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- (71) Applicant (for AT, AU, BE, BG, BH, BR, CA, CH, CN, CO, DE, EC, ES, FI, FR, GB, GR, HR, HU, ID, IE, IL, IN, IS, IT, JP, KR, LR, LS, LU, LV, LY, MA, MC, MN, MT, MW, MX, MY, MZ, NA, NL, NO, NZ, PE, PG, PH, PL, QA, RO, RS, RW, SD, SE, SG, SI, SL, SM, SY, SZ, TN, TZ, UG, US, VC, ZA, ZM, ZW only): **BODHI TECHNOLOGY VENTURES LLC** [US/US]; Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801 (US).

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- (74) Agents: CRETSINGER, Cathy E. et al.; Kilpatrick Townsend & Stockton LLP, Eighth Floor, Two Embarcadero Center, San Francisco, California 94111 (US).

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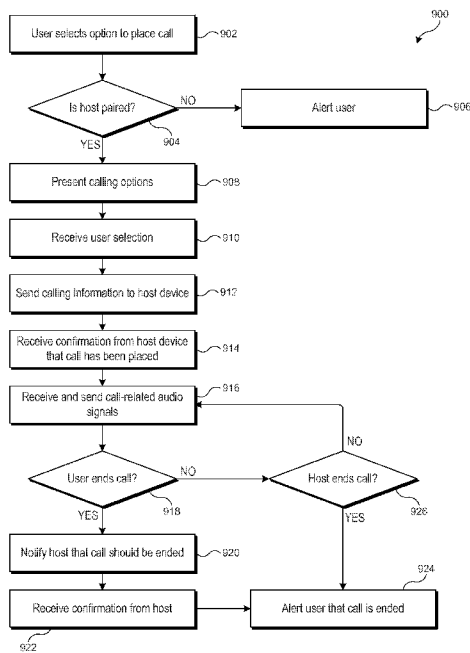


FIG. 9

(57) Abstract: A wearable device that communicates with a host device can be used to initiate a communication functionality of the host device (e.g., telephone calls, text messages). The wearable device can obtain user input indicating a recipient of the communication and in some instances content for the communication and can provide an instruction to the host device. The host device can use the indicated recipient and content to initiate communication and where applicable to send the content. Recipients and/or content can be selected from predefined lists available on the wearable device.

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## PROVIDING REMOTE INTERACTIONS WITH HOST DEVICE USING A WIRELESS DEVICE

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### CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to commonly-owned International Application No. PCT/US/2013/032498, filed March 15, 2013, entitled “Providing Remote Interactions with Host Device Using a Wireless Device,” the disclosure of which is incorporated herein by  
10 reference in its entirety.

### BACKGROUND

[0002] The present disclosure relates generally to wireless electronic devices and in particular to providing remote interactions with a host device using a wireless device.

15 [0003] Mobile electronic devices, such as mobile phones, smart phones, tablet computers, media players, and the like, have become quite popular. Many users carry a device almost everywhere they go and use their devices for a variety of purposes, including making and receiving phone calls, sending and receiving text messages and emails, navigation (e.g., using maps and/or a GPS receiver), purchasing items in stores (e.g., using contactless payment  
20 systems), and/or accessing the Internet (e.g., to look up information).

[0004] However, a user’s mobile device is not always readily accessible. For instance, when a mobile device receives a phone call, the device may be in a user’s bag or pocket, and the user may be walking, driving, carrying something, or involved in other activity that makes it inconvenient or impossible for the user to reach into the bag or pocket to find the  
25 device.

### SUMMARY

[0005] Certain embodiments of the present invention relate to wearable electronic devices that can be connected (e.g., via wireless pairing) with another device (referred to herein as a  
30 “host device”), such as a smart phone, other mobile phone, tablet computer, media player,

laptop computer, or the like. When paired, the wearable device can provide access to various functionalities of the host device.

[0006] In some embodiments, a wearable device can be operated by a user to respond to an event notification generated by a host device. The wearable device can receive a notification of the event from the host device and present the user with an alert and a prompt to respond. If the user responds to the prompt, the wearable device can transmit the response to the host device. For example, a user can respond to a phone call, text message, or other communication received at the host device.

[0007] In some embodiments, a wearable device can be operated by a user to initiate a functionality of a host device, independently of any prior event notification. For example, the wearable device can present a user interface via which the user can select a functionality to be invoked and further interfaces to control that functionality. Accordingly, a user can operate a wearable device to provide a phone number and instruct a host device to place a phone call to that number, or a user can operate a wearable device to send a text message to a specified recipient, or a user can operate a wearable device to control media playback and/or any other functionality available on a particular host device.

[0008] Certain embodiments of the invention relate to placing a phone call using a wearable device that communicates with a host device having a telephone transceiver. In some embodiments, a wearable device can obtain user input indicative of a call to be placed, including identifier of a recipient of the call. For example, the wearable device can present to the user a list of the user's contacts and can receive a user input selecting one of the contacts from the list as the recipient. As another example, the wearable device can present to the user a virtual keypad, which the user can operate to enter a phone number to be called. The wearable device can send an instruction to the host device to place a phone call and provide the identifier of the recipient. The host device can place the call. In some embodiments, e.g., where the recipient is identified as a contact, the host device can perform a lookup operation to determine a phone number associated with the contact, then place the call to that phone number. Once the call has been placed, the host device can send confirmation to the wearable device. In response to receiving the confirmation, the wearable device can present a control operable by the user to terminate the call.

[0009] While the call is in progress, the host device can route audio signals associated with the call between the telephone transceiver and an audio device, and the routing can be based

at least in part on a user preference setting of the host device. For instance, the host device can route a call-related audio output signal received at the telephone transceiver to the wearable device, which can deliver the signal to a speaker (which can be part of the wearable device or a separate device). As another example, the wearable device can also obtain a call-related audio input signal from a microphone (which can be part of the wearable device or a separate device) and can send the call-related audio input signal to the host device, which can route the signal to the telephone transceiver. In other embodiments, the host device can route call-related audio input and/or call-related audio output from and/or to audio devices other than the wearable device.

10 [0010] In some embodiments, a call can continue until it is terminated. For example, the wearable device can detect user operation of the control operable to end the call and can send a notification to the host device that the call should be ended. As another example, the wearable device can receive a notification from the host device that the call has ended (e.g., because the recipient terminated the call) and can present an alert to the user indicating that  
15 the call has ended.

[0011] Certain embodiments of the invention relate to sending a message (such as a text message) using a wearable device that communicates with a host device having a telecommunication interface. In some embodiments, the wearable device can obtain user input indicative of a recipient of a message and further user input indicative of content of the message. For example, the wearable device can present to the user a list of the user's  
20 contacts and can receive a user input selecting one of the contacts from the list as the recipient. The wearable device can also present to the user a list of predefined messages and can receive a user input selecting one of the messages from the list as the message content. The wearable device can send an instruction to the host device to send the message, and the  
25 instruction can include an identifier of the recipient and an indication of the content of the message. In response to the instruction, the host can create a message based on the provided indication of content. For example, if the content indication provides an identifier of a message selected from a list, the host device can perform a lookup operation to obtain corresponding message content and include that content in the message. The host device can  
30 send the message to a destination address determined based on the recipient identifier. The host can send a confirmation to the wearable device that the message has been sent, and the wearable device can so inform the user.

[0012] Certain embodiments relate to facilitating user operation of a wearable device, e.g., by automatically activating a user interface of the wearable device in response to an event indicating that a user is likely to begin using the wearable device. For example, the wearable device can have a motion sensor that it can use to detect a motion characteristic of a user moving the wearable device into a viewing position. In the case of a wrist-worn device, for instance, the characteristic motion can correspond to a motion that moves the user's wrist into the user's line of sight. In response to detecting this motion, the wearable device can activate a user interface component such as a display, a touch sensor, a touchscreen interface (which can include a display and a touch sensor), a microphone, or the like. Other components of the wearable device can be automatically activated based on motion detection as well. In some embodiments, the wearable device can also detect whether it is being worn, and motion detection to trigger automatic activation can be limited to instances where the device is being worn.

[0013] The following detailed description together with the accompanying drawings will provide a better understanding of the nature and advantages of the present invention.

#### BRIEF DESCRIPTION OF THE DRAWINGS

- [0014] FIG. 1 shows a wearable device communicating wirelessly with a host device according to an embodiment of the present invention.
- [0015] FIG. 2 is a simplified block diagram of a wearable device according to an embodiment of the present invention.
- [0016] FIGs. 3A and 3B illustrate a user operating a wearable device according to an embodiment of the present invention
- [0017] FIG. 4 is a flow diagram of a process for responding to an event notification according to an embodiment of the present invention.
- [0018] FIG. 5 illustrates an interface for alerting a user according to an embodiment of the present invention.
- [0019] FIG. 6 illustrates another interface for alerting a user according to an embodiment of the present invention.

[0020] FIG. 7 illustrates a user interface for selecting a predefined message according to an embodiment of the present invention.

[0021] FIG. 8 is a flow diagram of a process for generating an event notification and receiving a response according to an embodiment of the present invention

5 [0022] FIG. 9 is a flow diagram of a process for initiating a phone-call functionality of a host device according to an embodiment of the present invention.

[0023] FIG. 10 illustrates a function-selection user interface according to an embodiment of the present invention.

10 [0024] FIG. 11 illustrates a user interface for placing a call according to an embodiment of the present invention.

[0025] FIG. 12 illustrates a keypad user interface according to an embodiment of the present invention.

[0026] FIG. 13 illustrates a contacts user interface according to an embodiment of the present invention.

15 [0027] FIG. 14 is a flow diagram of a process for placing a call using a wearable device according to an embodiment of the present invention.

[0028] FIG. 15 is a flow diagram of a process for sending a text message using a wearable device according to an embodiment of the present invention.

20 [0029] FIG. 16 illustrates a user interface for selecting a predefined message according to an embodiment of the present invention.

#### DETAILED DESCRIPTION

[0030] Certain embodiments of the present invention relate to wearable electronic devices that can be connected (e.g., via wireless pairing) with another device (referred to herein as a "host device"), such as a smart phone, other mobile phone, tablet computer, media player, laptop computer, or the like. When paired, the wearable device can provide access to various functionality of the host device.

[0031] In some embodiments, a wearable device can be operated by a user to respond to an event notification generated by a host device. The wearable device can receive a notification

of the event from the host device and present the user with an alert and a prompt to respond. If the user responds to the prompt, the wearable device can transmit the response to the host device. For example, a user can respond to a phone call, text message, or other communication received at the host device.

5 [0032] In some embodiments, a wearable device can be operated by a user to initiate a functionality of a host device, independently of any prior event notification. For example, the wearable device can present a user interface via which the user can select a functionality to be invoked and further interfaces to control that functionality. Accordingly, a user can operate a wearable device to provide a phone number and instruct a host device to place a phone call to  
10 that number, or a user can operate a wearable device to send a text message to a specified recipient, or a user can operate a wearable device to control media playback and/or any other functionality available on a particular host device.

[0033] FIG. 1 shows a wearable device 100 communicating wirelessly with a host device 102 according to an embodiment of the present invention. In this example, wearable device  
15 100 is shown as a wristwatch-like device with a face portion 104 connected to straps 106a, 106b.

[0034] Face portion 104 can include, e.g., a touchscreen display 105 that can be appropriately sized depending on where on a user's person wearable device 100 is intended to be worn. A user can view information presented by wearable device 100 on touchscreen  
20 display 105 and provide input to wearable device 100 by touching touchscreen display 105. In some embodiments, touchscreen display 105 can occupy most or all of the front surface of face portion 104.

[0035] Straps 106a, 106b can be provided to allow device 100 to be removably worn by a user, e.g., around the user's wrist. In some embodiments, straps 106a, 106b can be made of  
25 any flexible material (e.g., fabrics, flexible plastics, leather, chains or flexibly interleaved plates or links made of metal or other rigid materials) and can be connected to face portion 104, e.g., by hinges. Alternatively, straps 106a, 106b can be made of a rigid material, with one or more hinges positioned at the junction of face 104 and proximal ends 112a, 112b of straps 106a, 106b and/or elsewhere along the lengths of straps 106a, 106b to allow a user to  
30 put on and take off wearable device 100. Different portions of straps 106a, 106b can be made of different materials; for instance, flexible or expandable sections can alternate with rigid sections. In some embodiments, one or both of straps 106a, 106b can include removable

sections, allowing wearable device 100 to be resized to accommodate a particular user's wrist size. In some embodiments, straps 106a, 106b can be portions of a continuous strap member that runs behind or through face portion 104. Face portion 104 can be detachable from straps 106a, 106b; permanently attached to straps 106a, 106b; or integrally formed with straps 106a,  
5 106b.

