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(54) **NOTIFICATIONS ON A USER DEVICE BASED ON ACTIVITY DETECTED BY AN ACTIVITY MONITORING DEVICE**

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See application file for complete search history.

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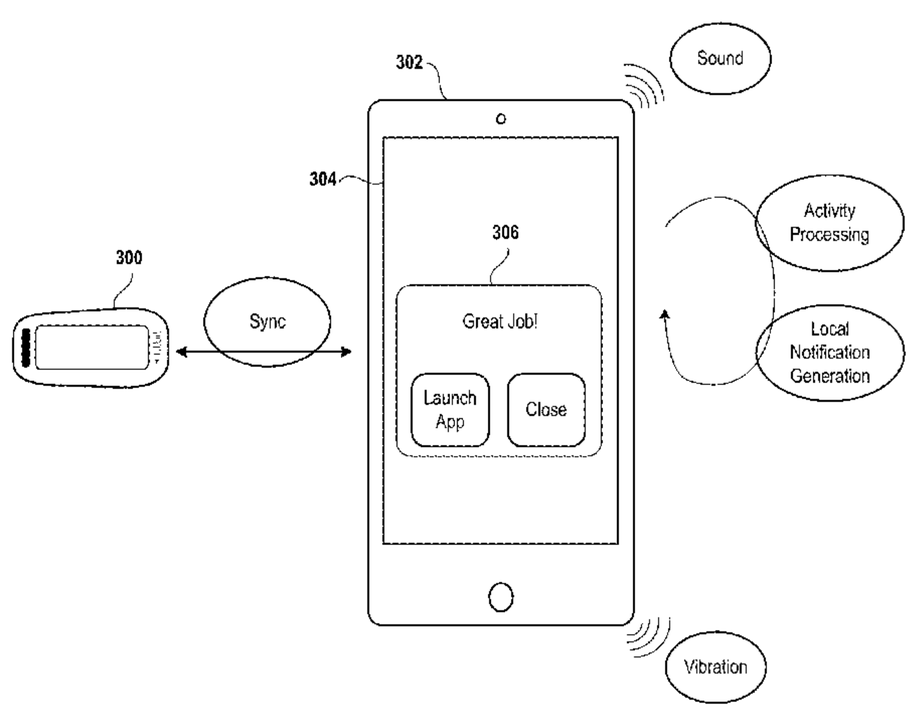
(57) **ABSTRACT**

A method for generating a notification on a mobile device is provided, including the following method operations: establishing a wireless connection between the mobile device and an activity monitoring device; receiving, at the mobile device, activity data from the activity monitoring device via the wireless connection; processing the activity data to determine an activity metric for a user of the activity monitoring device; comparing the activity metric against a predefined threshold, the predefined threshold being mapped to a notification message; determining, based on the comparing, that the activity metric has reached or exceeds the predefined threshold; displaying the notification message on the mobile device after determining that the activity metric reached or exceeded the predefined threshold.

30 Claims, 13 Drawing Sheets



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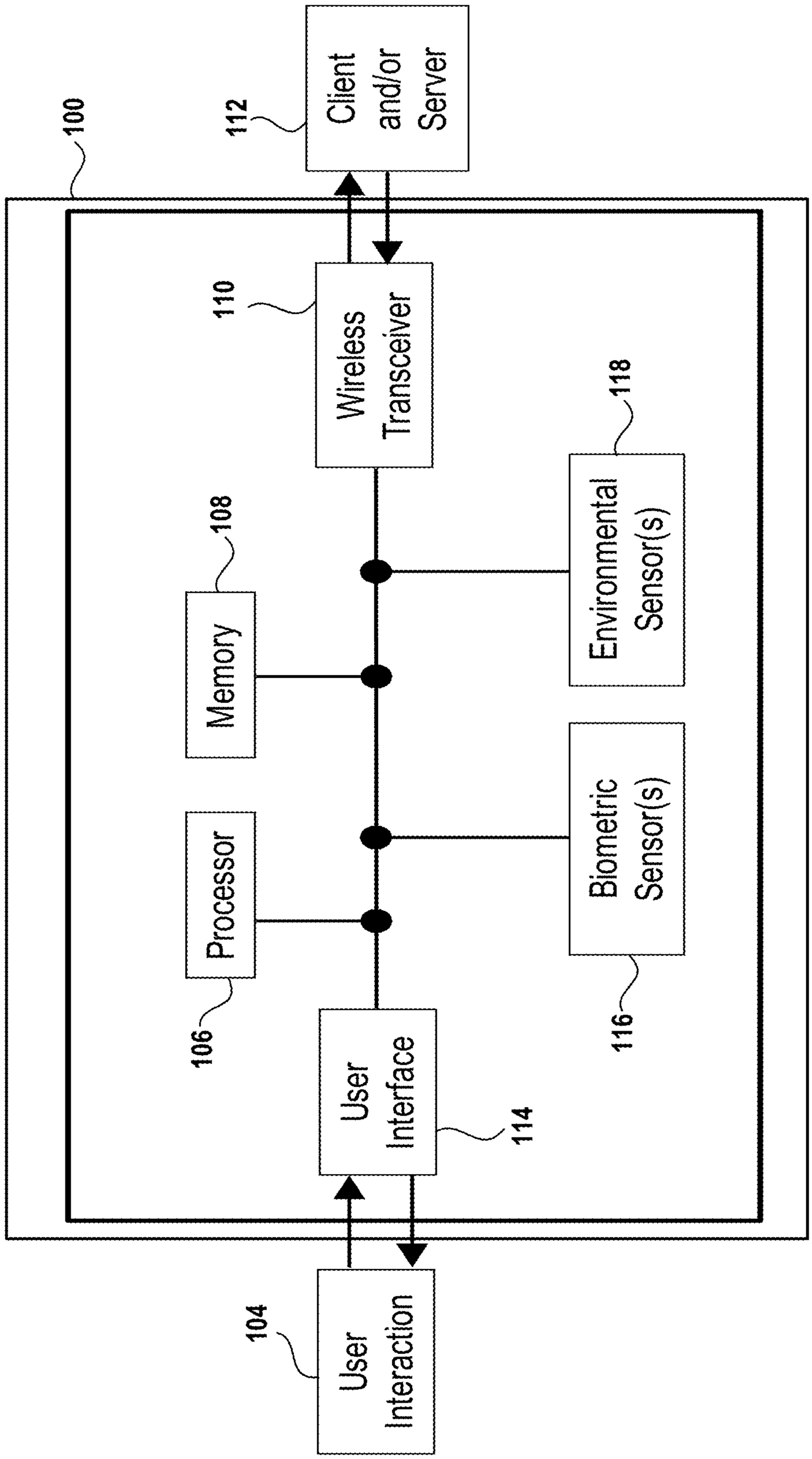
100
112
Client and/or Server
110
Wireless Transceiver
108
Memory
106
Processor
114
User Interface
118
Environmental Sensor(s)
116
Biometric Sensor(s)
104
User Interaction

FIG. 1A

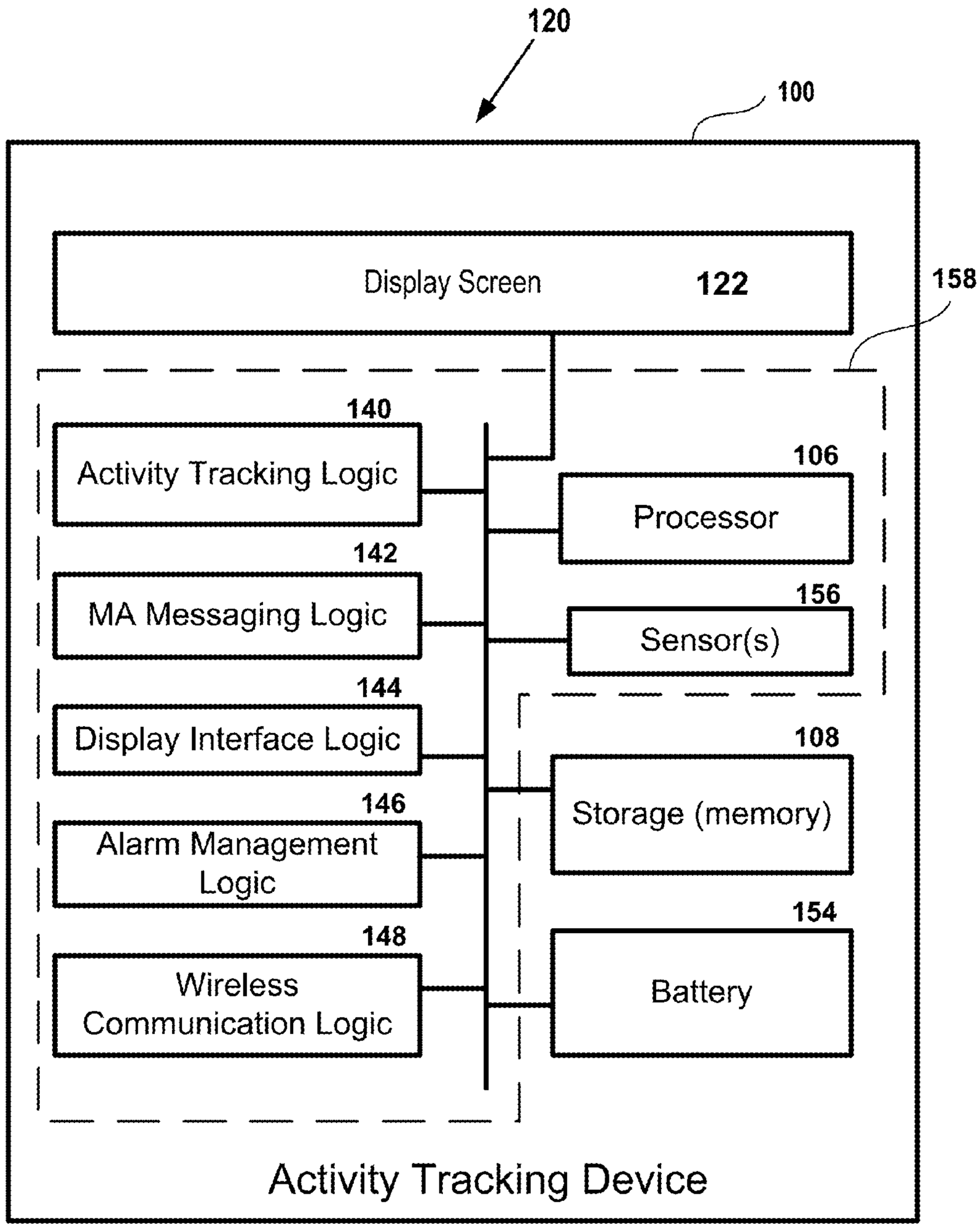
120
100
Display Screen
122
158
140
Activity Tracking Logic
106
Processor
142
MA Messaging Logic
156
Sensor(s)
144
Display Interface Logic
108
Storage (memory)
146
Alarm Management Logic
154
148
Wireless Communication Logic
Battery
Activity Tracking Device

FIG. 1B

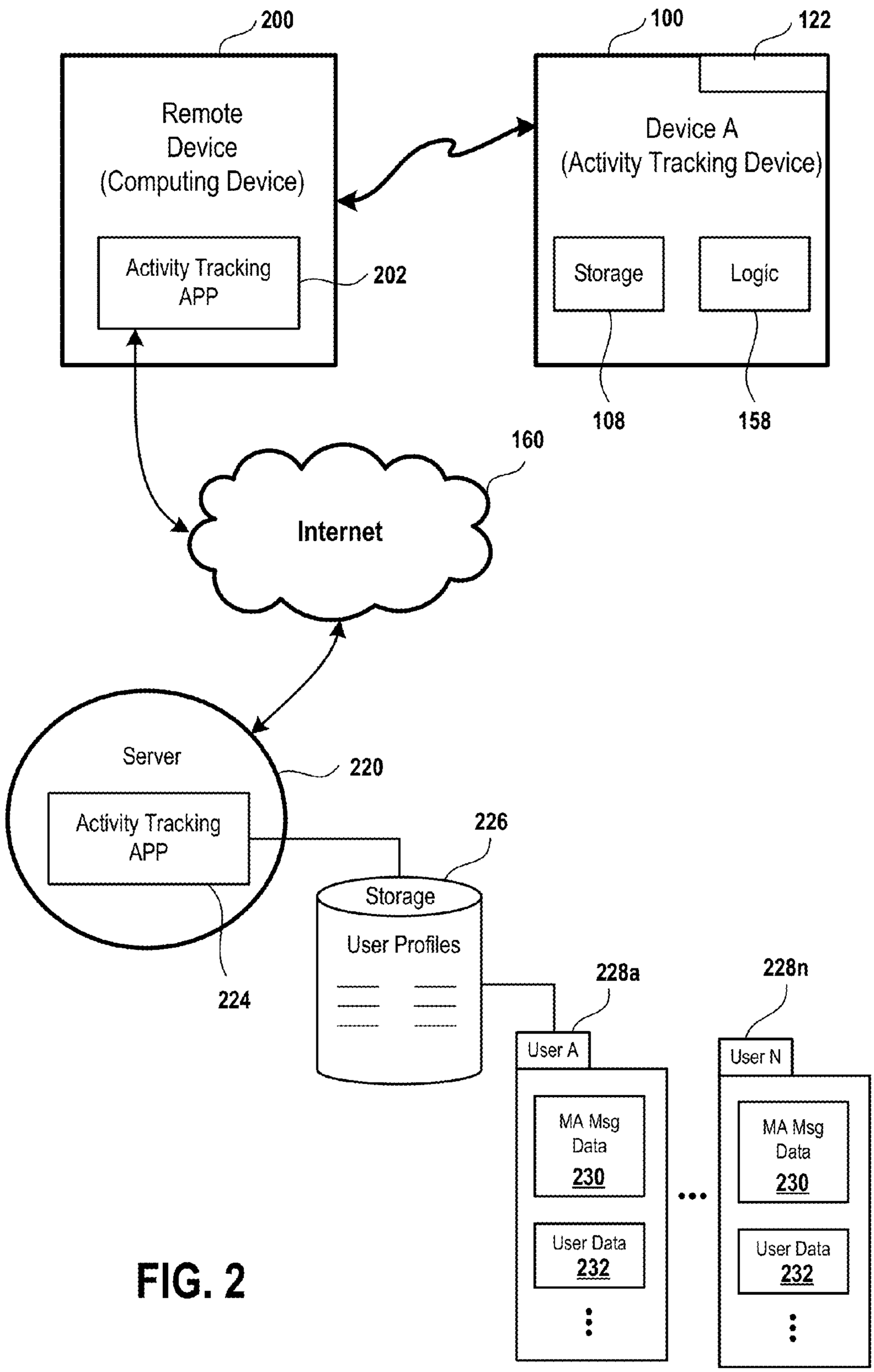
200
Remote Device (Computing Device)
Activity Tracking APP
202
100
122
Device A (Activity Tracking Device)
Storage
Logic
108
158
160
Internet
Server
220
Activity Tracking APP
224
226
Storage
User Profiles
228a
228n
User A
User N
MA Msg Data
230
User Data
232

