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(54) **PATCH INCLUDING AN EXTERNAL FLOATING HIGH-PASS FILTER AND AN ELECTROCARDIOGRAPH (ECG) PATCH INCLUDING THE SAME**

PFLASTER MIT EINEM EXTERNEN SCHWEBENDER HOCHPASSFILTER UND ELEKTROKARDIOGRAPH (EKG)-PFLASTER DAMIT

PASTILLE COMPRENANT UN FILTRE PASSE-HAUT FLOTTANT EXTERNE ET PASTILLE D'ÉLECTROCARDIOGRAPHE (ECG) LA COMPRENANT

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(73) Proprietor: **Samsung Electronics Co., Ltd.**
Gyeonggi-do, 443-742 (KR)

(72) Inventors:
- **YAN, Long**
445-701 Hwaseong-si, Gyeonggi-do (KR)
- **BAEK, Min Gun**
445-701 Hwaseong-si, Gyeonggi-do (KR)
- **JO, Hee Jae**
445-701 Hwaseong-si, Gyeonggi-do (KR)

(74) Representative: **Kuhnen & Wacker**
Patent- und Rechtsanwaltsbüro PartG mbB
Prinz-Ludwig-Straße 40A
85354 Freising (DE)

(56) References cited:
KR-A- 20120 097 997
US-A1- 2008 150 631
US-A1- 2011 009 729
US-A1- 2014 221 850

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Description

Technical Field

[0001] Exemplary embodiments of the inventive concept relate to an electrocardiograph (ECG) patch, and more particularly, to an ECG patch including two electrodes and a floating high-pass filter.

Discussion of Related Art

[0002] ECG monitoring is the process of recording the electrical activity of the heart over a period of time using electrodes placed on a person's body. These electrodes detect tiny electrical changes on the person's skin that arise from the heart depolarizing during each heartbeat. An ECG patch placed near the heart allows ECG signals to be easily acquired. Generally, an ECG patch includes ECG electrodes for detecting ECG signals and a bias electrode for supplying a bias voltage to a person's body. The bias electrode is typically attached to the person's body together with the ECG electrodes.

[0003] From US 2014/0221850 A1 there is known a monitor device and associated methodology for the monitoring of heart related parameters, including ECG. The detection of heart related parameters is predicated on the location of inequipotential signals located within regions of the human body conventionally defined as equivalent for the purpose of detection of heart related electrical activity. The device comprises a wearable sensor device adapted to be worn in an equivalence region of the individual; at least two electrodes attached to the wearable sensor device and adapted to be mounted within the equivalence region and to detect a heart-related signal; and a processor in electronic communication with the at least two electrodes an programmed to determine a sleep related parameter of the individual. From US 2011/0009729 A1 there is known an apparatus for measuring physiological signals by distributing modules according to functions. The apparatus includes first and second detection electrodes, a physiological signal detection module, a power supply module, and a connection line. The detection electrodes are adhered to a target skin to detect physiological signals. The physiological signal detection module is installed at the first detection electrode to generate physiological signal from the physiological signals detected by the first and second detection electrodes. The power supply module is installed at the second detection electrode to supply power to the physiological signal detection module. A connection line connects the physiological signal detection module and the power supply module.

SUMMARY

[0004] According to an exemplary embodiment of the inventive concept, there is provided an electrocardiograph (ECG) patch comprising: a first electrode; a second electrode; a high pass filter configured to receive a bias voltage and provide the bias voltage to the first electrode and the second electrode; and a signal processing unit configured to generate the bias voltage and provide the bias voltage to the high pass filter.

[0005] According to an exemplary embodiment of the inventive concept, there is provided an ECG patch comprising: a first patch including a first electrode, a high pass filter and an ECG signal processing unit; a second patch including a second electrode and a battery; and a cable including a first wire for providing a bias voltage from the first patch to the second electrode, a second wire for providing an operating voltage to the second patch and a third wire for providing a ground voltage to the second patch.

[0006] According to an exemplary embodiment of the inventive concept, there is provided a data processing system comprising: an ECG patch comprising a first electrode, a second electrode, a high pass filter configured to generate a bias voltage to be provided to the first electrode and the second electrode, and a wireless transceiver; and a mobile communication device configured to communicate with the ECG patch.

[0007] According to an exemplary embodiment of the inventive concept, there is provided a data processing system comprising: an ECG patch comprising a first electrode, a second electrode, a high pass filter configured to generate a bias voltage to be provided to the first electrode and the second electrode, and a wireless transceiver; a health care server configured to receive ECG medical data of a person wearing the ECG patch; and a mobile computing device configured to the receive the ECG medical data of the person from the health care server.

[0008] According to an exemplary embodiment of the inventive concept, an ECG patch comprises: a first electrode configured to detect a first ECG signal; a second electrode configured to detect a second ECG signal; a high-pass filter configured to perform high-pass filtering on the first ECG signal to generate a first high-pass filtered signal, and to perform high-pass filtering on the second ECG signal to generate a second high-pass filtered signal; and a signal processing unit configured to generate an ECG output signal based on a difference between the first ECG signal and the second ECG signal, wherein the high-pass filter is further configured to generate a first bias voltage based on a driving voltage and provide the first bias voltage to the first electrode, and to generate a second bias voltage based on the driving voltage and provide the second bias voltage to the second electrode.

[0009] According to an exemplary embodiment of the inventive concept, an ECG patch comprises: a first patch including a first electrode and an ECG sensor; a second patch including a second electrode; and a cable connected between the first patch and the second patch, wherein the ECG sensor is configured to receive a first high-pass filtered signal and a second high-pass filtered signal and amplify a voltage difference between the first and second high-pass filtered signals to generate an output voltage, wherein the first patch includes a high-pass filter configured to generate a first bias voltage and a second bias voltage using a driving voltage and to provide the first bias voltage to the first electrode and the second bias voltage to the second electrode.

