(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 March 2014 (06.03.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/035494 A1

(51) International Patent Classification:
*A61N 1/372* (2006.01) *A61B 5/00* (2006.01)

(21) International Application Number:
PCT/US2013/040736

(22) International Filing Date:
13 May 2013 (13.05.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/693,398 27 August 2012 (27.08.2012) US
61/693,402 27 August 2012 (27.08.2012) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published**:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: LOCATION-BASED USER TO AND PROGRAMMING OF AN IMPLANTABLE MEDICAL DEVICE

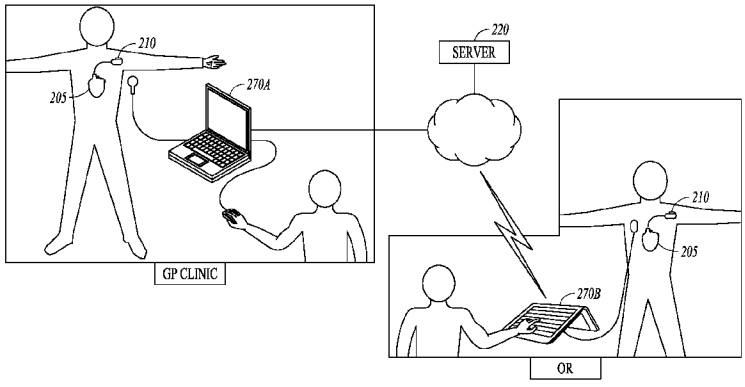


*FIG. 2*

(57) Abstract: An apparatus comprises an external device for communication with an implantable device. The external device includes a communication circuit configured to receive a communication signal from at least one other device different from the implantable device, a locating circuit configured to determine a location of the external device using the received communication signal, and a control circuit electrically coupled to the communication circuit and the locating circuit. The control circuit is configured to determine whether the determined location imposes a limit on functionality of an implantable device, and provide user access to an implantable device feature according to the determined location.

WO 2014/035494 A1

# LOCATION-BASED USER ACCESS TO AND PROGRAMMING OF AN IMPLANTABLE MEDICAL DEVICE

## CLAIM OF PRIORITY

Benefit of priority is hereby claimed to Hoyme et al., U.S. Provisional Patent Application Serial Number 61/693,398, entitled "LOCATION-BASED SERVICES", filed on August 27, 2012, and benefit of priority is also hereby claimed to Hoyme et al., U.S. Provisional Patent Application Serial Number 61/693,402, entitled "USE CASE-BASED SERVICES", filed on August 27, 2012, each of which is hereby incorporated by reference herein in its respective entirety.

## BACKGROUND

Medical devices include devices designed to be implanted into a patient. Some examples of these implantable medical devices (IMDs) include cardiac function management (CFM) devices such as implantable pacemakers, implantable cardioverter defibrillators (ICDs), cardiac resynchronization therapy devices (CRTs), and devices that include a combination of such capabilities. The devices can be used to treat patients or subjects using electrical or other therapy or to aid a physician or caregiver in patient diagnosis through internal monitoring of a patient's condition. The devices may include one or more electrodes in communication with one or more sense amplifiers to monitor electrical heart activity within a patient, and often include one or more sensors to monitor one or more other internal patient parameters. Other examples of IMDs include implantable diagnostic devices, implantable drug delivery systems, or implantable devices with neural stimulation capability.

IMDs can be sophisticated devices that can provide many advanced functions. External devices, such as IMD programmers, can communicate with an IMD using wireless telemetry and can be used to set device parameters. IMDs can also provide diagnostic data from one or more physiologic sensors. The programmers or other external devices IMDs can also be used to collect diagnostic data obtained by one or more physiologic sensors of the IMD. Programming IMDs has become more complicated as therapeutic and diagnostic features are added to

these types of devices. Interfaces to interact with these devices can be difficult for someone who only occasionally has to access the device. Therefore, it is desirable to simplify interactions with these complicated devices.

## OVERVIEW

This document relates generally to systems, devices, and methods for communication among an implantable device and external devices. An apparatus example includes an external device for communication with an implantable device. The external device includes a communication circuit configured to receive a communication signal from at least one other device different from the implantable device, a locating circuit configured to determine a location of the external device using the received communication signal, and a control circuit electrically coupled to the communication circuit and the locating circuit. The control circuit is configured to determine whether the determined location imposes a limit on functionality of an implantable device, and provide user access to an implantable device feature according to the determined location.

This section is intended to provide an overview of subject matter of the present patent application. It is not intended to provide an exclusive or exhaustive explanation of the invention. The detailed description is included to provide further information about the present patent application.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, which are not necessarily drawn to scale, like numerals may describe similar components in different views. Like numerals having different letter suffixes may represent different instances of similar components. The drawings illustrate generally, by way of example, but not by way of limitation, the various examples discussed in the present document.

FIG. 1 is an illustration of an example of portions of a system that includes an IMD.

FIG. 2 is an illustration representing programming an IMD at different locations.

FIG. 3 is a flow diagram of a method of providing location-based medical device services to a user.

FIG. 4 is a block diagram of an example of portions of an external device for communication with an implantable device.

FIG. 5 is a flow diagram of an example of a method of providing varying medical device services based on location and a type of user.

FIG. 6 is a block diagram of portions of an example of an external device for communication with an implantable device.

FIG. 7 is flow diagram of an example of a method for operating an external device that communicates with an implantable device.

## DETAILED DESCRIPTION

FIG. 1 is an illustration of an example of portions of a system that includes an IMD 110. Examples of IMD 110 include, without limitation, a pacemaker, a defibrillator, a cardiac resynchronization therapy (CRT) device, or a combination of such devices. The system 100 also typically includes an external device 170, such as an IMD programmer, that communicates wireless signals 190 with the IMD 110, such as by using radio frequency (RF) or other telemetry signals.

The IMD 110 can be coupled by one or more leads 115A-C to heart 105. Cardiac leads 115A-C include a proximal end that is coupled to IMD 110 and a distal end, coupled by electrical contacts or "electrodes" to one or more portions of a heart 105. The electrodes typically deliver cardioversion, defibrillation, pacing, or resynchronization therapy, or combinations thereof to at least one chamber of the heart 105. The electrodes may be electrically coupled to sense amplifiers to sense electrical cardiac signals. Sensed electrical cardiac signals can be sampled to create an electrogram. An electrogram can be analyzed by the IMD and/or can be stored in the IMD 110 and later communicated to the external device 170 where the sampled signals can be displayed for analysis.

As explained previously herein, programming of IMDs can be complicated and interfaces to interact with these devices can be difficult for someone who only occasionally has to access the device. The functions needed to be performed by an

external device can be tied to location. Therefore, user interaction with the IMD can be simplified if the user interface only includes those functions tied to a given location.

FIG. 2 is an illustration representing programming an IMD at different locations. One of the locations may be a general practice (GP) clinic. An external device 270A, 270B is used to program an IMD 210. Functionality at the general practice clinic may only require that certain information be read from the IMD 210 (e.g., for the physician or for uploading to one or more servers 220 remote from the general practice clinic), while functionality at a cardiologist's office may require full programming capability. The services required at the general practice clinic can be much more limited than the services required at the cardiologist's office and the user interface for the external device 270A, 270B can therefore be greatly simplified when the external device is located at the general practice clinic. In another example, the location is an operating room (OR). The IMD 210 may be an ICD. The required functionality of the user interface of the external device 270A, 270B may only be to turn defibrillation detection and therapy in the IMD 210 off and on.

It can be seen that the capabilities provided by the external device 270 can be changed based on the location of the device. If the external device 270A, 270B is able to determine its location, the user interface of the external device 270A, 270B can be automatically tailored and often simplified to meet the requirements of the location.

FIG. 3 is a flow diagram of a method 300 of providing location-based medical device services to a user. At block 305, a wireless communication signal is received using an external device. The external device can communicate with an implantable device (e.g., an IMD) and receive the wireless communication signal from at least one other device separate from the implantable device. As shown in FIG. 1, the wireless communication signal can be received from, among other things, a local area network (LAN) 192, a cellular telephone network 194, and a global positioning system (GPS) satellite 196. The wireless communication signal may be received using a communication circuit different from a telemetry circuit or

telemetry system used for communication between the external device and the implantable device.

At block 310, the location of the external device is determined by the external device according to the received communication signal. The external device also determines whether the location is associated with limiting functionality of the implantable device. At block 315, user access to implantable device features is configured by the external device according to the determined location.

FIG. 4 is a block diagram of an example of portions of an external device 470 for communication with an implantable device. The external device 470 includes a communication circuit 425, a locating circuit 430, and a control circuit 435 that is electrically coupled to the communication circuit 425 and the locating circuit 430. In some examples, the communication circuit 425 includes a radio frequency (RF) receiver or transceiver. The communication circuit 425 receives a communication signal from at least one other device different from the implantable device, and the locating circuit 430 determines a location of the external device 470 using the received communication signal. The external device 470 may communicate with an implantable device using the communication circuit 425, or the external device 470 may include a separate telemetry circuit (not shown) for communication with the implantable device.

The control circuit 435 can include a microprocessor, a digital signal processor, application specific integrated circuit (ASIC), or other type of processor, interpreting or executing instructions in software modules or firmware modules. The control circuit 435 can include other circuits or sub-circuits to perform the functions described. These circuits may include software, hardware, firmware or any combination thereof. Multiple functions can be performed in one or more of the circuits or sub-circuits as desired.

The control circuit 435 determines whether the determined location imposes a limit on functionality of an implantable device and provides user access to one or more implantable device features according to the determined location. For example, the control circuit 435 may determine that the location of the external device is an OR, an emergency room (ER), a magnetic resonance imaging (MRI)

clinic, a catheterization lab, a cardiology clinic, an electrophysiology clinic, a hospital, or a general practice clinic, and configure (e.g., selectively provide or limit) user access to implantable device features accordingly.

The locating circuit 430 can include one or more of software, firmware, and hardware to perform the functions described herein. In certain examples, the locating circuit 430 is integral to the control circuit 435. In some examples, a tablet computer or a cellular telephone is integrated into the external device 470, and the locating circuit 430 is included in the tablet computer or cellular telephone.

