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(54) Title: A REMOTE PATIENT MANAGEMENT DEVICE AND METHOD

(57) Abstract: The present invention relates to a remote patient management device (1) and method (1000) which facilitates to particularly follow up chronic diseases and keep them under control and enables to transfer measurement results,which should be made by people with these diseases and transmitted to healthcare personnel properly, in an easy and safe way automatically.

A REMOTE PATIENT MANAGEMENT DEVICE AND METHOD

Technical Field

The present invention relates to a remote patient management device and method which facilitates to particularly follow up chronic diseases and keep them under control.

Background of the Invention

Nowadays, healthcare personnel such as nurse, doctor can follow up patient's condition from a distance by means of wire or wireless communication devices. Particularly, patients with chronic diseases can be followed up with remote patient follow-up systems. People with these diseases are enabled to make tests, which are required to be realized, by themselves away from healthcare personnel and it is not necessary anymore for the patient to make effort to go to a health centre by means of these systems. After the patient make the tests required by means of the medical devices owned by him/her, data concerning the test are automatically transmitted to health centres where healthcare personnel are present or medical data centre whereto healthcare personnel can have access.

There are systems which are known in the state of the art and enable to follow up patient's condition from a distance. In addition, in the state of the art there are special software which have bluetooth capacity on thereof and are prepared for mobile devices such as mobile phones whereto software can be installed from outside in order to make contact with medical measuring devices that have bluetooth short-range wireless communication capacity, collect and transmit test measurement results to another information system. However, installation of this software and carrying out bluetooth matches between the mobile device and medical devices include difficulties particularly for users who are elder, children, with mental disabilities or with a low level of education. Also, it is required that health measurement values can be transferred from medical device to mobile device,

mobile device is on and in operation, bluetooth services are available and software collecting data on thereof is in operation as well. Each requirement is supposed to be controlled by the user before and after measurement because data communication cannot be provided in cases where any of the said requirements is not ensured. Leaving bluetooth services on and the fact that communication software is always in operation increase energy consumption of mobile device. And this is not preferred by users. In addition to these, keeping bluetooth service continuously on leads to serious security risks in mobile devices in which sensitive personal information can be stored.

In the state of the art, there are also systems which manage medical devices via short-range communication methods and gather data. The said systems are designed as medical data collection devices for general purpose and need complex user interactions both at the step of start using and regular use. In addition, due to the fact that sizes of the said systems can be large as well these devices have portability problems.

The International patent document no. WO2008/073584 discloses a wireless processing system and method of monitoring a medical device and connecting to a medical device. In an embodiment of the invention which is disclosed in the said International patent document, the system comprises a processor, a medical device transceiver, a user interface, a data transmission transceiver, a memory that is connected to the processor and storage members. The medical device transceiver enables to receive medical data from a plurality of medical devices wirelessly. Medical data received are transmitted to an intermediate device by means of a data transmission transceiver. The user interface provided in the system may comprise microphone and speaker in order that the system and the user are in voice communication.

The United States patent document no. US20 10/0049005 discloses a wireless device which enables transmission of medical data. The said device comprises a wireless interface, a processor and a medical equipment interface which enables to make

contact with the medical equipment. The processor is in touch with the medical equipment interface and the wireless interface. The protocol adaptation takes place from a protocol of incoming data received at the medical equipment interface to a protocol of data to be transmitted through the wireless interface, or vice versa. The data protocol comprises filtering, gathering, partitioning, prioritizing or discarding the incoming data individually or in group.

Summary of the Invention

Objective of the invention is to realize a remote patient management device and method which enables people with chronic disease to make their tests on a regular basis and transmission of test measurement values to healthcare personnel reliably.

Another objective of the invention is to realize a remote patient management device and method which can establish a connection with medical devices defined and manage the said devices.

A yet another objective of the invention is to realize a remote patient management device and method which provides information such as time, calibration, etc. and information necessary for operation of medical devices defined to said devices.

A further objective of the invention is to realize a remote patient management device and method which can read results of measurements carried out by medical devices defined.

A yet further objective of the invention is to realize a remote patient management device and method which performs operations with minimum user interaction.

Detailed Description of the Invention

The "Remote Patient Management Device and Method" realized to fulfil the objectives of the present invention is shown in the figures attached, in which:

Figure 1 is a schematic view of the inventive remote patient management device.

Figure 2 is a schematic view of architecture of the inventive remote patient management device.

Figure 3 is a flow diagram regarding the inventive remote patient management method.

Figure 4 is a flow diagram regarding step of "making suitability for operation test of device sub-systems and updates thereof involved in the inventive remote patient management method.

Figure 5 is continuation of the flow diagram provided in the Figure 4.

Figure 6 is a flow diagram regarding step of "matching the device with at least one medical device" involved in the inventive remote patient management method.

Figure 7 is continuation of the flow diagram provided in the Figure 6.

Figure 8 is a flow diagram regarding step of "obtaining results of measurements from the medical device and transmitting them to a remote server" involved in the inventive remote patient management method.

Figure 9 is continuation of the flow diagram provided in the Figure 8.

The components illustrated in the figures are individually numbered, where the numbers refer to the following:

1. Remote patient management device
2. Body
3. Visual unit
4. Sound generating unit
5. Input unit
6. Short-range communication module
7. Long-range communication module
8. Control module
9. Adaptation layer
10. Application
11. Processor

12. Medical device library

13. Update unit

14. Non-volatile memory

1000. Remote patient management method

Throughout the description, devices which make tests of patients as medical device, are portable or non-portable, get test results and can connect to the remote patient management device (1) via any wireless communication protocol are disclosed. A server where the remote patient management device (1) transmits the results of the test measurement received from the medical device, information about the remote patient management device (1) and the medical devices are present, and can connect to the remote patient management device (1) via any wireless communication protocol is mentioned as a remote server.

The inventive remote patient management device (1) comprises:

a body (2);

a plurality of visual units (3) which are located on the body (2) and enable to inform and warn the user visually;

at least one sound generating unit (4) which is located on the body (2) and enables to warn and inform the user vocally;

at least one input unit (5) which is located on the body (2) and enables the user to carry out input processes;

at least one short-range communication module (6) which is located in the body (2) and comprises at least one interface enabling to get in contact with devices that are present at short-range such as medical devices that will make tests of the patient;

at least one long-range communication module (7) which is located in the body (2) and comprises at least one interface enabling to get in contact with remote servers such as transmitting test measurement results of the patient to healthcare centers;

at least one control module (8) which enables the visual unit (3), the sound generating unit (4) and the input unit (5) to fulfil their duties and to carry out

short communication by means of the short-range communication module (6) and remote communication by means of the long-range communication module (7).

The inventive remote patient management device (1) also comprises at least two adaptation layers (9) which enable the control module (8) to interact with the short-range communication module (6) and the long-range communication module (7) in an isolated manner. The said adaptation layers (9) present a standard set of function, which is necessary for get in contact with medical devices and remote servers, to the control module (8).

The control module (8) involved in the inventive remote patient management device (1) comprises:

at least one application (10) which controls services that enable remote management of the device (1) and updates, and all components;

at least one processor (11) which enables to run the application (10);

at least one medical device library (12) in which identity information relating to the medical devices connected, treatment information and necessary operating information are included;

at least one update unit (13) which enables to control retrieval of information relating to the application (10) or the medical devices connected from remote server; and

at least one non-volatile memory (14) in which the application (10) and the medical device library (12) are kept confidential.

With the visual unit (3) provided in the inventive remote patient management device (1), the user is enabled to be informed about the operations carried out by the device (1). While the device (1) is performing a process in the event that an error occurs in the process, the visual unit (3) ensures that the user is warned about the error in the process in a luminous way. In addition, the visual unit (3) enables to inform the user that the process is concluded successfully in a luminous way as a result of the device (1) performing a process successfully. In a preferred embodiment of the invention,

as a result of completion of a process successfully colour of the light emitting from the visual unit (3) and the colour of the light emitting from the visual unit (3) in the event that an error occurs in a process are different so that the user will not be confused.

With the sound generating unit (4) provided in the inventive remote patient management device (1), the user is enabled to be informed about operations carried out by the device (1). While the device (1) is performing a process in the event that an error occurs in the process, the sound generating unit (4) ensures that the user is warned about the error in the process vocally. In addition, the sound generating unit (4) enables to inform the user that the process is concluded successfully vocally as a result of the device (1) performing a process successfully. In a preferred embodiment of the invention, as a result of completion of a process successfully the tone of the voice coming from the sound generating unit (4) and the tone of the voice coming from the sound generating unit (4) in the event that an error occurs in a process are different so that the user will not be confused.

