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(71) Applicant: **3M INNOVATIVE PROPERTIES COMPANY** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(72) Inventors: **YLITALO, Caroline M.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **URBAN, Henning T.**; Bollstanäsvägen 3, SE-19189 Sollentuna (SE). **LONG, Andrew W.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **BILLINGSLEY, Britton G.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **BENNAARS-EIDEN, Assumpta A.G.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **WURM, Michael G.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(74) Agent: **SCHOLZ, Katherine M.** et al.; 3M Center, Office of Intellectual Property Counsel, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

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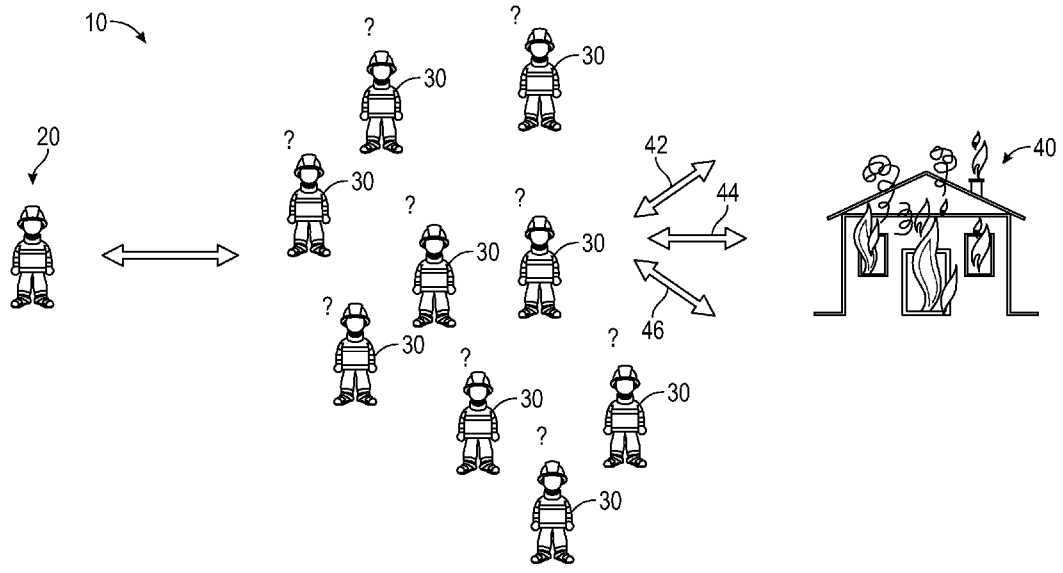


FIG. 1

(57) Abstract: A worker fitness feedback device is presented that includes a fitness sensor configured to receive fitness data from a worker. The fitness data includes a fitness feedback for the worker. The device also includes a fitness recorder configured to record the fitness feedback for the worker and provide the fitness feedback to a database. The fitness feedback is associated with the worker in the database. The device also includes a communication component configured to receive a request for fitness data for the worker, and, based on the received request, provide a prompt for the worker to provide fitness data. The prompt is a visual, audio, haptic or other notification to the worker. The device also includes a controller configured to cause the fitness sensor to receive fitness data, and the fitness recorder to record the fitness feedback.

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SYSTEMS AND METHODS FOR PROVIDING WORKER FITNESS DATA

Background

Maintaining the safety and health of workers is a major concern across many industries. Various rules and regulations have been developed to aid in addressing this concern. Such rules provide sets of requirements to ensure proper administration of personnel health and safety procedures. To help in maintaining worker safety and health, some individuals may be required to don, wear, carry, or otherwise use a personal protective equipment (PPE) article, if the individuals enter or remain in work environments that have hazardous or potentially hazardous conditions.

Consistent with evolving rules and regulations related to safety, safety is an important concern in any workplace requiring the use of PPE. Companies or businesses employing workers wearing articles of PPE also want to ensure that workers are complying with relevant laws, regulations and company policies related to proper use and maintenance of PPE.

Manually monitoring the use of PPE in a given workplace can be cumbersome and time consuming for supervisors or other individuals with safety inspection or compliance roles within an organization. Improved methods and systems for monitoring safety compliance, PPE maintenance, communicating with workers about various topics and providing safety-related contextual information in a work environment requiring the use of PPE would be welcomed.

Summary

A worker fitness feedback device is presented that includes a fitness sensor configured to receive fitness data from a worker. The fitness data includes a fitness feedback for the worker. The device also includes a fitness recorder configured to record the fitness feedback for the worker and provide the fitness feedback to a database. The fitness feedback is associated with the worker in the database. The device also includes a communication component configured to receive a request for fitness data for the worker, and, based on the received request, provide a prompt for the worker to provide fitness data. The prompt is a visual, audio, haptic or other notification to the worker. The device also includes a controller

configured to cause the fitness sensor to receive fitness data, and the fitness recorder to record the fitness feedback.

The details of one or more examples of the disclosure are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of the disclosure will be apparent from the description and drawings, and from the claims.

Brief Description of Drawings

The following figures provide illustrations of the present invention. They are intended to further describe and clarify the invention, but not to limit scope of the invention.

FIG. 1 illustrates an environment in which embodiments of the present invention may be useful.

FIGS. 2A and 2B illustrate feedback devices in accordance with embodiments herein.

FIG. 3 is a system diagram of an exemplary PPE system providing a remote user interface for PPE users.

FIG. 4 illustrates an example method of providing health indications for a worker in accordance with embodiments herein.

FIG. 5 illustrates an example supervisor interface for monitoring worker health in accordance with embodiments herein.

FIG. 6 illustrates an example method for providing worker assignments in accordance with embodiments herein.

FIG. 7 illustrates an example method for providing worker recommendations in accordance with embodiments herein.

FIGS. 8-10 illustrate example devices that can be used in the embodiments shown in previous Figures.

The figures are not necessarily to scale. Like numbers used in the figures refer to like components. However, it will be understood that the use of a number to refer to a component in a given figure is not intended to limit the component in another figure labeled with the same number.

Detailed Description

FIG. 1 illustrates an environment in which embodiments of the present invention may be useful. An environment 10 includes a variety of workers 30, each of which may be

assigned to one of several tasks, 42, 44, 46 relative to a project 40. As illustrated in FIG. 1, environment 10 is an active housefire to which a series of firefighters 30 and their supervisor 20 have responded. An active housefire 40 may present several tasks that require firefighters 30 to break into groups, or proceed individually to complete. For example, an upper level may have potential rescue victims needing to be retrieved using a ladder, while a main floor may require firefighters 30 to enter and check for trapped individuals or pets. Additionally, the fire needs to be brought under control using water or other fire suppressants. While all firefighters 30 may be competently trained to handle each of these tasks, it is up to supervisor 20 to determine who to send for each task 42, 44, 46, for this particular operation 40.

While all firefighters receive basic training in responding to an active fire situation, each individual may experience, and respond to, stress differently. However, a variety of extenuating factors may affect an individual's fitness for a given day. For example, whether an individual has recently been drinking alcohol or is still recovering from the aftereffects, or whether an individual had a good night of sleep. Additionally, personal life events may raise an individual's stress level or affect their ability to concentrate or otherwise carry out a given task. Further, an individual may be experiencing other symptoms, like dizziness, that may make them particularly unsuited to a given task, like climbing a ladder.

And since the group of firefighters 30 may often work together, a team mentality may develop such that each individual 30 may feel like they are 'letting down' their teammates if they express an inability to complete an assignment on a given day. In addition to putting their own safety at risk, this may result in danger to their teammates and to any potential victims, bystanders, or other individuals or property in environment 10.

An objective metric of fitness is needed that can provide an on-site supervisor, such as fire chief 20, with quick feedback about which firefighters 30 are better suited for each of tasks 42, 44, or 46. Chief 20 can then assign firefighters 30 to the tasks to which they are suited on a given day. Such a solution can keep morale of individual team members high by setting them up for success in a given assignment, and can keep all team members safe. It may also help avoid adverse outcomes.

However, in order for such a solution to be adopted, it has to be acceptable to the workers, such as firefighters 30, who will be providing the fitness data. In the age of smart phones and watches, there is a lot of concern about employers having significant quantities of private data. Many workers do not want to wear heart monitors or other devices that

provide constant feedback over a working shift. Many workers have concerns that such data could be stored or used inappropriately. Therefore, for a solution to be adopted broadly enough to be effective, it must be cognizant of these concerns.

Some embodiments described herein utilize data received to provide a momentary snapshot of a worker's fitness. Some embodiments herein also provide a dashboard that a supervisor can use to assign workers to tasks based on their reported fitness. Data from previous assignments, as well as responses to current fitness tests may be utilized to improve team efficacy.

The scenario of a team of firefighters 30 is provided as one example of where such solutions could be implemented. However, it is expressly contemplated that other settings may also benefit from snapshots of fitness data for workers. For example, knowing stress levels of law enforcement officials responding to stressful situations, such as active shooter or riot situations may assist in identifying individual officers best capable to de-escalate and safely resolve the situation. Additionally, industrial settings may benefit from identifying a worker best suited for a close-quarters or underground operation that may induce higher levels of stress. An ability to periodically check-in on workers in such stressful situations may also assist in changing out workers before an adverse situation occurs. Other suitable scenarios are also expressly contemplated.

FIGS. 2A and 2B illustrate feedback devices in accordance with embodiments herein. FIG. 2A illustrates a worker 30 interacting with a fitness device 50, which provides output to a device 150. As discussed above, worker 30 may be a firefighter, as illustrated, or another individual with a high stress job such as a law enforcement officer, construction worker, industrial worker, first responder, etc.

Fitness device 50 may, as illustrated in FIG. 2A, be a touch-activated device that records information detected through momentary interaction with a worker 30. For example, device 30 may be a device such as the mobile EKG monitoring device AliveCor™ provided by Kardia Mobile, which is designed to capture an electrocardiogram when a user applies pressure through skin contact with sensors 52. Fitness device 50 may be a mobile device that an individual 30 can carry with them during a shift or an operation. Fitness device 50 is not designed to have constant contact, or provide a constant stream of information concerning individual 30.

Fitness device 50 may not have a display or other feedback indicator in some embodiments. In other embodiments, such as that discussed below with respect to FIG. 2B fitness device 50 may have a user interface or a communication component. In other embodiments, fitness device 50 may provide visual, audio, haptic or other feedback to a user 30.

Fitness device 50 may also transmit results to a remote device 150, or multiple devices 150. For example, results may be provided to a device 150 owned or associated with worker 30, in some embodiments. In other embodiments, results may be provided to a device 150 controlled or operated by a supervisor or safety officer, who may make worker assignments or decisions based on the received data.

FIG. 2B illustrates a device 160 that may serve as a combination of the devices 50 and 150 of FIG. 2A. For example, smart phones and smart devices are increasingly including sensors that can record health and fitness information. One or more sensors 162 capable of capturing fitness information may be present on device 160. Such information may be periodically collected and transmitted to a remote device. Device 160 may include an interface 164 that provides an indication, either positive 166 or negative 168, to a worker. Other indications are expressly contemplated, such as a percentage fitness level, operation assignment, health recommendation, etc.

FIG. 3 is a system diagram of an exemplary fitness monitoring system 200. Fitness monitoring system 200 may include one or more user devices 260, each associated with a worker, and each configured to receive fitness data about the worker. System 200 may also include a safety officer device 230 that presents a safety officer, or supervisor, with aggregated or individual data received from individual user devices 260. System 200 may also have a database 220 that stores information from previous operations. As illustrated in FIG. 3, system 200 may operate through a wireless network 210, where some or all of information in database 220 may be stored locally on either device 260 or device 230, in a cloud database, or in a remote server database. Wireless network 210 may facilitate communication by known or future developed wireless technology including WiFi, cellular, Bluetooth®, a Bluetooth® tag or beacon, a node for communication with an ANT network, NFC or any other type of active wireless communication device. While blocks are illustrative of functionality that may be present in either of devices 260, 230, it is expressly

contemplated that aggregation and communication of information illustrated in FIG. 3 may occur, in other embodiments, using other suitable system configurations.

A safety officer or supervisor may operate a safety officer device 230, which may be a mobile device, in one embodiment, such as an application installed on a smart cellular phone, tablet or other mobile computing device. Safety officer device 230 may include a display 232, an input device 234, such as a mouse, keyboard or touchscreen, and wireless communication functionality 236 that connects to network 210. Device 230 also includes a processor 238 that facilitates functionality of device 230.

Safety officer device 230 may include a dashboard platform 240 which may facilitate obtaining, analyzing and displaying relevant information to a safety officer, for example using display 232. A user interface generator 252 may generate a graphical user interface that is projected onto display 232. A user interface complier 254 may receive incoming data and provide analysis and relevant results to user interface generator 252.

When a safety officer needs to have an updated view of worker fitness in an environment, he or she may actuate an update regime. The update regime may cause a previous results retriever 242 to communicate with database 220 to retrieve relevant previous results, for example past worker assignments 224, past performance of those workers 226, past fitness data 228, and past survey results 212. Other information 214 may also be retrieved from database 220. The update regime may also cause request generator 244 to generate a requested status update that, using request communicator 246, is communicated over network 210, by wireless communication functionality 236 to a communication component 268 of user device 260. The request generator may retrieve a current worker list 222 from database 220. The current worker list 222 may include workers that have clocked in for a given shift, or may be based on another metric, such as the individuals assigned to a given firetruck or squad, for example. Response receiver 248 may provide received responses to user interface data compiler 254. Data compiler 254 may update fitness metrics for each worker, as illustrated in the example embodiment of FIG. 5. Data compiler 254 may also retrieve relevant results for a supervisor to see. For example, a user may provide feedback that they are currently “dizzy” or “tired” and such keywords may be filtered up and provided as an alert, for example on display 232.

Dashboard platform 240 may also include an assignment recommender 256 which may, based on a job list 216 stored in database 220, provide a recommended assignment list

for each of a series of workers based on the retrieved fitness information. For example, assignment recommender 256 may recommend that the most fit individual, with sufficient experience, and a good history of handling tight spaces, be assigned to enter a confined space . Dashboard platform 240 may also include other functionality 258, such as predictive learning technology as discussed herein.

