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(54) **PHYSIOLOGICAL MONITORING SYSTEM USING BLUETOOTH LOW ENERGY MESH NETWOK**

PHYSIOLOGISCHES ÜBERWACHUNGSSYSTEM ÜBER EIN BLUETOOTH-MESH-NETZWERK MIT NIEDRIGER ENERGIE

SYSTÈME DE SURVEILLANCE PHYSIOLOGIQUE AU MOYEN D'UN RÉSEAU MAILLÉ À FAIBLE ÉNERGIE BLUETOOTH

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a physiological monitoring system, and more particularly to a physiological monitoring system using a Bluetooth low energy mesh network.

BACKGROUND OF THE INVENTION

[0002] With increasing development of modern medical science and technology, aging population and declining fertility rate, modern societies gradually become aged societies and thus the improvement of health care demands is needed. That is, the health care needs for the elderly population gradually increase. In addition, the health care needs for the patients due to illness and for the physically disabled persons due to accident also gradually increase.

[0003] Nowadays, the number of medical personnel cannot comply with the increasing needs for medical care. Even if the medical personnel work overtime, the immediate measures to provide medical care cannot be taken and thus the medical quality is impaired. For example, the process of measuring the patients' physiological values such as the blood pressure values is an indispensable process during the medical care period. For example, health care workers have to go to the wards to periodically and successively measure the physiological values and record the physiological values on papers, and then go back to the nursing station to input the physiological values to a computer for filing. Because of the routine manual measurement tasks, a large number of health care workers cannot provide health care services more actively.

[0004] Therefore, there is a need of providing a novel physiological monitoring system in order to overcome the above drawbacks. United States Patent Application Publication US 2013/029330 (Kamen et al.) discloses the usage of a Bluetooth Low Energy mesh network comprising a plurality of medical sensors used for patient monitoring. International Application WO 2013/086036, published under the PCT, discloses in general a telehealth monitoring system that uses a gateway and monitors a plurality of physiological parameters using the Bluetooth technology. Similar remote monitoring and remote control of medication dispensing is taught by International Application WO 2014/106096.

SUMMARY OF THE INVENTION

[0005] An object of the present invention provides a physiological monitoring system using a Bluetooth low energy mesh network in order to overcome the drawbacks of the conventional technology.

[0006] In accordance with an aspect of the present invention, there is provided a physiological monitoring system using a Bluetooth low energy mesh network. The physiological monitoring system includes a main control device and plural physiological detection devices. The main control device includes a data processor and a main control terminal Bluetooth low energy transmission module. The data processor generates a measurement command signal. The measurement command signal contains an identification code of the main control device. After the measurement command signal is received by the main control terminal Bluetooth low energy transmission module, the measurement command signal is externally broadcasted. Each physiological detection device includes a peripheral terminal Bluetooth low energy transmission module receiving the measurement command signal, a detection processor and a physiological sensor. After the measurement command signal is received by the detection processor through the Bluetooth low energy mesh network, the measurement command signal is transmitted to the physiological sensor. A physiological value of a subject is detected by the physiological sensor according to the measurement command signal, and then the physiological value is transmitted to the detection processor. A physiological data signal is generated by the detection processor according to the physiological value and an identification code of the physiological detection device, and the physiological data signal is externally broadcasted through the peripheral terminal Bluetooth low energy transmission module. After the physiological data signal is received by the main control terminal Bluetooth low energy transmission module of the main control device through the Bluetooth low energy mesh network, the data processor generates a medical record table corresponding to the subject according to the physiological data signal.

[0007] In an embodiment, the main control device further includes a warning device, and the data processor determines whether a warning drive signal is generated according to the medical record table. The warning device is driven to issue a warning notification signal in response to the warning drive signal.

[0008] In an embodiment, the warning device is light alarm or a buzzer.

[0009] In an embodiment, the measurement command signal from the main control device further contains a speech driving signal, and each physiological detection device further includes a speech input/output device. After the speech driving signal is decoded by the detection processor, a corresponding speed information is broadcasted by the speech input/output device.

[0010] In an embodiment, the physiological detection device further includes an input device. When the detection processor receives a responding command through the input device, the detection processor enables the physiological sensor to detect the physiological value of the subject.

[0011] In an embodiment, the medical record table contains a device address field and a physiological value field. According to the received physiological data signal,

the data processor records the identification code of the physiological detection device into the device address field and records the physiological value into the physiological value field corresponding to the identification code of the physiological detection device.

[0012] In an embodiment, the main control device further includes a physiological data evaluation unit and a warning device. The physiological data evaluation unit judges whether the physiological value lies in a reference value range, thereby determining whether the data processor issues a warning drive signal to drive the warning device.

[0013] In an embodiment, the physiological value includes a heart rate, a blood pressure value or a body temperature.

[0014] In an embodiment, the physiological monitoring system further includes at least one fixed terminal Bluetooth low energy transmission device. The at least one fixed terminal Bluetooth low energy transmission device is arranged between the main control device and the plural physiological detection devices, so that a transmission path of externally broadcasting the measurement command signal and the physiological data signal is expanded.

[0015] In an embodiment, the physiological monitoring system further includes a cloud database. The medical record table is stored in the cloud database.

[0016] In an embodiment, the physiological detection device is a wearable device.

[0017] In an embodiment, the wearable device further includes a detector, and the detector is electrically connected with the detection processor. When the wearable device is detached from the subject, the detection processor notifies the main control device.

[0018] In an embodiment, the physiological detection device further includes at least one quick response code or a near field communication tag that provides an information of the subject of the physiological detection device.

[0019] From the above descriptions, the physiological monitoring system of the present invention uses a Bluetooth low energy mesh network to transmit signal in a broadcasting manner. The low energy Bluetooth has many benefits such as low power consumption, low cost and high operation speed. Moreover, all devices in the mesh network can transmit and receive signals between each other through the serial connection between the devices or intermediate nodes (e.g., the fixed terminal Bluetooth low energy transmission devices). Consequently, the signal transmission is not restricted to specified distance and range while meeting the low energy requirements of the medical facilities. Moreover, the physiological monitoring system of the present invention further provides the mechanism of transmitting the speed information and the mechanism of allowing the subject to input the responding command. Consequently, the subject can realize that a detecting process will be performed on the subject and determine whether the detecting process is accepted or not. In other words, the detecting safety in the automatic measurement process is enhanced.

[0020] The above objects and advantages of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed description and accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

FIG. 1A & 1B are schematic functional block diagram illustrating a physiological monitoring system using a Bluetooth low energy mesh network according to an embodiment of the present invention; and

FIG. 2 schematically the architecture of the physiological monitoring system of FIG. 1A & 1B applied to a health care center.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0022] The present invention will now be described more specifically with reference to the following embodiments and accompanying drawings.

