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Slavin et al.

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(54) **SAFETY MONITORING PLATFORM**

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(Continued)

(51) **Int. Cl.**
A61B 5/00 (2006.01)
A61B 5/01 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G08B 21/0453*** (2013.01); ***A61B 5/002*** (2013.01); ***A61B 5/0022*** (2013.01); ***A61B 5/0071*** (2013.01); ***A61B 5/01*** (2013.01); ***A61B 5/02055*** (2013.01); ***A61B 5/14542*** (2013.01); ***A61B 5/443*** (2013.01); ***A61B 5/681*** (2013.01); ***A61B 5/747*** (2013.01); ***A61B 7/04*** (2013.01); ***G08B 21/043*** (2013.01); ***G08B 21/0423*** (2013.01); ***G08B 21/0446*** (2013.01); ***G08B 25/016*** (2013.01); ***G08B 25/10*** (2013.01); ***H04L 67/306*** (2013.01); ***H04W 4/02*** (2013.01); ***H04W 4/38*** (2018.02); *A61B 5/021* (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC A61B 5/002; A61B 5/0022; A61B 5/0071; A61B 5/01; A61B 5/02055; A61B 5/14542; A61B 5/443; A61B 5/681; G08B 21/0453; G08B 21/0446; H04L 67/306
See application file for complete search history.

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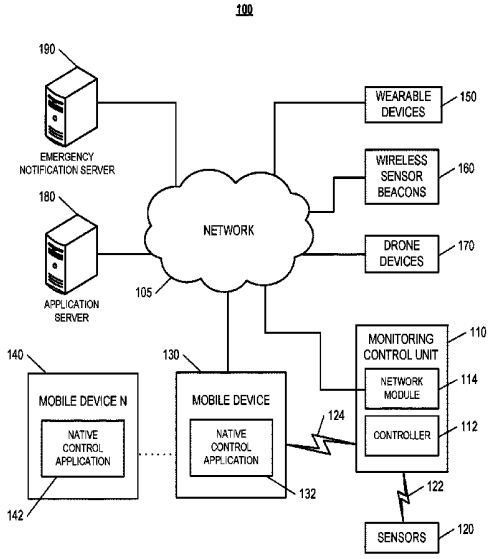
Assistant Examiner — Mancil Littlejohn, Jr.
(74) *Attorney, Agent, or Firm* — Fish & Richardson P.C.

(57) **ABSTRACT**

In some implementations, a system can transmit communications indicating an occurrence of a particular type of safety incident experienced by a user. Registration information that indicates that a plurality of safety devices of different types are to be registered with the user is initially obtained. Sensor data from the plurality of safety devices of different types are obtained. An occurrence of a particular type of safety incident experienced by the user is then selected from among a plurality of types of safety incidents. The selection may be based at least on the obtained sensor data and the obtained registration information. A communication is then provided to another user to indicate the occurrence of the particular type of safety incident experienced by the user in response to selecting the occurrence of the particular type of safety incident.

19 Claims, 9 Drawing Sheets



Related U.S. Application Data

(60) Provisional application No. 62/205,879, filed on Aug. 17, 2015.

(51) **Int. Cl.**

A61B 5/08	(2006.01)
A61B 7/04	(2006.01)
H04W 4/02	(2018.01)
H04W 4/38	(2018.01)
A61B 5/021	(2006.01)
A61B 5/024	(2006.01)
A61B 5/145	(2006.01)
G08B 21/04	(2006.01)
G08B 25/01	(2006.01)
G08B 25/10	(2006.01)
H04L 29/08	(2006.01)
A61B 5/0205	(2006.01)

(52) **U.S. Cl.**

CPC *A61B 5/024* (2013.01); *A61B 5/08* (2013.01); *A61B 2562/0219* (2013.01)

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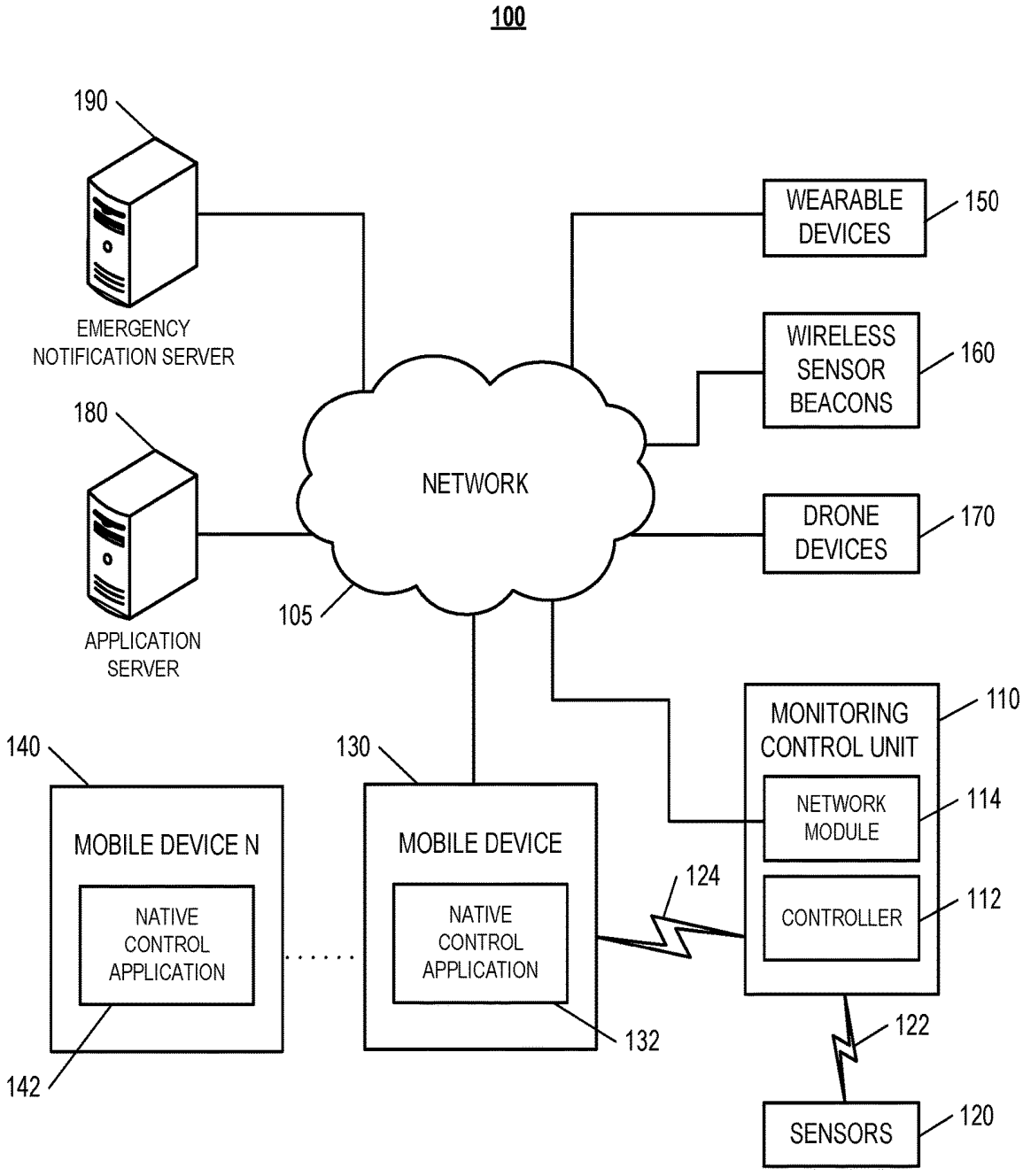
100
190
EMERGENCY NOTIFICATION SERVER
180
APPLICATION SERVER
NETWORK
105
WEARABLE DEVICES
150
WIRELESS SENSOR BEACONS
160
DRONE DEVICES
170
MONITORING CONTROL UNIT
110
NETWORK MODULE
114
CONTROLLER
112
122
SENSORS
120
124
140
MOBILE DEVICE N
NATIVE CONTROL APPLICATION
142
130
MOBILE DEVICE
NATIVE CONTROL APPLICATION
132

FIG. 1

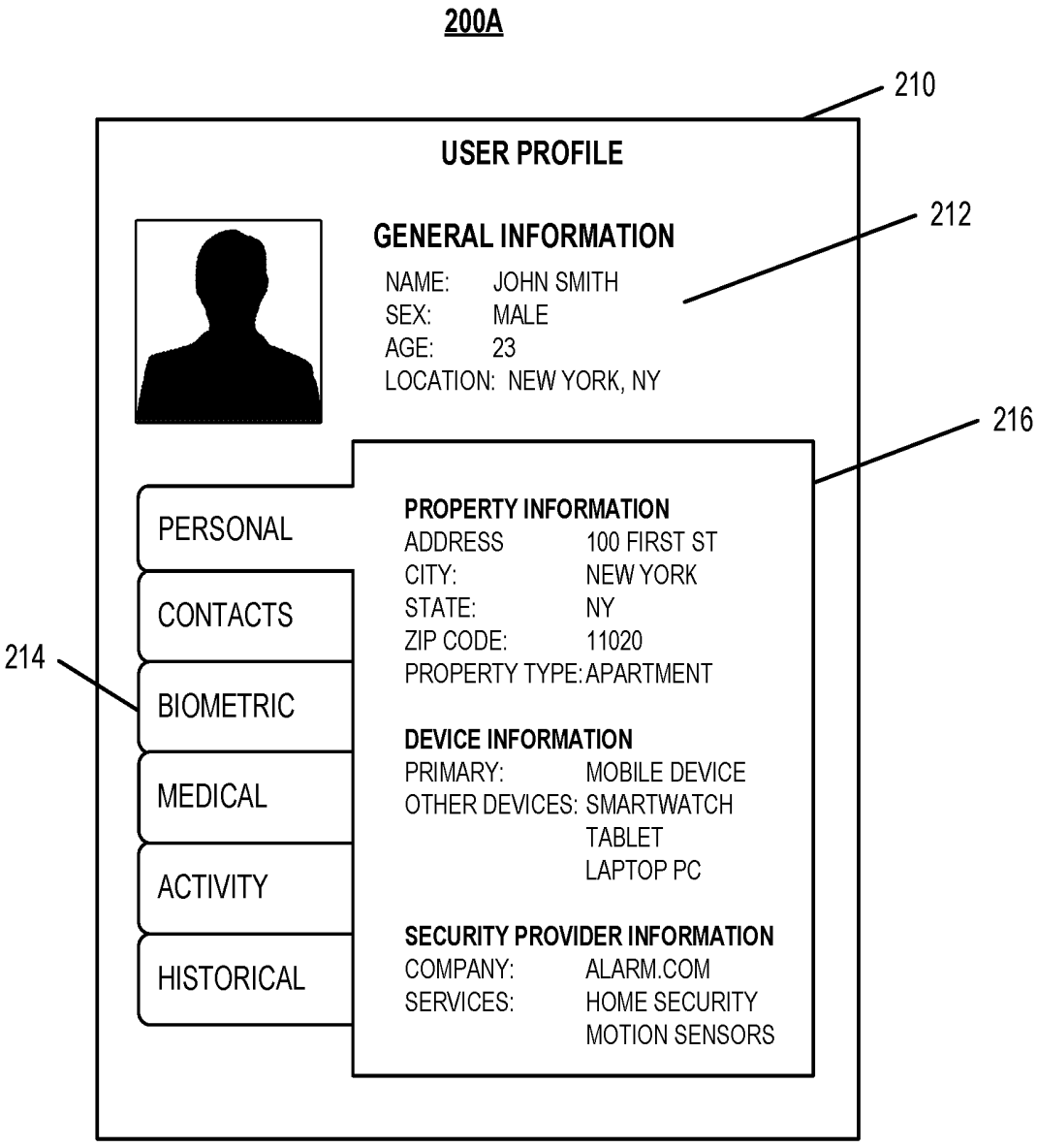
200A
210
USER PROFILE
212
GENERAL INFORMATION
NAME: JOHN SMITH
SEX: MALE
AGE: 23
LOCATION: NEW YORK, NY
216
214
PERSONAL
CONTACTS
BIOMETRIC
MEDICAL
ACTIVITY
HISTORICAL
PROPERTY INFORMATION
ADDRESS 100 FIRST ST
CITY: NEW YORK
STATE: NY
ZIP CODE: 11020
PROPERTY TYPE: APARTMENT
DEVICE INFORMATION
PRIMARY: MOBILE DEVICE
OTHER DEVICES: SMARTWATCH
TABLET
LAPTOP PC
SECURITY PROVIDER INFORMATION
COMPANY: ALARM.COM
SERVICES: HOME SECURITY
MOTION SENSORS

FIG. 2A

200B

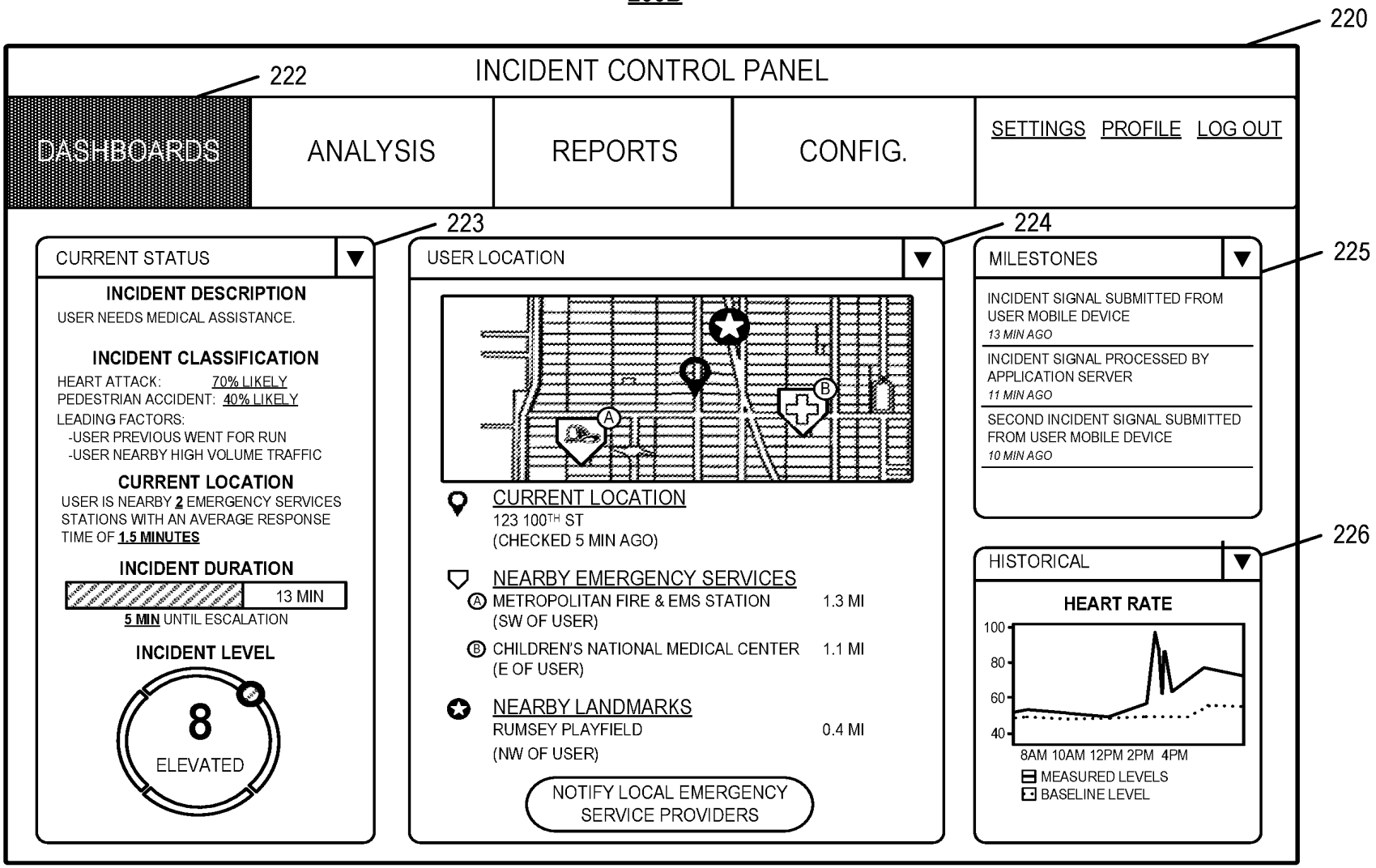
220
INCIDENT CONTROL PANEL
222
DASHBOARDS
ANALYSIS
REPORTS
CONFIG.
SETTINGS PROFILE LOG OUT
223
CURRENT STATUS
INCIDENT DESCRIPTION
USER NEEDS MEDICAL ASSISTANCE.
INCIDENT CLASSIFICATION
HEART ATTACK: 70% LIKELY
PEDESTRIAN ACCIDENT: 40% LIKELY
LEADING FACTORS:
-USER PREVIOUS WENT FOR RUN
-USER NEARBY HIGH VOLUME TRAFFIC
CURRENT LOCATION
USER IS NEARBY 2 EMERGENCY SERVICES STATIONS WITH AN AVERAGE RESPONSE TIME OF 1.5 MINUTES
INCIDENT DURATION
13 MIN
5 MIN UNTIL ESCALATION
INCIDENT LEVEL
8
ELEVATED
224
USER LOCATION
A
B
CURRENT LOCATION
123 100TH ST
(CHECKED 5 MIN AGO)
NEARBY EMERGENCY SERVICES
A METROPOLITAN FIRE & EMS STATION 1.3 MI
(SW OF USER)
B CHILDREN'S NATIONAL MEDICAL CENTER 1.1 MI
(E OF USER)
NEARBY LANDMARKS
RUMSEY PLAYFIELD 0.4 MI
(NW OF USER)
NOTIFY LOCAL EMERGENCY SERVICE PROVIDERS
225
MILESTONES
INCIDENT SIGNAL SUBMITTED FROM USER MOBILE DEVICE
13 MIN AGO
INCIDENT SIGNAL PROCESSED BY APPLICATION SERVER
11 MIN AGO
SECOND INCIDENT SIGNAL SUBMITTED FROM USER MOBILE DEVICE
10 MIN AGO
226
HISTORICAL
HEART RATE
100
80
60
40
8AM 10AM 12PM 2PM 4PM
MEASURED LEVELS
BASELINE LEVEL