[0036] The distal ends of straps 106a, 106b opposite face portion 104 can provide complementary clasp members 108a, 108b that can be engaged with each other to secure the distal ends of straps 106a, 106b to each other, forming a closed loop. In this manner, device 100 can be secured to a user's person, e.g., around the user's wrist; clasp members 108a,  
10 108b can be subsequently disengaged to facilitate removal of device 100 from the user's person. The design of clasp members 108a, 108b can be varied; in various embodiments, clasp members 108a, 108b can include buckles, magnetic clasps, mechanical clasps, snap closures, etc. In some embodiments, one or both of clasp members 108a, 108b can be movable along at least a portion of the length of corresponding strap 106a, 106b, allowing  
15 wearable device 100 to be resized to accommodate a particular user's wrist size.

[0037] Straps 106a, 106b can be two distinct segments, or they can be formed as a continuous band of an elastic material (including, e.g., elastic fabrics, expandable metal links, or a combination of elastic and inelastic sections), allowing wearable device 100 to be put on and taken off by stretching a band formed straps 106a, 106b. In such embodiments, clasp  
20 members 108a, 108b can be omitted.

[0038] Straps 106a, 106b and/or clasp members 108a, 108b can include sensors that allow wearable device 100 to determine whether it is being worn at any given time. Wearable device 100 can operate differently depending on whether it is currently being worn or not. For example, wearable device 100 can inactivate various user interface and/or RF interface  
25 components when it is not being worn. In addition, in some embodiments, wearable device 100 can notify host device 102 when a user puts on or takes off wearable device 100.

[0039] Host device 102 can be any device that communicates with wearable device 100. In FIG. 1, host device 102 is shown as a smart phone; however, other host devices can be substituted, such as a tablet computer, a media player, any type of mobile phone, a laptop or  
30 desktop computer, or the like. Other examples of host devices can include point-of-sale terminals, security systems, environmental control systems, and so on. Host device 102 can communicate wirelessly with wearable device 100, e.g., using protocols such as Bluetooth or

Wi-Fi. In some embodiments, wearable device 100 can include an electrical connector 110 that can be used to provide a wired connection to host device 102 and/or to other devices, e.g., by using suitable cables. For example, connector 110 can be used to connect to a power supply to charge an onboard battery of wearable device 100.

5 [0040] In some embodiments, wearable device 100 and host device 102 can interoperate to enhance functionality available on host device 102. For example, wearable device 100 and host device 102 can establish a pairing using a wireless communication technology such as Bluetooth. While the devices are paired, host device 102 can send notifications of selected events (e.g., receiving a phone call, text message, or email message) to wearable device 100,  
10 and wearable device 100 can present corresponding alerts to the user. Wearable device 100 can also provide an input interface via which a user can respond to an alert (e.g., to answer a phone call or reply to a text message). In some embodiments, wearable device 100 can also provide a user interface that allows a user to initiate an action on host device 102, such as placing a phone call, sending a text message, or controlling media playback operations of  
15 host device 102. Techniques described herein can be adapted to allow a wide range of host device functions to be enhanced by providing an interface via wearable device 100.

[0041] It will be appreciated that wearable device 100 and host device 102 are illustrative and that variations and modifications are possible. For example, wearable device 100 can be implemented in any wearable article, including a watch, a bracelet, a necklace, a ring, a belt,  
20 a jacket, or the like. In some instances, wearable device 100 can be a clip-on device or pin-on device that has a clip or pin portion that attaches to the user's clothing. The interface portion (including, e.g., touchscreen display 105) can be attached to the clip or pin portion by a retractable cord, and a user can easily pull touchscreen display 105 into view for use without removing the clip or pin portion, then let go to return wearable device 100 to its  
25 resting location. Thus, a user can wear device 100 in any convenient location.

[0042] Wearable device 100 can be implemented using electronic components disposed within face portion 104, straps 106a, 106b, and/or clasp members 108a, 108b. FIG. 2 is a simplified block diagram of a wearable device 200 (e.g., implementing wearable device 100) according to an embodiment of the present invention. Wearable device 200 can include  
30 processing subsystem 202, storage subsystem 204, user interface 206, RF interface 208, connector interface 210, power subsystem 212, environmental sensors 214, and strap sensors 216. Wearable device 200 can also include other components (not explicitly shown).

[0043] Storage subsystem 204 can be implemented, e.g., using magnetic storage media, flash memory, other semiconductor memory (e.g., DRAM, SRAM), or any other non-transitory storage medium, or a combination of media, and can include volatile and/or non-volatile media. In some embodiments, storage subsystem 204 can store media items  
5 such as audio files, video files, image or artwork files; information about a user's contacts (names, addresses, phone numbers, etc.); information about a user's scheduled appointments and events; notes; and/or other types of information, examples of which are described below. In some embodiments, storage subsystem 204 can also store one or more application  
10 programs to be executed by processing subsystem 210 (e.g., video game programs, personal information management programs, media playback programs, interface programs associated with particular host devices and/or host device functionalities, etc.).

[0044] User interface 206 can include any combination of input and output devices. A user can operate input devices of user interface 206 to invoke the functionality of wearable device 200 and can view, hear, and/or otherwise experience output from wearable device 200 via  
15 output devices of user interface 206.

[0045] Examples of output devices include display 220, speakers 222, and haptic output generator 224. Display 220 can be implemented using compact display technologies, e.g., LCD (liquid crystal display), LED (light-emitting diode), OLED (organic light-emitting diode), or the like. In some embodiments, display 220 can incorporate a flexible display  
20 element or curved-glass display element, allowing wearable device 200 to conform to a desired shape. One or more speakers 222 can be provided using small-form-factor speaker technologies, including any technology capable of converting electronic signals into audible sound waves. In some embodiments, speakers 222 can be used to produce tones (e.g., beeping or ringing) and can but need not be capable of reproducing sounds such as speech or  
25 music with any particular degree of fidelity. Haptic output generator 224 can be, e.g., a device that converts electronic signals into vibrations; in some embodiments, the vibrations can be strong enough to be felt by a user wearing wearable device 200 but not so strong as to produce distinct sounds.

[0046] Examples of input devices include microphone 226, touch sensor 228, and camera  
30 229. Microphone 226 can include any device that converts sound waves into electronic signals. In some embodiments, microphone 226 can be sufficiently sensitive to provide a representation of specific words spoken by a user; in other embodiments, microphone 226

can be usable to provide indications of general ambient sound levels without necessarily providing a high-quality electronic representation of specific sounds.

[0047] Touch sensor 228 can include, e.g., a capacitive sensor array with the ability to localize contacts to a particular point or region on the surface of the sensor and in some instances, the ability to distinguish multiple simultaneous contacts. In some embodiments, touch sensor 228 can be overlaid over display 220 to provide a touchscreen interface (e.g., touchscreen interface 105 of FIG. 1), and processing subsystem 202 can translate touch events (including taps and/or other gestures made with one or more contacts) into specific user inputs depending on what is currently displayed on display 220.

10 [0048] Camera 229 can include, e.g., a compact digital camera that includes an image sensor such as a CMOS sensor and optical components (e.g. lenses) arranged to focus an image onto the image sensor, along with control logic operable to use the imaging components to capture and store still and/or video images. Images can be stored, e.g., in storage subsystem 204 and/or transmitted by wearable device 200 to other devices for storage. Depending on implementation, the optical components can provide fixed focal distance or variable focal distance; in the latter case, autofocus can be provided. In some embodiments, camera 229 can be disposed along an edge of face member 104 of FIG. 1, e.g., the top edge, and oriented to allow a user to capture images of nearby objects in the environment such as a bar code or QR code. In other embodiments, camera 229 can be disposed on the front surface of face member 104, e.g., to capture images of the user. Zero, one, or more cameras can be provided, depending on implementation.

[0049] In some embodiments, user interface 206 can provide output to and/or receive input from an auxiliary device such as a headset. For example, audio jack 230 can connect via an audio cable (e.g., a standard 2.5-mm or 3.5-mm audio cable) to an auxiliary device. Audio jack 230 can include input and/or output paths. Accordingly, audio jack 230 can provide audio to the auxiliary device and/or receive audio from the auxiliary device. In some embodiments, a wireless connection interface can be used to communicate with an auxiliary device.

[0050] Processing subsystem 202 can be implemented as one or more integrated circuits, e.g., one or more single-core or multi-core microprocessors or microcontrollers, examples of which are known in the art. In operation, processing system 202 can control the operation of wearable device 200. In various embodiments, processing subsystem 202 can execute a

variety of programs in response to program code and can maintain multiple concurrently executing programs or processes. At any given time, some or all of the program code to be executed can be resident in processing subsystem 210 and/or in storage media such as storage subsystem 204.

5 [0051] Through suitable programming, processing subsystem 202 can provide various functionality for wearable device 200. For example, in some embodiments, processing subsystem 202 can execute an operating system (OS) 232 and various applications for interfacing with a host device, such as a phone-interface application 234, a text-interface application 236, and/or a media interface application 238. In some embodiments, some or all  
10 of these application programs can interact with a host device, e.g., by generating messages to be sent to the host device and/or by receiving and interpreting messages from the host device. In some embodiments, some or all of the application programs can operate locally to wearable device 200. For example, if wearable device 200 has a local media library stored in storage subsystem 204, media interface application 238 can provide a user interface to select  
15 and play locally stored media items. Examples of interface applications are described below.

[0052] RF (radio frequency) interface 208 can allow wearable device 200 to communicate wirelessly with various host devices. RF interface 208 can include RF transceiver components such as an antenna and supporting circuitry to enable data communication over a wireless medium, e.g., using Wi-Fi (IEEE 802.11 family standards), Bluetooth<sup>®</sup> (a family of  
20 standards promulgated by Bluetooth SIG, Inc.), or other protocols for wireless data communication. RF interface 208 can be implemented using a combination of hardware (e.g., driver circuits, antennas, modulators/demodulators, encoders/decoders, and other analog and/or digital signal processing circuits) and software components. In some  
25 embodiments, RF interface 208 can provide near-field communication (“NFC”) capability, e.g., implementing the ISO/IEC 18092 standards or the like; NFC can support wireless data exchange between devices over a very short range (e.g., 20 centimeters or less). Multiple different wireless communication protocols and associated hardware can be incorporated into RF interface 208.

[0053] Connector interface 210 can allow wearable device 200 to communicate with  
30 various host devices via a wired communication path, e.g., using Universal Serial Bus (USB), universal asynchronous receiver/transmitter (UART), or other protocols for wired data communication. In some embodiments, connector interface 210 can provide a power port,

allowing wearable device 200 to receive power, e.g., to charge an internal battery. For example, connector interface 210 can include a connector such as a mini-USB connector or a custom connector, as well as supporting circuitry. In some embodiments, the connector can be a custom connector that provides dedicated power and ground contacts, as well as digital data contacts that can be used to implement different communication technologies in parallel; for instance, two pins can be assigned as USB data pins (D+ and D-) and two other pins can be assigned as serial transmit/receive pins (e.g., implementing a UART interface). The assignment of pins to particular communication technologies can be hardwired or negotiated while the connection is being established. In some embodiments, the connector can also provide connections for audio and/or video signals, which may be transmitted to or from host device 202 in analog and/or digital formats.

[0054] In some embodiments, connector interface 210 and/or RF interface 208 can be used to support synchronization operations in which data is transferred from a host device to wearable device 200 (or vice versa). For example, as described below, a user can customize certain information for wearable device 200 (e.g., a “favorite” contacts list and/or specific predefined text messages that can be sent). While user interface 206 can support data-entry operations, a user may find it more convenient to define customized information on a separate device (e.g., a tablet or smartphone) that has a larger interface (e.g., including a real or virtual alphanumeric keyboard), then transfer the customized information to wearable device 200 via a synchronization operation. Synchronization operations can also be used to load and/or update other types of data in storage subsystem 204, such as media items, application programs, and/or operating system programs. Synchronization operations can be performed in response to an explicit user request and/or automatically, e.g., when wireless device 200 resumes communication with a particular host device or in response to either device receiving an update to its copy of synchronized information.

[0055] Environmental sensors 214 can include various electronic, mechanical, electromechanical, optical, or other devices that provide information related to external conditions around wearable device 200. Sensors 214 in some embodiments can provide digital signals to processing subsystem 202, e.g., on a streaming basis or in response to polling by processing subsystem 202 as desired. Any type and combination of environmental sensors can be used; shown by way of example are accelerometer 242, a magnetometer 244, a gyroscope 246, and a GPS receiver 248.