FIG. 2

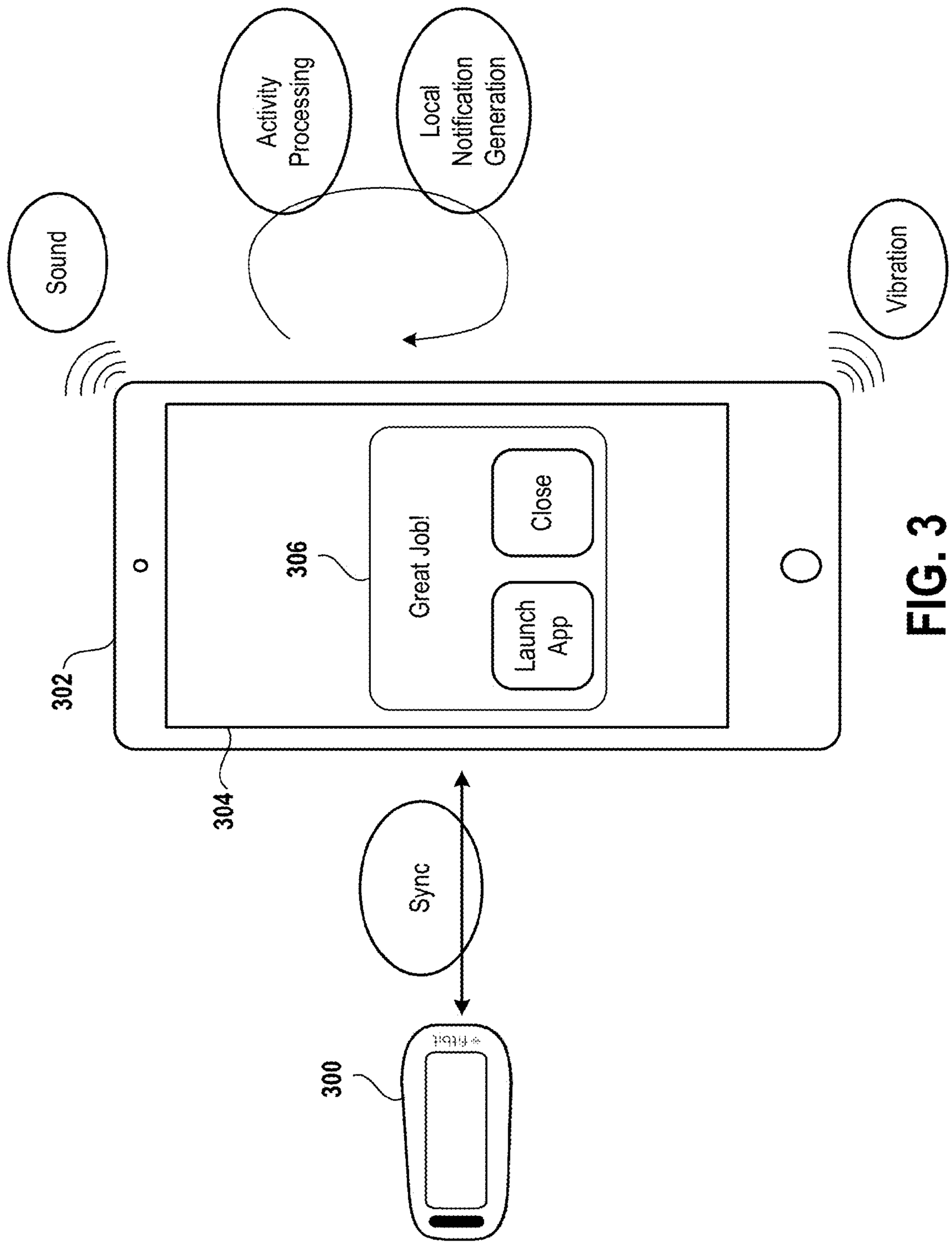
Activity Processing
Local Notification Generation
Sound
Vibration
302
306
Great Job!
Close
Launch App
304
Sync
300
fitbit

FIG. 3

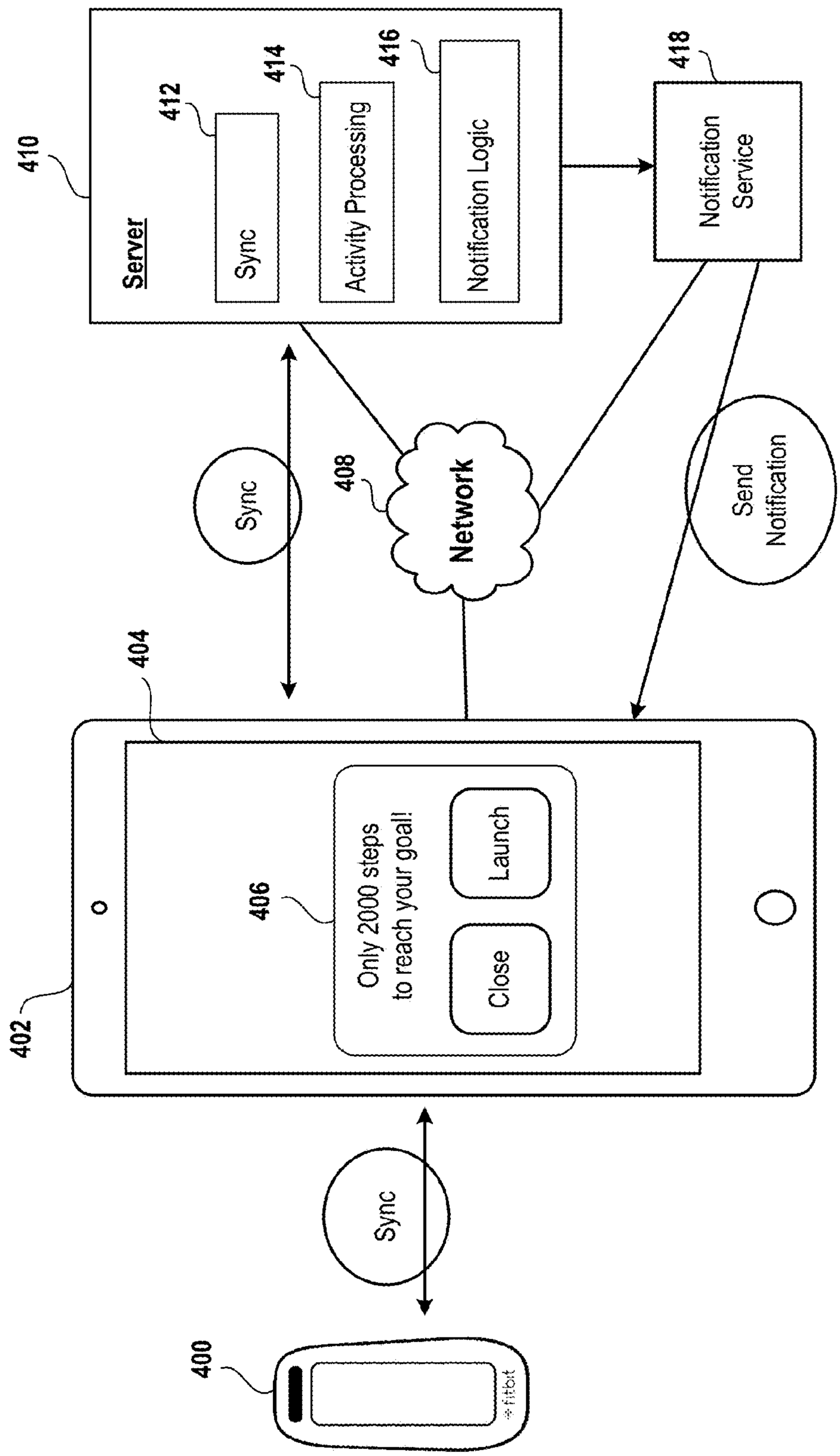
410
Server
412
Sync
414
Activity Processing
416
Notification Logic
418
Notification Service
Sync
408
Network
Send Notification
404
402
406
Only 2000 steps to reach your goal!
Close
Launch
Sync
400
fitbit

FIG. 4

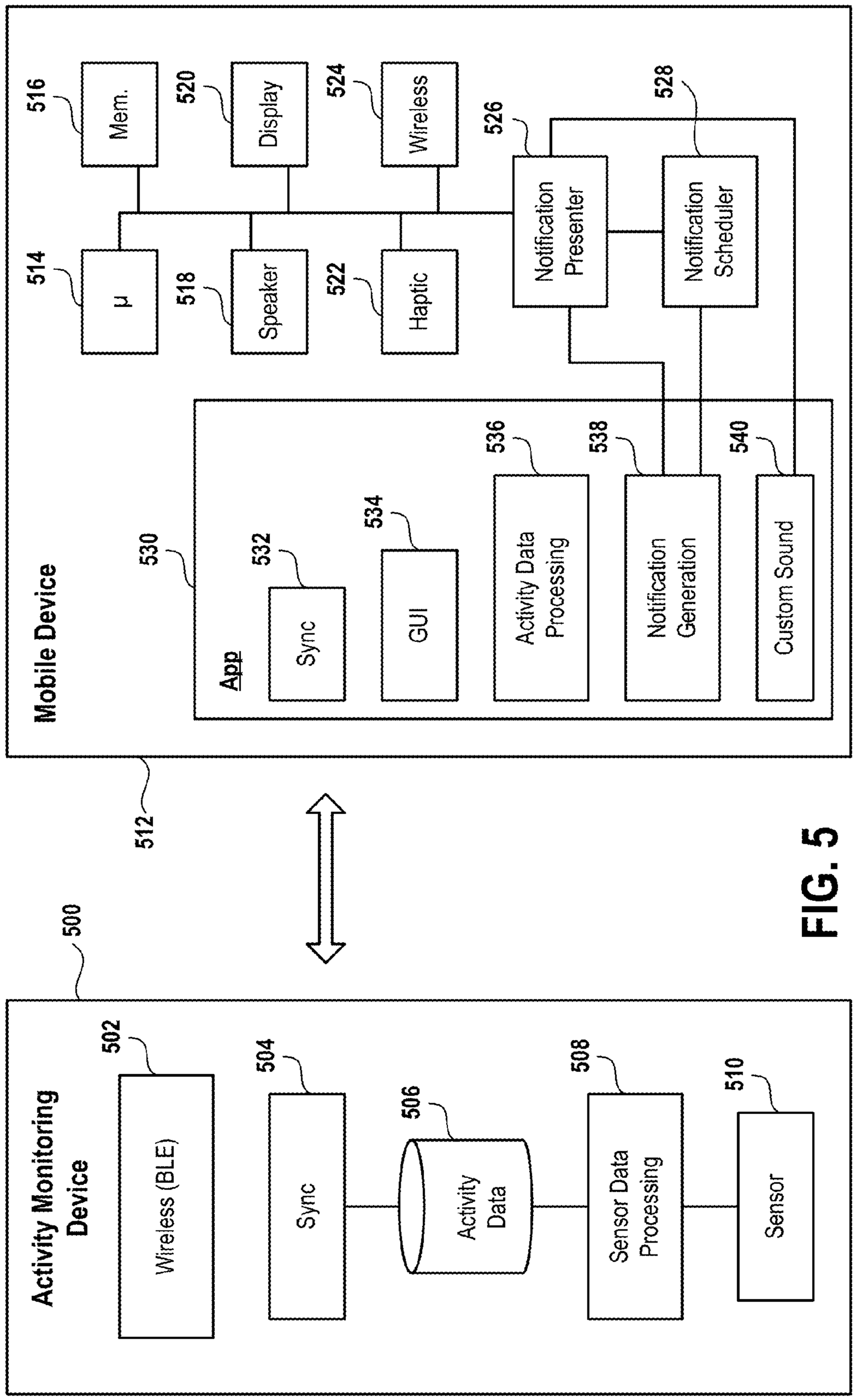
Mobile Device
512
516
Mem.
520
Display
524
Wireless
526
Notification Presenter
528
Notification Scheduler
514
μ
518
Speaker
522
Haptic
530
App
532
Sync
534
GUI
536
Activity Data Processing
538
Notification Generation
540
Custom Sound
500
Activity Monitoring Device
502
Wireless (BLE)
504
Sync
506
Activity Data
508
Sensor Data Processing
510
Sensor

FIG. 5

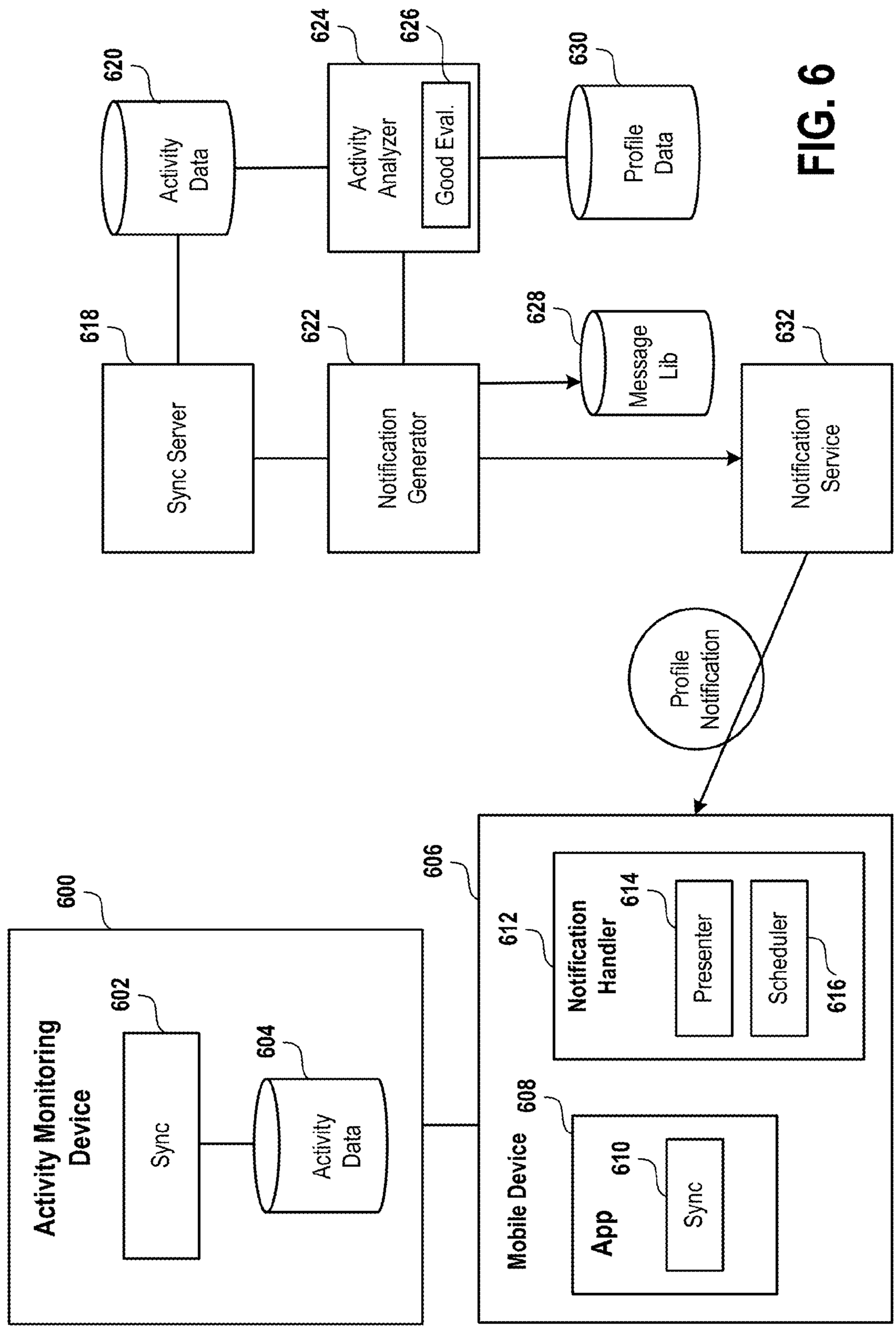
600
Activity Monitoring Device
602
Sync
604
Activity Data
606
Mobile Device
608
App
610
Sync
612
Notification Handler
614
Presenter
616
Scheduler
Profile Notification
618
Sync Server
620
Activity Data
622
Notification Generator
624
Activity Analyzer
626
Good Eval.
628
Message Lib
630
Profile Data
632
Notification Service