FIG. 2B

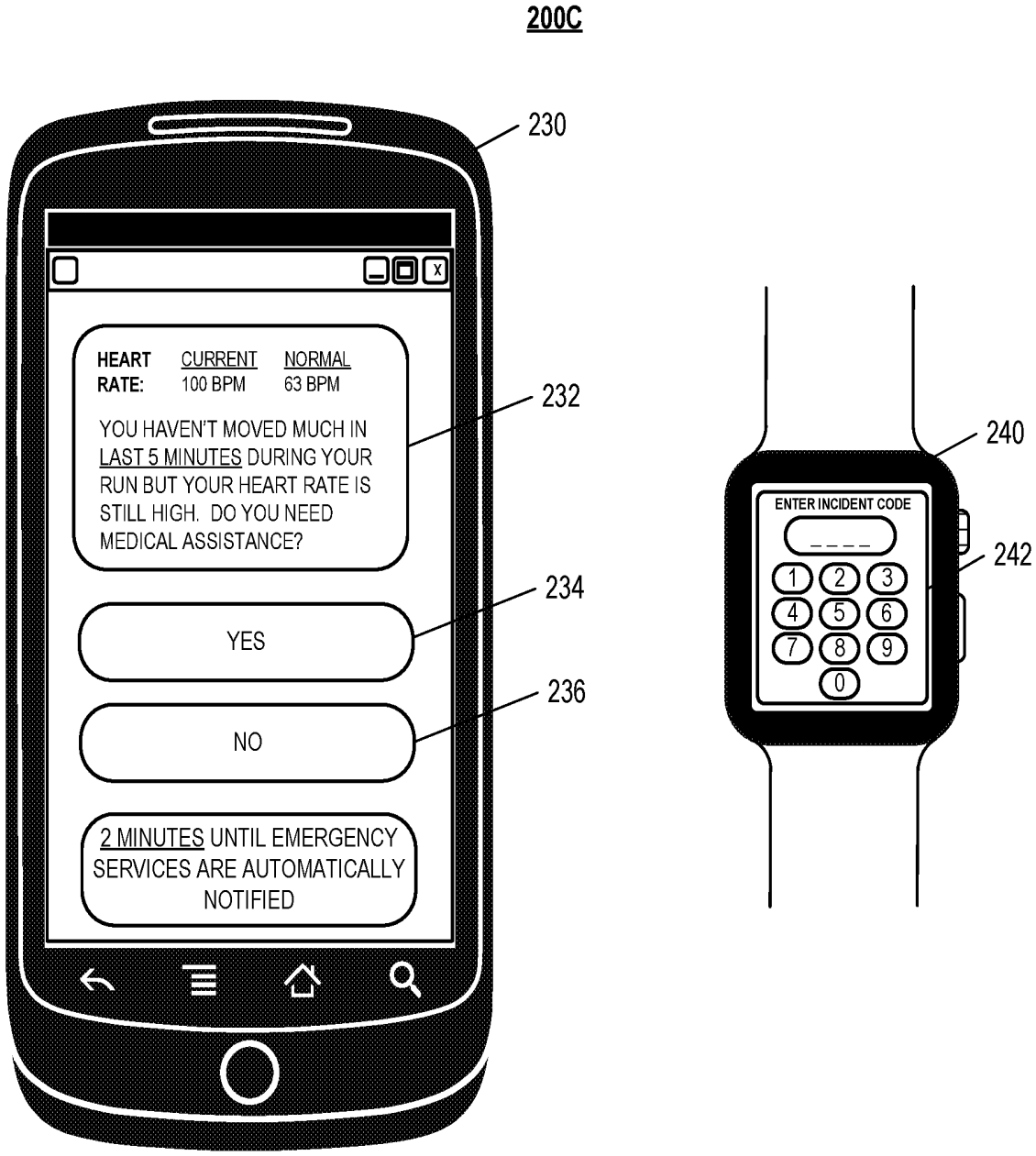
200C
230
HEART RATE:
CURRENT
100 BPM
NORMAL
63 BPM
YOU HAVEN'T MOVED MUCH IN LAST 5 MINUTES DURING YOUR RUN BUT YOUR HEART RATE IS STILL HIGH. DO YOU NEED MEDICAL ASSISTANCE?
232
YES
234
NO
236
2 MINUTES UNTIL EMERGENCY SERVICES ARE AUTOMATICALLY NOTIFIED
240
ENTER INCIDENT CODE
242
1 2 3
4 5 6
7 8 9
0

FIG. 2C

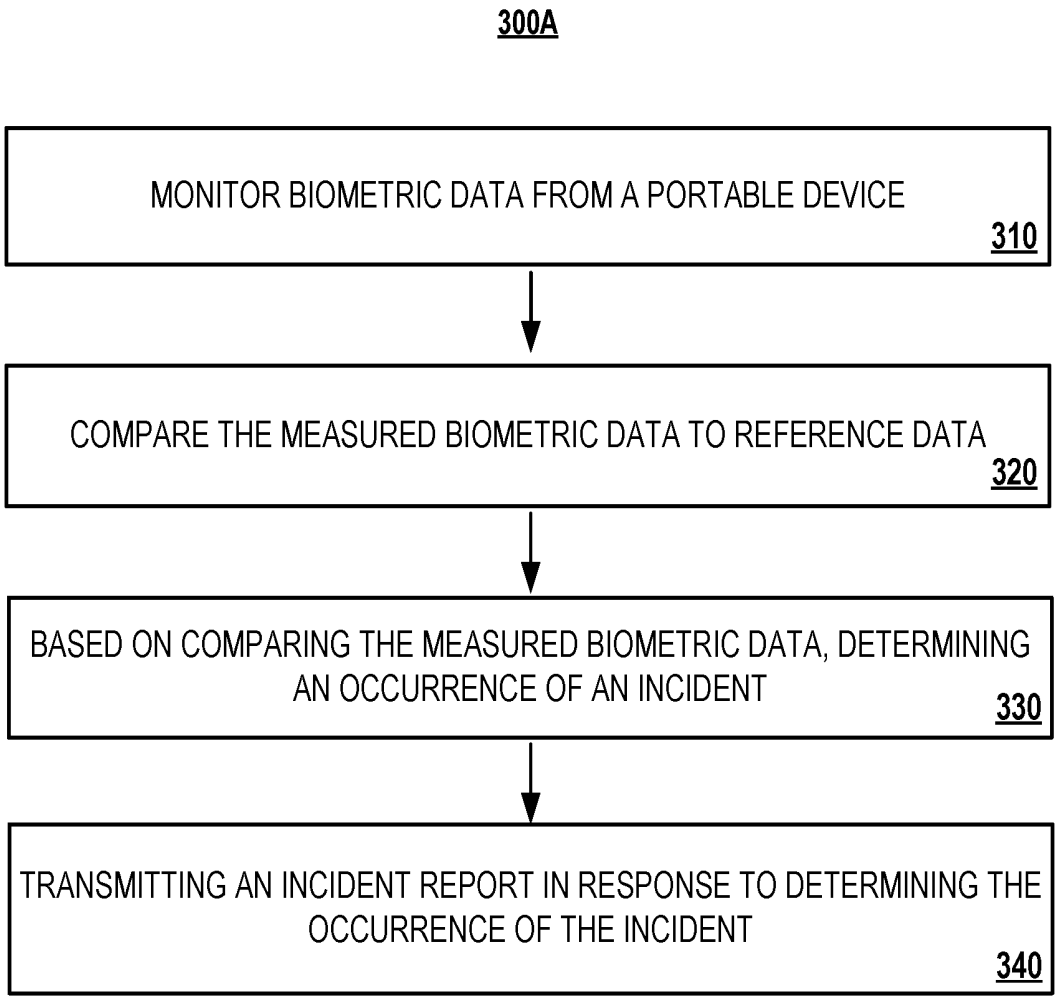
300A
MONITOR BIOMETRIC DATA FROM A PORTABLE DEVICE
310
COMPARE THE MEASURED BIOMETRIC DATA TO REFERENCE DATA
320
BASED ON COMPARING THE MEASURED BIOMETRIC DATA, DETERMINING AN OCCURRENCE OF AN INCIDENT
330
TRANSMITTING AN INCIDENT REPORT IN RESPONSE TO DETERMINING THE OCCURRENCE OF THE INCIDENT
340

FIG. 3A

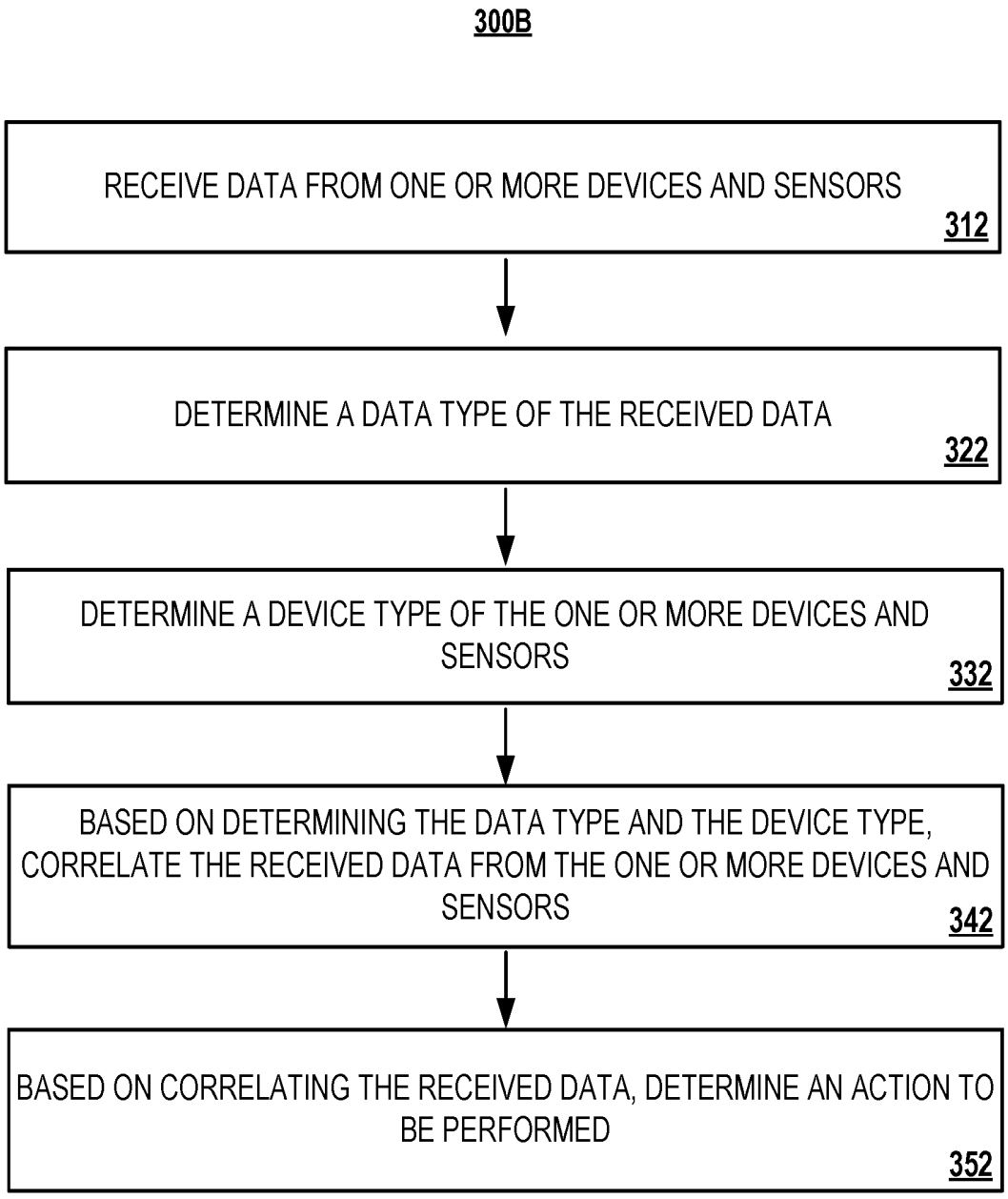
300B
RECEIVE DATA FROM ONE OR MORE DEVICES AND SENSORS
312
DETERMINE A DATA TYPE OF THE RECEIVED DATA
322
DETERMINE A DEVICE TYPE OF THE ONE OR MORE DEVICES AND SENSORS
332
BASED ON DETERMINING THE DATA TYPE AND THE DEVICE TYPE, CORRELATE THE RECEIVED DATA FROM THE ONE OR MORE DEVICES AND SENSORS
342
BASED ON CORRELATING THE RECEIVED DATA, DETERMINE AN ACTION TO BE PERFORMED
352