[0023] FIG. 1A & 1B are schematic functional block diagram illustrating a physiological monitoring system using a Bluetooth low energy mesh network according to an embodiment of the present invention. In this context, the term "Bluetooth low energy mesh network" is abbreviated to a "BLE mesh network".

[0024] As shown in FIG. 1A & 1B, the physiological monitoring system using the BLE mesh network comprises a main control device 200, plural physiological detection devices 110, 120, a fixed terminal Bluetooth low energy transmission device 300 and a cloud database 400. The main control device 200 comprises a main control terminal Bluetooth low energy transmission module 220, a data processor 210, a warning device 230 and a physiological data evaluation unit 240, which are electrically connected with each other. The physiological detection device 110 comprises a peripheral terminal Bluetooth low energy transmission module 112, a detection processor 111, a physiological sensor 113, a speech input/output device 114 and an input device 115, which are electrically connected with each other. The physiological detection device 120 comprises a peripheral terminal Bluetooth low energy transmission module 122, a detection processor 121, a physiological sensor 123, a speech input/output device 124 and an input device 125, which are electrically connected with each other.

[0025] Hereinafter, the basic operations of the physiological monitoring system will be illustrated with reference to FIG. 1A & 1B. For example, the physiological monitoring system of the present invention can be applied to a health care center. As mentioned above, the

health care workers have to go to the wards to measure the patients' physiological values in person according to the conventional technology. In contrast, the health care worker can use the physiological monitoring system of the present invention to measure the patients' physiological values without the need of going to the wards in person. For measuring the patients' physiological values, the health care worker may firstly operate the main control device 200 in a nursing station (e.g., a computer in the nursing station) to issue a measurement command signal A. For example, the measurement command signal A is a program code containing an identification code of the main control device. According to the identification code of the main control device, the physiological detection devices can recognize that the measurement command signal A is issued from the main control device. In particular, the measurement command signal A is generated by the data processor 210, and then externally broadcasted by the main control terminal Bluetooth low energy transmission module 220. The broadcasted measurement command signal A can be received by the physiological detection devices 110 and 120 through the fixed terminal Bluetooth low energy transmission device 300, or the broadcasted measurement command signal A can be directly received by the physiological detection devices 110 and 120. Each physiological detection device is correlated with a corresponding subject (or a patient). In accordance with the present invention, the wireless medical network for the health care center has to comply with the requirement of low energy and low radio frequency interference. Consequently, the physiological monitoring system of the present invention uses the BLE mesh network to transmit signals between the main control device and the physiological detection device. In addition, if the main control device is far from the physiological detection device, the physiological monitoring system is further equipped with the fixed terminal Bluetooth low energy transmission device 300 to expand the signal transmission range and the signal transmission stability.

[0026] In an embodiment, the measurement command signal A contains a speech driving signal E, and the physiological detection device 110 contains default speed information. After the speech driving signal E is received by the physiological detection device 110, the speech driving signal E is transmitted to the detection processor 111. In response to the speech driving signal E of the measurement command signal A, the detection processor 111 drives the speech input/output device 114 (e.g., a speaker) to broadcast the default speed information. For example, the content of the default speed information includes an inquiry from the health care worker to inquire the subject whether a blood pressure measuring operation is done. After the subject hears the content of the default speed information, the subject may input a responding command F into the physiological detection device 110 through the input device 115 (e.g., a touch screen). Then, the responding command F is transmitted to the detection processor 111. According to the responding command F, the detection processor 111 determines whether the measurement command signal A is transmitted to the physiological sensor 113. If the responding command F indicates the message "No" or no responding command F is generated, the detection processor 111 does not transmit the measurement command signal A to the physiological sensor 113. Whereas, if the responding command F indicates the message "Yes", the detection processor 111 transmits the measurement command signal A to the physiological sensor 113. According to the measurement command signal A, a physiological value B1 of the subject is detected by the physiological sensor 113. The physiological value B1 is transmitted back to the detection processor 111. Then, a physiological data signal C1 is generated by the detection processor 111 according to the physiological value B1 and an identification code of the physiological detection device 110, and the physiological data signal C1 is externally broadcasted through the peripheral terminal Bluetooth low energy transmission module 112. Similarly, while the physiological detection device 111 performs the blood pressure measuring operation on another subject, a physiological value B2 of the subject and a physiological data signal C2 are acquired.

[0027] Due to the mechanism of transmitting the speed information and the mechanism of allowing the subject to input the responding command, the subject can realize that a detecting process will be performed on the subject and determine whether the detecting process is accepted or not. Consequently, the systematic safety of the physiological monitoring system is enhanced. For example, during the process of measuring the blood pressure, the gasbag wound around the arm or wrist of the subject is inflated. The inflated gasbag may oppress the blood vessel of the subject and discomfort the subject. If the subject judges that the current body condition is not feasible for the blood pressure measurement or the current scenario is not feasible for the blood pressure measurement, the subject can input the corresponding responding command to reject the blood pressure measurement. Consequently, the possibility of injuring the subject in the improper condition is minimized.

[0028] After the physiological data signals C1 and C2 are received by the main control device 200, the subsequent steps will be described. In particular, the physiological data signals C1 and C2 are received by the main control terminal Bluetooth low energy transmission module 220 of the main control device 200 and then transmitted to the data processor 210. According to the physiological data signals C1 and C2, the data processor 210 generates medical record tables 211 corresponding to the subjects. The medical record table 211 contains a device address field 211a and a physiological value field 211b. According to the received physiological data signals C1 and C2, the data processor 210 records the identification codes of the physiological detection devices 110 and 120 into the device address fields 211a, and records

the physiological values B1 and B2 (e.g., blood pressure values, heart rates or body temperatures) into the physiological value fields 211b corresponding to the identification codes of the physiological detection devices 110 and 120. In particular, the device address fields 211a correspond to the subjects of the physiological detection devices 110 and 120. According to the identification codes of the physiological detection devices 110 and 120 in the device address fields 211a (e.g., the IP addresses of the physiological detection devices 110 and 120), the names of the subjects are realized and the medical record tables 211 corresponding to the subjects of the physiological detection devices 110 and 120 are generated. Afterwards, the medical record tables 211 can be stored into the cloud database 400.

[0029] From the above descriptions, the physiological monitoring system of the present invention uses the Bluetooth low energy mesh network to automatically search the physiological values of the subjects. Consequently, the measurement process is quickly performed, the medical record tables are automatically generated, the human resources of the health care workers is saved, the health care efficiency is enhanced, and the human error is reduced.