With the input unit (5) provided in the inventive remote patient management device (1), information of user relating to processes are enabled to be input to the device (1) manually. For example, information about medical device which will make measurement relating to user's disease can be input to the device (1) by the user via the input unit (5) manually. In an embodiment of the invention, keypad is used as the input unit (5). In an alternative embodiment of the invention, touch screen is used as the input unit (5).

The short-range communication module (6) provided in the inventive remote patient management device (1) comprises at least one communication interface which enables the device (1) to get in contact with devices such as medical device located at short-range.

In an embodiment of the invention, the short-range communication module (6) comprises bluetooth communication interface which is defined by IEEE 802.15.1 standard.

In another embodiment of the invention, the short-range communication module (6) also comprises wireless personal networks communication interface which is defined by IEEE 802.15.4 standard.

In yet another embodiment of the invention, the short-range communication module (6) also comprises wireless fidelity (Wi-Fi) communication interface which is defined by IEEE 802. 11 series.

In a further embodiment of the invention, the short-range communication module (6) also comprises infrared communication interface.

In a yet further embodiment of the invention, the short-range communication module (6) also comprises wire serial communication interface.

Other than the above-mentioned examples, the short-range communication module (6) also comprises any short-range communication interface which can operate in accordance with the adaptation layer (9) located between the control module (8) and the short-range communication module (6).

The long-range communication module (7) provided in the inventive remote patient management device (1) comprises at least one communication interface which enables the device (1) to get in contact with the servers located at long-range.

In an embodiment of the invention, the long-range communication module (7) comprises communication interface of global system for mobile communications (GSM).

In an embodiment of the invention, the long-range communication module (7) also comprises Ethernet communication interface.

In an embodiment of the invention, the long-range communication module (7) also comprises wireless fidelity (Wi-Fi) communication interface.

Other than the above-mentioned examples, the long-range communication module (7) also comprises any long-range communication interface which can operate in accordance with the adaptation layer (9) located between the control module (8) and the long-range communication module (7).

In the inventive remote patient management device (1), the control module (8) can be activated or deactivated over the adaptation layers (9) of the short-range communication interfaces and long-range communication interfaces which are located inside the short-range communication module (6) and the long-range communication module (7).

In an embodiment of the invention, the long-range communication module (7) comprises at least one subscriber identity module (SIM). By means of the said subscriber identity module, measurement results received from medical devices are transmitted to remote servers such as health centres by being encrypted with certificate keys and encryption methods. Thus, unauthorized access to measurement results from the outside are prevented.

The remote patient management device (1) uses security keys, security certificates and digital signing methods which are provided by the subscriber identity module for secure communication and to store personal health data safely.

In an alternative embodiment of the invention, the inventive remote patient management device (1) comprises a rechargeable battery as power supply. The said battery enables to supply the power needed by the device (1) while the device (1) is performing its duties. In a derivative of this embodiment of the invention, the user is

warned about charging the battery by means of the visual unit (3) and the sound generating unit (4) when the battery charge level drops down below a predetermined level.

The inventive remote patient management device (1) can be available in preferably three different statuses so as to prevent high power consumption. In one of the said statuses, only the visual unit (3) and the sound generating unit (4) can receive energy from the battery, all remaining modules are deprived of energy. This status of the device (1) is called as off-mode. In another one of these statuses, all units in the device (1) can receive power from the battery. However, units are in sleep mode within the period while they are not used but they are in a position where they can be used at any time. This status of the device (1) is called as sleep mode. In another status of the device (1), all units receive energy from the battery. This status of the device (1) is called as operation mode. Due to the off-mode of the device (1), in transportation vehicles such as aircraft it is ensured that the device (1) can be carried without damaging electronic equipment of the transportation vehicle. Due to the sleep mode of the device (1), it is ensured that energy received from battery is reduced while the device (1) is not in operation mode and this provides longer battery life.

The remote patient management method (1000) which enables people with chronic disease to make their tests on a regular basis and transmission of test measurement values to healthcare personnel reliably essentially comprises steps of:

turning on the device (1) (1100);

making suitability for operation test of device (1) sub-systems and updates thereof (1200);

matching the device (1) with at least one medical device (1300);

obtaining results of measurements from the medical device and transmitting them to a remote server (1400); and

turning off the device (1) (1500).

In the inventive method (1000), firstly the device (1) is turned on and it is made operable (1100). Upon the device (1) starts operating, the application (10) carries out operation tests in order to determine whether the visual unit (3), the sound generating unit (4), the input unit (5), the short-range communication module (6), the long-range communication module (7) and the adaptation layers (9) of the device (1) operate properly; and enables updates to be loaded from remote servers in the event that there is a new update by interrogating whether there is any update relating to the device (1) (1200). After it is determined that sub-systems of the device (1) are suitable for operation and existing updates are loaded (1200), the device (1) is matched with medical device or devices enabling the patient to make measurements required for his/her health (1300). Subsequent to the matching process (1300), medical devices transfer the measurement results to the device and the device (1) transmits the said results reaching itself to the remote server (1400). The device (1) is turned off and the method is terminated after the measurement results are transmitted to the remote server.

Making suitability for operation test of device (1) sub-systems and updates thereof (1200) comprises sub-steps of:

booting the application (10), which is located in the non-volatile memory (14), by the processor (11) (1201);

running the application (10), booting of which is carried out, by the processor (11) (1202);

making suitability for operation tests of sub-systems by the application (10) (1203);

if it is determined that there is error during tests, giving the user visual and audible warning that there is error (1204);

reporting the error to the remote server (1205);

if it is determined that there is no error during tests, booting the data in the medical device library (12) and the user adjustment data in the non-volatile memory (14) by the processor (11) (1206);

establishing connection with the remote server by the application (10) over the long-range communication adaptation layer (9) (1207);

making connection, package and long-range access test by the application (10) (1208);

if it is determined that there is error during connection, package and long-range access tests, giving the user visual and audible warning that there is error (1209);

if it is determined that there is no error during connection, package and long-range access tests, giving the user visual and audible notification that there is no error (1210);

controlling by the application (10) whether there is short-range communication adaptation layer (9) or short-range communication interfaces that were activated during error tests (121 1);

if it is determined that there is/are short-range communication adaptation layer (9) or short-range communication interfaces which was/were activated during error tests as a result of the control process (121 1), switching the short-range communication adaptation layer (9) or the short-range communication interfaces which were activated to sleep mode by the application (10) (1212);

if it is determined that there is/are no short-range communication adaptation layer (9) or short-range communication interfaces which was/were activated during error tests as a result of the control process (121 1), connecting to remote server over the short-range communication adaptation layer (9) (1213);

after connecting to the remote server, controlling whether there is update for the application (10) or the medical device library (12) (1214);

if it is determined that there is update after controlling whether there is update at the remote server (1214), downloading the updates to the update unit (13) (1215);

if it is determined that there is error during downloading of the updates to the update unit (13), reporting the error to the server (1216) and switching the communication interfaces to sleep mode (1219);

if it is determined that there is no error during downloading of the updates to the update unit (13), configuring the updates by the update unit (13) (1217); restart of the device (1) (1218); and booting the application (10) located in the non-volatile memory (14) by the processor (11) (1201);

if it is determined that there is no update after controlling whether there is update at the remote server (1214), switching the communication interfaces to sleep mode (1219).