[0010] According to an exemplary embodiment of the inventive concept, there is provided an ECG patch comprising: a first electrode; a second electrode; a wire; and a high-pass filter configured to generate a first bias voltage and a second bias voltage, apply the first bias voltage to the first electrode via a transmission line and apply the second bias voltage to the second electrode via the wire.

[0011] According to an exemplary embodiment of the inventive concept, there is provided an ECG patch comprising: a first electrode configured to detect a first ECG signal from a heart of a person; a second electrode configured to detect a second ECG signal from the heart of the person; a high-pass filter configured to perform high-pass filtering on the first ECG signal to generate a first high-pass filtered signal, and to perform high-pass filtering on the second ECG signal to generate a second high-pass filtered signal; and an ECG processing unit including an ECG sensor configured to sense a difference between the first high-pass filtered signal and the second high-pass filtered signal and generate an ECG output signal corresponding to the sensing result, and a bias voltage generating circuit configured to provide a bias voltage to the high pass filter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The above and other features of the inventive concept will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

FIG. 1 is a perspective view of a wearable electrocardiograph (ECG) patch including two ECG electrodes and a floating high-pass filter according to an exemplary embodiment of the inventive concept;

FIG. 2 is a perspective view showing a state where the wearable ECG patch illustrated in FIG. 1 is placed around a human heart, according to an exemplary embodiment of the inventive concept;

FIG. 3 is a detailed block diagram of the wearable ECG patch illustrated in FIG. 1, according to an exemplary embodiment of the inventive concept;

FIG. 4 is a schematic diagram of the layout of a floating high-pass filter and ECG transmission lines included in a first patch of the wearable ECG patch illustrated in FIG. 1, according to an exemplary embodiment of the inventive concept; and

FIG. 5 is a schematic diagram of the layout of a printed circuit board (PCB) included in the first patch of the wearable ECG patch illustrated in FIG. 1, according to an exemplary embodiment of the inventive concept.

FIG. 6 is a detailed block diagram of the wearable ECG patch illustrated in FIG. 1, according to an exemplary embodiment of the inventive concept;

FIG. 7 is a diagram of a data processing system which includes the ECG signal processing unit shown in FIG. 6, according to an exemplary embodiment of the inventive concept; and

FIGS. 8, 9, and 10 are diagrams illustrating data processing systems which include the wearable ECG patch shown in FIG. 1, according to an exemplary embodiment of the inventive concept.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0013] FIG. 1 is a perspective view of a wearable electrocardiograph (ECG) patch 100 including two ECG electrodes and a floating high-pass filter according to an exemplary embodiment of the inventive concept. FIG. 2 is a perspective view showing a state where the wearable ECG patch 100 illustrated in FIG. 1 is placed around a human heart, according to an exemplary embodiment of the inventive concept.

[0014] Referring to FIG. 1, the wearable ECG patch 100 may include a first patch 110, a second patch 150, and a cable 170. The wearable ECG patch 100 may be called an ECG patch or an ECG sensor patch.

[0015] ECG electrodes 112 and 152 are placed on the patches 110 and 150, respectively. The wearable ECG patch 100 does not require special ECG electrodes for body biasing to be implemented in any of the patches 110 and 150. Accordingly, the wearable ECG patch 100 includes only two ECG electrodes 112 and 152. The ECG electrodes 112 and 152 are ECG electrodes or ECG signal electrodes which are placed on the body, and more particularly, around the heart of a person 300.

[0016] In FIG. 2, reference numeral 111 denotes an adhesive layer for fixing or attaching the first ECG electrode 112 of the first patch 110 to the surface of the person's chest around the heart and reference numeral 151 denotes an adhesive layer for fixing or attaching the second ECG electrode 152 of the second patch 150 to the surface of the person's chest around the heart. Each of the adhesive layers 111 and 151 may include a conductive gel but is not limited thereto. In addition, reference numerals 111 and 151 may denote disposable ECG electrodes which are electrically connected to ECG electrodes 112 and 152, respectively.

[0017] FIG. 3 is a detailed block diagram of the wearable ECG patch 100 illustrated in FIG. 1, according to an exemplary embodiment of the inventive concept. Referring to FIG. 3, V_{ECG} denotes the voltage of an ECG signal generated by the heartbeat of the person 300; Z_{elec} in an electrode interface model IFM denotes a contact impedance between each modeled ECG electrode 112 or 152 and the person 300; V_{hc} denotes a voltage difference, e.g., a direct current (DC) component between the ECG electrodes 112 and 152; and ΔZ denotes a difference between the impedance of the first patch 110 and the contact impedance of the second patch 150. ΔZ is one of the factors increasing motion noise. The motion noise may be increased by the motion of the person 300 or a physical difference between the ECG electrodes 112 and 152 (e.g., a difference between the thicknesses of the adhesive layers 111 and 151 existing between the respective ECG electrodes 112 and 152 and the body of the person 300). The contact impedance Z_{elec} may be determined by resistance (e.g., 51 kΩ) and capacitance (e.g., 47 nF) and the voltage difference V_{hc} may be ±300 mV, but these values 51 kΩ, 47 nF, and ±300 mV are just examples.

[0018] 50/60 Hz denotes power noise generated from a noise source (NS) and Ic denotes noise current generated from the NS. For instance, when the person 300 with the wearable ECG patch 100 placed on the body around the heart is near the NS, e.g., a fluorescent light or a measuring device, which operates at a frequency of 50 or 60 Hz, the power noise 50/60 Hz and the noise current Ic may influence the body of the person 300. Fc denotes capacitance between an earth ground (GND) and the body of the person 300; VSS_{PCB} denotes a ground (or a ground of a printed circuit board (PCB)) of an ECG signal processing unit 120; and CC denotes capacitance between the earth GND and the PCB ground VSS_{PCB}.

[0019] Referring to FIGS. 1 through 3, the first patch 110 includes the first ECG electrode 112, the ECG signal processing unit 120, a high-pass filter 130, and transmission lines 122-1, 122-2, and L1.