[0030] In this embodiment, the physiological detection device 110 further comprises a detector 116 and a near field communication (NFC) tag 117, and the physiological detection device 120 further comprises a detector 126 and a NFC tag 127. The detector 116 is electrically connected with the detection processor 111 for detecting whether the physiological detection device 110 is detached from the installation position. Similarly, the detector 126 is electrically connected with the detection processor 121 for detecting whether the physiological detection device 120 is detached from the installation position. For example, the physiological detection devices 110 and 120 are wearable devices that are worn on the wrists or arms of the subjects for detecting the physiological values of the subjects. If the physiological detection device 110 or 120 is detached from the subject, the detector 116 or 126 issues a notification signal to the main control device 200 through the detection processor 111 or 121. Consequently, the health care worker can go to the ward to realize the condition of the subject immediately. The NFC tag 117 is located at a side of the physiological detection device 11, and the NFC tag 127 is located at a side of the physiological detection device 12. Preferably but not exclusively, the NFC tags 117 and 127 are quick response codes. If the physiological detection device 110 or 120 is detached from the subject, the health care worker can inquire the NFC tag 117 or 127 about the subject corresponding to the physiological detection device 110 or 120. Consequently, while the physiological detection device 110 or 120 is worn on or installed on the subject, the possibility of erroneously detecting the physiological value will be minimized.

[0031] In this embodiment, the main control device 200 further comprises the warning device 230 and the physiological data evaluation unit 240. The physiological data evaluation unit 240 is used for judging whether the physiological values B1 and B2 (e.g., blood pressure values, heart rates or body temperatures) lie in a reference value range in order to determine whether the data processor 210 issues a warning drive signal D to drive the warning device 230. The reference value range is the human physiological range value in the normal condition. For example, the normal body temperature is in the range between 36 and 37.5 degrees Celsius, and the normal blood pressure is defined as a systolic pressure below 120 mmHg and a diastolic pressure below 80 mmHg. If the received physiological value is beyond the normal value range, the warning device 230 issues a warning notification signal to warn the health care workers to perform proper treatment. In other words, the physiological monitoring system of the present invention can facilitate warning and processing the health care immediately and increase the health care safety. In an embodiment, the warning device 230 is a light alarm, and the warning notification signal is the flash of red light. In another embodiment, the warning device 230 is a buzzer, and the warning notification signal is a sound.

[0032] Hereinafter, the application of the physiological monitoring system to a health care center will be illustrated with reference to FIG. 2. FIG. 2 schematically the architecture of the physiological monitoring system of FIG. 1A & 1B applied to a health care center. The paths of the measurement command signal A (i.e., from the main control device 200) and the physiological data signals C1~C7 (i.e., from the physiological detection devices 110~170) broadcasted through the BLE mesh network are also shown in FIG. 2. Consequently, the process of transferring the physiological data signals by the physiological monitoring system will be described in more details.

[0033] As shown in FIG. 2, the plural physiological detection devices 110~170 are installed in the health care center. In practice, these physiological detection devices are installed according to the usage conditions of the patients. In this embodiment, the physiological detection devices 110-150 are fixed on the hospital beds 1~5, the physiological detection device 160 is installed on a movable wheelchair, and the physiological detection device 170 is a wearable device worn on a patient. For complying with the specification of the network transmission energy in the health care center, the effective transmission distance of the BLE mesh network used in the physiological monitoring system of the present invention has limitations. Consequently, if the distance between the main control device and the physiological detection device is very long, the necessary broadcasting signal is possibly lost. For example, in case that the main control device is installed in the nursing station and the physiological detection devices installed on the hospital beds or worn on the patients are distributed in different floors, the broadcasting signals are possibly lost. For solving the above drawbacks, the physiological monitoring system of the

present invention further comprises plural fixed terminal Bluetooth low energy transmission devices 310-330. The plural fixed terminal Bluetooth low energy transmission devices 310-330 are arranged between the main control device 320 and the plural physiological detection devices 110-170 in order to intermediately receive and transfer the broadcasting signals.

[0034] When the health care worker intends to measure of the physiological values of the patients, the health care worker may operate the main control device 200 in the nursing station to externally broadcast the measurement command signal A. The measurement command signal A is issued in a broadcasting manner. That is, the measurement command signal A is not exclusively transmitted to a specified object. Any physiological detection device and any fixed terminal Bluetooth low energy transmission device within the effective network transmission range can receive the measurement command signal A from the main control device 200. For example, as shown in FIG. 2, the physiological detection device 160 is within the effective network transmission range of the main control device 200. Consequently, the physiological detection device 160 can directly receive the measurement command signal A from the main control device 200. Moreover, since the fixed terminal Bluetooth low energy transmission device 330 is also within the effective network transmission range of the main control device 200, the fixed terminal Bluetooth low energy transmission device 330 can directly receive the measurement command signal A from the main control device 200 and externally broadcast the measurement command signal A. Moreover, the fixed terminal Bluetooth low energy transmission devices 310 and 320 and the physiological detection device 170 are within the effective network transmission range of the fixed terminal Bluetooth low energy transmission device 330. Consequently, the fixed terminal Bluetooth low energy transmission devices 310 and 320 and the physiological detection device 170 can receive the measurement command signal A from the fixed terminal Bluetooth low energy transmission device 330 and externally broadcast the measurement command signal A. Similarly, since the physiological detection devices 110 and 120 are within the effective network transmission range of the fixed terminal Bluetooth low energy transmission device 310, the physiological detection devices 110 and 120 can receive the measurement command signal A from the fixed terminal Bluetooth low energy transmission device 310. Similarly, since the physiological detection devices 130, 140 and 150 are within the effective network transmission range of the fixed terminal Bluetooth low energy transmission device 320, the physiological detection devices 130, 140 and 150 can receive the measurement command signal A from the fixed terminal Bluetooth low energy transmission device 320.

[0035] Similarly, the physiological data signals C1~C7 from the physiological detection devices 110-170 are externally broadcasted by the physiological detection devices 110-170. After these physiological data signals C1~C7 are received by the corresponding fixed terminal Bluetooth low energy transmission devices 310~330 within the effective network transmission ranges of the physiological detection devices 110-170, these physiological data signals C1~C7 are externally broadcasted to be received by the main control device 200.

[0036] From the above descriptions, the physiological monitoring system of the present invention uses a BLE mesh network to transmit signal in a broadcasting manner. The low energy Bluetooth has many benefits such as low power consumption, low cost and high operation speed. Moreover, all devices in the mesh network can transmit and receive signals between each other through the serial connection between the devices or intermediate nodes (e.g., the fixed terminal Bluetooth low energy transmission devices). Consequently, the signal transmission is not restricted to specified distance and range while meeting the low energy requirements of the medical facilities.

[0037] Moreover, the physiological monitoring system of the present invention further provides the mechanism of transmitting the speed information and the mechanism of allowing the subject to input the responding command. Consequently, the subject can realize that a detecting process will be performed on the subject and determine whether the detecting process is accepted or not. In other words, the detecting safety in the automatic measurement process is enhanced.