User device 260 may be associated with an individual worker. User device 260 includes one or more fitness sensors 270, which may be present as part of user device 260, as illustrated in FIG. 2A, or may be a separate device, such as illustrated in FIG. 2B. In some embodiments, user device 260 includes a user interface generator 262, that presents a user interface 282 on display 280. In such embodiments, display 280 may, in addition to presenting a notification when a fitness request has been received, may also present a feedback request 284 for a worker that may include such questions as "did you drink any alcohol within the last 12 hours?" or "did you get 8 hours of sleep last night?" or "how are you feeling today?" For example, nurses or doctors that have not slept well or are feeling ill should avoid intense tasks and sick patients, respectively.

In embodiments where user device 260 is a smart device, such as a smart cellular phone or tablet, it may include application data 264 stored in a memory (not shown in FIG. 3) that, when accessed by a processor (not shown in FIG. 3), causes user interface generator 262 to provide the application interface. User device 260 could be stored on a user's person, such as in a pocket, or may be worn by user in a variety of ways. For example, user device 260 may be worn on a cord or lanyard around a user's neck, may be on a fob or dongle, or may be attached to an article of clothing. Particularly in embodiments where user device 260 is a separate device from a worker's mobile cellular phone, device 260 may be stored on a user's person and may provide an indication that a fitness status update is desired either through audio, haptic, or other suitable method.

A fitness sensor 270 receives fitness data directly from a user of device 260. In some embodiments, fitness sensor 270 requires skin contact on one or more electrodes, sensor pads, or other data collecting features, such as a breathalyzer. Fitness sensor 270 may collect any of the following: EKG (also known as ECG, electro cardio graph, which measures heart electrical activity), PPG (photo plethymyography, which measures heart rate and heart rate variability), SPO2 (also known as SPOx a pulse oximetry sensor), temperature, skin galvanic response, cortisol levels, other stress indicators, sleep data, blood alcohol content,

or any other relevant fitness information. Fitness sensor 270 may provide information to fitness recorder 266 which may store the recorded information in a memory of device 260, may provide it to safety officer device 230 using communication component 268, or may provide it to database 220.

In some embodiments, the user interface 282 displays a message for the user, received by communication component 268. The message may include either a response that the user is fit to continue a current operation, may be an assignment to a new operation, maybe a safety recommendation for example to take a break in the shade or drink water to hydrate, or may be an indication that the user should report for further testing. For example, a unique message may be a message sent by the user's supervisor and associated with a unique identifier stored in device 260 indicative of the user's identity. The unique message may be automatically generated by dashboard platform 240 management software based on information retrieved from database 220.

Many other examples of information to display, user interaction and setting modification through the user interface will be apparent to one of skill in the art upon reading the present disclosure.

FIG. 4 illustrates an example method of providing health indications for a worker in accordance with embodiments herein. Method 300 may illustrate an embodiment of how the system of FIGS. 2 or 3 may work as understood from a worker's perspective. However, method 300 may also be practiced by another suitable system than those illustrated in FIGS. 2 or 3.

In block 310, a request for fitness information is received by a worker. The request may be received by a device associated with the worker, such as a smart phone application notification as audio, visual, haptic or other feedback, as indicated in block 352. The request may also come over a communication channel, as indicated in block 354, such as through a communications unit in / covering the worker's ear. Such a request may be an automated request or a supervisor requesting a worker, or workers, provide an update. A sensor, such as the sensor 50 of FIG. 2B may also provide feedback indicating that a fitness check is needed, such as through visual (e.g. a flashing light or indicator), audio (such as a chirping or other alarm sound), haptic (such as vibrating), or another suitable feedback mechanism, as indicated in block 356. The request may be received because it is detected that a shift has started for the user, as indicated in block 302, periodically, as indicated in block 304,

before a specific operation, as indicated in block 306, or for another reason, as indicated in block 308.

In block 320, a fitness test is conducted. The fitness test may include a worker interacting with sensors, electrodes, or another data collection device to provide: EKG data 322, PPG data 323, cortisol levels 324, another stress indicator 325, sleep data 326, or other information 328, such as SpO2, temperature, skin galvanic response, sweat levels or other feedback. For example, a user may indicate that they are currently feeling dizzy, faint, nauseous, dehydrated, etc. The test may be conducted using a sensor device 312, such as illustrated in FIG. 2A, or using a smart device, as illustrated in FIG. 2B, such as a smart phone, smart watch, etc. The test can also be accomplished using other methods 316, in some embodiments.

In block 330, a decision is made. The decision may be based on a threshold 332, such as a user having cortisol levels that are too high for a given task. The decision may be based on a projected response 334, such as a police officer having a stress level likely to cause a situation to escalate instead of de-escalate. The decision can also be made based on a projected environment. For example, if a user is going into a higher stress environment, such as a hot area or a confined space, the acceptable current stress level for a worker might be lower than for a lower stress environment.

In block 340, the results are communicated. The results may be communicated on the same device that took the feedback in block 320. For example, the smart device may both present the request for data and present results on the same user interface. In another embodiment, the results may be communicated through a separate device. For example, a communications device in a user's headset, helmet, or hearing protection may provide an audio-based response. Additionally, a heads-up display may provide the results. Other suitable results communication methods are also contemplated. The results may be as simple as a Yes or No decision on whether a worker can continue with a given task or be part of a given operation, as indicated in block 342. The results may also indicate a percent fitness, as indicated in block 344. The results may also be communicated as a recommendation for a worker, as indicated in block 346. The recommendation may be to report for further testing, such as if a potential dangerous health condition is detected, like a thready pulse, a raised temperature or an arrythmia. The results may also be a designated task or role for the worker, as indicated in block 348. In some embodiments, reporting

fitness as a metric comparable between workers may cause morale problems or tension. It may be desired, instead, for either only a supervisor to see numerical scores or for a system, such as system 200, to assign tasks based on the numerical scores without providing them to workers.

FIG. 5 illustrates an example supervisor device for monitoring worker health in accordance with embodiments herein. Device 400 may be presented to a supervisor of a team of workers and / or to a safety officer in charge of a work site. Device 400 is illustrated as a tablet, however other suitable devices are also possible, including a mobile phone, heads up display, laptop, desktop computer or other suitable computing device. Device 400 includes a user interface 410 that presents relevant results received from workers' fitness checks. For example, as illustrated in FIG. 5, a series of workers 440 are illustrated, broken up into teams organized by different operators 430. However, while operators are illustrated in FIG. 5, teams could also be organized into different operational groups, or as individuals assigned to individual pieces of machinery. Other suitable organizational schemes for workers 440 are envisioned depending on the working environment. Each worker 440 has an associated stress indicator 444, which is illustrated in FIG. 5 as a percentage of acceptable stress. As illustrated, a group 440 of overstressed individuals are excluded from current assignments because their stress level is too high. A variety of individual stress levels 420 are also illustrated.

FIG. 6 illustrates an example method for providing worker assignments based on worker fitness in accordance with embodiments herein. Method 500 may illustrate, from a system perspective, how individual fitness results are requested and received.

In block 510, a request for information is sent from a system. The request for information may be a request for a current fitness check in, for example sent to an individual worker 516, or a group of workers 518. The group of workers may be a full team, such as an entire fire squad or an entire law enforcement precinct, or may be a subgroup of workers, such as only a deployed group of law enforcement officers, or a group of workers assigned to a particular type of equipment or work zone. The information request may be sent to an application on a device associated with a worker, as indicated in block 512, or may be sent to a database, as indicated in block 514. For example, all workers may be prompted to provide an initial fitness check at the start of a shift or operation, but a system request may not be initiated until later. Those most recent test results may be requested from a database.

In addition to requesting a current fitness check, past results of fitness checks may be requested, as indicated in block 502. Additionally, previous assignment information for a given worker, or workers, may be requested from a database, as indicated in block 504. Previous worker performance may also be retrieved, as indicated in block 506, such as stress responses in similar scenarios, work history, training and certification history, etc. Other information may also be requested as relevant. For example, as indicated in block 560, a system may learn, based on previous performance 506 of previous work assignments, to improve future assignments and better predict how a worker will respond to a given environmental stressor.

In block 520, a health indication is received. The health indication may be a fitness check result, as indicated in block 522, as well as results of past fitness checks, as indicated in block 524. Additionally, feedback may be provided by a user, as indicated in block 526. For example, a report that the user did not sleep well, consumed illicit substances, or is currently feeling ill may be provided. Other feedback may also be received, as indicated in block 528. The fitness check may include EKG data, PPG data, cortisol levels, another stress indicator, sleep data, or other information, such as sweat levels or other feedback.

In block 530, a group of workers are categorized by their health indication. For example, the workers may be ranked by a fitness level, as indicated in block 532, as illustrated in FIG. 5, for example. The workers may also be separated into whether they are above or below one or more stress threshold levels. For example, the least stressed workers may be grouped together, and the most stressed workers may be grouped together. The workers may be separated based on whether additional review is needed, as indicated in block 536. For example, if a user reports as ill or dizzy, or has a high temperature, they may need to be pulled from a worksite altogether and evaluated for a health condition such as dehydration or heat-related illness. Other categorization, or multiple categorization schemes, may also be applied.

In block 540, assignments are made. Assignments may be made manually by a supervisor by viewing the data, as indicated in block 552. The assignments may also be made automatically, as indicated in block 554. For example, the system may balance current stress levels and previous responses to select a lower (but not least) stressed, more (but not most) experienced worker for a confined space entry assignment. The assignments may also be made semi autonomously, as indicated in block 556, for example with the system

suggesting assignments for some or all workers subject to review / approval from a supervisor. Assignments may be made based on whether a user falls within an acceptable threshold, as indicated in block 542. For example, a user that falls within a lowest acceptable stress category may be assigned to a higher stress assignment, while a user falling within a highest acceptable stress category may be assigned to a lower stress assignment, while a user that is above a highest acceptable stress category is removed from a work environment. Assignments may also be made based on a fitness level, as indicated in block 544, for example by organizing workers based on a fitness metric, such as cortisol present, stress level, EKG or PPG response, etc. Assignments may be communicated to workers based on a worker-by-worker recommendation of fit or not fit for a task, as indicated in block 546. Assignment may also be communicated as a role or task assigned to a given worker, as indicated in block 548.

In some embodiments, as illustrated in block 550, performance of workers is recorded. For example, recording performance may assist a system in learning to better predict stress responses of workers in a given environment. Recording performance may include recording individual performance, as indicated in block 562. Individual performance may be as simple as satisfactory or unsatisfactory, or may include future fitness results to provide a better understanding of how an individual responded to a given situation. Recording performance may also include recording operational performance 564, including whether an operation was successful, on time, etc. Environment, or worksite information may also be recorded, as indicated in block 566. For example, an individual will respond to a stressful situation differently if the temperature is hot than if the temperature is mild. Additionally, the presence of precipitation or other extenuating circumstances may affect how an individual responds. Information may be recorded automatically, for example by retrieving environmental information from environmental sensors, or manually, by prompting a supervisor or safety officer to provide feedback.

In block 560, based on the performance indications, the system may undergo progressive learning to better predict in the future how individual workers, or workers in a worksite generally, will respond to different stress stimuli. Such information may be requested in an indication request in block 510, or may be accessed when assignments are being made, in block 540.

FIG. 7 illustrates an example method for providing worker recommendations in accordance with embodiments herein. Method 600 may illustrate how a worker dashboard, such as that described in FIG. 3 or illustrated in FIG. 4 may provide recommendations for a safety officer or supervisor on a worksite.

In block 610, a fitness check request is sent. The fitness check may be sent based on an indication received through a user interface of a safety officer or supervisor's device. The fitness check may be automatically generated, for example to periodically require workers to check-in, or may be sent by a supervisor when a new operation is underway. The fitness check may include a request for feedback on a user's physical condition 602, may include a request for feedback 604, or may request other information 606. For example, a physical condition check may require a user to interact with a sensor to provide a snapshot of physical health information. A feedback request may include providing a user with questions about how they are feeling that may indicate suitability or cognitive ability for a given task. For example, challenge questions, such as math or trivia, may be presented to ensure that a worker is not cognitively impaired.

In block 620, status information is received. Fitness information may be received from a number of workers 650-1 through 651-N, depending on the number of workers on a given worksite or under the control of a given supervisor. The request may be generated based on a number of sensor devices that were activated or checked out at the beginning of a shift, or are generally checked out or assigned to a user. The request may be territorially limited, for example only sending to devices within a certain distance of a safety officer's device, or within a certain work zone. The fitness status request may include a request for physical data such as a heart rate 612, a stress level 614, or other information 616, which may include provided feedback, historic information, previous assignments and current assignments as well as regular job duties.

In block 630, worker conditions are updated for the workers who provided a response to a fitness check request. In one embodiment, workers who did not provide a fitness check when requested may be prompted again, or may be the subject of an alert or notification provided on a dashboard. Updating worker conditions may include, for each of workers 650-1 through 650-N, updating a display icon representing the worker, as indicated in block 622, and / or providing an alert, as indicated in block 624, for workers who have exceeded a stress threshold. Additionally, updating a worker condition may include

recording the update, as indicated in block 626. Recording updates may be important both for predicting future performance as well as ensuring that an audit trail is available. Updating a display and providing an alert may include both changing a visible user interface or providing a push notification that updates are available.

In block 640, a recommendation is provided. The recommendation may be provided for any, some, or all of workers 650-1 through 650-N. For example, while some workers may be fine to start or continue a previously assigned task, a personnel change may be recommended, as indicated in block 632, based on an exceeded threshold. Additionally, a new assignment may be recommended for a given worker, as indicated in block 634, which may be communicated to a worker. Further evaluation may be recommended based on a physical or cognitive response, as indicated in block 636. Other recommendations, as indicated in block 638, may also be indicated.

FIGS. 8-10 illustrate example devices that can be used in the embodiments shown in previous Figures.

FIG. 8 illustrates an example mobile device that can be used in the embodiments shown in previous Figures. FIG. 8 is a simplified block diagram of one illustrative example of a handheld or mobile computing device that can be used as either a worker's device or a supervisor / safety officer device, for example, in which the present system (or parts of it) can be deployed. For instance, a mobile device can be deployed in the operator compartment of computing device for use in generating, processing, or displaying the data.

FIG. 8 provides a general block diagram of the components of a mobile cellular device 716 that can run some components shown and described herein. Mobile cellular device 716 interacts with them or runs some and interacts with some. In the device 716, a communications link 713 is provided that allows the handheld device to communicate with other computing devices and under some embodiments provides a channel for receiving information automatically, such as by scanning. Examples of communications link 713 include allowing communication though one or more communication protocols, such as wireless services used to provide cellular access to a network, as well as protocols that provide local wireless connections to networks.