[0056] Some environmental sensors can provide information about the location and/or motion of wearable device 200. For example, accelerometer 242 can sense acceleration (relative to freefall) along one or more axes, e.g., using piezoelectric or other components in conjunction with associated electronics to produce a signal. Magnetometer 244 can sense an ambient magnetic field (e.g., Earth's magnetic field) and generate a corresponding electrical signal, which can be interpreted as a compass direction. Gyroscopic sensor 246 can sense rotational motion in one or more directions, e.g., using one or more MEMS (micro-electro-mechanical systems) gyroscopes and related control and sensing circuitry. Global Positioning System (GPS) receiver 248 can determine location based on signals received from GPS satellites.

[0057] Other sensors can also be included in addition to or instead of these examples. For example, a sound sensor can incorporate microphone 226 together with associated circuitry and/or program code to determine, e.g., a decibel level of ambient sound. Temperature sensors, proximity sensors, ambient light sensors, or the like can also be included.

[0058] Strap sensors 216 can include various electronic, mechanical, electromechanical, optical, or other devices that provide information as to whether wearable device 200 is currently being worn. For instance, clasp sensor 250 can be at least partially disposed within either or both of clasp members 108a, 108b of FIG. 1 and can detect when clasp members 108a, 108b are engaged with each other or disengaged from each other. For example, engaging clasp members 108a, 108b to each other can complete an electrical circuit, allowing current to flow through clasp sensor 250; disengaging clasp members 108a, 108b from each other can break the circuit. As another example, one or more contact sensors 252 can be disposed in straps 106a, 106b and can detect contact with a user's skin, e.g., based on capacitive sensing, galvanic skin response, or the like. Contact sensors 252 can also include pressure sensors (e.g., piezoelectric devices) or the like. Any other type of sensor that indicates whether wearable device 200 is currently being worn can be used in addition to or instead of strap sensors 216. For instance, physiological or biometric sensors, such as pulse sensors, ECG sensors, or the like can be provided. In some embodiments, physiological or biometric sensors can be used in verifying the identity of the wearer of wearable device 200.

[0059] Power subsystem 212 can provide power and power management capabilities for wearable device 200. For example, power subsystem 212 can include a battery 240 (e.g., a rechargeable battery) and associated circuitry to distribute power from battery 240 to other

components of wearable device 200 that require electrical power. In some embodiments, power subsystem 212 can also include circuitry operable to charge battery 240, e.g., when connector interface 210 is connected to a power source. In some embodiments, power subsystem 212 can include a “wireless” charger, such as an inductive charger, to charge battery 240 without relying on connector interface 210. In some embodiments, power subsystem 212 can also include other power sources, such as a solar cell, in addition to or instead of battery 240.

[0060] In some embodiments, power subsystem 212 can control power distribution to components within wearable device 200 to manage power consumption efficiently. For example, power subsystem 212 can automatically place device 200 into a “hibernation” state when strap sensors 216 indicate that device 200 is not being worn. The hibernation state can be designed to reduce power consumption; accordingly, user interface 206 (or components thereof), RF interface 208, connector interface 210, and/or environmental sensors 214 can be powered down (e.g., to a low-power state or turned off entirely), while strap sensors 216 are powered up (either continuously or at intervals) to detect when a user puts on wearable device 200. As another example, in some embodiments, while wearable device 200 is being worn, power subsystem 212 can turn display 220 and/or other components on or off depending on motion and/or orientation of wearable device 200 detected by environmental sensors 214. For instance, if wearable device 200 is designed to be worn on a user’s wrist, power subsystem 212 can detect raising and rolling of a user’s wrist, as is typically associated with looking at a wristwatch, based on information provided by accelerometer 242. In response to this detected motion, power subsystem 212 can automatically turn display 220 and/or touch sensor 228 on; similarly, power subsystem 212 can automatically turn display 220 and/or touch sensor 228 off in response to detecting that user’s wrist has returned to a neutral position (e.g., hanging down).

[0061] Power subsystem 212 can also provide other power management capabilities, such as regulating power consumption of other components of wearable device 200 based on the source and amount of available power, monitoring stored power in battery 240, generating user alerts if the stored power drops below a minimum level, and so on.

[0062] In some embodiments, control functions of power subsystem 212 can be implemented using programmable or controllable circuits operating in response to control

signals generated by processing subsystem 202 in response to program code executing thereon, or as a separate microprocessor or microcontroller.

[0063] It will be appreciated that wearable device 200 is illustrative and that variations and modifications are possible. For example, strap sensors 216 can be omitted, and wearable device 200 can include a user-operable control (e.g., a button or switch) that the user can operate to indicate when wearable device 200 is being worn. Controls can also be provided, e.g., to turn on or off display 220, mute or unmute sounds from speakers 222, etc. In some embodiments, other environmental sensors (e.g., accelerometer 242) can be used to determine whether wearable device 200 is being worn, in addition to or instead of strap sensors 216. Wearable device 200 can include any types and combination of sensors and in some instances can include multiple sensors of a given type.

[0064] In various embodiments, a user interface can include any combination of any or all of the components described above, as well as other components not expressly described. For example, in some embodiments, the user interface can include, e.g., just a touchscreen, or a touchscreen and a speaker, or a touchscreen and a haptic device. Where the wearable device has an RF interface, a connector interface can be omitted, and all communication between the wearable device and other devices can be conducted using wireless communication protocols. A wired power connection, e.g., for charging a battery of the wearable device, can be provided separately from any data connection.

[0065] Further, while the wearable device is described with reference to particular blocks, it is to be understood that these blocks are defined for convenience of description and are not intended to imply a particular physical arrangement of component parts. Further, the blocks need not correspond to physically distinct components. Blocks can be configured to perform various operations, e.g., by programming a processor or providing appropriate control circuitry, and various blocks might or might not be reconfigurable depending on how the initial configuration is obtained. Embodiments of the present invention can be realized in a variety of apparatus including electronic devices implemented using any combination of circuitry and software.

[0066] A host device such as host device 102 of FIG. 1 can be implemented as an electronic device using blocks similar to those described above (e.g., processors, storage media, user interface devices, data communication interfaces, etc.) and/or other blocks or components. Those skilled in the art will recognize that any electronic device capable of

communicating with a particular wearable device can act as a host device with respect to that wearable device.

[0067] Communication between a host device and a wireless device can be implemented according to any communication protocol (or combination of protocols) that both devices are programmed or otherwise configured to use. In some instances, standard protocols such as Bluetooth protocols can be used. In some instances, a custom message format and syntax (including, e.g., a set of rules for interpreting particular bytes or sequences of bytes in a digital data transmission) can be defined, and messages can be transmitted using standard serial protocols such as a virtual serial port defined in certain Bluetooth standards.

10 Embodiments of the invention are not limited to particular protocols, and those skilled in the art with access to the present teachings will recognize that numerous protocols can be used.

[0068] In some embodiments, wearable device 200 can detect a transition from an “idle” position to an “active” position. For example, FIGs. 3A and 3B illustrate a user 300 wearing wearable device 302, which in this example is a wrist-worn device. As shown in FIG. 3A, when user 300 is not actively using wearable device 302, the user’s arm 304 may hang naturally at his side. To begin using wearable device 302, user 300 can rotate his arm to the position 304’ shown in FIG. 3B, raising the elbow to bring wearable device 302 into his line of sight. Dashed line 306 indicates an approximate motion path of wearable device 302. Motion sensors (e.g., accelerometer 242 and/or gyroscopic sensor 246) can detect a characteristic motion associated with bringing wearable device 302 into the user’s line of sight; upon detecting this motion, wearable device 302 can automatically prepare itself to be used, e.g., by activating user interface components such as display 220 and/or touch sensor 228. Other patterns of motion can also be detected and can trigger activation of user interface components; for example, shaking of the wrist or a specific motion pattern of the arm or hand (e.g., moving in an “S” curve or circle or triangle). In some embodiments, wearable device 302 (or other wearable devices described herein) can have a button (e.g., on the side of face 104 in FIG. 1) that a user can toggle to turn on or off a touchscreen interface; the button can be provided in addition to or instead of motion-based detection of activation.

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[0069] Referring again to FIG. 1, in some embodiments, host device 102 can send various event notifications to wearable device 100, and the user can respond to the notifications via wearable device 100. For example, host device 102 can alert wearable device 100 to incoming communications such as phone calls, text messages, voicemail messages, email

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messages, and the like; upcoming meetings or events; stock market events such as change in price of a particular stock; location-based reminders; and/or any other event that can be identified by host device 102. In some embodiments, the user may be able to select which types of events should generate notifications to wearable device 102, e.g., by interacting with a settings menu provided on host device 102.

[0070] FIG. 4 is a flow diagram of a process 400 for responding to an event notification according to an embodiment of the present invention. Process 400 can be implemented in a wearable device, e.g., wearable device 100 of FIG. 1 or wearable device 200 of FIG. 2, which can be interacting with host device 102. In some embodiments, the implementation of process 400 can include program code executed by a processor of wearable device 100.

[0071] At block 402, wearable device 100 can pair with a host device, e.g., host device 102. For example, standard Bluetooth pairing techniques can be used; other techniques for establishing a wireless connection between two devices can be used. In some embodiments, an initial pairing between two devices may involve user interaction with one or both devices to confirm that the pairing should be established. Once the initial pairing is established, the two devices can automatically reconnect to each other (without further user intervention) any time they come within communication range and are operating their respective RF transceivers.

[0072] At block 404, wearable device 100 can receive an event notification from host device 102. For example, host device 102 can send a notification indicating an incoming phone call, text message, or email message. At block 406, wearable device 100 can present an alert to the user and can prompt the user for a response. The alert can include, e.g., an audible alert, a vibration, a visual alert, or any combination of multiple alerts. The prompt can include, e.g., a visual prompt on display 220, an audio prompt (e.g., a voice prompt), or the like.

[0073] FIG. 5 illustrates an alert-and-prompt screen 500 that can be displayed at block 406 when the event notification corresponds to an incoming phone call. Screen 500 can show an identifier of the caller 502; the identifier can be determined by host device 102 (e.g., based on a contacts list stored therein and/or caller identifying information received by host device 102) and sent to wearable device 100 as part of the event notification. Screen 500 can also prompt the user to respond to the call, e.g., by selecting virtual button 504 to instruct the phone to answer the call, virtual button 506 to instruct the phone to place the caller on hold,

virtual button 508 to instruct the phone to divert the call to voicemail, and virtual button 510 to decline the call. Other alerts and prompts can be used, depending on the type of event, available response options, screen size of the wearable device, user preferences, and similar design considerations.

5 [0074] In some embodiments, a sequence of screens can be presented as part of prompting the user for a response. For example, FIG. 6 illustrates a prompt screen 600 that can be displayed at block 406 of process 400 when the event notification corresponds to an incoming text message. Screen 600 shows an identifier of the sender of the text 602; as with a phone caller, the identifier of a sender of a text can be determined by host device 102 (e.g., based on  
10 a contacts list stored therein and/or source identifying information received by host device 102). Screen 600 can also show a preview of the text message 604; in some embodiments, the user can scroll (e.g., by sliding a finger up or down on a touchscreen) to view more message content. Screen 600 can also prompt the user to respond to the text, e.g., by selecting virtual button 606 to reply to the text or virtual button 608 to exit from screen 600  
15 without responding.

[0075] If the user selects virtual button 606, a message selection screen 700 as shown in FIG. 7 can be displayed, providing a menu of predefined text messages from which the user can select. For example, virtual button 702 can be selected to send a “yes” message, virtual button 704 can be selected to send a “no” message; virtual button 706 can be selected to send  
20 a “thanks” message; and virtual button 708 can be selected to send a “later” message indicating that the user will contact the sender later. It is to be understood that buttons 702, 704, 706, 708 may not contain the full text message to be sent but rather a short identifier. For example, the “no” identifier on button 704 can be associated with a less terse message such as “No, sorry,” and the “later” identifier on button 708 can be associated with a more  
25 specific message such as “I’ll call you later.”

[0076] Referring again to FIG. 4, at block 408, wearable device 100 can receive a user input in response to the prompt. For example, the user can select virtual buttons via one or more of screens 500, 600, or 700, depending on context and what the user desires to do. At block 410, wearable device 100 can transmit a response message to the host based on the  
30 received user input.

[0077] It is not required that a user actually respond to any particular alert on wearable device 100. For example, in some embodiments process 400 can simply time out and end at

block 408 if the user does not provide input within some fixed time period (e.g., 1 minute, 2 minutes, 5 minutes); the time period can be different for different types of events. As another example, a user can select the “close” option (button 608) from a screen such as screen 600, and this can be interpreted by wearable device 100 as an indication that the user does not  
5 intend to respond. In some instances, a user may instead choose to respond to an alert by using host device 102 directly; in such cases, host device 102 can notify wearable device 100 if a response is received directly at host device 102.