[0020] The first ECG electrode 112 may detect a first ECG signal from the heart of the person 300. The high-pass filter 130 may perform high-pass filtering on the first ECG signal to generate a first high-pass filtered ECG signal ECG_P.

[0021] The ECG signal processing unit 120 may include a plurality of pads 121-1, 121-2, 121-3, 121-4, and 121-5, an ECG sensor 123, a voltage regulator 125, a voltage divider 127, and a driver 129. The ECG signal processing unit 120, which can process bio signals ECG_P and ECG_N, may be an ECG chip or a bio-processor.

[0022] The ECG sensor 123 may sense a difference between the first high-pass filtered ECG signal ECG_P input through the first pad 121-1 and a second high-pass filtered ECG signal ECG_N input through the second pad 121-2 and may generate and process an ECG output signal corresponding to the sensing result.

[0023] The voltage regulator 125 may receive an operating voltage VDD through the third pad 121-3, may regulate the operating voltage VDD, and may generate an operating voltage of the ECG sensor 123 included in the ECG signal processing unit 120. The operating voltage VDD is generated by a battery 154 embedded in the second patch 150 and may be supplied to the voltage regulator 125 through a second wire W2 and the third pad 121-3.

[0024] The voltage divider 127 may divide the voltage (e.g., VDD) that has been regulated by the voltage regulator 125 to generate a driving voltage. The driving voltage may be VDD/2 but is not limited thereto. The driver 129 may drive the driving voltage VDD/2 to the high-pass filter 130 through the fifth pad 121-5. The driver 129 may have a gain of 1 and may be implemented as a current driver, but the inventive concept is not limited to this example.

[0025] The high-pass filter 130 may generate a first bias voltage and a second bias voltage using the driving voltage VDD/2, may apply the first bias voltage to the body of the person 300 through the third transmission line L1 and the first ECG electrode 112, and may apply the second bias voltage to the body of the person 300 through a first wire W1 and the second ECG electrode 152. The level of the first bias voltage may be the same as the level of the second bias voltage, but the inventive concept is not limited to this example. The levels of the first and second bias voltages may be determined by the driving voltage, e.g., VDD/2, output from the driver 129 when the ECG electrodes 112 and 152 are attached to the body of the person 300.

[0026] Accordingly, the first ECG electrode 112 may apply the first bias voltage to the body of the person 300 and detect a first ECG signal at a time, and the second ECG electrode 152 may apply the second bias voltage to the body of the person 300 and detect a second ECG signal at a time. The times may be the same, substantially simultaneous or different from each other.

[0027] Since the driving voltage VDD/2 is applied to the high-pass filter 130, the high-pass filter 130 may be implemented as a floating high-pass filter. The high-pass filter 130 may include a plurality of capacitors 132 and 135 and a plurality of resistors 131, 133, 134, and 136. Although the high-pass filter 130 is placed outside the ECG signal processing unit 120 in the embodiment illustrated in FIG. 3, the high-pass filter 130 may be integrated into or placed within the ECG signal processing unit 120.

[0028] The first capacitor 132 is connected between the third transmission line L1 and the first transmission line 122-1. The second capacitor 135 is connected between the first wire W1 and the second transmission line 122-2. The first transmission line 122-1 is connected to the first pad 121-1. The second transmission line 122-2 is connected to the second pad 121-2.

[0029] The first resistor 131 is connected between the third transmission line L1 and a node ND connected to the fifth pad 121-5. The second resistor 133 is connected between the first transmission line 122-1 and the node ND. The third resistor 134 is connected between the node ND and the second transmission line 122-2. The fourth resistor 136 is connected between the node ND and the first wire W1.

[0030] The capacitors 132 and 135 may have the same capacitance C and the resistors 131, 133, 134, and 136 may have the same resistance R. However, the resistors 131 and 136 may have a resistance R1 and the resistors

133 and 134 may have a resistance R2. In this case, the resistance R1 may be different from the resistance R2. Each of the resistors 131, 133, 134, and 136 may be a passive or an active resistance element. Each of the capacitors 132 and 135 may be a switched capacitor.

[0031] A common-mode DC gain $G_{CM,\ DC}$ of the high-pass filter 130 may be 1. For instance, when R=R1=R2, a cutoff frequency $f_{HPf,\ -3dB}$ of the high-pass filter 130 is $1/2\pi$ RC and a differential input impedance $Z_{in,\ Diff}$ approximates R.

[0032] When the ECG electrodes 112 and 152 are attached to the body of the person 300 around the heart and the driving voltage VDD/2 is applied to the high-pass filter 130, a voltage of the first transmission line 122-1 is $VDD/2 + G1 \cdot V_{ECG}/2 + V_{hc}/2$ and a voltage of the second transmission line 122-2 is $VDD/2 - G1 \cdot V_{ECG}/2 + V_{hc}/2$, where G1 may denote a gain which is determined by the capacitance C, the resistance R2, and a frequency of the voltage V_{ECG}. Although the formulas illustrated in FIG. 3 do not include G1, in practice these formulas may include G1.

[0033] Accordingly, differential DC inputs (e.g., V_{hc}) are attenuated by the high-pass filter 130 and the attenuated differential DC inputs may be eliminated from the ECG sensor 123. The body of the person 300 is biased by two resistors 131 and 136 and two ECG electrodes 112 and 152. In other words, the ECG patch 100 does not include a separate bias electrode for exclusively supplying a bias voltage.

[0034] The ground of the battery 154 and the PCB ground VSS_{PCB} may be connected with each other through a third wire W3 and the fourth pad 121-4.

[0035] The second patch 150 may include the second electrode 152 and the battery 154. The second ECG signal detected by the second electrode 152 is transmitted to the high-pass filter 130 through the first wire W1. The high-pass filter 130 performs high-pass filtering on the second ECG signal to output the second high-pass filtered ECG signal ECG_N. The second high-pass filtered ECG signal ECG_N may be transmitted to the ECG sensor 123 through the second transmission line 122-2 and the second pad 121-2.