In other examples, applications can be received on a removable Secure Digital (SD) card that is connected to an interface 715. Interface 715 and communication links 713 communicate with a processor 717 (which can also embody a processor) along a bus 719

that is also connected to memory 721 and input/output (I/O) components 723, as well as clock 725 and location system 727.

I/O components 723, in one embodiment, are provided to facilitate input and output operations and the device 716 can include input components such as buttons, touch sensors, optical sensors, microphones, touch screens, proximity sensors, accelerometers, orientation sensors and output components such as a display device, a speaker, and or a printer port. Other I/O components 723 can be used as well.

Clock 725 illustratively comprises a real time clock component that outputs a time and date. It can also provide timing functions for processor 717.

Illustratively, location system 727 includes a component that outputs a current geographical location of device 716. This can include, for instance, a global positioning system (GPS) receiver, a LORAN system, a dead reckoning system, a cellular triangulation system, or other positioning system. It can also include, for example, mapping software or navigation software that generates desired maps, navigation routes and other geographic functions.

Memory 721 stores operating system 729, network settings 731, applications 733, application configuration settings 735, data store 737, communication drivers 739, and communication configuration settings 741. Memory 721 can include all types of tangible volatile and non-volatile computer-readable memory devices. It can also include computer storage media (described below). Memory 721 stores computer readable instructions that, when executed by processor 717, cause the processor to perform computer-implemented steps or functions according to the instructions. Processor 717 can be activated by other components to facilitate their functionality as well.

FIG. 9 shows that the device can also be a smart phone 871. Smart phone 871 has a touch sensitive display 873 that displays icons or tiles or other user input mechanisms 875. Mechanisms 875 can be used by a user to run applications, make calls, perform data transfer operations, etc. In general, smart phone 871 is built on a mobile operating system and offers more advanced computing capability and connectivity than a feature phone. Note that other forms of the devices are possible.

FIG. 10 is one example of a computing environment in which elements of systems and methods described herein, or parts of them (for example), can be deployed. With reference to FIG. 10, an example system for implementing some embodiments includes a

general-purpose computing device in the form of a computer 910. Components of computer 910 may include, but are not limited to, a processing unit 920 (which can comprise a processor), a system memory 930, and a system bus 921 that couples various system components including the system memory to the processing unit 920. The system bus 921 may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. Memory and programs described with respect to systems and methods described herein can be deployed in corresponding portions of FIG. 10.

Computer 910 typically includes a variety of computer readable media. Computer readable media can be any available media that can be accessed by computer 910 and includes both volatile/nonvolatile media and removable/non-removable media. By way of example, and not limitation, computer readable media may comprise computer storage media and communication media. Computer storage media is different from, and does not include, a modulated data signal or carrier wave. It includes hardware storage media including both volatile/nonvolatile and removable/non-removable media implemented in any method or technology for storage of information such as computer readable instructions, data structures, program modules or other data. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by computer 910. Communication media may embody computer readable instructions, data structures, program modules or other data in a transport mechanism and includes any information delivery media. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal.

The system memory 930 includes computer storage media in the form of volatile and/or nonvolatile memory such as read only memory (ROM) 931 and random-access memory (RAM) 932. A basic input/output system 933 (BIOS) containing the basic routines that help to transfer information between elements within computer 910, such as during start-up, is typically stored in ROM 931. RAM 932 typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by processing

unit 920. By way of example, and not limitation, FIG. 9 illustrates operating system 934, application programs 935, other program modules 936, and program data 937.

The computer 910 may also include other removable/non-removable and volatile/nonvolatile computer storage media. By way of example only, FIG. 10 illustrates a hard disk drive 941 that reads from or writes to non-removable, nonvolatile magnetic media, nonvolatile magnetic disk 952, an optical disk drive 955, and nonvolatile optical disk 956. The hard disk drive 941 is typically connected to the system bus 921 through a non-removable memory interface such as interface 940, and optical disk drive 955 are typically connected to the system bus 921 by a removable memory interface, such as interface 950.

Alternatively, or in addition, the functionality described herein can be performed, at least in part, by one or more hardware logic components. For example, and without limitation, illustrative types of hardware logic components that can be used include Field-programmable Gate Arrays (FPGAs), Application-specific Integrated Circuits (e.g., ASICs), Application-specific Standard Products (e.g., ASSPs), System-on-a-chip systems (SOCs), Complex Programmable Logic Devices (CPLDs), etc.

The drives and their associated computer storage media discussed above and illustrated in FIG. 10, provide storage of computer readable instructions, data structures, program modules and other data for the computer 910. In FIG. 10, for example, hard disk drive 941 is illustrated as storing operating system 944, application programs 945, other program modules 946, and program data 947. Note that these components can either be the same as or different from operating system 934, application programs 935, other program modules 936, and program data 937.

A user may enter commands and information into the computer 910 through input devices such as a keyboard 962, a microphone 963, and a pointing device 961, such as a mouse, trackball or touch pad. Other input devices (not shown) may include a joystick, game pad, satellite receiver, scanner, or the like. These and other input devices are often connected to the processing unit 920 through a user input interface 960 that is coupled to the system bus but may be connected by other interface and bus structures. A visual display 991 or other type of display device is also connected to the system bus 921 via an interface, such as a video interface 990. In addition to the monitor, computers may also include other peripheral output devices such as speakers 997 and printer 96, which may be connected through an output peripheral interface 995.

The computer 910 is operated in a networked environment using logical connections, such as a Local Area Network (LAN) or Wide Area Network (WAN) to one or more remote computers, such as a remote computer 980.

When used in a LAN networking environment, the computer 910 is connected to the LAN 971 through a network interface or adapter 970. When used in a WAN networking environment, the computer 910 typically includes a modem 972 or other means for establishing communications over the WAN 973, such as the Internet. In a networked environment, program modules may be stored in a remote memory storage device. FIG. 9 illustrates, for example, that remote application programs 985 can reside on remote computer 980.

In the present detailed description of the preferred embodiments, reference is made to the accompanying drawings, which illustrate specific embodiments in which the invention may be practiced. The illustrated embodiments are not intended to be exhaustive of all embodiments according to the invention. It is to be understood that other embodiments may be utilized and structural or logical changes may be made without departing from the scope of the present invention. The following detailed description, therefore, is not to be taken in a limiting sense, and the scope of the present invention is defined by the appended claims.

Unless otherwise indicated, all numbers expressing feature sizes, amounts, and physical properties used in the specification and claims are to be understood as being modified in all instances by the term "about." Accordingly, unless indicated to the contrary, the numerical parameters set forth in the foregoing specification and attached claims are approximations that can vary depending upon the desired properties sought to be obtained by those skilled in the art utilizing the teachings disclosed herein.

As used in this specification and the appended claims, the singular forms "a," "an," and "the" encompass embodiments having plural referents, unless the content clearly dictates otherwise. As used in this specification and the appended claims, the term "or" is generally employed in its sense including "and/or" unless the content clearly dictates otherwise.

Spatially related terms, including but not limited to, "proximate," "distal," "lower," "upper," "beneath," "below," "above," and "on top," if used herein, are utilized for ease of description to describe spatial relationships of an element(s) to another. Such spatially

related terms encompass different orientations of the device in use or operation in addition to the particular orientations depicted in the figures and described herein. For example, if an object depicted in the figures is turned over or flipped over, portions previously described as below or beneath other elements would then be above or on top of those other elements.

As used herein, when an element, component, or layer for example is described as forming a "coincident interface" with, or being "on," "connected to," "coupled with," "stacked on" or "in contact with" another element, component, or layer, it can be directly on, directly connected to, directly coupled with, directly stacked on, in direct contact with, or intervening elements, components or layers may be on, connected, coupled or in contact with the particular element, component, or layer, for example. When an element, component, or layer for example is referred to as being "directly on," "directly connected to," "directly coupled with," or "directly in contact with" another element, there are no intervening elements, components or layers for example. The techniques of this disclosure may be implemented in a wide variety of computer devices, such as servers, laptop computers, desktop computers, notebook computers, tablet computers, hand-held computers, smart phones, and the like. Any components, modules or units have been described to emphasize functional aspects and do not necessarily require realization by different hardware units. The techniques described herein may also be implemented in hardware, software, firmware, or any combination thereof. Any features described as modules, units or components may be implemented together in an integrated logic device or separately as discrete but interoperable logic devices. In some cases, various features may be implemented as an integrated circuit device, such as an integrated circuit chip or chipset. Additionally, although a number of distinct modules have been described throughout this description, many of which perform unique functions, all the functions of all of the modules may be combined into a single module, or even split into further additional modules. The modules described herein are only exemplary and have been described as such for better ease of understanding.

If implemented in software, the techniques may be realized at least in part by a computer-readable medium comprising instructions that, when executed in a processor, performs one or more of the methods described above. The computer-readable medium may comprise a tangible computer-readable storage medium and may form part of a computer program product, which may include packaging materials. The computer-

readable storage medium may comprise random access memory (RAM) such as synchronous dynamic random access memory (SDRAM), read-only memory (ROM), non-volatile random access memory (NVRAM), electrically erasable programmable read-only memory (EEPROM), FLASH memory, magnetic or optical data storage media, and the like. The computer-readable storage medium may also comprise a non-volatile storage device, such as a hard-disk, magnetic tape, a compact disk (CD), digital versatile disk (DVD), Blu-ray disk, holographic data storage media, or other non-volatile storage device.

The term "processor," as used herein may refer to any of the foregoing structure or any other structure suitable for implementation of the techniques described herein. In addition, in some aspects, the functionality described herein may be provided within dedicated software modules or hardware modules configured for performing the techniques of this disclosure. Even if implemented in software, the techniques may use hardware such as a processor to execute the software, and a memory to store the software. In any such cases, the computers described herein may define a specific machine that is capable of executing the specific functions described herein. Also, the techniques could be fully implemented in one or more circuits or logic elements, which could also be considered a processor.

A worker fitness feedback device is presented that includes a fitness sensor configured to receive fitness data from a worker. The fitness data include a fitness feedback for the worker. The worker fitness feedback device includes fitness recorder configured to record the fitness feedback for the worker and provide the fitness feedback to a database. The fitness feedback is associated with the worker in the database. The worker fitness feedback device also includes a communication component configured to receive a request for fitness data for the worker, and, based on the received request, provide a prompt for the worker to provide fitness data. The prompt is a visual, audio, haptic or other notification to the worker. The worker fitness feedback device also includes a controller configured to cause the fitness sensor to receive fitness data, and the fitness recorder to record the fitness feedback.

The worker fitness feedback device may be implemented such that the fitness feedback includes a time-limited view of a fitness criteria for the worker. The time-limited view includes only the time the worker is in physical contact with the fitness sensor.

The worker fitness feedback device may be implemented such that the fitness criteria is selected from the group consisting of: ekg measurements, ppg measurements for heart rate, ppg measurement for heart rate variability, SPO2 measurements, cortisol level measurements, stress indicator measurement, and blood alcohol content measurement.

The worker fitness feedback device may be implemented such that the fitness feedback also includes a response to a survey.

The worker fitness feedback device may be implemented such that the communication component only provides the fitness feedback in response to a received request for current fitness feedback from a requesting device.

The worker fitness feedback device may be implemented such that the communication component is configured to send the received fitness data to the requesting device.

The worker fitness feedback device may be implemented such that the communication component, in response to a received request from a requesting device, provides the recorded fitness feedback.

The worker fitness feedback device may be implemented such that the device also includes a display component; and a graphical user interface generator configured to generate a graphical user interface for display on the display component.

The worker fitness feedback device may be implemented such that the display component is an integral part of the worker fitness feedback device.

The worker fitness feedback device may be implemented such that the display component is wirelessly connected to the fitness sensor.

The worker fitness feedback device may be implemented such that the graphical user interface generator generates a graphical user interface that displays the fitness feedback.

The worker fitness feedback device may be implemented such that the graphical user interface generator generates a graphical user interface that displays a received request for fitness feedback.

The worker fitness feedback device may be implemented such that when the communication component receives a work assignment based on the provided fitness data, the work assignment is displayed on the display component.

The worker fitness feedback device may be implemented such that when the communication component receives an assignment change notification based on the provided fitness data, the new assignment is displayed on the display component.

The worker fitness feedback device may be implemented such that when the communication component receives an indication that the worker is to report for further evaluation, the indication is presented on the display component.

The worker fitness feedback device may be implemented such that when the communication component receives an indication that the worker is dismissed from the worksite, the indication is presented on the display component.

The worker fitness feedback device may be implemented such that the request for fitness data is from a safety officer device. The fitness feedback is provided to the safety officer device.

The worker fitness feedback device may be implemented such that the request is received over a wireless communication protocol.

The worker fitness feedback device may be implemented such that the request is automatically generated based on an indication of a start-of-shift, a period of time since last request, or a device-start up.

A worker fitness monitoring device is presented that includes a request generator configured to generate a request for fitness data for a worker. The device also includes a fitness data receiver configured to receive a fitness data indication. The device also includes a communication component configured to send the request for fitness data to a fitness device associated with the worker, and receive a fitness data response. The device also includes a graphical user interface generator that generates a user interface for projection on a display component that presents the received fitness data indication and the fitness data response and a recommendation for the worker based on the received fitness data indication. The device also includes a controller that, in response to a received command from a user, causes the request generator to generate a request, the communication component to send the request and receive the fitness data indication, the response receiver to receive the fitness data indication, and the graphical user interface generator to present the received fitness data indication and fitness data response.

The worker fitness monitoring device may be implemented such that the fitness data indication includes a historical datapoint associated with the worker.

The worker fitness monitoring device may be implemented such that the fitness data indication includes: a past assignment, a past performance, a past fitness data response, a past survey result.

The worker fitness monitoring device may be implemented such that the fitness data response is a current data response selected from the group consisting of: ekg measurements, ppg measurements, SPO2 measurement, blood pressure measurement, cortisol level measurements, stress indicator measurement, blood alcohol content measurement, and surface response.

The worker fitness monitoring device may be implemented such that the fitness data indication is received from the fitness device associated with the worker over a wireless network.

The worker fitness monitoring device may be implemented such that the fitness data indication is received from a database.

The worker fitness monitoring device may be implemented such that the database is remote from the worker fitness monitoring device.

The worker fitness monitoring device may be implemented such that the response receiver also retrieves a survey response from the fitness device associated with the worker.

The worker fitness monitoring device may be implemented such that the communication component operates on a wireless protocol.