In some examples, the locating circuit 430 determines the location of the external device 470 using global positioning (e.g., GPS, or assisted GPS). The communication signal may include one or more messages transmitted from satellites and the locating circuit 430 may determine the location of the external device 470 using the satellite transmission.

The locating circuit 430 may cross reference coordinates determined by global positioning with map information to determine that the coordinates are related to a hospital location or to a type of clinic for example. The map information may be stored in a memory circuit 440 integral to, or electrically coupled to, the control circuit 435, or the map information may be stored in a remote server (e.g., a cloud server or cloud computer) accessed by the control circuit 435 using the communication circuit 425 or other port (e.g. a universal serial bus) to access the Internet.

In some examples, the locating circuit 430 determines the location of the external device 470 using cellular phone tower (e.g., cell site) information. The communication circuit 425 may receive a communication signal transmitted from a cell tower. The received communication signal may identify the cell tower transmitting the signal and the locating circuit 430 determines the location of the external device 470 from the cell tower identification. The locating circuit 430 may cross reference the cell tower information with location information (e.g., using a lookup table) from the memory or from access to cloud computing resources to determine the location of the external device 470.

In some examples, the locating circuit 430 determines the location of the external device 470 using wireless fidelity (WiFi) network mapping. The communication circuit 425 may receive a communication signal transmitted by a wireless fidelity (WiFi) network. The received communication signal may identify the WiFi network the locating circuit 430 may include a cross reference of WiFi nodes or networks for one or more areas. The received communication signal may identify the WiFi node or network (e.g., using an internet protocol address), and the location can then be determined from the cross reference. In certain examples, the communication signal identifies a LAN and the locating circuit 430 identifies the location of the external device 470 from the identification of the LAN.

In some examples, the locating circuit 430 uses a combination of two or more methods to identify the location of the external device. WiFi network or LAN information may provide intra-building information to the locating circuit 430. This information can help to further identify a function being performed at a location initially identified with GPS or cell tower information.

For instance, the communication circuit 425 may receive both a cell tower signal and a signal from a LAN network. The locating circuit 430 may identify a more general area using the cell tower signal (e.g., to identify that the external device is in a hospital) and identify a more specific area using the LAN signal (e.g., identify that the external device 470 is located in an operating theater or OR).

In some examples, when a location of the external device 470 is determined, the locating circuit 430 may identify a communication network associated with the determined location. The control circuit 435 may store an identifier for the communication network in the memory circuit in association with the determined location in the memory circuit 440. The locating circuit 430 can then deduce the location the next time an identifying signal is received from the communication network.

In some examples, the locating circuit 430 detects physical activity to determine if the location is changing or to adjust the location determination. The external device 470 may include an activity sensor 445 electrically coupled to the locating circuit. Some examples of an activity sensor include an accelerometer and

a tilt switch. The locating circuit 430 estimates the location of the external device 470 according to the location determined using the received communication signal and subsequent motion sensed using the activity sensor. This may be useful to detect a change in the intra-building location of the external device 470.

As explained previously herein, the control circuit 435 configures user access to one or more implantable device features according to the determined location. The external device 470 may include a user interface 450 electrically coupled to the control circuit. The user interface 450 may include one or more of a display, a mouse, a keyboard, and a touch sensitive or multi-touch sensitive display screen.

Using the user interface 450, the control circuit 435 may present implantable device features as available to a user according to the determined location. For example, the features may be selectable via indications presented on one or more user interface menus. The control circuit 435 may exclude presentation by the user interface 450 of an implantable device feature limited by the determined location. Excluding a feature may include not presenting the feature on a displayed menu or ghosting the feature on the display to indicate that the feature is not available to the user.

For example, it may be desirable to suspend the delivery of defibrillation therapy to a patient who is in an ER of a hospital. In response to the locating circuit 430 determining that the location of the external device 470 is an ER, the control circuit 435 configures the user interface to allow the user to enable or disable delivery of defibrillation therapy by the implantable device. The control circuit 435 may also allow the user to change a tachyarrhythmia detection rate of the implantable device in order to make the implantable device less sensitive to detection of tachyarrhythmia.

In another example, it may be desirable to place the implantable device in an electrocautery mode when the patient is undergoing surgery. In electrocautery mode, defibrillation or cardioversion therapy is disabled if the implantable device is an ICD. If the implantable device provides pacing therapy, electrocautery mode may include providing asynchronous pacing. In asynchronous pacing, the pacing

pulses are delivered according to a timer and not according to sensed cardiac events. This prevents non-cardiac events (e.g., the electrocautery) that may be sensed by the implantable device from influencing the therapy being provided. In response to the locating circuit 430 determining that the location of the external device 470 is an OR, the control circuit 435 allows a user to initiate the electrocautery mode in the implantable device. In certain examples, the control circuit 435 prevents access to implantable device features other than electrocautery mode when determining that the external device is in an ER. In certain examples, the control circuit 435 allows some information stored in the implantable device to be read or uploaded from the implantable device by the user.

In another example, it may be desirable to place the implantable device in an MRI mode when the patient is to undergo magnetic resonance imaging. Similar to the electrocautery mode, defibrillation or cardioversion therapy can be disabled in the MRI mode to avoid noise from the MRI causing false positive indications of the need for therapy. The MRI mode may also involve asynchronous pacing, and the asynchronous pacing may be delivered at a rate that is higher than a determined intrinsic rate. Pacing at a rate higher than the intrinsic rate prevents the implantable device from pacing into an intrinsic depolarization due to the presence of noise.

In response to the locating circuit 430 determining that the location of the external device 470 is an MRI clinic, the control circuit 435 configures the user interface 450 to allow a user to enable an MRI mode in the implantable device. In some examples, the control circuit 435 configures the user interface 450 to allow a user to initiate a device-automated pacing threshold test when it is determined that the external device 470 is located in an MRI clinic. In certain examples, the control circuit 435 does not allow user access to MRI mode or electrocautery mode, or these modes are disabled, unless the external device 470 is in an MRI clinic or OR, respectively.

For various locations, such as an OR, ER, or MRI clinic, it may be desirable to turn one or both of tachyarrhythmia detection and cardioversion/defibrillation therapy off. There is a concern that the user of the external device 470 may leave the detection or therapy turned off when the patient leaves the location. In some

examples, the control circuit 435 provides, on the user interface, an indication or alert as a reminder to turn one or both of the cardioversion/defibrillation therapy and tachyarrhythmia detection back on.

In some examples, the control circuit 435 presents a first alert to a user that delivery of defibrillation therapy is disabled and initiates a timer in the external device 470. The timer may be a timer circuit integral to, or electrically coupled to, the control circuit 435. The control circuit 435 may generate a second alert, upon timeout of the timer, regarding the disabled defibrillation therapy or disabled tachyarrhythmia detection.

In some examples, in response to the locating circuit 430 determining that the location of the external device 470 is a general practice clinic, the control circuit 435 configures the user interface to allow user read-only access to at least a portion of data or other information stored in the implantable device.

The control circuit 435 may initiate an action by the external device, without participation by a user, upon determining the location of the external device. For instance, the control circuit 435 may initiate communication of information to a remote server in response to the locating circuit 430 determining a location of the external device. The information to be communicated can be selected according to the determined location. In some examples, the remote server to receive the information is identified according to the determined location. For instance, the determined location may be a major medical center (e.g., Mayo Clinic). The control circuit 435 may initiate a transfer of information to a remote server associated with the medical center in response to determining that the external device 470 is located at the medical center. The selected information may be communicated to the remote server absent participation or prompting by a user. This allows specified information to be made readily accessible to those people with the appropriate training. In some examples, emergency information can be transferred to a remote server and actions to address the emergency can be automatically dispatched.

The selected information may include location information and identification information of the external device. In this way, a field clinical engineer (FCE) or other device expert may be able to determine the locations of all units on a given

site (e.g., a hospital). This information may be relayed to a handheld device (e.g., a smart phone) of the FCE. Alerts from external devices may also be relayed to such handheld devices.

For some locations, the control circuit 435 allows user access to substantially all of the features of the implantable medical device. For instance, if the locating circuit 430 determines that the external device is located in the office of a cardiologist, a cardiology clinic, or an electrophysiology clinic, the control circuit 435 may allow user access to all programmable device parameters. Some device capability, such as changing executable code in the implantable device may still not be allowed by the control circuit 435.

Other levels of functionality may be desired for other locations. For instance, if the locating circuit 430 determines that the external device is located in a catheterization lab, the control circuit 435 may turn cardioversion or defibrillation therapy off and allow user access to pacing therapy capture detection tests.

In some examples, the control circuit 435 presents the user interface in a language appropriate to the detected location. For example, certain languages or language dialects can be associated with particular locations. The control circuit 435 may display user options in the language specified for the determined location.

In some examples, the external device 470 is dedicated to a certain location. In other words, it is intended that the external device 470 only be used at a specified location. When the locating circuit 435 determines that the location of the external device 470 is not at the specified location, the control circuit 435 may disable the external device 470 altogether (e.g., "brick" the device).

It can be seen from the examples described herein that because functions required to be performed by an external device are often dependent upon location, determining the location with the external device can lead to simplification of user interaction with an implantable device.

Additionally, access to features of a device located at the general practice clinic may be different for different personnel (e.g., a nurse at a general practice clinic or technician at an MRI clinic may be given access to a different subset of features than a doctor). Thus, the user interface can be even more simplified based

on user role information. Access to features at a location such as a cardiologist's office may require role or other identity information to be entered into the external device to ensure the qualifications of the user. Thus, entering identity information into the external device can also provide security to the access given to IMD device features.

FIG. 5 is a flow diagram of an example of a method 500 of providing varying medical device services based on location and a type of user. At block 505, a wireless communication signal is received using an external device. The external device can communicate with an implantable device and receive the wireless communication signal from at least a third device separate from the implantable device using any of the wireless communication methods described herein.

At block 510, the location of the external device is determined by the external device according to the received communication signal. The external device may also determine whether the location is associated with limiting functionality of the implantable device.

At block 515, user identity information is received into the external device, such as by an input port. The external device may determine whether the identity information corresponds to a user role associated with limiting functionality of the implantable device. At block 520, user access to implantable device features is configured by the external device according to the determined location and the received user identity information.