FIG. 3B

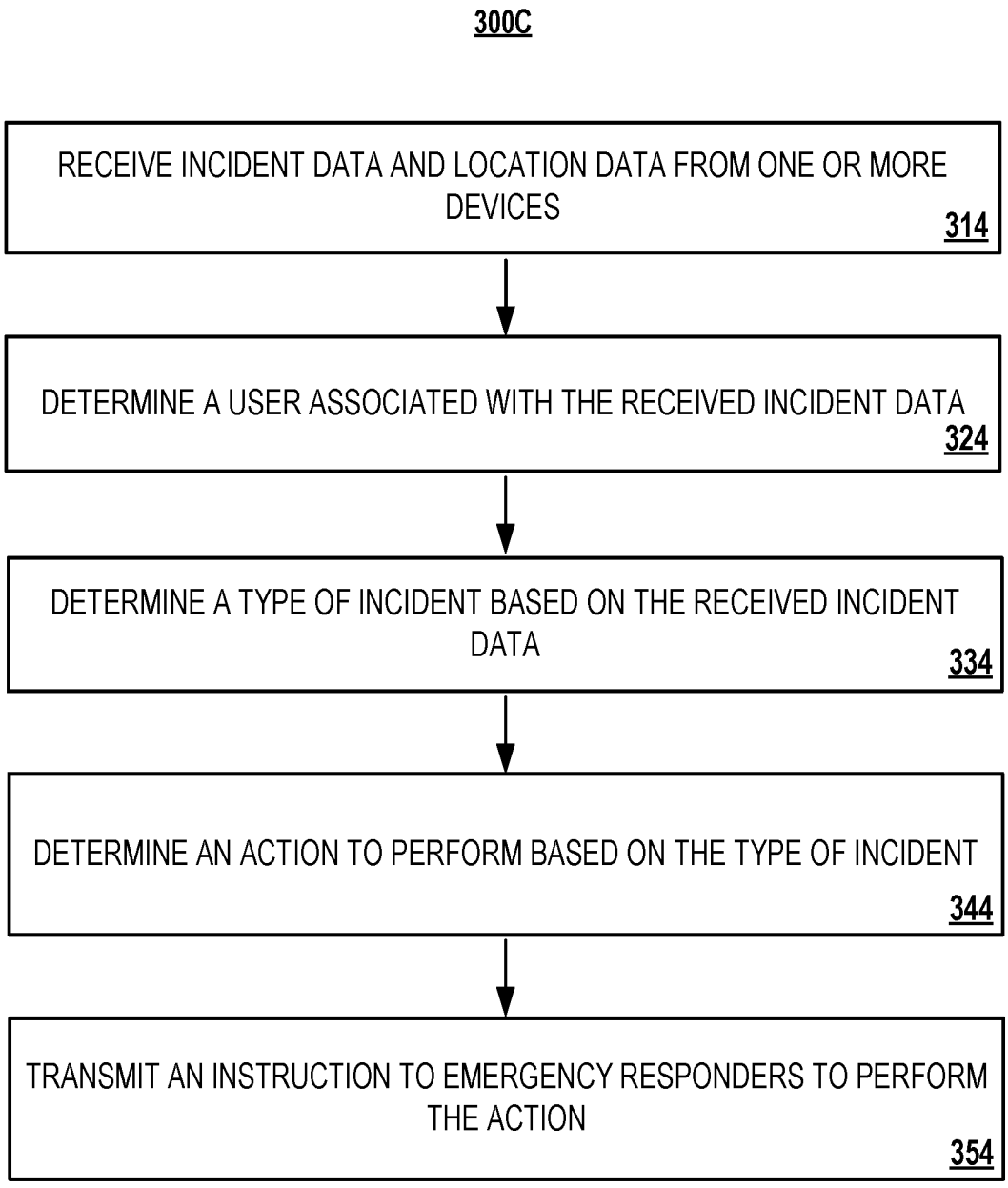
300C
RECEIVE INCIDENT DATA AND LOCATION DATA FROM ONE OR MORE DEVICES
314
DETERMINE A USER ASSOCIATED WITH THE RECEIVED INCIDENT DATA
324
DETERMINE A TYPE OF INCIDENT BASED ON THE RECEIVED INCIDENT DATA
334
DETERMINE AN ACTION TO PERFORM BASED ON THE TYPE OF INCIDENT
344
TRANSMIT AN INSTRUCTION TO EMERGENCY RESPONDERS TO PERFORM THE ACTION
354

FIG. 3C

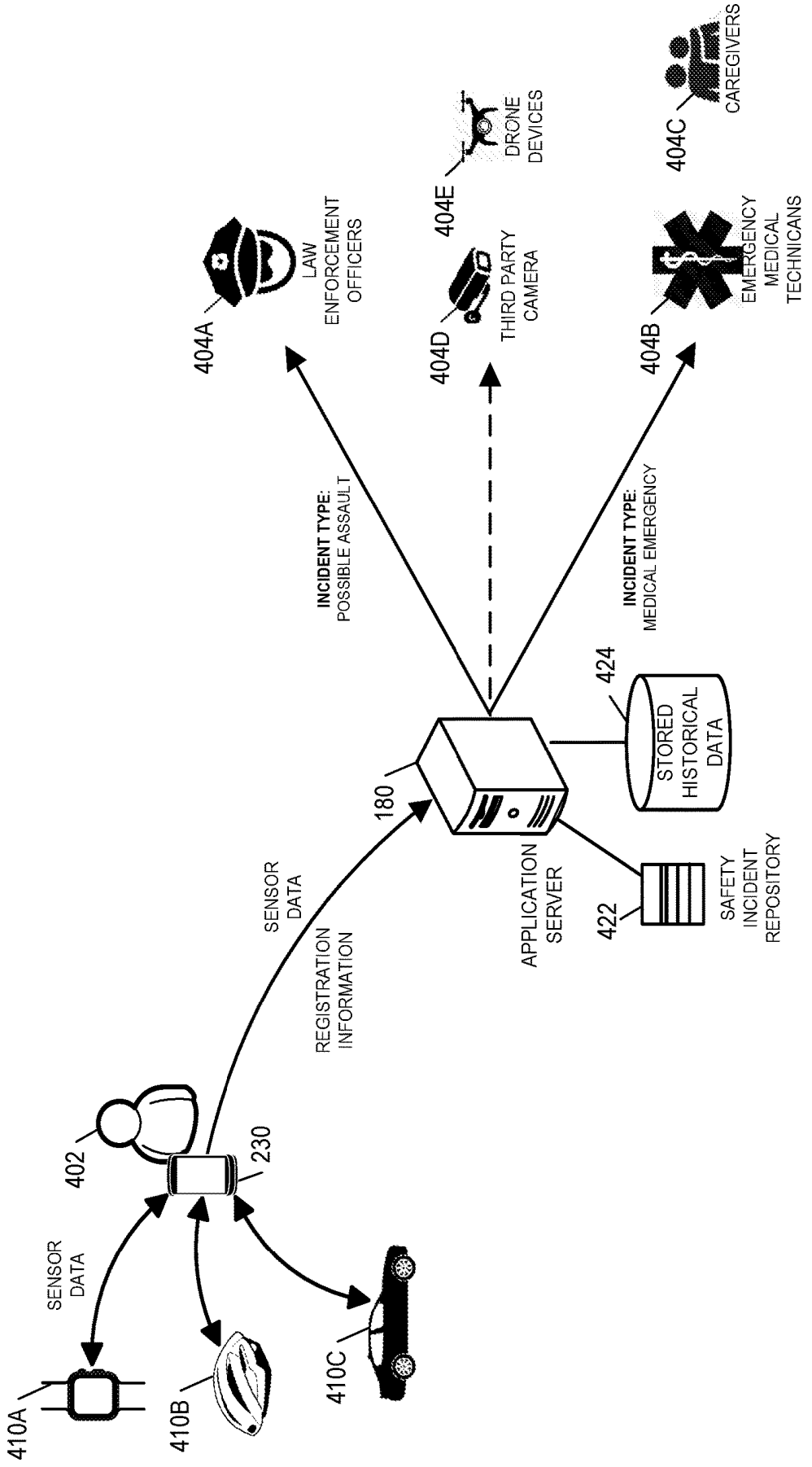
404A
LAW ENFORCEMENT OFFICERS
404E
DRONE DEVICES
404D
THIRD PARTY CAMERA
404C
CAREGIVERS
404B
EMERGENCY MEDICAL TECHNICANS
INCIDENT TYPE: POSSIBLE ASSAULT
INCIDENT TYPE: MEDICAL EMERGENCY
424
STORED HISTORICAL DATA
180
APPLICATION SERVER
422
SAFETY INCIDENT REPOSITORY
SENSOR DATA
REGISTRATION INFORMATION
402
230
SENSOR DATA
410A
410B
410C

FIG. 4

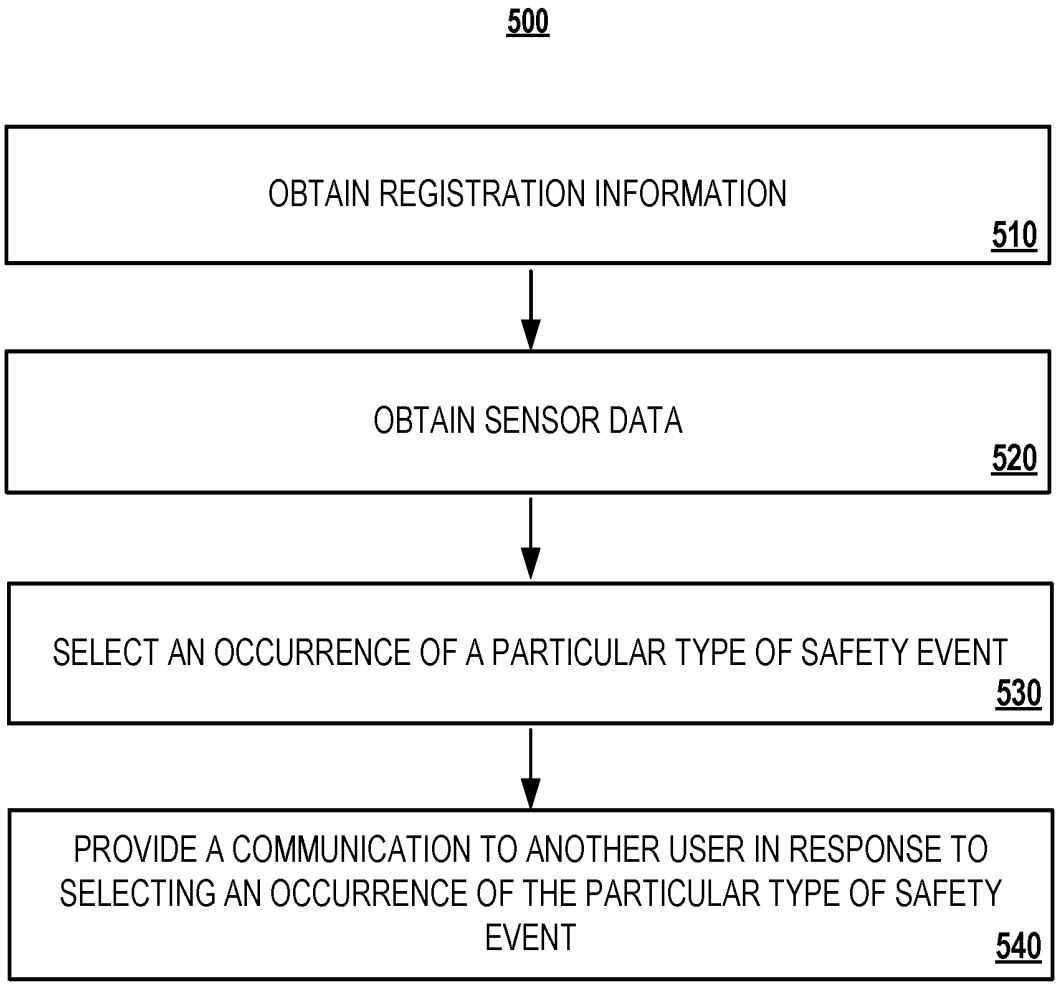
500
OBTAIN REGISTRATION INFORMATION
510
OBTAIN SENSOR DATA
520
SELECT AN OCCURRENCE OF A PARTICULAR TYPE OF SAFETY EVENT
530
PROVIDE A COMMUNICATION TO ANOTHER USER IN RESPONSE TO SELECTING AN OCCURRENCE OF THE PARTICULAR TYPE OF SAFETY EVENT
540

FIG. 5

SAFETY MONITORING PLATFORM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 15/235,590, filed on Aug. 12, 2016, now allowed, which claims the benefit of U.S. Provisional Patent Application No. 62/205,879 filed on Aug. 17, 2015, all which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

This disclosure relates to monitoring systems and, for example, portable safety monitoring.

BACKGROUND

Users may use mobile communication devices such as smartphones during emergencies. For example, a user may dial **911** to request emergency assistance during an emergency incident.

SUMMARY

Techniques are described for monitoring safety of users with a monitoring platform. The monitoring platform may receive sensor data from various sensors. The various sensor may include sensors that are wearable or incorporated into objects used by the user. For instance, a user may use a wearable device that measures biometric data of the user, a mobile computing device that tracks a user's location, and a bicycle with an embedded accelerometer that measures movement of the bicycle. The devices and sensors may report the measured data to the monitoring platform and the monitoring platform may receive the measured data and determine whether a safety incident has occurred. For example, the monitoring platform may **1** !receive heart rate information that indicates that a user's blood pressure is rapidly lowering, location information that indicates a user is not moving, and accelerometer data that indicates that a user's bicycle suddenly stopped. In response, the monitoring platform may determine that the user is likely to have had a bicycling accident and be seriously injured. In response to determining that a safety issue has likely occurred, the monitoring platform may notify other users or emergency responders. For example, in response to determining that a user is likely to have had a bicycling accident and be seriously injured, the monitoring platform may transmit data to emergency responders indicating that a user is likely to have had a bicycling accident and be seriously injured, the measured data, a location of the user, and a user profile with a photo of the user and past medical information of the user.

Implementations of the described techniques may include hardware, a method or process implemented at least partially in hardware, or a computer-readable storage medium encoded with executable instructions that, when executed by a processor, perform operations.

The details of one or more implementations are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings.

DESCRIPTION OF DRAWINGS

FIG. **1** illustrates an example of a system.

FIGS. **2**A-**2**C illustrate examples of user interfaces in a safety monitoring platform.

FIGS. **3**A-**3**C illustrate examples of processes for detecting safety incidents.

FIG. **4** illustrates examples of transmission sequences for a detected occurrence of a particular type of safety incident experienced by a user.

FIG. **5** illustrates an example of a process for providing communications indicating an occurrence of a particular type of safety incident experienced by a user.

DETAILED DESCRIPTION

FIG. **1** illustrates an example of a monitoring platform **100** that may be configured to monitor safety of users. The monitoring platform **100** may include a network **105**, a monitoring control unit **110**, sensors **120**, one or more mobile devices **130**, **140**, wearable devices **150**, one or more beacons **160**, drone devices **170**, an application server **180**, and an emergency notification server **190**. The network **105** may be configured to enable electronic communications between devices connected to the network **105**. For example, the network **105** may be configured to enable exchange of electronic communications between the monitoring control unit **110**, the sensors **120**, the one or more mobile devices **130**, **140**, the wearable devices **150**, the one or more beacons **160**, the drone devices **170**, the application server **180**, and the emergency notification server **190**.

The network **105** may include, for example, one or more of the Internet, Wide Area Networks (WANs), Local Area Networks (LANs), e.g., Wi-Fi, analog or digital wired and wireless telephone networks, e.g., a public switched telephone network (PSTN), Integrated Services Digital Network (ISDN), a cellular network, and Digital Subscriber Line (DSL), Ethernet, Internet Protocol (IP) over broadband, radio, television, cable, satellite, or any other delivery or tunneling mechanism for carrying data. The network **105** may include multiple networks or subnetworks, each of which may include, for example, a wired or wireless data pathway. The network **105** may also include a circuit-switched network, a packet-switched data network, or any other network able to carry electronic communications (e.g., data or voice communications). For example, the network **105** may include networks based on the Internet protocol (IP), asynchronous transfer mode (ATM), the PSTN, packet-switched networks based on IP, X.25, or Frame Relay, or other comparable technologies and may support voice using, for example, VoIP, or other comparable protocols used for voice communications. The network **105** may include one or more networks that include wireless data channels and wireless voice channels. The network **105** may also be a wireless network, a broadband network, or a combination of networks including a wireless network and a broadband network.

The monitoring control unit **110** may include a controller **112** and a network module **114**. The controller **112** may be configured to control a system, e.g., a home security system associated with a property that includes the monitoring control unit **110**. In some examples, the controller **112** may include a processor or other control circuitry configured to execute instructions of a program that controls operation of a home security system. In these examples, the controller **112** may be configured to receive input from sensors, detectors, or other devices associated with the home security

system, e.g., a motion sensor, a security camera, an occupancy sensor, or a thermostat. For example, the controller **112** may be configured to control operation of the network module **114** included in the monitoring control unit **110**.

The network module **114** may be a communication device configured to exchange communications over the network **105**. The network module **114** may be a wireless communication module configured to exchange wireless communications over the network **105**. For example, the network module **114** may be a wireless communication device configured to exchange communications over a wireless data channel. In this example, the network module **114** may transmit user location data within or external to the property, environmental data from the property, e.g., indoors at the property or outdoors at the property, or other data over a wireless data channel. The wireless communication device may include one or more GSM modules, a radio modem, a cellular transmission module, or any type of module configured to exchange communications in one of the following formats: GSM or GPRS, CDMA, EDGE or EGPRS, EV-DO or EVDO, UMTS, or IP.