The worker fitness monitoring device may be implemented such that it also includes an assignment recommendation generator that, based on the received fitness data indication and received fitness data response, provides a recommended work assignment for the worker.

The worker fitness monitoring device may be implemented such that the worker is a first worker, and also comprising a second device associated with a second worker that provides a second fitness data indication and a second fitness data response. The assignment recommendation generator, based on the first and second fitness data indications and first and second fitness data responses, recommends the first worker as more suitable for a first assignment.

The worker fitness monitoring device may be implemented such that the recommended work assignment is displayed on a display component of the worker fitness monitoring device.

The worker fitness monitoring device may be implemented such that the first assignment is displayed, on a display component of the worker fitness monitoring device, such that it is associated with the first worker.

The worker fitness monitoring device may be implemented such that the recommendation is for the worker to be removed from a worksite.

The worker fitness monitoring device may be implemented such that the recommendation is for the worker to report for a cognitive assessment.

The worker fitness monitoring device may be implemented such that the recommendation is to switch a current first assignment associated with the first worker with a current second assignment associated with the second worker.

A method of conducting a fitness test on a worker on a worksite is presented. The method includes receiving a request, on a device associated with the worker, for a fitness test result. The method also includes conducting, using a fitness sensor, a fitness test on the worker and receiving a fitness result. The method also includes communicating the fitness result, using a wireless communication component of the device. The fitness sensor conducts the fitness test based on a limited interaction time with the worker.

The method may be implemented such that the fitness test is an EKG test, a PPG test, a SPO2 test, a skin galvanic response test, blood pressure test, a cortisol level test, a stress test, a cognitive test, or a blood alcohol test.

The method may be implemented such that it also includes presenting a fitness decision, based on the fitness result, on a display associated with the device.

The method may be implemented such that the fitness decision is based on a comparison of the fitness result to a threshold fitness result.

The method may be implemented such that the fitness decision is based on a projected response based on the fitness result.

The method may be implemented such that the fitness decision is based on the fitness result and a worksite condition.

The method may be implemented such that the worksite condition includes a heat index, a forecasted weather condition, or a present stress trigger.

The method may be implemented such that communicating the fitness result includes sending the fitness result to a second device using a wireless communication protocol.

The method may be implemented such that it also includes presenting a fitness decision, based on the fitness result, on a display associated with the device. The fitness decision is received from the second device.

The method may be implemented such that the fitness decision is a recommendation for the worker. The recommendation is to remove the worker from a worksite, for the worker to report for further evaluation, or for the worker to switch to a new assignment.

The method may be implemented such that communicating includes wirelessly sending and receiving the fitness result to a database remote from the device.

The method may be implemented such that the fitness sensor is an integrated component of the device associated with the worker.

The method may be implemented such that the fitness sensor is communicatively coupled to the device associated with the worker.

The method may be implemented such that the request for a fitness test result is automatically generated based on a detected start of shift, a periodic check-in time, or a detected start of new operation.

The method may be implemented such that the request for a fitness test result is presented to the worker as a visual alert, audio alert, or haptic feedback alert on the device.

The method may be implemented such that the request for a fitness test result is presented to the worker as a visual alert, audio alert, or haptic feedback alert from the sensor.

The method may be implemented such that the limited contact time includes a skin to sensor contact time of less than about 1% of a shift length for the worker.

The method may be implemented such that the limited contact time includes a skin to sensor contact time of less than about 0.1% of a shift length for the worker.

The method may be implemented such that the fitness result is either a pass result or a fail result.

The method may be implemented such that the fitness result is a percentage of fitness remaining.

A method of assigning a work assignment to a worker in a worksite is presented. The method includes requesting, from a device, a fitness test result for the worker in the worksite. The method also includes receiving, on the device, the fitness test result. The fitness test result is received wirelessly from a worker device associated with the worker. The fitness test result is a snapshot result comprising a fitness metric measured over a short time. The method also includes assigning an operational task to the worker based on the fitness test result. The method also includes communicating the operational task to the worker by wirelessly communicating the operational task to a device associated with the worker.

The method may be implemented such that the short time is less than about 5 minutes.

The method may be implemented such that the short time is less than about 1 minute.

The method may be implemented such that the device associated with the worker is a PPE associated with the worker. the PPE includes a speaker or display.

The method may be implemented such that the device associated with the worker is a fitness test device that includes a fitness sensor configured to capture the fitness test result.

The method may be implemented such that it also includes retrieving a past performance data for the worker. Assigning the operational task includes assigning based on the fitness test result and a past performance data.

The method may be implemented such that the past performance data includes a past fitness test result for the worker.

The method may be implemented such that the past performance data includes a past assignment for the worker.

The method may be implemented such that the past performance data includes a performance metric for the past assignment.

The method may be implemented such that the past performance data includes a series of past fitness test results for the worker.

The method may be implemented such that the fitness test result includes textual feedback from the worker in response to a survey question.

The method may be implemented such that assigning an operational task includes analyzing the textual feedback for cognitive or physical wellbeing of the worker.

The method may be implemented such that the worker is a first worker, the operational task is a first operational task. The method also includes requesting a second fitness test result from a second worker, receiving the fitness test result from a second worker. The first operational task is assigned to the first worker, and a second operational task is assigned to the second worker.

The method may be implemented such that the first operational task is assigned based on a comparison of the fitness result to the second fitness result and, based on the comparison, determining that the first worker is better suited to the first operational task.

The method may be implemented such that it includes retrieving a past performance result for the first and second workers. The first operational task assigned to first worker based on a comparison of the retrieved past performance results for the first and second workers.

The method may be implemented such that it also includes recording a performance metric for the worker during the operational task.

The method may be implemented such that it includes receiving recorded performance associated with a previous fitness test result request for the worker.

The method may be implemented such that the worker is a plurality of workers, requesting a fitness test result includes requesting the fitness test result from each of the plurality of workers, receiving the test result includes receiving the fitness test result from each of the plurality of workers, and further including categorizing the plurality of workers into a first feedback category and a second feedback category. Assigning the worker an operational role includes each of the plurality of workers an operational role based on the feedback category.

The method may be implemented such that the first feedback category is above a stress threshold, second feedback category is below a stress threshold.

The method may be implemented such that the first feedback category includes workers able to continue working. The second category includes workers needing to report for additional testing, leave the worksite, or change to a lower stress operational role.

The method may be implemented such that assigning an operational role includes a consideration of the fitness test result in combination with a past fitness test result, a projected stress response, an operation parameter or a weather forecast indication.

The method may be implemented such that the fitness test result is an EKG test result, a PPG test result, SPO2 test result, skin galvanic response test result, blood pressure test result, a cortisol level test result, a stress test result, a cognitive test result, or a blood alcohol test result.

A method of distributing work assignments to workers in a worksite is presented that includes sending a fitness check request to each of a plurality of workers in the worksite. Each of the plurality of workers are associated with a fitness device, and the fitness check request is sent wirelessly from a worker fitness platform to each of the plurality of fitness devices. The method also includes receiving a fitness indication from each of the plurality of fitness devices. The fitness indication is sent wirelessly from each of the plurality of fitness devices to the worker fitness platform. The method also includes categorizing the workers based on the received plurality of fitness indications. The method also includes automatically generating a worker assignment for at least some of the plurality of workers based on the categorized fitness indications.

The method may be implemented such that automatically generating the worker assignment includes determining that a first worker is better suited for a first task than a second worker, based on the received fitness indications, and assigning the first task to the first worker based on the comparison.

The method may be implemented such that it includes assigning a second task to a second worker based on a determination that the second worker is better suited for the second task than a third worker, based on the received fitness indications.

The method may be implemented such that n automatically generating also includes retrieving another feedback metric for the first and second worker, comparing the received fitness indications and the other received feedback metrics, assigning the first task to the first worker based on the comparison.

The method may be implemented such that the other metric includes a past fitness indication, a past performance metric, a first task operational parameter, a predicted stress response for each of the first and second workers, an experience level of each of the first and second workers or a weather forecast indication for the worksite.

The method may be implemented such that the fitness indication includes an EKG test result, a PPG test result, an SPO2 test result, a blood pressure test result, a skin galvanic response test result, a cortisol level test result, a stress test result, a cognitive test result, a heart rate test result, a blood pressure test result, a temperature test result or a blood alcohol test result.

The method may be implemented such that the fitness indication also includes an answer from each of the plurality of workers to a provided survey question.

The method may be implemented such that the worker fitness platform is presented to a user on a device with a display component. The method further includes updating the display component to reflect the most recently received fitness indications from each of the plurality of workers.

The method may be implemented such that it also includes providing the worker assignment on the display component.

The method may be implemented such that providing an alert that one of the plurality of workers does not meet a minimum threshold for an operational task.

The method may be implemented such that the minimum threshold is a threshold to continue working on the worksite and the alert is a recommendation to remove the worker for treatment or further testing.

The method may be implemented such that communicating the worker assignment to each of the plurality of workers. Communicating includes wirelessly communicating the worker assignment to each of the plurality of workers.

The method may be implemented such that the worker assignment is provided wirelessly to each of the plurality of fitness devices.

The method may be implemented such that it includes recording the worker assignment.

The method may be implemented such that it includes associating a performance metric with each of the plurality of workers after the worker assignment is completed.

What is claimed is:

1. A worker fitness feedback device comprising:
   a fitness sensor configured to receive fitness data from a worker, wherein the fitness data comprise a fitness feedback for the worker;
   a fitness recorder configured to record the fitness feedback for the worker and provide the fitness feedback to a database, wherein the fitness feedback is associated with the worker in the database;
   a communication component configured to receive a request for fitness data for the worker, and, based on the received request, provide a prompt for the worker to provide fitness data, wherein the prompt is a visual, audio, haptic or other notification to the worker; and
   a controller configured to cause the fitness sensor to receive fitness data, and the fitness recorder to record the fitness feedback.
2. The worker fitness feedback device of claim 1, wherein the fitness feedback comprises a time-limited view of a fitness criteria for the worker, wherein the time-limited view comprises only the time the worker is in physical contact with the fitness sensor.
3. The worker fitness feedback device of claim 2, wherein the fitness criteria is selected from the group consisting of: EKG measurements, PPG measurements for heart rate, PPG measurement for heart rate variability, SPO2 measurements, cortisol level measurements, stress indicator measurement, and blood alcohol content measurement.
4. The worker fitness feedback device of claim 2, wherein the fitness feedback also comprises a response to a survey.
5. The worker fitness feedback device of any of claims 1-4, wherein the communication component only provides the fitness feedback in response to a received request for current fitness feedback from a requesting device.
6. The worker fitness feedback device of claim 5, wherein the communication component is configured to send the received fitness data to the requesting device.

7. The worker fitness feedback device of any of claims 1-6, wherein the communication component, in response to a received request from a requesting device, provides the recorded fitness feedback.
8. The worker fitness feedback device of any of claims 1-7, wherein the device also comprises:
   a display component; and
   a graphical user interface generator configured to generate a graphical user interface for display on the display component.
9. The worker fitness feedback device of claim 8, wherein the display component is an integral part of the worker fitness feedback device.
10. The worker fitness feedback device of claim 8, wherein the graphical user interface generator generates a graphical user interface that displays a received request for fitness feedback.
11. The worker fitness feedback device of claim 8, and wherein, when the communication component receives a work assignment based on the provided fitness data, the work assignment is displayed on the display component.
12. The worker fitness feedback device of claim 8, and wherein, when the communication component receives an assignment change notification based on the provided fitness data, the new assignment is displayed on the display component.
13. The worker fitness feedback device of claim 8, and wherein, when the communication component receives an indication that the worker is to report for further evaluation, the indication is presented on the display component.
14. The worker fitness feedback device of claim 8, and wherein, when the communication component receives an indication that the worker is dismissed from the worksite, the indication is presented on the display component.
15. The worker fitness feedback device of any of claims 1-16, wherein the request for fitness data is from a safety officer device, and wherein the fitness feedback is provided to the safety officer device.
16. The worker fitness feedback device of claim 17, wherein the request is automatically generated based on an indication of a start-of-shift, a period of time since last request, or a device-start up.

17. A worker fitness monitoring device comprising:

a request generator configured to generate a request for fitness data for a worker;

a fitness data receiver configured to receive a fitness data indication;

a communication component configured to send the request for fitness data to a fitness device associated with the worker, and receive a fitness data response;

a graphical user interface generator that generates a user interface for projection on a display component that presents the received fitness data indication and the fitness data response and a recommendation for the worker based on the received fitness data indication; and

a controller that, in response to a received command from a user, causes the request generator to generate a request, the communication component to send the request and receive the fitness data indication, the response receiver to receive the fitness data indication, and the graphical user interface generator to present the received fitness data indication and fitness data response.

18. The worker fitness monitoring device of claim 20, wherein the fitness data indication comprises a historical datapoint associated with the worker.

19. The worker fitness monitoring device of claim 21, wherein the fitness data indication comprises: a past assignment, a past performance, a past fitness data response, a past survey result.

20. The worker fitness monitoring device of any of claims 20-22, wherein the fitness data response is a current data response selected from the group consisting of: EKG measurements, PPG measurements, SPO2 measurement, blood pressure measurement, cortisol level measurements, stress indicator measurement, blood alcohol content measurement, and surface response.

21. The worker fitness monitoring device of any of claims 20-28, and further comprising:

an assignment recommendation generator that, based on the received fitness data indication and received fitness data response, provides a recommended work assignment for the worker.

22. The worker fitness monitoring device of claim 29, wherein the worker is a first worker, and also comprising a second device associated with a second worker that provides a second fitness data indication and a second fitness data response, and wherein the assignment recommendation generator, based on the first and second fitness data indications and first and second fitness data responses, recommends the first worker as more suitable for a first assignment.

23. The worker fitness monitoring device of claim 29, wherein the recommended work assignment is displayed on a display component of the worker fitness monitoring device.

24. The worker fitness monitoring device of claim 31, wherein the first assignment is displayed, on a display component of the worker fitness monitoring device, such that it is associated with the first worker.

25. The worker fitness monitoring device of claim 31, and wherein the recommendation is to switch a current first assignment associated with the first worker with a current second assignment associated with the second worker.

26. A method of conducting a fitness test on a worker on a worksite, the method comprising:

receiving a request, on a device associated with the worker, for a fitness test result;

conducting, using a fitness sensor, a fitness test on the worker and receiving a fitness result;

communicating the fitness result, using a wireless communication component of the device; and

wherein the fitness sensor conducts the fitness test based on a limited interaction time with the worker.