[0078] FIG. 8 is a flow diagram of a process 800 for generating an event notification and receiving a response according to an embodiment of the present invention. Process 800 can  
10 be implemented in a host device, e.g., host device 102 of FIG. 1, which can be interacting with a wearable device 100 that executes process 400 of FIG. 4 or similar processes. In some embodiments, the implementation of process 800 can include program code executed by a processor of host device 102.

[0079] At block 802, host device 102 can detect an event that triggers a user alert, such as  
15 an incoming call or text message. At block 804, host device 102 can determine whether a wearable device (e.g., wearable device 100) is currently paired. If not, then at block 806, host device 102 can wait for a user input at its local interface to determine whether and how the user chooses to respond.

[0080] If wearable device 100 is currently paired, then at block 808, host device 102 can  
20 send an event notification to wearable device 100. Any communication protocol can be used, including standard Bluetooth messages (e.g., incoming call alert), a message that conforms to a customized serial protocol that can be transmitted using Bluetooth’s virtual serial port capability, or messages conforming to other protocols that are mutually understood by the host device and the wearable device. The notification can include information identifying the  
25 type of event (e.g., incoming phone call, text message received, stock market alert, etc.) and additional details specific to the event (e.g., name or other identifier of the caller, content of a text message, etc.).

[0081] At block 810, host device 102 can wait for a response, which can come from either  
30 the wearable device or a local user interface of host device 102. For example, a user may receive an alert of an incoming call on wearable device 100 but choose to answer the call using host device 102. Accordingly, host device 102 can monitor activity on the connection

to wearable device 100 to detect a response and at the same time present a local interface (e.g., on its own touchscreen display) and monitor that interface to detect a response.

[0082] At block 812, host device 102 can process the received response, regardless of whether it was received from wearable device 100 or via a local user interface of host device 102. For example, referring to FIG. 5, if a user selects one of virtual buttons 504, 506, 508, 510 from screen 500 on wearable device 100, host device 102 can receive a response from wearable device 100 indicating which button was selected. In response to answer button 504 being selected, host device 102 can answer the call; call audio can be routed to wearable device 100 or to another audio input/output device, such as an internal audio interface of host device 102 or a wireless headset that is paired with or otherwise in communication with host device 102. In response to hold button 506 being selected, host device 102 can answer the call and play a message to the caller indicating that the caller should hold. The user can later take the call off hold, e.g., via a local user interface of host device 102 or via wearable device 100, allowing the user to speak with the caller. In response to voicemail button 508 being selected, host device 102 can redirect the call to a voicemail account associated with the user, allowing the caller to leave a message. In response to decline button 510 being selected, host device 102 can reject or terminate the call.

[0083] As another example, referring to FIG. 7, if a user selects to reply to a text message with a predefined response, e.g., by selecting one of buttons 702, 704, 706, 708 on screen 700, host device 102 can generate and send the corresponding text message back to the sender. In some embodiments, wearable device 100 may provide an index or other short name as an identifier for the text message. Host device 102 can maintain a lookup table or other data structure that maps the identifier to the actual message to be sent (e.g., a short-name identifier such as "later" or an index such as "3" can be mapped to "I'll call you later," which is the message that would be sent). In some embodiments, a user can define a set of text messages to be included in the predefined list by interacting with host device 102, and host device 102 can provide short names and/or other identifiers for the user-defined messages to wearable device 100, e.g., in a synchronization operation.

[0084] It is not required that a user actually respond to a particular alert, either locally on host device 102 or via wearable device 100. In some instances, process 800 can allow the alert to time out after a specific period (e.g., 1 minute, 2 minutes, 5 minutes) if the user does not respond, in which case process 800 can end at block 806 or 810. For example, if an

incoming call is not answered within the specified time period after generating the alert, host device 102 can take a default action such as diverting the call to a voicemail system. In some embodiments, if the user does not respond within the specified time period, host device 102 can discontinue the alert and/or replace the alert with an informational notice that is visible to the user (e.g., a missed-call notification or the like).

[0085] It will be appreciated that processes 400 and 800 are illustrative and that variations and modifications are possible. Steps described as sequential may be executed in parallel, order of steps may be varied, and steps may be modified, combined, added or omitted. For instance, in some embodiments, a host device can present a user alert via its own local interface in addition to sending a notification to a wearable device; in some embodiments, the host device presents a user alert via its own local user interface only when the wearable device is not paired; and in some embodiments, the user can specify whether the host should send a particular notification to the wearable device, present an alert locally, do both, or do neither. A user alert on a host device or a wearable device can take the form of any sensory input detectable by a human and can include visual alerts (e.g., lights; displayed text, icons and or images), audible alerts (e.g., tones, buzzes, ringtones, musical sounds, and/or speech sounds), and/or tactile alerts (e.g., a vibration).

[0086] The particular response options described above, e.g., with reference to FIGs. 5-7, are also illustrative, and the user may have other options for responding to a given alert. Further, while processes 400 and 800 have been described with reference to specific types of events (incoming call, incoming text message), it is to be understood that notifications of other types of events can be processed in the same manner. For any type of event, the user can have the option to select one of a set of responses (which may be limited) via the wearable device's user interface or to use the host device's local user interface to respond. In some instances, the host device's interface can offer a larger or different range of possible response options than the wearable device (e.g., composing an arbitrary message as opposed to selecting from a finite set of predefined messages).

[0087] In some embodiments, in addition to or instead of responding to an event on the host device, a user can use a wearable device to initiate a functionality of the host device, e.g., placing a phone call, sending a text message that is not in response to a received text message, or initiating any other functionality that is available on a particular host device. FIG. 9 is a flow diagram of a process 900 for initiating a phone-call functionality of a host

device according to an embodiment of the present invention. Process 900 can be implemented in a wearable device, e.g., wearable device 100 of FIG. 1 or wearable device 200 of FIG. 2, which can be interacting with a host device 102 that provides a telephone transceiver capable of communicating over a phone network (e.g., a cellular telephony network, voice-over-IP system, or the like). In some embodiments, the implementation of process 900 can include program code executed by a processor of wearable device 100.

[0088] At block 902, a user can select an option to place a call using the user interface of wearable device 100. For example, referring to FIG. 10, a user interface of wearable device 100 can include a function selection screen 1000. Function selection screen 1000 can be a default screen that appears when the display of wearable device 100 is activated or it can be a different screen that the user can access through a touch gesture or sequence of gestures (e.g., to navigate through menus) on a touchscreen display, a hand or arm gesture detected by motion sensors built into wearable device 100, or other operations. Function selection screen 1000 can include various virtual buttons that the user can select to invoke a functionality of host device 102, such as “call” button 1002 to place a call, “text” button 1004 to send a text message, and “music” button 1006 to invoke a media player functionality of host device 102. In this example, a user can select an option to place a call by selecting button 1002.

[0089] Referring again to FIG. 9, at block 904, wearable device 100 can determine whether it is currently paired with a host device 102 that is capable of making phone calls. If not, wearable device 100 can alert the user at block 906. The user can take corrective action, such as getting within range of host device 102, turning host device 102 on, etc.

[0090] Assuming wearable device 100 is paired with a phone-capable host device 102, then at block 908, wearable device 100 can present the user with calling options, and at block 910, wearable device 100 can receive user input selecting a calling option. For example, when a user selects call button 1002 of FIG. 10, an interface such as screen 1100 of FIG. 11 may be displayed. FIG. 11 shows options for placing a call, such as an emergency call button 1102 that can be programmed to place a call to a phone number associated with an emergency service (such as 911 in the United States or 112 in many European countries), a keypad button 1104 to allow a user to dial a number, and a contacts button 1106 to allow a user to look up a contact.

[0091] If the user selects keypad button 1104, wearable device 100 can present a keypad interface, such as screen 1200 of FIG. 12. Screen 1200 includes a virtual phone keypad 1202

(e.g., a standard phone keypad with digits 0-9 and “star” and “pound” keys) and a number box 1204 to show the digits entered so far. In some embodiments, other controls can be provided (e.g., back, cancel, and done buttons); in some embodiments, gestures can be associated with various control functions such as erasing a digit, canceling the operation, or  
5 indicating that entry of the number is complete. A user can operate keypad interface screen 1200 to dial an arbitrary number.

[0092] If, from screen 1100 of FIG. 11, the user chooses contacts button 1106, wearable device 100 can present a selectable contacts list, such as screen 1300 of FIG. 13. Screen 1300 can present the names of some or all of a user’s contacts, e.g., as virtual buttons 1302,  
10 1304, 1306, 1308. If the number of contacts exceeds the available space on screen 1300, the list can be scrollable (e.g., using upward or downward gestures on a touchscreen) to allow the user to view and select from any number of contacts.

[0093] Wearable device 100 can maintain various amounts of contact information. For example, wearable device 100 can maintain a list of names of the user’s contacts, which it  
15 can obtain, e.g., via synchronization operations with host device 102 or with other devices. Wearable device 100 can maintain just the name and/or other information about each contact (e.g., phone numbers, photos) as desired. In some embodiments, a user can designate a subset of her contacts to be synchronized with wearable device 100, and host device 102 can have a larger list of contacts than wearable device 100 as well as more information about  
20 each contact. Alternatively, wearable device 100 can obtain contact information from host device 102 in real time, e.g., with user-defined favorite contacts or most-recently-contacted contacts being presented first and various options to retrieve additional contacts. Accordingly, a user can operate wearable device 100 to select a contact to be called.

[0094] Referring again to FIG. 9, once the user input that determines a number to be called  
25 has been received (block 910), process 900 can send a call instruction to host device 102 at block 912 to instruct host device 102 to place the call. In some instances, e.g., where keypad screen 1200 was used, the call instruction can include a phone number. In some instances, e.g., where contacts screen 1300 was used to select the party to be called, the call instruction can include the selected contact’s name (or other unique identifier), from which host device  
30 102 can determine the phone number to be called, e.g., by looking up the information in a user’s contact list. Host device 102 can place the call, and at block 914, wearable device 100

can receive confirmation that the call has been placed. This confirmation can indicate whether the call connected, or it can be sent before the call is actually connected.

[0095] At block 916, wearable device 100 can receive and send call-related audio signals, allowing the user to communicate with the caller. Call-related audio signals can include input  
5 audio signals (e.g., speech of the user picked up by a microphone and delivered to the host device for transmission via the phone network) and/or output audio signals (e.g., speech of the other caller received at the host device via the phone network and delivered to a speaker). In some instances, output and/or input audio signals can be sent to and/or received from a  
10 built-in speaker and/or microphone of wearable device 100. In other instances, wearable device 100 can send output audio to and/or receive input audio from external devices such as a wired or wireless headset. It is not required that all call-related audio signals, or indeed any call-related audio signals, be routed through wearable device 100. For example, host device 102 can route input (or output) audio to (or from) a device other than wearable device 100 while using wearable device 100 to route the output (or input) audio, and wearable device  
15 100 can process the portion of audio for which it is in the routing path. In some instances, all call-related audio signals can be routed to and from devices other than wearable device 100, in which case wearable device 100 would not receive or send call-related audio signals but may simply wait until the call is completed. In some embodiments, wearable device 100 can make other functions available to the user while a call is in progress.

20 [0096] In some embodiments, while a call is in progress, wearable device 100 can display a control operable by the user to end the call. At block 918, if this control is operated, then at block 920, wearable device 100 can alert host device 102 that the call should be ended. Host device 102 can terminate the call and return a confirmation to wearable device 100 at block 922. Wearable device 100 can present an alert to the user at block 924 to confirm that the  
25 call has ended.

[0097] Host device 102 can also detect a call-termination event not originating from wearable device 100, e.g., if the other party disconnects or if the connection is dropped by the phone network. If this occurs, host device 102 can send an event notification to wearable device 100. Accordingly, if the user does not end the call at block 918, then at block 926,  
30 wearable device 100 can determine whether host device 102 has sent a call termination notification. If so, then wearable device 100 can alert the user at block 924. Otherwise, the

call can continue (block 1408) until either the user terminates it or the host detects a termination event.

[0098] FIG. 14 is a flow diagram of a process 1400 for placing a call using a wearable device according to an embodiment of the present invention. Process 1400 can be implemented in a host device, e.g., host device 102 of FIG. 1, which can be interacting with a wearable device 100 that executes process 900 of FIG. 9 or similar processes, and host device 102 can provide a telephone transceiver capable of communicating over a phone network (e.g., a cellular telephony network, voice-over-IP system, or the like) In some embodiments, the implementation of process 1400 can include program code executed by a processor of host device 102.

[0099] At block 1402, host device 102 can receive a call instruction from a paired wearable device 100 that instructs host device 102 to place a phone call. The call instruction can include, e.g., a phone number to be called or an identifier of a contact. At block 1404, host device 102 can place the call. In some embodiments, placing the call can include using the contact identifier received at block 1402 to look up a corresponding phone number. At block 1406, host device 102 can send a confirmation that the call has been placed. The confirmation can be sent, e.g., while the call is still being connected.