FIG. 6

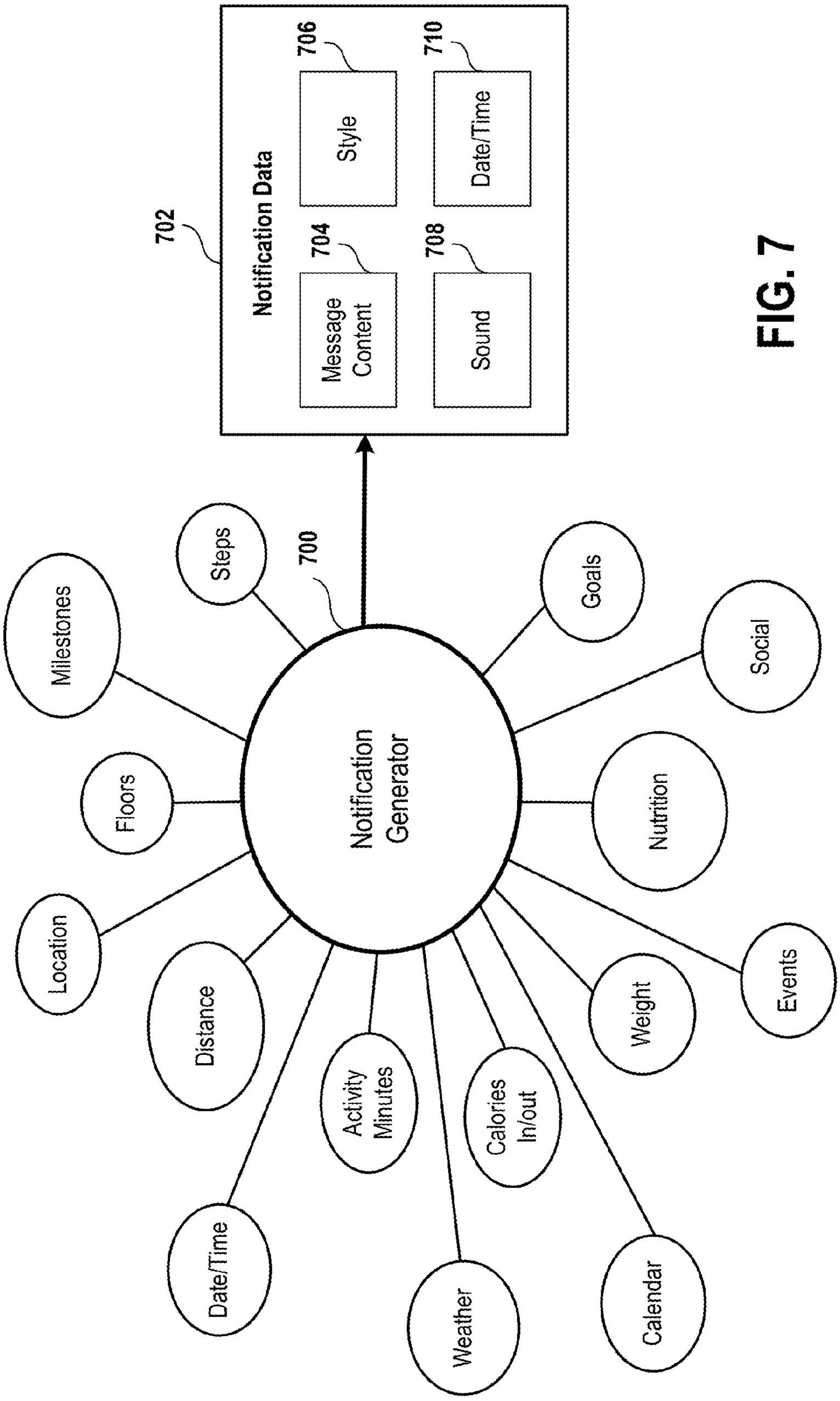
Notification Data
702
706
Style
710
Date/Time
704
Message Content
708
Sound
700
Notification Generator
Milestones
Steps
Goals
Social
Floors
Nutrition
Location
Events
Distance
Weight
Activity Minutes
Calories In/out
Date/Time
Weather
Calendar

FIG. 7

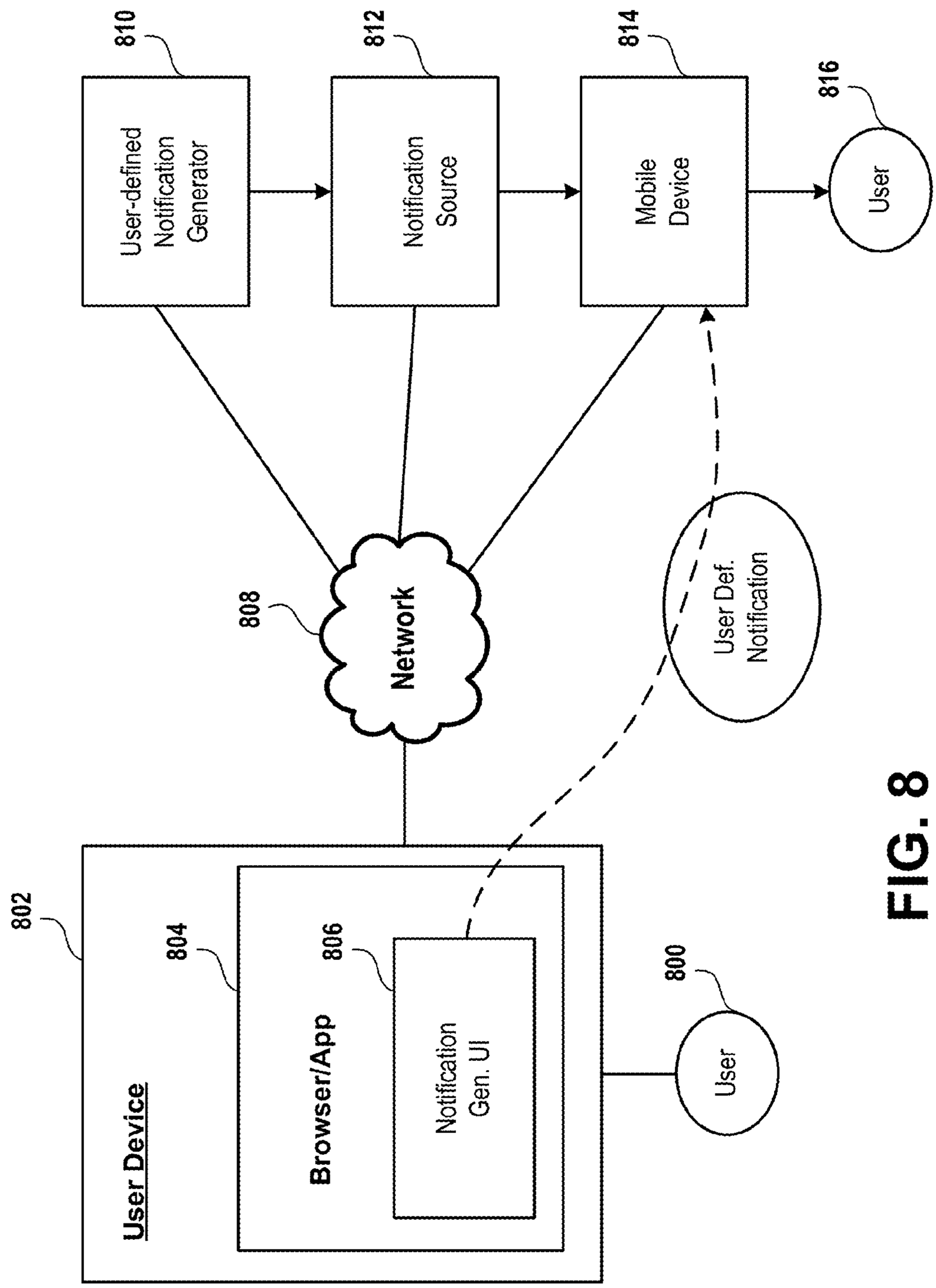
810
User-defined Notification Generator
812
Notification Source
814
Mobile Device
816
User
808
Network
User Def. Notification
802
User Device
804
Browser/App
806
Notification Gen. UI
800
User

FIG. 8

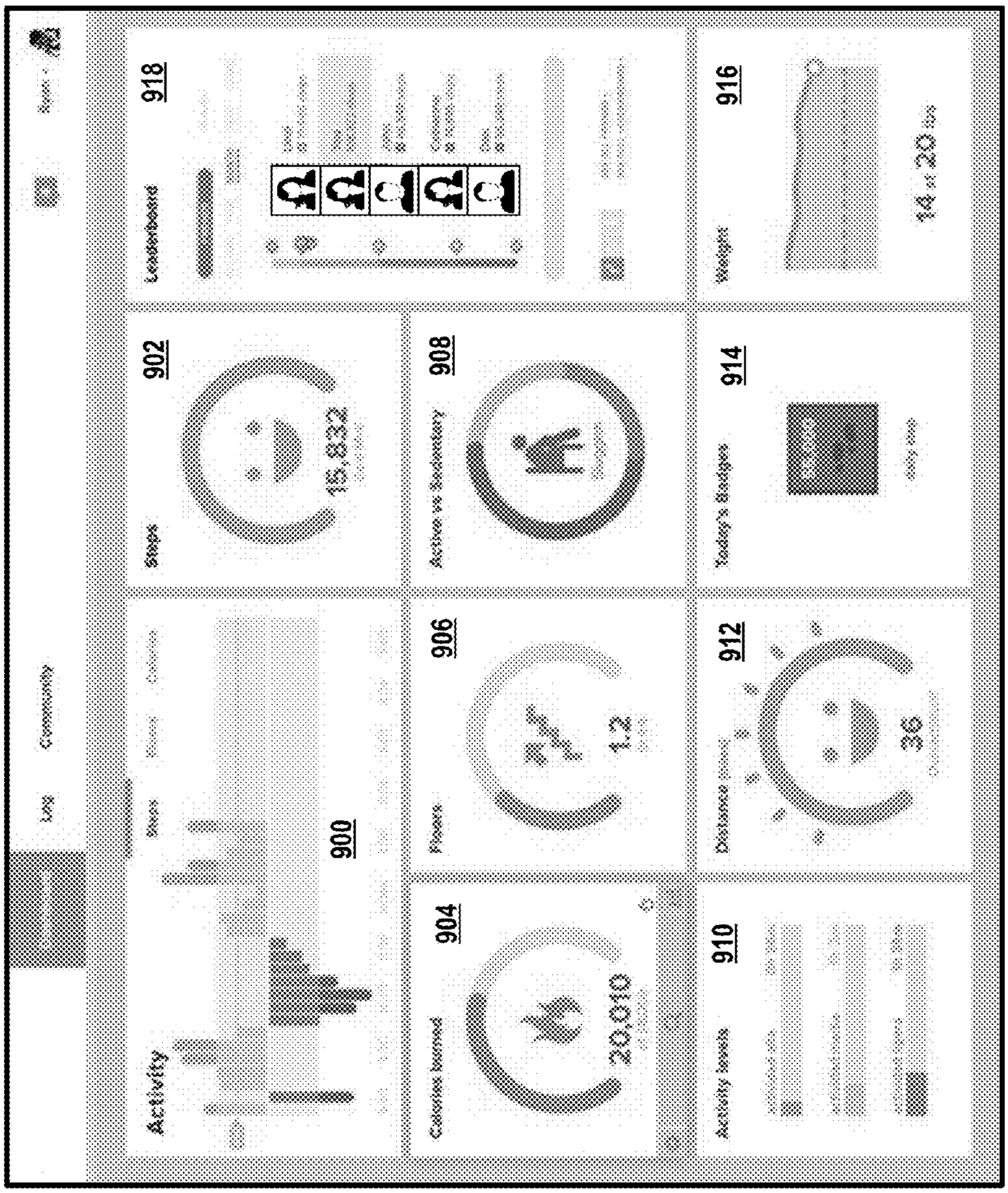
Community
Log
Activity
900
Steps
902
15,832
Leaderboard
918
Calories burned
904
20,010
Floors
906
1.2
Activity
908
Weights
916
14 of 20
Today's Badges
914
Activity levels
910
Distance
912
36