[0036] The cable 170 may include the first wire W1 for transmitting the second ECG signal detected by the second ECG electrode 152 placed in the second patch 150 to the first patch 110, the second wire W2 for transmitting the operating voltage VDD to the first patch 110, and the third wire W3 for transmitting a ground voltage to the first patch 110. The cable 170 may be a shielded cable.

[0037] FIG. 4 is a schematic diagram of the layout of the floating high-pass filter 130 and ECG transmission lines included in the first patch 110 of the wearable ECG patch 100 illustrated in FIG. 1, according to an exemplary embodiment of the inventive concept. Referring to FIG. 4, when the ECG patch 100 is implemented in a PCB including a plurality of layers LAYER1 through LAYER6, the ECG signal processing unit 120 may be placed at the first layer LAYER1 and the high-pass filter 130 may be placed at the sixth layer LAYER6, but the inventive concept is not limited to the current embodiment.

[0038] A first electrostatic discharge (ESD) protection circuit 140 may be placed between the electrodes 112 and 152 and the high-pass filter 130. The high-pass filter 130 may be placed as close as possible to the ECG sensor 123. A transmission line for supplying a ground voltage VSS may be placed at the fifth layer LAYER5. ESD protection circuits 140 and 142, the first transmission line 122-1 for transmitting the first high-pass filtered ECG signal ECG_P, and the second transmission line 122-2 for transmitting the second high-pass filtered ECG signal ECG_N may be placed at the sixth layer LAYER6, but the inventive concept is not limited to the current embodiment.

[0039] FIG. 5 is a schematic diagram of the layout of a PCB included in the first patch 110 of the wearable ECG patch 100 illustrated in FIG. 1, according to an exemplary embodiment of the inventive concept. Referring to FIG. 5, a transmission line for transmitting the first high-pass filtered ECG signal ECG_P and the high-pass filter 130 are placed at the sixth layer LAYER6, a transmission line 210 placed at the fifth layer LAYER5 to transmit a ground voltage may have a structure for shielding the transmission line for transmitting the first high-pass filtered ECG signal ECG P to prevent coupling noise between digital lines 230 placed at the fourth layer LAYER4 and the transmission line placed at the sixth layer LAYER6 to transmit the first high-pass filtered ECG signal ECG_P. In addition, a shielding structure 220 or a shielding layer 220 may be placed between the digital lines 230 and the high-pass filter 130 to prevent coupling noise between the digital lines 230 and the high-pass filter 130.

[0040] FIG. 6 is a detailed block diagram of the wearable ECG patch illustrated in FIG. 1, according to an exemplary embodiment of the inventive concept. Referring to FIGS. 1, 2, 3, and 6, an ECG processing unit 120-1 may include an ECG sensor 123, an analog-to-digital converter (ADC) 410, a central processing unit (CPU) 420, a memory controller 430, an internal memory device 435, a security circuit 440, and a wireless transceiver 450. Referring to FIGS. 1, 3, and 6, the ECG patch may include a memory device 460 and a sensor 470.

[0041] Referring to FIGS. 3 and 6, the ECG sensor 123 may receive a first high-pass filtered ECG signal ECG_P and a second high-pass filtered ECG signal ECG_N, process (or amplify) a voltage difference between the first high-pass filtered ECG signal ECG_P and the second high-pass filtered ECG signal ECG_N, and generate an ECG output corresponding to a result of the process (or amplification).

[0042] The ADC 410 may convert the ECG output into an ECG digital signal and output the ECG digital signal to the CPU 420. The CPU 420 may analyze a heart rhythm of a person using the ECG digital signal. The CPU 420 may detect, predict, or analyze sudden cardiac arrest (SCA) of a person using the ECG digital signal. For example, the CPU 420 may detect, predict, or analyze cardiac arrhythmias such as ventricular fibrillation and/or ventricular tachycardia using the ECG digital signal.

[0043] The memory controller 430, under the control of the CPU 420, may transmit data related to the high-pass filtered ECG signals ECG P and ECG_N to the internal memory device 435 and/or the memory device 460 and receive data related to the high-pass filtered ECG signals ECG_P and ECG_N from the internal memory device 435 and/or the memory device 460.

[0044] The internal memory device 435 may be a read only memory (ROM), a random access memory (RAM), a dynamic RAM (DRAM), or a static RAM (SRAM), but is not limited thereto. The memory device 460 may store a boot image for booting the ECG patch 100 and an application program to be performed by the CPU 420. The memory device 460 may comprise a volatile memory and/or a non-volatile memory. The volatile memory may be a RAM, a DRAM, or an SRAM, but is not limited thereto. The non-volatile memory may be an electrically erasable programmable ROM (EEPROM), a NAND-type flash memory, a NOR-type flash memory, a magnetic RAM (MRAM), a spin-transfer torque MRAM, a ferroelectric RAM (FeRAM), a phase change RAM (PRAM), a resistive RAM (RRAM), a holographic memory, a molecular electronics memory device, or an insulator resistance change memory, but is not limited thereto.

[0045] The internal memory device 435 and/or the memory device 460 may store information on a person such as a patient (e.g., patient data) and/or data related to the high-pass filtered ECG signals ECG_P and ECG_N under the control of the memory controller 430. For example, the data may include high-pass filtered ECG signals ECG_P and ECG_N, data related to a heart rate, data related to cardiac arrhythmias, data related to ventricular fibrillation (e.g., a history of ventricular fibrillation and a history of defibrillation), and/or sensing data generated by the sensor 470. For example, the data may be encoded or decoded by the security circuit 440.

[0046] The security circuit 440 may encode data output from the CPU 420 and related to a heart rhythm into security data, and output the encoded security data to the wireless transceiver 450. In addition, the security circuit 440 may decode the data transmitted from the wireless transceiver 450 and transmit the decoded data to the CPU 420. For example, the security circuit 440 may be configured, e.g., programmed, with an encryption and decryption code.