[0038] While the invention has been described in terms of what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention needs not be limited to the disclosed embodiments. On the contrary, it is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended claims which are to be accorded with the broadest interpretation so as to encompass all such modifications and similar structures.

Claims

1. A physiological monitoring system using a Bluetooth low energy mesh network, the physiological monitoring system comprising:

   a main control device (200) comprising a data processor (210) and a main control terminal Bluetooth low energy transmission module (220), wherein the data processor (210) generates a measurement command signal (A), and the measurement command signal (A) contains an identification code of the main control device (200), wherein after the measurement command signal (A) is received by the main control terminal Bluetooth low energy transmission module (220), the measurement command signal (A) is externally broadcasted; and

   plural physiological detection devices

(110-170), wherein each physiological detection device (110-170) comprises a peripheral terminal Bluetooth low energy transmission module (112,122) receiving the measurement command signal (A), a detection processor (111,121) and a physiological sensor (113,123), **characterized in that** each of the physiological detection devices (110-170) further comprises an input device (115, 125), through which an associated subject may input a responding command (F) into the physiological detection device (110-170) after the detection processor (111,121) receives the measurement command signal (A) from the main control terminal Bluetooth low energy transmission module (220) through the Bluetooth low energy mesh network, wherein the detection processor (111,121) does not transmit the command signal (A) to the physiological sensor (113,123) if the responding command (F) indicates a NO message or no responding command (F) is generated, and the detection processor (111,121) transmits the measurement command signal (A) to the physiological sensor (113,123) if the responding command (F) indicates a YES message, wherein a physiological value (B1,B2) of a subject is detected by the physiological sensor (113,123) according to the measurement command signal (A), and then the physiological value (B1,B2) is transmitted to the detection processor (111,121), wherein a physiological data signal (C1-C7) is generated by the detection processor (111,121) according to the physiological value (B1,B2) and an identification code of the physiological detection device (110-170), and the physiological data signal (C1-C7) is externally broadcasted through the peripheral terminal Bluetooth low energy transmission module (112,122), wherein after the physiological data signal (C1-C7) is received by the main control terminal Bluetooth low energy transmission module (220) of the main control device (200) through the Bluetooth low energy mesh network, the data processor (210) generates a medical record table (211) corresponding to the subject according to the physiological data signal (C1-C7).

2. The physiological monitoring system according to claim 1, wherein the main control device (200) further comprises a warning device (230), and the data processor (210) determines whether a warning drive signal is generated according to the medical record table (211), wherein the warning device (230) is driven to issue a warning notification signal (D) in response to the warning drive signal.

3. The physiological monitoring system according to claim 2, wherein the warning device (230) is light alarm or a buzzer.

4. The physiological monitoring system according to claim 1, wherein the measurement command signal (A) from the main control device (A) further contains a speech driving signal (E), and each physiological detection device (110-170) further comprises a speech input/output device (114,124), wherein after the speech driving signal (E) is decoded by the detection processor (111,121), a corresponding speech information is broadcasted by the speech input/output device (114,124).

5. The physiological monitoring system according to claim 1, wherein if the responding command (F) indicates a negative message or no responding command (F) is generated, the detection processor (111,121) does not transmit the measurement command signal (A) to the physiological sensor (113,123).

6. The physiological monitoring system according to claim 1, wherein the medical record table (211) contains a device address field (211a) and a physiological value field (211b), wherein according to the received physiological data signal (C1-C7), the data processor (210) records the identification code of the physiological detection device (110-170) into the device address field (211a) and records the physiological value (B1,B2) into the physiological value field (211b) corresponding to the identification code of the physiological detection device(110-170).

7. The physiological monitoring system according to claim 6, wherein the main control device (200) further comprises a physiological data evaluation unit (240) and a warning device (230), wherein the physiological data evaluation unit (240) judges whether the physiological value (B1,B2) lies in a reference value range, thereby determining whether the data processor (111,121) issues a warning drive signal (D) to drive the warning device (230).

8. The physiological monitoring system according to claim 1, wherein the physiological value (B1,B2) includes a heart rate, a blood pressure value or a body temperature.

9. The physiological monitoring system according to claim 1, further comprising at least one fixed terminal Bluetooth low energy transmission device (300-330), wherein the at least one fixed terminal Bluetooth low energy transmission device (300-330) is arranged between the main control device (200) and the plural physiological detection devices (110-170), so that a transmission path of externally broadcasting the measurement command signal (A)

and the physiological data signal (C1-C7) is expanded.

10. The physiological monitoring system according to claim 1, further comprising a cloud database (400), wherein the medical record table (211) is stored in the cloud database (400).

11. The physiological monitoring system according to claim 1, wherein the physiological detection device (110-170) is a wearable device.

12. The physiological monitoring system according to claim 11, wherein the wearable device further comprises a detector (116,126), and the detector (116,126) is electrically connected with the detection processor (111,121), wherein when the wearable device is detached from the subject, the detection processor (116,126) notifies the main control device (200).

13. The physiological monitoring system according to claim 1, wherein the physiological detection device (110-170) further comprises at least one quick response code or a near field communication tag (117,127) that provides an information of the subject of the physiological detection device (110-170).

Patentansprüche

1. Physiologisches Überwachungssystem, das ein vermaschtes Niedrigenergie-Bluetooth-Netzwerk nutzt, wobei das physiologische Überwachungssystem umfasst:

eine Hauptsteuervorrichtung (200), die einen Datenprozessor (210) und ein Hauptsteuerendgerät-Niedrigenergie-Bluetooth-Übertragungsmodul (220) umfasst, wobei der Datenprozessor (210) ein Messanweisungssignal (A) erzeugt und das Messanweisungssignal (A) einen Identifizierungskode der Hauptsteuervorrichtung (200) enthält, wobei nach dem Empfangen des Messanweisungssignals (A) durch das Hauptsteuerendgerät-Niedrigenergie-Bluetooth-Übertragungsmodul (220) das Messanweisungssignal (A) extern übertragen wird; und
eine Mehrzahl von physiologischen Erfassungsvorrichtungen (110-170), wobei jede physiologische Erfassungsvorrichtung (110-170) ein peripheres Endgerät-Niedrigenergie-Bluetooth-Übertragungsmodul (112, 122), welches das Messanweisungssignal (A) empfängt, einen Erfassungsprozessor (111, 121) und einen physiologischen Sensor (113, 123) umfasst,
dadurch gekennzeichnet, dass jede der physiologischen Erfassungsvorrichtungen (110-170) ferner eine Eingabevorrichtung (115, 125) umfasst, durch die eine dazugehörige Person eine Antwortanweisung (F) in die physiologische Erfassungsvorrichtung (110-170) eingeben kann, nachdem der Erfassungsprozessor (111, 121) das Messanweisungssignal (A) von dem Hauptsteuerendgerät-Niedrigenergie-Bluetooth-Übertragungsmodul (220) durch das vermaschte Niedrigenergie-Bluetooth-Netzwerk empfangen hat, wobei der Erfassungsprozessor (111, 121) das Anweisungssignal (A) nicht zu dem physiologischen Sensor (113, 123) überträgt, wenn die Antwortanweisung (F) eine NEIN-Nachricht anzeigt oder keine Antwortanweisung (F) erzeugt wird, und der Erfassungsprozessor (111, 121) das Messanweisungssignal (A) zu dem physiologischen Sensor (113, 123) überträgt, wenn die Antwortanweisung (F) eine JA-Nachricht anzeigt, wobei ein physiologischer Wert (B1, B2) einer Person durch den physiologischen Sensor (113, 123) gemäß dem Messanweisungssignal (A) erfasst wird und dann der physiologische Wert (B1, B2) zu dem Erfassungsprozessor (111, 121) übertragen wird, wobei ein physiologisches Datensignal (C1-C7) durch den Erfassungsprozessor (111, 121) gemäß dem physiologischen Wert (B1, B2) und einem Identifizierungskode der physiologischen Erfassungsvorrichtung (110-170) erzeugt wird, und das physiologische Datensignal (C1-C7) durch das peripheres Endgerät-Niedrigenergie-Bluetooth-Übertragungsmodul (112, 122) extern übertragen wird, wobei, nachdem das physiologische Datensignal (C1-C7) durch das Hauptsteuerendgerät-Niedrigenergie-Bluetooth-Übertragungsmodul (220) der Hauptsteuervorrichtung (200) mittels des vermaschten Niedrigenergie-Bluetooth-Netzwerks empfangen worden ist, der Datenprozessor (210) eine medizinische Aufzeichnungstabelle (211), die der Person entspricht, gemäß dem physiologischen Datensignal (C1-C7) erzeugt.

2. Physiologisches Überwachungssystem nach Anspruch 1, bei dem die Hauptsteuervorrichtung (200) ferner eine Warnvorrichtung (230) umfasst und der Datenprozessor (210) bestimmt, ob ein Warnansteuerungssignal gemäß der medizinischen Aufzeichnungstabelle (211) erzeugt wird, wobei die Warnvorrichtung (230) so angesteuert wird, dass sie ein Warnbenachrichtigungssignal (D) als Reaktion auf das Warnansteuerungssignal ausgibt.

3. Physiologisches Überwachungssystem nach Anspruch 2, bei dem die Warnvorrichtung (230) ein Lichtalarm oder ein Summer ist.

4. Physiologisches Überwachungssystem nach An-

spruch 1, bei dem das Messanweisungssignal (A) von der Hauptsteuervorrichtung (A) ferner ein Sprachansteuerungssignal (E) enthält und jede physiologische Erfassungsvorrichtung (110-170) ferner eine Spracheingabe/Ausgabe-Vorrichtung (114, 124) umfasst, wobei, nachdem das Sprachansteuerungssignal (E) durch den Erfassungsprozessor (111, 121) dekodiert worden ist, eine entsprechende Sprachinformation durch die Spracheingabe/Ausgabe-Vorrichtung (114, 124) übertragen wird.

5. Physiologisches Überwachungssystem nach Anspruch 1, bei dem, wenn die Antwortanweisung (F) eine negative Nachricht angibt oder keine Antwortanweisung (F) erzeugt wird, der Erfassungsprozessor (111, 121) das Messanweisungssignal (A) nicht zu dem physiologischen Sensor (113, 123) überträgt.

6. Physiologisches Überwachungssystem nach Anspruch 1, bei dem die medizinische Aufzeichnungstabelle (211) ein Vorrichtungsadressfeld (211a) und ein physiologischer Wert-Feld (211b) enthält, wobei gemäß dem empfangenen physiologischen Datensignal (C1-C7) der Datenprozessor (210) den Identifizierungskode der physiologischen Erfassungsvorrichtung (110-170) in dem Vorrichtungsadressfeld (211a) aufzeichnet und den physiologischen Wert (B1, B2) in dem physiologischer Wert-Feld (211b) entsprechend dem Identifizierungskode der physiologischen Erfassungsvorrichtung (110-170) aufzeichnet.

7. Physiologisches Überwachungssystem nach Anspruch 6, bei dem die Hauptsteuervorrichtung (200) ferner eine physiologische Daten-Bewertungseinheit (240) und eine Warnvorrichtung (230) umfasst, wobei die physiologische Daten-Bewertungseinheit (240) beurteilt, ob der physiologische Wert (B1, B2) in einem Referenzwertbereich liegt, wodurch bestimmt wird, ob der Datenprozessor (111, 121) ein Warnansteuerungssignal (D) zum Ansteuern der Warnvorrichtung (230) ausgibt.

8. Physiologisches Überwachungssystem nach Anspruch 1, bei dem der physiologische Wert (B1, B2) die Herzfrequenz, den Blutdruckwert oder die Körpertemperatur umfasst.

9. Physiologisches Überwachungssystem nach Anspruch 1, das ferner mindestens eine Niedrigenergie-Bluetooth-Übertragungsvorrichtung mit feststehendem Endgerät (300-330) umfasst, wobei die mindestens eine Niedrigenergie-Bluetooth-Übertragungsvorrichtung mit feststehendem Endgerät (300-330) zwischen der Hauptsteuervorrichtung (200) und der Mehrzahl von physiologischen Erfassungsvorrichtungen (110-170) angeordnet ist, so dass ein Übertragungsweg einer externen Übertragung des Messanweisungssignals (A) und des physiologischen Datensignals (C1-C7) erweitert wird.

10. Physiologisches Überwachungssystem nach Anspruch 1, das ferner eine Cloud-Datenbank (400) umfasst, wobei die medizinische Aufzeichnungstabelle (211) in der Cloud-Datenbank (400) gespeichert ist.

11. Physiologisches Überwachungssystem nach Anspruch 1, bei dem die physiologische Erfassungsvorrichtung (110-170) eine tragbare Vorrichtung ist.

12. Physiologisches Überwachungssystem nach Anspruch 11, bei dem die tragbare Vorrichtung ferner einen Detektor (116, 126) umfasst und der Detektor (116, 126) elektrisch mit dem Erfassungsprozessor (111, 121) verbunden ist, wobei, wenn die tragbare Vorrichtung von der Person abgenommen wird, der Erfassungsprozessor (116, 126) die Hauptsteuervorrichtung (200) benachrichtigt.

13. Physiologisches Überwachungssystem nach Anspruch 1, bei dem die physiologische Erfassungsvorrichtung (110-170) ferner mindestens einen Schnellantwortkode oder einen Nahfeld-Kommunikationsanhänger (117, 127) aufweist, der Informationen über die Person der physiologischen Erfassungsvorrichtung (110-170) bereitstellt.