27. The method of claim 36, wherein the fitness test is an EKG test, a PPG test, a SPO2 test, a skin galvanic response test, blood pressure test, a cortisol level test, a stress test, a cognitive test, or a blood alcohol test.

28. The method of claim 36 or 37, wherein the method also comprises:

presenting a fitness decision, based on the fitness result, on a display associated with the device.

29. The method of claim 38, wherein the fitness decision is based on a comparison of the fitness result to a threshold fitness result.

30. The method of any of claims 36-46, wherein the fitness sensor is an integrated component of the device associated with the worker.
31. The method of any of claims 36-47, wherein the fitness sensor is communicatively coupled to the device associated with the worker.
32. The method of any of claims 36-48, wherein the request for a fitness test result is automatically generated based on a detected start of shift, a periodic check-in time, or a detected start of new operation.
33. The method of any of claims 36-51, wherein the limited contact time comprises a skin to sensor contact time of less than about 1% of a shift length for the worker.
34. The method of any of claims 36-53, wherein the fitness result is either a pass result or a fail result.
35. A method of assigning a work assignment to a worker in a worksite, the method comprising:

requesting, from a device, a fitness test result for the worker in the worksite;

receiving, on the device, the fitness test result, wherein the fitness test result is received wirelessly from a worker device associated with the worker, and wherein the fitness test result is a snapshot result comprising a fitness metric measured over a short time;

assigning an operational task to the worker based on the fitness test result; and

communicating the operational task to the worker by wirelessly communicating the operational task to a device associated with the worker.

36. The method of claim 56, wherein the short time is less than about 5 minutes.
37. The method of any of claims 56-58, wherein the device associated with the worker is a PPE associated with the worker, wherein the PPE comprises a speaker or display.
38. The method of any of claims 56-59, wherein the device associated with the worker is a fitness test device that comprises a fitness sensor configured to capture the fitness test result.
39. The method of any of claims 56-67, wherein the worker is a first worker, the operational task is a first operational task, and also comprising:

requesting a second fitness test result from a second worker;

receiving the fitness test result from a second worker; and

wherein the first operational task is assigned to the first worker, and a second operational task is assigned to the second worker.

40. The method of any of claims 56-72, wherein the worker is a plurality of workers, requesting a fitness test result comprises requesting the fitness test result from each of the plurality of workers, receiving the test result comprises receiving the fitness test result from each of the plurality of workers, and further comprising:

categorizing the plurality of workers into a first feedback category and a second feedback category; and

wherein assigning the worker an operational role comprises each of the plurality of workers an operational role based on the feedback category.

41. A method of distributing work assignments to workers in a worksite, the method comprising:

sending a fitness check request to each of a plurality of workers in the worksite, wherein each of the plurality of workers are associated with a fitness device, and the fitness check request is sent wirelessly from a worker fitness platform to each of the plurality of fitness devices;

receiving a fitness indication from each of the plurality of fitness devices, wherein the fitness indication is sent wirelessly from each of the plurality of fitness devices to the worker fitness platform;

categorizing the workers based on the received plurality of fitness indications; and

automatically generating a worker assignment for at least some of the plurality of workers based on the categorized fitness indications.

AMENDED CLAIMS
received by the International Bureau on 17 August 2021 (17.08.21)

1. A worker fitness feedback device comprising:
   a fitness sensor configured to receive fitness data from a worker, wherein the fitness data comprise a fitness feedback for the worker;
   a fitness recorder configured to record the fitness feedback for the worker and provide the fitness feedback to a database, wherein the fitness feedback is associated with the worker in the database;
   a communication component configured to receive a request for fitness data for the worker, and, based on the received request, provide a prompt for the worker to provide fitness data, wherein the prompt is a visual, audio, haptic or other notification to the worker; and
   a controller configured to cause the fitness sensor to receive fitness data, and the fitness recorder to record the fitness feedback.
2. The worker fitness feedback device of claim 1, wherein the fitness feedback comprises a time-limited view of a fitness criteria for the worker, wherein the time-limited view comprises only the time the worker is in physical contact with the fitness sensor.
3. The worker fitness feedback device of claim 2, wherein the fitness criteria is selected from the group consisting of: EKG measurements, PPG measurements for heart rate, PPG measurement for heart rate variability, SPO2 measurements, cortisol level measurements, stress indicator measurement, and blood alcohol content measurement.
4. The worker fitness feedback device of claim 2, wherein the fitness feedback also comprises a response to a survey.
5. The worker fitness feedback device of any of claims 1-4, wherein the communication component only provides the fitness feedback in response to a received request for current fitness feedback from a requesting device.
6. The worker fitness feedback device of claim 5, wherein the communication component is configured to send the received fitness data to the requesting device.

7. The worker fitness feedback device of any of claims 1-6, wherein the communication component, in response to a received request from a requesting device, provides the recorded fitness feedback.
8. The worker fitness feedback device of any of claims 1-7, wherein the device also comprises:
   a display component; and
   a graphical user interface generator configured to generate a graphical user interface for display on the display component.
9. The worker fitness feedback device of claim 8, wherein the display component is an integral part of the worker fitness feedback device.
10. The worker fitness feedback device of claim 8, wherein the graphical user interface generator generates a graphical user interface that displays a received request for fitness feedback.
11. The worker fitness feedback device of claim 8, and wherein, when the communication component receives a work assignment based on the provided fitness data, the work assignment is displayed on the display component.
12. The worker fitness feedback device of claim 8, and wherein, when the communication component receives an assignment change notification based on the provided fitness data, the new assignment is displayed on the display component.
13. The worker fitness feedback device of claim 8, and wherein, when the communication component receives an indication that the worker is to report for further evaluation, the indication is presented on the display component.
14. The worker fitness feedback device of claim 8, and wherein, when the communication component receives an indication that the worker is dismissed from the worksite, the indication is presented on the display component.
15. The worker fitness feedback device of any of claims 1-14, wherein the request for fitness data is from a safety officer device, and wherein the fitness feedback is provided to the safety officer device.
16. The worker fitness feedback device of claim 15, wherein the request is automatically generated based on an indication of a start-of-shift, a period of time since last request, or a device-start up.

17. A worker fitness monitoring device comprising:
    a request generator configured to generate a request for fitness data for a worker;
    a fitness data receiver configured to receive a fitness data indication;
    a communication component configured to send the request for fitness data to a fitness device associated with the worker, and receive a fitness data response;
    a graphical user interface generator that generates a user interface for projection on a display component that presents the received fitness data indication and the fitness data response and a recommendation for the worker based on the received fitness data indication; and
    a controller that, in response to a received command from a user, causes the request generator to generate a request, the communication component to send the request and receive the fitness data indication, the response receiver to receive the fitness data indication, and the graphical user interface generator to present the received fitness data indication and fitness data response.
18. The worker fitness monitoring device of claim 17, wherein the fitness data indication comprises a historical datapoint associated with the worker.
19. The worker fitness monitoring device of claim 18, wherein the fitness data indication comprises: a past assignment, a past performance, a past fitness data response, a past survey result.
20. The worker fitness monitoring device of any of claims 17-19, wherein the fitness data response is a current data response selected from the group consisting of: EKG measurements, PPG measurements, SPO2 measurement, blood pressure measurement, cortisol level measurements, stress indicator measurement, blood alcohol content measurement, and surface response.
21. The worker fitness monitoring device of any of claims 17-20, and further comprising:
    an assignment recommendation generator that, based on the received fitness data indication and received fitness data response, provides a recommended work assignment for the worker.

22. The worker fitness monitoring device of claim 21, wherein the worker is a first worker, and also comprising a second device associated with a second worker that provides a second fitness data indication and a second fitness data response, and wherein the assignment recommendation generator, based on the first and second fitness data indications and first and second fitness data responses, recommends the first worker as more suitable for a first assignment.
23. The worker fitness monitoring device of claim 21, wherein the recommended work assignment is displayed on a display component of the worker fitness monitoring device.
24. The worker fitness monitoring device of claim 21, wherein the recommended work assignment is a first assignment that is displayed, on a display component of the worker fitness monitoring device, such that it is associated with the first worker.
25. The worker fitness monitoring device of claim 21, and wherein the recommended work assignment is to switch a current first assignment associated with the first worker with a current second assignment associated with the second worker.
26. A method of conducting a fitness test on a worker on a worksite, the method comprising:
receiving a request, on a device associated with the worker, for a fitness test result;
conducting, using a fitness sensor, a fitness test on the worker and receiving a fitness result;
communicating the fitness result, using a wireless communication component of the device; and
wherein the fitness sensor conducts the fitness test based on a limited interaction time with the worker.
27. The method of claim 26, wherein the fitness test is an EKG test, a PPG test, a SPO2 test, a skin galvanic response test, blood pressure test, a cortisol level test, a stress test, a cognitive test, or a blood alcohol test.
28. The method of claim 26 or 27, wherein the method also comprises:
presenting a fitness decision, based on the fitness result, on a display associated with the device.
29. The method of claim 28, wherein the fitness decision is based on a comparison of the fitness result to a threshold fitness result.

AMENDED SHEET (ARTICLE 19)

30. The method of any of claims 28-29, wherein the fitness sensor is an integrated component of the device associated with the worker.
31. The method of any of claims 26-30, wherein the fitness sensor is communicatively coupled to the device associated with the worker.
32. The method of any of claims 26-31, wherein the request for a fitness test result is automatically generated based on a detected start of shift, a periodic check-in time, or a detected start of new operation.
33. The method of any of claims 26-32, wherein the limited contact time comprises a skin to sensor contact time of less than about 1% of a shift length for the worker.
34. The method of any of claims 26-33, wherein the fitness result is either a pass result or a fail result.
35. A method of assigning a work assignment to a worker in a worksite, the method comprising:

requesting, from a device, a fitness test result for the worker in the worksite;

receiving, on the device, the fitness test result, wherein the fitness test result is received wirelessly from a worker device associated with the worker, and wherein the fitness test result is a snapshot result comprising a fitness metric measured over a short time;

assigning an operational task to the worker based on the fitness test result; and

communicating the operational task to the worker by wirelessly communicating the operational task to a device associated with the worker.
36. The method of claim 35, wherein the short time is less than about 5 minutes.
37. The method of any of claims 35-36, wherein the device associated with the worker is a PPE associated with the worker, wherein the PPE comprises a speaker or display.
38. The method of any of claims 35-37, wherein the device associated with the worker is a fitness test device that comprises a fitness sensor configured to capture the fitness test result.
39. The method of any of claims 35-38, wherein the worker is a first worker, the operational task is a first operational task, and also comprising:

requesting a second fitness test result from a second worker;

receiving the fitness test result from a second worker; and

wherein the first operational task is assigned to the first worker, and a second operational task is assigned to the second worker.

40. The method of any of claims 35-39, wherein the worker is a plurality of workers, requesting a fitness test result comprises requesting the fitness test result from each of the plurality of workers, receiving the test result comprises receiving the fitness test result from each of the plurality of workers, and further comprising:

categorizing the plurality of workers into a first feedback category and a second feedback category; and

wherein assigning the worker an operational role comprises each of the plurality of workers an operational role based on the feedback category.

41. A method of distributing work assignments to workers in a worksite, the method comprising:

sending a fitness check request to each of a plurality of workers in the worksite, wherein each of the plurality of workers are associated with a fitness device, and the fitness check request is sent wirelessly from a worker fitness platform to each of the plurality of fitness devices;

receiving a fitness indication from each of the plurality of fitness devices, wherein the fitness indication is sent wirelessly from each of the plurality of fitness devices to the worker fitness platform;

categorizing the workers based on the received plurality of fitness indications; and

automatically generating a worker assignment for at least some of the plurality of workers based on the categorized fitness indications.

