 3, 11.

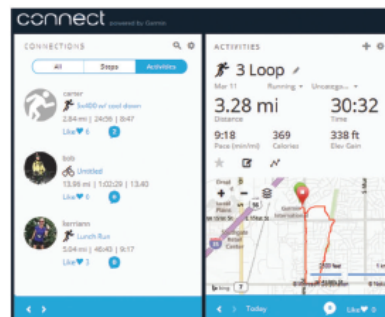


Purple	Superior
Blue	Excellent
Green	Good
Orange	Fair
Red	Poor

Store your activities: After you complete and save an activity with your device, you can upload that activity to Garmin Connect and keep it as long as you want.

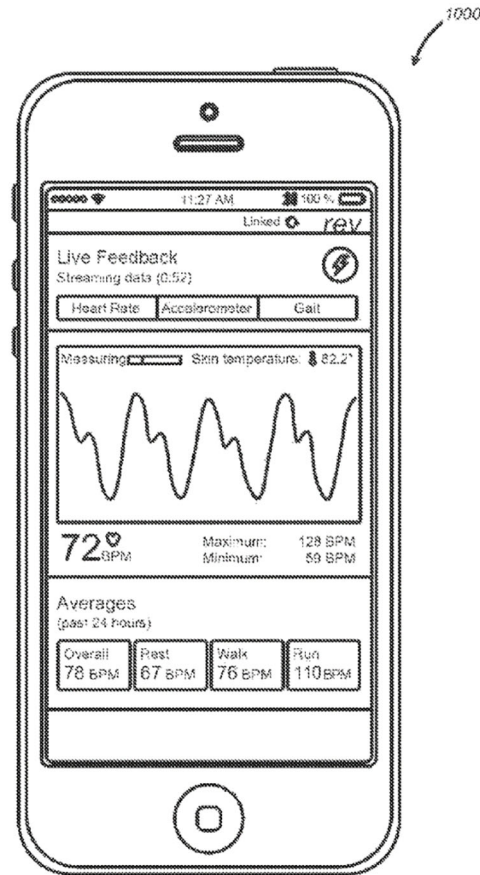
Analyze your data: You can view more detailed information about your activity, including time, distance, elevation, heart rate, calories burned, cadence, VO2 max., running dynamics, an overhead map view, pace and speed charts, and customizable reports.

NOTE: Some data requires an optional accessory such as a heart rate monitor.



The Garmin product also included software to store historical data about the health measurements and to perform analysis and provide graphical visualizations. *Id.* at 5-6. The Garmin product included a “Recovery Advisor,” which provided feedback by “display[ing] how much time remains before [the user] is fully recovered and

ready for the next hard workout.” *Id.* at 12. This included “Recovery check,” which “provides a real-time indication of [the user’s] state of recovery within the first several minutes of an activity” and “Recovery time,” which counts down [time] until it is optimal for [the user] to attempt another hard workout.” *Id.* Tran also teaches the use of biosensor information to determine qualitative and quantitative aspects of both a user’s physical activities and mental activities and to create appropriate notifications and warnings. Ex-1028 (Tran), 11:41-67, 38:43-59. Von Badinski also teaches the processing of biosensor information and its comparison to reference data to determine how and when to alert a user and a user interface on a mobile device for reporting current and historical health and fitness information to a user. Ex-1029 (Von Badinski) at 4:16-29, 5:26-33, 15:9-23, Figs. 10-11.



See also Ex-1031 (Teller '731), Figs. 7-9, 21:43-47 (“[A]ctivity level web page 200 may include at least one hyperlink 220 to allow a user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to activity level and affiliate advertising elsewhere on the network.”), 21:45-22:26 (discussing mental activities measured), 22:28-34 (“The preferred mind centering web page may also include an indication of the total time spent on mind centering activities, shown at 275, hyperlinks 280 which allow the user to directly access relevant news items and articles, suggestions for refining or improving daily

routine with respect to mind centering and affiliate advertising, and a calendar 285 for choosing among views having variable and selectable time periods.”), 23:19-25 (“The sleep web page 290 may also include hyperlinks 320 which allow the user to directly access sleep related news items and articles, suggestions for refining or improving daily routine with respect to sleep and affiliate advertising available elsewhere on the network, and a sleep calendar 325 for choosing a relevant time interval.”), Table 3 (one of the things continually measured is “readiness”); Ex-1032 (Teller ’117), Figs. 7-9, 21:43-47, 22:28-34, 23:19-25, Table 3.

3. Dependent Claims 2-6

- a. Claim 2: A method according to claim 1, wherein obtaining the user's movements is performed by measuring the user's movements or by retrieving the user's movement data from a separate device.**

213. Wisbey-Ahmed teaches Claim 2, for the same reasons described in Section VIII.B.3.a.

- b. Claim 3: A method according to claim 1, further comprising measuring at least one biosignal during the activity period.**

214. Wisbey-Ahmed teaches Claim 3, for the same reasons described in Section VIII.B.3.b.

- c. **Claim 4: A method according to claim 1, wherein the at least one biosignal is selected from the group consisting of an electrocardiogram, a photoplethysmogram, an electromyogram, an electrooculogram, a heart rate, a heart rate variability, a body temperature, a resting heart rate, an average heart rate and signals related to breathing.**

215. Wisbey-Ahmed teaches Claim 4, for the same reasons described in Section VIII.B.3.c.

- d. **Claim 5: A method according to claim 1, wherein determining the rest summary comprises at least one of determining a sleep factor, determining a sleep balance, determining lowest body temperature during rest and determining a resting heart rate.**

216. Wisbey-Ahmed teaches Claim 5, for the same reasons described in Section VIII.B.3.d.

217. This claim is also taught by Ahmed, for the same reasons described in Section VIII.A.3.d.

218. A POSITA would have been motivated to combine Wisbey's teachings with Ahmed's teachings and had a reasonable expectation of success in doing so, for the same reasons discussed in Section VIII.C.1.

- e. **Claim 6: A method according to claim 1, further comprising providing the user with appropriate instructions, related to at least one of physical activity, mental activity and rest, for improving the user's readiness score.**

219. Wisbey-Ahmed teaches Claim 6.

220. As explained for Element 1[h], the Wisbey-Ahmed combination

teaches displaying on a user interface elements contributing to the readiness score and instructions related to physical and mental activities for improving the readiness score. Wisbey further teaches providing the user with appropriate instructions related to at least the user's physical activity and rest to improve the user's readiness score, for the same reasons described in Section VIII.B.3.e.

IX. CONCLUSION

221. For the reasons set forth above, I believe that Claims 1-6 of the '429 Patent are unpatentable in view of the prior art.

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

223. I reserve the right to supplement my opinions in the future to respond to any arguments that the Patent Owner raises and to take into account new information as it becomes available to me.

224. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

U.S. Patent No. 10,842,429
Declaration of Andrew Wolfe Ph.D.

Dated: June 28, 2024

Respectfully Submitted,



Andrew Wolfe Ph.D.