FIG. 6 is a block diagram of portions of an example of an external device 670 for communication with an implantable device. The external device 670 includes a communication circuit 625, a locating circuit 630, a port 655, and a control circuit 635 that is electrically coupled to the communication circuit 625 and the locating circuit 630. The communication circuit 625 receives a communication signal from at least one other device different from the implantable device, and the locating circuit 630 determines a location of the external device 670 using the received communication signal. The external device can receive user identity information via the port 655.

The control circuit 635 allows user access to an implantable device feature according to the determined location and received user identity information. For example, the control circuit 635 may determine that the location of the external device is an OR, an ER, an MRI clinic, or a general practice clinic. Together with the user identification information, the control circuit 635 can configure (e.g., selectively provide or limit) user access to implantable device features according to the location. The locating circuit 630 may determine the location of the external device 670 using any of the locating method described herein.

The external device can receive the user identity information via the port 655, and the port 655 may include a communication port, or COMM port, to receive the user identity information. The COMM port may be a wired port or a wireless port. The COMM port may communicate using a standard protocol such as a USB protocol or firewire protocol.

In some examples, a user interface 650 is coupled to the port 655 to receive the user identity information. The user interface 650 may include one or more of a display, a mouse, a keyboard, and a touch sensitive or multi-touch sensitive display screen.

Using the port 655 to receive user identity information can also provide a level of security to accessing features of the implantable device. In some examples, the port 655 is coupled to a card reader that determines the user identity from an identification card of the user. The card reader may scan the identification card for information when the card is held before the card reader, or the identification card may be swiped through the card reader to provide the identity information. In some examples, the port 655 is coupled to a biometric scanner (e.g., a finger print scanner, a hand print scanner, etc.) and the port 655 receives biometric information of a user.

In some examples, a fourth device that is associated with the user identity information can be involved in obtaining the user identity information. The fourth device may be, among other things, a cellular telephone associated with the user, or a personal electronic device associated with the user that can access the internet. The communication circuit 625 may transmit access information receivable by the

fourth device according to a telephone number or an IP address associated with the user identity information.

The fourth device may retransmit the access information back to the external device 670 where it is received by the communication circuit 625. The control circuit 635 verifies that the received access information corresponds to the transmitted access information and allows user access to the implantable device feature or features according to the verification.

The access information can be machine readable. In some examples, the external device 670 includes a scanning circuit 660 that may be coupled to the port 655. The scanning circuit 660 may optically read the access information, such as by reading a barcode. The communication circuit 625 may transmit a barcode receivable by a telephone (e.g., a smartphone) associated with the user identity information. The scanning circuit 660 scans the barcode displayed on the telephone and the control circuit 635 verifies that the scanned barcode is the same as the transmitted barcode.

In some examples, the external device 670 includes a camera or other imaging device. The control circuit 635 initiates the taking of an image (e.g., a photograph) of the user who is given access to the external device 670. The image may be included in a record of access to the external device 670.

It can be seen from the examples described herein that because functions required to be performed by an external device are often dependent upon location, determining the location with the external device can lead to simplification of user interaction with an implantable device. Including user identification to determine the interface can simplify user interaction as well provide security in accessing the implantable device features.

As explained previously herein, the control circuit 635 configures user access to one or more implantable device features according to the determined location and user identity information. The control circuit 635 may present (e.g., display) implantable device features on a user interface 650 as available to a user according to the determined location and received user identity information. For example, the features may be selectable via indications presented on one or more

user interface menus. The control circuit 635 may exclude presentation by the user interface 650 of an implantable device feature limited by one or both of the determined location and the user identity information. Excluding a feature may include not presenting the feature on a displayed menu or ghosting the feature on the display to indicate that the feature is not available to the user.

For example, it may be desirable to suspend the delivery of defibrillation therapy to a patient who is in an ER of a hospital. In response to the locating circuit 630 determining that the location of the external device 670 is an ER and receiving information that the user is a physician, the control circuit 635 configures the user interface 650 to allow the user to enable or disable delivery of defibrillation therapy by the implantable device. The control circuit 635 may also allow the user to change a tachyarrhythmia detection rate of the implantable device in order to make the implantable device less sensitive to detection of tachyarrhythmia.

In another example, it may be desirable to place the implantable device in an electrocautery mode when the patient is undergoing surgery. In electrocautery mode, defibrillation or cardioversion therapy is disabled if the implantable device is an ICD. If the implantable device provides pacing therapy, electrocautery mode may include providing asynchronous pacing. In asynchronous pacing, the pacing pulses are delivered according to a timer and not according to sensed cardiac events. This prevents non-cardiac events (e.g., the electrocautery) that may be sensed by the implantable device from influencing the therapy being provided. In response to the locating circuit 630 determining that the location of the external device 670 is an OR and based on the user identity information, the control circuit 635 allows an approved user to initiate the electrocautery mode in the implantable device.

In certain examples, the control circuit 635 prevents access to implantable device features other than electrocautery mode when determining that the external device is in an ER. In certain examples, the control circuit 635 prevents access to the electrocautery mode (e.g., does not provide the electrocautery mode in the displayed menu) according to the received user identity information. In certain examples, the control circuit 635 allows some information stored in the implantable

device to be read or uploaded from the implantable device by the user based on the determined location and the user identity information.

In another example, it may be desirable to place the implantable device in an MRI mode when the patient is to undergo magnetic resonance imaging. Similar to the electrocautery mode, defibrillation or cardioversion therapy can be disabled in the MRI mode to avoid noise from the MRI causing false positive indications of the need for therapy. The MRI mode may also involve asynchronous pacing, and the asynchronous pacing may be delivered at a rate that is higher than a determined intrinsic rate. Pacing at a rate higher than the intrinsic rate prevents the implantable device from pacing into an intrinsic depolarization due to the presence of noise.

In response to the locating circuit 630 determining that the location of the external device 670 is an MRI clinic and based on the user identity, the control circuit 635 configures the user interface 650 to allow an approved user to enable an MRI mode in the implantable device. In some examples, the control circuit 635 configures the user interface 650 to allow the user to initiate a device-automated pacing threshold test when it is determined that the external device 670 is located in an MRI clinic. In certain examples, the control circuit 635 does not allow user access to MRI mode or electrocautery mode, or these modes are disabled, unless the external device 670 is in an MRI clinic or OR, respectively. In certain examples, the control circuit 635 does not allow user access to MRI mode or electrocautery mode when the identity information identifies the user as a technical support specialist rather than a physician.

In some examples, in response to the locating circuit 630 determining that the location of the external device 670 is a general practice clinic and the identity information identifying the user as a physician or nurse, the control circuit 635 configures the user interface 650 to allow user read-only access to at least a portion of data or other information stored in the implantable device.

In some examples, the control circuit 635 presents or displays features as available on the user interface according to the determined location, the received user identity and the type of implantable device. For instance, services related to

cardioversion and defibrillation are only presented if the implantable device has one or both of cardioversion and defibrillation capability.

For some locations, the control circuit 635 allows user access to substantially all of the features of the implantable medical device. For instance, if the locating circuit 630 determines that the external device is located in the office of a cardiologist or a cardiology clinic and the control circuit 635 determines that the user is a cardiologist, the control circuit 635 may allow user access to all programmable device parameters. In another example, if the control circuit 635 determines that the user is a manufacturer's representative, the control circuit 635 may allow access to all features of the implantable device regardless of the location of the external device 670. Some device capability, such as changing executable code in the implantable device may still not be allowed by the control circuit 635.

When the control circuit 635 detects a change in location of the external device (e.g., as indicated by the locating circuit 630), the control circuit 635 can change user access to one or more implantable device features according to the changed location and identity information. For instance, control circuit 635 may change the user interface presented to a user when the location is changed from an office to an OR even though the user information remains unchanged.

For various locations, such as an OR, ER, or MRI clinic, it may be desirable to turn one or both of tachyarrhythmia detection and cardioversion/defibrillation therapy off. There is a concern that the user of the external device 670 may leave the detection or therapy turned off when the patient leaves the location.

FIG. 7 is flow diagram of an example of a method 700 for operating an external device that communicates with an implantable device. At block 705, a user option is presented by the external device (e.g., using a user interface) to disable delivery of defibrillation therapy by the implantable device.

At block 710, an indication is received into the external device to disable delivery of the defibrillation therapy. The defibrillation therapy is disabled in the implantable device in response to receiving the indication. At block 715, an alert is generated when a triggering event occurs and defibrillation therapy by the implantable device remains disabled. The alert may be generated by the external

device or by a separate device that communicates the alert to the external device. The external device may then present the alert to the user.

Returning to the example of FIG. 6, the control circuit 635 can present a user option on the user interface 650 to disable delivery of one or both of defibrillation therapy and cardioversion therapy by the implantable device. The port 655 may receive an indication into the external device 670 to disable delivery of the defibrillation and/or cardioversion therapy.

The control circuit 635 communicates a disable of the therapy to the implantable device in response to receiving the indication. The disable may be a device command communicated using wireless telemetry. In response to the control circuit 635 detecting a triggering event, the control circuit 635 presents an alert to a user (e.g., using the user interface 650) when the triggering event occurs and defibrillation therapy by the implantable device remains disabled.

In some examples, the triggering event includes expiration of a timed duration. The external device 670 can include a timer circuit 665 electrically coupled to or integral to the control circuit 635. The control circuit 635 initiates timing of a specified (e.g., programmed) time duration by the timer circuit 665 in response to communication of the disable to the implantable device.

If the specified time duration expires and the defibrillation or cardioversion therapy by the implantable device remains disabled, the control circuit generates the alert and the alert is presented to the user. A complication to the approach can arise if the external device 670 is turned off or powered down. This could also turn off the timer circuit 665 and expiration of the timed duration would not be detected. In some examples, the control circuit 635 maintains circuit power to the timer circuit when the therapy is disabled until the defibrillation therapy by the implantable device is enabled or the alert is generated.

In some examples, the timing is done by a device different from the external device 670. In certain examples, the timing device is a server remote from the external device 670. The control circuit 635 may communicate an indication that delivery of defibrillation therapy is disabled to the remote server. When therapy is re-enabled using the external device 670, the control circuit 635 may communicate

an indication to the remote server that delivery of defibrillation therapy is re-enabled. The control circuit 635 receives the alert from the remote server when the remote server fails to receive the indication that the delivery of defibrillation therapy is re-enabled a specified time duration after receiving the indication that delivery of defibrillation therapy is disabled. The control circuit 635 then presents the alert to the user.