[0047] The wireless transceiver 450 may transmit encoded security data output from the security circuit 440 to an external Internet of Things (IoT) device 500 (e.g., a wireless communication device, a smart watch, a smart phone, a tablet personal computer (PC), a wearable computer, a mobile internet device, etc.) under the control of the CPU 440. The ECG processing unit 120-1 may use a communication circuit, e.g., the wireless transceiver 450, for connecting to the external IoT device 500. For example, the ECG processing unit 120-1 may determine what kind of external smart device the communication circuit is connected to.

[0048] The wireless transceiver 450 may transmit data related to the high-pass filtered ECG signals ECG_P and ECG_N, e.g., security data or biological data, to the external IoT device 500 through a local area network (LAN), a wireless LAN (WLAN) such as wireless fidelity (Wi-Fi), a wireless personal area network (WPAN) such as Bluetooth, a wireless universal serial bus (USB), a Zigbee connection, a near field communication (NFC) connection, a radio-frequency identification (RFID) connection, or a mobile cellular network. For example, the mobile communication network may be a 3rd generation (3G) mobile communication network, a 4th generation (4G) mobile communication network, or a long term evolution mobile communication network (LTE™). For example, the wireless transceiver 450 may include a transceiver and an antenna for modem communication. The Bluetooth interface may support Bluetooth Low Energy (BLE).

[0049] FIG. 7 is a diagram of a data processing system which includes the ECG signal processing unit 120-1 shown in FIG. 6, according to an exemplary embodiment of the inventive concept. Referring to FIGS. 6 and 7, a user of a IoT device 500 may execute, e.g., select for use, an application installed in the IoT device 500 (S110).

[0050] A communication module (or wireless transceiver) of the IoT device 500 may transmit an information request to the ECG processing unit 120 or 120-1 (hereinafter collectively referred to as 120) under the control of the application performed by a CPU of the IoT device 500 (S120). A CPU 420 of the ECG processing unit 120, for example bio-processor 120, may require authentication by performing an information request through the wireless transceiver 450 (S130).

[0051] After the authentication is completed, the CPU 420 may read patient information and biological information from the memory device 435 or 460 using the memory controller 430, and transmit the patient information and the biological information to the wireless transceiver 450 through the security circuit 440. The wireless transceiver 450 may transmit the patient information and the biological information to the IoT device 500 through a wireless network (S140).

[0052] The application executed by a CPU included in the IoT device 500 may display patient information 520 and/or biological information 530 on a display device 510 of the IoT device 500 (S150). For example, the patient information 520 may include the age 521, blood type 522, family doctor (medical attendant) 523, and/or a medical history 524 of the patient. The biological information 530 may include heart rate 531 and an ECG waveform 532.

[0053] A user of the IoT device 500 may determine a state of a patient to which the wearable ECG patch 100 is attached using the patient information 520 and/or the biological information 530, and perform a proper medical treatment or emergency diagnosis on the patient according to a result of the determination.

[0054] FIGS. 8, 9, and 10 are diagrams illustrating data processing systems which include the wearable ECG patch shown in FIG. 1, according to exemplary embodiments of the inventive concept. Referring to FIG. 8, a data processing system 800A may be used to provide a telemedicine service. The data processing system 800A may include the wearable ECG patch 100 and a first medical server (health care sever) 820 which can communicate with the wearable ECG patch 100 through a wireless network 810, e.g., the internet or Wi-Fi.

[0055] According to one example, the data processing system 800A may further include a second medical server (health care server) 850 which can communicate with the wearable ECG patch 100 and/or the first medical server 820 through the wireless network 810. For example, a health insurance corporation and/or an insurance company may manage the second medical server 850 and a database 855.

[0056] The wireless transceiver 450 of the wearable ECG patch 100 may transmit data HDATA corresponding to the ECG signals ECG_P and ECG_N. The application may store a uniform resource locator (URL) of the first medical server 820 and/or a URL of the second medical server 850. Accordingly, the wireless transceiver 450 of the wearable ECG patch 100 may transmit data HDATA to the first medical server 820 (S801) and/or the second medical server 850 (S821) through the network 810 under the control of the CPU 420 or a control of an application program ("app") performed by the CPU 420.

[0057] The data HDATA may include the ECG signals ECG_P and ECG_N, data generated based on the ECG signals ECG_P and ECG_N, and patient information. For example, data generated based on the ECG signals ECG P and ECG_N may include data on ventricular fibrillation, data on ventricular tachycardia, a heart rate, arrhythmia, or a defibrillation history of the patient, but is not limited thereto.

[0058] The wireless network 810 may transmit the data HDATA to the first medical server 820 and/or the second medical server 850 (S803 and/or S821). The first medical server 820 may store the data HDATA in database 821 (S804), and transmit the data HDATA to a computing device 845 of a doctor working at a medical institution 840 through a network 830 (S805). For example, the computing device 845 of a doctor may be a PC or a tablet PC, but is not limited thereto. The doctor may work at a medical institution, a public health care center, a clinic, a hospital, or a rescue center, for example.

[0059] The doctor may diagnose a state of the patient using the data HDATA displayed through the computing device 845 and input diagnostic data into the computing device 845 (S807). The computing device 845 transmits the diagnostic data DDATA to the first medical server 820 through the network 830 (S809), and the first medical server 820 stores the diagnostic data DDATA in the database 821 (S804) and transmits the diagnostic data DDATA to the network 810 (S811). The network 810 may transmit the diagnostic data DDATA to the wearable ECG patch 100 (S813) or to the second medical server 850 (S821). The ECG patch 100 may store the diagnostic data DDATA in the memory device 435 or 460. The second medical server 850 may store the diagnostic data DDATA in the database 855 (S823).

[0060] Each of the servers 820 and 850 may store or analyze each of the data HDATA and DDATA in the databases 821 and 855. In addition, each of the servers 820 and 850 may transmit a result of the analysis to the networks 810 and 830.