The network module **114** also may be a wired communication module configured to exchange communications over the network **105** using a wired connection. For instance, the network module **114** may be a modem, a network interface card, or another type of network interface device. The network module **114** may be an Ethernet network card configured to enable the monitoring control unit **110** to communicate over a local area network and/or the Internet. The network module **114** also may be a voiceband modem configured to enable the alarm panel to communicate over the telephone lines of Plain Old Telephone Systems (POTS). In some implementations, the alarm panel may be a broadband or cellular gateway where the network module **114** may enable the monitoring control unit **110** to communicate over the network **105**.

The sensors **120** may include cameras, pressure sensors, temperature sensors, motion sensors, occupancy sensors, or device sensors that may communicate with the monitoring control unit **110** over the communication link **122**. For example, the sensors **120** may provide the monitoring control unit **110** sensor data indicating when users left a home, when users arrived home, what users are home, what users were doing before they left the home and an appearance of users when they left the home.

In other implementations, the sensors **120** may include motion sensors, pressure sensors, or other sensors that determine occupancy and usage of appliances/features within the property. For example, in one instance, motion and temperature sensors may be placed on the walls within a room to determine if a person is currently occupying or not occupying the room. In another instance, the sensors **120** may be placed on particular objects and/or appliances to monitor user activity and user safety within a property. For example, touch sensors may be placed on common appliances such as, for e.g., an oven, a stove, a blender, a space heater, which may cause personal injuries to users. In some implementations, the sensors **120** within the property may collect user activity data based on proximity with the wearable devices **150** to track user movement within the property. In another example, the sensors **120** may only collect user activity data when the user is located within property based on location data transmitted from the wearable devices **150** indicating that the user is within a particular distance (e.g., 5 meters) from the sensors **120**.

The one or more mobile devices **130**, **140** may be devices that host one or more native applications, e.g., the native applications **132**, **142**. The one or more mobile devices **130**, **140** may be cellular phones or non-cellular locally networked devices. The one or more mobile devices **130**, **140** may include a cell phone, a smart phone, a tablet PC, a personal digital assistant ("PDA"), or any other portable device configured to communicate over a network. For example, implementations also may include portable music players, other communication devices, and handheld or portable electronic devices for gaming, communications, and/or data organization. The one or more mobile devices **130**, **140** may be the same or may include mobile devices of different types. The one or more mobile devices **130**, **140** may perform functions unrelated to the monitoring platform **100**, such as placing personal telephone calls, playing music, playing video, displaying pictures, browsing the Internet, maintaining an electronic calendar, etc.

In some implementations, the one or more mobile devices **130**, **140** may communicate with and receive data from the monitoring control unit **110** using the communication link **124**. For instance, the one or more mobile devices **130**, **140** may communicate with the monitoring control unit **110** using various local wireless protocols, such as Wi-Fi, Bluetooth, Z-Wave, ZigBee, HomePlug (Ethernet over power line), or wired protocols such as Ethernet, USB, and other wired protocols based on the RS232, RS485, and/or RS422 standards. The one or more mobile devices **130**, **140** may connect locally to the monitoring platform **100**, its sensors, and other devices. The local connection may improve the speed of communications because communicating through the network **105** with a remote server, e.g., the application server **180**, may be slower.

Although the one or more mobile devices **130**, **140** are shown communicating with the monitoring control unit **110**, the one or more mobile devices **130**, **140** may communicate directly with the sensors **120**, the wearable devices **150**, the beacons **160**, the drone devices **170**, and other devices controlled by the monitoring control unit **110**. In some implementations, the one or more mobile devices **130**, **140** may replace the monitoring control unit **110** and perform the functions of the monitoring control unit **110** for local control and long range or offsite communication.

In other implementations, the one or more mobile devices **130**, **140** may receive data captured by the monitoring control unit **110** through the network **105**. The one or more mobile devices **130**, **140** may receive the data from the monitoring control unit **110** through the network **105** or the application server **180** and may relay data received from the monitoring control unit **110** to the one or more mobile devices **130**, **140** through the network **105**. In this regard, the application server **180** may facilitate communications between the one or more mobile devices **130**, **140** and the monitoring control unit **110**.

Although the one or more mobile devices **130**, **140** are shown in FIG. **1** as being connected to the network **105**, in some implementations, the one or more mobile devices **130**, **140** are not connected to the network **105**. In these implementations, the one or more mobile devices **130**, **140** may communicate directly with one or more of the monitoring platform **100** components and no network connection, e.g., connection to the Internet, or reliance on remote servers is needed.

In some implementations, a mobile device **130**, **140** may be able to determine a geographic location associated with the mobile device **130**, **140**, and may communicate information identifying a geographic location associated with the mobile device **130**, **140** to the sensors **120** or the wearable devices **150**. For example, a mobile device **130**, **140** may

determine the current geographic location of the mobile device **130**, **140** by using global positioning system (GPS) capabilities. In other implementations, a geographic location associated with a mobiles device **130**, **140** may be determined using other methods, for example, by using Wi-Fi access point triangulation data, cellular network triangulation data, or IP address information, when the mobile device **130**, **140** has network connectivity. The mobile device **130**, **140** may additionally or alternatively transmit data identifying the geographic location of the mobile device **130**, **140** over the network **105** to the application server **180**, or to the monitoring control unit **110**.

The one or more mobile devices **130**, **140** may each include a native applications **132**, **142**, respectively, as represented more particularly in FIGS. **2**A-**2**C. The native applications **132**, **142** refers to a software/firmware program running on the corresponding mobile devices that enables the safety monitoring features described within this disclosure. The one or more mobile devices **130**, **140** may load or install the native applications **132**, **142** based on data received over a network or data received from local media. The native monitoring applications **132**, **142** may run on mobile devices' platforms, such as Apple iOS, iPhone, iPod touch, Blackberry, Google Android, Windows Mobile, etc.

The native applications **132**, **142** identifies and displays user data such as, for e.g., a geographic location associated with the mobile device **132**, **142** and communicates information identifying the geographic location to various devices within the monitoring platform **100** such the sensors **120**, the wearable devices **150**, or the monitoring control unit **110**. In some instances, the native applications **132**, **142** may also transmit user data to the application server **180**. For example, a mobile device **130**, **140** having the native application **132**, **142** may determine a geographic location of the mobile device **130**, **140** using GPS capabilities, and may communicate data identifying the geographic location to the application server **180**. In some instances, the native application **132**, **142** may check the location of the mobile device **130**, **140** periodically and may automatically detect when a user associated with the mobile device **130**, **140** is going toward or away from a property.

The wearable devices **150** may be portable electronic devices that may be incorporated into items of clothing and accessories worn by a user. The wearable devices **150** may be activity trackers, smartwatches, smart glasses, handhelds, bracelets, necklace pendants, or any wearable device configured to communicate over a network. The wearable devices **150** may include devices of different types. The wearable devices **150** may perform functions unrelated to the monitoring platform **100**, such as monitoring user activity data such as, for e.g., biometric data, fitness data, sleep data, user-inputted data, and any other type of quantitative data.

In some implementations, the wearable devices **150** may include an integrated panic button that a user may push to have the wearable devices **150** transmit a distress signal indicating that the user requires emergency assistance to either the application server **180** or the emergency notification server **190**.

In some implementations, the wearable devices **150** may include embedded sensors that measure various biometric data such as, for e.g., heart rate or rhythm, breathing rate, blood oxygen level, blood pressure, skin temperature, skin moisture. In some implementations, the wearable devices **150** may include hardware components such as an accelerometer, a gyroscope, a microphone, a camera, image sensors, video sensors, sound sensors, and/or an automated speech recognizer.

The wearable devices **150** may constantly monitor and process data transmitted between the components of the monitoring platform **100** such as, e.g., the monitoring control unit **110**, the sensors **120**, or the one or more mobile devices **130**, **140**.

In some implementations, the wearable devices **150** may function independently of the components of the monitoring platform **100** and include a separate network module that enables the wearable devices **150** to connect to the components of the monitoring platform **100** by exchanging wireless communications over the network **105**. For instance, the wearable devices **150** may include one or more GSM modules, a radio modem, a cellular transmission mode, or any type of module configured to exchange communications in the following formats: LTE, GSM or GPRS, CDMA, EDGE, EGPRS, EV-DO or EVDO, UMTS, or IP. In other instances, the wearable devices may be capable of using various local wireless protocols, such as Wi-Fi, ANT, Bluetooth, Z-Wave, ZigBee, HomePlug (Ethernet over powerline), or wired protocols such as Ethernet, USB, and other wired protocols based on the RS232, RS485, and/or RS422 standards. For example, the wearable devices **150** may transmit measured data to the one or more mobile devices **130**, **140** over a local wireless protocol and the one or more mobile devices **130**, **140** may then transmit the data received by the wearable devices **150** to the application server **180**.

The one or more wireless sensor beacons **160** can be devices capable of emitting and/or receiving information over a wireless communication channel. For example, the wireless sensor beacons **160** may utilize Bluetooth Low Energy (BLE), also known as Bluetooth Smart, or other wireless technologies such as, for e.g., Wi-Fi, near-field communications (NFC), or other wireless technologies, to communicate with the devices connected over the network **105**. The wireless sensor beacons **160** may be commercially available beacon devices or other types of beacon devices. The wireless sensor beacons **160** may communicate with the devices of the monitoring platform **105** by emitting messages (e.g., pings) that include information identifying the wireless sensor beacons **160**.

In some implementations, devices of the monitoring platform **100** such as the one or more mobile devices **130**, **140**, and the wearable devices **150** may communicate with the wireless sensor beacons **160** by receiving message from the one or more wireless sensor beacons **160** identifying one or more of the wireless sensor beacons **160**. For example, each of the one or more wireless sensor beacons **160** may be associated with a unique universal identifier (UUID) that identifies a particular wireless sensor beacon within a group of two or more wireless sensor beacons within a particular geographic location, for e.g., a shopping complex.

In some implementations, a particular wireless sensor beacon **160** may be associated with particular regions within a geographic location, for e.g., particular floors or individual shops within a shopping complex, to monitor user data by exchanging communications with nearby one or more mobile devices **130**, **140** or wearable devices **150**. For example, one or more wireless sensor beacons **160** may be placed within multiple floors of a shopping complex, each with different UUIDs and a particular set of latitude and longitude coordinates that are associated with a defined region (e.g., a section within a store, an outdoor area, a building, a venue or other space).

Each of the one or more wireless sensor beacons **160** may broadcast information to allow the devices of the monitoring platform **100** to recognize the one or more of the wireless sensor beacons **160**. In some instances, the one or more wireless sensor beacons **160** broadcast their information periodically for particular periods of time (e.g., every second, every millisecond). The one or more wireless sensor beacons **160** may broadcast this information using wireless communications protocols such as, for e.g., BLE. In some implementations, information broadcasted by the one or more wireless sensor beacons **160** may also be broadcasted on particular frequencies or power levels to control the types of devices on the monitoring platform **100** that receive the information. For example, the one or more wireless sensor beacons **160** may transmit information to the one or more mobile devices **130**, **140** and the wearable devices **150**, on different frequencies, respectively.

In some implementations, the one or more wireless sensor beacons **160** may be placed in common regions that experience high user traffic volumes such as, for e.g., a public park, a tourist attraction, a public transportation station, a commercial complex, or other types of highly populated locations. In such implementations, the one or more wireless sensor beacons **160** may be configured with third-party electronic transportation or safety platforms to transmit information to the devices connected to the monitoring platform **100**. For example, the one or more wireless sensor beacons **160** may detect a hazardous condition on a subway line based on receiving safety signals from the transportation authority and in response, transmit this information to the one or more mobile devices **130**, **140** or the wearable devices **150**.

In some implementations, the one or more wireless sensor beacons **160** may be configured to operate with a particular mobile application that is installed on the devices connected to the monitoring platform **100**. For example, the particular mobile application may include a software development kit (SDK) that enables the devices connected to the monitoring platform to exchange communications with the one or more wireless sensor beacons **160**. For instance, the different devices connected to the monitoring platform **100** may independently exchange communications with the one or more wireless sensor beacons **160**. In such instances, a wearable device **150** may be able to transmit a distress signal including user data to the one or more wireless sensor beacons without the user having his/her mobile device with him. In other instances, the one or more wireless beacons **160** may receive redundant signal transmissions from the different devices connected to the monitoring platform **100** to ensure that distress signal is adequately transmitted to the application server **180** when one or more of the devices connected to the monitoring platform **100** malfunctions. For example, if a user is involved in a car crash that destroys his/her wearable device and mobile device, the monitoring platform **100** may determine that these devices are unable to transmit the distress signal and instead transmit a distress signal including cached data stored on other devices connected to the monitoring platform **100** such as the one or more wireless sensor beacon **160** or the drone devices **170**.

In some implementations, the one or more wireless sensor beacons **160** may be connected to emergency call booths that enable the one or more wireless sensor beacons **160** to identify devices within a particular distance (e.g., 30 meters) when the devices transmit a distress signal to the monitoring platform **100**. For example, the emergency call booths may monitor a particular frequency that includes the frequency of the outgoing distress signals transmitted by nearby devices. In response to detecting that a nearby device has transmitted a distress signal within a particular time period (e.g., 5 minutes), the particular wireless sensor beacon **160** that is connected to the emergency call may then transmit a signal including location information to the emergency notification server **190**.

The drone devices **170** may be an unmanned device that is capable of movement. For example, the drone devices **170** may be capable of moving throughout a location based on automated control technology and/or user input control provided by either the user or by the devices connected to the monitoring platform **100**. In this example, the drone devices **170** may be able to fly, roll, walk, or otherwise move about a location. The drone devices **170** may include helicopter type devices (e.g., quad copters), rolling helicopter type devices (e.g., roller copter devices that can fly and also roll along the grounds, walls, or ceiling), land vehicle type devices (e.g., automated cars that drive around a property), and plane type devices (e.g., unmanned aircraft).

In some implementations, the drone devices **170** may be dispatched in response to an incident signal indicating that a user may require emergency assistance. For example, if a user has been injured during a known running route, the wearable device **150** may transmit data to the application server **180** from which the application server **180** may determine there is a likely safety incident, and in response, transmit an incident signal and a location of the user to the emergency notification server **190** and also transmit a dispatch instruction with the user location to the drone devices **170**. The application server **180** may determine the location of the user during an incident based on comparing current data collected by the sensors **120**, one or more mobile devices **130**, **140**, the wearable device **150**, or the one or more wireless sensor beacons **160** to historical information about the user or user activity. In such examples, the monitoring platform **100** may deploy the drone devices **170** to the determined location. In some instances, the drone devices **170** may be equipped with a broadband connection that allows the drone devices **170** to connect with the network **105**.

In some implementations, the drone devices **170** may include data capture and recording devices. In some instance, the drone devices **170** may include one or more cameras, one or more motion sensors, one or more microphones, one or more biometric collection tools, one or more temperature sensors, one or more humidity sensors, one or more airflow sensors, and/or other types of sensors that may be useful in capturing monitoring data related to user safety. For example, once dispatched to a location where the user may require emergency assistance, the drone devices **170** may capture a video feed of the user showing the extent of injury and transmit the video feed to either the application server **180** or the emergency notification server **190** to alert emergency responders about the user's condition. In other examples, the drone devices **170** may be outfitted with thermal-imaging cameras capable of identifying locations, people, or pets through structural features of a location. For example, the drone devices **170** may be deployed to a property in which a user is located and may use the thermal-imaging cameras to determine a particular location within the property where the user may be trapped inside the property. In such examples, the drone devices **170** may transmit the captured thermal video footage to the emergency notification server **190** such as a nearby fire station.

In some implementations, the drone devices **170** may also include output devices. In such implementations, the drone devices **170** may include one or more displays, one or more

speakers, one or more projectors, and/or any type of output devices that allow the drone devices **170** to communicate information to nearby emergency contacts. For example, if a user is physically disabled as the result of an incident and unable to use wearable devices **150** or mobile devices, the user may record a distress message or video using the drone devices **170**, which may then transmit the message or video to the application server **180** or the emergency notification server **190**.

In some implementations, the drone devices **170** may be configured to record visual verifications and/or identify perpetrator identification for particular types of incidents. For example, in response to safety incidents determined by the application server **180**, the application server **180** may deploy the drone devices **170** to record video footage. In some instances, the drone devices **170** may be configured to operate within certain geographic regions (e.g., a gated residential community). The drone devices **170** may be centrally operated by a security provider such as an alarm security company providing security services to a particular geographic region. In such instances, the drone devices **170** may be stored in a central home base with a charging and control station and deployed as a mobile solution in response to an incident signals for users.