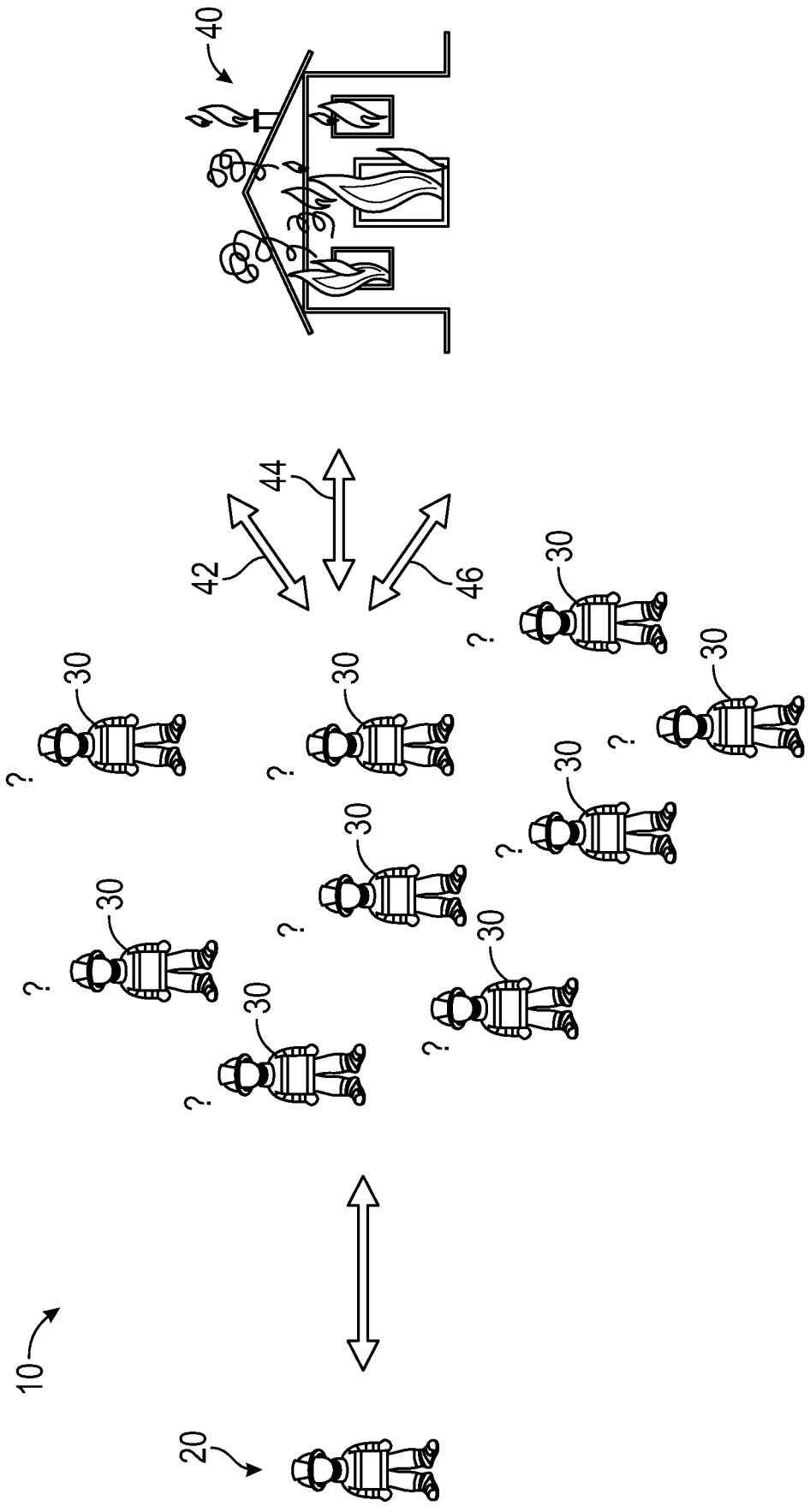


FIG. 1

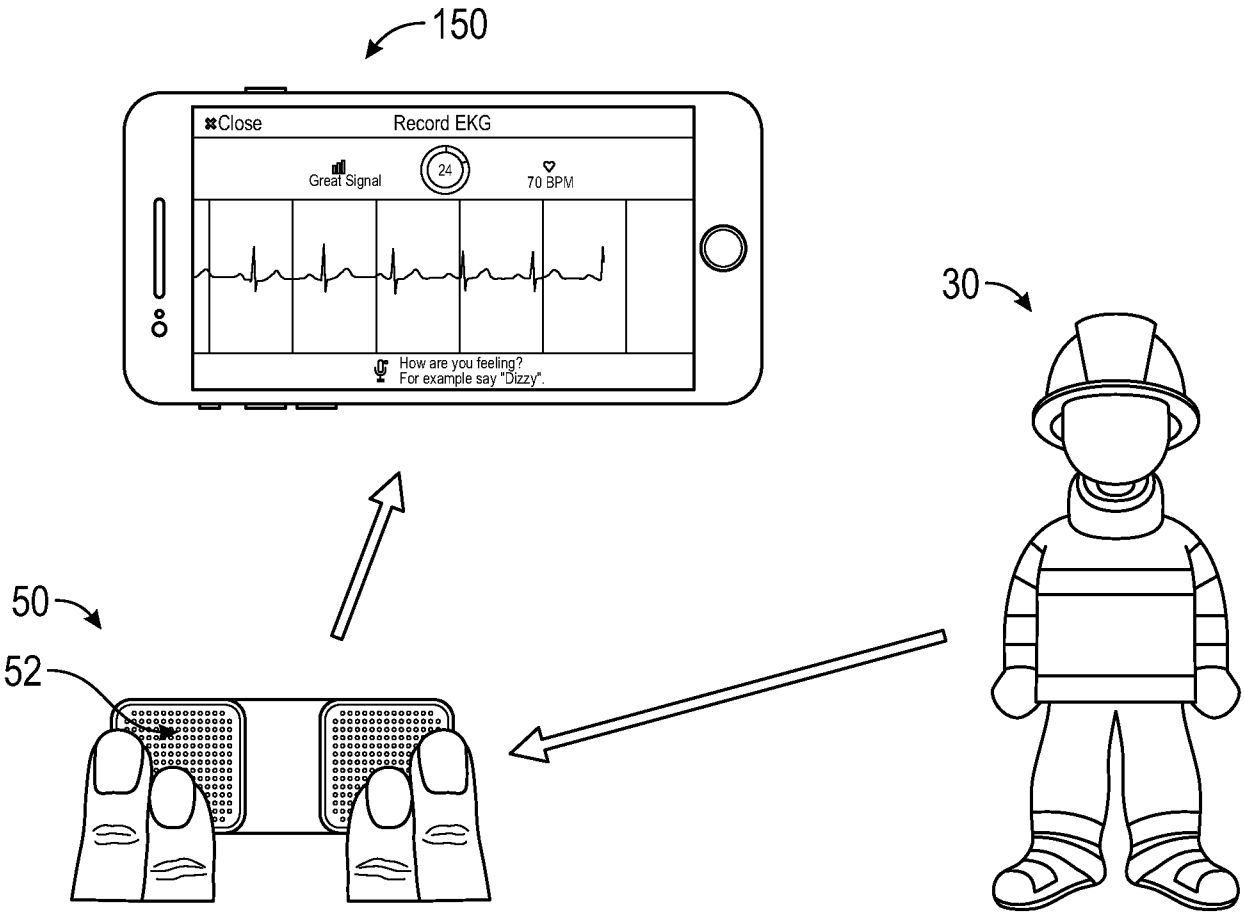

150
Close
Record EKG
Great Signal
24
70 BPM
How are you feeling?
For example say "Dizzy".
30
50
52

FIG. 2A

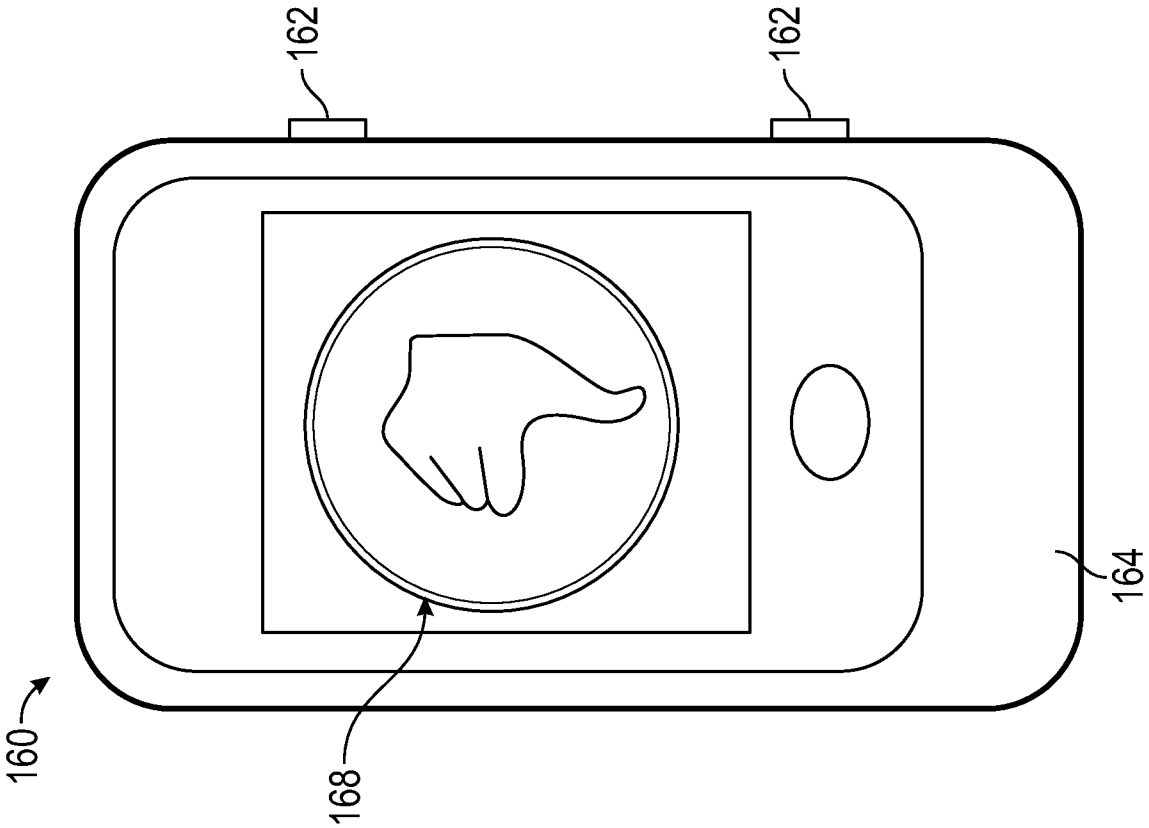


FIG. 2B

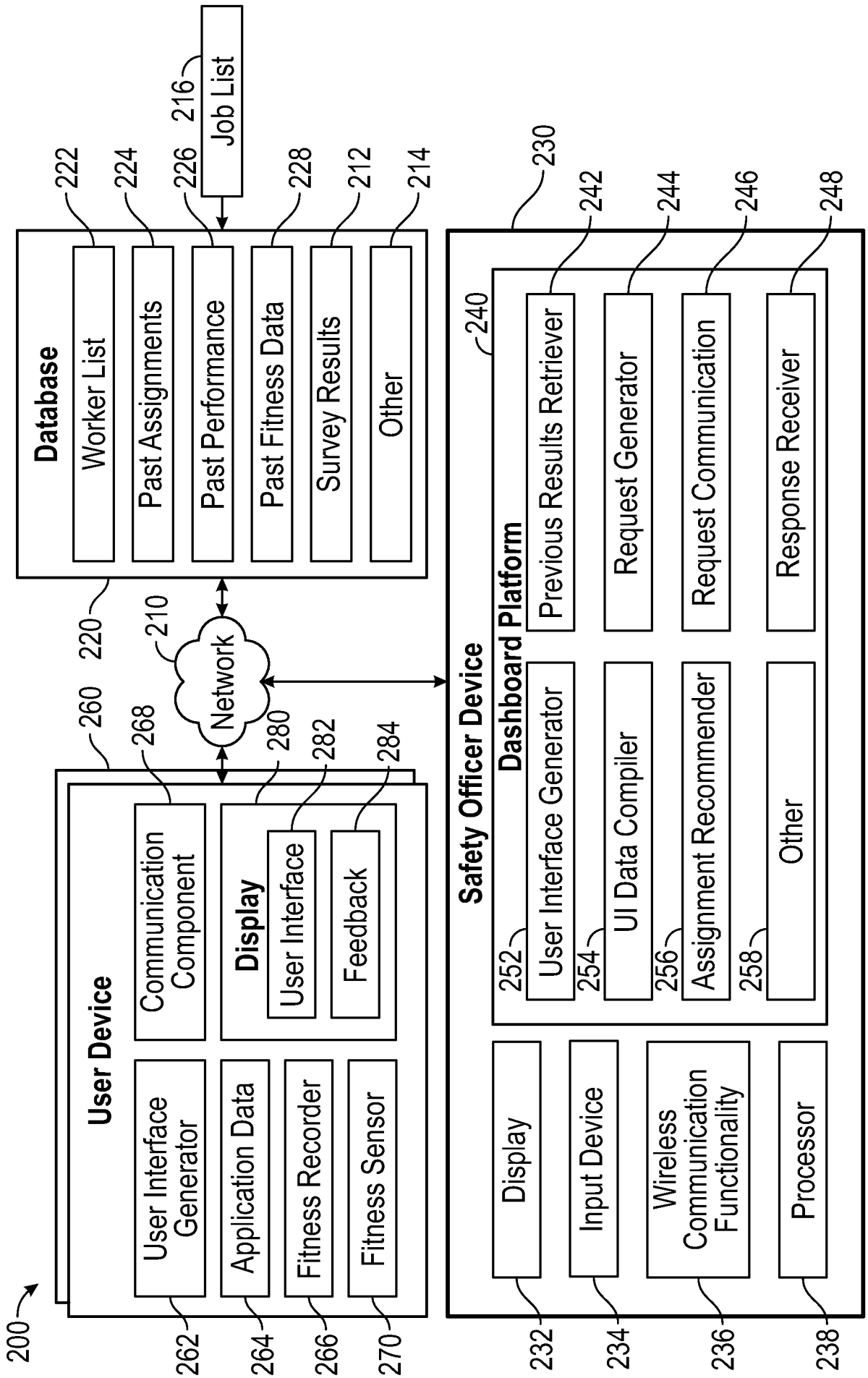

200
User Device
260
Communication Component
268
Display
280
User Interface
282
Feedback
284
User Interface Generator
262
Application Data
264
Fitness Recorder
266
Fitness Sensor
270
Network
210
220
Database
Worker List
222
Past Assignments
224
Past Performance
226
Past Fitness Data
228
Survey Results
212
Other
214
Job List
216
Safety Officer Device
230
Dashboard Platform
240
User Interface Generator
252
UI Data Compiler
254
Assignment Recommender
256
Other
258
Previous Results Retriever
242
Request Generator
244
Request Communication
246
Response Receiver
248
Display
232
Input Device
234
Wireless Communication Functionality
236
Processor
238