[0100] At block 1408, host device 102 can route the call-related audio signals (including input and output audio signals as described above with reference to FIG. 9) to and from appropriate input and output devices. Audio input and output devices can include an internal microphone or speaker of host device 102 and/or an external microphone or speaker connected to host device 102 by wired or wireless connections, including in some instances wearable device 100. In some embodiments, host device 102 can determine the routing based on what other devices are currently connected to host device 102 and/or user-specified preferences regarding audio routing. Accordingly, call-related audio can be routed to wearable device 100 or to another device. In some instances, input and output audio can be routed differently; for example, host device 102 can receive input audio from wearable device 102 while providing output audio to a different device.

[0101] At block 1410, host device 102 can determine whether wearable device 102 has sent a message indicating that the call should end. If so, then host device 102 can end the call at block 1412 and send confirmation to wearable device 100 at block 1414.

[0102] If, at block 1410, wearable device 102 has not indicated that the call should end, then at block 1416, host device 100 can determine whether it has received notification via the phone network that the call has ended (e.g., that the other endpoint has terminated the call or that the connection has been dropped). In addition, in some embodiments, a user who  
5 operated wearable device 102 to place a particular call can operate the user interface of host device 100 to end the call. If host device 102 detects any of these call-ending events, then host device 100 can notify wearable device 102 that the call has ended at block 1418. In some embodiments, the notification at block 1418 can include an indication of how the call ended (e.g., terminated by the other endpoint, dropped call, etc.).

10 [0103] If, at block 1416, host device 100 does not detect that the call has ended, then process 1400 can return to block 1408 to continue to route audio for the call. Accordingly, the call can continue until it is terminated by either party.

[0104] Similar processes can be used to send other types of communication, such as text messaging. For example, FIG. 15 is a flow diagram of a process 1500 for sending a text  
15 message using a wearable device, e.g., wearable device 100 of FIG. 1 or wearable device 200 of FIG. 2, which can be interacting with a host device 102 that provides a telecommunication interface capable of communicating text messages over a network (e.g., a cellular telephony network, cellular data network, the Internet, or the like) In some embodiments, the implementation of process 1500 can include program code executed by a processor of  
20 wearable device 100.

[0105] At block 1502, a user can select an option to send a text message, e.g., by selecting text button 1004 from interface screen 1000 of FIG. 10. At block 1504, wearable device 100 can determine whether it is currently paired with a host device 102 that is capable of making phone calls. If not, wearable device 100 can alert the user at block 1506. The user can take  
25 corrective action, such as getting within range of host device 102, turning host device 102 on, etc.

[0106] At block 1508, wearable device 100 can present the user with options for selecting a recipient, and at block 1510, wearable device 100 can receive the user's selection. In some instances, interface screens similar to those shown in FIGs. 11-13 can be used. For example,  
30 the user can send a text to an arbitrary phone number by entering the number into keypad 1202 of screen 1200, or the user can select a contact from screen 1300. In some embodiments, the same list of contacts can be used for both calls and text messages; in other

embodiments, a user can define different lists of favorite contacts for different communication media.

[0107] At block 1512, wearable device 100 can present the user with options for texts to send, and at block 1514, wearable device 100 can receive the user's selection. For example, similarly to process 400 described above, a user can have a predefined list of texts to send, 5 allowing the user to avoid entering the text character-by-character. FIG. 16 illustrates an interface screen 1600 for selecting a predefined text message that can be used at block 1512. The predefined text messages can be different depending on whether the user is initiating a new text message (as in process 1500) or responding to a received text message (as in process 10 400). For example, button 1602 can be associated with a text such as "I'm leaving now" and button 1604 with a text such as "I'm running late," which are examples of text messages that a user might send to a person she is going to meet. Button 1606 can be associated with a text such as "Please call me," which requests the recipient to take a particular action. Button 1608 can be associated with a text such as "Do you need anything from the grocery store?" which a 15 user might send while on the way to the store. Other options can be provided in addition to or instead of these examples, and in some embodiments the user can define specific text messages and short identifiers in a manner similar to that described above with reference to FIG. 7.

[0108] In some embodiments, wearable device 100 can provide an option to enter an 20 arbitrary text using alphanumeric or other character systems. For example, each character in a character system can be mapped to a different touch gesture, and a user can enter text by making touch gestures on touchscreen display 105. As another example, each character can be mapped to a different sequence of taps (e.g., Morse code or the like), and a user can enter text by tapping touchscreen display 105. As yet another example, touchscreen display 105 25 can present a compact virtual keypad in which a character is determined based on the key location and number of times the user taps the key.

[0109] At block 1516, wearable device 100 can instruct the host device to send the text message and can provide an identifier of the intended recipient (e.g., phone number or name) and an identifier of the text to be sent; the identifier can be, e.g., an index, a short identifier, 30 or the actual text entered or selected by the user. As in process 900 described above, host device 102 can use the recipient identifier to determine the phone number, and as in processes 400 and 800 described above, host device 102 can use a short identifier of the text message to

identify the actual message to be sent. In some embodiments, at block 1518, wearable device 100 can receive a confirmation from host device 102 that the text was sent and/or received; if desired, wearable device 100 can present a corresponding alert or informational message to the user.

5 [0110] It will be appreciated that the communication-initiation processes described above are illustrative and that variations and modifications are possible. Steps described as sequential may be executed in parallel, order of steps may be varied, and steps may be modified, combined, added or omitted. Messages can be sent using various communication media and formats, including text messages (sent, e.g., via a short messaging service (SMS)  
10 provided by a cellular communication network that carries voice and/or data); email messages, instant messages, social-network messages (any of which can be sent, e.g., via an Internet interface of the host device); and other types of messages.

[0111] In some embodiments, a user can define “quick-access” actions, such as “call Mom” or “text Bob that I’m running late” that can be executed with a reduced number of input  
15 actions (e.g., a single gesture to bring up a quick-access list, followed by tapping on the appropriate entry). This can facilitate communication by and with users who are in the midst of other activities and find it inconvenient to locate their phone to send a quick message or place a call.

[0112] Control over host device functions is not limited to communication functions. For  
20 example, in some embodiments, a host device 102 can have media player capabilities, allowing a user to select and play media tracks (e.g., audio and/or video), and wearable device 100 can provide remote control over media playback operations of a host device.

[0113] Referring again to FIG. 10, interface screen 1000 for wearable device 100 includes a button 1006 that can be selected to control media playback in a host device. In some  
25 embodiments, in response to user selection of button 1006, wearable device 100 can present an interface to select and control media player functions of host device 102. For example, wearable device 100 can display lists of playlists, albums, artists, genres, or songs from which the user can select tracks to play; once a track is playing, wearable device 100 can provide playback controls such as play, pause, skip to previous or next track, rewind, fast-  
30 forward, volume control and the like, and the user can control playback using touch gestures on the display device.

[0114] In addition or instead, control can be provided based on movement of wearable device 100 itself. For example, accelerometers, gyroscopes, or the like can be used to detect motion of wearable device 100, and certain motions can be defined as spatial gestures, which in turn can be interpreted as controls. Thus, in some embodiments, a user can control the  
5 volume, e.g., by circling her wrist or arm clockwise to increase and counterclockwise to lower. Other gestures can be associated with other actions, e.g., a quick up-and-down to play, a quick down-and-up to pause, quick right-then-left to skip ahead, quick left-then-right to skip back, etc. Different gestures can be associated with different control operations as desired.

10 [0115] It is to be understood that other devices can be controlled by a wearable device. For example, a wearable device can provide control over environmental systems (e.g., heating, lights) through an appropriate user interface.

[0116] While the invention has been described with respect to specific embodiments, one skilled in the art will recognize that numerous modifications are possible and that  
15 components, operations, and/or other features that may be described with respect to different embodiments can be incorporated into the same embodiment. Wearable devices can interact with host devices to facilitate a variety of operations with increased convenience to the user.

[0117] All user interfaces shown herein are also illustrative. Sizes of user interfaces or graphical elements thereof can be modified according to a particular desired form factor of a  
20 wearable device and/or host device. Icons can be used in addition to or instead of text to identify associated functions, and the number and arrangement of controls can be varied to facilitate user operation. In some embodiments, the user may be able to scroll the display, e.g., by dragging one or two fingers along the surface of a touchscreen display to see more options than can be presented at once. Further, while the foregoing description may refer to  
25 graphical user interfaces, other interfaces can also be used. For example, an audio input interface can be provided by allowing the user to speak into a microphone of a wearable device; the wearable device can interpret the audio signal locally to determine a corresponding instruction or send the audio to a host device for interpretation. Similarly, an audio output interface can be provided by using a speaker on the wearable device to produce  
30 sounds. The sounds can include tones (beeps, whirrs, etc.) and/or speech sounds; for example, synthesized speech can be generated on a host device and transmitted to the wearable device as a digital audio signal, or the wearable device can include its own speech

synthesizer. In some embodiments where a wearable device is worn on the user's hand, wrist, or arm, user input can include spatial gestures with the hand, wrist, and/or arm that are detected using motion sensors of the wearable device in addition to or instead of touch gestures involving contact with a touch-sensitive surface of the wearable device. Different  
5 gestures can be assigned different meanings, and the meaning of a gesture can be context-dependent, e.g., depending on what operations of the host device and/or wearable device are currently in progress. Thus, the same gesture can, in different contexts, indicate hanging up a call or stopping playback of a media track. Touch gestures and spatial gestures can be used in various combinations as desired.

10 [0118] The foregoing description may make reference to specific examples of a wearable device (e.g., a wrist-worn device) and/or a host device (e.g., a smart phone). It is to be understood that these examples are illustrative and not limiting; other devices can be substituted and can implement similar functional blocks and/or algorithms to perform operations described herein and/or other operations.

15 [0119] Embodiments of the present invention, e.g., in methods, apparatus, computer-readable media and the like, can be realized using any combination of dedicated components and/or programmable processors and/or other programmable devices. The various processes described herein can be implemented on the same processor or different processors in any combination. Where components are described as being configured to perform certain  
20 operations, such configuration can be accomplished, e.g., by designing electronic circuits to perform the operation, by programming programmable electronic circuits (such as microprocessors) to perform the operation, or any combination thereof. Further, while the embodiments described above may make reference to specific hardware and software components, those skilled in the art will appreciate that different combinations of hardware  
25 and/or software components may also be used and that particular operations described as being implemented in hardware might also be implemented in software or vice versa.

[0120] Computer programs incorporating various features of the present invention may be encoded and stored on various computer readable storage media; suitable media include magnetic disk or tape, optical storage media such as compact disk (CD) or DVD (digital  
30 versatile disk), flash memory, and other non-transitory media. Computer readable media encoded with the program code may be packaged with a compatible electronic device, or the

program code may be provided separately from electronic devices (e.g., via Internet download or as a separately packaged computer-readable storage medium).

[0121] Thus, although the invention has been described with respect to specific embodiments, it will be appreciated that the invention is intended to cover all modifications and equivalents within the scope of the following claims.

5

WHAT IS CLAIMED IS:

- 1           1.     A method of placing a phone call, the method comprising:  
2                 establishing communication, by a wearable electronic device, with a host  
3 device, the host device including a telephone transceiver;  
4                 obtaining, by the wearable device, user input indicative of a call to be placed,  
5 the user input including an identifier of a recipient of the call to be placed;  
6                 sending, by the wearable device, an instruction to the host device to place a  
7 phone call, the instruction including the identifier of the recipient;  
8                 receiving, by the wearable device, a confirmation from the host device that the  
9 call has been placed; and  
10                in response to receiving the confirmation, presenting, by the wearable device  
11 to the user, a control operable by the user to terminate the call.
- 1           2.     The method of claim 1 further comprising, after receiving the  
2 confirmation that the call has been placed:  
3                 receiving, by the wearable device, a call-related audio output signal from the  
4 host device; and  
5                 delivering, by the wearable device, the call-related audio output signal to a  
6 speaker.
- 1           3.     The method of claim 1 further comprising, after receiving the  
2 confirmation that the call has been placed:  
3                 obtaining, by the wearable device, a call-related audio input signal from a  
4 microphone; and  
5                 sending, by the wearable device, the call-related audio input signal to the host  
6 device.
- 1           4.     The method of claim 1 wherein obtaining the user input indicative of a  
2 call to be placed includes:  
3                 presenting to the user, by the wearable device, a list of contacts; and  
4                 receiving, by the wearable device, a user input selecting a contact from the list  
5 of contacts to be the recipient of the call.
- 1           5.     The method of claim 1 wherein obtaining the user input indicative of a  
2 call to be placed includes:

3           presenting to the user, by the wearable device, a virtual keypad; and  
4           receiving, by the wearable device, a user input comprising a sequence of digits  
5 selected from the virtual keypad as a phone number of the recipient of the call.