In some implementations, the drone devices **170** may be delivery drones (e.g., a parcelcopter) that may be utilized by the monitoring platform **100** to provide supplies or other equipment to a user in response to the application server **180** detecting the occurrence of an incident. For instance, the drone devices **170** that are delivery drones may be used to dispatch first aid kits and/or other emergency medical equipment (e.g., gauze, bandages, braces, epi pens, tourniquets, etc.). In such instances, the drone devices **170** may delivery particular supplies based on the classification of the incident by the application server **180**.

In some implementations, after the application server **180** determines an incident, the application server **180** may select the particular drone device **170** to deploy to the incident from a set of drone devices **170** based on particular attributes such as, for e.g., charge levels, location of the incident, and the direction of user movement. For example, the set of drone devices **170** may include various drone devices **170** with varying battery capacities, aerial speeds, and/or device features. In such examples, the monitoring platform **100** may choose the particular drone device **170** to be deployed that can get to the location of the incident the fastest and has enough battery to monitor the user for a reasonable amount of time (e.g., fifteen minutes).

In some implementations, multiple drone devices from the set of drone devices **170** may be deployed based on the particular nature of the safety incident. For example, the application server **180** may deploy multiple drone devices if the received user data indicates the safety incident is a life-critical incident (e.g., a house fire) that causes a loss of life. In some instances, the multiple drone devices may be deployed sequentially to maximize response time and conserve resources. For example, the multiple drones may include a diagnostic drone device, which is deployed initially to minimize response time, and a support drone device that provide the user with emergency supplies to help with the emergency event. In another example, an initial drone device may be deployed to minimize response time while a secondary drone is deployed as a backup if the battery of the initial drone runs out.

The application server **180** may be an electronic device configured to determine a safety incident of a user. For example, the application server **180** may determine from received sensor data whether the user is injured or in danger. To make the determination, the application server **180** may provide control services by exchanging electronic communications with the monitoring control unit **110** and the one or more mobile devices **130**, **140** over the network **105**. For example, the application server **180** may be configured to monitor user data generated by the devices connected to the monitoring platform **100** such as the sensors **120**, the one or more mobile devices **130**, **140**, the wearable devices **150**, the one or more wireless sensor beacons **160**, and the drone devices **170**. In this example, the application server **180** may exchange electronic communications over the network **105** to send and/or receive information regarding user activity such as biometric data, activity data, location data and health data. The application server **180** also may receive information regarding activity within or external to the property from the one or more mobile devices **130**, **140** or the wearable devices **150**.

In some implementations, the application server **180** may store a user profile with user data transmitted from the devices connected to the monitoring platform **100** as represented in FIG. **2**A. For instance, the devices connected to the monitoring platform **100** may periodically transmit various types of user data to the application server **180**. The application server **180** may aggregate the different types of user data such as personal data, biometric data, activity data, and historical data into a user profile. In some instances, the application server **180** may use the user profile to learn normal usage patterns such as activity patterns (e.g., common exercise routines) and normal biometric measurements (e.g., resting heart rate, baseline blood pressure, normal skin temperature, baseline breathing rate). For example, the application server **180** may periodically receive user data collected by the devices connected to the monitoring platform **100** such as, for e.g., the one or more mobile devices **130**, **140**, or the wearable devices **150**, and log the user data into the user profile. The application server **180** may then aggregate the received user data over particular time periods (e.g., six months) and perform trend analyses to determine normal biometric measurements for the user. In another example, the application server **180** may receive user activity data (e.g., steps taken, calories burnt) and compare the activity data with location data to determine usage patterns such as exercise locations, exercise routines, and other activity patterns.

In some implementations, the application server **180** may determine incidents and generate incident reports indicating that a user requires emergency assistance. For example, an incident may be any type of safety incident that is detected by the application server **180** based on the user data collected by the devices of the monitoring platform **100**. For example, the application server **180** may determine that a user may be having a heart attack based on the particular wearable device **150** that measures heart rate data that the current heart rate is too high compared to a reference measurement. In response, the application server **180** may transmit an incident report to the emergency notification server **190** that includes various types of user data such as, for e.g., heart rate measurements, user activity data indicating prior physical activity, historical measurements of heart rates hours prior to the incident. In some instances, the incident report received by the emergency notification server **190** may include a control panel interface as represented in FIG. **2**B.

In another example, the application server **180** may determine from received sensor data that a user was running along a trip route saved in a user's profile and mid-way

between the route, the user's breathing pattern and heart rate corresponded to those when the user is unconscious or asleep and that the user is still moving. In response, the application server **180** may determine that there is a safety issue. For example, the application server **180** may determine that the user may have been kidnapped. If the application server's **180** confidence that the user has been kidnapped is high, the application server **180** may immediately notify emergency personnel. If the application server's **180** confidence that the user has been kidnapped is moderate, the application server **180** may display a prompt and an audio alert on the user's mobile device, wearable device or heads up display indicating that the application server **180** has determined that the user may be in danger and how the application server **180** made the determination, and a countdown indicating that emergency personnel will be notified if the user does not verify that there is no safety issue within a specific period of time (e.g. thirty seconds). The application server **180** may require that the user enter a passcode on the user's mobile device to verify that no notification should be made.

In some instances, the application server **180** may be configured to determine particular duress codes sent by the user in the event of an emergency incident. For instance, the user may enter a pre-determined or customized duress code it appears as if the user has cancelled the alarm but actually transmits a duress signal to the application server **180**. For example, the user may enter the duress code during a robbery.

In yet another example, the application server **180** may receive an indication that a user has activated a panic button on a necklace worn by the user, sensor data indicating that the user was traveling at a high speed corresponding to a car and is no longer moving, and sensor data indicating that the user's car airbags have deployed. In response, the application server **180** may determine that the user has been in a car accident and is seriously injured and may notify emergency personnel accordingly.

In some instances, the application server **180** may monitor the user location of the user when he/she is close to or inside the property to determine how to process an incident signal. For example, if the user is involved in an incident outside the property, the application server **180** may transmit the incident signal to the emergency notification server **190** and if the user is involved in an incident inside the property, the application server **180** may instruct the monitoring control unit **110** to transmit the incident signal to the home security provider for the home.

The emergency notification server **190** may be an electronic device of an emergency service provider configured to exchange communications from the devices connected to the monitoring platform **100** such as the sensors **120**, the one or more mobile devices **130**, **140**, the wearable devices **150**, the one or more wireless sensor beacons **160**, the drone devices **170**, the monitoring control unit **110**, or the application server **180**. For instance, the emergency notification server **190** may be configured to receive incident reports from the application server **180** in response to the application server **180** detecting a safety incident where a user requires emergency assistance. In such instances, the emergency notification server **190** may be an electronic device configured to an emergency responder such as an emergency medial responder, a fire department, or a public safety access point.

In some implementations, the emergency notification server **190** may be a third party entity separate from the monitoring platform **100**. For example, the emergency notification server **190** may be a central alarm station for a security service provider, a campus security server in a school or school/university police department, or security gateway for a particular residential neighborhood. For instance, the emergency notification server **190** may be registered to the monitoring platform **100** using a connection bridge such as an application (e.g., mobile application including user accounts), using a unique user identifier such as a username and password or a Quick Response (QR) to add the third party monitoring platform **100** to the user profile of the monitoring platform **100**. In other instances, the emergency notification server **190** may be registered to users within a particular geographic location (e.g., a gated residential community) where users within the geographical location are registered to the emergency notification server **190** of the particular location.

In some implementations, the application server **180** may determine the occurrence of an incident based on comparing extrinsic data surrounding the user location and the user data collected by the devices connected to the monitoring platform **100**. For instance, the application server **180** may monitor current weather, daylight level, air quality, and/or other external conditions to determine whether the user data indicates suspicious conditions. For example, if the current weather indicates a thunderstorm, then the application server **180** may determine that the user location indicating that the user is stationary outside may be suspicious, e.g., the user may have been struck by lightning or the user is being forced to stay stationary outside. In another example, if it is night time, the application server **180** may determine that the user is more likely to be performing night time activities, e.g., stargazing, walking, jogging as opposed to football or basketball, and determine whether there is likely to be a safety incident based on the types of night time activities in which the user might have been engaged. In yet another example, if it is night time but the user data indicates that the user is currently performing activities outside that are better suited for sunlight, e.g., football or basketball, the monitoring platform **100** may also determine that this may be suspicious. In another example, if the user medical history in the application server **180** indicates that the user may have asthma but that the user is located in an area with low air quality, the application server **180** may predict that the user may likely have an asthma attack or may determine that the user is likely suffering an asthma attack.

In some implementations, the application server **180** may aggregate user data collected by devices of multiple users that are all connected to the monitoring platform **100** to gather data surrounding mass casualty incidents. For example, if there is a large-scale emergency within a particular location (e.g., earthquake, terror attack, public evacuation, etc.), the application server **180** may determine the presence of such an emergency based on aggregating suspicious data from multiple devices within the particular location. The application server **180** may compare the aggregated data to other types of environmental data (e.g., seismic activity, electromagnetic pulses, or radiation) that are be collected from sensors located nearby or within the particular location where there may be abnormal activity.

In some implementations, the monitoring platform **100** may additionally or alternatively include various features. For example, the monitoring platform **100** may include a peer-to-peer location sharing feature that enables users to send location information collected from the one or more mobile devices **130**, **140** or the wearable devices **150** to emergency contacts. In another example, the monitoring platform **100** may include a distress signal forwarding feature that enables a user to transmit a distress signal

including user location information from either the one or more mobile devices **130**, **140** or the wearable devices **150** to the emergency notification server **190**, which may be associated with an emergency responder such as, for e.g., a fire station, an emergency medical services facility, or a police station. In another example, the monitoring platform **100** may include mobile applications that use the location data collected by the one or more mobile devices **130**, **140** and the wearable devices **150** to determine the nearby authorities having jurisdiction (AHJ) or the public safety access points (PSAP) in case of an emergency incident within the user location.

The monitoring platform **100** as described within this disclosure may be adapted to function with a variety of wearable devices, communication devices, and networks with long-term extensibility. For example, new wearable devices and applications may be adapted to operate with the monitoring platform **100** by adapting the new wearable devices to run mobile applications that are capable of exchanging communications with the devices connected to the monitoring platform **100**. In some instances, the monitoring platform **100** may include a mobile application ecosystem that includes customized mobile applications that are built for particular mobile devices, wearable devices, communication devices, safety sensors, drone devices, and wireless sensor beacons such that these devices may exchange communications over the network **105** with emergency responders. For instance, particular examples of wearables device may include a smart motorcycle helmet or a smart skiing helmet that can transmit speed and crash information to emergency medical responders, including the location on the helmet of the impact(s) and the number of impacts(s). In another instance, vehicles such as cars, motorcycles, and public transportation may include smart sensors that transmit distress signals to nearby emergency responders in response to a vehicular crash. In other instances, wearable devices may include miniaturized personal health devices used to monitor the movement of patients with chronic diseases such as, for e.g., Parkinson's disease.

FIGS. **2**A-**2**C illustrate example user interfaces in a safety monitoring platform. FIG. **2**A represents a user interface **200**A including a user profile that collects various types of data. FIG. **2**B represents a user interface **200**B for viewing incident reports. FIG. **2**C represents a user interface **200**C that determines if a user requires emergency assistance.

Referring now to FIG. **2**A, the user interface **200**A may include a user profile **210** that displays general information **212**, user data types **214**, and user data **216**. The user profile **210** may be associated with each user that is registered within the monitoring platform **100**. For example, registered users may include users that use the devices connected to the monitoring platform (e.g., one or more mobile devices **130**, **140**, the wearable devices **150**, etc.) or emergency contacts of such users. In some instances, a separate user profile **210** is created for each particular device connected to the monitoring platform **100**. For example, the wearable devices **150** may associate a particular user profile **210** for each registered user and the one or more mobile devices **130**, **140** may associate a different user profile **210** for each registered user.

The user profile **210** may include general information **212** as represented in FIG. **2**A. In some instances, the general information **212** may also include email, phone number, and/or any other information that identifies the registered user. The user profile **210** may also include other data types **214**, which represent the different types of user data generated by the monitoring platform **100**. For example, the user profile **210** may include contact information for emergency contacts in an address book of family of friends with names, emails, phone numbers, or physical addresses that the monitoring platform **100** contacts in cases of emergency or when registered user requires assistance. In another example, the data types **214** may include biometric data such as height, weight, heart rate, blood pressure, blood type and breathing rate. In another example, the data types **214** may include activity data such as exercise routines, common walking or running routes, steps taken, and other types of exercise data. The data types **214** may also include historical data that includes previous user data within a particular time period (e.g. 6 months) and may be used by the monitoring platform **100** as reference data when comparing to current user data to determine the occurrence of an emergency incident. In some instances, the historical data may be transmitted to the user and/or other specified contacts during reoccurring time intervals (e.g., weekly).

In some implementations, the user profile **210** may include user selections identifying people or pets that the user of the user profile **210** frequently go on "trips" including rules that reference the people or pets that are a part of the "trip." A "trip" may represent any outdoor activity outside the user's home such as, for e.g., running exercises, work or school commutes, common or reoccurring travel paths, or frequent locations visited. In some instances, the user selections identifying the people include other registered users of the monitoring platform **100**. In such instances, the user data of each particular user may be shared amongst the particular user profiles **210** of each individual user during a "trip." For example, if two users participate in the same running exercise, the user data collected from each of their wearable devices may be aggregated by the monitoring platform **100** for incident detection.

In some implementations, the user profile **210** may be created for domestic pets that are frequently taken on "trips." For example, a registered user may create a user profile **210** for a dog that is regularly walked. In some instances, the dog may also wear a wearable device that locates and identifies the dog and stores corresponding data in the user profile **210** of the dog. In such instances, the user profile **210** may be used to identify the dog in case of an emergency incident.

In some implementations, the "trips" included in the user profile **210** may specify various types of user activity data. For instance, the "trips" may include user-specified routes for reoccurring activities such as running, hiking, walking pets. In other instances, the "trips" may include nearby points of interest such as local parks or transportation stops that user may frequently visit. In such instances, the wearable devices **150** may use the points of interests to map out frequent pathways used by the users to generate an activity log. In other instances, the time spent at points of interest may be tracked to generate activity information about how much time the user typically spends at the points of interest. For example, the amount of time spent may be compared to particular activities to correlate activity type and time spent at points of interest.

In some implementations, the user activity data specified by "trips" may be combined to generate a set of "trip rules" that represent particular user activities. For example, a "trip rule" may include a set of parameters such as a user activity (e.g., walking the dog), a time period for performing the user activity (e.g., 20 minutes), and a route between points of interest (e.g., down two streets from the user's property). In some instances, the monitoring platform **100** may initiate a "trip rule" manually after a user specifies that they are about to perform a particular user activity. For example, a user may submit an input to one of the devices connected to the

monitoring platform **100** specifying the various "trip rule" parameters, and in response the monitoring platform **100** may track user activity to ensure that the "trip rule" is maintained. In other instances, the monitoring platform **100** may initiate a "trip rule" automatically based on detecting user activity indicating a likelihood that the user may be performing the particular activity associated with the "trip rule." For example, if a user is leaving his house at the same time and day of the week when he/she usually walks his dog, the "trip rule" for dog walking may be automatically initiated based on the monitoring platform **100** comparing the current user activity with historical data of user activity. As described above, the trip rules may be used by an application server to determine when there is a safety incident. For example, the application server may determine from the trip rules that a user is on a trip and in response, may determine the safety incidents that may be applicable when the user is on a trip.

In some implementations, the user profile **210** may additionally include designated safe routes or areas that represent user-specified routes or locations where the user exhibits normal activity. For example, the designated safe locations may include commonly visited locations such as a user's home address, work address, or home addresses or frequent contacts. In other examples, designated safe routes may be routes that the user frequently follows between common locations such as a work commute, running routes, or other routes that indicate normal user activity.

Referring now to FIG. **2**B, the user interface **200**B may include a control panel interface **220** that displays data visualization tabs **222**, a current status **223**, a user location **224**, milestones **225**, and historical data **226**. The control panel interface **220** may be a software application running on the application server **180** and designed for use by a central system operator of the monitoring platform **100**. For example, the control panel interface **220** may be used to route incident signals transmitted from devices connected to the monitoring platform **100**, for e.g., the one or more mobile devices **130**, **140**, the wearable devices **150**, the one or more wireless beacons **160**, or the drone devices **170**, to the emergency notification server **190**.