In the inventive method (1000), in order to make suitability for operation test of device (1) sub-systems and updates thereof (1200) firstly the processor (11) carries out booting the application (10) which is located in the non-volatile memory (14) (1201). The application (10) booting of which is carried out is run by the processor (11) (1202). After the application (10) is run, firstly suitability for operation tests of sub-systems -the visual unit (3), the sound generating unit (4), the input unit (5), the short-range communication module (6), the long-range communication module (7)- are made (1203). After the said error tests, if it is determined that there is error in any of the sub-systems the user is warned via the visual unit (3) by giving out light and the sound generating unit (4) by making a warning sound (1204). Errors, which are detected as a consequence of the error test after the user is warned, are sent to the remote server by being put into report form (1205). If no error is detected as a consequence of the error tests made by the application (10), booting of the data in the medical device library (12) and the user adjustment data in the non-volatile memory (14) is carried out by the processor (11) (1206). After the booting process (1206) is performed, connection is established with the remote server by the long-range communication adaptation layer (9) activating at least one of the long-range communication interfaces in the long-range communication module (7) (1207). The application (10) makes connection, package and long-range access tests after it is connected to the remote server (1208). If error is detected as a consequence of the test process (1208) performed by the application (10), the user is warned that there is error via the visual unit (3) by giving out light and the sound generating unit (4) by making a warning sound (1209). If no error is detected as a consequence of the test process (1208) performed by the application (10), the user is informed that there

is no error via the visual unit (3) by giving out light and the sound generating unit (4) by making a notification sound (1210). After detecting that there is no error and informing the user (1210), it is controlled whether the short-range communication adaptation layer (9) and/or the short-range communication interfaces located in the short-range communication module (6) were activated during error tests (121 1). If it is determined that the short-range communication adaptation layer (9) and/or the short-range communication interfaces located in the short-range communication module (6) were activated as a result of the control process (121 1), the activated units are switched to sleep mode (1212). If it is determined that the short-range communication adaptation layer (9) and the short-range communication interfaces located in the short-range communication module (6) were not activated as a result of the control process (121 1), connection is established with the remote server by the long-range communication adaptation layer (9) activating at least one of the short-range communication interfaces located in the long-range communication module (7) (1213). After connection is established with the remote server (1213), it is controlled whether there is update for the application (10) or the medical device library (12) (1214). If any update is detected, these updates are downloaded to the update unit (13) (1215). It is controlled whether there is error in the process of downloading update. If it is determined that there is error during downloading of the updates to the update unit (13), the error detected is transmitted to the remote server by being put into report form (1216) and the communication interfaces switched to sleep mode (1219). If it is determined that there is no error after downloading of the updates to the update unit (13), the update is configured by the update unit (13) (1217) and the device (1) restarts (1218). Upon restart of the application and booting of the application (10) located in the non-volatile memory (14) is performed by the processor (11) (1201), the above-stated processes are carried out respectively. If it is determined that there is no update as a consequence of controlling whether there is update at the remote server (1214), the communication interfaces are switched to sleep mode (1219).

Step of matching the device (1) with at least one medical device (1300) comprises sub-steps of:

controlling whether short-range communication interface which will enable to get in contact with medical device is located in the short-range communication module (6) (1301);

if it is determined that the short-range communication interface which will enable to get in contact with medical device is not located in the short-range communication module (6) as a result of the control process (1301), connecting to remote server over long-range communication adaptation layer (1302);

recording short-range communication interface which will enable to get in contact with medical device in medical device library (12) by the update unit (13) (1303);

adding the short-range communication interface downloaded to the short-range communication adaptation layer (9) (1304);

if it is determined that the short-range communication interface which will enable to get in contact with medical device is located in the short-range communication module (6) as a result of the control process (1301), transmitting information of with what type of medical device matching will be made to the update unit (13) (1305);

triggering the application (10) by the update unit (13) using matching information (1306);

bringing the short-range communication adaptation layer (9) into a state waiting for communication with the medical device defined by the application (10) (1307);

bringing the medical device into matching state (1308);

initiation of matching process by the application (10) (1309);

if it is detected that there is error during the matching process (1309), giving the user visual and audible warning that there is error (1310) and reporting the error to the remote server (131 1);

if it is detected that there is no error during the matching process (1309), giving the user visual and audible notification that there is no error (1312) and conveying the matching process to the remote server over the short-range communication adaptation layer (9) (1313);

registering identity information related to the medical device which is matched and the communication module of the medical device, on the non-volatile memory (14) and the medical device library (12) (1314);

switching the communication interfaces to sleep mode (1315).

In the inventive method (1000), in order that the device (1) is matched with at least one medical device firstly it is controlled whether the short-range communication interface which will enable to get in contact with medical device is located in the short-range communication module (6) (1301). If it is determined that the short-range communication interface which will enable to get in contact with medical device is not located in the short-range communication module (6) as a result of the control process (1301), connection is established with the remote server upon the short-range communication adaptation layer (9) activates at least one of the long-range communication interfaces in the long-range communication module (7) (1302). After connection is established with the remote server, the update unit (13) records short-range communication interface which will enable to get in contact with medical device in medical device library (12) (1303). The short-range communication interface recorded in the medical device library (12) is added to the short-range communication adaptation layer (9) (1304). If it is determined that the short-range communication interface which will enable to get in contact with medical device is located in the short-range communication module (6) as a result of the control process (1301), information of with what type of medical device matching will be made is transmitted to the update unit (13) (1305). In an embodiment of the invention, information of with what type of medical device matching will be made is transferred to the update unit (13) over the short-range communication adaptation layer (9). In an alternative embodiment of the invention, information of with what type of medical device matching will be made is transferred to the update unit (13) by the user using the input unit (4). Then, the update unit (13) transmits the matching request to the application (10) together with communication protocol information of the medical device to be matched (1306). The application (10) enables the short-range communication adaptation layer (9) to

activate the suitable ones of the short-range communication interfaces in the short-range communication module (6) (1307). In this case, the device (1) has now started waiting for the medical device to be matched. Then, the medical device is brought into matching state (1308). After the medical device is brought into matching state, the application (10) initiates the matching process (1309). During the matching process (1309), it is controlled whether there is error. If it is detected that there is error during the matching process (1309), the user is warned via the visual unit (3) by giving out light and the sound generating unit (4) by making a warning sound (1310). Errors, which are detected as a consequence of the error test after the user is warned, are sent to the remote server by being put into report form (131 1). If it is detected that there is no error during the matching process (1309), the user is notified via the visual unit (3) by giving out light and the sound generating unit (4) by making a notification sound that there is no error (1312). After the user is informed (1312), the matching process is notified to the remote server using at least one of the long-range communication interfaces (1313). Then, the identity information related to the medical device which is matched and the medical device communication protocol are registered in the non-volatile memory (14) and the medical device library (12) (1314) and the communication interfaces are switched to sleep mode (1315).

Step of obtaining results of measurements from the medical device and transmitting them to a remote server (1400) comprises sub-steps of:

reading medical devices, which are defined in the medical device library (12) previously, by the application (10) (1401);

running short-range communication interfaces on the short-range communication adaptation layer (9) (1402);

controlling whether medical device which will make measurement requires pre-measurement information such as calibration, time in order to start measuring (1403);

if it is determined that medical device which will make measurement requires pre-measurement information such as calibration, time in order to

start measuring after the controlling process (1403), controlling whether the medical device is previously defined (1404);

if it is determined that the medical device is not previously defined after the controlling process (1403), giving the user visual and audible warning that the medical device is not defined (1405);

if it is determined that the medical device is previously defined as a consequence of the controlling process (1404), running the communication protocol of the medical device and establishing connection with the medical device (1406);

sending necessary pre-measurement information from the medical device library (12) to the medical device (1407);

controlling whether process of receiving measurement results is completed (1408);

if it is determined that process of receiving measurement results is not completed as a consequence of the controlling process (1408), giving the user visual and audible information that measurement results are still being received (1409);

if it is determined that process of receiving measurement results is completed as a consequence of the controlling process (1408), controlling whether there is error in receiving measurement results (1410);

if it is determined that there is error in receiving measurement results as a consequence of the controlling process (1410), giving the user visual and audible warning that there is error (141 1) and switching the communication interfaces to sleep mode (1418);

if it is determined that there is no error in receiving measurement results as a consequence of the controlling process (1410), giving the user visual and audible warning that the measurement results are received faultlessly (1412);

encrypting the measurement results received with certificate keys and encryption method (1413);

registering the measurement result encrypted on the non-volatile memory (14) (1414);

sending the measurement result registered to the remote server by means of communication interface over the long-range communication adaptation layer (9) (1415);

giving the user visual and audible notification that the measurement result is sent to the remote server (1416);

deleting the measurement result on the non-volatile memory (14) after it is sent to the remote server (1417); and

switching communication interfaces to sleep mode (1418).