FIG. 9

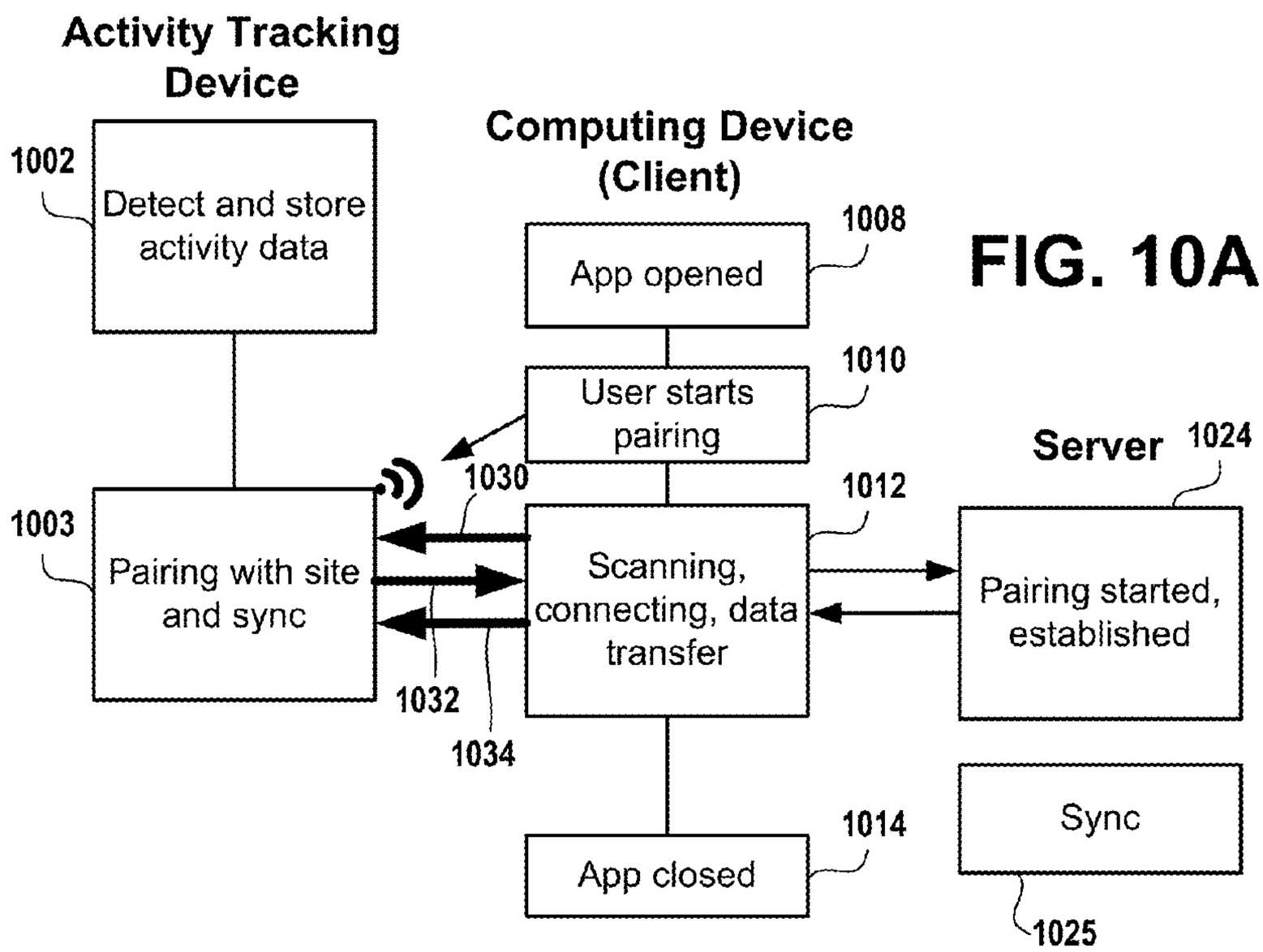

FIG. 10A

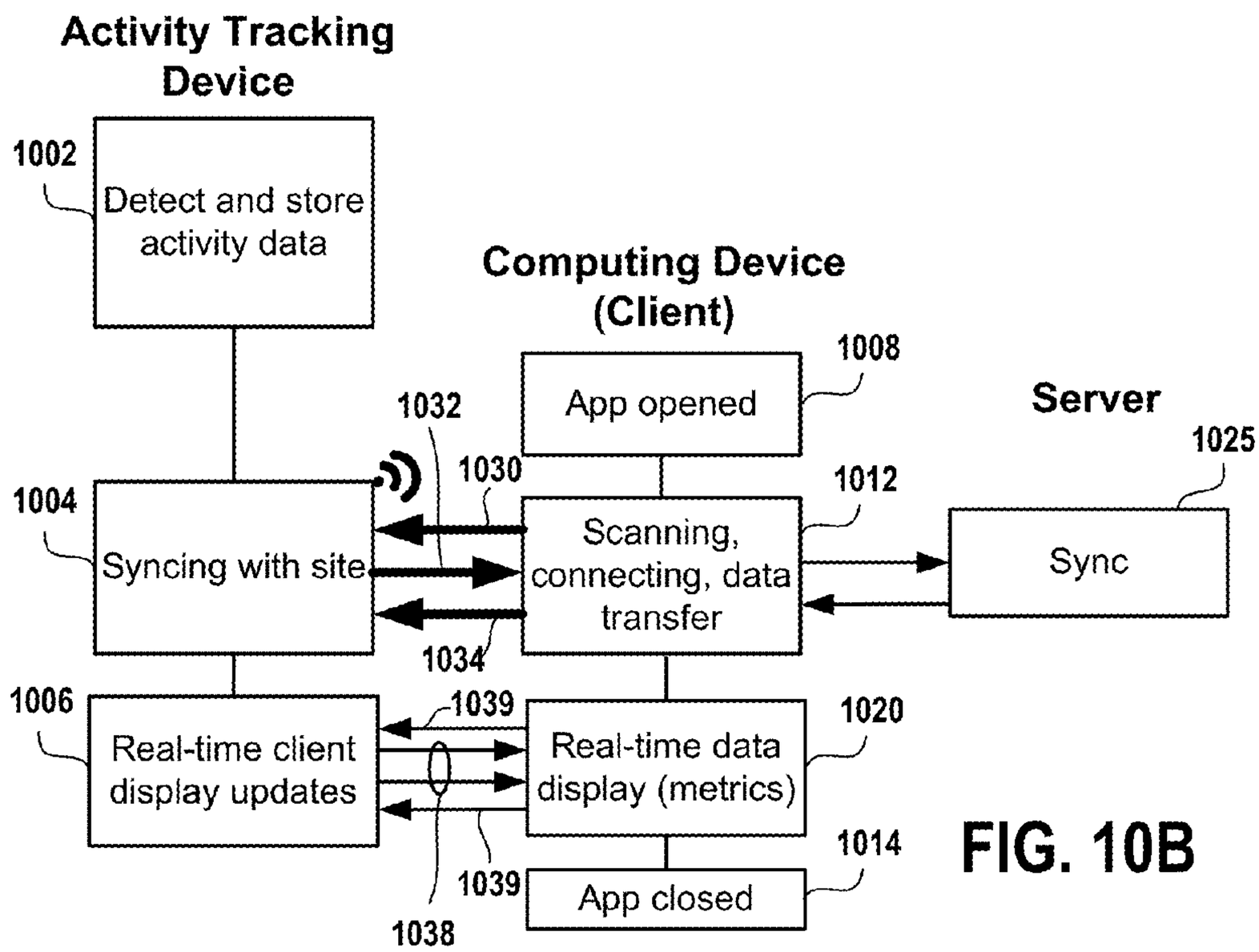

FIG. 10B

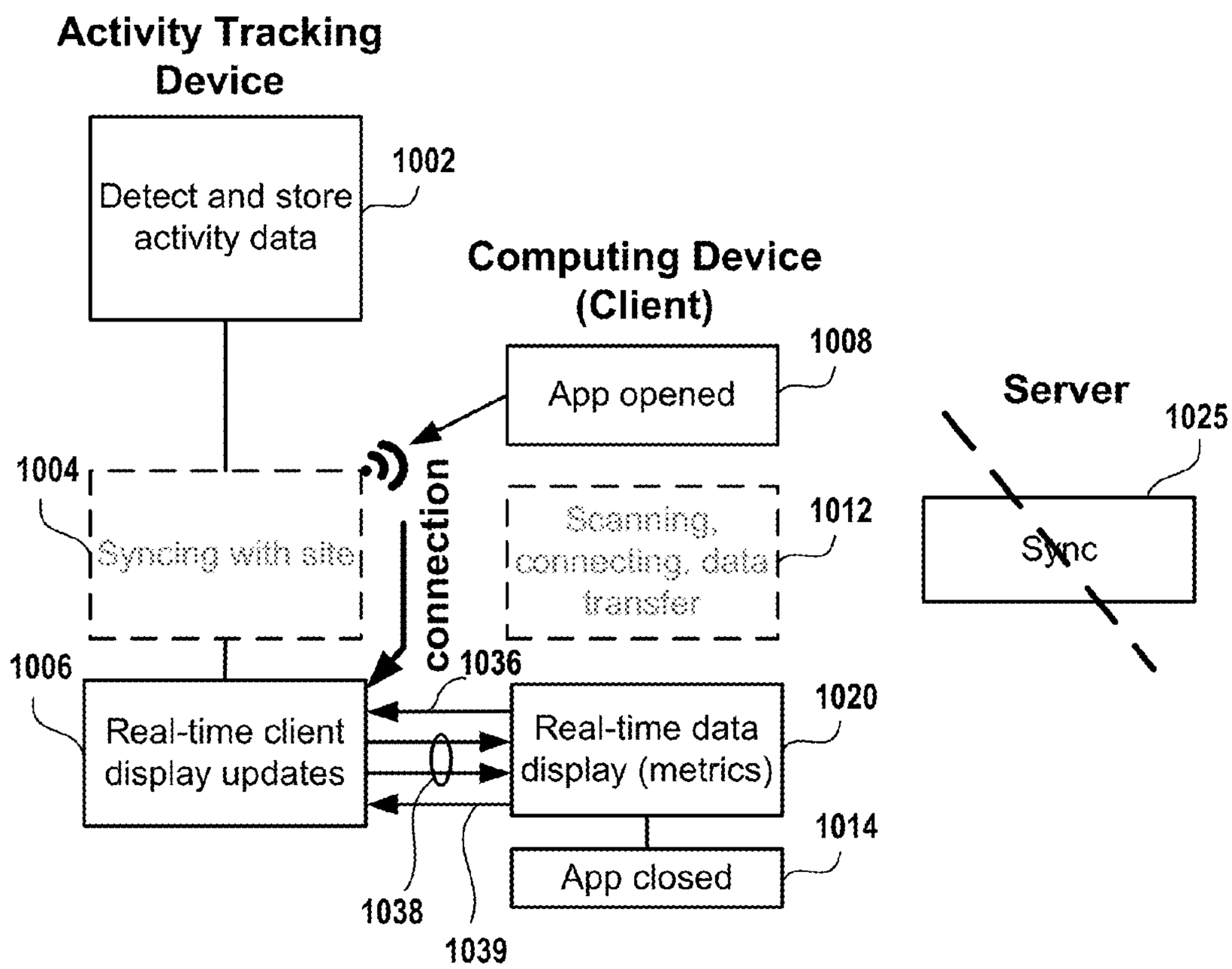
Activity Tracking Device
Detect and store activity data
1002
Computing Device (Client)
App opened
1008
Server
1025
1004
Syncing with site
connection
Scanning, connecting, data transfer
1012
Sync
1006
1036
Real-time client display updates
Real-time data display (metrics)
1020
1014
App closed
1038
1039

FIG. 10C

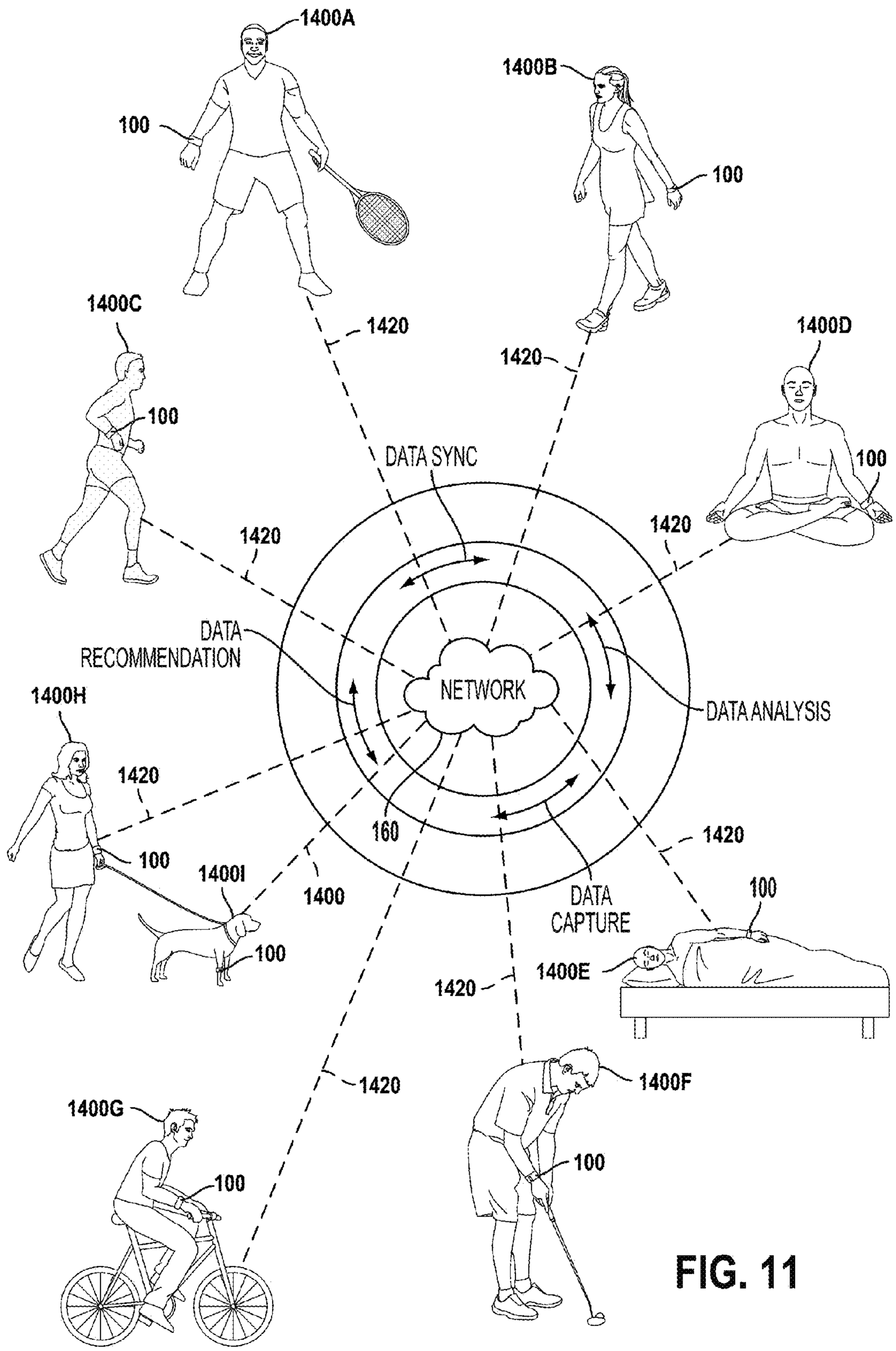
1400A
100
1400B
100
1400C
100
1420
1420
1400D
100
DATA SYNC
1420
1420
DATA
RECOMMENDATION
NETWORK
DATA ANALYSIS
1400H
1420
160
1420
100
1400I
1400
DATA
CAPTURE
100
100
1400E
1420
1420
1400F
1400G
100
100

FIG. 11

NOTIFICATIONS ON A USER DEVICE BASED ON ACTIVITY DETECTED BY AN ACTIVITY MONITORING DEVICE

CLAIM OF PRIORITY

This application is a continuation of U.S. patent application Ser. No. 14/271,412, filed on May 6, 2014, titled "Notifications on a User Device Based on Activity Detected by an Activity Monitoring Device," which is a continuation-in-part of U.S. patent application Ser. No. 14/192,282, filed on Feb. 27, 2014, titled "Methods, Systems and Devices for Physical Contact Activated Display and Navigation", which is hereby incorporated by reference in its entirety.

FIELD

The present disclosure relates to systems and methods for presenting notifications on a user device based on user activity detected by an activity monitoring device.

BACKGROUND

In recent years, the need for health and fitness has grown tremendously. The growth has occurred due to a better understanding of the benefits of good fitness to overall health and wellness. Unfortunately, although today's modern culture has brought about many new technologies, such as the Internet, connected devices and computers, people have become less active. Additionally, many office jobs require people to sit in front of computer screens for long periods of time, which further reduces a person's activity levels. Furthermore, much of today's entertainment options involve viewing multimedia content, computer social networking, and other types of computer involved interfacing. Although such computer activity can be very productive as well as entertaining, such activity tends to reduce a person's overall physical activity.

To provide users concerned with health and fitness a way of measuring or accounting for their activity or lack thereof, fitness activity trackers have recently grown in popularity. Fitness activity trackers are used to measure activity, such as walking, motion, running, sleeping, being inactive, bicycling, exercising on an elliptical trainer, and the like. Typically, the data collected by such devices can be transferred and viewed on a computing device.

It is in this context that embodiments of the invention arise.

SUMMARY

Embodiments described in the present disclosure provide systems, apparatus, computer readable media, and methods for presenting notifications on a user device based on user activity detected by an activity monitoring device.

In one embodiment, a method for generating a notification on a mobile device is provided including: establishing a wireless connection to an activity monitoring device; receiving activity data from the activity monitoring device via the wireless connection; processing the activity data to determine an activity metric for a user of the activity monitoring device; comparing the activity metric against a predefined threshold, the predefined threshold being mapped to a notification message; in response to determining that the activity metric reaches or exceeds the predefined threshold, scheduling the notification message for display on the mobile device at a specified date and time; wherein the method is executed by at least one processor.

In one embodiment, the notification message defines one or more of an alert, a banner, a badge on an icon associated to the application, or a sound.

In one embodiment, establishing the wireless connection defines communication between a background executed application on the mobile device and the activity monitoring device.

In one embodiment, displaying the notification message includes triggering a local notification presenter.

In one embodiment, the notification message is displayed on the mobile device at the specified date and time.

In one embodiment, the activity metric defines one or more of a number of steps taken, a number of floors climbed, a number of calories burned, a distance traveled, or a number of active minutes.

In one embodiment, the predefined threshold defines a quantified achievement amount of an activity goal set for the user; wherein the notification message identifies the quantified achievement amount of the activity goal.

In one embodiment, the quantified achievement amount of the activity goal is less than 100%, 100%, or greater than 100% of the activity goal.

In one embodiment, the method further includes: when the specified date and time is reached, processing activity data from the activity monitoring device to identify a current state of activity of the user; and presenting or delaying presentation of the notification message, based on the identified current state of activity of the user.

In one embodiment, processing activity data to identify the current state of activity of the user includes processing location data to identify a speed or a location of the user; and presenting or delaying presentation of the notification message is based on the identified speed or location of the user.

In another embodiment, a server-executed method for presenting a notification on a mobile device is provided, including: establishing communication with the mobile device; receiving activity data from the mobile device, the activity data being processed by the mobile device from logged data received from an activity monitoring device; processing the activity data to determine an activity metric for a user of the activity monitoring device; comparing the activity metric against a predefined threshold, the predefined threshold being mapped to a notification message; in response to determining that the activity metric reaches or exceeds the predefined threshold, sending the notification message to a notification service, the notification service configured to transmit the notification message to the mobile device for rendering on the mobile device, wherein rendering the notification message includes scheduling the notification message for a time window; wherein the method is executed by at least one processor.

In one embodiment, the notification message defines one or more of an alert, a banner, a badge on an icon associated to the application, or a sound.

In one embodiment, establishing communication with the mobile device includes establishing communication with a background executed application on the mobile device.

In one embodiment, rendering the notification message on the mobile device includes triggering a notification handler.

In one embodiment, rendering the notification message occurs at the specified date and time.

In one embodiment, the activity metric defines one or more of a number of steps taken, a number of floors climbed, a number of calories burned, a distance traveled, or a number of active minutes.

In one embodiment, the predefined threshold defines a quantified achievement amount of an activity goal set for the

user; wherein the notification message identifies the quantified achievement amount of the activity goal.

In one embodiment, the quantified achievement amount of the activity goal is less than 100%, 100%, or greater than 100% of the activity goal.

In one embodiment, the method further includes: when the time window is reached, processing activity data from the activity monitoring device to identify a current state of activity of the user; and presenting or delaying presentation of the notification message, based on the identified current state of activity of the user.

In one embodiment, processing activity data to identify the current state of activity of the user includes processing location data to identify a speed or a location of the user; and presenting or delaying presentation of the notification message is based on the identified speed or location of the user.