[0061] Referring to FIG. 9, a data processing system 800B may be used to provide a remote medical service. The data processing system 800B may include the wearable ECG patch 100, an IoT device 801 (for example a smart watch or a smart phone), and the first medical server 820 which can communicate with the IoT device 801 through the wireless network 810. The IoT device 801 may be the IoT device 500 of the examples shown in and described with reference to FIGS. 6 and 7, but is not limited thereto. The data processing system 800A of FIG. 9 is similar to the data processing system 800B of FIG. 8, in terms of its structure and operation, except for the IoT device 801 through which the wearable ECG patch 100 transmits or receives data to or from the wireless network 810.

[0062] The wearable ECG patch 100 may transmit data HDATA generated by the wearable ECG patch 100 to the IoT device 801 (S800). For example, the wearable ECG patch 100 may automatically transmit the data HDATA to the IoT device 801 according to a request of the IoT device 801 or when an abnormality is detected in the heart function of a patient (S800). The IoT device 801 may transmit the data HDATA to the network 810 (S801), and receive diagnostic data DDATA output from the network 810 (S813). The IoT device 801 may display the diagnostic data DDATA on a display of the IoT device 801. Accordingly, a user of the IoT device 801 may provide appropriate medical care to or perform first aid on a patient who wears the wearable ECG patch 100, using the diagnostic data DDATA.

[0063] Referring to FIG. 10, a data processing system 900 may be used to provide a remote medical service. The data processing system 900 may include the wearable ECG patch 100 and a mobile computing device 910 which can communicate with the wearable ECG patch 100 through a network 905. The data processing system 900 may further include a medical server (health care server) 915 which can communicate with the mobile computing device 910 through a network 912.

[0064] The wireless transceiver 450 of the wearable ECG patch 100 may transmit data HDATA corresponding to the ECG signals ECG_P and ECG N to the mobile computing device 910 through the network 905 under the control of the CPU 420 or a control of an app performed by the CPU 420 (S901).

[0065] For example, the mobile computing device 910 may be a smart phone, a tablet PC, a minimally invasive device (MID), an IoT device, or an internet of everything (IoE) device, but is not limited thereto. A user of the mobile computing device 910 which can perform an app to be described with reference to FIG. 10 may be a medical team, a guardian, or a passerby. The passerby may be someone who has completed first aid training; however, the inventive concept is not limited thereto.

[0066] An app performed by a CPU of the mobile computing device 910 may be represented by an icon(s), interface, etc. displayed on a display of the mobile computing device 910. The mobile computing device 910 may transmit the data HDATA to the medical server 915 through the network 912 under the control of the app (S903 and S905). The mobile computing device 910 stores a URL of the medial server 915, such that the mobile computing device 910 may transmit the data HDATA to the medical server 915 corresponding to a URL under the control of an app (S903 and S905).

[0067] The medical server 915 may store the data HDATA in the database 917 (S906), and transmit the data HDATA to a computing device 925 of a doctor working at a medical institution 920 through a network 914.

[0068] The doctor may diagnose a state of a patient using the data HDATA displayed through the computing device 925 and input diagnostic data into the computing device 925 (S907). The computing device 925 may transmit the diagnostic data DDATA to the medical server 915 through the network 914, and the medical server 915 may store the diagnostic data DDATA in the database 917 (S906), and transmit the diagnostic data DDATA to the mobile computing device 910 through the network 912 (S909 and S911). The mobile computing device 910 may display the diagnostic data DDATA of the doctor on a display of the mobile computing device 910. Accordingly, a user of the mobile computing device 910 may provide appropriate medical care to or perform first aid on a patient who wears the wearable ECG patch 100, using the diagnostic data DDATA.

[0069] As described above, according to an exemplary embodiment of the inventive concept, an ECG patch includes two electrodes and a floating high-pass filter but does not include a bias electrode for applying a bias voltage to a human body. To generate the bias voltage, the ECG patch uses the high-pass filter, and applies the bias voltage to the human body through the ECG electrodes. In other words, since the ECG patch does not include a bias electrode, a form factor for the ECG patch is reduced in size. Further, since the ECG patch has a minimum number of electrodes, a contact area between the ECG patch and the skin is minimized, so that the convenience of attaching/detaching the ECG patch to the skin increases and an area of the skin impacted by the attached electrodes is also minimized.

[0070] The invention is defined by appended claims 1-18.

Claims

1. An electrocardiograph (ECG) patch (100), comprising:

   a first electrode (112);
   a second electrode (152);
   a high-pass filter (130) configured to receive a bias voltage;
   a signal processing unit (120) configured to generate the bias voltage and provide the bias voltage to the high-pass filter (130)
   characterized in that
   the high-pass-filter is configured to provide the bias voltage to the first electrode (112) and the second electrode (152);

2. The ECG patch (100) of claim 1, wherein the signal processing (120) unit comprises:

   a voltage regulator (125) configured to receive an operating voltage;
   a voltage divider (127) configured to divide the voltage that has been regulated by the voltage regulator (125) to generate the bias voltage; and
   a driver (129) configured to drive the bias voltage to the high-pass filter (130).

3. The ECG patch (100) of claim 2, wherein the driver (129) is a current driver.

4. The ECG patch (100) of claim 2 or 3, wherein the operating voltage is provided from a battery (154) to the voltage regulator (125).

5. The ECG patch (100) of any one of claims 1 to 4, wherein the high-pass filter (130) is a floating high-pass filter (130).

6. The electrocardiograph (ECG) patch (100) of any one of claims 1 to 5 comprising a first patch (110) and a second patch (150),
   wherein the first electrode, the high-pass filter and the ECG signal processing unit are provided in the first patch (110),
   wherein the second electrode (152) and a battery (154) is provided in the second patch (150); and
   wherein a cable (170) is provided including a first wire (W1) for providing a bias voltage from the first patch (110) to the second electrode (152), a second wire (W2) for providing an operating voltage to the second patch (150) and a third wire (W3) for providing a ground voltage to the second patch (150).

7. The ECG patch (100) of claim 6 , wherein the high-pass filter (130) is configured to receive the bias voltage from the ECG signal processing unit (120), provide the bias voltage to the first electrode (112) and provide the bias voltage to the second electrode (152) through the first wire (W1).