In some examples, the control circuit 635 transmits a status that defibrillation/cardioversion therapy is disabled to a remote server. The remote server may track multiple implantable devices whose therapy is disabled, and may time durations for each of the implantable devices. For example, the remote server may store a table in memory for the implantable devices. The table may include an indication of therapy status as "off" when the therapy is disabled and therapy "on" when enabled or re-enabled. A timed duration can be initiated for any device whose status for one of the devices remains off when the timed duration for that device expires. The remote server may then send a reminder to a person, hospital, or clinic to re-enable the therapy.

In certain examples, the implantable device times the duration when the therapy is disabled. The control circuit 635 receives the alert from the implantable device when the control circuit fails to re-enable the delivery of defibrillation therapy after the specified time duration. The control circuit 635 then presents the alert to the user.

In certain examples, the control circuit 635 also transmits the alert that therapy was not re-enabled to a separate device such as a remote server. The remote server may send a reminder to a person, a hospital, or clinic to re-enable the therapy.

In some examples, the triggering event includes a change in location of the external device 670. According to the location or locations of the external device 670 determined by the locating circuit 630, the control circuit 635 generates the alert when determining that the location of the external device 670 has changed while defibrillation therapy by the implantable device remains disabled.

Detecting the disabling of one or both of defibrillation therapy and cardioversion therapy and providing a reminder to caregivers to re-enable the

therapy, can prevent inadvertent disabling by caregivers allowing a patient to receive the full benefit of the therapy provided by the implantable device.

5

## ADDITIONAL NOTES AND EXAMPLES

Example 1 includes subject matter (such as an apparatus or device) comprising an external device for communication with an implantable device. The external device comprises a communication circuit configured to receive a communication signal from at least one other device different from the implantable device, a locating circuit configured to determine a location of the external device using the received communication signal, and a control circuit electrically coupled to the communication circuit and the locating circuit. The control circuit is configured to: determine whether the determined location imposes a limit on functionality of an implantable device, and provide user access to an implantable device feature according to the determined location.

In Example 2, the subject matter of Example 1 optionally includes a control circuit configured to determine that the location of the external device is at least one of an operating room (OR), an emergency room (ER), a magnetic resonance imaging (MRI) clinic, a catheterization laboratory, a cardiology clinic, an electrophysiology clinic, a hospital, and a general practice clinic.

In Example 3, the subject matter of one or any combination of Examples 1 and 2 optionally includes a locating circuit configured to determine the location of the external device using at least one of global positioning, wireless fidelity (WiFi) network mapping, cellular telephone tower identification, and local area network (LAN) identification.

In Example 4, the subject matter of one or any combination of Examples 1-3 optionally includes an activity sensor electrically coupled to the locating circuit. The locating circuit is optionally configured to estimate the location of the external device according to the location determined using the received communication signal and subsequent motion sensed using the activity sensor.

In Example 5, the subject matter of one or any combination of Examples 1-4 optionally includes a user interface electrically coupled to the control circuit. The control circuit is optionally configured to: present, using the user interface, the implantable device feature as available to a user according to the determined

location, and exclude presentation by the user interface of an implantable device feature limited by the determined location.

In Example 6, the subject matter of Example 5 optionally includes a control circuit configured to allow, in response to the locating circuit determining that the location of the external device is an ER and via the user interface, a user to at least one of: enable or disable delivery of defibrillation therapy by the implantable device, and change a tachyarrhythmia detection rate of the implantable device.

In Example 7, the subject matter of one or any combination of Examples 5 and 6 optionally includes a control circuit configured to allow, via the user interface and in response to the locating circuit determining that the location of the external device is an OR, a user to initiate an electrocautery mode in the implantable device in which defibrillation therapy is disabled. When the electrocautery mode is initiated by a user, the control circuit is optionally configured to: present a first alert to a user that delivery of defibrillation therapy is disabled, initiate a timer in the external device, and generate a second alert, upon timeout of the timer, regarding the disabled defibrillation therapy.

In Example 8, the subject matter of one or any combination of Examples 5-7 optionally includes a control circuit configured to allow, via the user interface and in response to the locating circuit determining that the location of the external device is an MRI clinic, a user to at least one of: enable an MRI mode in which cardiac pacing pulses are delivered asynchronously and at a rate higher than a determined intrinsic rate, and initiate a device-automated pacing threshold test.

In Example 9, the subject matter of one or any combination of Examples 5-8 optionally includes a control circuit configured to allow, via the user interface and in response to the locating circuit determining that the location of the external device is a general practice clinic, user read-access to at least a portion of information stored in the implantable device.

In Example 10, the subject matter of one or any combination of Examples 5-9 optionally includes a control circuit configured to display the user interface in a language specified for the determined location.

In Example 11, the subject matter of one or any combination of Examples 1-10 optionally includes a memory circuit integral to or electrically coupled to the control circuit. The locating circuit is optionally configured to identify a communication network associated with the determined location, and the control circuit is optionally configured to store an identifier for the communication network in the memory circuit in association with the determined location.

In Example 12, the subject matter of one or any combination of Examples 1-11 optionally includes a control circuit configured to: selectively load information stored in the implantable device according to the determined location, identify a remote server according to the determined location, and communicate the information to the remote server absent participation by a user.

Example 13, can include subject matter (such as a method, a means for performing acts, or a machine-readable medium including instructions that, when performed by the machine, cause the machine to perform acts), or can optionally be combined with the subject matter of one or any combination of Examples 1-10 to include such subject matter, comprising receiving a wireless communication signal using an external device, wherein the external device is configured to communicate with an implantable device and receive the wireless communication signal from at least one other device; determining, by the external device according to the received communication signal, a location of the external device and that the determined location is associated with limiting functionality of the implantable device; and configuring, by the external device, user access to an implantable device feature according to the determined location.

Such subject matter can include means for receiving a wireless communication signal using an external device, an illustrative example of which include a communication circuit configured to communicate wirelessly with one or more of a LAN, a cellular telephone network, a GPS, or a proprietary medical device telemetry system or circuit. Such subject matter can include means for determining, by the external device according to the received communication signal, a location of the external device and that the determined location is associated with limiting functionality of the implantable device, an illustrative example of which is

a locating circuit included in the external device. Such subject matter can include means for configuring, by the external device, user access to an implantable device feature according to the determined location, an illustrative example of which is a control circuit included in the external device.

In Example 14, the subject matter of Example 13 can optionally include the external device determining that the location is at least one of an operating room (OR), an emergency room (ER), a magnetic resonance imaging (MRI) clinic, a catheterization laboratory, a cardiology clinic, an electrophysiology clinic, a hospital, and a general practice clinic.

In Example 15, the subject matter of one or any combination of Examples 13 and 14 optionally includes the external device determining the location using at least one of a global positioning system (GPS), wireless fidelity (WiFi) network mapping, cellular telephone tower identification, and local area network (LAN) identification.

In Example 16, the subject matter of one or any combination of Examples 13-16 optionally includes the external device determining that the location is a location where defibrillation therapy should be turned off in the implantable device and, in response to the determination, enabling user access for at least one of: disabling delivery of defibrillation therapy by the implantable device, and presenting a reminder to enable defibrillation therapy when the defibrillation therapy is disabled.

In Example 17, the subject matter of one or any combination of Examples 13-16 optionally includes the external device determining that the location is an OR and enabling user access for initiating an electrocautery mode in the implantable device in response to the determination.

In Example 18, the subject matter of one or any combination of Examples 13-17 optionally includes the external device determining that the location is an MRI clinic, and the external device enabling, in response to the determination, at least one of: user access to enable an MRI mode in which pacing therapy is delivered asynchronously at a rate higher than a determined intrinsic rate, and user access to enable a device-automated pacing threshold test.

In Example 19, the subject matter of one or any combination of Examples 13-18 optionally includes the external device determining that the location is a general practice clinic, and, in response to the determination, enabling user read-access to at least a portion of data stored in the implantable device.

In Example 20, the subject matter of one or any combination of Examples 13-19 optionally includes selectively loading, by the external device, information stored in the implantable device according to the determined location, identifying a remote server according to the determined location, and communicating the information to the remote server absent participation by a user.

Example 21 can include subject matter (such as an apparatus), or can optionally be combined with the subject matter of one or any combination of Examples 1-20 to include such subject matter, comprising an external device for communication with an implantable device. The external device can include: a communication circuit configured to receive a communication signal from at least a third device separate from the external device and the implantable device, a locating circuit configured to determine a location of the external device using the received communication signal, a port configured to receive user identity information into the external device, and a control circuit electrically coupled to the communication circuit, the locating circuit, and the port. The control circuit is configured to allow user access to an implantable device feature according to the determined location and received user identity information.

In Example 22, the subject matter of Example 21 optionally includes a communication circuit configured to transmit access information receivable by a fourth device that is associated with the user identity information, and receive the access information into the external device. The control circuit is optionally configured to verify that the received access information corresponds to the transmitted access information, and allow user access to the implantable device feature according to the verification.

In Example 23, the subject matter of one or any combination of Examples 21 and 22 optionally includes a scanning circuit. The communication circuit is optionally configured to transmit a barcode receivable by a telephone associated

with the user identity information, the scanning circuit is optionally configured to scan a barcode displayed on the telephone, and the control circuit is optionally configured to verify that the scanned barcode is the same as the transmitted barcode.

In Example 24, the subject matter of one or any combination of Examples 21-23 optionally includes a port is configured to receive biometric information of a user.

In Example 25, the subject matter of one or any combination of Examples 21-24 optionally includes a camera. The control circuit is optionally configured to initiate obtaining an image of a user given access to the external device, and include the image in a record of access to the external device.

In Example 26, the subject matter of one or any combination of Examples 21-25 optionally includes a control circuit configured to detect a change in location of the external device, and change user access to one or more implantable device features according to the changed location and identity information.

In Example 27, the subject matter of one or any combination of Examples 21-26 optionally includes a control circuit configured to disable the external device when determining that the location of the external device is outside of an approved area for the user identity information.