In another embodiment, a method for presenting a notification on a user device is provided including: defining an activity goal; determining a series of notification thresholds, each notification threshold defining a quantified level of achievement of an activity goal, each notification threshold being mapped to a corresponding notification message; receiving activity data measured by an activity monitoring device; processing the activity data to determine an activity metric; when the activity metric reaches one of the notification thresholds in the series of notification thresholds, triggering presentation of the corresponding notification message on a user device, wherein triggering presentation of the corresponding notification message includes scheduling the corresponding notification message for a specified date and time; wherein the method is executed by at least one processor.

In one embodiment, triggering presentation of the corresponding notification message on the user device includes activating a push notification service to transmit the notification message to the user device for rendering on the user device.

In one embodiment, triggering presentation of the corresponding notification message on the user device includes triggering a local notification presenter to display the corresponding notification message on the user device.

In one embodiment, each notification message identifies the quantified level of achievement defined by the notification threshold to which the notification message is mapped.

In one embodiment, the notification message defines one or more of an alert, a banner, a badge on an icon associated to the application, or a sound.

In one embodiment, the method further includes: rendering the notification message on the user device at the specified date and time.

In one embodiment, the activity metric defines one or more of a number of steps taken, a number of floors climbed, a number of calories burned, a distance traveled, or a number of active minutes.

In one embodiment, the method further includes: when the specified date and time is reached, processing activity data from the activity monitoring device to identify a current state of activity of the user; and presenting or delaying presentation of the notification message, based on the identified current state of activity of the user.

In another embodiment, a method for triggering a notification to a user of an activity monitoring device is provided, including: receiving activity data from one or more sensors of an activity monitoring device; processing the activity data to determine an activity metric for a user of the activity monitoring device; comparing the activity metric against a predefined threshold, the predefined threshold being mapped to a notification message; in response to determining that the activity metric reaches or exceeds the predefined threshold, establishing communication with a user device, and triggering display of the notification message on the user device, wherein triggering display of the notification message includes scheduling the notification message for display during a time window; wherein the method is executed by at least one processor.

In one embodiment, the notification message is generated in response to the determining that the activity metric reaches or exceeds the predefined threshold; and triggering display of the notification message on the user device includes sending the notification message to the user device.

In one embodiment, the method further includes: when the time window is reached, processing activity data from the one or more sensors of the activity monitoring device to identify a current state of activity of the user; and presenting or delaying presentation of the notification message, based on the identified current state of activity of the user.

In another embodiment, a server-executed method for presenting a notification on a mobile device is provided, including: establishing communication with the mobile device; receiving activity data from an activity monitoring device; processing the activity data to determine an activity metric for a user of the activity monitoring device; comparing the activity metric against a predefined threshold, the predefined threshold being mapped to a notification message; in response to determining that the activity metric reaches or exceeds the predefined threshold, sending the notification message to a notification service, the notification service configured to transmit the notification message to a mobile device for rendering on the mobile device; wherein the method is executed by at least one processor.

Other aspects will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of embodiments described in the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments described in the present disclosure may best be understood by reference to the following description taken in conjunction with the accompanying drawings.

FIG. **1**A shows a block diagram of an activity tracking device, in accordance with one embodiment of the present invention.

FIG. **1**B illustrates an example of an activity tracking device including example components utilized for tracking activity and motion of the device, and associated interfaces to a display screen, in accordance with one embodiment of the present invention.

FIG. **2** illustrates an example of activity tracking device in communication with a remote device, in accordance with one embodiment of the present invention.

FIG. **3** illustrates a system for presenting a locally generated notification, in accordance with an embodiment of the invention.

FIG. **4** illustrates a system for triggering notifications on a user device based on activity detected by an activity monitoring device, in accordance with an embodiment of the invention.

FIG. **5** illustrates components of a system for presenting a notification on a mobile device, in accordance with an embodiment of the invention.

FIG. **6** illustrates a system for rendering a notification to a user based on tracked activity of the user, in accordance with an embodiment of the invention.

FIG. **7** illustrates a variety factors which may be considered for purposes of triggering a notification, in accordance with embodiments of the invention.

FIG. **8** illustrates a system for enabling a first user to define a notification for presentation to a second user, in accordance with an embodiment of the invention.

FIG. **9** illustrates a graphical user interface for accessing activity related information of a user based on an activity monitoring device, in accordance with an embodiment of the invention.

FIGS. **10**A-**10**C illustrate embodiments of communication operations between an activity tracking device, a client device, and a backend server, in accordance with one embodiment of the present invention.

FIG. **11** illustrates an example where various types of activities of users can be captured or collected by activity tracking devices, in accordance with various embodiments of the present invention.

DETAILED DESCRIPTION

Embodiments described in the present disclosure provide systems, apparatus, computer readable media, and methods for presenting notifications on a user device based on user activity detected by an activity monitoring device.

It should be noted that there are many inventions described and illustrated herein. The present inventions are neither limited to any single aspect nor embodiment thereof, nor to any combinations and/or permutations of such aspects and/or embodiments. Moreover, each of the aspects of the present inventions, and/or embodiments thereof, may be employed alone or in combination with one or more of the other aspects of the present inventions and/or embodiments thereof. For the sake of brevity, many of those permutations and combinations will not be discussed separately herein.

Further, in the course of describing and illustrating the present inventions, various circuitry, architectures, structures, components, functions and/or elements, as well as combinations and/or permutations thereof, are set forth. It should be understood that circuitry, architectures, structures, components, functions and/or elements other than those specifically described and illustrated, are contemplated and are within the scope of the present inventions, as well as combinations and/or permutations thereof.

FIG. **1** shows a block diagram of an activity tracking device **100**, in accordance with one embodiment of the present invention. The activity tracking device **100** is contained in a housing, which may be worn or held by a user. The housing may be in the form of a wristband, a clip on device, a wearable device, or may be held by the user either in the user's hand or in a pocket or attached to the user's body. The activity tracking device **100** includes device components **102**, which may be in the form of logic, storage, and glue logic, one or more processors, microelectronics, and interfacing circuitry. In one example, the components **102** will include a processor **106**, memory **108**, a wireless transceiver **110**, a user interface **114**, biometric sensors **116**, and environmental sensors **118**.

The environmental sensors **118** may be in the form of motion detecting sensors. In some embodiments, a motion sensor can be one or more of an accelerometer, or a gyroscope, or a rotary encoder, or a calorie measurement sensor, or a heat measurement sensor, or a moisture measurement sensor, or a displacement sensor, or an ultrasonic sensor, or a pedometer, or an altimeter, or a linear motion sensor, or an angular motion sensor, or a multi-axis motion sensor, or a combination thereof. The biometric sensors **116** can be defined to measure physiological characteristics of the user that is using the activity tracking device **100**. The user interface **114** provides a way for communicating with the activity tracking device **100**, in response to user interaction **104**. The user interaction **104** can be in the form of physical contact (e.g., without limitation, tapping, sliding, rubbing, multiple taps, gestures, etc.).

In some embodiments, the user interface **114** is configured to receive user interaction **104** by way of proximity sensors, button presses, touch sensitive screen inputs, graphical user interface inputs, voice inputs, sound inputs, etc. The activity tracking device **100** can communicate with a client and/or server **112** using the wireless transceiver **110**. The wireless transceiver **110** will allow the activity tracking device **100** to communicate using a wireless connection, which is enabled by wireless communication logic. The wireless communication logic can be in the form of a circuit having radio communication capabilities. The radio communication capabilities can be in the form of a Wi-Fi connection, a Bluetooth connection, a low-energy Bluetooth connection, or any other form of wireless tethering or near field communication. In still other embodiments, the activity tracking device **100** can communicate with other computing devices using a wired connection (not shown). As mentioned, the environmental sensors **118** can detect motion of the activity tracking device **100**.

The motion can be activity of the user, such as walking, running, stair climbing, etc. The motion can also be in the form of physical contact received on any surface of the activity tracking device **110**, so long as the environmental sensors **118** can detect such motion from the physical contact. Such physical contact may be in the form of a tap or multiple taps by a finger upon the housing of the activity tracking device **100**.

FIG. **1**B illustrates an example of activity tracking device **100** of FIG. **1**A, showing some additional example components utilized for tracking activity and motion of the device, and associated interfaces to display screen **122**. In one embodiment, examples of a display screen **122** can include, but are not limited to, liquid crystal display (LCD) screens, light emitting diode (LED) screens, organic light emitting diode (OLED) screens, plasma display screens, etc.

As shown in FIG. **1**B, the activity tracking device **100** includes logic **158**. Logic **158** may include activity tracking logic **140**, motion-activated messaging logic **142**, display interface logic **144**, alarm management logic **146**, wireless communication logic **148**, processor **106**, and sensors **156**. Additionally, storage (e.g. memory) **108**, and a battery **154** can be integrated within the activity tracking device **100**. The activity tracking logic **140** can include logic that is configured to process motion data produced by sensors **156**, so as to quantify the motion and produce identifiable metrics associated with the motion.

Some motions will produce and quantify various types of metrics, such as step count, stairs climbed, distance traveled, very active minutes, calories burned, etc. The physical contact logic **142** can include logic that calculates or determines when particular physical contact can qualify as an input. To qualify as an input, the physical contact detected by sensors **156** should have a particular pattern that is identifiable as input. For example, the input may be predefined to be a double tap input, and the physical contact logic **142** can analyze the motion to determine if a double tap indeed occurred in response to analyzing the sensor data produced by sensors **156**.

The display interface logic **144** is configured to interface with the processor and the motion-activated messaging logic to determine when specific messages will be displayed on the

display screen **122** of the activity tracking device **100**. The display interface logic **144** can act to turn on the screen, display metric information, display characters or alphanumeric information, display graphical user interface graphics, or combinations thereof. Alarm management logic **146** can function to provide a user interface and settings for managing and receiving input from a user to set an alarm. The alarm management logic can interface with a timekeeping module (e.g., clock, calendar, time zone, etc.), and can trigger the activation of an alarm. The alarm can be in the form of an audible alarm or a non-audible alarm.

A non-audible alarm can provide such alarm by way of a vibration. The vibration can be produced by a motor integrated in the activity tracking device **100**. The vibration can be defined to include various vibration patterns, intensities, and custom set patterns. The vibration produced by the motor or motors of the activity tracking device **100** can be managed by the alarm management logic **146** in conjunction with processing by the processor **106**. The wireless communication logic **148** is configured for communication of the activity tracking device with another computing device by way of a wireless signal. It should be appreciated that the activity tracking device may communicate directly with another computing device, or indirectly via any number of intermediary devices, such as a wireless router, or other types of networking equipment (e.g. routers, switches, repeaters, etc.). The wireless signal can be in the form of a radio signal. As noted above, the radio signal can be in the form of a Wi-Fi signal, a Bluetooth signal, a low energy Bluetooth signal, or combinations thereof. The wireless communication logic can interface with the processor **106**, storage **108** and battery **154** of device **100**, for transferring activity data, which may be in the form of motion data or processed motion data, stored in the storage **108** to the computing device.

In one embodiment, processor **106** functions in conjunction with the various logic components **140**, **142**, **144**, **146**, and **148**. The processor **106** can, in one embodiment, provide the functionality of any one or all of the logic components. In other embodiments, multiple chips can be used to separate the processing performed by any one of the logic components and the processor **106**. Sensors **156** can communicate via a bus with the processor **106** and/or the logic components. The storage **108** is also in communication with the bus for providing storage of the motion data processed or tracked by the activity tracking device **100**. Battery **154** is provided for providing power to the activity tracking device **100**.

FIG. **2** illustrates an example of activity tracking device **100** in communication with a remote device **200**. Remote device **200** is a computing device that is capable of communicating wirelessly with activity tracking device **100** and with the Internet **160**. Remote device **200** can support installation and execution of applications. Such applications can include an activity tracking application **202**. Activity tracking application **202** can be downloaded from a server. The server can be a specialized server or a server that provides applications to devices, such as an application store. Once the activity tracking application **202** is installed in the remote device **200**, the remote device **200** can communicate or be set to communicate with activity tracking device **100** (Device A). The remote device **200** can be a smartphone, a handheld computer, a tablet computer, a laptop computer, a desktop computer, or any other computing device capable of wirelessly interfacing with Device A and the Internet.

In one embodiment, remote device **200** communicates with activity tracking device **100** over a Bluetooth connection. In one embodiment, the Bluetooth connection is a low energy Bluetooth connection (e.g., Bluetooth LE, BLE, or Bluetooth Smart). Low energy Bluetooth is configured for providing low power consumption relative to standard Bluetooth circuitry. Low energy Bluetooth uses, in one embodiment, a 2.4 GHz radio frequency, which allows for dual mode devices to share a single radio antenna. In one embodiment, low energy Bluetooth connections can function at distances up to 50 meters, with over the air data rates ranging between 1-3 megabits (Mb) per second. In one embodiment, a proximity distance for communication can be defined by the particular wireless link, and is not tied to any specific standard. It should be understood that the proximity distance limitation will change in accordance with changes to existing standards and in view of future standards and/or circuitry and capabilities.

Remote device **200** can also communicate with the Internet **160** using an Internet connection. The Internet connection of the remote device **200** can include cellular connections, wireless connections such as Wi-Fi, and combinations thereof (such as connections to switches between different types of connection links). The remote device, as mentioned above, can be a smartphone or tablet computer, or any other type of computing device having access to the Internet and with capabilities for communicating with the activity tracking device **100**.

A server **220** is also provided, which is interfaced with the Internet **160**. The server **220** can include a number of applications that service the activity tracking device **100**, and the associated users of the activity tracking device **100** by way of user accounts. For example, the server **220** can include an activity management application **224**. The activity management application **224** can include logic for providing access to various devices **100**, which are associated with user accounts managed by server **220**. Server **220** can include storage **226** that includes various user profiles associated with the various user accounts. The user account **228*a*** for user A and the user account **228*n*** for user N are shown to include various information.

The information can include, without limitation, data associated with motion-activated messaging **230**, user data, etc. As will be described in greater detail below, the motion-activated messaging data **230** includes information regarding a user's preferences, settings, and configurations which are settable by the user or set by default at the server **220** when accessing a respective user account. The storage **226** will include any number of user profiles, depending on the number of registered users having user accounts for their respective activity tracking devices. It should also be noted that a single user account can have various or multiple devices associated therewith, and the multiple devices can be individually customized, managed and accessed by a user. In one embodiment, the server **220** provides access to a user to view the user data **232** associated with activity tracking device.

The data viewable by the user includes the tracked motion data, which is processed to identify a plurality of metrics associated with the motion data. The metrics are shown in various graphical user interfaces of a website enabled by the server **220**. The website can include various pages with graphical user interfaces for rendering and displaying the various metrics for view by the user associated with the user account. In one embodiment, the website can also include interfaces that allow for data entry and configuration by the user.

FIG. **3** illustrates a system for presenting a locally generated notification, in accordance with an embodiment of the invention. In the illustrated embodiment, an activity monitoring device **300** is configured to record activity data based on output from various sensors included in the activity monitoring device **300**. The activity data may include raw sensor data

and/or data identifying specific user activity processed from the raw sensor data, such as individual steps taken over time, changes in distance over time, altitude changes over time, etc. The activity data recorded by the activity monitoring device **300** may be further processed at the activity monitoring device **300** to determine various activity metrics which quantify the activity data, such as determining the number of steps taken, distance traveled, steps/floors climbed, calories burned, active minutes, etc.

During a synchronization operation with a user device **302**, the activity monitoring device **300** uploads the activity data and/or activity metrics to the user device **302**. The user device **302** can be any computing device, including, without limitation, a mobile device, cellular phone, tablet computer, personal computer, laptop computer, or any other computing device that may be configured to present notifications in accordance with embodiments described herein. It will be appreciated that during the synchronization operation, previously collected activity data and/or activity metrics can be uploaded to the user device **302**. In addition, synchronization may entail ongoing updates from the activity monitoring device **300** to the user device **302**. That is, as new activity data or metrics are generated at the activity monitoring device **300**, they can be uploaded to the user device **302** in a continuing fashion. This continual uploading may occur with various frequency depending upon the desired level of time synchronization between generation of activity data at the activity monitoring device and receipt by the user device. In one embodiment, updates may occur with sufficient frequency to be substantially real-time or near real-time. In other embodiments, updates may occur with less frequency. In one embodiment, updates occur when new activity data/metrics are available. In various embodiments, updates occur when a threshold amount of new activity data is accumulated, or when a threshold change in activity data/metrics occurs, or when specific types of activity data are generated, etc. Additionally, it will be appreciated that in various embodiments, various combinations of techniques can be employed to provide ongoing continual updates from the activity monitoring device **300** to the user device **302**.