In the inventive method (1000), in order to obtain results of measurements from the medical device and transmit them to a remote server (1400) firstly the application (10) reads medical devices which are defined in the medical device library (12) (1401). Then, the short-range communication adaptation layer (9) activates at least one of the short-range communication interfaces in the short-range communication module (6) (1402). It is controlled whether the medical device which will make measurement requires pre-measurement information such as calibration, time in order to start measuring (1403). If it is determined that the medical device which will make measurement requires pre-measurement information, it is controlled whether the said medical device is previously defined (1404). If the medical device is not previously defined, the user is warned via the visual unit (3) by giving out light and the sound generating unit (4) by making a warning sound that the medical device is not previously defined (1405). If it is determined that the medical device is previously defined, the communication protocol of the medical device is run and connection is established with the medical device (1406), and pre-measurement information required by the medical device are sent to the medical device defined (1407). Then, it is waited for transmission of the measurement result from the medical device to the device (1). It is controlled whether the process of receiving measurement results are completed at pre-determined intervals (1408). If it is determined that process of receiving measurement results is not completed as a consequence of the controlling process (1408), the user is informed via the visual unit (3) by giving out light and the sound generating unit (4) by making a notification sound that it is continued to receive the measurement results (1409). If it

is determined that receiving measurement results is completed as a consequence of the controlling process (1408), it is controlled whether there is error in receiving measurement results (1410). If it is determined that there is error in receiving measurement results as a consequence of the controlling process (1410), the user is warned via the visual unit (3) by giving out light and the sound generating unit (4) by making a warning sound that the measurement results have been received incorrectly (141 1) and the communication interfaces are switched to sleep mode (1418). If it is determined that there is no error in receiving measurement results as a consequence of the controlling process (1410), the user is informed via the visual unit (3) by giving out light and the sound generating unit (4) by making a notification sound that the measurement results have been received successfully (1412). The measurement results which have been received successfully are encrypted with certificate keys and encryption method (1413). In the preferred embodiment of the invention, encryption process is realized by reading the personalized digital security certificate on the SIM. The measurement results encrypted are registered on the non-volatile memory (14) in the form of "not sent yet" (1414). The measurement results registered are sent to the remote server by means of communication interfaces over the long-range communication adaptation layer (9) (1415). After the measurement results are sent to the remote server, the user is informed via the visual unit (3) by giving out light and the sound generating unit (4) by making a warning sound that the measurement results have been sent to the remote server successfully (1416). Lastly, the measurement results which have been registered on the non-volatile memory (14) in the form of "not sent yet" previously are deleted from the non-volatile memory (14) and the communication interfaces are switched to sleep mode (1418).

Via the short-range communication interfaces that it contains on thereof, the inventive remote patient management device (1) can manage medical devices defined by establishing a connection with them; provide information such as time, calibration, etc. which are required in order that medical devices operate; read measurement results which are made by medical devices defined; and transmits the

said measurement results to remote servers via long-range communication interfaces using secure communication methods by enabling to determine the user's identity.

With the inventive remote patient management device (1): identification of medical measurement devices to each other, carrying out security matches, managing medical measurement devices and reading measurement results are performed with minimum user interaction possible

Security definitions required for carrying out communication with medical devices can be carried out both over the remote patient management device (1) and with remote access, and both by the user and technical assistance personnel.

It is possible to develop various embodiments of the inventive remote patient management device (1) and method (1000), it cannot be limited to examples disclosed herein and it is essentially according to claims.

CLAIMS

1. A remote patient management device (1) **comprising**

a body (2);

a plurality of visual units (3) which are located on the body (2) and enable to inform and warn the user visually;

at least one sound generating unit (4) which is located on the body (2) and enables to warn and inform the user vocally;

at least one input unit (5) which is located on the body (2) and enables the user to carry out input processes;

and **characterized by**

at least one short-range communication module (6) which is located in the body (2) and comprises at least one interface enabling to get in contact with devices that are present at short-range such as medical devices that will make tests of the patient;

at least one long-range communication module (7) which is located in the body (2) and comprises at least one interface enabling to get in contact with remote servers such as transmitting test measurement results of the patient to healthcare centers;

at least one control module (8) which enables the visual unit (3), the sound generating unit (4) and the input unit (5) to fulfil their duties and to carry out short communication by means of the short-range communication module (6) and remote communication by means of the long-range communication module (7).

2. A remote patient management device (1) according to Claim 1, **characterized by** at least two adaptation layers (9) which enable the control module (8) to interact with the short-range communication module (6) and the long-range communication module (7) in an isolated manner.

3. A remote patient management device (1) according to Claim 2, **characterized by** adaptation layer (9) which presents a standard set of

function, that is necessary for getting in contact with medical devices and remote servers, to the control module (8).

4. A remote patient management device (1) according to any of the preceding claims, **characterized by** control module (8) having:

at least one application (10) which controls services that enable remote management of the device (1) and updates, and all components;

at least one processor (11) which enables to run the application (10);

at least one medical device library (12) in which identity information relating to the medical devices connected, treatment information and necessary operating information are included;

at least one update unit (13) which enables to control retrieval of information relating to the application (10) or the medical devices connected from remote server; and

at least one non-volatile memory (14) in which the application (10) and the medical device library (12) are kept confidential.

5. A remote patient management device (1) according to any of the preceding claims, **characterized by** input unit (5) which is keypad.

6. A remote patient management device (1) according to any of Claim 1 to 5, **characterized by** input unit (5) which is touch screen.

7. A remote patient management device (1) according to any of the preceding claims, **characterized by** short-range communication module (6) which has bluetooth communication interface that is defined by IEEE 802.15.1 standard.

8. A remote patient management device (1) according to any of the preceding claims, **characterized by** short-range communication module (6) which has

wireless personal networks communication interface that is defined by IEEE 802.15.4 standard.

9. A remote patient management device (1) according to any of the preceding claims, **characterized by** short-range communication module (6) which has Wireless Fidelity (Wi-Fi) communication interface that is defined by IEEE 802.1 1 series.

10. A remote patient management device (1) according to any of the preceding claims, **characterized by** short-range communication module (6) which has infrared communication interface.

11. A remote patient management device (1) according to any of the preceding claims, **characterized by** short-range communication module (6) which has wire serial communication interface.

12. A remote patient management device (1) according to any of the preceding claims, **characterized by** long-range communication module (7) which has interface of global system for mobile communications.

13. A remote patient management device (1) according to any of the preceding claims, **characterized by** long-range communication module (7) which has Ethernet communication interface.

14. A remote patient management device (1) according to any of the preceding claims, **characterized by** long-range communication module (7) which has Wireless Fidelity communication interface.

15. A remote patient management device (1) according to any of the preceding claims, **characterized by** at least one subscriber identity module which enables to send measurement results that are received from medical devices

to remote servers by being encrypted with certificate keys and encryption methods.

16. A remote patient management method (1000) enabling people with chronic disease to make their tests on a regular basis and transmission of test measurement values to healthcare personnel reliably essentially comprising steps of:

turning on the device (1) (1100);

making suitability for operation test of device (1) sub-systems and updates thereof (1200);

matching the device (1) with at least one medical device (1300);

obtaining results of measurements from the medical device and transmitting them to a remote server (1400); and

turning off the device (1) (1500).

17. A remote patient management method (1000) according to Claim 16, **characterized by** step of making suitability for operation test of device (1) sub-systems and updates thereof (1200) having sub-steps of:

booting the application (10), which is located in the non-volatile memory (14), by the processor (11) (1201);

running the application (10) booting of which is carried out, by the processor (11) (1202);

making suitability for operation tests of sub-systems by the application (10) (1203);

if it is determined that there is error during tests, giving the user visual and audible warning that there is error (1204);

reporting the error to the remote server (1205);

if it is determined that there is no error during tests, booting the data in the medical device library (12) and the user adjustment data in the non-volatile memory (14) by the processor (11) (1206);

establishing connection with the remote server by the application (10) over the long-range communication adaptation layer (9) (1207);

making connection, package and long-range access test by the application (10) (1208);

if it is determined that there is error during connection, package and long-range access tests, giving the user visual and audible warning that there is error (1209);

if it is determined that there is no error during connection, package and long-range access tests, giving the user visual and audible notification that there is no error (1210);

controlling by the application (10) whether there is short-range communication adaptation layer (9) or short-range communication interfaces that were activated during error tests (121 1);

if it is determined that there is/are short-range communication adaptation layer (9) or short-range communication interfaces which was/were activated during error tests as a result of the control process (121 1), switching the short-range communication adaptation layer (9) or the short-range communication interfaces which were activated to sleep mode by the application (10) (1212);

if it is determined that there is/are no short-range communication adaptation layer (9) or short-range communication interfaces which was/were activated during error tests as a result of the control process (121 1), connecting to remote server over the short-range communication adaptation layer (9) (1213);

after connecting to the remote server, controlling whether there is update for the application (10) or the medical device library (12) (1214);

if it is determined that there is update after controlling whether there is update at the remote server (1214), downloading the updates to the update unit (13) (1215);

if it is determined that there is error during downloading of the updates to the update unit (13), reporting the error to the server (1216) and switching the communication interfaces to sleep mode (1219);

if it is determined that there is no error during downloading of the updates to the update unit (13), configuring the updates by the update unit (13) (1217); restart of the device (1) (1218); and booting of the application (10) located in the non-volatile memory (14) by the processor (11) (1201);

if it is determined that there is no update after controlling whether there is update at the remote server (1214), switching the communication interfaces to sleep mode (1219).