In Example 28, the subject matter of one or any combination of Examples 21-27 optionally includes a locating circuit configured to determine the location of the external device using at least one of a global positioning system (GPS), wireless fidelity (WiFi) network mapping, cellular telephone tower identification, and local area network (LAN) identification.

Example 29 can include subject matter (such as a method, a means for performing acts, or a machine-readable medium including instructions that, when performed by the machine, cause the machine to perform acts), or can optionally be combined with the subject matter of one or any combination of Examples 1-28 to include such subject matter, comprising: receiving a wireless communication signal using an external device (the external device is configured to communicate with an implantable device and receive the wireless communication signal from at least a third device), determining, by the external device, a location of the external device

according to the received communication signal, receiving user identity information into the external device, and configuring, by the external device, user access to an implantable device feature according to the determined location and received user identity information.

Such subject matter can include means for receiving a wireless communication signal using an external device, an illustrative example of which include a communication circuit configured to communicate wirelessly with one or more of a LAN, a cellular telephone network, a GPS, or a proprietary medical device telemetry system or circuit. Such subject matter can include means for determining a location of the external device according to the received communication signal, an illustrative example of which is a locating circuit included in the external device. Such subject matter can include means for receiving user identity information into the external device, an illustrative example of which includes a port such as a COMM port, that communicates serially using a standard protocol such as a USB protocol or firewire protocol, or a parallel COMM port. Such subject matter can include means for configuring user access to an implantable device feature according to the determined location and received user identity information, an illustrative example of which is a control circuit that can include a microprocessor, a digital signal processor, application specific integrated circuit (ASIC), or other type of processor.

In Example 30, the subject matter of Example 29 optionally includes transmitting access information, associated with the user identity information, receivable by a fourth device, receiving the access information into the external device, and verifying that the received access information corresponds to the transmitted access information.

In Example 31 the subject matter of one or any combination of Examples 29 and 30 optionally includes receiving biometric information of a user into the external device.

In Example 32, the subject matter of one or any combination of Examples 29-31 optionally includes determining that the location of the external device has

changed, and reconfiguring the user access according to the changed location and user identity information.

Example 33 includes subject matter (such as an apparatus), or can optionally be combined with the subject matter of one or any combination of Examples 1-32 to include such subject matter, comprising an external device. The external device can include: a communication circuit configured to communicate with an implantable device, a user interface, a control circuit electrically coupled to the user interface and communication circuit and configured to present a user option to disable delivery of defibrillation therapy by the implantable device, a port configured to receive an indication into the external device to disable delivery of the defibrillation therapy. The control circuit is also configured to communicate a disable of the defibrillation therapy to the implantable device in response to receiving the indication, detect a triggering event, and present an alert to a user when the triggering event occurs and defibrillation therapy by the implantable device remains disabled.

In Example 34, the subject matter of Example 33 optionally includes a timer circuit electrically coupled to or integral to the control circuit. The control circuit is optionally configured to: initiate timing of a specified time duration by the timer circuit in response to communication of the disable to the implantable device, generate the alert when the specified time duration expires and the defibrillation therapy by the implantable device remains disabled, and maintain circuit power to the timer circuit until at least one of the defibrillation therapy by the implantable device is enabled or the alert is generated.

In Example 35, the subject matter of Example 33 optionally includes a control circuit configured to: communicate an indication that delivery of defibrillation therapy is disabled to a server remote from the external device, communicate an indication that delivery of defibrillation therapy is re-enabled to the remote server, and receive the alert from the remote server when the remote server fails to receive the indication that the delivery of defibrillation therapy is re-enabled a specified time duration after receiving the indication that delivery of defibrillation therapy is disabled.

In Example 36, the subject matter of Example 33 optionally includes a control circuit configured to receive the alert from the implantable device when the control circuit fails to re-enable the delivery of defibrillation therapy after a specified time duration.

In Example 37, the subject matter of one or any combination of Examples 33-36 optionally includes a locating circuit configured to determine a location of the external device, and the control circuit is optionally configured to generate the alert when determining that the location of the external device has changed while defibrillation therapy by the implantable device remains disabled.

Example 38 can include subject matter (such as a method, a means for performing acts, or a machine-readable medium including instructions that, when performed by the machine, cause the machine to perform acts), or can optionally be combined with the subject matter of one or any combination of Examples 1-37 to include such subject matter, comprising: presenting a user option to disable delivery of defibrillation therapy by an implantable device, wherein the external device is configured to communicate with the implantable device, receiving an indication into the external device to disable delivery of the defibrillation therapy and disabling the defibrillation therapy in response thereto, and generating an alert when a triggering event occurs and defibrillation therapy by the implantable device remains disabled.

Such subject matter can include means for presenting a user option to disable delivery of defibrillation therapy by an implantable device, an illustrative example of which includes a user interface on the external device or a separate device and the user interface having a display. Such subject matter can include means for communicating with the implantable device, an illustrative example of which includes a far-field radio frequency transceiver or a near field inductive telemetry circuit. Such subject matter can include means for receiving an indication into the external device to disable delivery of the defibrillation therapy, an illustrative example of which includes a port such as a COMM port, that communicates serially using a standard protocol such as a USB protocol or firewire protocol, a parallel COMM port, or a port connected to a user interface having a mouse or keypad. Such subject matter can include means for disabling the defibrillation therapy, an

illustrative example of which includes a control circuit that includes logic circuits, a microprocessor, a digital signal processor, application specific integrated circuit (ASIC), or other type of processor. Such subject matter can include means for generating an alert when a triggering event occurs and defibrillation therapy by the implantable device remains disabled, an illustrative example of which includes a control circuit.

In Example 39, the subject matter of Example 38 can optionally include initiating a timer circuit of the remote server in response to the received indication, and communicating the alert from the remote server to the external device and presenting the alert to a user via the external device. The triggering event can optionally include a timeout of the timer circuit of the remote server while defibrillation therapy by the implantable device remains disabled.

In Example 40, the subject matter of Example 38 optionally includes determining, by the external device, a location of the external device. The triggering event optionally includes the external device determining that the location has changed while defibrillation therapy by the implantable device remains disabled.

Example 41 can include, or can optionally be combined with any portion or combination of any portions of any one or more of Examples 1-40 to include, subject matter that can include means for performing any one or more of the functions of Examples 1-40, or a machine-readable medium including instructions that, when performed by a machine, cause the machine to perform any one or more of the functions of Examples 1-40.

Each of these non-limiting examples can stand on its own, or can be combined in various permutations or combinations with one or more of the other examples.

The above detailed description includes references to the accompanying drawings, which form a part of the detailed description. The drawings show, by way of illustration, specific embodiments in which the invention can be practiced. These embodiments are also referred to herein as "examples." All publications, patents, and patent documents referred to in this document are incorporated by

reference herein in their entirety, as though individually incorporated by reference. In the event of inconsistent usages between this document and those documents so incorporated by reference, the usage in the incorporated reference(s) should be considered supplementary to that of this document; for irreconcilable inconsistencies, the usage in this document controls.

In this document, the terms "a" or "an" are used, as is common in patent documents, to include one or more than one, independent of any other instances or usages of "at least one" or "one or more." In this document, the term "or" is used to refer to a nonexclusive or, such that "A or B" includes "A but not B," "B but not A," and "A and B," unless otherwise indicated. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein." Also, in the following claims, the terms "including" and "comprising" are open-ended, that is, a system, device, article, or process that includes elements in addition to those listed after such a term in a claim are still deemed to fall within the scope of that claim. Moreover, in the following claims, the terms "first," "second," and "third," etc. are used merely as labels, and are not intended to impose numerical requirements on their objects.

Method examples described herein can be machine or computer-implemented at least in part. Some examples can include a computer-readable medium or machine-readable medium encoded with instructions operable to configure an electronic device to perform methods as described in the above examples. An implementation of such methods can include code, such as microcode, assembly language code, a higher-level language code, or the like. Such code can include computer readable instructions for performing various methods. The code can form portions of computer program products. Further, the code can be tangibly stored on one or more volatile or non-volatile computer-readable media during execution or at other times. These computer-readable media can include, but are not limited to, hard disks, removable magnetic disks, removable optical disks (e.g., compact disks and digital video disks), magnetic cassettes, memory cards or sticks, random access memories (RAM's), read only memories (ROM's), and the like.

The above description is intended to be illustrative, and not restrictive. For example, the above-described examples (or one or more aspects thereof) may be used in combination with each other. Other embodiments can be used, such as by one of ordinary skill in the art upon reviewing the above description. The Abstract is provided to comply with 37 C.F.R. §1.72(b), to allow the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims. Also, in the above Detailed Description, various features may be grouped together to streamline the disclosure. This should not be interpreted as intending that an unclaimed disclosed feature is essential to any claim. Rather, inventive subject matter may lie in less than all features of a particular disclosed embodiment. Thus, the following claims are hereby incorporated into the Detailed Description, with each claim standing on its own as a separate embodiment. The scope of the invention should be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

THE CLAIMED INVENTION IS:

1. An external device for communication with an implantable device, the external device comprising:

a communication circuit configured to receive a communication signal from at least one other device different from the implantable device;

a locating circuit configured to determine a location of the external device using the received communication signal; and

a control circuit electrically coupled to the communication circuit and the locating circuit and configured to:

determine whether the determined location imposes a limit on functionality of an implantable device; and

provide user access to an implantable device feature according to the determined location.

2. The external device of claim 1, wherein control circuit is configured to determine that the location of the external device is at least one of an operating room (OR), an emergency room (ER), a magnetic resonance imaging (MRI) clinic, a catheterization laboratory, a cardiology clinic, an electrophysiology clinic, a hospital, and a general practice clinic.

3. The external device of claim 1, wherein the locating circuit is configured to determine the location of the external device using at least one of global positioning, wireless fidelity (WiFi) network mapping, cellular telephone tower identification, and local area network (LAN) identification.

4. The external device of claim 3, including:

an activity sensor electrically coupled to the locating circuit,

wherein the locating circuit is configured to estimate the location of the external device according to the location determined using the received communication signal and subsequent motion sensed using the activity sensor.