Revendications

1. Système de surveillance physiologique utilisant un réseau maillé à basse énergie Bluetooth, le système de surveillance physiologique comprenant :

un dispositif de commande principal (200) comprenant un processeur de données (210) et un module de transmission à basse énergie Bluetooth de terminal de commande principal (220), dans lequel le processeur de données (210) génère un signal d'ordre de mesure (A), et le signal d'ordre de mesure (A) contient un code d'identification du dispositif de commande principal (200), dans lequel le signal d'ordre de mesure (A) est diffusé de manière externe après réception du signal d'ordre de mesure (A) par le module de transmission à basse énergie Bluetooth de terminal de commande principal (220) ; et
plusieurs dispositifs de détection physiologique (110-170), dans lequel chaque dispositif de détection physiologique (110-170) comprend un module de transmission à basse énergie Bluetooth de terminal périphérique (112, 122) recevant le signal d'ordre de mesure (A), un processeur de détection (111, 121) et un capteur phy-

siologique (113, 123),
caractérisé en ce que chacun des dispositifs de détection physiologique (110-170) comprend en outre un dispositif d'entrée (115, 125) par lequel un sujet associé peut entrer un ordre de réponse (F) dans le dispositif de détection physiologique (110-170) après que le processeur de détection (111, 121) a reçu le signal d'ordre de mesure (A) du module de transmission à basse énergie Bluetooth (220) de terminal de commande principal via le réseau maillé à basse énergie Bluetooth, dans lequel le processeur de détection (111, 121) ne transmet pas le signal d'ordre (A) au capteur physiologique (113, 123) si l'ordre de réponse (F) indique un message NON ou si aucun ordre de réponse (F) n'est généré, et le processeur de détection (111, 121) transmet le signal d'ordre de mesure (A) au capteur physiologique (113,123) si l'ordre de réponse (F) indique un message OUI, dans lequel une valeur physiologique (B1, B2) d'un sujet est détectée par le capteur physiologique (113, 123) en fonction du signal d'ordre de mesure (A), et ensuite la valeur physiologique (B1, B2) est transmise au processeur de détection (111, 121), dans lequel un signal de données physiologiques (C1-C7) est généré par le processeur de détection (111, 121) en fonction de la valeur physiologique (B1, B2) et d'un code d'identification du dispositif de détection physiologique (110-170), et le signal de données physiologiques (C1-C7) est diffusé de manière externe par le module de transmission à basse énergie Bluetooth de terminal périphérique (112, 122), dans lequel, après que le signal de données physiologiques (C1-C7) a été reçu par le module de transmission à basse énergie Bluetooth de terminal de commande principal (220) du dispositif de commande principal (200) via le réseau maillé à basse énergie Bluetooth, le processeur de données (210) génère une table d'enregistrements médicaux (211) correspondant au sujet en fonction du signal de données physiologiques (C1-C7).

2. Système de surveillance physiologique selon la revendication 1, dans lequel le dispositif de commande principal (200) comprend en outre un dispositif d'avertissement (230), et le processeur de données (210) détermine si un signal de pilotage d'avertissement est généré en fonction de la table d'enregistrements médicaux (211), dans lequel le dispositif d'avertissement (230) est piloté pour émettre un signal de notification d'avertissement (D) en réponse au signal de pilotage d'avertissement.

3. Système de surveillance physiologique selon la revendication 2, dans lequel le dispositif d'avertissement (230) est une alarme lumineuse ou un buzzer.

4. Système de surveillance physiologique selon la revendication 1, dans lequel le signal d'ordre de mesure (A) du dispositif de commande principal (A) contient en outre un signal de pilotage vocal (E), et chaque dispositif de détection physiologique (110-170) comprend en outre un dispositif d'entrée/sortie vocale (114, 124), dans lequel, après que le signal de pilotage vocale (E) a été décodé par le processeur de détection (111, 121), une information vocale correspondante est diffusée par le dispositif d'entrée/sortie vocale (114, 124).

5. Système de surveillance physiologique selon la revendication 1, dans lequel, si l'ordre de réponse (F) indique un message négatif ou si aucun ordre de réponse (F) n'est généré, le processeur de détection (111, 121) ne transmet pas le signal d'ordre de mesure (A) au capteur physiologique (113, 123).

6. Système de surveillance physiologique selon la revendication 1, dans lequel la table d'enregistrements médicaux (211) contient un champ d'adresse de dispositif (211a) et un champ de valeur physiologique (211b), dans lequel, en fonction du signal de données physiologiques reçu (C1-C7), le processeur de données (210) enregistre le code d'identification du dispositif de détection physiologique (110-170) dans le champ d'adresse de dispositif (211a) et enregistre la valeur physiologique (B1, B2) dans le champ de valeur physiologique (211b) correspondant au code d'identification du dispositif de détection physiologique (110-170).

7. Système de surveillance physiologique selon la revendication 6, dans lequel le dispositif de commande principal (200) comprend en outre une unité d'évaluation de données physiologiques (240) et un dispositif d'avertissement (230), dans lequel l'unité d'évaluation de données physiologiques (240) évalue si la valeur physiologique (B1, B2) se situe dans une plage de valeurs de référence, déterminant ainsi si le processeur (111, 121) émet un signal de pilotage d'avertissement (D) pour piloter le dispositif d'avertissement (230).

8. Système de surveillance physiologique selon la revendication 1, dans lequel la valeur physiologique (B1, B2) inclut une fréquence cardiaque, une valeur de tension artérielle ou une température corporelle.

9. Système de surveillance physiologique selon la revendication 1, comprenant en outre au moins un dispositif de transmission à basse énergie Bluetooth de terminal fixe (300-330), dans lequel ledit au moins un dispositif de transmission à basse énergie Bluetooth de terminal fixe (300-330) est disposé entre le

dispositif de commande principal (200) et les plusieurs dispositifs de détection physiologique (110-170), de sorte qu'un trajet de transmission pour la diffusion externe du signal d'ordre de mesure (A) et du signal de données physiologiques (C1-C7) est étendu.

10. Système de surveillance physiologique selon la revendication 1, comprenant en outre une base de données en nuage (400), dans lequel la table d'enregistrements médicaux (211) est stockée dans la base de données en nuage (400).

11. Système de surveillance physiologique selon la revendication 1, dans lequel le dispositif de détection physiologique (110-170) est un dispositif portable.

12. Système de surveillance physiologique selon la revendication 11, dans lequel le dispositif portable comprend en outre un détecteur (116, 126), et le détecteur (116, 126) est connecté électriquement au processeur de détection (111, 121), dans lequel, lorsque le dispositif portable est détaché du sujet, le processeur de détection (116, 126) le notifie au dispositif de commande principal (200).