The control panel interface **220** may display data visualization tabs **222**. For example, as shown in FIG. **2**B, the data visualization tabs **222** may include "DASHBOARDS," "ANALYSIS," "REPORTS," and "CONFIG." The data visualization tabs **222** may alter the data displayed on the control panel interface **220**. As shown in the example, the "DASHBOARDS" tab displays information related to an incident signal. In another example, the "REPORTS" tab displays user reports that include previously received user data from devices within a particular geographic location (e.g., a neighborhood community, or a postal zip code), or certain types of users (e.g., residential vs. commercial users). In such an example, the user reports may include locally cached user data on the application server **180**. In another example, the "CONFIG." tab may include filters to adjust views of the received incident signals such as viewing by zip code, incident type, severity, or other classifications.

The control panel interface **220** may also display a current status **223**. The current status **223** shows information related to a recently received incident signal. The current status **223** may include an incident description that represents a textual description of the particular type of incident, an incident classification that may represent a prediction of the type of incident by the monitoring platform **100**, a current location for the particular device generating the incident signal, an incident duration describing the time lapse between when the incident signal has been transmitted, and an incident level that represents the severity of the incident signal.

As shown in the example, the incident signal may include an elevated heart rate (e.g., 100 beats per minute), which is indicative of a potential heart attack. In response, the monitoring platform **100** may provide an incident description that indicates that the user may need medical assistance. Based on the user data included in the incident signal, the monitoring platform **100** may determine that incident is seventy percent likely to be a heart attack. The monitoring platform **100** may also include alternative likelihoods based on additional user data nearby the user device transmitting the incident signal. For instance, if the incident signal is generated in a densely populated location with high traffic volumes, the monitoring platform may determine, based on such extrinsic data, that an alternative classification for the incident may be a pedestrian accident. In some instances, the control panel interface **220** may also display a list of leading factors based on the user data included in the incident signal.

The monitoring platform **100** may determine a current location of the incident based on location data included in the incident signal. As shown in the example, the monitoring platform **100** may also determine an average response time based on determining nearby emergency service stations such as finding nearby hospitals and fire stations as will discussed more specifically below. The monitoring platform **100** may use the predicted response time to generate a visualization that represents the urgency of the incident. In some instances, the current status **223** may also display an incident level that represents a severity prediction by the monitoring platform **100**. For instance, the monitoring platform may calculate a multi-factorial score, e.g., between one and ten, that represents a user risk as a result of the incident. For example, if the user data included in an incident signal indicates minimal risk of harm or injury to the user, then the severity may be a lower number, for e.g., one, whereas if the incident is a heart attack that may cause death without emergency assistance, then the severity may be a higher number, for e.g., ten.

The control panel interface **220** may display a user location **224**. The monitoring platform **100** may use global positioning system (GPS) data received from the user device transmitting the incident signal to determine the user position. The user location **224** may display a map with a pin to locate the user. As shown in the example, the map also includes points of interest such as, for e.g., landmarks and nearby emergency services. The user location **224** may also include a list of landmarks and nearby emergency services in relation to the user location and the current distance between the user position and the points of interest. The user location **224** may also display an option to select one of the points of interest displayed on the user location **224**.

As shown in the example, an operator may select one of the nearby emergency notification servers from the list points of interest and press a button to notify local emergency notification servers and in response, the incident signal may be routed to the selected emergency notification server, which may be, for e.g., the emergency notification server **190**. In some instances, the emergency notification server **190** may receive an incident report that includes user data identifying the user needing emergency assistance, location data of the incident, or relevant data related to the type of incident such as biometric data indicating a particular health-related injury (e.g., blood type, known allergens, medical history, recent heart rhythm that could indicate a potential heart attack).

The control panel interface **220** may display milestones **225**. The milestones **225** may indicate events related to the incident such as, for e.g., when the incident signal transmitted from the user device, the incident signal being processed by the application server **180**, or additional incident signals being transmitted representing user updates or conditions. For instance, if a particular incident is urgent, then the milestones **225** may indicate where in the transmission cycle the incident signal is currently in. In other instances, the milestones **225** may indicate potential signal transmission issues. For example, if the user device is destroyed in the incident, than the milestones **225** may indicate that alternative communication means, for e.g., communicating with an emergency contact, may be necessary.

The control panel interface **220** may display historical data **226**. The historical data **226** may display user data over particular periods of time (e.g., six hours) that may indicate potential or insights related to the cause of the incident. As shown in the example, the historical data **226** may display measured heart rate over the last ten hours after the monitoring platform determines, based on the user data included in the incident signal, that the incident may be a heart attack. In such an example, the historical data **226** may show the measured heart rate relative to the baseline heart rate to represent problematic trends indicating the cause of the incident. In some instances, the data displayed in the historical data **226** may be transmitted to the emergency notification server to provide additional information about the incident to help emergency service responders provide assistance to the user. As shown in the example, if the incident is identified by the monitoring platform **100** as a user having a heart attack, heart rate data from hours before the incident may be transmitted in the incident report such that emergency medication technicians that are dispatched may have greater knowledge in assessing the user's physical condition.

Referring now to FIG. **2**C, the user interface **200**C may be shown on a mobile device **230**, a wearable device **240**, or a heads up display (HUD) (not shown) that display an incident notification **232**, user response options **234**, **236** and an automated response option **238**. The mobile device **230** may be shown on devices connected to the monitoring platform **100** such as, for e.g., the one or more mobile devices **130**, **140**, or the wearable devices **150**. The mobile device **230** may be presented to a user that is currently either wearing or carrying the device in response to the monitoring platform **100** determining that the user may need emergency assistance. A user may provide an input using either of the user response options **234**, **236** indicating whether the alert is a false alarm or if the user does actually require medical assistance.

As shown in the example, the monitoring platform **100** may receive heart rate data from a particular wearable device **150**, which regularly monitors the heart rate of a user. In response to detecting an abnormally high heart rate, for e.g., 100 BPM, the monitoring platform **100** may transmit the notification **232** to a particular device connected to the monitoring platform **100**, for e.g., the one or more mobile devices **130**, **140**, or the wearable devices **150**, asking the user if he/she needs medical assistance. The notification **232** may be transmitted to the particular user device electronically and may be presented either as an alert in the operating system of the particular wearable device **150**, or through a mobile application that is installed on the particular user device, or shown on the HUD. In some instances, the heads up display may also be used to represent information related to the notification **232** using a virtual or augmented reality projection within the field of view of the user.

The user response options **234**, **236** allow the user provide to provide a user input in response to the notification **232** indicating whether the incident trigger is a false alarm or if the user does actually need emergency assistance. As shown in the example, the user may provide an input on the user response option **234** if he/she does need emergency assistance, or user input response option **236** if he/she does not need emergency assistance.

In some instances, the user response options **234**, **236** may additionally or alternatively include a code entry **242** that is displayed on the wearable device **240** for the user to submit a code that indicates whether the incident trigger is a false positive or a false negative. For example, in response to an incident trigger, the user may be presented with user response options **234**, **236** that includes a code entry. The user may enter various codes corresponding to different user statuses such as, for example, a distress code that indicates that the user is in danger, a duress code that indicates that the user has cancelled the incident signal but is still in danger, or a cancel code that indicates that the incident trigger is a false positive signal.

In some implementations, the mobile device **230** may also include an automated response option **238** that shows a time period for providing a user input before emergency notification servers are automatically notified about the potential incident. For example, in some instances where a user is unable to provide an input to the one or more mobile devices **130**, **140** or the particular wearable device **150** because of physical injury, the mobile device **230** may transmit an automated signal to the application server **180** indicating that the user has failed to provide a user input and an instruction that emergency notification servers should be dispatched to the user's location. In some instances, once the automated signal has been transmitted to the application server **180**, the application server **180** may transmit an incident signal to the emergency notification server **190**. Additionally or alternatively, the application server **180** may notify emergency contacts of the user that the user has failed to provide a response to a potential emergency incident.

In some implementations, notification **232** and the user response options **234**, **236** may additionally or alternatively include incident-specific questions that are directed to gather information about user risk in response to the application server **180** potentially flagging an incident. For example, for abnormal heart rate measurements, the notification **232** may also include questions to the user such as, for example, "when was the last time you exercised?", or "when was the last time you felt a shortness of breath?", "do you have chest pain?", "are you light headed?", or "are you experiencing numbness, pain or tingling in your arms?". The user response options **234**, **236** may include different response options such as time periods or gradations of severity. In such implementations, mobile device **230** may be utilized to gather user input during particular activities that are specifically likely to put a user in danger or may likely cause injury (e.g., an intense sporting event) and generating historical data that may be used to improve the predictive capabilities of the monitoring platform **100**.

In some implementations, the notification **232** may be additionally or alternatively transmitted to the particular wearable device using other types of notification that alert a user such as, for e.g., an alert sound, a vibration, or other types of haptic feedback. In other implementations, the user response options **234**, **236** may include other types of user

input such as, for e.g., providing a unique password or passphrase, a unique gesture, or a voice query.

In some implementations, the notification **232** may be transmitted redundantly to multiple users that are registered to the monitoring platform **100**. For example, in some instances, the notification **232** may be transmitted to both the user and an emergency contact to notify the emergency contact that the user may potentially need emergency assistance. As discussed previously in FIG. **2**A, in other examples where a particular is associated with a "trip," the monitoring platform **100** may transmit the notification **232** to all user that are designated as being associated with the "trip" if the incident falls within the boundaries set by the "trip" (e.g., particular location, particular time of day, particular user activity, etc.). Additionally or alternatively, in some instances, the user may specify notification settings that control how the notifications are transmitted to multiple users. In one example, a user may set the notification settings to indicate that the notification **232** may only be sent to contacts that are designated as emergency contacts in the user profile **210**.

In other implementations, the notification **232** may be transmitted redundantly to multiple user devices connected to the monitoring platform **100**. For instance, the notification **232** may be sent to both of the mobile device **230**, the wearable device **240**, and/or the HUD. In such instances, when one of the user devices is destroyed during an incident (e.g., a car crash), the notification **232** is transmitted to a working device to increase the likelihood of receiving a user input indicating whether a user needs medical assistance.

FIGS. **3**A-**3**C illustrate example processes **300**A-**300**C, respectively, for detecting user safety incidents outside a property. Briefly, the process **300**A represents a process for determining the occurrence of an incident based on biometric data, the process **300**B represents a process for determining an action to be performed in response to an incident based on data type and user type, and the process **300**C represents a process for transmitting a signal to emergency responders in response to an incident.

Referring to FIG. **3**A, the process **300**A may include monitoring biometric data from a portable device (**310**), comparing the received biometric data to reference data (**320**), based on comparing the received biometric data, determining occurrence of an incident (**330**), and transmitting an incident report in response to determining occurrence of the incident (**340**).

The process **300**A may include monitoring biometric data from a portable device (**310**). For example, the application server **180** may monitor biometric data measured by devices connected to the monitoring platform **100** such as, for e.g., the one or more mobile devices **130**, **140** or the wearable devices **150**. For instance, biometric data may include heart rate, heart rhythm, skin temperature and moisture, breathing rate, blood pressure, and any other health-related user data. The application server **180** may collect the biometric data periodically over particular periods of time (e.g., daily, weekly, etc.) and store it within a repository on the application server **180**.

The process **300**A may include comparing the measured biometric data to reference data (**320**). For example, the application server **180** may compare the measured biometric data from the particular wearable device **150** against reference data stored on the application server **180**. The reference data may be historical data collected previously from the user to establish a baseline measurement (e.g., baseline heart rate, baseline blood pressure, etc.). For example, the reference data may be initially measured when the user creates the user profile **210** within the application server **180** or sets up the particular wearable device **150** as a new device connected to the monitoring platform **100**.

In some instances, the reference data may be updated as the application server **180** collects historical user data that suggests general trends that baseline measurements have changed. For example, if a user begins a new exercise routine that impacts his/her baseline heart rate over six months, the application server **180** may adjust the reference data including baseline heart rate based on determining that the historical heart rate data over six months indicates an increase in baseline measurements. In such implementations, the application server **180** may aggregate historical data and perform linear regression analysis to determine whether the changes in baseline measurements are indicative of physiological changes or due to external conditions (e.g., seasonal weather changes, changes in environment, etc.).

In some implementations, the application server **180** may also aggregate biometric data from other users within a particular group or classification (e.g., gender, age group, geographic location, etc.) to calculate the reference data to compare the measured biometric data. In such implementations, the reference data may include historical biometric data from other users that are identified by the application server **180** as being similar to the user of the measured biometric data. For example, the application server **180** may aggregate heart rate data based on gender, age demographic, for a particular activity such as running to determine reference biometric data for a particular user performing such an activity.

The process **300**A may include, based on comparing the measured biometric data, determining an occurrence of an incident (**330**). For example, the application server **180** may determine the occurrence of an incidence in response to determining that the measured biometric data is abnormally high or abnormally low compared to the reference data. In such implementations, the application server **180** may use a threshold level of difference between the measured biometric data and the reference biometric data. For example, the application server **180** may determine that a user is having an incident such as a heart attack when a user's measured heart rate is 100 beats per minute (BPM) compared to the user's baseline heart rate of 63 BPM. In such an example, the threshold level of difference between the measured heart rate and the baseline heart rate may be 30 BPM. Other examples of data that the application server **180** may compare irregular heart rhythms, increased sweating, exhaustion, pain indications in arms, neck, or shoulders. In such examples, the application server **180** may send periodic instructions to the mobile device **130** or the wearable device **150** to collect information from the user.

In other instances, received user data may also indicate an occurrence of an incident. For example, a sudden acceleration or deceleration of biometric data (e.g., heart rate, breathing rate, blood pressure, skin temperature, skin moisture). In other instances, an abnormal location relative to an expected route or a designated safe area, an unusually slower or faster user pace, a particular gyroscopic position (e.g., closer to the ground), sounds associated with distress detected by a microphone, or the user not returning to an expected location with a particular time period (e.g., not unlocking a door with their unique user code or disarming a security system within a specified time period), may also indicate the occurrence of an incident.

In some implementations, the application server **180** may alternatively determine the occurrence of an incident without comparing the measured biometric data to reference

data. For instance, in such implementations, instead of comparing the measured biometric data to reference data, the application server **180** may instead track the measured values over a particular period of time to determine the occurrence of an incident. For example, the application server **180** may track heart rate measurements from either the mobile device **130** or the wearable device **150**, and in response to detecting an acute decrease or increase in measured heart rate, determine an occurrence of an incident that may be a heart attack. In such an example, the application server **180** determines the occurrence of the heart attack incident without comparing the reference measured heart rate data to reference heart rate data.

The process **300**A may include transmitting an incident report in response to determining occurrence of the incident (**340**). For example, the application server **180** may transmit the incident report to the emergency notification server **190**. In some implementations, as represented in FIG. **2**B, the application server **180** may include a control panel interface **220** for displaying generated incident reports from the devices connected to the monitoring platform **100**. In some instances, the application server **180** may also send incident reports to emergency contacts identified in the user profile **210** associated with the user involved in the incident. In such instances, the incident report may include relevant user data and a notification indicating that the user may need emergency assistance.

Referring now to FIG. **3**B, the process **300**B may include receiving data from one or more devices and sensors (**312**), determining a data type of the received data (**322**), determining a device type of the one or more devices and sensors (**332**), based on determining the data type and the device type, correlate the received data from the one or more devices and sensors (**342**), and based on correlating the received data, determining an action to be performed (**352**).

The process **300**B may include receiving data from one or more devices and sensors (**312**). For example, the application server **180** may receive user data from devices connected to the monitoring platform **100** such as, for e.g., the sensors **120**, the one or more mobile devices **130**, **140**, or the wearable devices **150**.

In some implementations, in addition to receiving user data from devices connected to the monitoring platform **100**, the application server **180** may also receive extrinsic data surrounding the user location and the user data collected by the devices connected to the monitoring platform **100**. For instance, the application server **180** may receive data indicating the current weather, daylight level, air quality, and/or other external conditions to determine whether the user data indicates suspicious conditions.