5. The external device of claim 1, including a user interface electrically coupled to the control circuit, wherein the control circuit is configured to:

present, using the user interface, the implantable device feature as available to a user according to the determined location; and

exclude presentation by the user interface of an implantable device feature limited by the determined location.

6. The external device of claim 5, wherein in response to the locating circuit determining that the location of the external device is an ER, the control circuit is configured to allow, via the user interface, a user to at least one of:

enable or disable delivery of defibrillation therapy by the implantable device; and

change a tachyarrhythmia detection rate of the implantable device.

7. The external device of claim 5,

wherein in response to the locating circuit determining that the location of the external device is an OR, the control circuit is configured to allow, via the user interface, a user to initiate an electrocautery mode in the implantable device, wherein defibrillation therapy is disabled in the electrocautery mode, and

wherein, when the electrocautery mode is initiated by a user, the control circuit is configured to:

present a first alert to a user that delivery of defibrillation therapy is disabled,

initiate a timer in the external device; and

generate a second alert, upon timeout of the timer, regarding the disabled defibrillation therapy.

8. The external device of claim 5, wherein in response to the locating circuit determining that the location of the external device is an MRI clinic, the control circuit is configured to allow, via the user interface, a user to at least one of:

enable an MRI mode in which cardiac pacing pulses are delivered asynchronously and at a rate higher than a determined intrinsic rate; and

initiate a device-automated pacing threshold test.

9. The external device of claim 5, wherein in response to the locating circuit determining that the location of the external device is a general practice clinic, the control circuit is configured to allow, via the user interface, user read-access to at least a portion of information stored in the implantable device.

10. The external device of claim 5, wherein the control circuit is configured to display the user interface in a language specified for the determined location.

11. The external device of claim 1, including:

a memory circuit integral to or electrically coupled to the control circuit,

wherein the locating circuit is configured to identify a communication network associated with the determined location, and

wherein the control circuit is configured to store an identifier for the communication network in the memory circuit in association with the determined location.

12. The external device of any one of claims 1-11, wherein the control circuit is configured to:

selectively load information stored in the implantable device according to the determined location;

identify a remote server according to the determined location; and

communicate the information to the remote server absent participation by a user.

13. A method comprising:

receiving a wireless communication signal using an external device, wherein the external device is configured to communicate with an implantable device and receive the wireless communication signal from at least one other device;

determining, by the external device according to the received communication signal, a location of the external device and that the determined location is associated with limiting functionality of the implantable device; and

configuring, by the external device, user access to an implantable device feature according to the determined location.

14. The method of claim 13, wherein the determining a location of the external device includes the external device determining that the location is at least one of an operating room (OR), an emergency room (ER), a magnetic resonance imaging (MRI) clinic, a catheterization laboratory, a cardiology clinic, an electrophysiology clinic, a hospital, and a general practice clinic.

15. The method of claim 13, wherein the determining a location of the external device includes the external device determining the location using at least one of a global positioning system (GPS), wireless fidelity (WiFi) network mapping, cellular telephone tower identification, and local area network (LAN) identification.

16. The method of claim 13,

wherein the determining a location of the external device includes the external device determining that the location is a location where defibrillation therapy should be turned off in the implantable device, and

wherein the configuring user access to an implantable device feature includes the external device enabling user access for at least one of:

disabling delivery of defibrillation therapy by the implantable device; and

presenting a reminder to enable defibrillation therapy when the defibrillation therapy is disabled.

17. The method of claim 13,

wherein the determining a location of the external device includes the external device determining that the location is an OR, and

wherein the configuring user access to an implantable device feature includes the external device enabling user access for initiating an electrocautery mode in the implantable device.

18. The method of claim 13,

wherein the determining a location of the external device includes the external device determining that the location is an MRI clinic, and

wherein the configuring user access to an implantable device feature includes the external device enabling at least one of:

user access to enable an MRI mode in which pacing therapy is delivered asynchronously at a rate higher than a determined intrinsic rate; and

user access to enable a device-automated pacing threshold test.

19. The method of claim 13,

wherein the determining a location of the external device includes the external device determining that the location is a general practice clinic, and

wherein the configuring user access to an implantable device feature includes the external device enabling user read-access to at least a portion of data stored in the implantable device.

20. The method of any one of claims 13-19, including:

selectively loading, by the external device, information stored in the implantable device according to the determined location;

identifying a remote server according to the determined location; and

communicating the information to the remote server absent participation by a user.

21. An external device for communication with an implantable device, the external device comprising:

a communication circuit configured to receive a communication signal from at least a third device separate from the external device and the implantable device;

a locating circuit configured to determine a location of the external device using the received communication signal;

a port configured to receive user identity information into the external device; and

a control circuit electrically coupled to the communication circuit, the locating circuit, and the port, wherein the control circuit is configured to allow user access to an implantable device feature according to the determined location and received user identity information.

22. The external device of claim 21,

wherein the communication circuit is configured to:

transmit access information receivable by a fourth device that is associated with the user identity information; and

receive the access information into the external device, and

wherein the control circuit is configured to:

verify that the received access information corresponds to the transmitted access information; and

allow user access to the implantable device feature according to the verification.

23. The external device of claim 22, including a scanning circuit,

wherein the communication circuit is configured to transmit a barcode receivable by a telephone associated with the user identity information,

wherein the scanning circuit is configured to scan a barcode displayed on the telephone, and

wherein the control circuit is configured to verify that the scanned barcode is the same as the transmitted barcode.

24. The external device of claim 21, wherein the port is configured to receive biometric information of a user.

25. The external device of claim 21, including a camera, wherein the control circuit is configured to:

initiate obtaining an image of a user given access to the external device; and

include the image in a record of access to the external device.

26. The external device of claim 21, wherein the control circuit is configured to:

detect a change in location of the external device; and

change user access to one or more implantable device features according to the changed location and identity information.

27. The external device of claim 21, wherein the control circuit is configured to disable the external device when determining that the location of the external device is outside of an approved area for the user identity information.

28. The external device of any one of claim 21-27, wherein the locating circuit is configured to determine the location of the external device using at least one of a global positioning system (GPS), wireless fidelity (WiFi) network mapping, cellular telephone tower identification, and local area network (LAN) identification.

29. A method comprising:

receiving a wireless communication signal using an external device, wherein the external device is configured to communicate with an implantable device and receive the wireless communication signal from at least a third device;

determining, by the external device, a location of the external device according to the received communication signal;

receiving user identity information into the external device; and

configuring, by the external device, user access to an implantable device feature according to the determined location and received user identity information.

30. The method of claim 29, including:

transmitting, by the external device, access information receivable by a fourth device, wherein the access information is associated with the user identity information;

receiving the access information into the external device; and

verifying, with the external device, that the received access information corresponds to the transmitted access information.

31. The method of claim 29, wherein receiving user identity information into the external device includes receiving biometric information of a user into the external device.

32. The method of any one of claims 29-31, including:

determining, by the external device, that the location of the external device has changed; and

reconfiguring the user access according to the changed location and user identity information.

33. An external device comprising:

a communication circuit configured to communicate with an implantable device;

a user interface;

a control circuit electrically coupled to the user interface and communication circuit and configured to present a user option to disable delivery of defibrillation therapy by the implantable device;

a port configured to receive an indication into the external device to disable delivery of the defibrillation therapy, and

wherein the control circuit is further configured to:

communicate a disable of the defibrillation therapy to the implantable device in response to receiving the indication;

detect a triggering event; and

present an alert to a user when the triggering event occurs and defibrillation therapy by the implantable device remains disabled.

34. The external device of claim 33, including:

a timer circuit electrically coupled to or integral to the control circuit;

wherein the control circuit is configured to:

initiate timing of a specified time duration by the timer circuit in response to communication of the disable to the implantable device;

generate the alert when the specified time duration expires and the defibrillation therapy by the implantable device remains disabled; and

maintain circuit power to the timer circuit until at least one of the defibrillation therapy by the implantable device is enabled or the alert is generated.

35. The external device of claim 33, wherein the control circuit is configured to:

communicate an indication that delivery of defibrillation therapy is disabled to a server remote from the external device;

communicate an indication that delivery of defibrillation therapy is re-enabled to the remote server; and

receive the alert from the remote server when the remote server fails to receive the indication that the delivery of defibrillation therapy is re-enabled a specified time duration after receiving the indication that delivery of defibrillation therapy is disabled.

36. The external device of claim 33, wherein the control circuit is configured to receive the alert from the implantable device when the control circuit fails to re-enable the delivery of defibrillation therapy after a specified time duration.

37. The external device of any one of claims 33-37, including:

a locating circuit configured to determine a location of the external device,

wherein the control circuit is configured to generate the alert when determining that the location of the external device has changed while defibrillation therapy by the implantable device remains disabled.

38. A method comprising:

presenting, by an external device, a user option to disable delivery of defibrillation therapy by an implantable device, wherein the external device is configured to communicate with the implantable device;

receiving an indication into the external device to disable delivery of the defibrillation therapy and disabling the defibrillation therapy in response thereto; and

generating an alert when a triggering event occurs and defibrillation therapy by the implantable device remains disabled.

39. The method of claim 38, including:

communicating the indication to disable delivery of defibrillation therapy to a server remote from the external device;

initiating a timer circuit of the remote server in response to the received indication, wherein the triggering event includes a timeout of the timer circuit of the remote server while defibrillation therapy by the implantable device remains disabled; and

communicating the alert from the remote server to the external device and presenting the alert to a user via the external device.

40. The method of any one of claims 38 and 39, including:

determining, by the external device, a location of the external device, and

wherein the triggering event includes the external device determining that the location has changed while defibrillation therapy by the implantable device remains disabled.