13. Système de surveillance physiologique selon la revendication 1, dans lequel le dispositif de détection physiologique (110-170) comprend en outre au moins un code de réponse rapide ou une étiquette de communication en champ proche (117, 127) qui fournit des informations sur le sujet du dispositif de détection physiologique (110-170).

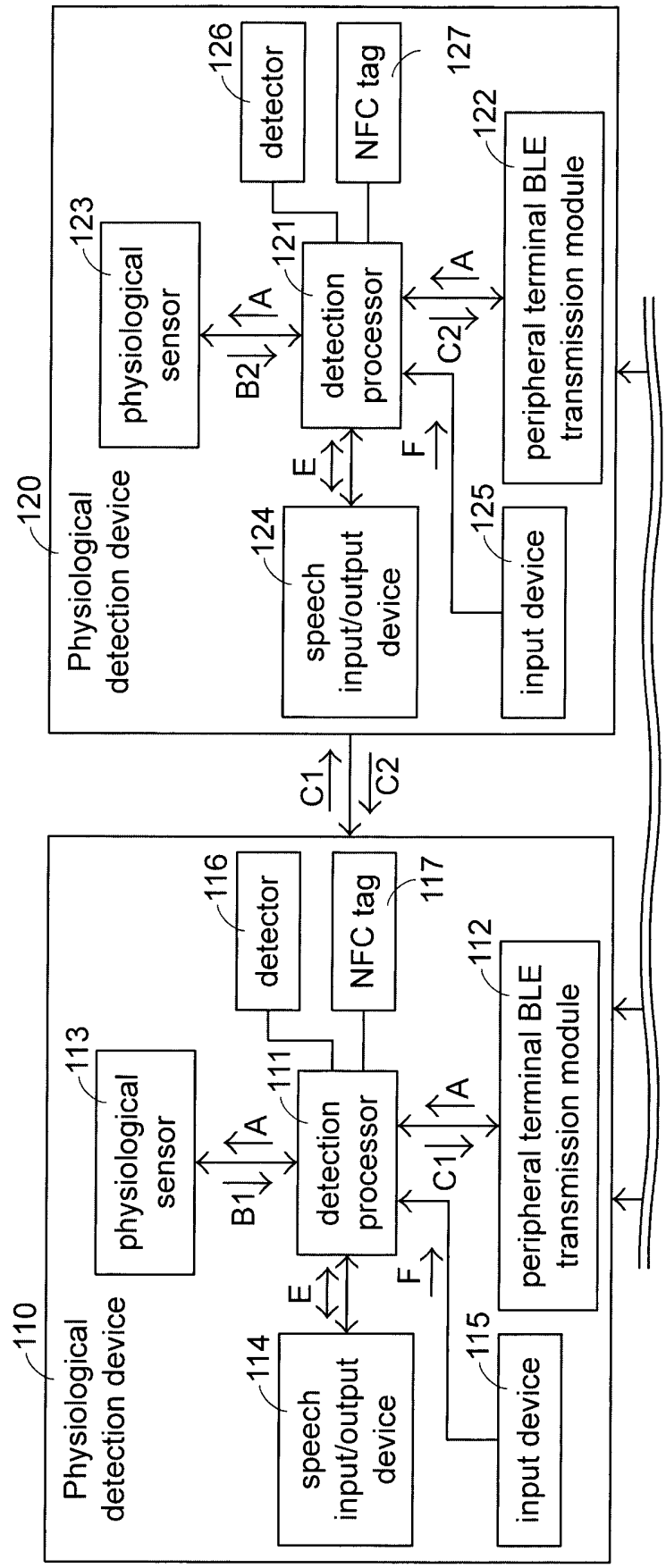
Physiological detection device
110
physiological sensor
113
detector
116
NFC tag
117
detection processor
111
speech input/output device
114
input device
115
peripheral terminal BLE transmission module
112
B1
A
C1
E
F
C2
Physiological detection device
120
physiological sensor
123
detector
126
NFC tag
127
detection processor
121
speech input/output device
124
input device
125
peripheral terminal BLE transmission module
122
B2
A
C2
E
F
C1
C2

FIG.1A

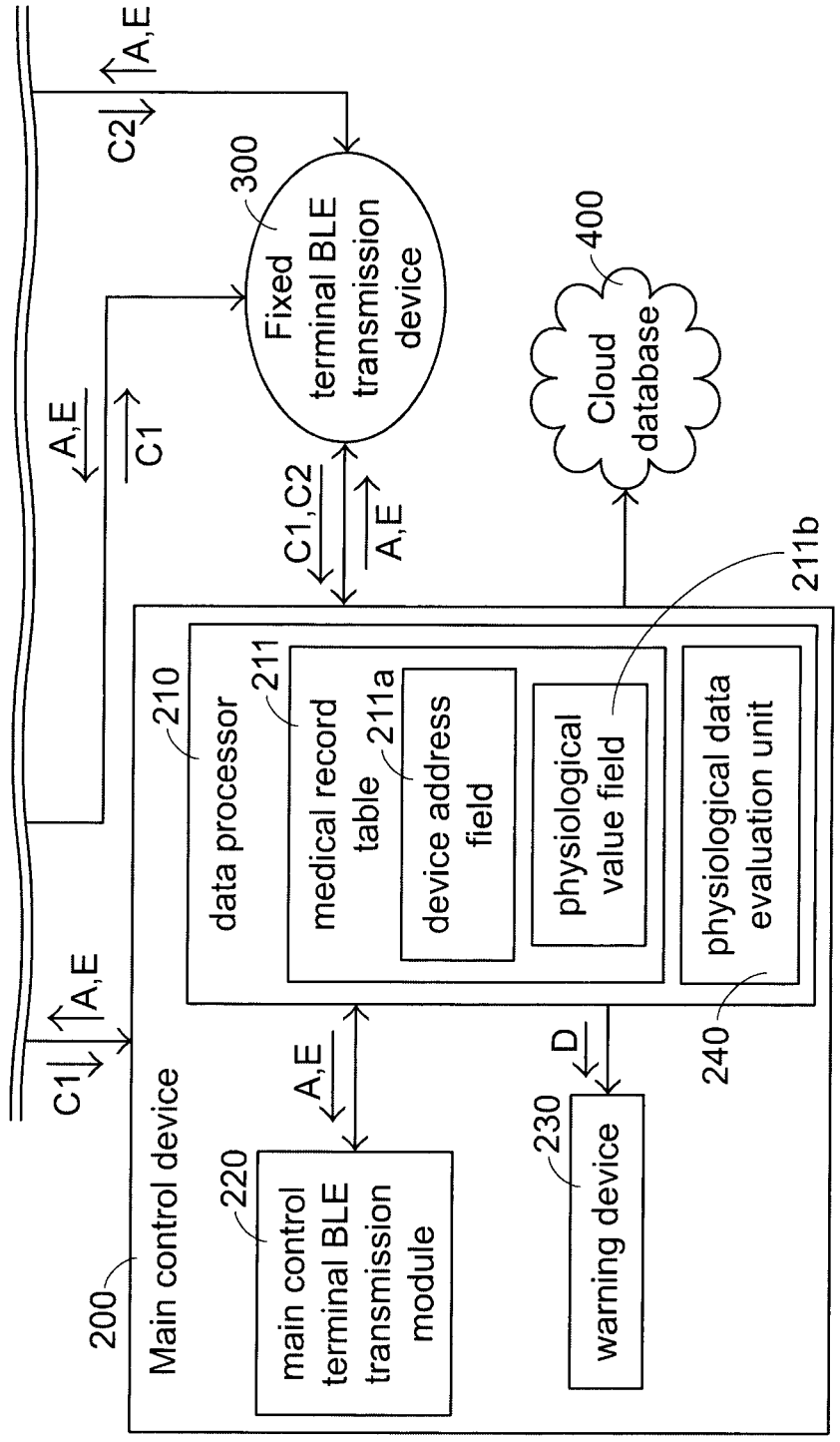
A,E
C2
300
Fixed terminal BLE transmission device
400
Cloud database
A,E
C1
C1,C2
A,E
211b
210
data processor
211
medical record table
211a
device address field
physiological value field
physiological data evaluation unit
C1
A,E
A,E
D
240
200
Main control device
220
main control terminal BLE transmission module
230
warning device