18. A remote patient management method (1000) according to Claim 16 or 17, **characterized by** step of matching the device (1) with at least one medical device (1300) having sub-steps of:

controlling whether short-range communication interface which will enable to get in contact with medical device is located in the short-range communication module (6) (1301);

if it is determined that the short-range communication interface which will enable to get in contact with medical device is not located in the short-range communication module (6) as a result of the control process (1301), connecting to remote server over long-range communication adaptation layer (1302);

recording short-range communication interface which will enable to get in contact with medical device in medical device library (12) by the update unit (13) (1303);

adding the short-range communication interface downloaded to the short-range communication adaptation layer (9) (1304);

if it is determined that the short-range communication interface which will enable to get in contact with medical device is located in the short-range communication module (6) as a result of the control process (1301), transmitting information of with what type of medical device matching will be made to the update unit (13) (1305);

triggering the application (10) by the update unit (13) using matching information (1306);

bringing the short-range communication adaptation layer (9) into a state waiting for communication with the medical device defined by the application (10) (1307);

bringing the medical device into matching state (1308);

initiation of matching process by the application (10) (1309);

if it is detected that there is error during the matching process (1309), giving the user visual and audible warning that there is error (1310) and reporting the error to the remote server (131 1);

if it is detected that there is no error during the matching process (1309), giving the user visual and audible notification that there is no error (1312) and conveying the matching process to the remote server over the short-range communication adaptation layer (9) (1313);

registering identity information related to the medical device which is matched and the communication module of the medical device, on the non-volatile memory (14) and the medical device library (12) (1314);

switching the communication interfaces to sleep mode (1315).

19. A remote patient management method (1000) according to Claim 16 or 18, **characterized by** obtaining results of measurements from the medical device and transmitting them to a remote server (1400) having sub-steps of:

reading medical devices, which are defined in the medical device library (12) previously, by the application (10) (1401);

running short-range communication interfaces on the short-range communication adaptation layer (9) (1402);

controlling whether medical device which will make measurement requires pre-measurement information such as calibration, time in order to start measuring (1403);

if it is determined that medical device which will make measurement requires pre-measurement information such as calibration, time in

order to start measuring after the controlling process (1403), controlling whether the medical device is previously defined (1404);

if it is determined that the medical device is not previously defined after the controlling process (1403), giving the user visual and audible warning that the medical device is not defined (1405);

if it is determined that the medical device is previously defined as a consequence of the controlling process (1404), running the communication protocol of the medical device and establishing connection with the medical device (1406);

sending necessary pre-measurement information from the medical device library (12) to the medical device (1407);

controlling whether process of receiving measurement results is completed (1408);

if it is determined that process of receiving measurement results is not completed as a consequence of the controlling process (1408), giving the user visual and audible information that measurement results are still being received (1409);

if it is determined that process of receiving measurement results is completed as a consequence of the controlling process (1408), controlling whether there is error in receiving measurement results (1410);

if it is determined that there is error in receiving measurement results as a consequence of the controlling process (1410), giving the user visual and audible warning that there is error (1411) and switching the communication interfaces to sleep mode (1418);

if it is determined that there is no error in receiving measurement results as a consequence of the controlling process (1410), giving the user visual and audible warning that the measurement results are received faultlessly (1412);

encrypting the measurement results received with certificate keys and encryption method (1413);

registering the measurement result encrypted on the non-volatile memory (14) (1414);

sending the measurement result registered to the remote server by means of communication interface over the long-range communication adaptation layer (9) (1415);

giving the user visual and audible notification that the measurement result is sent to the remote server (1416);

deleting the measurement result on the non-volatile memory (14) after it is sent to the remote server (1417); and

switching communication interfaces to sleep mode (1418).