5

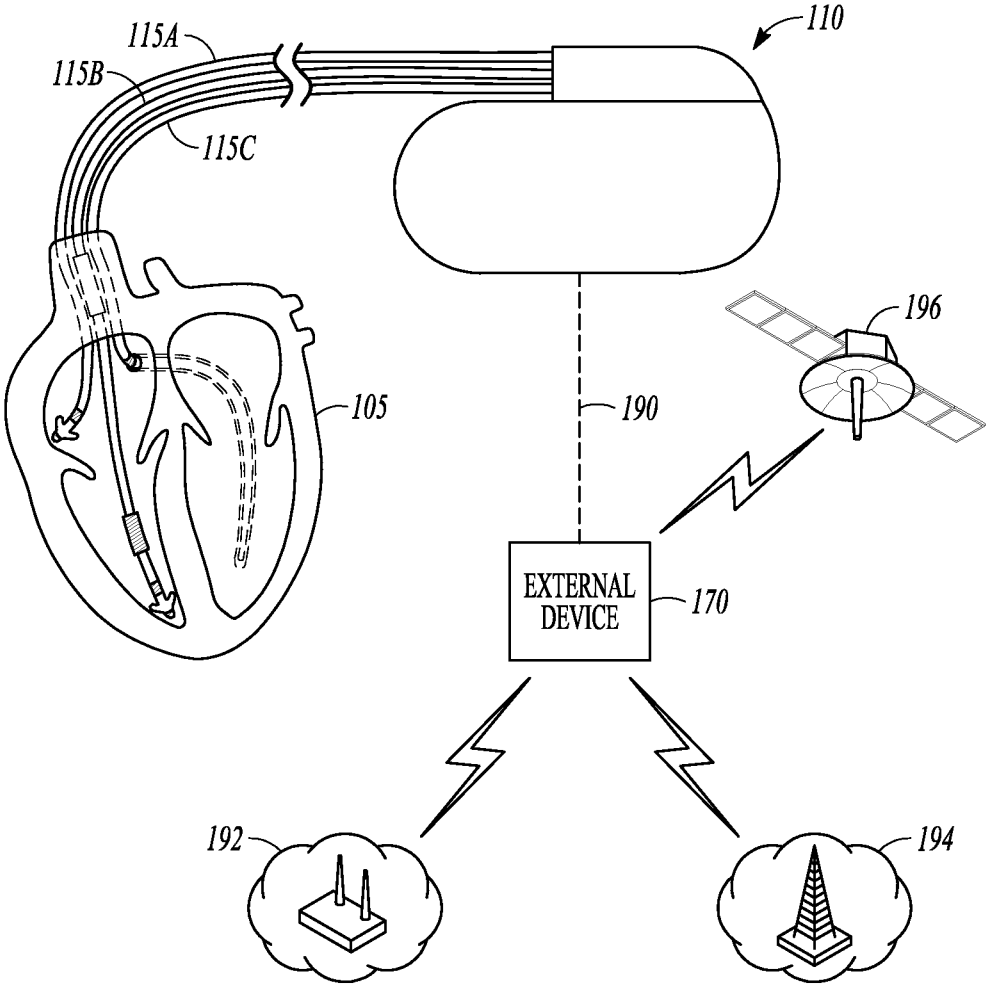


*FIG. 1*

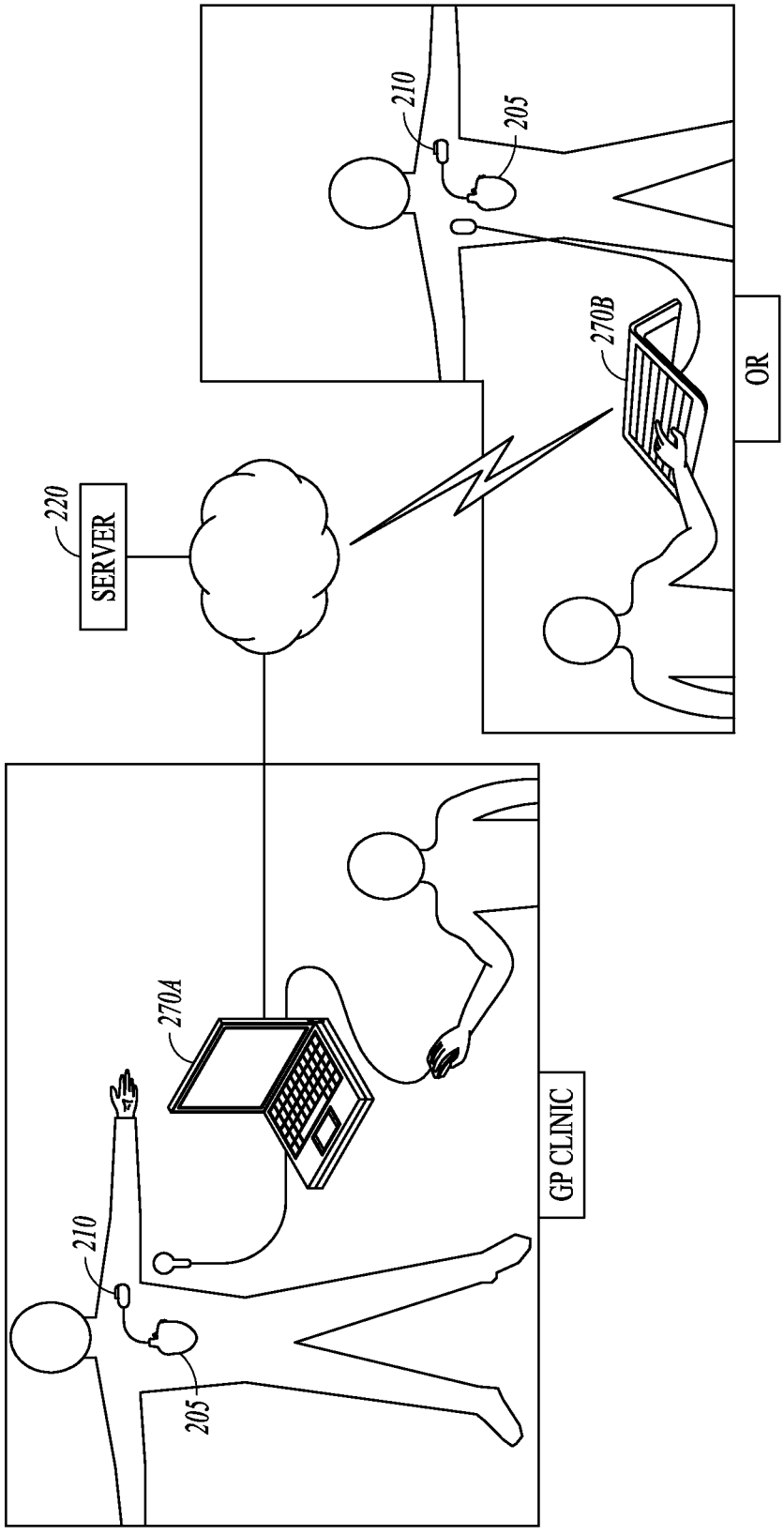


FIG. 2

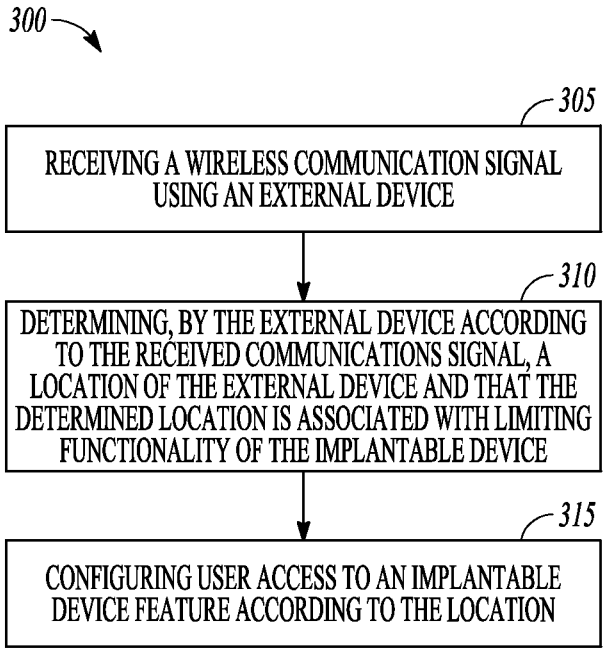
300
305
RECEIVING A WIRELESS COMMUNICATION SIGNAL USING AN EXTERNAL DEVICE
310
DETERMINING, BY THE EXTERNAL DEVICE ACCORDING TO THE RECEIVED COMMUNICATIONS SIGNAL, A LOCATION OF THE EXTERNAL DEVICE AND THAT THE DETERMINED LOCATION IS ASSOCIATED WITH LIMITING FUNCTIONALITY OF THE IMPLANTABLE DEVICE
315
CONFIGURING USER ACCESS TO AN IMPLANTABLE DEVICE FEATURE ACCORDING TO THE LOCATION

*FIG. 3*

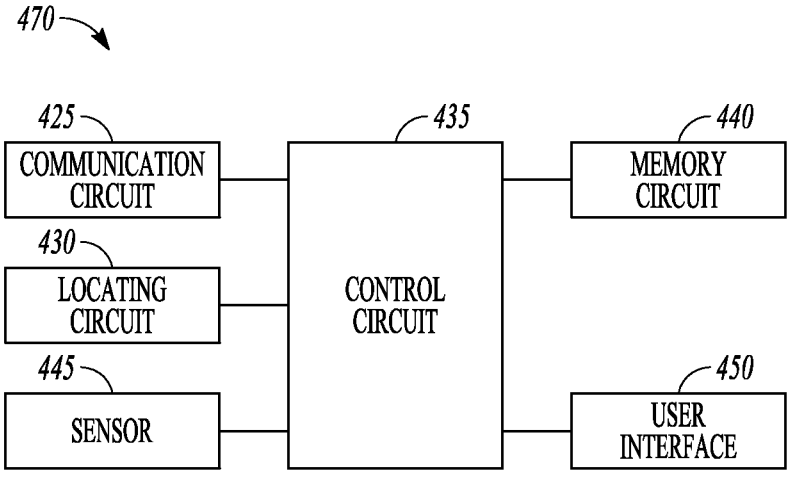
470
425
COMMUNICATION CIRCUIT
430
LOCATING CIRCUIT
445
SENSOR
435
CONTROL CIRCUIT
440
MEMORY CIRCUIT
450
USER INTERFACE