The process **300**B may include determining a data type of the received data (**322**). For example, the application server **180** may categorize various types of user data such as, for e.g., biometric data, activity data, location data, or scheduling data. The application server **180** may include a repository of data types that include keywords, data values, and data categories that are associated with particular data types. For example, user data including heart rate may be categorized as biometric data whereas steps walked may be categorized as activity data.

The process **300**B may include determining a device type of the one or more devices and sensors (**332**). For example, the application server **180** may categorize the devices connected to the monitoring platform **100** that generate and transmit the user data. For instance, the application server **180** may determine the type of mobile device of the one or more mobile devices (e.g., the operating system), the type of device of the wearable devices **150** (e.g., fitness tracker, smartwatch, audio recorder, heart rate monitor, etc.), or the type of sensor of the one or more sensors **120** (e.g., motion sensor, temperature sensor, occupancy sensor, etc.). In some instances, the application server **180** may also determine the manufacturer and serial number of the devices and include this is the device type.

The process **300**B may include, based on determining the data type and the device type, correlating the received data from the one or more devices and sensors (**342**). For example, the application server **180** may correlate data transmitted by particular device types that are complementary and may allow the monitoring platform to generate predictions of user activity and conditions. For instance, heart rate data from a wearable device **150** may be correlated with weather data from the one or more mobile devices **130**, **140** to determine if the outside weather conditions may place the user at risk of dehydration or excessive fatigue based on the temperature and humidity in the location where the user may be located. In another example, location data transmitted from the one or more mobile devices **130**, **140** may be correlated with activity data transmitted from the wearable devices **150** to determine common exercise patterns (e.g., time periods of activity, reoccurring exercise locations, frequency of exercise, etc.). In such implementations, the correlated data may be aggregated into a data model that predicts current user conditions and calculates a likelihood of the user getting involved in a safety incident.

The process **300**B may include, based on correlating the received data, determining an action to be performed (**352**). For example, the application server **180** may determine an action to be performed based on correlating the received user data from devices connected to the application server **180**. For instance, the application server **180** may initially predict a potential based on the correlated data, and in response, determine an action that addresses the incident to ensure user safety.

For example, after correlating heart rate data indicating an elevated heart rate with location data indicating that the user is stationary and activity data indicating that the user was currently performing running exercises, the application server **180** may initially determine that the user may be at risk of a heart attack. The monitoring platform **100** may then determine that the action to be performed may be to transmit a distress signal to emergency medical responders with the user location and biometric data indicating symptoms of a heart attack. In another example, after correlating current location data with activity data indicating an expected route and heart rate data, the application server **180** may determine that the user may have been kidnapped based on determining that the user is moving faster than expected in a different route than expected and has an elevated heart rate. The application server **180** may then determine that the action to be performed may be to contact law enforcement authorities with a signal indicating that a kidnapping may have taken place.

In some implementations, the action to be performed may include providing notifications to emergency contacts. For example, the application server **180** may provide notifications that include performing an action (e.g., sounding a siren, generating alert beeps, or flashing a light indicator) in the home security system of the user's property or at the home security system of an emergency contact's property. In another example, the application server **180** may provide an alert to user devices of emergency contacts either through email, SMS, a mobile application, or other communication standards. In some instances, particular emergency contacts

may be contacted based on their proximity to the incident location. For example, the application server **180** may provide notifications to individuals that are located within a particular radius (e.g., five miles) of the potential incident and are identified as emergency contacts. In other examples where the incident may take place on commercial or university property, the action to be performed may include alerting local authorities such as security personnel, campus police, or other private emergency response personnel.

In some implementations, the action to be performed may include enabling local privately or publicly-owned cameras to capture video feeds of the incident as it is taking place. For example, in such implementations, the application server **180** may determine the incident location based on location data included in the received user data and then camera feeds that may be accessible near the incident location.

In other implementations, the action to be performed may include deploying one or more drones to the user location to capture live video footage of the user and transmit the live video footage of the user to emergency responders to improve the chances of recovery.

Referring now to FIG. **3**C, the process **300**C may include receiving incident data and location data from one or more devices (**314**), determining a user associated with the received incident data (**324**), determining a type of incident based on the received incident data (**334**), determining an action to be performed based on the type of incident (**344**), and transmitting an instruction to emergency responders to perform the action (**354**).

The process **300**C may include receiving incident data and location data from one or more devices (**314**). For example, the application server **180** may receive an incident signal including location data transmitted using devices connected to the monitoring platform **100** such as, for example, the one or more mobile devices **130**, **140**, or the wearable devices **150**. In some instances, the incident signal may be manually transmitted by the user after an incident takes place and the user needs emergency assistance. In other instances, the incident signal may be automatically transmitted by the devices connected to the monitoring platform **100** in response to measuring user data that indicates an abnormality compared to expected levels for user data. For example, if a user loses consciousness during an exercise routine and remains stationary, the wearable device **150** may determine, based on the reduced breathing pattern and user motion, that the user may need medical assistance and automatically transmit an incident signal to the application server **180**.

The process **300**C may include determining a user associated with the received incident data (**324**). For example, the application server **180** may parse user profiles to identify the user associated with the received incident data. In some instances, the user profile may be associated with the received incident data using a unique user identification number that is included in the received incident data. In other instances, the device generating the incident data such as, for e.g., the one or more mobile devices **130**, **140** or the wearable devices **150** may be associated with user profiles stored on the application server **180**.

The process **300**C may include determining a type of incident based on the received incident data (**334**). For example, the application server **180** may parse the received incident data to determine the type of incident that the user may be experiencing. For instance, the incident data may include a distress signal message from the user indicating the particular problem that the user may be experiencing. In such instances, the application server **180** may parse the distress signal message for particular keywords to classify the type of incident. For example, if the distress signal message includes health-oriented keywords such as "pain," "heart," "breathing," the application server **180** may classify the incident as a health risk, whereas if the distress signal message includes safety-related keywords such as "help," "secure," or "robbed" the monitoring platform **100** may classify the incident as a safety or security risk.

In other implementations, the incident data may include all current user data measured by the devices connected to the monitoring platform **100**. In such implementations, the application server **180** may correlate and aggregate the user data to classify the incident based on the most likely classification of the event. For instance, if the incident data includes elevate heart rate and increased breathing rate, the application server **180** may classify the incident as a health-related incident, whereas if the incident data includes unusual location data and/or activity data that suggests irregular or abnormal activity, the application server **180** may classify the incident as a safety-related incident.

The process **300**C may include determining an action to be performed based on the type of incident (**344**). For example, after classifying the type of incident that the user may be experiencing, the application server **180** may determine an appropriate action that needs to be performed to reduce risk of injury from the incident. For instance, if the incident is classified as a health-related incident, the application server **180** may then aggregate the received biometric data to determine a predicted treatment to reduce the risk of physical injury. For example, if the heart rate data indicates that the user may be experiencing a heart attack, the application server **180** may determine that the action to be performed may be to provide oxygen therapy or other actions for the treatment of chest pain.

The process **300**C may include transmitting an instruction to emergency responders to perform the action (**354**). For example, after the application server **180** has determined an action to be performed in response to the classified incident, the application server **180** may then transmit an instruction to the emergency notification server **190** to perform the action. For instance, the emergency notification server **190** may be an emergency room department of a hospital, a police station, a fire station or any other type of emergency responder. In such instances, the instruction may include relevant user data, a description of the problem, and a potential recommendation based on the user data received from the devices connected to the monitoring platform **100**. For example, if the application server **180** determines that the user is at risk of a heart attack, the instruction to the emergency notification server **190** may include heart rate data, breathing data, blood pressure data, and medical history of the patient from the user profile. The instruction may also include a recommended treatment option based on common emergency treatments for heart attacks. In another example, if the application server **180** determines that the user is in a house with a fire, the instruction may include temperature data, information about the property from the user profile and recommendations for potential entrances and exits to the location where the user is trapped.

In some implementations, the instruction to the emergency responders may be transmitted by an operator that receives the incident signal through an interface on the application server **180**. In such implementations, the operator may connect to an emergency responder such as, for e.g., a **911** operator or PSAP, using the control panel interface **220** as represented in FIG. **2**B. For example, the operator may

transmit live and recorded video footage captured by deployed drone devices **170**, establish an audio bridge between the user device (e.g., the one or more mobile devices **130**, **140** or the wearable devices **150**) and the emergency responder, or request information from nearby emergency contacts or neighbors to gather information about the incident.

FIG. **4** illustrates examples of transmission sequences for detected occurrence of safety incidents experienced by a user **402**. The occurrence of a safety incident may initially be determined by the application server **180** based on sensor data obtained from various safety devices **410**A, **410**B, and **410**C. The application server **180** then identifies a classification for the particular safety incident experienced by the user **402**, and then transmits a communication indicating the occurrence of the particular safety incident to another user or entity based on identified classification.

The safety devices **410**A-C may be different types of sensing devices (e.g., a wearable smart watch, a helmet with an integrated impact sensor, a vehicle operated by the user **402**) that collect different types of sensor data that indicate present safety conditions associated with the user **402**. For instance, as discussed above, the safety device **410**A may collect various biometric measurements that indicate a present physical condition of the user **402**. As an example, the safety device **410**A may be a wearable device that periodically measures the heart rate or the breathing rate of the user. In this example, if the measured rate exceeds or drops below a predetermined threshold associated with the baseline heart rate of the user **102**, then this information may be used by the application server **180** to identify the occurrence of a safety incident experienced by the user **402**.

In another instance, the safety device **410**B may be a wearable device that includes impact detection sensors that are configured to detect when the user **402** has been involved in a possible accident collision and requires immediate medical assistance. As an example, the safety device **410**B may be a bicycle helmet worn by the user **402** that detects when the user **402** has possibly fallen off his/her bicycle and may be injured but is unable to request medical assistance because he/she is unconscious. In this example, the safety device **410**B may include an aftermarket sensor device that is placed on a surface of the helmet. The aftermarket device may include one or more gyroscopes and/or accelerometers that enables the detection of a crash event when the user **402** rides a bicycle by performing various types of inertial measurements.

In another instance, the safety device **410**C may be a vehicle (e.g., a bicycle or car) that includes sensors that collects information on the user's operation of the vehicle. For example, a car may include a sensor that tracks vehicle movements (e.g., number of directional changes, vehicle speed, frequency of hard breaking, etc.) that are indicative of vehicular accidents and/or other safety incidents. In this example, the data collected by sensors can be used to determine if the user **402** has been involved in an accident and may be unconscious or unable to request emergency assistance.

Additionally or alternatively, the safety devices **410**A-**410**C may provide some information that other safety devices also provide. For example, a safety device in the form of a smartwatch worn on a wrist may provide a geographic location corresponding to a user along with other biometric specific information and a safety device in the form of a vehicle may also provide a geographic location corresponding to a user along with other vehicle movement information.

In some implementations, the sensor data collected by each of the safety devices **410**A-C may be directly transmitted to the application server **180**. In such implementations, the application server **180** may receive registration information for the user **402** that identifies the safety devices that are registered to the user **402**. The registration information may be included in a user profile stored within the stored historical data **424** as discussed above. The registration information may also include device identifiers that enable the application server **180** to associate incoming data transmissions from the safety devices **410**A-C with the user profile of the user **402**.

Additionally or alternatively, the safety devices **402** may also transmit sensor data to the client device **230** associated with the user **402**. In such implementations, the safety devices **410**A-C may be configured to exchange communications with the mobile device **230** using one or more wireless communication protocols (e.g., Bluetooth, near-field communication, etc.). The mobile device **230** may then be used as an intermediate device that processes the received sensor data from the safety devices **410**A-C, aggregates the sensor data into a single data package, and transmit the aggregated data package to the application server **180** through a cellular data connection.

In some implementations, the mobile device **230** may label the sensor data provided to the application server **180** with an identifier for the user **402** so that the application server **180** may determine that the received sensor data is for the user **402**. The mobile device **230** may determine to provide the information from a particular safety device in response to determining that the user **402** has registered the safety device as a device that the user **402** would like for the mobile device **230** to provide the application server **180** for safety monitoring purposes.

Additionally or alternatively, in some implementations, the safety devices **410**A-C may be configured to redundantly exchange data communications with the application server **180** to minimize latency in data transmissions from the safety devices **410**A-C that indicate a life-threatening emergency condition for the user **402**. For instance, in such implementations, the safety devices **410**A-C may be configured to identify a severity associated with an occurrence of a safety incident experienced by the user **402**, and adjust the transmission of data accordingly to maximize the likelihood of sensor data being received by the application server **180**. As an example, if the user **402** has been involved in a collision that destroys the mobile device **230** and makes the user **402** unconscious, then the safety devices **410**A-C may redirect the transmission of sensor data directly to the application server **180** instead of through the mobile device **230**. In another example, sensor data that is determined to include life-critical information (e.g., data indicating a vehicle fire) may be redundantly transmitted over multiple transmission pathways to maximize the likelihood that life-critical information is received by the application server **180**.

Upon receiving the sensor data collected by the safety devices **410**A-C and/or the registration information of the user **402**, the application server **180** may determine whether the user **402** has experienced the occurrence of a safety incident. As described above, this determination may be based on a satisfaction of at least one condition associated with various types of safety indicators indicated by the sensor data. For instance, if the sensor data represents a monitored heart rate of the user **402**, then an example of a safety indicator may be a threshold measured heart rate that is used to indicate that the user **402** is either experiencing anxiety and/or distress. In this example, sensor data indi-

cating an abnormal high measured heart rate may be used to determine an occurrence of a safety incident associated with a medical emergency. In another instance, if the sensor data represents impact detection data, an example of a safety indicator may be a threshold measured acceleration towards the ground indicative of a crash or collision. In this example, accelerometer data indicating an abnormally high rate of motion towards the ground may be used to determine that the user **402** was involved in a crash while riding a bicycle.

The application server **180** may also determine a type of safety incident that is being experienced by the user **402**. For instance, in some implementations, the application server **180** may access a safety incident repository **422** that specifies a list of different incident types (e.g., medical emergencies, personal attack by a perpetrator, traffic-related accidents, etc.), and select a particular incident type that coincides with the safety incident experienced by the user **402**. The safety incident repository **422** may include mappings between incident type, related sensor data, and users/entities that can provide emergency assistance in response to the user. For example, the safety incident repository **422** may specify safety indicators for each incident type that are used to determine an occurrence of a particular type of safety incident.

In some implementations, determinations of the occurrence of safety incident and/or the particular type of safety incident by the application server **180** may be based on information included within the stored historical data **424**. As described above with respect to FIG. **1**, the stored historical data **424** may include historical information associated with the user **402**, and/or historical information associated with other users that are determined to be similar to the user **402**. For example, the application server **180** may obtain historical data that indicates user-specific information to identify the occurrence of related types of safety incidents (e.g., an increased likelihood of an occurrence of a heart attack if the historical data indicates a medical history of high blood pressure). In another example, the application server **180** may obtain public safety data for the location associated with the user **402** that indicates types of safety incidents experienced by other users (e.g., an increased likelihood of an assault in a high-risk location where other individuals have been reported to be attacked or an area of highway where other users have also been in car accidents).

Although the determination of the occurrence of the safety incident and/or the particular type of safety incident may be passively determined by the application server **180**, in some implementations, such determinations may also be performed directly by the user **402**. For example, the user **402** may submit one or more user inputs on the mobile device **230** indicating that he/she has recently experienced or is currently experiencing a safety incident. In such an example, the application server **180** may simply route the incident signal provided by the user **402** to the appropriate entity or user using similar techniques described throughout.

The application server **180** then generates and transmits a communication to notify the occurrence of the safety incident to another user. As described above, the generated communication may include information related to the obtained sensor data collected by the safety devices **410**A-C. The communication may be selectively transmitted to a particular user/entity based on the occurrence of a particular type of safety incident determined by the application server **180** to be experienced by the user **402**.

In the examples depicted in FIG. **4**, if the application server **180** determines that the incident type for an occurrence of a safety incident is a potential assault, the application server **180** may transmit the generated communication to devices associated with a law enforcement officer **404**A, e.g., servers of a law enforcement agency or a mobile computing device of a particular law enforcement officer. Alternatively, if the incident type is determined to be a medical emergency, the application server **180** may instead transmit the generated communication to devices associated with an emergency medical technician **404**B or an authorized caretaker **404**C.