Figure 1

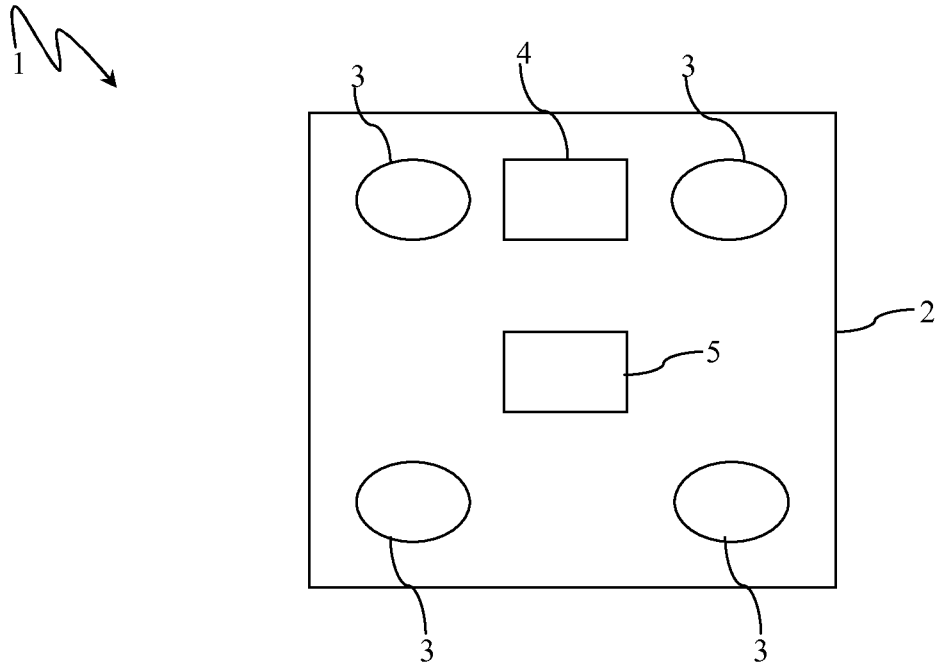


Figure 2

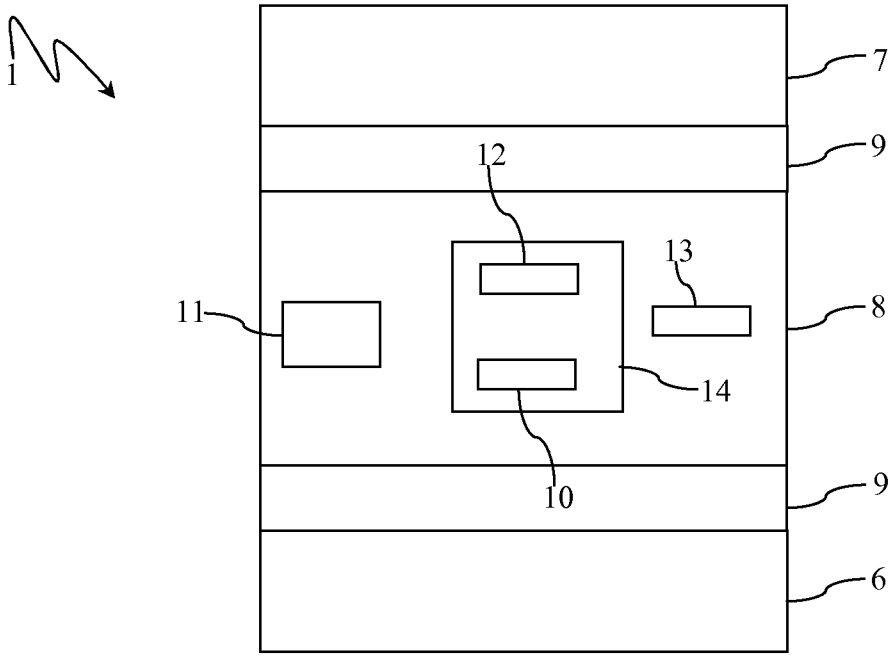


Figure 3

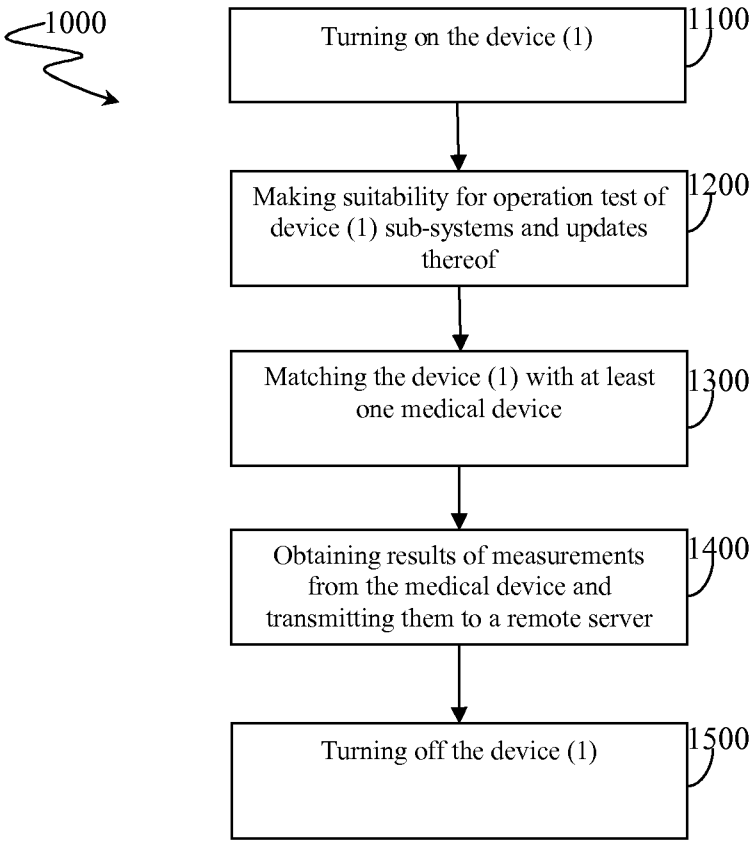

1000
Turning on the device (1)
1100
Making suitability for operation test of device (1) sub-systems and updates thereof
1200
Matching the device (1) with at least one medical device
1300
Obtaining results of measurements from the medical device and transmitting them to a remote server
1400
Turning off the device (1)
1500

Figure 4

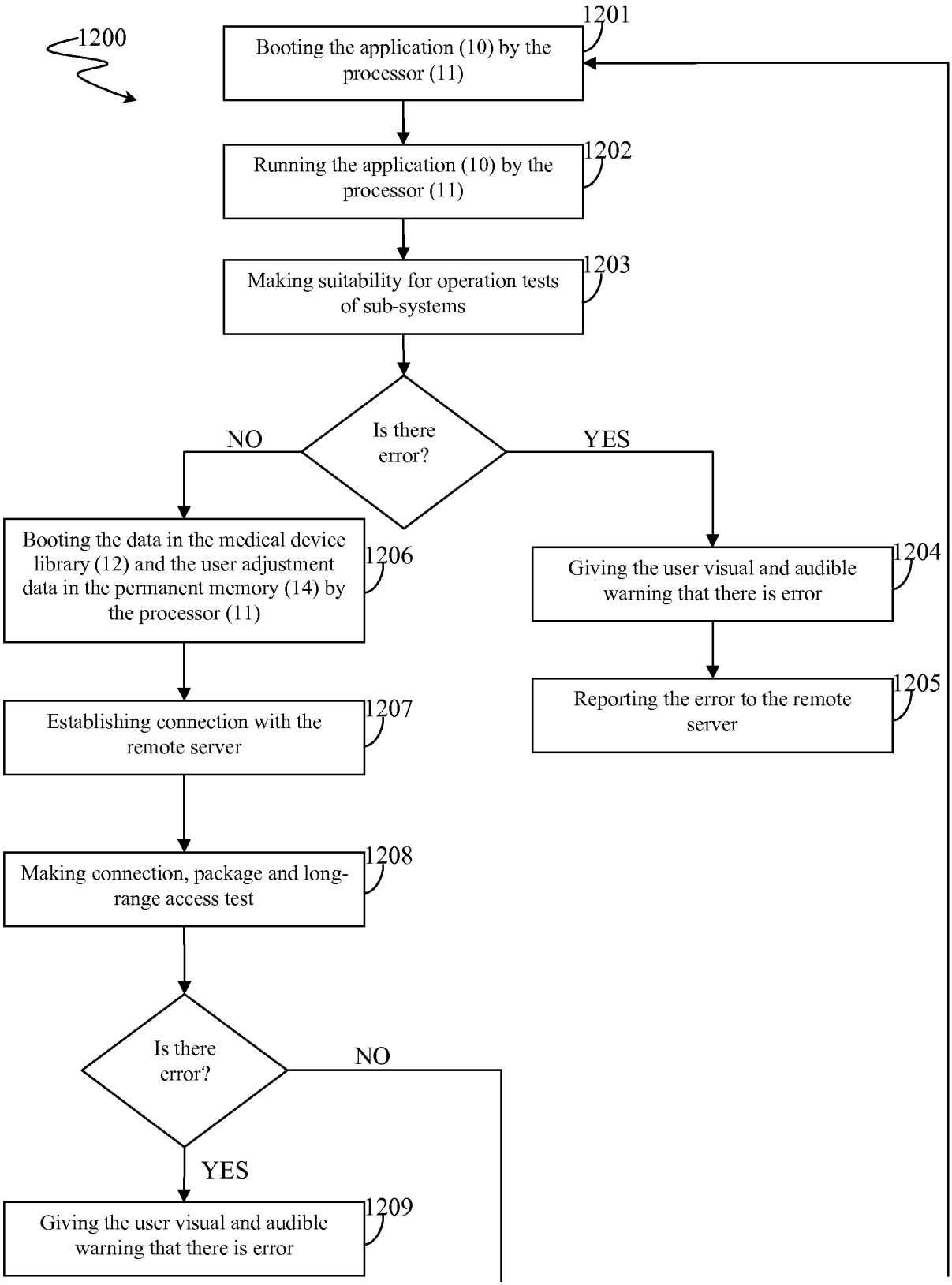

1200
1201
Booting the application (10) by the processor (11)
1202
Running the application (10) by the processor (11)
1203
Making suitability for operation tests of sub-systems
Is there error?
NO
YES
1206
Booting the data in the medical device library (12) and the user adjustment data in the permanent memory (14) by the processor (11)
1204
Giving the user visual and audible warning that there is error
1205
Reporting the error to the remote server
1207
Establishing connection with the remote server
1208
Making connection, package and long-range access test
Is there error?
NO
YES
1209
Giving the user visual and audible warning that there is error