1           6.       The method of claim 1 further comprising:  
2           detecting, by the wearable device, user operation of the control operable to end  
3 the call; and  
4           sending, by the wearable device, a notification to the host device that the call  
5 should be ended.

1           7.       The method of claim 1 further comprising:  
2           subsequently to receiving the confirmation that the call has been placed,  
3 receiving, by the wearable device, a notification from the host device that the call has ended;  
4 and  
5           presenting, by the wearable device, an alert to the user indicating that the call  
6 has ended.

1           8.       A method of placing a phone call, the method comprising:  
2           establishing communication, by a host device that includes a telephone  
3 transceiver, with a wearable device;  
4           receiving, by the host device, an instruction from the wearable device to place  
5 a phone call, the instruction including an identifier of a recipient of the phone call;  
6           placing, by the host device, the phone call using the telephone transceiver;  
7           sending, by the host device, a confirmation to the wearable device that the call  
8 has been placed; and  
9           routing, by the host device, audio signals associated with the call between the  
10 telephone transceiver and an audio device, the routing being based at least in part on a user  
11 preference setting of the host device.

1           9.       The method of claim 8 wherein the audio device is a device other than  
2 the wearable device.

1           10.      The method of claim 8 wherein the audio device is the wearable  
2 device.

1           11.     The method of claim 8 wherein the identifier of the recipient includes  
2     an identifier of a contact in a contact list accessible to the host device, and wherein placing  
3     the phone call includes:  
4           performing a lookup operation on the contact list to obtain a phone number of  
5     the contact; and  
6           placing the phone call to the phone number.

1           12.     The method of claim 8 wherein the identifier of the recipient includes a  
2     phone number and placing the phone call includes placing the phone call to the phone  
3     number.

1           13.     A method of sending a message, the method comprising:  
2           establishing communication, by a wearable electronic device, with a host  
3     device, the host device including a telecommunication interface;  
4           obtaining, by the wearable device, a first user input indicative of a recipient of  
5     a message;  
6           obtaining, by the wearable device, a second user input indicative of a content  
7     of the message;  
8           sending, by the wearable device, an instruction to the host device to send the  
9     message, the instruction including an identifier of the recipient and an indication of the  
10    content of the message; and  
11          receiving, by the wearable device, a confirmation from the host device that the  
12    message has been sent.

1           14.     The method of claim 13 wherein the message comprises a text  
2     message.

1           15.     The method of claim 14 wherein obtaining the first user input includes:  
2           presenting to the user, by the wearable device, a list of contacts; and  
3           receiving, by the wearable device, a user input selecting a contact from the list  
4     of contacts to be the recipient of the message.

1           16.     The method of claim 14 wherein obtaining the first user input includes:  
2           presenting to the user, by the wearable device, a virtual keypad; and

3 receiving, by the wearable device, a user input comprising a sequence of digits  
4 selected from the virtual keypad as a phone number of the recipient of the message.

1 17. The method of claim 14 wherein obtaining the second user input  
2 includes:

3 presenting to the user, by the wearable device, a list of predefined text  
4 messages; and

5 receiving, by the wearable device, a user input selecting a predefined text  
6 message from the list of predefined text messages.

1 18. A method of sending a message, the method comprising:

2 establishing communication, by a host device that includes a  
3 telecommunication interface, with a wearable device;

4 receiving, by the host device, an instruction from the wearable device to send  
5 a message, the instruction including a recipient identifier identifying a recipient of the  
6 message and a content identifier identifying content to be included in the message;

7 creating, by the host device, a message to be sent based at least in part on the  
8 content identifier;

9 determining, by the host device, a destination address for the message based at  
10 least in part on the recipient identifier; and

11 sending, by the host device, the message to the destination address via the  
12 telecommunication interface.

1 19. The method of claim 18 wherein the message comprises a text  
2 message.

1 20. The method of claim 18 wherein the recipient identifier includes an  
2 identifier of a contact in a contact list accessible to the host device and wherein determining  
3 the destination address includes performing a lookup operation on the contact list to obtain a  
4 phone number of the contact, wherein the phone number is the destination address.

1 21. The method of claim 18 wherein the content identifier includes an  
2 identifier of one of a plurality of predefined message texts and wherein creating the message  
3 to be sent includes inserting the predefined message text identified by the content identifier  
4 into the message.

1                   22.     A method of operating a wearable device, the method comprising, by  
2 the wearable device:

3                   detecting, using a motion sensor of the wearable device, a motion  
4 characteristic of a user moving the wearable device into a viewing position; and  
5                   in response to detecting the motion, activating a user interface component of  
6 the wearable device.

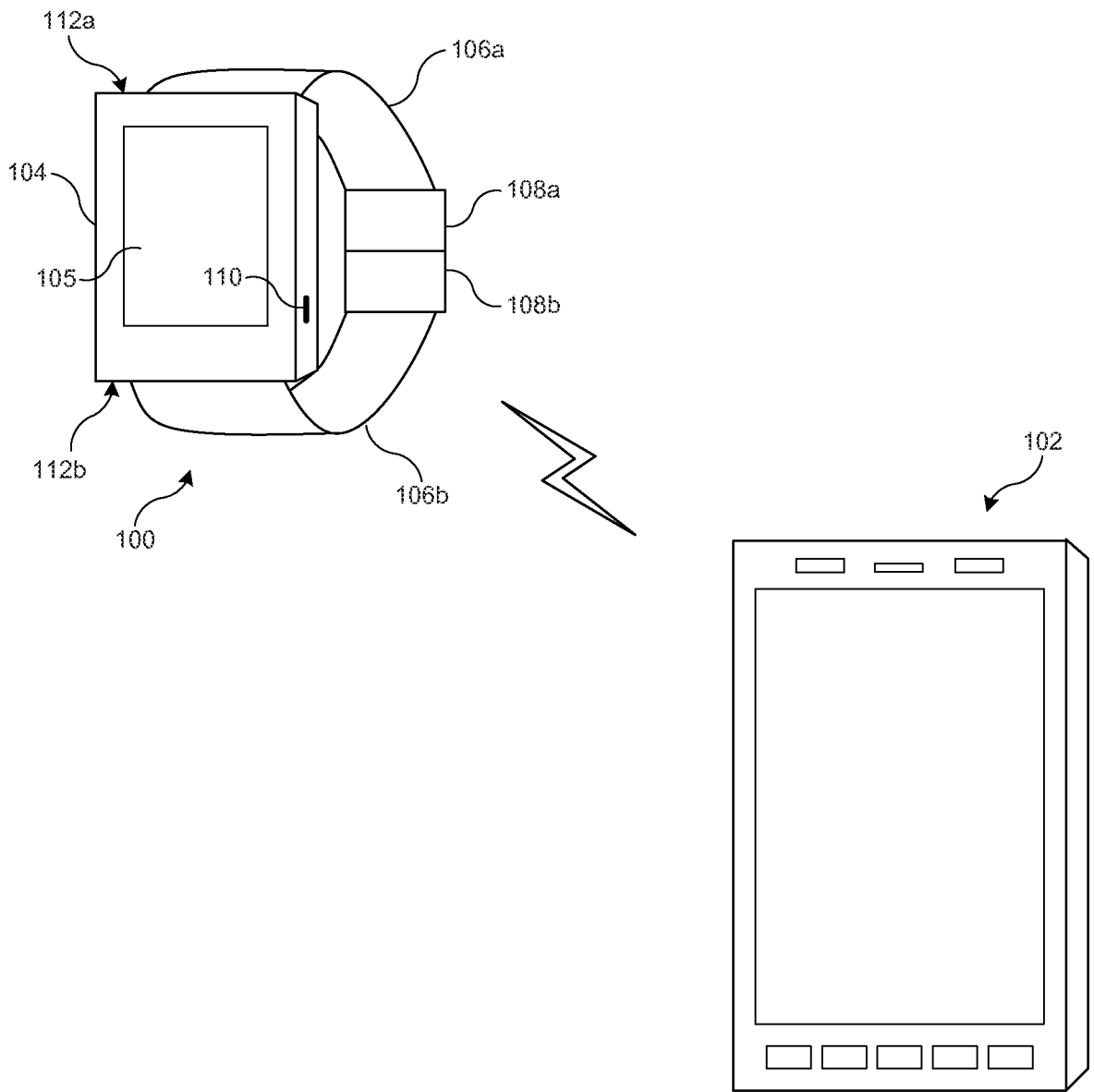
1                   23.     The method of claim 22 further comprising:  
2                   detecting, using a sensor of the wearable device, that the wearable device is  
3 currently being worn,  
4                   wherein the motion is detected only if the wearable device is currently being  
5 worn.

1                   24.     The method of claim 22 wherein the user interface component includes  
2 a display.

1                   25.     The method of claim 22 wherein the user interface component includes  
2 a touch sensor.

1                   26.     The method of claim 22 wherein the user interface component includes  
2 a touchscreen interface.

1                   27.     The method of claim 22 wherein the wearable device is adapted to be  
2 worn on a user's wrist and wherein the motion characteristic of a user moving the wearable  
3 device into a viewing position corresponds to the user's wrist being moved into a line of  
4 sight.