FIG. 3

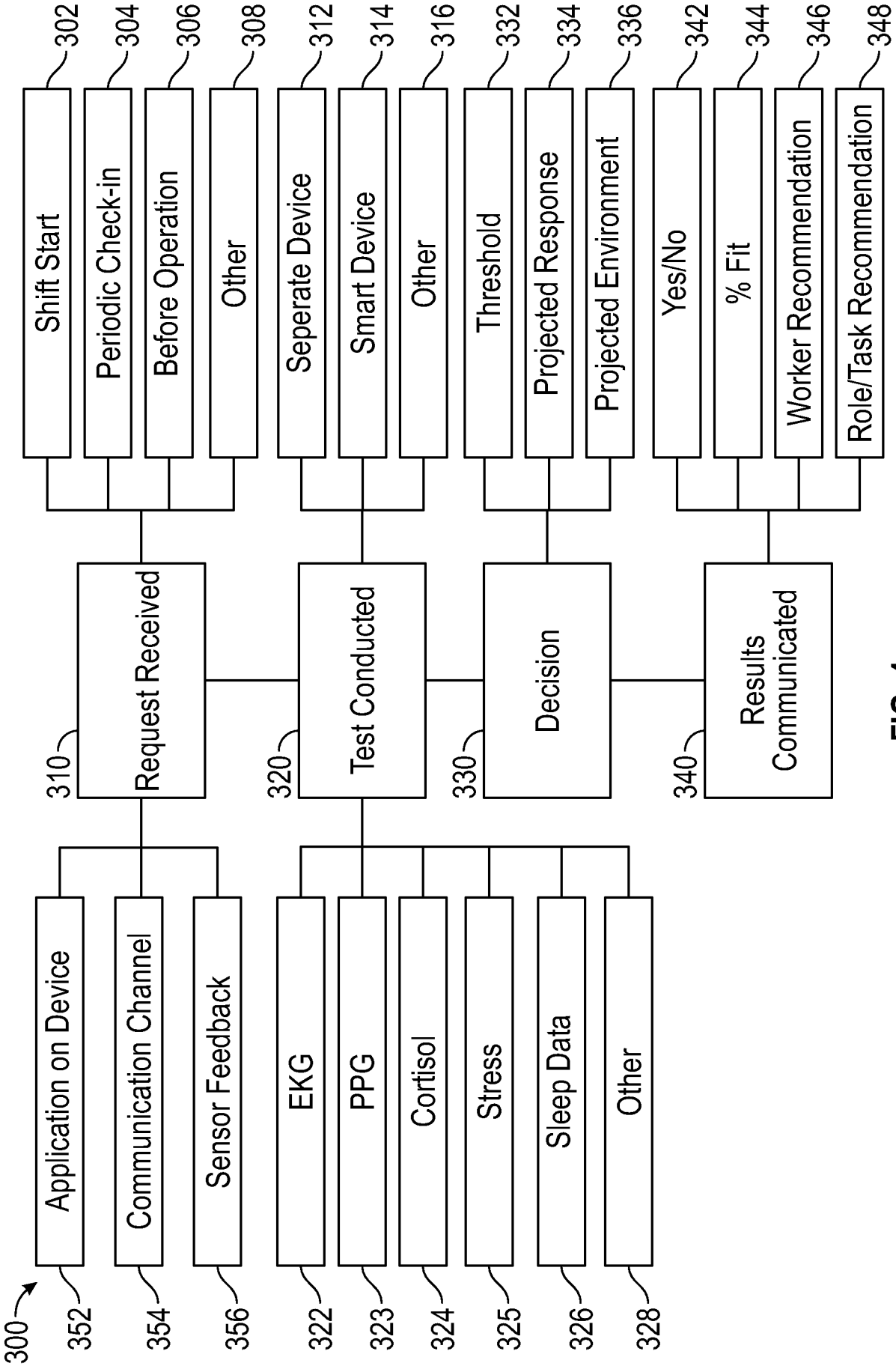

300
352
Application on Device
354
Communication Channel
356
Sensor Feedback
322
EKG
323
PPG
324
Cortisol
325
Stress
326
Sleep Data
328
Other
310
Request Received
320
Test Conducted
330
Decision
340
Results Communicated
302
Shift Start
304
Periodic Check-in
306
Before Operation
308
Other
312
Seperate Device
314
Smart Device
316
Other
332
Threshold
334
Projected Response
336
Projected Environment
342
Yes/No
344
% Fit
346
Worker Recommendation
348
Role/Task Recommendation

FIG. 4

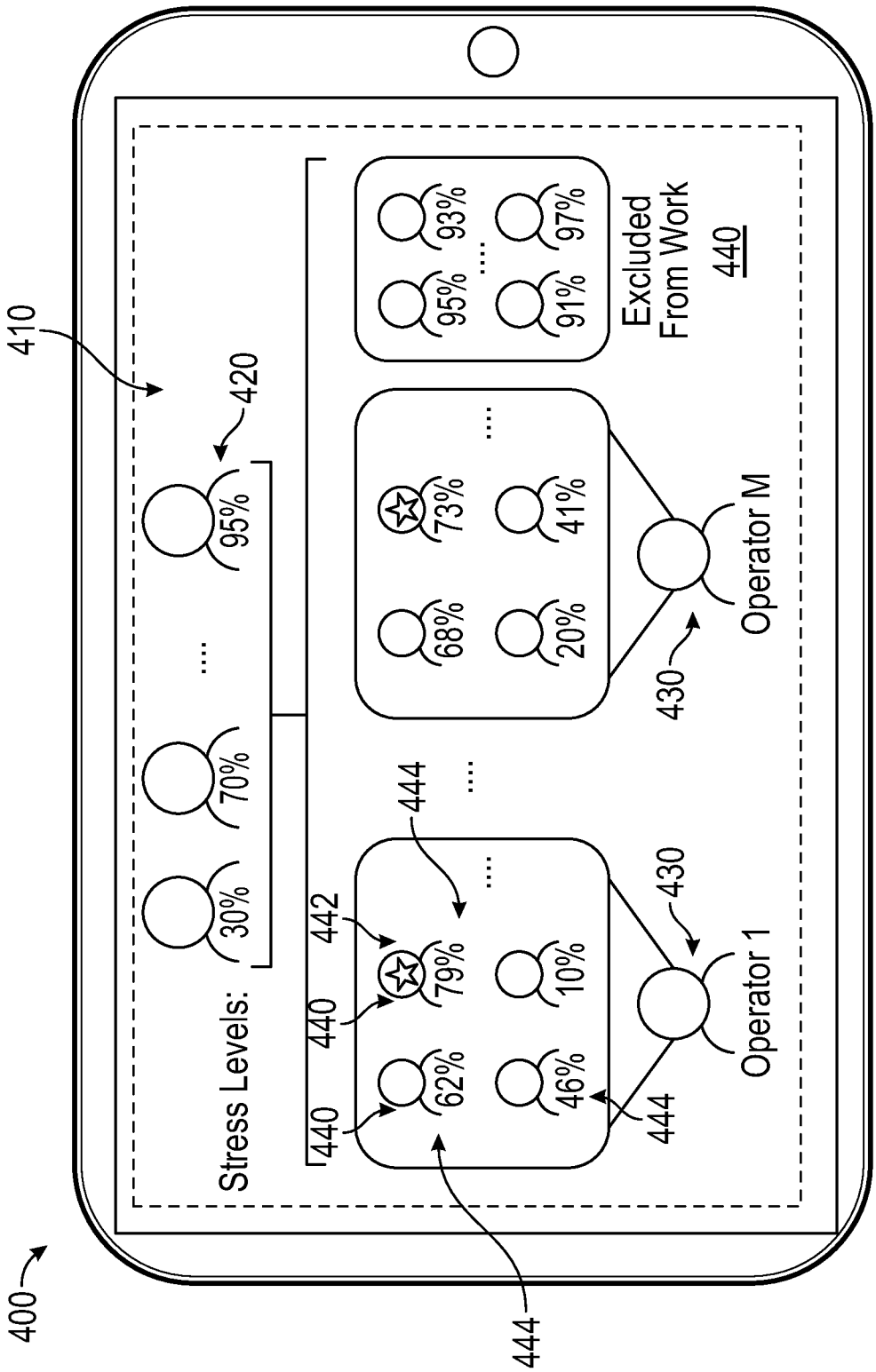

400
410
420
Stress Levels:
95%
70%
30%
440
442
444
62%
79%
10%
46%
Operator 1
430
444
68%
73%
41%
20%
Operator M
430
Excluded From Work
440
95%
93%
91%
97%
444

FIG. 5

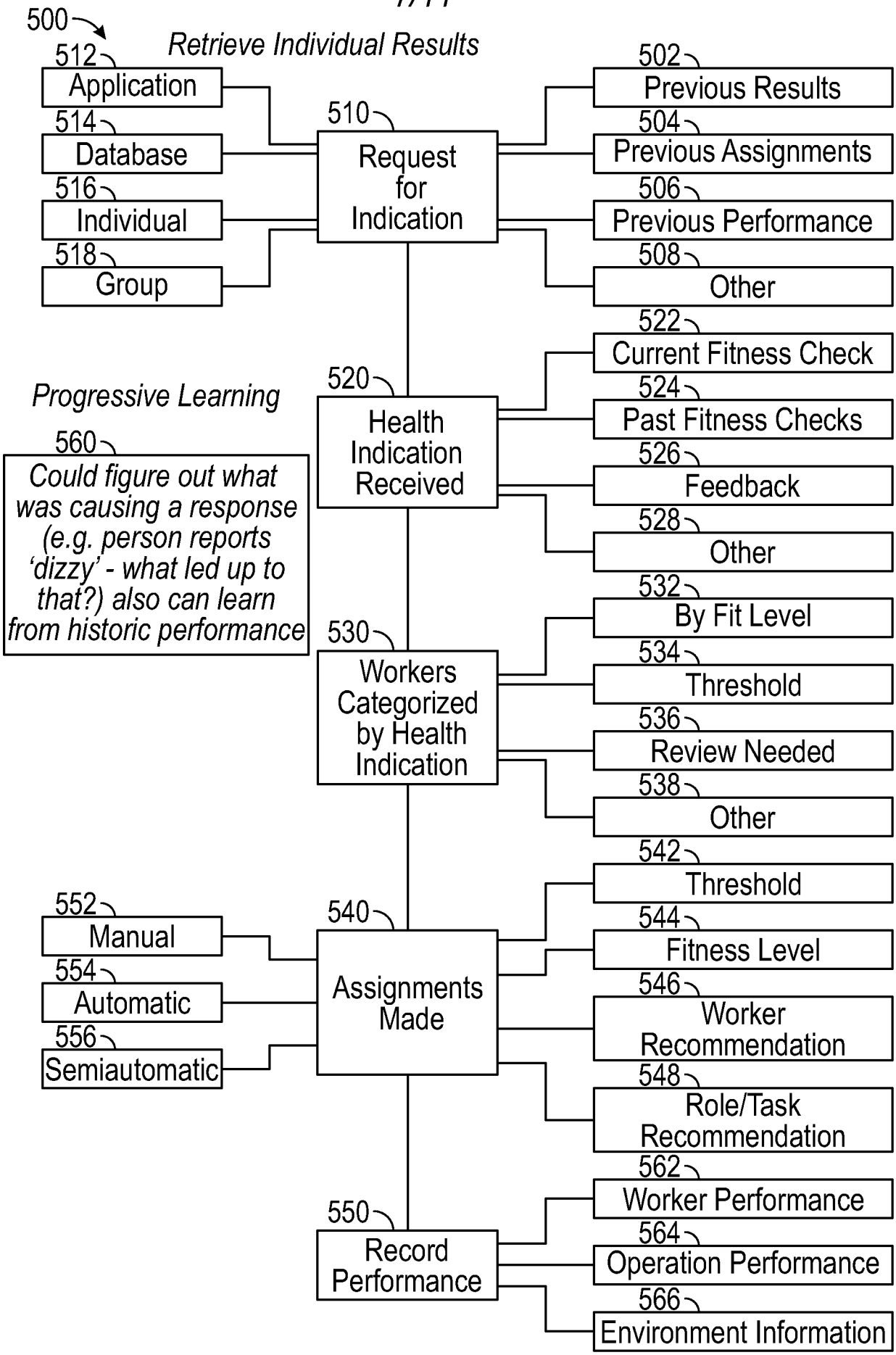

500
Retrieve Individual Results
512
Application
514
Database
516
Individual
518
Group
510
Request for Indication
502
Previous Results
504
Previous Assignments
506
Previous Performance
508
Other
Progressive Learning
560
Could figure out what was causing a response (e.g. person reports 'dizzy' - what led up to that?) also can learn from historic performance
520
Health Indication Received
522
Current Fitness Check
524
Past Fitness Checks
526
Feedback
528
Other
530
Workers Categorized by Health Indication
532
By Fit Level
534
Threshold
536
Review Needed
538
Other
552
Manual
554
Automatic
556
Semiautomatic
540
Assignments Made
542
Threshold
544
Fitness Level
546
Worker Recommendation
548
Role/Task Recommendation
550
Record Performance
562
Worker Performance
564
Operation Performance
566
Environment Information

FIG. 6

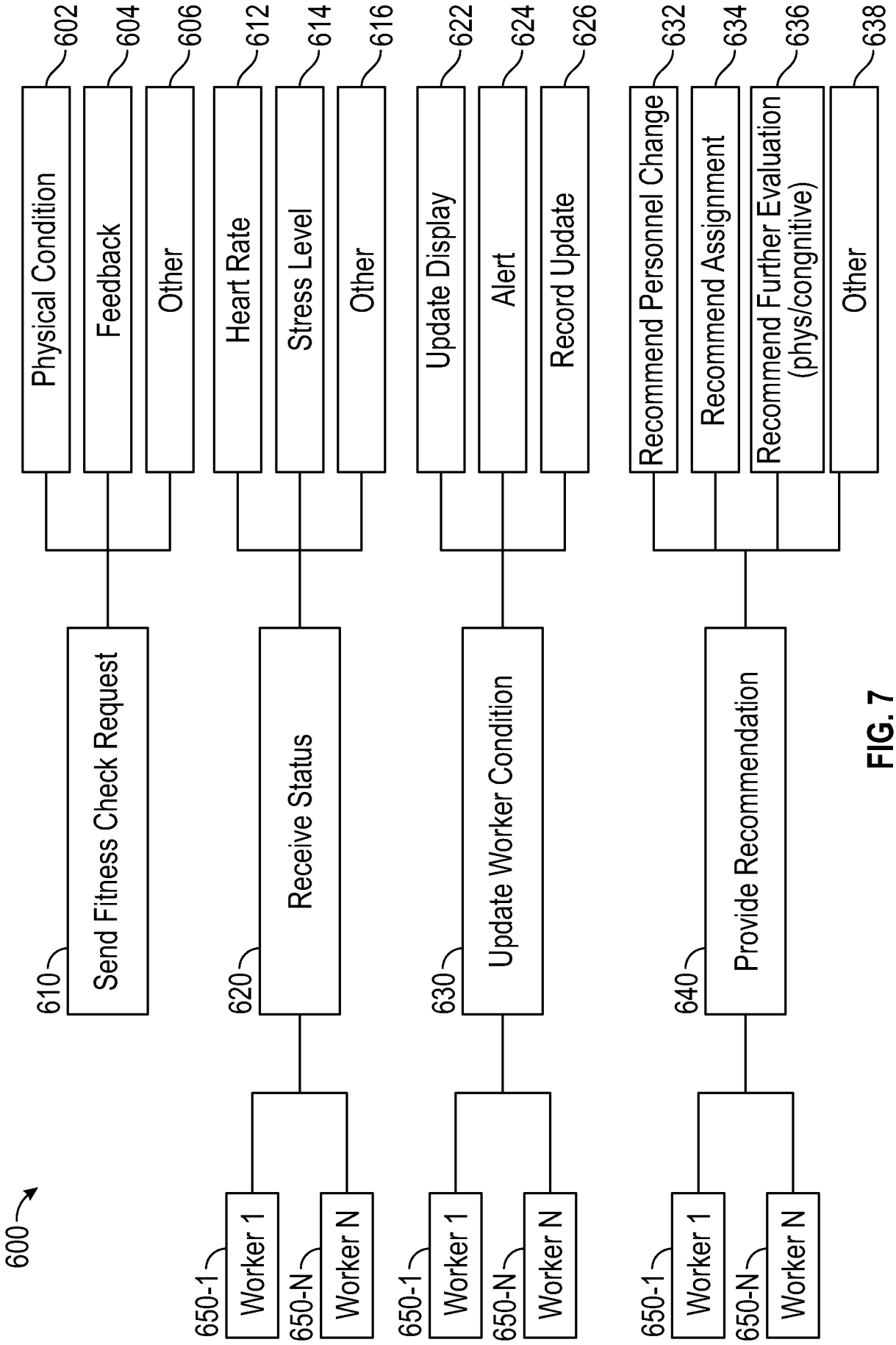

600
610
Send Fitness Check Request
620
Receive Status
630
Update Worker Condition
640
Provide Recommendation
650-1
Worker 1
650-N
Worker N
602
Physical Condition
604
Feedback
606
Other
612
Heart Rate
614
Stress Level
616
Other
622
Update Display
624
Alert
626
Record Update
632
Recommend Personnel Change
634
Recommend Assignment
636
Recommend Further Evaluation (phys/congnitive)
638
Other