Figure 5

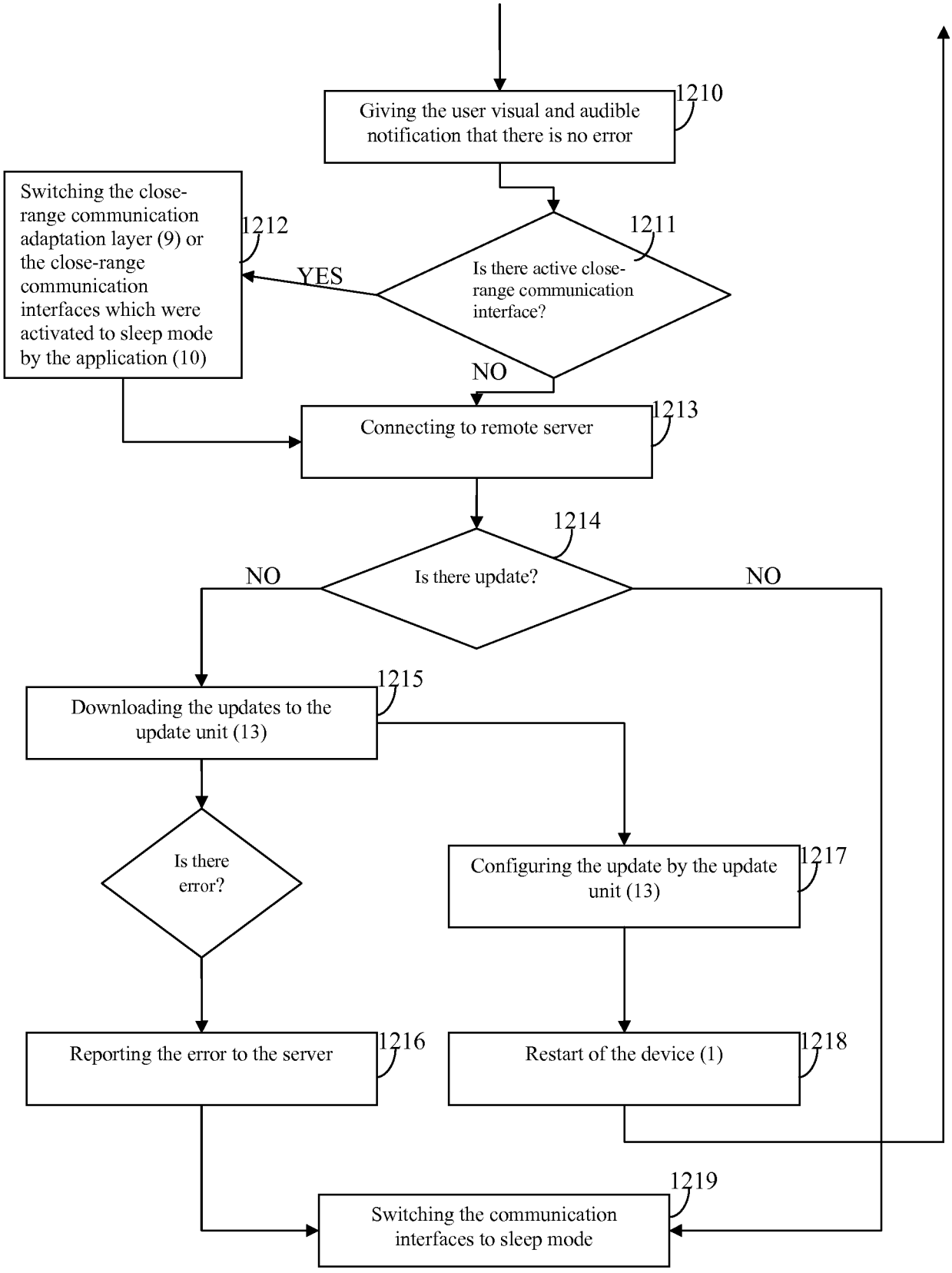

Giving the user visual and audible notification that there is no error
1210
Is there active close-range communication interface?
1211
YES
Switching the close-range communication adaptation layer (9) or the close-range communication interfaces which were activated to sleep mode by the application (10)
1212
NO
Connecting to remote server
1213
Is there update?
1214
NO
NO
Downloading the updates to the update unit (13)
1215
Is there error?
Configuring the update by the update unit (13)
1217
Reporting the error to the server
1216
Restart of the device (1)
1218
Switching the communication interfaces to sleep mode
1219

Figure 6

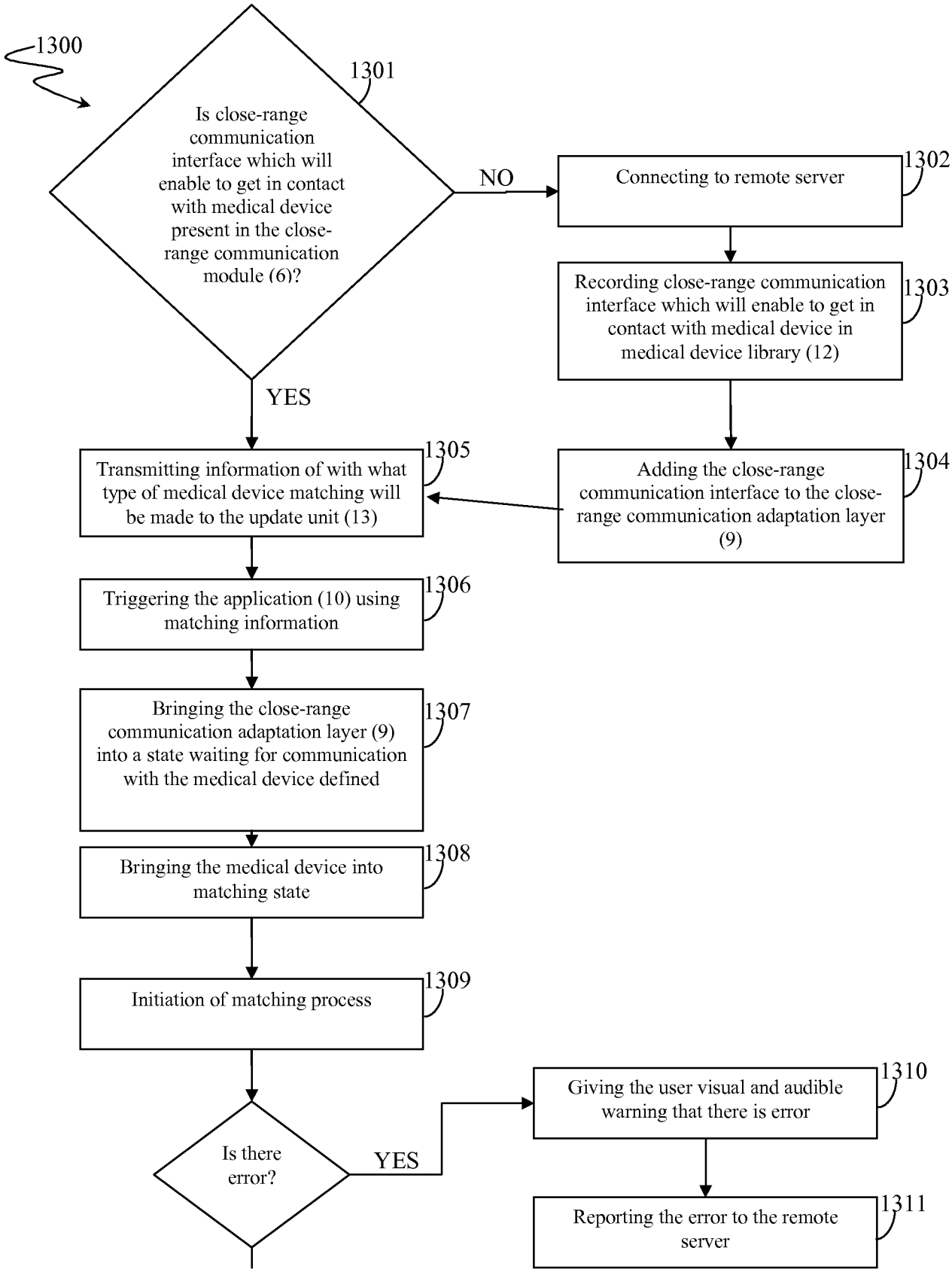

1300
1301
Is close-range communication interface which will enable to get in contact with medical device present in the close-range communication module (6)?
NO
YES
1302
Connecting to remote server
1303
Recording close-range communication interface which will enable to get in contact with medical device in medical device library (12)
1304
Adding the close-range communication interface to the close-range communication adaptation layer (9)
1305
Transmitting information of with what type of medical device matching will be made to the update unit (13)
1306
Triggering the application (10) using matching information
1307
Bringing the close-range communication adaptation layer (9) into a state waiting for communication with the medical device defined
1308
Bringing the medical device into matching state
1309
Initiation of matching process
Is there error?
YES
1310
Giving the user visual and audible warning that there is error
1311
Reporting the error to the remote server

Figure 7

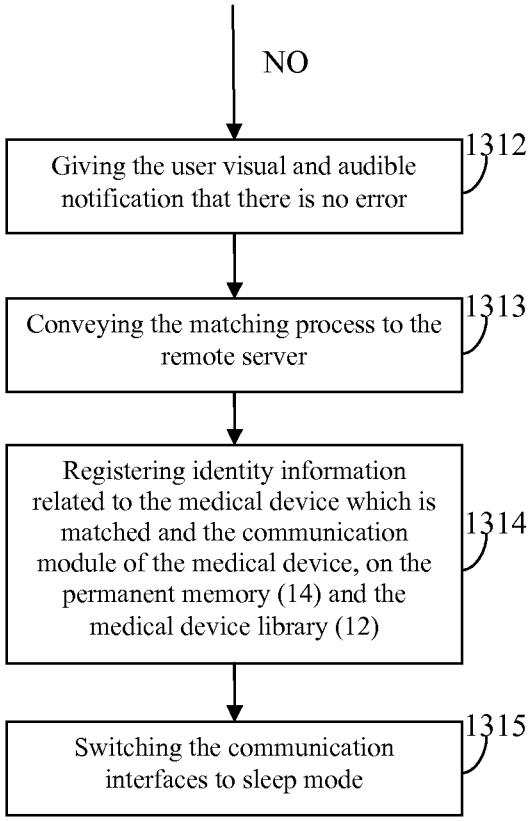

NO
Giving the user visual and audible notification that there is no error
1312
Conveying the matching process to the remote server
1313
Registering identity information related to the medical device which is matched and the communication module of the medical device, on the permanent memory (14) and the medical device library (12)
1314
Switching the communication interfaces to sleep mode
1315