At the user device **302**, the activity data/metrics can be processed to determine whether a notification should be provided to the user on the user device **302**. If a notification is triggered, then a local notification generation process occurs, and a notification is provided to the user at the user device **308**. In one embodiment, the notification defines a display of a notification message **306** on a display **304** of the user device **302**. In the illustrated embodiment, the notification message **306** is configured to congratulate the user, and the display of the notification message **306** further includes buttons which allow the user to close the message, or launch an application on the user device **302** for interfacing with the activity monitoring device **300**. In other embodiments, additional methods for notifying the user can be activated, such as a flashing light or a sound or a vibration/haptic feedback at the user device **302**.

A notification can be triggered based on the activity data/metrics in a number of ways, and the specific embodiments described herein are provided by way of example, and not by way of limitation. For example, in some embodiments, a notification is presented when a threshold for a particular activity metric is reached. By way of example, a notification may be presented when one of the following thresholds is reached: a threshold number of steps taken, a threshold number of steps/floors (or altitude) climbed, a threshold distance traveled, a threshold number of active minutes achieved, a threshold number of calories burned, etc.

Thresholds may define goals for the user to attain. Such goals can be generic or otherwise system-defined goals, such as specific milestones denoting various achievement levels. Thresholds may also be user-defined, indicating personal goals of a particular user. Notifications which are triggered by reaching such thresholds can thus be indicative of achievements by the user, and serve to congratulate or encourage the user in their fitness activity.

Furthermore, in some embodiments, notification thresholds can be defined as a portion (ranging from less than 100% to greater than 100%) of a specific milestone or goal. It may be useful to inform the user of their progress toward a particular goal, and therefore, notification thresholds can be configured to update the user as they progress towards the goal. For example, notification thresholds may be defined at regular subdivisions of the goal, such as at 25%, 50%, 75%, and 100% of the goal. In other words, notification thresholds may be defined at the following: 1/n, 2/n, 3/n, etc., where n is the number of portions into which the goal metric amount is subdivided. It will be appreciated that at each of these thresholds, a corresponding notification message can be triggered to be presented on the user device, perhaps indicative of the activity metric amount relative to the goal that has been achieved, or the activity metric amount remaining to achieve the goal. Of course, in various embodiments, some or all of such thresholds may be utilized, and such may depend upon user-defined settings defining the notification thresholds which will trigger notifications presented to a specific user. For example, the user may indicate that they wish to receive notifications each time they reach another 20% of their goal, or that they only wish to receive a notification when they are within 20% of achieving their goal (i.e. have reached 80% of their goal) or when they have achieved their goal, etc.

Additionally, it will be appreciated that notification thresholds may be set for a predefined quantity of a given activity metric that is remaining to achieve a particular goal. For example, a notification threshold may be set for when a user is within x number of steps (or stairs/floors climbed, distance traveled, calories burned, active minutes, etc.) of reaching their goal. Furthermore, notifications may be triggered when the user reaches a predefined amount exceeding a particular goal, such as a specific fraction or percentage exceeding the goal, or a predefined number amount of a specific activity metric exceeding the goal. A notification message triggered by such an event may congratulate the user on exceeding the goal or milestone (e.g. congratulate the user on being an "overachiever").

In the presently described embodiments, it is broadly contemplated that activity data and metrics are detected at the activity monitoring device, whereas the processing of such data to trigger display of a notification is performed at the user device on which the notification is displayed. It should be appreciated that this is merely one example of a division of processing operations between the activity monitoring device and the user device, in order to produce display of a notification on the user device. In other embodiments, the various processing operations which are required to effect display of a notification on the user device can be divided between the activity monitoring device and the user device in any possible configuration. For example, in one embodiment, the processing of the activity data as well as the triggering of the notification are performed at the activity monitoring device, and upon triggering of the notification, the notification message is sent to the user device for display on the user device (e.g. a smart watch).

FIG. **4** illustrates a system for triggering notifications on a user device based on activity detected by an activity monitor-

ing device, in accordance with an embodiment of the invention. The illustrated embodiment is conceptually similar to that shown and described with reference to FIG. **3**; however, in the embodiment of FIG. **4**, the notification is triggered at a remote server, which in turn is configured to push a notification to the user device. As shown, an activity monitoring device **400** is configured to upload activity data/metrics to a user device **402** during a synchronization process, which can be a foreground or background synchronization process. The user device **402** in turn is configured to upload the activity data/metrics to a remote server **410** as part of the synchronization process. Additionally, it is noted that the user device **402** may process the activity data/metrics received form the activity monitoring device **400** to generate additional activity data/metrics prior to uploading to the server **410**.

The server **410** is configured to include a synchronization module **412** for handling the server-side processing of the synchronization procedure, including receiving and storing the activity data/metrics received from the user device **402**. An activity processing module **414** is configured to process or analyze the activity data/metrics to determine whether a notification should be triggered. If it is determined that a notification should be triggered, then notification logic **416** is activated to generate the notification. The generation of the notification may include retrieving a notification message that corresponds to a given notification threshold, and communicating the notification message to a notification service **418** and instructing or requesting the notification service **418** to "push" the notification to the user device **402**. A "push" notification will be understood by those skilled in the art to define a notification that is sent to and rendered on a client device (e.g. user device **402** in the illustrated embodiment) by a remote system/server. A push notification is initiated by the remote system (e.g. notification service **418**), though the resulting notification is presented on the client device (e.g. user device **402**). One example of a push notification service is the Apple Push Notification Service.

In the illustrated embodiment, a notification message **406** is presented on the display **404** of the user device **402**. By way of example, the notification message **406** indicates that the user needs **2000** more steps to reach their goal. Option buttons are presented to either close the notification, or launch an application that can interface with the activity monitoring device **4000**.

FIG. **5** illustrates components of a system for presenting a notification on a mobile device, in accordance with an embodiment of the invention. An activity monitoring device **500** is provided for tracking activity of a user. In the illustrated embodiment, the activity monitoring device **500** includes a wireless module **502** for handling wireless communication with the mobile device **512**. A sync module **504** is configured to handle data synchronization operations, including uploading activity data/metrics from an activity data storage **506** to the mobile device **512**. One or more sensors **510** can include any of various environmental or biometric sensors. A sensor data processing module **508** is configured to process data generated by the sensors **510**.

The mobile device **512** includes a processor **514** and a memory **516** for executing and storing program instructions, respectively. A speaker **518** is provided for reproducing predefined sounds. A display **520** is provided for visually rendering information. A haptic feedback module **522** is configured to provide tactile feedback, such as vibration of the mobile device **512**. A wireless module **524** is configured to handle wireless communication of the mobile device, including wireless communication with the activity monitoring device **500**. In one embodiment, the wireless communication between the activity monitoring device **500** and the mobile device **512** is a Bluetooth low energy connection.

A notification presenter **526** is configured to present notifications on the mobile device. The notification presenter **526** receives requests from applications (e.g. application **530**) to present a notification on the mobile device **512**. The requests may define content of the notification, such as a message, sound, haptic feedback, whether an option to launch the application (in the foreground) from which the notification request was generated, etc. In response to receiving a notification request, the notification presenter **526** is configured to activate the relevant modules of the mobile device **512** to present the notification to the user. For example, a message may be displayed on the display **520**, or a sound may be played through the speaker **518**, or haptic sensations may be provided via the haptic module **522**.

The application **530** includes a sync module **532** for handling synchronization operations with the activity monitoring device **500**, including receiving activity data/metrics from the activity monitoring device **500**. This may occur over the aforementioned wireless connection via the wireless module **524**. The application **530** may define a graphical user interface **534** configured to enable the user to comprehend data from the activity monitoring device **500**, as well as manage the device. An activity data processing module **536** is configured to process and analyze activity data/metrics received from the activity monitoring device **500**. This may entail generation of and/or updating of activity metrics.

A notification generator **538** is configured to determine when to trigger a notification based on activity data/metrics of the user. As has been discussed, various thresholds may be defined based on various activity metric goals. The notification generator **538** can thus be configured to compare a particular activity metric against one or more predefined threshold values to determine whether or not to trigger a notification to the user. When a given predefined threshold value is reached, then the notification generator **538** is configured to retrieve and associated notification message and generate a notification to the user. If the notification is to be presented immediately, then he notification presenter **526** is activated. The notification generator **538** communicates the relevant parameters of the notification, including the notification message content and any other optionally define parameters, to the notification presenter **526**, which is then configured to execute the rendering of the notification, such as by displaying the notification message on the display **520** of the device **512**.

The notification generator **538** may also be configured to determine whether the present time is an appropriate time to provide a notification to the user. For example, it may not be desirable to provide a notification to the user during hours of the day when the user is likely to be asleep, or when it can be determined that the user is otherwise unlikely to be able to view or comprehend notification. In such instances, it can be useful to schedule notification for a later time. Therefore, the notification generator **538** can be configured to activate a notification scheduler **528**, which receives the relevant information defining the notification, and schedules the rendering of the notification on the mobile device **512** for a later time. In another embodiment, the notification scheduler **528** can be configured to schedule the notification for rendering during a specified time window or period of time. In another embodiment, the notification scheduler **528** functions as a configurable timer that then triggers the notification generator **538** to activate the notification presenter **526** in order to render the notification to the user. It should be appreciated that though notifications can be scheduled for rendering, the actual ren-

dering of the scheduled notification can be subject to other considerations (e.g. current state of activity detected via the activity monitoring device, or other considerations described herein for determining whether to render a notification).

It will be appreciated that there can be many instances when the user is unlikely to be able to view or comprehend the notification, or when it is otherwise undesirable to provide a notification to the user, even though a notification threshold has been reached. For example, data obtained from a calendar associated with the user may indicate that the user is busy or occupied during a specific time period, and therefore it is not desirable to notify the user during the specific time period. It might also be determined that the user is currently engaged in physical activity based on data received from the activity monitoring device, and that the user is therefore unavailable to receive a notification.

In one embodiment, real-time data received from the activity monitoring device is analyzed to determine a current state of activity of the user, and based on the determined state of activity, a notification can be rendered to the user in immediate response to reaching a particular activity metric threshold, or may be delayed. However, in other embodiments, the current state of activity can be utilized to determine whether to present, or delay the presentation of, the notification message. The state of activity of the user can identify particular physical activity states, such as running, walking, swimming, biking, etc. which may be applied to determine when to present a notification message. For example, a user might reach a milestone during the course of a run, and so a notification message is prepared for the user. However, the presentation of the notification message can be delayed until it is determined that the user has slowed to a walk or otherwise stopped running. In this manner, the notification is presented to the user during a time when the user is more likely to be able or willing to view it.

In some embodiments, location data (e.g., GPS data) can be utilized to determine when to present a notification message. For example, location data can be analyzed to determine the current speed or location of the user, and a notification message may be presented or delayed based on the speed or location of the user. In one embodiment, a notification message may be presented when the current speed is determined to be below a predefined threshold speed. Otherwise, when the current speed reaches or exceeds the predefined threshold speed, the presentation of the notification message is delayed until it falls below the predefined threshold speed. In another embodiment, variance in the speed of the user can be utilized to determine when to present a notification message. For example, in one embodiment, a notification message is presented if the speed of the user varies by less than a predefined amount; whereas the notification message is not presented if the variance of the speed of the user reaches or exceed the predefined amount.

In another embodiment, location data can be analyzed to determine the user's location with respect to geographical features, and the presentation of notification messages can be determined based on such information. For example, a notification message might be presented when it is determined that the user has reached the end of a trail, or climbed to the top of a hill, etc. In another example, a notification message might be delayed until it is determined that the user has returned to a particular geographic location, such as their home or their starting point (e.g., a parking lot, trailhead, etc.).

In one embodiment, when it is determined that the user is currently engaged in physical activity having an intensity level above a certain threshold, then the rendering of the notification is delayed until the intensity level of the physical activity is reduced to the threshold. In another embodiment, if it is determined based on real-time data received from the activity monitoring device that the user is currently sleeping, then the notification is delayed until it is determined that the user is currently awake. The foregoing examples of activity based delay of a notification are provided merely by way of example, without limitation. In various embodiments, it will be appreciated that activity of a user as determined from real-time data received from the activity monitoring device can be analyzed in a variety of ways to determine when it is appropriate to render a notification to the user, and thereby delay or schedule or present a notification accordingly.

FIG. **6** illustrates a system for rendering a notification to a user based on tracked activity of the user, in accordance with an embodiment of the invention. An activity monitoring device **600** is configured to detect and record activity of the user, and includes activity data storage **604** for storing such detected activity of the user. A synchronization module **602** is configured to handle synchronization operations with a mobile device **606**, including uploading of activity data/metrics to the mobile device **606**.

The mobile device **606** includes an application **608** that is configured to interface with the activity monitoring device **600**. The application **608** includes a synchronization module **610** that is configured to handle synchronization operations at a mobile device **606**, which may include receiving activity data/metrics from the activity monitoring device **600**, as well as uploading activity data/metrics to a synchronization server **618**. It will be appreciated that activity data and/or metrics can be processed to various extents by each of the activity monitoring device **600** and the mobile device **606**.

The synchronization server **618** is configured to receive and store the activity data/metrics from the mobile device **606** into an activity data storage **620**. An activity analyzer **624** is configured to access profile data associated with the user of the activity monitoring device from a profile data storage **630**. This profile data can define one or more activity metric goals for the user. In addition, the profile data may define various notification thresholds in relation to a specific activity metric goal, as has been discussed above. By way of example, one threshold may be defined for when a user's activity metric approaches to within a certain amount of the activity metric goal, another defined by the activity metric goal itself, and another defined when the user exceeds the activity metric goal by a certain amount. Each of these thresholds can be associated with a particular notification message that is stored in a message library **628**.

The activity analyzer **624** includes a threshold evaluation module **626** that is configured to determine when the relevant activity metric of the user reaches a predefined threshold, and thereupon trigger a notification generator **622** to retrieve the notification message associated with the predefined threshold from the message library **628**, and activate a notification service **632** to send a push notification request to the mobile device **606**. In one embodiment, the notification generator **622** accesses an API of notification service **632**, providing a request to the notification service **632** with relevant parameters including the contents of the notification message and identification of the specific mobile device **606** to which the push notification is to be sent.

Mobile device **606** includes a notification handler **612** that is configured to manage notification requests. In the illustrated embodiment, the notification handler **612** of the mobile device **606** receives a push notification requests from the notification service **632**, and, and activates a notification presenter **614** that is configured to render the push notification on

the mobile device **606**. Alternatively, the notification handler **612** also includes a notification scheduler **616** that is configured to schedule the push notification for rendering at a later time.

Though systems for presenting a notification to a user have been described with reference to presentation of the notification on a mobile device, it will be appreciated by those skilled in the art that notifications in accordance with various embodiments of the invention can be rendered on any other type of computing device that is configured for rendering such notifications. It will be understood that a notification may be presented to a user in different formats depending upon the context in which the notification is rendered. For example, during an active session of the computing device, the notification may be rendered as a pop up message or window within the contextual operating environment on the computing device, and clicking on an appropriate location may cause it to disappear, or may activate the activity tracking application for viewing information that is related to the notification.

In a mobile device operating environment, a notification presentation may depend upon whether its associated application is presently running in the foreground. If so, then the notification information (or payload) may be passed directly to the foreground application and is handled by the application based on the application's configuration. Whereas, if the application is not running or is only running in the background, then the notification is rendered (or scheduled to be rendered) on the mobile device with an option to "view" or otherwise launch the application into the foreground. Selection of this option may cause the notification payload to be passed to the application, as the application is launched into the foreground.