In some implementations, the application server **180** may also transmit data related to the safety incident experienced by the user **402** to devices associated with external monitoring systems. As an example, if the system determines a safety incident has occurred in a particular location, then the application server **180** may transmit instructions to a third party camera **404**D or a drone device **404**E. In some instances, the third party camera **404**D and the drone device **404**E may be devices that are determined by the application server **180** to be nearby the occurrence of the safety incident experienced by the user. Accordingly, the third party camera **404**D may pan and tilt to put the particular in view and provide the footage to the application server **180** to provide to safety responders. For example, the application server **180** may provide the footage to emergency responders **404**B so that the responders have more context regarding the safety incident. In another example, the application server **180** may provide an instruction to the drone device **404**E to fly to the particular location and similarly obtain video footage to provide others, or bring supplies for use in handling the safety incident. In some instances, the third party camera **404**D and the drone devices **404**E may be associated with a security service provided by a third party monitoring service provider **402**. In such instances, the user **402** may have a subscription for monitoring and/or security services from the monitoring service provider.

In some implementations, the selective transmission of the communication may also include determining an appropriate user or entity based on the location of the user **402**. For example, the application server **180** may receive location data from the mobile device **230** indicating a location associated with the occurrence of the safety incident experienced by the user **402**. The application server **180** may determine that the user **402** is experiencing a medical emergency based on using techniques described above and identify an emergency medical technician as the entity to receive the communication. The application server **180** may then transmit the communication to the emergency medical technicians that are determined to be closest to the location associated with the occurrence of safety incident. In another example, the application server **180** may determine that the user **402** may be under duress and that the user **402** is on property of a particular entity and, in response, notify security associated with the entity and a law enforcement agency.

In some implementations, the application server **180** may also provide indications of areas that frequently have safety issues. For example, the application server **180** may include an indication in the communication to another user that the location the user is now in has had frequent assaults. In another example, the application server **180** may generate a report that indicates portions of a highway that have more frequent accidents so that determinations may be made whether the number of accidents for those portions may be reduced.

FIG. **5** illustrates an example of a process **500** for providing communications indicating an occurrence of a particular type of safety incident experienced by a user. Briefly,

the process **500** may include obtaining registration information (**510**), obtaining sensor data (**520**), selecting an occurrence of a particular type of safety incident (**530**), and providing communication to another user in response to selecting an occurrence of the particular type of safety incident (**540**).

In more detail, the process **500** may include obtaining registration information (**510**). For instance, the application server **180** may obtain registration information that indicates that safety devices **410**A, **410**B, and **410**C are registered with the user **402**. In some implementations, the registration information may be included in a user profile for the user that is stored within the stored historical data **424**. In other implementations, the registration information may be transmitted from the mobile device **230**.

The process **500** may include obtaining sensor data (**520**). For instance, the application server **180** may obtain sensor data from the safety devices **410**A, **410**B and **410**C. As described above, the sensor data may include various types of information related to the present safety conditions of the user **402**. For example, the sensor data may include biometric data indicating a physiological state of the user **402** (e.g., heart rate or blood pressure), accelerometer and/or gyroscope data indicating movement of the user **402** while performing a type of activity, or other types of data that may be used to determine if the user has experienced an occurrence of a safety incident.

The process **500** may include selecting an occurrence of a particular type of safety incident (**530**). For instance, the application server **180** may select an occurrence of a particular type of safety incident experienced by the user **402** from among a plurality of types of safety incidents that are included within the safety incident repository **424**. The selection of the occurrence of the particular type of safety incident experienced by the user **402** may be based on the sensor data obtained from the safety devices **410**A, **410**B, and **410**C, and/or the registration information that indicates that the safety devices **410**A, **410**B, and **410**C are registered with the user **402**. As described above, in some implementations, the application server **180** accesses the safety incident repository **422**, which includes a list of different types of safety incidents and specifies different safety indicators associated with each type of safety incident. In such implementations, the application server **180** determines the satisfactions of conditions associated with the safety indicators based on the obtained sensor data, and then selects a particular type of safety incident from among the list of different types of safety incidents in order to select an occurrence of the particular type of safety incident experienced by the user **402**.

The process **500** may include providing communication to another user in response to selecting an occurrence of the particular type of safety incident (**540**). For instance, in response to selecting the occurrence of the particular type of safety incident experienced by the user **402** from among the plurality of types of safety incidents included within the safety incident repository **424**, the application server **180** may provide a communication to another user indicating the occurrence of the particular type of safety incident experienced by the user. Examples of users or entities that receive the communication may include law enforcement officers **404**A, medical responders **404**B, or authorized caretakers **404**C. The communication may be selectively provided to another user based on, for example, the particular type of safety incident experienced by the user **402**, the location of the safety incident, among other types of information that indicates whether another user will responsive to the safety incident experienced by the user **402**.

The described systems, methods, and techniques may be implemented in digital electronic circuitry, computer hardware, firmware, software, or in combinations of these elements. Apparatus implementing these techniques may include appropriate input and output devices, a computer processor, and a computer program product tangibly embodied in a machine-readable storage device for execution by a programmable processor. A process implementing these techniques may be performed by a programmable processor executing a program of instructions to perform desired functions by operating on input data and generating appropriate output. The techniques may be implemented in one or more computer programs that are executable on a programmable system including at least one programmable processor coupled to receive data and instructions from, and to transmit data and instructions to, a data storage system, at least one input device, and at least one output device. Each computer program may be implemented in a high-level procedural or object-oriented programming language, or in assembly or machine language if desired; and in any case, the language may be a compiled or interpreted language. Suitable processors include, by way of example, both general and special purpose microprocessors. Generally, a processor will receive instructions and data from a read-only memory and/or a random access memory. Storage devices suitable for tangibly embodying computer program instructions and data include all forms of non-volatile memory, including by way of example semiconductor memory devices, such as Erasable Programmable Read-Only Memory (EPROM), Electrically Erasable Programmable Read-Only Memory (EEPROM), and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks; and Compact Disc Read-Only Memory (CD-ROM). Any of the foregoing may be supplemented by, or incorporated in, specially designed application-specific integrated circuits (ASICs).

It will be understood that various modifications may be made. For example, other useful implementations could be achieved if steps of the disclosed techniques were performed in a different order and/or if components in the disclosed systems were combined in a different manner and/or replaced or supplemented by other components. Accordingly, other implementations are within the scope of the disclosure.

What is claimed is:

1. A method performed by one or more computers, the method comprising:

identifying a safety device that is associated with a user profile of a user, wherein the user profile identifies a path that was previously travelled by the user;

obtaining sensor data collected by the safety device that is associated with the user profile of the user;

determining that the user was travelling along the path based on the sensor data;

determining a current location of the safety device;

determining that the user has deviated from the path based on the current location of the safety device and the determination that the user was travelling along the path based on the sensor data;

determining that a safety indicator associated with the path has been satisfied based on the determination that the user has deviated from the path, wherein the safety indicator is defined in part by historical safety data of the user and historical safety data of other users that are determined to be similar to the user;

determining that the user has experienced an occurrence of a particular safety incident based at least on the determination that the safety indicator associated with the path has been satisfied; and

in response to determining that the user has experienced the occurrence of the particular safety incident, providing a communication to another user that indicates the occurrence of the particular safety incident.

2. The method of claim **1**, wherein:

the user profile of the user indicates prior occurrences of safety incidents previously experienced by the user; and

the determination of the occurrence of the particular safety incident at the current location is based on the prior occurrences of the safety incidents previously experienced by the user and safety incidents previously occurring at the current location of the safety device.

3. The method of claim **1**, further comprising:

in response to determining the occurrence of the particular safety incident at the current location, updating the user profile to indicate the occurrence of the particular safety incident at the current location.

4. The method of claim **1**, wherein:

the safety device is a wearable device that collects biometric data of the user; and

the method further comprises:

identifying a second safety device that is associated with the user profile of the user, the second safety device being a vehicle operated by the user;

obtaining sensor data collected by the second safety device that is associated with the user profile of the user; and

the determination of the occurrence of the particular safety incident at the current location is based at least on sensor data collected by the wearable device, sensor data collected by the vehicle operated by the user, and historical data corresponding to the current location of the safety device.

5. The method of claim **1**, wherein providing the communication to another user comprises:

determining one or more data types associated with the sensor data; and

determining another particular user to provide the communication based on the particular safety incident at the current location and the one or more data types determined to be associated with the sensor data.

6. The method of claim **1**, wherein:

the safety indicator is associated with a condition that, once satisfied, indicates an occurrence of a corresponding safety incident; and

determining that the safety indicator associated with the path has been satisfied comprises:

determining, based on the sensor data, that a condition for the safety indicator has been satisfied.

7. The method of claim **1**, wherein the another user comprises one or more of a law enforcement officer, an emergency medical technician, or an authorized caretaker for the user.

8. The method of claim **1**, wherein the current location of the safety device is determined based on global positioning system data collected by the safety device.

9. A system comprising:

one or more computers; and

one or more storage devices storing instructions that, when executed by the one or more computers, cause the one or more computers to perform operations comprising:

identifying a safety device that is associated with a user profile of a user, wherein the user profile identifies a path that was previously travelled by the user;

obtaining sensor data collected by the safety device that is associated with the user profile of the user;

determining that the user was travelling along the path based on the sensor data;

determining a current location of the safety device;

determining that the user has deviated from the path based on the current location of the safety device and the determination that the user was travelling along the path based on the sensor data;

determining that a safety indicator associated with the path has been satisfied based on the determination that the user has deviated from the path, wherein the safety indicator is defined in part by historical safety data of the user and historical safety data of other users that are determined to be similar to the user;

determining that the user has experienced an occurrence of a particular safety incident based at least on the determination that the safety indicator associated with the path has been satisfied; and

in response to determining that the user has experienced the occurrence of the particular safety incident, providing a communication to another user that indicates the occurrence of the particular safety incident.

10. The system of claim **9**, wherein:

the user profile of the user indicates prior occurrences of safety incidents previously experienced by the user; and

the determination of the occurrence of the particular safety incident at the current location is based on the prior occurrences of the safety incidents previously experienced by the user and safety incidents previously occurring at the current location of the safety device.

11. The system of claim **9**, wherein the operations further comprise:

in response to determining the occurrence of the particular safety incident at the current location, updating the user profile to indicate the occurrence of the particular safety incident at the current location.

12. The method of claim **1**, wherein:

the safety device is a wearable device that collects biometric data of the user; and

the operations further comprise:

identifying a second safety device that is associated with the user profile of the user, the second safety device being a vehicle operated by the user;

obtaining sensor data collected by the second safety device that is associated with the user profile of the user; and

the determination of the occurrence of the particular safety incident at the current location is based at least on sensor data collected by the wearable device, sensor data collected by the vehicle operated by the user, and historical data corresponding to the current location of the safety device.

13. A non-transitory computer-readable storage device encoded with computer program instructions that, when executed by one or more computers, cause the one or more computers to perform operations comprising:

identifying a safety device that is associated with a user profile of a user, wherein the user profile identifies a path that was previously travelled by the user;

obtaining sensor data collected by the safety device that is associated with the user profile of the user;

determining that the user was travelling along the path based on the sensor data;

determining a current location of the safety device;

determining that the user has deviated from the path based on the current location of the safety device and the determination that the user was travelling along the path based on the sensor data;

determining that a safety indicator associated with the path has been satisfied based on the determination that the user has deviated from the path, wherein the safety indicator is defined in part by historical safety data of the user and historical safety data of other users that are determined to be similar to the user;

determining that the user has experienced an occurrence of a particular safety incident based at least on the determination that the safety indicator associated with the path has been satisfied; and

in response to determining that the user has experienced the occurrence of the particular safety incident, providing a communication to another user that indicates the occurrence of the particular safety incident.

14. The device of claim **13**, wherein:

the user profile of the user indicates prior occurrences of safety incidents previously experienced by the user; and

the determination of the occurrence of the particular safety incident at the current location is based on the prior occurrences of the safety incidents previously experienced by the user and safety incidents previously occurring at the current location of the safety device.

15. The device of claim **13**, wherein the operations further comprise:

in response to determining the occurrence of the particular safety incident at the current location, updating the user profile to indicate the occurrence of the particular safety incident at the current location.

16. The device of claim **13**, wherein:

the safety device is a wearable device that collects biometric data of the user; and

the operations further comprise:

identifying a second safety device that is associated with the user profile of the user, the second safety device being a vehicle operated by the user;

obtaining sensor data collected by the second safety device that is associated with the user profile of the user; and

the determination of the occurrence of the particular safety incident at the current location is based at least on sensor data collected by the wearable device, sensor data collected by the vehicle operated by the user, and historical data corresponding to the current location of the safety device.

17. The method of claim **1**, further comprising:

determining a travel speed associated with the user travelling along the path;

determining that the travel speed associated with the user travelling along the path exceeds a historical travel speed that was determined when the user previously travelled along the path; and

determining that the user has experienced the occurrence of a particular safety incident comprises determining, based on the determination that the travel speed associated with the user travelling along the path exceeds the historical travel speed that was determined when the user previously travelled along the path, that the user has likely been kidnapped.

18. The method of claim **1**, wherein:

the sensor data comprises a heart rate measured for the user; and

determining that the user has experienced the occurrence of a particular safety incident comprises:

determining that the heart rate measured for the user exceeds a historical heart rate that was measured when the user previously travelled along the path; and

determining that the user has experienced the occurrence of a particular safety incident comprises determining, based on the determination that the heart rate measured for the user exceeds the historical heart rate that was measured when the user previously travelled along the path.

19. The method of claim **1**, wherein:

The user profile identifies an expected time period for the user to travel along the path that was previously travelled by the user; and

determining that the user has experienced the occurrence of a particular safety incident comprises:

determining that a current time period during which the user was travelling along the path exceeds the expected time period; and

determining that the user has experienced the occurrence of a particular safety incident comprises determining, based on the determination that the current time period during which the user was travelling along the path exceeds the expected time period.

* * * * *

专利名称(译)	安全监控平台		
公开(公告)号	US10586437	公开(公告)日	2020-03-10
申请号	US15/843437	申请日	2017-12-15
[标]申请(专利权)人(译)	ALARM.COM INC.		
申请(专利权)人(译)	ALARM.COM INCORPORATED		
当前申请(专利权)人(译)	ALARM.COM INCORPORATED		
[标]发明人	SLAVIN ALISON JANE ROBERTS AARON LEE		
发明人	SLAVIN, ALISON JANE ROBERTS, AARON LEE		
IPC分类号	A61B5/00 A61B5/0205 H04L29/08 G08B25/10 G08B25/01 G08B21/04 A61B5/021 A61B5/024 A61B5/145 H04W4/38 H04W4/02 A61B7/04 A61B5/08 A61B5/01 H04W4/90		
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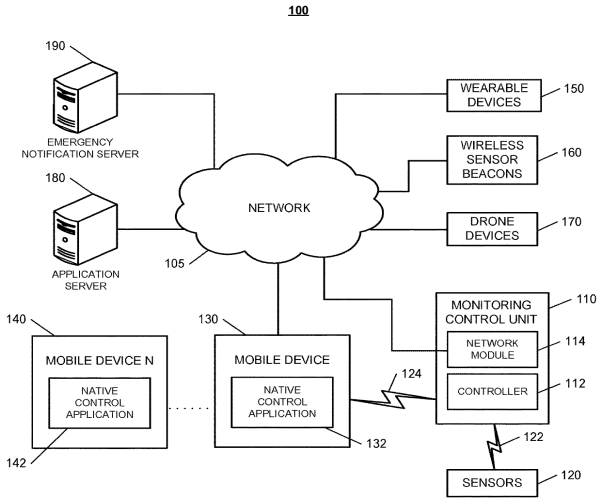
代理机构(译)	FISH & RICHARDSON P.C.		
审查员(译)	LIM，史蒂芬		
优先权	62/205879 2015-08-17 US		
外部链接	Espacenet		

摘要(译)

在一些实现中，系统可以发送指示用户经历的特定类型的安全事件的发生的通信。 首先，获得表示要向用户注册不同类型的多个安全装置的注册信息。 从多个不同类型的安全装置获得传感器数据。 然后从多种类型的安全事件中选择用户经历的特定类型的安全事件的发生。 该选择可以至少基于所获得的传感器数据和所获得的注册信息。 然后，响应于选择特定类型的安全事件的发生，向另一用户提供通信以指示该用户经历的特定类型的安全事件的发生。