**FIG. 1**

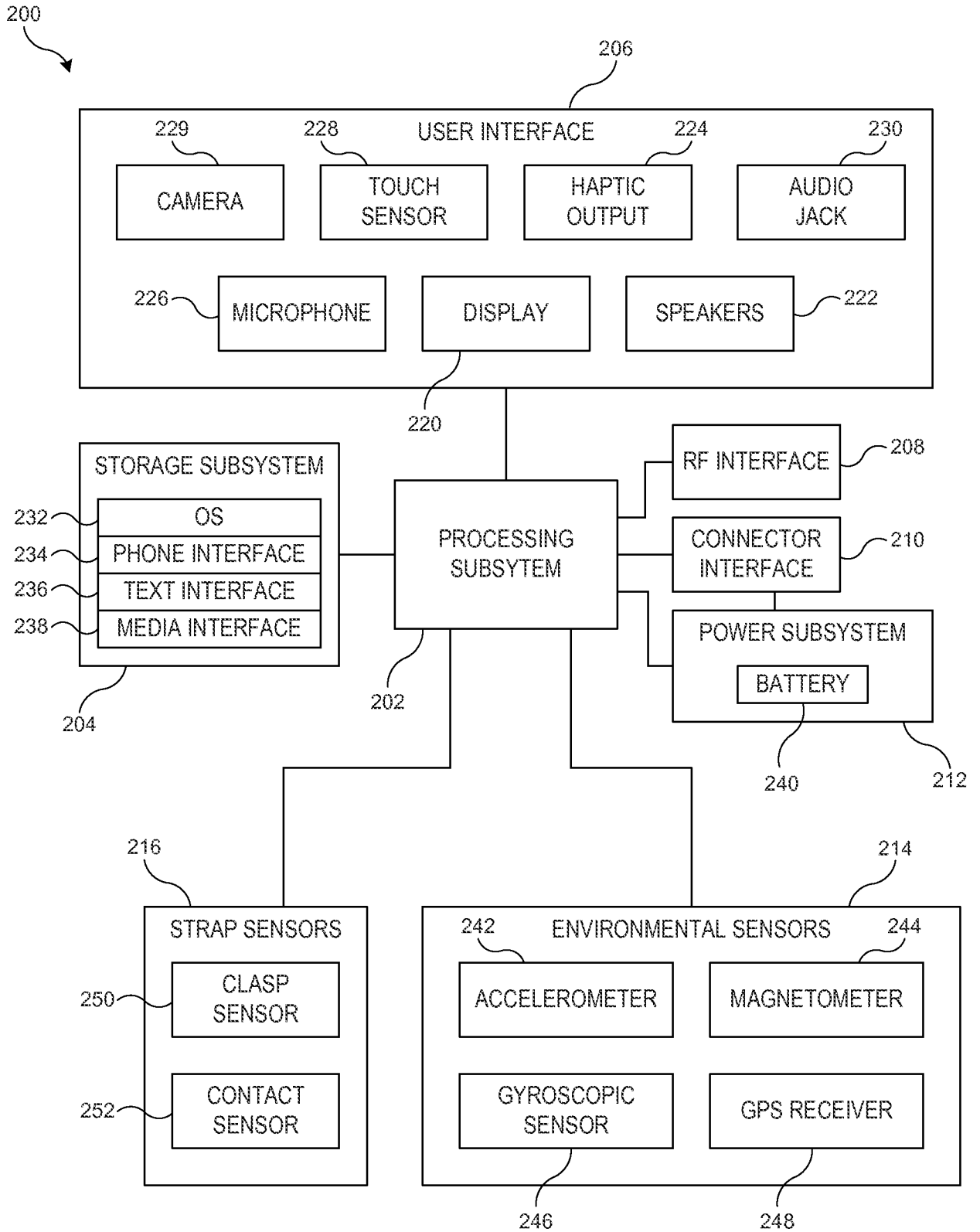
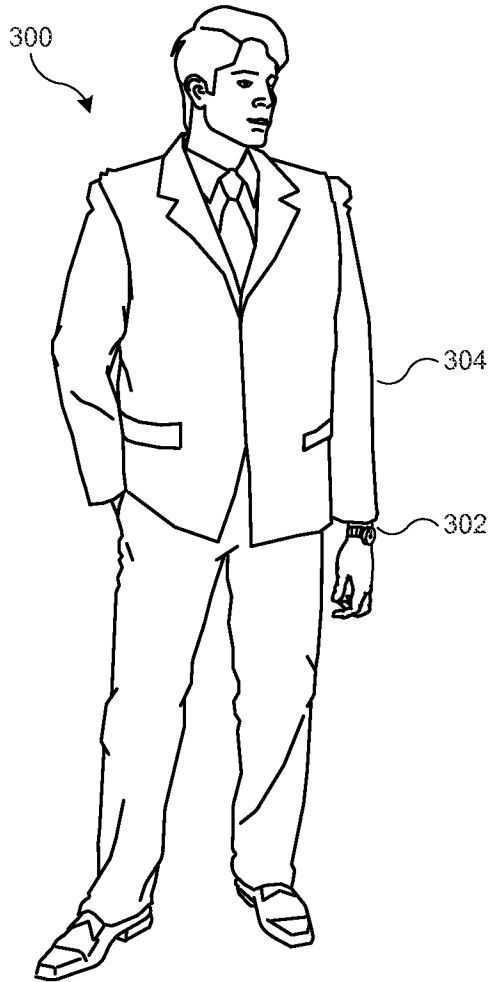
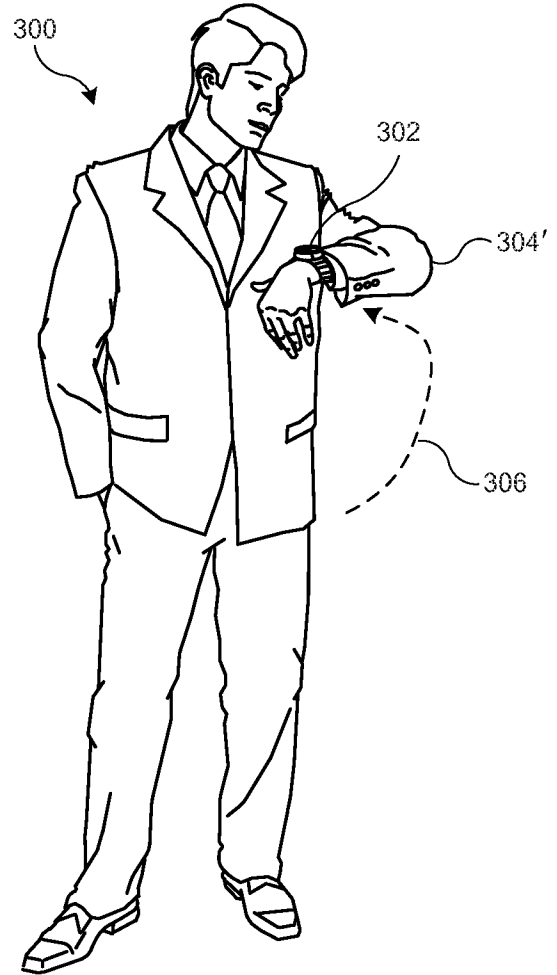