In various embodiments, it will be appreciated that notifications in accordance with embodiments of the invention can be generated based a number of factors, alone or in combination. FIG. **7** illustrates a variety factors which may be considered for purposes of triggering a notification, in accordance with embodiments of the invention. Furthermore, the content of a resulting notification can include or be based upon data defined by such factors. In the illustrated embodiment, a notification engine **700** is configured to evaluate the various factors and generate a notification based on such factors when it is determined that a notification should be provided to the user. Broadly speaking, notification data may be generated to define a given notification, including such information items as the following: message content **704** which defines text for a notification; a style **706** designating a particular style for the notification, such as a pop-up message, a badged icon, or other selectable notification style; a sound **708** defining or identifying audio to be rendered in accordance with the notification; a date/time **710** at which the notification is to be rendered.

As has been discussed, specific goals and/or milestones can be utilized to define thresholds for activity metrics of a user which will trigger generation of notifications. In addition to these threshold-based triggers, notifications can be defined in relation to user activity in other ways. For example, the notification generator **700** can be configured to generate notifications at regular intervals (e.g. daily, weekly, etc.) which update the user about one or more activity metrics, or their progress toward a goal/milestone, etc. The content of such notifications might include a current amount of a particular activity metric or an amount remaining to achieve a particular goal or milestone.

In another embodiment, notifications can be generated based on a detected change in activity data/metrics, such as an increase or decrease in the activity data/metric by a certain amount. The detected change may also be considered relative to the amount of time over which the change occurs. For example, a change of a particular amount occurring within a particular timespan may trigger a notification (e.g. user runs a mile in eight minutes, burns 500 calories in an hour, climbs ten floors in three minutes, etc.). In another embodiment, a change relative to an earlier time period may trigger a notification (e.g. increasing/decreasing the number of steps taken in a week over that taken during the previous week). In other embodiments, personal best accomplishments for a given user may trigger notifications (e.g. walking the most steps, or burning the most calories, or climbing the most stairs/floors, or traveling the greatest distance, over a given timespan such as a single day). In another embodiment, achieving a particular rate of change in an activity metric may trigger a notification (e.g. running at or above a particular speed, climbing at or above a particular rate of altitude gain, exercising at or above a particular calorie burning rate, etc.). It will be appreciated that in the foregoing embodiments relating to notifications generated in response to detected changes in activity data/metrics, the content of such notifications can include or be based upon the data which defines the change in the activity data/metrics. Such notifications may also include congratulatory messages, an option to share to a social network, etc.

It will be appreciated that notifications can be triggered and generated based on any number of activity metrics, including a number of steps taken, number of floors/stairs climbed, distance traveled, number of active minutes, calories burned, etc. Notifications may also be triggered or generated based on additional fitness related information, such as an indicated or calculated weight of the user, nutrition information provided by or otherwise associated with the user, etc. Additionally, notifications can be generated based on numerous other factors, some of which are described herein by way of example, without limitation.

In one embodiment, the notification may be generated based on an identified location of the user. For example, the notification might be triggered by a change in location of the user, such as detection that the user has moved to a different city, state, or country. The content of a notification can be configured to be location sensitive, for example, utilizing the appropriate language of the identified location of the user, which may also include the usage of local terminology or slang.

In one embodiment, a notification can be generated based on a current date or time. For example, a notification occurring during the morning hours of the day may include the phrase "good morning." As another example, on the date of a holiday, the contents of a notification can be configured to reference the holiday or otherwise be appropriate to the holiday (e.g. "Happy Halloween"). A similar concept can be extended to encompass multiple days or seasons, wherein notification messages during such time include content that is thematically appropriate to the season (e.g. "Happy holidays!").

In one embodiment, a notification can be generated based on the current or forecasted weather, which may be determined in accordance with an identified location of the user. For example, if the weather is determined to be cold, then a notification may encourage the user to dress warmly, whereas if the weather is determined to be hot, then a notification may encourage the user to stay hydrated. It will be appreciated that a great variety of weather appropriate messages can be generated as notifications to the user.

In one embodiment, a notification can be generated based on a calendar associated with a given user. For example, the

timing of notifications can be determined in part based on the user's calendar, such as by avoiding sending notifications to the user during times when it is indicated on the calendar that the user is busy or occupied. A notification might reference a specific event listed on the user's calendar, such as in the case of a reminder notification which reminds the user about an upcoming event, or a post-event notification occurring after the expiration of an event on the user's calendar. A post-event notification might encourage a user to log details about the event, share to a social network, etc.

In a related embodiment, a notification can be generated based on local or community events occurring in the geographic vicinity of the user. A notification might inform a user about an upcoming event (e.g. a local charity run), or if it is known that a user has participated in such an event, then he notification might encourage the user to log details about the event, rate the event, share about the event to the social network, etc.

In one embodiment, a notification can be generated based on social network activity associated with the user, such as posts generated by friends/members of a social graph of the user.

FIG. **8** illustrates a system for enabling a first user to define a notification for presentation to a second user, in accordance with an embodiment of the invention. In the illustrated embodiment, the first user **800** interacts with a user device **802**. The first user **800** accesses a notification generation user interface **806**, which may be included as part of an application or accessed via a browser as indicated by reference **804**. Broadly speaking, the notification generation user interface **806** provides tools for the user **800** to define the contents and other options for a notification to be presented to a second user **816**. By way of example, the user interface **806** may provide a text entry interface for the user **800** to enter text to be included in the notification, a user selection interface for the user **800** to identify the user to whom the notification will be sent, as well as other options which may define various aspects of the notification.

These definitional aspects of the notification as specified by the user **800** are communicated over the network **808** to a user-defined notification generator **810**. The user-defined notification generator **810** is configured to send a request to a notification service **812** to generate a notification to the second user **816** based on the parameters provided by the first user **800**. The notification service **812** in turn generates a push notification to a corresponding mobile device **814** that is associated with the user **816**. Though a push notification to a mobile device is generally contemplated in accordance with embodiments of the invention, it will be appreciated that in other embodiments other types of devices accommodating other types of notification schemas can be employed to allow a notification having parameters defined by a first user to be sent to a second user.

FIG. **9** illustrates a graphical user interface for accessing activity related information of a user based on an activity monitoring device, in accordance with an embodiment of the invention. In the illustrated embodiment, a number of informational panels or modules are shown, providing information about various aspects of the user's activity as defined based on data from an activity monitoring device. An activity module **900** is configured to provide a graphical display of the number of steps taken, floors climbed, or calories burned over time. A steps module **902** is configured to display a number of steps taken by a user over a given time period. A calories burned module **904** is configured to display a number of calories burned over a given time period. A floors module **906** is configured to display a number of floors climbed by the user over a given time period. An active versus sedentary module **908** is configured to display relative amounts of time spent by the user in active physical activity versus sedentary activity. An activity levels module **910** is configured to display amount of time spent at various activity levels. A distance module **912** is configured to display a distance traveled by the user over a given period of time. A badges module **914** is configured to display badges or other types of milestone related data based on the activity of the user. A weight module **916** is configured to display current and/or historical weight data to the user.

A friends module **918** is configured to display friends of the user that may be in a social graph associated with the user. In one embodiment, the friends module **918** can be configured to provide a leaderboard display wherein activity data/metrics associated with friends of the user are shown, and wherein such friends may be listed in a ranked order based on the activity data/metrics, thereby providing a leaderboard with respect to a given activity data or metric. It will be appreciated that the user may select a given friend identified by the friends module **918** and generate or define a notification to be sent to the selected friend. Additionally, it is noted that notifications may be generated based on activity data/metrics associated with friends of the user, such as informational notifications when a friend achieves a certain goal or milestone, when a friend surpasses the user with respect to particular activity data/metrics, when the user surpasses a friend with respect to particular activity data/metrics, etc.

FIGS. **10A-10C** illustrate embodiments of communication operations between an activity tracking device, a client device, and a backend server, in accordance with one embodiment of the present invention.

The communication described with reference to the flow diagrams in FIGS. **10A-10C** should only be viewed as exemplary of operations that occur between the activity tracking device, a client device (computing device), and a backend server (server). In this illustrated example, thick pointed arrows indicate that a connection interval has been scaled up so as to operate data transfers at a first data transfer rate, while a thin pointed arrow indicates a connection interval that has been scaled down so as to operate data transfers at a second data transfer rate.

In one embodiment, the first transfer rate is designed to allow the transfer of larger amounts of data that have been stored on the activity tracking device over a period of time, such as since the last connection was made to a computing device. The activity tracking data stored on the activity tracking device can include, for example, motion data associated with the various activities performed by a user, data sensed by the activity tracking device, or data measured by the activity tracking device.

The various activities may include, without limitation, walking, running, jogging, walking up and down stairs, and general movement. Other information that can be stored by the activity tracking device can include, for example, measured information such as heart rate information, temperature information, etc. In one embodiment, storage of the activity tracking device will store this information for a period of time until a connection is made to a client device, such as a computing device configured to sync with the activity tracking device. In one embodiment, the computing device (client device) can be a smart phone, a tablet computer, a laptop computer, a desktop computer, or a general computing device.

In one embodiment, the first transfer rate is defined by scaling up the connection interval of the communication channel established between the activity tracking device and the client device. For example, if the communication channel

is a low energy Bluetooth connection, the connection interval can be scaled to enable a transfer of packets that is more frequent than the second transfer rate.

First Transfer Rate (Connection Interval Scale-Up)

The connection interval for the first transfer rate can be scaled up to set a throughput of packets, such that each packet is transferred in less than about 200 milliseconds (ms). In one example embodiment, the first transfer rate is set to transfer one packet every about 10 ms to about 30 ms. In another example embodiment, the first transfer rate can be one packet every about 20 ms. In one embodiment, each packet is about 20 bytes.

In one embodiment, the first data transfer rate may be defined in terms of a frequency, in a range of between about 500 Bps (bytes per second) and about 2 kBps (kilobytes per second). In one example data transfer rate is about 1 kBps (kilobyte per second).

Second Transfer Rate (Connection Interval Scale-Down)

The connection interval for the second transfer rate can scaled down to set a throughput of packets, such that each packet is transferred at an interval that is greater than about 200 milliseconds (ms). In one example embodiment, the second transfer rate is set to transfer a packet every 500 ms. In some embodiments, depending on the frequency of events or lack of events, the transfer rate can be set to update only after several seconds (e.g., about 1-10 seconds). In one embodiment, each packet is about 20 bytes.

In one embodiment, the second data transfer rate may define a frequency value that is less than 500 bps (bytes per second). In another embodiment, the second data transfer rate can be set to a value that is less than 100 bps (bytes per second). In still another example, the second data transfer rate can be about 1 Bps (1 byte per second). In some embodiments, depending on the frequency of events or lack of events, the transfer rate can be scaled down even further.

It should be understood that these example rates, parameters, and/or sizes can change over time, depending on standards, customizations, and/or optimizations. So therefore, these parameters should only be viewed as examples. It is further understood that the methods and devices defined herein can implement embodiments that include more than two data transfer rates. In fact, the number of data transfer rates can include any number, based on a number of predefined scaled up or scaled down connection intervals. The number of intervals will vary, of course, depending on the implementation.

By scaling the connection intervals up or down, it is not the actual throughput that is being changed, but rather the possible bandwidth that can be supported by the channel. In the first data transfer rate, the scaled setting uses almost all of the channel bandwidth. In the second data transfer rate, most of the available channel bandwidth goes unused. A consideration for both transfer rates is latency, so the system does not want to have to wait too long before a single event (e.g., essentially one bit of information) can go from one device to another.

Returning to FIG. **10**A, activity begins in operation **1002** where the activity tracking device detects and stores activity data associated with motion or data collected by the device. In the example of FIG. **10**A, it is assumed that the activity tracking device has never been synchronized a website (e.g., site) of a server. Therefore, a pairing of the activity tracking device to the site needs to occur, at least once.

The client device, in operation **1008** may detect that an application is opened on the client device. The application that is opened is the activity tracking application **202**, for example. In operation **1010**, the client device begins to pair with the activity tracking device. Pairing may occur, for example, upon request of a user that initiates the pairing.

The pairing, in this embodiment is a pairing between the activity tracking device and the site, which is enabled via the computing device client. For example, the scanning, connecting and data transfer at the computing device will enable the pairing with the site. If the activity tracking device has activity data, it will also be synchronized with the site, as shown in **1024** and **1025**. The communication between the computing device and the activity tracking device is carried out in accordance with the first transfer rate, which uses a scaled-up connection interval to transfer data. The first transfer rate can include, for example, command data **1030** requesting data from the activity tracking device, sending data **1032**, and acknowledgement information **1034** for received data. At this point, the user may wish to close application **1014** at the client computing device.

In FIG. **10**B, an example is shown of a connection where the activity tracking device had previously been paired to the site on the server, in accordance with one embodiment of the present invention. In operation **1002**, activity data is detected and stored on the activity tracking device. At some point, an application is opened **1008** at the computing device. As noted above, the application may be an activity tracking application **202**. An update condition is detected by the client device, which is identified by opening the application. The update condition will act to scale-up the connection interval, so as to set a first data transfer rate.

The thick arrows **1030**, **1032** and **1034** represent the first data transfer rate, which is a faster transfer rate than the second transfer rate. Once the syncing with the site **1004** and sync **1025** is complete, using the scanning, connecting and data transfer **1012** of the client, the operation of real-time client display updates **1006** is processed.

The update condition has now changed, which causes a scale down of the connection intervals between the activity tracking device and the computing device. This, as noted above, causes the second transfer rate to govern for data exchanged to the computing device for real-time data display. In one embodiment, arrow **1036** indicates a request from the computing device for real time updates. Arrows **1038** indicate data transfers of any data available for transfer, using the second data transfer rate. Arrow **1039** indicate a command that the client device has closed the application **1014**, so that the device can stop sending updates.

FIG. **10**C illustrates an embodiment where the activity tracking device is connected to the computing device, without a connection with the server. Without server connection, the computing device (client) will not establish a pairing with the server, but instead will only establish a connection with the activity tracking device to perform real-time client display updates. As noted above, the activity tracking device will be set to communicate with the computing device using the second transfer rate, which is a result of scaling down the connection interval for performing the transfer of updates.

In this embodiment, the transfer of updates takes place to the computing device, which can display updates from the tracker in substantial real time. In one embodiment, the updates are transferred at a rate that is substantially not noticeable to a user viewing a changing screen or display of the computing device (e.g., the display of a smartphone, a smart watch, glasses device, etc.). In one example, the substantial real-time updates occur with transfer delay to the display that is less than about 2 seconds. In other embodiments, the transfer delay is less than about 1 second. In still other embodiments, the transfer delay is less than about 0.6 second. To human perception, the updates would appear to

occur in real-time, wherein the updated activity data is continuously updated to the client device, and the display changes continuously or intermittently, depending on whether activity was captured or not. In some embodiments, the real time display will show numbers on a screen changing, such as counting steps, counting stairs, showing distance traveled, etc.

The communication between the client device and the server is executed using an Internet connection link, such as a Wi-Fi connection or cellular connection. As noted in this disclosure, the activity tracking device can be a wearable device on the wrist of a user, or a device that can be held by the user or attached to the user's clothing. As the user engages in motion or activities, the captured information can be transferred directly to the client device, such as a smart phone having an activity tracking application.

If the activity tracking application is open, and the user is viewing one or more screens or data provided by the activity tracking application, that motion or activity data is transferred to the smart phone for display. Thus, if the user is currently viewing a screen that displays metric data associated with the activity being performed by the user, that activity can be updated substantially in real time as the user engages in the activity. For example, if the user is walking while viewing the screen that displays the number of steps, the number of steps can be shown to increase as the user is walking and viewing the display on the smart phone.

As the flow diagrams of FIGS. **10**A-**10**C show, communication is managed between activity tracking device, the computing device, and the backend server. However, it should be understood that the communication between the activity tracking device and the client device can occur without having any Internet connection or connections to the backend server, as noted with response to FIG. **10**C. When Internet connection is established by the client device at some point, the client device can then synchronize with the backend server, such as during background syncs, or when the app on the client device is again opened.

FIG. **11** illustrates an example where various types of activities of users **1400**A-**1400**I can be captured by activity tracking devices **100**, in accordance with one embodiment of the present invention. As shown, the various types of activities can generate different types of data that can be captured by the activity tracking device **100**. The data, which can be represented as motion data (or processed motion data) can be transferred **1420** to a network **176** for processing and saving by a server, as described above. In one embodiment, the activity tracking device **100** can communicate to a device using a wireless connection, and the device is capable of communicating and synchronizing the captured data with an application running on the server. In one embodiment, an application running on a local device, such as a smart phone or tablet or smart watch can capture or receive data from the activity tracking device **100** and represent the tract motion data in a number of metrics.