FIG.1B

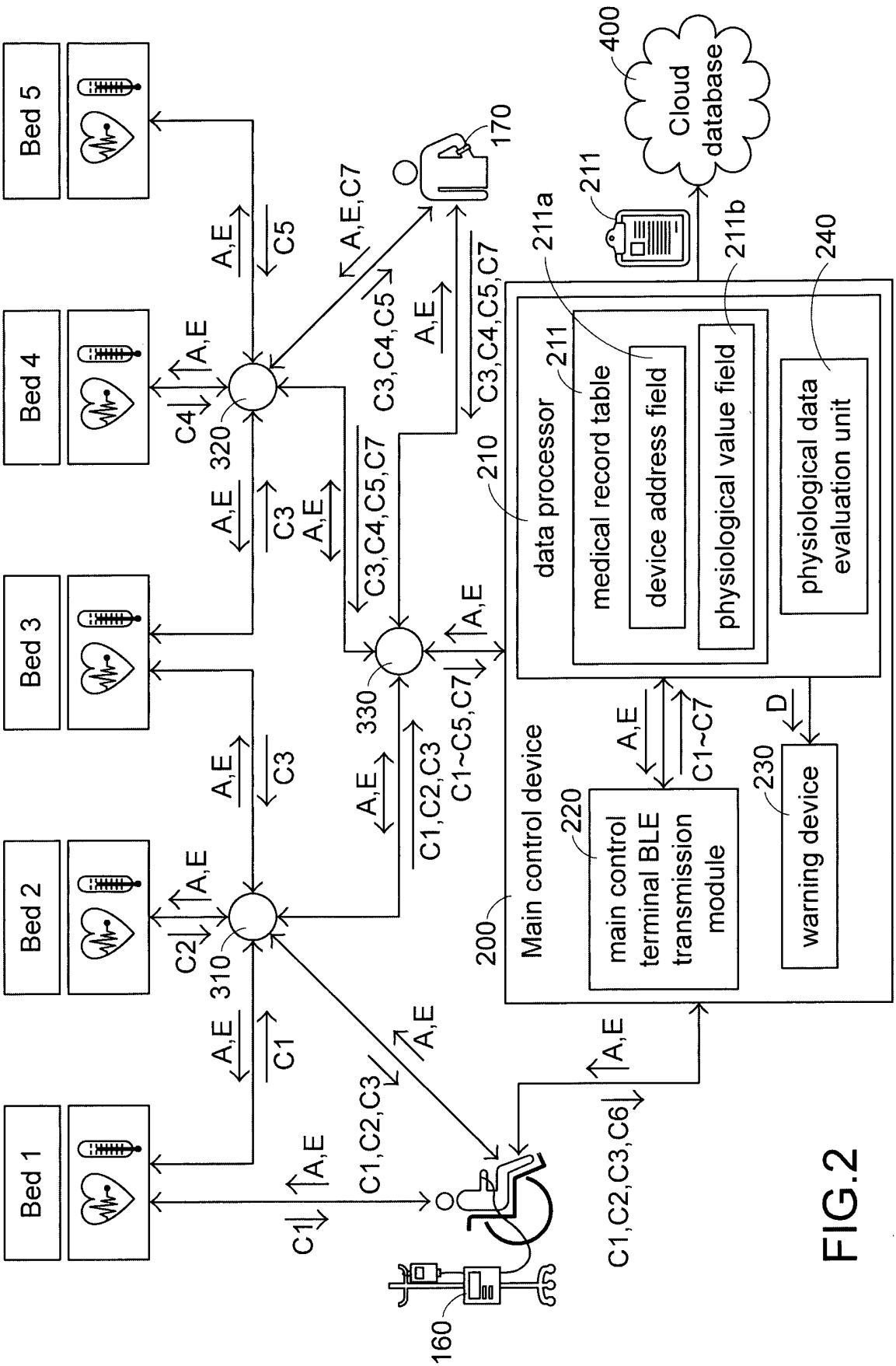
Bed 1
Bed 2
Bed 3
Bed 4
Bed 5
Main control device
200
data processor
210
medical record table
211
device address field
physiological value field
211b
physiological data evaluation unit
240
211a
211
Cloud database
400
main control terminal BLE transmission module
220
warning device
230
310
320
330
160
170
A,E
C1
C2
C3
C4
C5
C1,C2,C3
C3,C4,C5,C7
C3,C4,C5
C1~C5,C7
C1~C7
C1,C2,C3,C6
D

FIG.2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- WO 2013086036 A **[0004]**
- WO 2014106096 A **[0004]**

专利名称(译)	使用蓝牙低能量网状网络的生理监测系统		
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当前申请(专利权)人(译)	飞捷科技有限公司.		
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优先权	104136707 2015-11-06 TW		
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外部链接	Espacenet		

摘要(译)

提供了一种使用蓝牙低能量网状网络的生理监测系统。生理监测系统包括主控制装置和多个生理检测装置。主控制设备通过蓝牙低能量网状网络广播测量命令信号。在多个生理检测装置接收到测量命令信号之后，生成相应对象的生理数据信号，并通过蓝牙低能量网状网络进行外部广播。在主控制设备接收到生理数据信号之后，生成对应于对象的医疗记录表。因此，生理监测系统可以提高检测效率并节省人力资源。