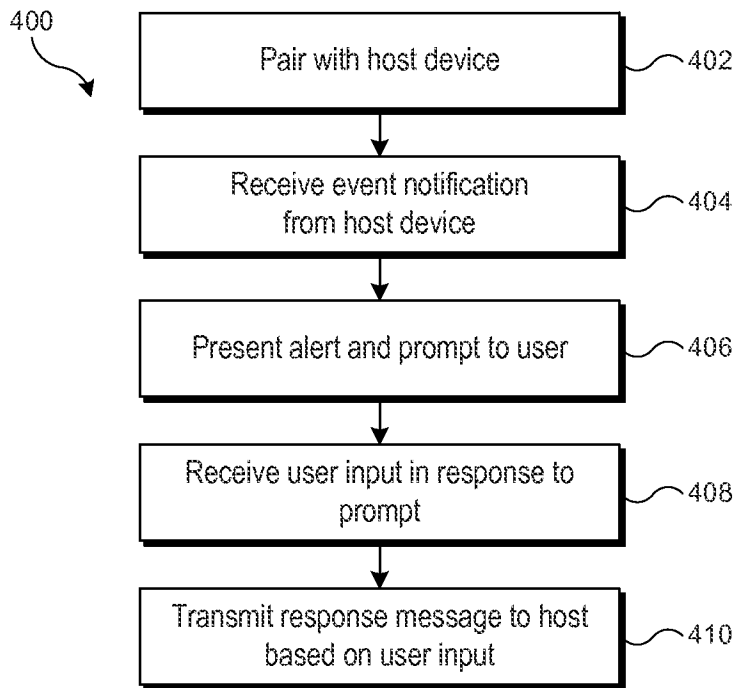
FIG. 2



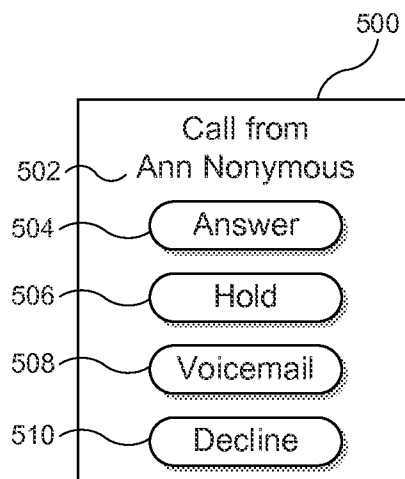
**FIG. 3A**



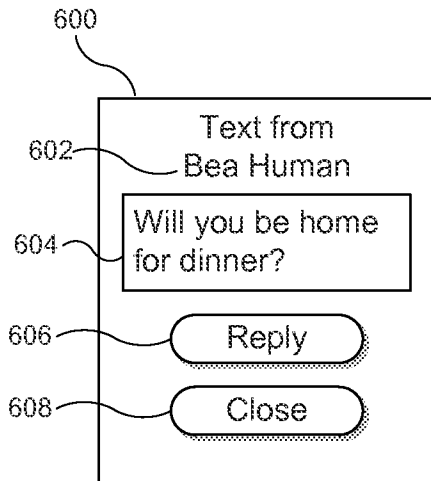
**FIG. 3B**



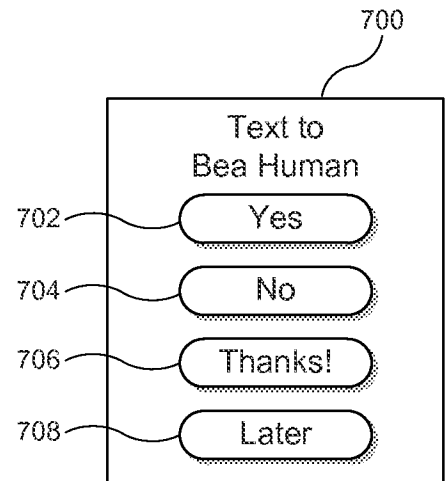
**FIG. 4**



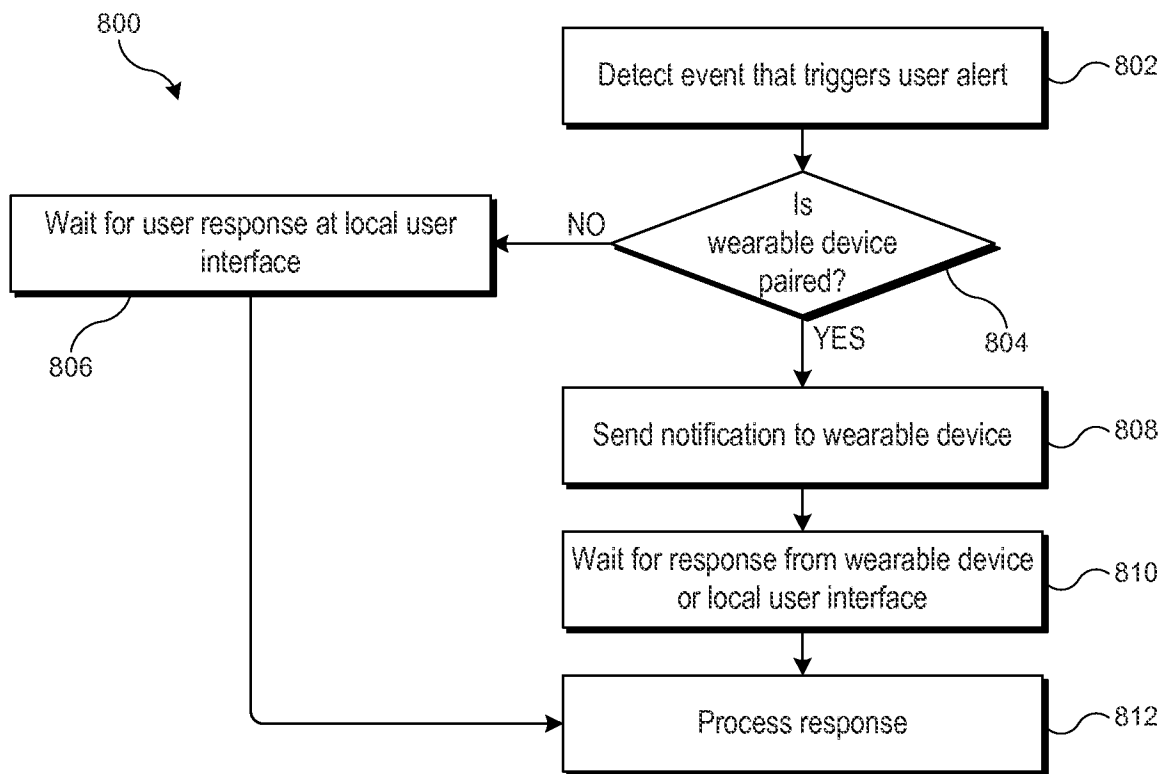
**FIG. 5**



**FIG. 6**



**FIG. 7**



**FIG. 8**

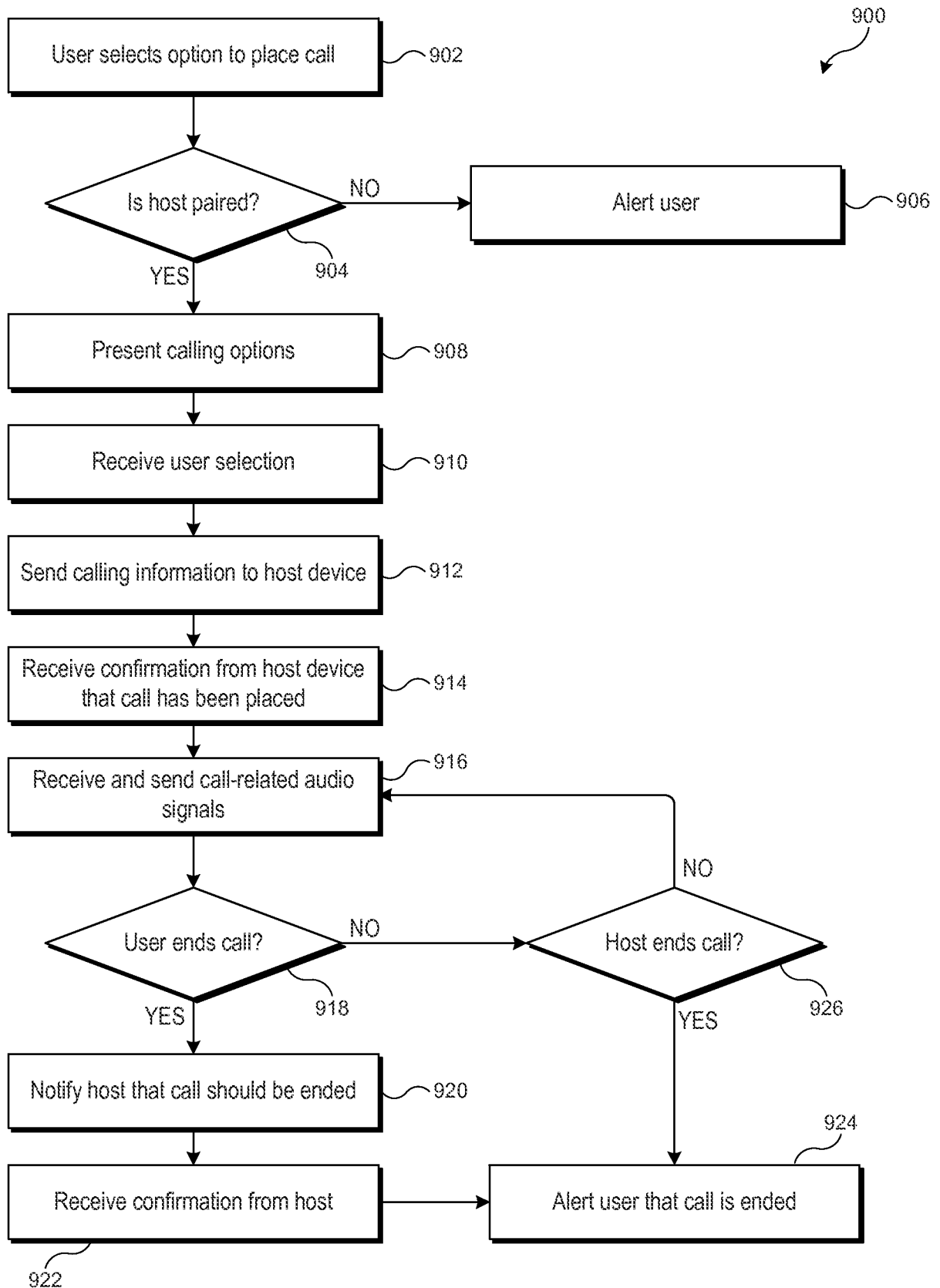
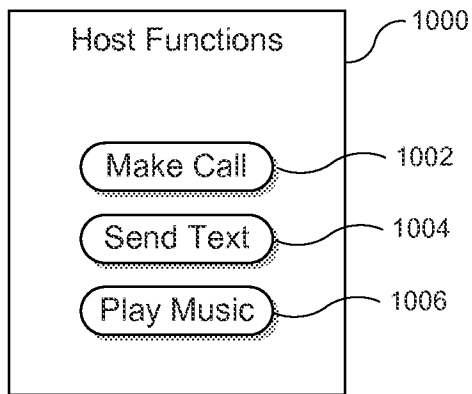
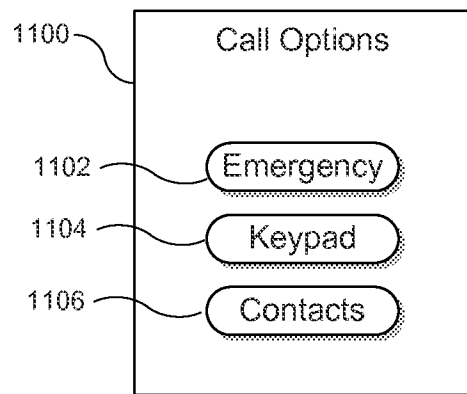


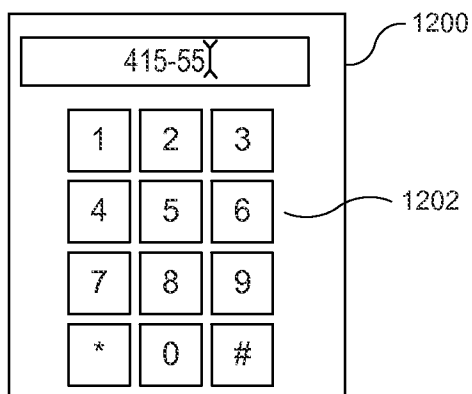
FIG. 9



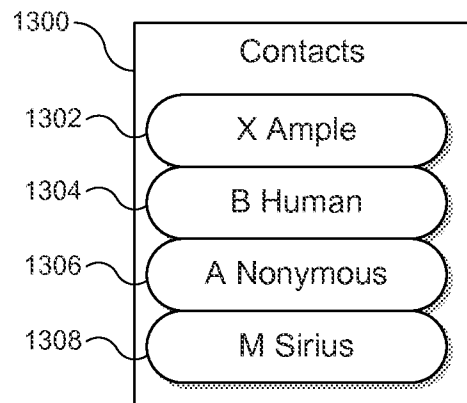
**FIG. 10**



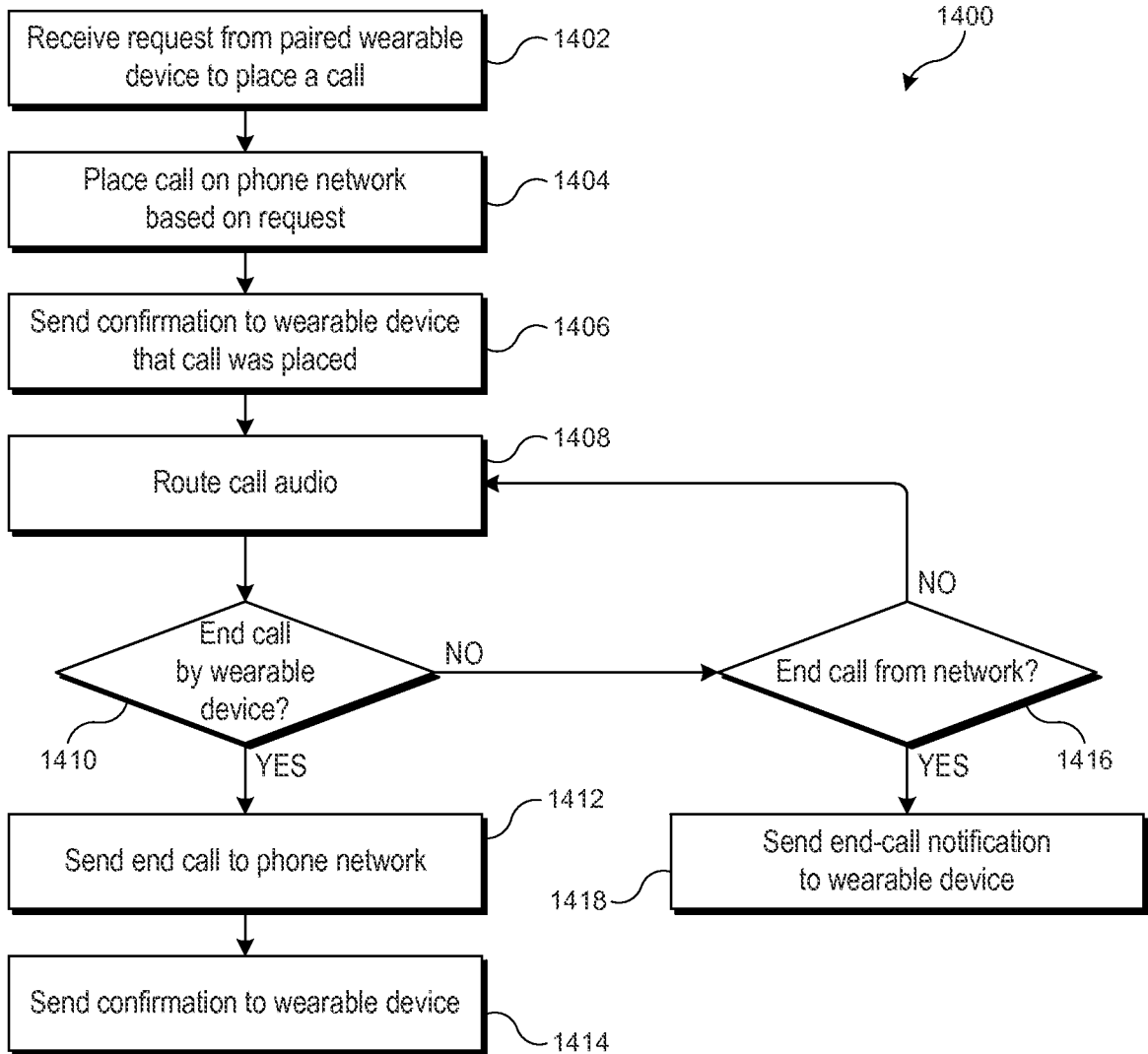
**FIG. 11**



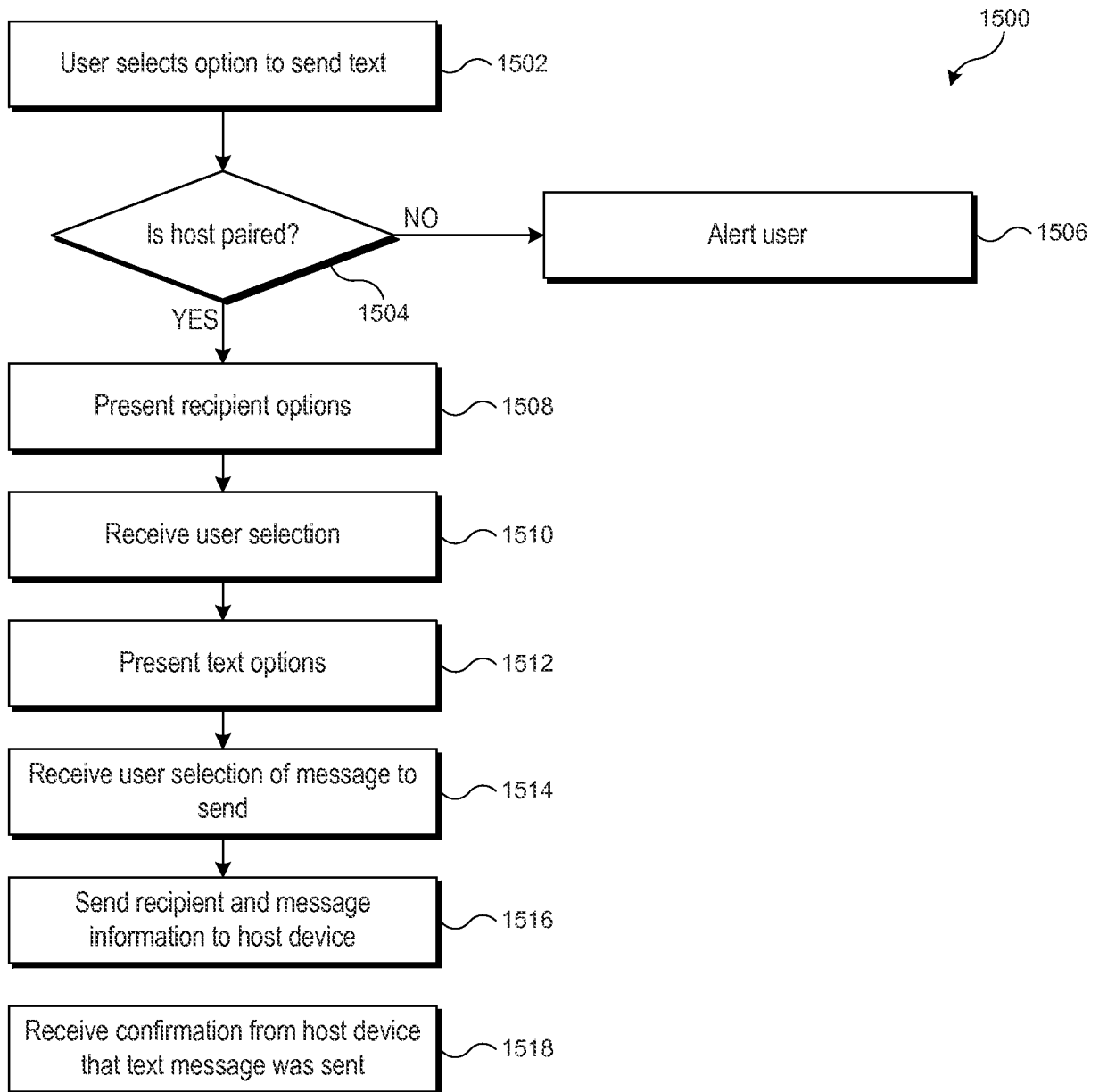
**FIG. 12**



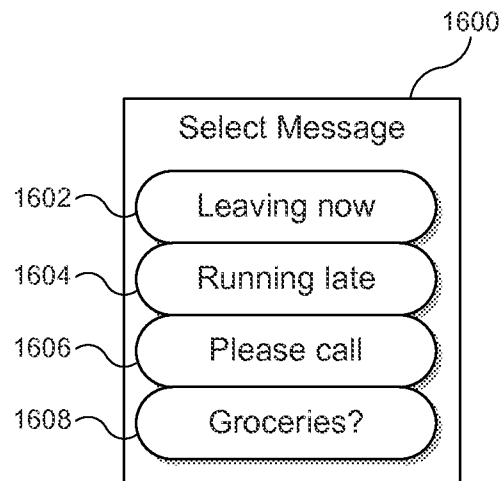
**FIG. 13**



**FIG. 14**



**FIG. 15**



**FIG. 16**