In one embodiment, the device collects one or more types of physiological and/or environmental data from embedded sensors and/or external devices and communicates or relays such metric information to other devices, including devices capable of serving as Internet-accessible data sources, thus permitting the collected data to be viewed, for example, using a web browser or network-based application. For example, while the user is wearing an activity tracking device, the device may calculate and store the user's step count using one or more sensors. The device then transmits data representative of the user's step count to an account on a web service, computer, mobile phone, or health station where the data may be stored, processed, and visualized by the user. Indeed, the device may measure or calculate a plurality of other physiological metrics in addition to, or in place of, the user's step count.

Some physiological metrics include, but are not limited to, energy expenditure (for example, calorie burn), floors climbed and/or descended, heart rate, heart rate variability, heart rate recovery, location and/or heading (for example, through GPS), elevation, ambulatory speed and/or distance traveled, swimming stroke/lap count, racquet swings/hits, golf swings, bicycle distance and/or speed, blood pressure, blood glucose, skin conduction, skin and/or body temperature, electromyography, electroencephalography, weight, body fat, caloric intake, nutritional intake from food, medication intake, sleep periods (i.e., clock time), sleep phases, sleep quality and/or duration (e.g. number of time awoken), pH levels, hydration levels, and respiration rate. The device may also measure or calculate metrics related to the environment around the user such as barometric pressure, weather conditions (for example, temperature, humidity, pollen count, air quality, rain/snow conditions, wind speed), light exposure (for example, ambient light, UV light exposure, time and/or duration spent in darkness), noise exposure, radiation exposure, and magnetic field.

Still further, other metrics can include, without limitation, calories burned by a user, weight gained by a user, weight lost by a user, stairs ascended, e.g., climbed, etc., by a user, stairs descended by a user, steps taken by a user during walking or running, a number of rotations of a bicycle pedal rotated by a user, sedentary activity data, driving a vehicle, a number of golf swings taken by a user, a number of forehands of a sport played by a user, a number of backhands of a sport played by a user, or a combination thereof. In some embodiments, sedentary activity data is referred to herein as inactive activity data or as passive activity data. In some embodiments, when a user is not sedentary and is not sleeping, the user is active. In some embodiments, a user may stand on a monitoring device that determines a physiological parameter of the user. For example, a user stands on a scale that measures a weight, a body fat percentage, a biomass index, or a combination thereof, of the user.

Furthermore, the device or the system collating the data streams may calculate metrics derived from this data. For example, the device or system may calculate the user's stress and/or relaxation levels through a combination of heart rate variability, skin conduction, noise pollution, and sleep quality. In another example, the device or system may determine the efficacy of a medical intervention (for example, medication) through the combination of medication intake, sleep and/or activity data. In yet another example, the device or system may determine the efficacy of an allergy medication through the combination of pollen data, medication intake, sleep and/or activity data. These examples are provided for illustration only and are not intended to be limiting or exhaustive.

This information can be associated to the users account, which can be managed by an activity management application on the server. The activity management application can provide access to the users account and data saved thereon. The activity manager application running on the server can be in the form of a web application. The web application can provide access to a number of websites screens and pages that illustrate information regarding the metrics in various formats. This information can be viewed by the user, and synchronized with a computing device of the user, such as a smart phone.

In one embodiment, the data captured by the activity tracking device **100** is received by the computing device, and the data is synchronized with the activity measured application on the server. In this example, data viewable on the computing device (e.g. smart phone) using an activity tracking application (app) can be synchronized with the data present on the server, and associated with the user's account. In this way, information entered into the activity tracking application on the computing device can be synchronized with application illustrated in the various screens of the activity management application provided by the server on the website.

The user can therefore access the data associated with the user account using any device having access to the Internet. Data received by the network **176** can then be synchronized with the user's various devices, and analytics on the server can provide data analysis to provide recommendations for additional activity, and or improvements in physical health. The process therefore continues where data is captured, analyzed, synchronized, and recommendations are produced. In some embodiments, the captured data can be itemized and partitioned based on the type of activity being performed, and such information can be provided to the user on the website via graphical user interfaces, or by way of the application executed on the users smart phone (by way of graphical user interfaces).

In an embodiment, the sensor or sensors of a device **100** can determine or capture data to determine an amount of movement of the monitoring device over a period of time. The sensors can include, for example, an accelerometer, a magnetometer, a gyroscope, or combinations thereof. Broadly speaking, these sensors are inertial sensors, which capture some movement data, in response to the device **100** being moved. The amount of movement (e.g., motion sensed) may occur when the user is performing an activity of climbing stairs over the time period, walking, running, etc. The monitoring device may be worn on a wrist, carried by a user, worn on clothing (using a clip, or placed in a pocket), attached to a leg or foot, attached to the user's chest, waist, or integrated in an article of clothing such as a shirt, hat, pants, blouse, glasses, and the like. These examples are not limiting to all the possible ways the sensors of the device can be associated with a user or thing being monitored.

In other embodiments, a biological sensor can determine any number of physiological characteristics of a user. As another example, the biological sensor may determine heart rate, a hydration level, body fat, bone density, fingerprint data, sweat rate, and/or a bioimpedance of the user. Examples of the biological sensors include, without limitation, a biometric sensor, a physiological parameter sensor, a pedometer, or a combination thereof.

In some embodiments, data associated with the user's activity can be monitored by the applications on the server and the users device, and activity associated with the user's friends, acquaintances, or social network peers can also be shared, based on the user's authorization. This provides for the ability for friends to compete regarding their fitness, achieve goals, receive badges for achieving goals, get reminders for achieving such goals, rewards or discounts for achieving certain goals, etc.

As noted, an activity tracking device **100** can communicate with a computing device (e.g., a smartphone, a tablet computer, a desktop computer, or computer device having wireless communication access and/or access to the Internet). The computing device, in turn, can communicate over a network, such as the Internet or an Intranet to provide data synchronization. The network may be a wide area network, a local area network, or a combination thereof. The network may be coupled to one or more servers, one or more virtual machines, or a combination thereof. A server, a virtual machine, a controller of a monitoring device, or a controller of a computing device is sometimes referred to herein as a computing resource. Examples of a controller include a processor and a memory device.

In one embodiment, the processor may be a general purpose processor. In another embodiment, the processor can be a customized processor configured to run specific algorithms or operations. Such processors can include digital signal processors (DSPs), which are designed to execute or interact with specific chips, signals, wires, and perform certain algorithms, processes, state diagrams, feedback, detection, execution, or the like. In some embodiments, a processor can include or be interfaced with an application specific integrated circuit (ASIC), a programmable logic device (PLD), a central processing unit (CPU), or a combination thereof, etc.

In some embodiments, one or more chips, modules, devices, or logic can be defined to execute instructions or logic, which collectively can be viewed or characterized to be a processor. Therefore, it should be understood that a processor does not necessarily have to be one single chip or module, but can be defined from a collection of electronic or connecting components, logic, firmware, code, and combinations thereof.

Examples of a memory device include a random access memory (RAM) and a read-only memory (ROM). A memory device may be a Flash memory, a redundant array of disks (RAID), a hard disk, or a combination thereof.

Embodiments described in the present disclosure may be practiced with various computer system configurations including hand-held devices, microprocessor systems, microprocessor-based or programmable consumer electronics, minicomputers, mainframe computers and the like. Several embodiments described in the present disclosure can also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a wire-based or wireless network.

With the above embodiments in mind, it should be understood that a number of embodiments described in the present disclosure can employ various computer-implemented operations involving data stored in computer systems. These operations are those requiring physical manipulation of physical quantities. Any of the operations described herein that form part of various embodiments described in the present disclosure are useful machine operations. Several embodiments described in the present disclosure also relate to a device or an apparatus for performing these operations. The apparatus can be specially constructed for a purpose, or the apparatus can be a computer selectively activated or configured by a computer program stored in the computer. In particular, various machines can be used with computer programs written in accordance with the teachings herein, or it may be more convenient to construct a more specialized apparatus to perform the required operations.

Various embodiments described in the present disclosure can also be embodied as computer-readable code on a non-transitory computer-readable medium. The computer-readable medium is any data storage device that can store data, which can thereafter be read by a computer system. Examples of the computer-readable medium include hard drives, network attached storage (NAS), ROM, RAM, compact disc-ROMs (CD-ROMs), CD-recordables (CD-Rs), CD-rewritables (RWs), magnetic tapes and other optical and non-optical data storage devices. The computer-readable medium can include computer-readable tangible medium distributed

over a network-coupled computer system so that the computer-readable code is stored and executed in a distributed fashion.

Although the method operations were described in a specific order, it should be understood that other housekeeping operations may be performed in between operations, or operations may be performed in an order other than that shown, or operations may be adjusted so that they occur at slightly different times, or may be distributed in a system which allows the occurrence of the processing operations at various intervals associated with the processing.

Although the foregoing embodiments have been described in some detail for purposes of clarity of understanding, it will be apparent that certain changes and modifications can be practiced within the scope of the appended claims. Accordingly, the present embodiments are to be considered as illustrative and not restrictive, and the various embodiments described in the present disclosure are not to be limited to the details given herein, but may be modified within the scope and equivalents of the appended claims.

What is claimed is:

1. A method, comprising:

establishing a wireless connection between a mobile device and an activity monitoring device;

receiving, at the mobile device, activity data from the activity monitoring device via the wireless connection;

processing the activity data to determine an activity metric for a user of the activity monitoring device;

comparing the activity metric against a predefined threshold, the predefined threshold being mapped to a notification message;

determining, based on the comparing, that the activity metric has reached or exceeds the predefined threshold;

accessing an electronic calendar associated with the user to obtain electronic calendar data;

displaying the notification message on the mobile device responsive to determining that the activity metric has reached or exceeded the predefined threshold, a timing of the display of the notification message being determined based on the electronic calendar data obtained from the electronic calendar associated with the user.

2. The method of claim **1**, wherein the notification message defines one or more of an alert, a banner, a badge on an icon associated to the application, a sound, or a tactile alert.

3. The method of claim **1**, wherein establishing the wireless connection defines communication between a background executed application on the mobile device and the activity monitoring device.

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

wherein the notification message is scheduled for display on the mobile device at a specified date and time.

5. The method of claim **4**, further comprising,

responsive to a specified date and time being reached, processing activity data from the activity monitoring device to identify a current state of activity of the user; and

presenting or delaying presentation of the notification message, based on the identified current state of activity of the user.

6. The method of claim **5**,

wherein processing activity data to identify the current state of activity of the user includes processing location data to identify a speed or a location of the user; and

wherein presenting or delaying presentation of the notification message is based on the identified speed or location of the user.

7. The method of claim **4**, further comprising,

responsive to a specified date and time being reached, processing activity data from the activity monitoring device to determine that the user is currently sleeping; and

responsive to determining that the user is currently sleeping, delaying presentation of the notification message.

8. The method of claim **1**, wherein the activity metric defines one or more of a number of steps taken, a number of floors climbed, a number of calories burned, an amount of energy expended, a distance traveled, a number of minutes slept, a number of minutes performing an activity, or a number of active minutes.

9. The method of claim **1**,

wherein the predefined threshold defines a quantified achievement amount of an activity goal set for the user; and

wherein the notification message identifies the quantified achievement amount of the activity goal.

10. The method of claim **9**,

wherein the quantified achievement amount of the activity goal is less than 100%, 100%, or greater than 100% of the activity goal.

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

determining, based on the obtained electronic calendar data, that the user is busy or occupied during a specific time period,

wherein the display of the notification message on the mobile device is prevented during the specific time period.

12. A server-executed method, comprising:

establishing communication with a mobile device over a network;

receiving, over the network, activity data from the mobile device, the activity data being processed by the mobile device from logged data received by the mobile device from an activity monitoring device;

processing the activity data to determine an activity metric for a user of the activity monitoring device;

comparing the activity metric against a predefined threshold, the predefined threshold being mapped to a notification message;

determining that the activity metric has reached or exceeds the predefined threshold;

sending the notification message over the network to a notification service in response to determining that the activity metric reached or exceeded the predefined threshold, the notification service transmitting the notification message to the mobile device to effect display of the notification message on the mobile device, wherein displaying the notification message includes scheduling the notification message for display during a specified time window.

13. The method of claim **12**, wherein the notification message defines one or more of an alert, a banner, a badge on an icon associated to the application, or a sound.

14. The method of claim **12**, wherein establishing communication with the mobile device includes establishing communication with a background executed application on the mobile device.

15. The method of claim **12**, wherein displaying the notification message on the mobile device includes triggering a notification handler.

16. The method of claim **12**, further comprising,

responsive to the time window being reached, processing activity data from the activity monitoring device to identify a current state of activity of the user; and

presenting or delaying presentation of the notification message, based on the identified current state of activity of the user.

17. The method of claim **16**,

wherein processing activity data to identify the current state of activity of the user includes processing location data to identify a speed or a location of the user; and

wherein presenting or delaying presentation of the notification message is based on the identified speed or location of the user.

18. The method of claim **12**, wherein the activity metric defines one or more of a number of steps taken, a number of floors climbed, an amount of energy expended, a number of calories burned, a distance traveled, or a number of active minutes.

19. The method of claim **12**,

wherein the predefined threshold defines a quantified achievement amount of an activity goal set for the user; and

wherein the notification message identifies the quantified achievement amount of the activity goal.

20. The method of claim **19**,

wherein the quantified achievement amount of the activity goal is less than about 100%, about 100%, or greater than about 100% of the activity goal.

21. A method, comprising:

defining an activity goal;

determining a series of notification thresholds, each notification threshold defining a quantified level of achievement of the activity goal, each notification threshold being mapped to a corresponding notification message;

establishing a wireless connection between a user device and an activity monitoring device;

receiving, at the user device, activity data measured by the activity monitoring device via the wireless connection;

processing the activity data to determine an activity metric;

responsive to the activity metric reaching one of the notification thresholds in the series of notification thresholds, accessing an electronic calendar associated with the user to obtain electronic calendar data, and triggering presentation of the corresponding notification message on the user device, a timing of the presentation of the corresponding notification message being determined based on the electronic calendar data obtained from the electronic calendar associated with the user, the timing being delayed when the electronic calendar data indicates the user is busy or occupied.

22. The method of claim **21**, wherein triggering presentation of the corresponding notification message on the user device includes activating a push notification service to transmit the notification message to the user device for rendering on the user device.

23. The method of claim **21**, wherein triggering presentation of the corresponding notification message on the user device includes triggering a local notification presenter to display the corresponding notification message on the user device.

24. The method of claim **21**, wherein each notification message identifies the quantified level of achievement defined by the notification threshold to which the notification message is mapped.

25. The method of claim **21**, wherein the notification message defines one or more of an alert, a banner, a badge on an icon associated to the application, or a sound.

26. The method of claim **21**, wherein triggering presentation of the notification message includes scheduling the notification message for display on the user device at a specified date and time.

27. The method of claim **26**, further comprising,

responsive to the specified date and time being reached, processing activity data from the activity monitoring device to identify a current state of activity of the user; and

presenting or delaying presentation of the notification message, based on the identified current state of activity of the user.

28. A method, comprising:

establishing a wireless connection between a user device and an activity monitoring device;

receiving, at the user device, activity data from one or more sensors of the activity monitoring device via the wireless connection;

processing the activity data to determine an activity metric for a user of the activity monitoring device;

comparing the activity metric against a predefined threshold, the predefined threshold being mapped to a notification message;

in response to determining that the activity metric has reached or exceeds the predefined threshold, triggering display of the notification message on the user device, the triggering display of the notification message including scheduling the notification message for display during a time window.

29. The method of claim **28**,

wherein the notification message is generated in response to the determining that the activity metric has reached or exceeds the predefined threshold; and

wherein triggering display of the notification message on the user device includes sending the notification message to the user device.

30. The method of claim **28**, further comprising,

responsive to the time window being reached, processing activity data from the one or more sensors of the activity monitoring device to identify a current state of activity of the user; and

presenting or delaying presentation of the notification message, based on the identified current state of activity of the user.

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