*FIG. 4*

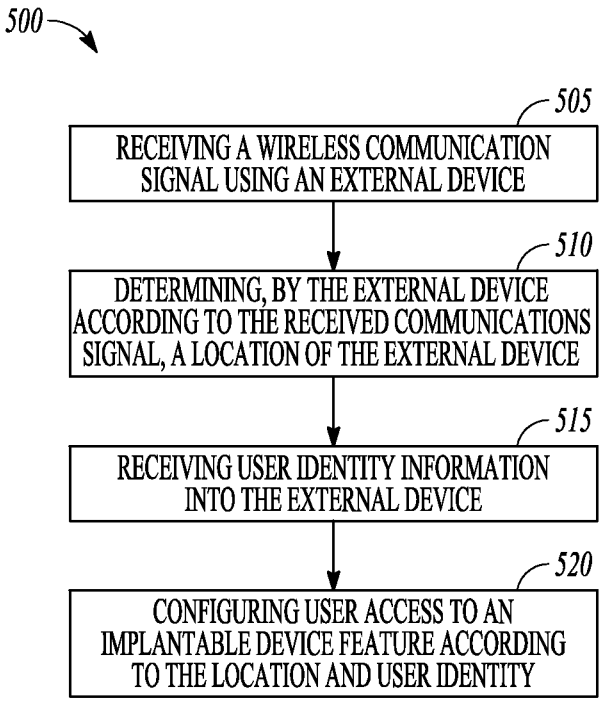
500
505
RECEIVING A WIRELESS COMMUNICATION SIGNAL USING AN EXTERNAL DEVICE
510
DETERMINING, BY THE EXTERNAL DEVICE ACCORDING TO THE RECEIVED COMMUNICATIONS SIGNAL, A LOCATION OF THE EXTERNAL DEVICE
515
RECEIVING USER IDENTITY INFORMATION INTO THE EXTERNAL DEVICE
520
CONFIGURING USER ACCESS TO AN IMPLANTABLE DEVICE FEATURE ACCORDING TO THE LOCATION AND USER IDENTITY

*FIG. 5*

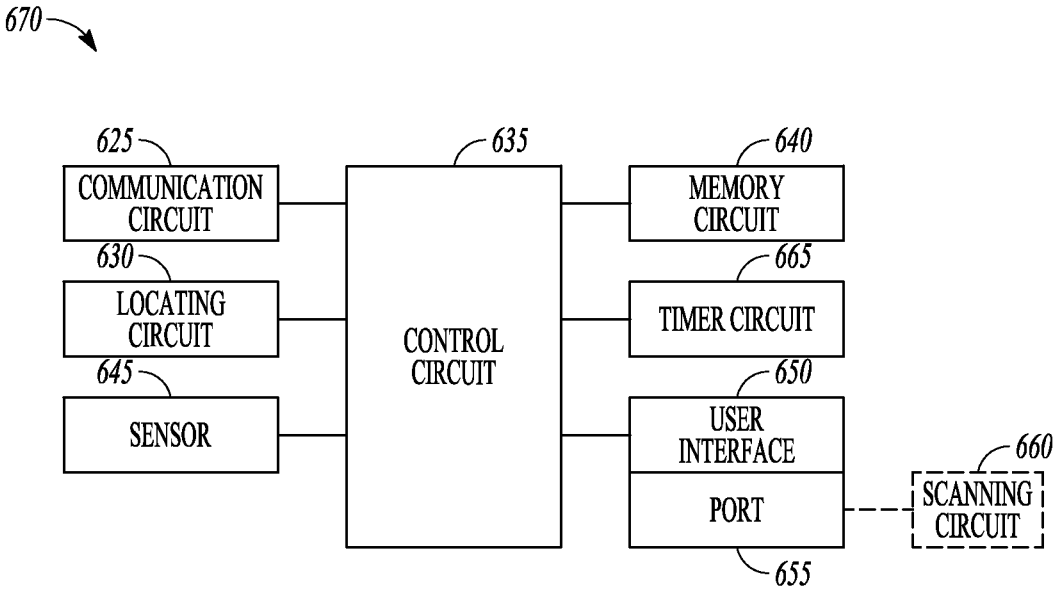
670
625
COMMUNICATION CIRCUIT
630
LOCATING CIRCUIT
645
SENSOR
635
CONTROL CIRCUIT
640
MEMORY CIRCUIT
665
TIMER CIRCUIT
650
USER INTERFACE
PORT
655
660
SCANNING CIRCUIT

*FIG. 6*

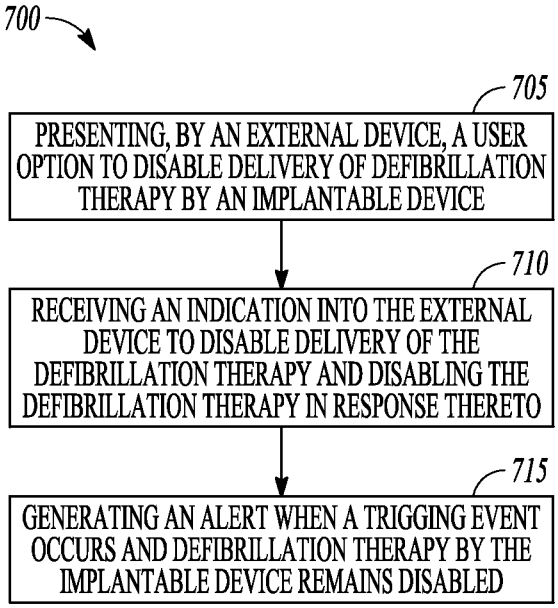
700
705
PRESENTING, BY AN EXTERNAL DEVICE, A USER OPTION TO DISABLE DELIVERY OF DEFIBRILLATION THERAPY BY AN IMPLANTABLE DEVICE
710
RECEIVING AN INDICATION INTO THE EXTERNAL DEVICE TO DISABLE DELIVERY OF THE DEFIBRILLATION THERAPY AND DISABLING THE DEFIBRILLATION THERAPY IN RESPONSE THERETO
715
GENERATING AN ALERT WHEN A TRIGGING EVENT OCCURS AND DEFIBRILLATION THERAPY BY THE IMPLANTABLE DEVICE REMAINS DISABLED

*FIG. 7*

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/040736

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searohable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applioant. Consequently, this international search report is restrioted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-32

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/040736

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61N1/372 A61B5/00
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61N A61B

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 2009/063187 A1 (JOHNSON DAVID C [US] ET AL) 5 March 2009 (2009-03-05)<br>abstract; figures 1A-E, 5A<br>paragraphs [0007] - [0008], [0035] - [0082]<br>----- | 1-32 |
| A | US 6 083 248 A (THOMPSON DAVID L [US])<br>4 July 2000 (2000-07-04)<br>abstract; figures 1-3, 7<br>column 4, line 64 - column 6, line 14<br>column 8, lines 6-65<br>----- | 1-32 |
| A | WO 2012/063154 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]; PATEL MAULIN DAHYABHAI [US]) 18 May 2012 (2012-05-18)<br>abstract; figures 1-4<br>page 2, line 5 - page 3, line 24<br>page 4, line 10 - page 8, line 5<br>----- | 1-32 |

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 29 August 2013 | 31/01/2014 |

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

2

Form PCT/ISA/210 (second sheet) (April 2005)

# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/040736

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 2006/287693 A1 (KRAFT CLIFFORD [US] ET AL) 21 December 2006 (2006-12-21) the whole document | 1-32 |

2

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2013/040736

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 2009063187 A1 | 05-03-2009 | EP 2185065 A2 | 19-05-2010 |
| | | JP 5254339 B2 | 07-08-2013 |
| | | JP 2011502369 A | 20-01-2011 |
| | | US 2009063187 A1 | 05-03-2009 |
| | | WO 2009032134 A2 | 12-03-2009 |
| US 6083248 A | 04-07-2000 | EP 1133255 A1 | 19-09-2001 |
| | | US RE42934 E1 | 15-11-2011 |
| | | US 6083248 A | 04-07-2000 |
| | | WO 0030529 A1 | 02-06-2000 |
| WO 2012063154 A1 | 18-05-2012 | CN 103200862 A | 10-07-2013 |
| | | EP 2637552 A1 | 18-09-2013 |
| | | JP 2013544585 A | 19-12-2013 |
| | | US 2013245387 A1 | 19-09-2013 |
| | | WO 2012063154 A1 | 18-05-2012 |
| US 2006287693 A1 | 21-12-2006 | NONE | |

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/** 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-32

External devices and methods for communicating with an implantable device. A contribution to the art seems to reside in the features of determining the functionality of and providing user access to the implantable device based on the location of the external device, thereby solving the problem of simplifying the interaction with and programming of implantable devices.

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2. claims: 33-40

An external device and method for communicating with an implantable device. A contribution to the art might reside in the features of disabling defibrillation therapy, thereby solving the problem of improving the reliability of therapy delivery by caregivers.

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| | | | |
|---|---|---|---|
| 专利名称(译) | 基于位置的用户访问和编程植入式医疗设备 | | |
| 公开(公告)号 | EP2888001A1 | 公开(公告)日 | 2015-07-01 |
| 申请号 | EP2013728263 | 申请日 | 2013-05-13 |
| [标]申请(专利权)人(译) | 心脏起搏器股份公司 | | |
| 申请(专利权)人(译) | 心脏起搏器，INC. | | |
| 当前申请(专利权)人(译) | 心脏起搏器，INC. | | |
| [标]发明人 | HOYME KENNETH P<br>KALGREN JAMES<br>LALONDE JOHN | | |
| 发明人 | HOYME, KENNETH P.<br>KALGREN, JAMES<br>LALONDE, JOHN | | |
| IPC分类号 | A61N1/372 A61B5/00 | | |
| CPC分类号 | A61B5/0033 A61N1/37247 A61N1/37264 | | |
| 代理机构(译) | PETERREINS，FRANK | | |
| 优先权 | 61/693398 2012-08-27 US<br>61/693402 2012-08-27 US | | |
| 其他公开文献 | EP2888001B1 | | |
| 外部链接 | Espacenet | | |


摘要(译)

一种装置包括用于与可植入装置通信的外部装置。外部设备包括：通信电路，被配置为从不同于可植入设备的至少一个其他设备接收通信信号;定位电路，被配置为使用所接收的通信信号确定外部设备的位置;以及控制电路，电连接到通信电路和定位电路。控制电路被配置为确定确定的位置是否对可植入设备的功能施加限制，并且根据确定的位置向用户提供对可植入设备特征的访问。