Figure 8

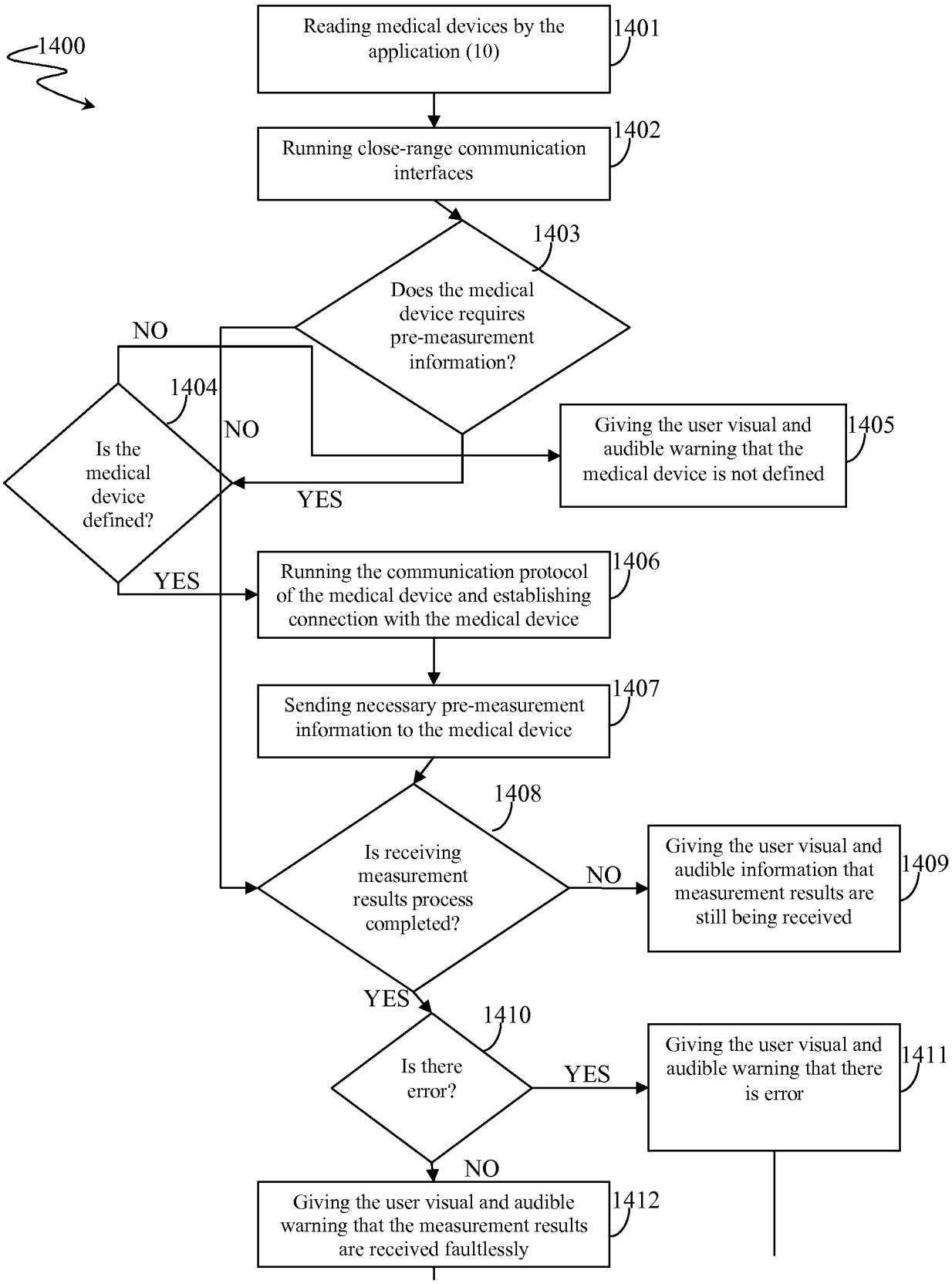
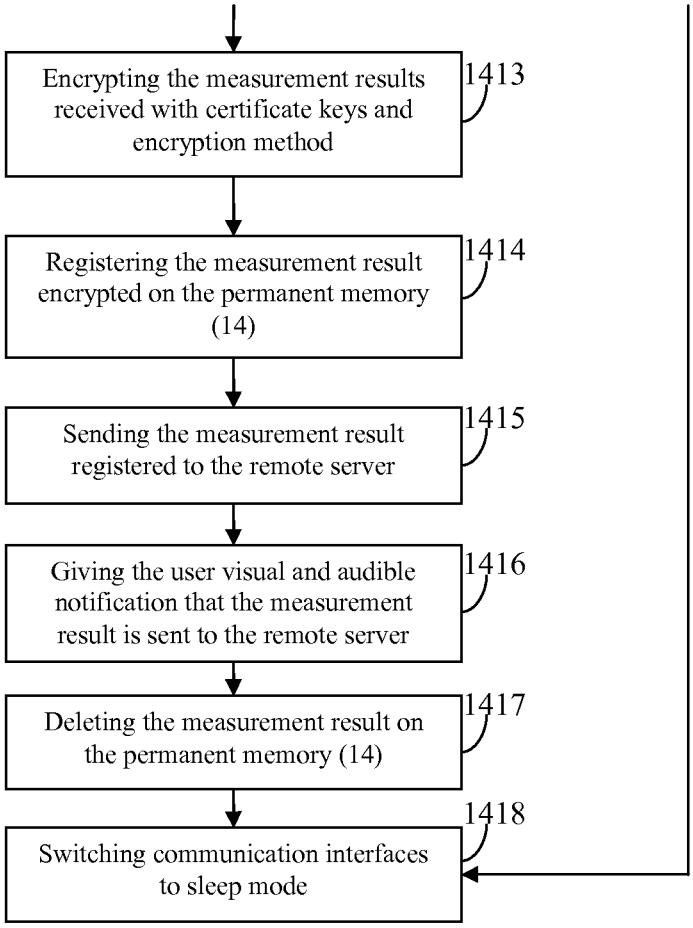

1400
Reading medical devices by the application (10)
1401
Running close-range communication interfaces
1402
1403
Does the medical device requires pre-measurement information?
NO
1404
Is the medical device defined?
NO
YES
Giving the user visual and audible warning that the medical device is not defined
1405
YES
Running the communication protocol of the medical device and establishing connection with the medical device
1406
Sending necessary pre-measurement information to the medical device
1407
1408
Is receiving measurement results process completed?
NO
Giving the user visual and audible information that measurement results are still being received
1409
YES
1410
Is there error?
YES
Giving the user visual and audible warning that there is error
1411
NO
Giving the user visual and audible warning that the measurement results are received faultlessly
1412

Figure 9


Encrypting the measurement results received with certificate keys and encryption method
1413
Registering the measurement result encrypted on the permanent memory (14)
1414
Sending the measurement result registered to the remote server
1415
Giving the user visual and audible notification that the measurement result is sent to the remote server
1416
Deleting the measurement result on the permanent memory (14)
1417
Switching communication interfaces to sleep mode
1418

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2012/050301

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F19/00
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)
G06F

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

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

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/100262 Al (ROCHE DIAGNOSTICS GMBH [DE] ; HOFFMANN LA ROCHE [CH]) 19 December 2002 (2002-12-19) the whol e document	1-19
X	W0 2006/108858 Al (HOFFMANN LA ROCHE [CH] ; ROCHE DIAGNOSTICS GMBH [DE] ; CR0NRATH CHRIST0P) 19 October 2006 (2006-10-19) the whol e document	1-19
A	W0 2009/032134 A2 (CARDIAC PACEMAKERS INC [US] ; LAL0NDE JOHN [US] ; H0YME KENNETH [US] ; MA) 12 March 2009 (2009-03-12) the whol e document	1-19
A	W0 2008/064053 A2 (MEDTRONIC MINIMED INC [US] ; PATEL HIMANSHU [US] ; ISTOC EMI L [US] ; LIN) 29 May 2008 (2008-05-29) the whol e document	1-19

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

☒ See patent family annex.

* Special categories of cited documents :

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"L" documentwhich may throw doubts on priority claim(s) orwhich 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
5 June 2012	14/06/2012

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2012/050301

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 02100262 Al	19-12-2002	AT 385734 T	15-03-2008
		CA 2448426 Al	19-12-2002
		DE 60225006 T2	05-03-2009
		DK 1395170 T3	09-06-2008
		EP 1395170 Al	10-03-2004
		EP 2255722 Al	01-12-2010
		ES 2300444 T3	16-06-2008
		JP 4488735 B2	23-06-2010
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