FIG. 7

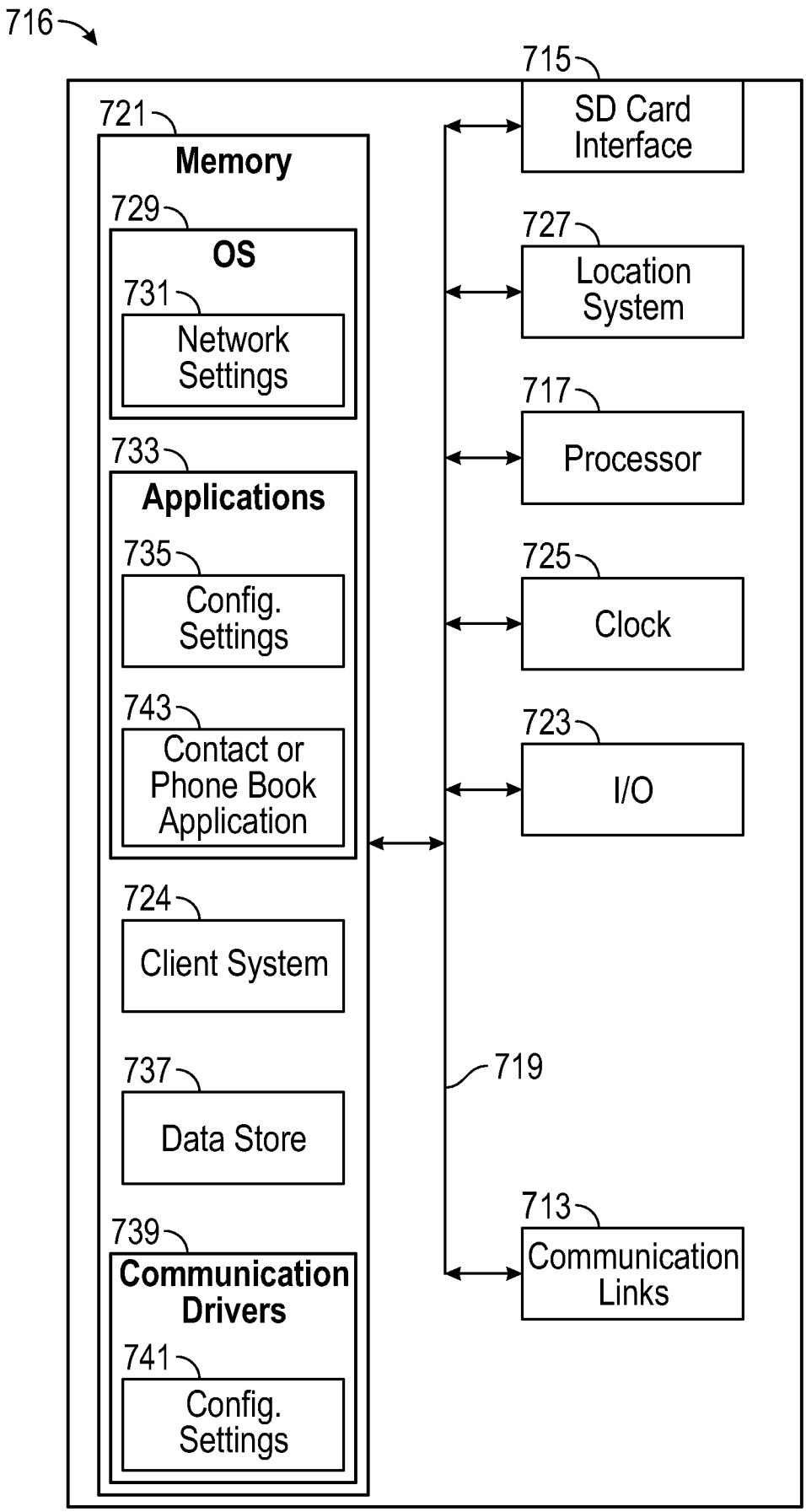

716
715
SD Card Interface
721
Memory
729
OS
731
Network Settings
727
Location System
717
Processor
733
Applications
735
Config. Settings
725
Clock
743
Contact or Phone Book Application
723
I/O
724
Client System
719
737
Data Store
713
Communication Links
739
Communication Drivers
741
Config. Settings

FIG. 8

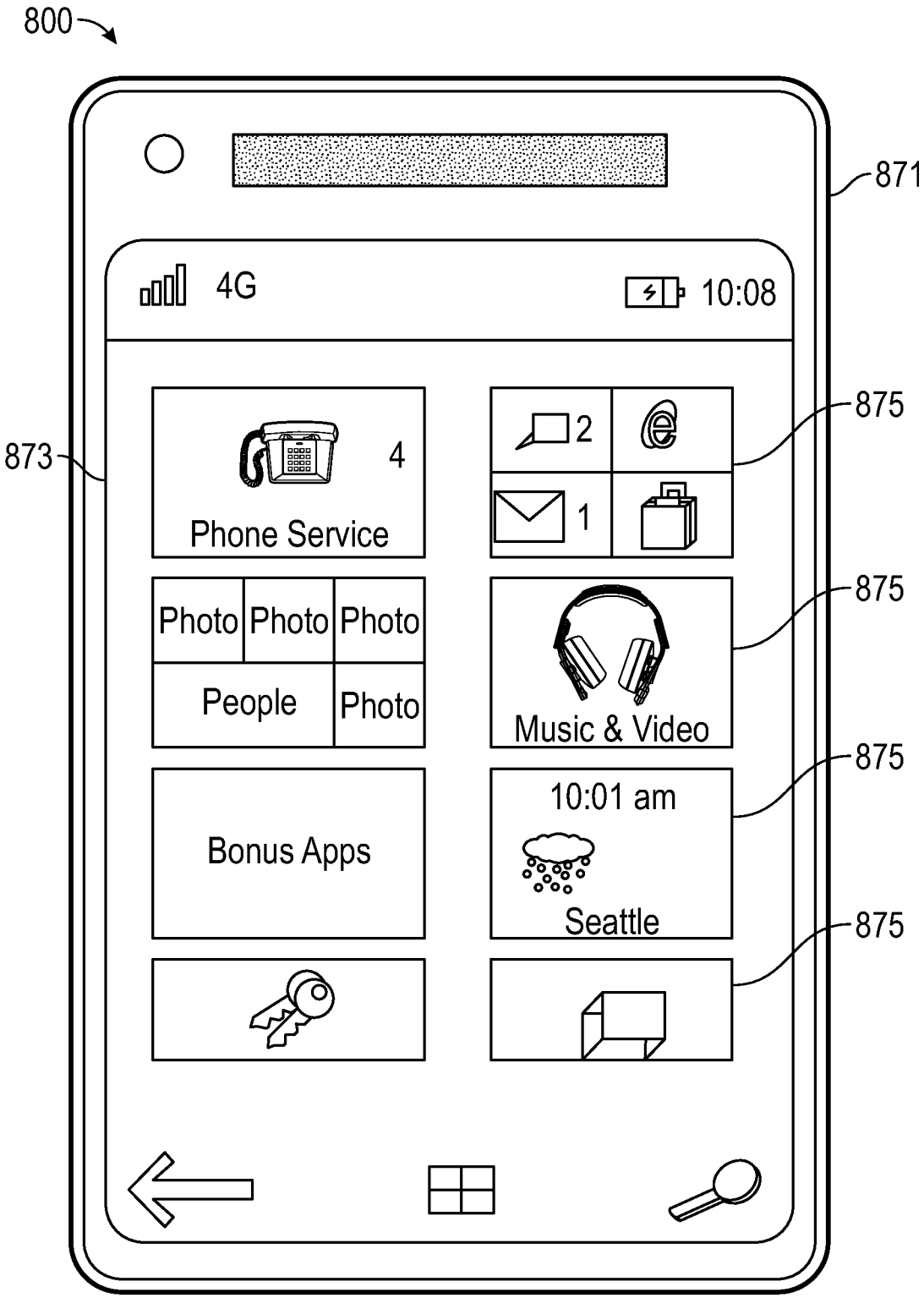

800
871
4G
10:08
873
4
Phone Service
2
1
875
Photo
Photo
Photo
People
Photo
Music & Video
875
Bonus Apps
10:01 am
Seattle
875
875

FIG. 9

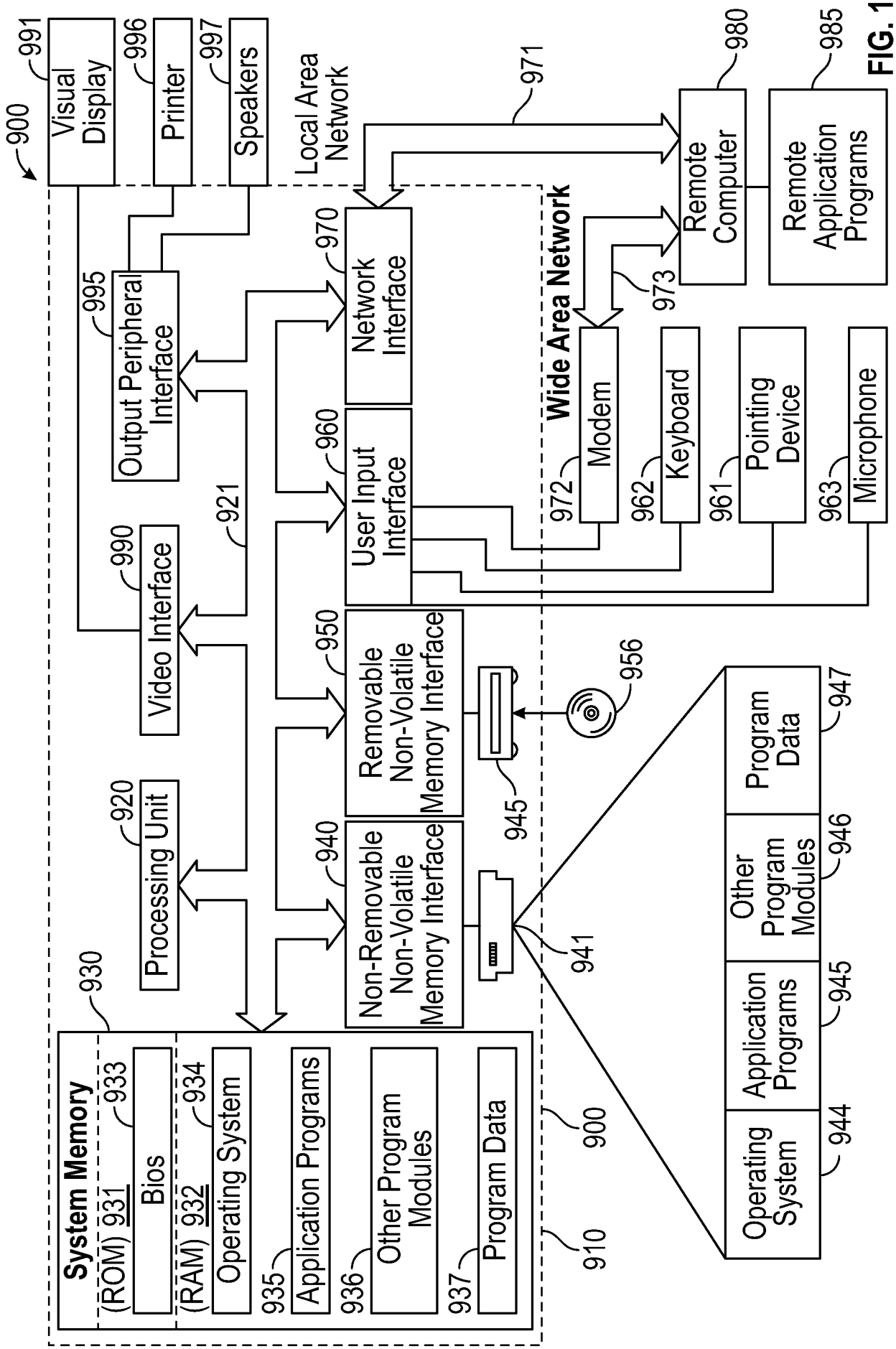

900
991
Visual Display
996
Printer
997
Speakers
Local Area Network
971
980
Remote Computer
985
Remote Application Programs
995
Output Peripheral Interface
970
Network Interface
Wide Area Network
973
960
User Input Interface
972
Modem
962
Keyboard
961
Pointing Device
963
Microphone
990
Video Interface
921
950
Removable Non-Volatile Memory Interface
956
945
920
Processing Unit
940
Non-Removable Non-Volatile Memory Interface
941
930
System Memory
(ROM) 931
933
Bios
(RAM) 932
934
Operating System
935
Application Programs
936
Other Program Modules
937
Program Data
900
910
947
Program Data
946
Other Program Modules
945
Application Programs
944
Operating System

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2021/052808

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06Q10/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06Q G08B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2018/033279 A1 (CHONG JAMES WEI WENG [SG] ET AL) 1 February 2018 (2018-02-01) abstract paragraphs [0002], [0003], [0012], [0014] - [0015], [0019] - [0024], [0083] -----	1-41

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 June 2021	09/07/2021

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Moltenbrey, Michael

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2021/052808

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2018033279 A1	01-02-2018	US 2018033279 A1	01-02-2018
		US 2018151049 A1	31-05-2018