8. The ECG patch (100) of any one of claims 6 to 7, wherein the high-pass filter (130) is configured to perform a high-pass filtering on a first ECG signal detected by the first electrode (112) to generate a first high-pass signal (ECG_P), and to perform a high-pass filtering on a second ECG signal detected by the second electrode (152) to generate a second high-pass signal (ECG_N), and
wherein the ECG signal processing unit (120) is configured to generate an ECG output signal based on a difference between the first high-pass filtered ECG signal (ECG_P) and the second high-pass filtered ECG signal (ECG_N).

9. The ECG of any one of claims 6 to 8, wherein the first patch (110) includes a printed circuit board having a plurality of layers, and wherein the ECG signal processing unit (120) is disposed at a first layer of the plurality of layers and the high- pass filter (130) is disposed at a last layer of the plurality of layers.

10. The ECG of claim 9, wherein the ECG signal processing unit (120) and the high-pass filter (130) are disposed opposite each other.

11. The ECG of claim 9 or 10, wherein a transmission line (210) for transmitting a ground voltage is configured to shield a transmission line for transmitting a first high-pass filtered signal.

12. The ECG of claim 11, wherein a shielding layer (220) is disposed between the high-pass filter (130) and signal lines of the ECG signal processing unit (120).

13. An electrocardiograph (ECG) patch (100) of any one of claims 1 to 12, wherein the first electrode (112) is configured to detect a first ECG signal; wherein the second electrode (152) is configured to detect a second ECG signal; wherein the high pass filter (130) is configured to perform high pass filtering on the first ECG signal to generate a first high-pass filtered signal (ECG P), and to perform high-pass filtering on the second ECG signal to generate a second high-pass filtered signal (ECG_N); and
wherein the signal processing unit (120) is configured to generate an ECG output signal based on a difference between the first ECG signal and the second ECG signal,
wherein the high-pass filter (130) is further configured to generate a first bias voltage based on a driving voltage and provide the first bias voltage to the first electrode (112), and to generate a second bias voltage based on the driving voltage and provide the second bias voltage to the second electrode (152).

14. The ECG patch (100) of claim 13, wherein the first bias voltage and the second bias voltage have the same level.

15. The ECG patch (100) of claim 13 or 14, wherein the first ECG signal is detected when the first bias voltage is applied to a person's body and the second ECG signal is detected when the second bias voltage is applied to the person's body.

16. The ECG patch (100) of any one of claims 13 to 15, wherein the high-pass filter (130) comprises:

a first capacitor (132) connected between a first transmission line (122-1) and a third transmission line (L1), wherein the first transmission line (122-1) is connected to a first pad of the signal processing unit (120);
a second capacitor (135) connected between a first wire (135) and a second transmission line (122-2), wherein the second capacitor (135) is connected to a second pad of the signal processing unit (120);
a first resistor (131) connected between the third transmission line (L1) and a first node (ND) connected to a fifth pad of the signal processing unit (120);
a second resistor (133) connected between the first transmission line (122-1) and the first node;
a third resistor (134) connected between the first node and the second transmission line (122-2); and
a fourth resistor (136) connected between the first node and the first wire (W1).

17. The ECG patch (100) of claim 16, wherein the first and second capacitors (132, 135) have the same capacitances as each other and the first to fourth resistors (131, 133, 134, 136) have the same resistances as each other.

18. The ECG patch (100) of claim 16 or 17, wherein the signal processing unit (120) comprises:

a voltage regulator (125) connected to a third pad of the signal processing unit (120) and configured to receive an operating voltage via the third pad and regulate the operating voltage, wherein the third pad is connected to a second wire (W2);
a voltage divider (127) configured to divide the voltage that has been regulated by the voltage generator to generate a driving voltage; and
a driver (129) configured to drive the driving voltage and provide the driving voltage to the high pass filter (130) through the fifth pad.

Patentansprüche

1. Elektrokardiographie- (EKG-) Patch (100), aufweisend:

eine erste Elektrode (112);
eine zweite Elektrode (152);
einen Hochpassfilter (130), der so konfiguriert ist, dass er eine Vorspannung empfängt;
eine Signalverarbeitungseinheit (120), die so konfiguriert ist, dass sie die Vorspannung erzeugt und die Vorspannung dem Hochpassfilter (130) bereitstellt,
dadurch gekennzeichnet, dass
der Hochpassfilter so konfiguriert ist, dass er die Vorspannung der ersten Elektrode (112) und der zweiten Elektrode (152) bereitstellt.

2. EKG-Patch (100) nach Anspruch 1, wobei die Signalverarbeitungseinheit (120) aufweist:

einen Spannungsregler (125), der konfiguriert ist zum Empfangen einer Betriebsspannung;
einen Spannungsteiler (127), der so konfiguriert ist, dass er die Spannung teilt, die durch den Spannungsregler (125) geregelt worden ist, zum Erzeugen der Vorspannung; und
einen Treiber (129), der so konfiguriert ist, dass er die Vorspannung zu dem Hochpassfilter (130) treibt.

3. EKG-Patch (100) nach Anspruch 2, wobei der Treiber (129) ein Stromtreiber ist.

4. EKG-Patch (100) nach Anspruch 2 oder 3, wobei die Betriebsspannung dem Spannungsregler (125) von einer Batterie (154) bereitgestellt wird.

5. EKG-Patch (100) nach einem der Ansprüche 1 bis 4, wobei der Hochpassfilter (130) ein potentialfreier Hochpassfilter (130) ist.

6. Elektrokardiographie- (EKG-) Patch (100) nach einem der Ansprüche 1 bis 5, aufweisend ein erstes Patch (110) und ein zweites Patch (150),
wobei die erste Elektrode, der Hochpassfilter und die EKG-Signalverarbeitungseinheit in dem ersten Patch (110) angeordnet sind,
wobei die zweite Elektrode (152) und eine Batterie (154) in dem zweiten Patch (150) angeordnet sind; und
wobei ein Kabel (170) bereitgestellt ist, das einen ersten Draht (W1) zum Bereitstellen einer Vorspannung von dem ersten Patch (110) an die zweite Elektrode (152), einen zweiten Draht (W2) zum Bereitstellen einer Betriebsspannung an das zweite Patch (150) und einen dritten Draht (W3) zum Bereitstellen eine Massespannung an das zweite Patch (150) beinhaltet.

7. EKG-Patch (100) nach Anspruch 6, wobei der Hochpassfilter (130) so konfiguriert ist, dass er die Vorspannung von der EKG-Signalverarbeitungseinheit (120) empfängt, die Vorspannung der ersten Elektrode (112) bereitstellt und die Vorspannung an die zweite Elektrode (152) durch den ersten Draht (W1) bereitstellt.

8. EKG-Patch (100) nach einem der Ansprüche 6 bis 7, wobei der Hochpassfilter (130) so konfiguriert ist, dass er einen Hochpassfilterungsvorgang an einem ersten EKG-Signal durchführt, das durch die erste Elektrode (112) erfasst wurde, so dass ein erstes Hochpasssignal (ECG_P) erzeugt wird, und einen Hochpassfilterungsvorgang an einem zweiten EKG-Signal ausführt, das durch die zweite Elektrode (152) erfasst wurde, so dass ein zweites Hochpasssignal (ECG N) erzeugt wird, und
wobei die EKG-Signalverarbeitungseinheit (120) so konfiguriert ist, dass sie ein EKG-Ausgangssignal basierend auf einer Differenz zwischen dem ersten hochpassgefilterten EKG-Signal (ECG P) und dem zweiten hochpassgefilterten EKG-Signal (ECG_N) erzeugt.

9. EKG-Patch nach einem der Ansprüche 6 bis 8, wobei das erste Patch (110) eine gedruckte Leiterplatte mit einer Mehrzahl von Schichten beinhaltet, und wobei die EKG-Signalverarbeitungseinheit (130) an einer ersten Schicht von der Mehrzahl von Schichten angeordnet ist und der Hochpassfilter (130) an einer letzten Schicht von der Mehrzahl von Schichten angeordnet ist.

10. EKG-Patch nach Anspruch 9, wobei die EKG-Signalverarbeitungseinheit (120) und der Hochpassfilter (130) einander gegenüberliegend angeordnet sind.

11. EKG-Patch nach Anspruch 9 oder 10, wobei eine Übertragungsleitung (210) zum Übertragen einer Massespannung so konfiguriert ist, dass sie eine Übertragungsleitung zum Übertragen eines ersten hochpassgefilterten Signals abschirmt.

12. EKG-Patch nach Anspruch 11, wobei eine Abschirmungsschicht (220) zwischen dem Hochpassfilter (130) und Signalleitungen der EKG-Signalverarbeitungseinheit (120) angeordnet ist.

13. Elektrokardiographie- (EKG-) Patch (100) nach einem der Ansprüche 1 bis 12,
wobei die erste Elektrode (112) so konfiguriert ist, dass sie ein erstes EKG-Signal erfasst;
wobei die zweite Elektrode (152) so konfiguriert ist, dass sie ein zweites EKG-Signal erfasst;
wobei der Hochpassfilter (130) so konfiguriert ist, dass er einen Hochpassfilterungsvorgang an einem ersten EKG-Signal ausführt, so dass ein erstes hochpassgefiltertes Signal (ECG_P) erzeugt wird, und einen Hochpassfilterungsvorgang an einem

zweiten EKG-Signal ausführt, so dass ein zweites hochpassgefiltertes Signal (ECG_N) erzeugt wird; und
wobei die Signalverarbeitungseinheit (120) so konfiguriert ist, dass sie ein EKG-Ausgangssignal basierend auf einer Differenz zwischen dem ersten EKG-Signal und dem zweiten EKG-Signal erzeugt, wobei der Hochpassfilter (130) ferner so konfiguriert ist, dass er eine erste Vorspannung basierend auf einer Antriebsspannung erzeugt und die erste Vorspannung der ersten Elektrode (112) bereitstellt, und eine zweite Vorspannung basierend auf der Antriebsspannung erzeugt und die zweite Vorspannung der zweiten Elektrode (152) bereitstellt.

14. EKG-Patch (100) nach Anspruch 13, wobei die erste Vorspannung und die zweite Vorspannung den gleichen Wert aufweisen.

15. EKG-Patch (100) nach Anspruch 13 oder 14, wobei das erste EKG-Signal erfasst wird, wenn die erste Vorspannung an einen Körper einer Person angelegt wird, und das zweite EKG-Signal erfasst wird, wenn die zweite Vorspannung an den Körper der Person angelegt wird.

16. EKG-Patch (100) nach einem der Ansprüche 13 bis 15, wobei der Hochpassfilter (130) aufweist:

einen ersten Kondensator (132), der zwischen eine erste Übertragungsleitung (122-1) und eine dritten Übertragungsleitung (L1) geschaltet ist, wobei die erste Übertragungsleitung (122-1) mit einem ersten Pad der Signalverarbeitungseinheit (120) verbunden ist;
einen zweiten Kondensator (135), der zwischen einen ersten Draht (135) und einer zweiten Übertragungsleitung (122-2) geschaltet ist, wobei der zweite Kondensator (135) mit einem zweiten Pad der Signalverarbeitungseinheit (120) verbunden ist;
einen ersten Widerstand (131), der zwischen die dritte Übertragungsleitung (L1) und einen ersten Knoten (ND) geschaltet ist, der mit einem fünften Pad der Signalverarbeitungseinheit (120) verbunden ist;
einen zweiten Widerstand (133), der zwischen die erste Übertragungsleitung (122-1) und den ersten Knoten geschaltet ist;
einen dritten Widerstand (134), der zwischen den ersten Knoten und die zweite Übertragungsleitung (122-2) geschaltet ist; und
einen vierten Widerstand (136), der zwischen den ersten Knoten und den ersten Draht (W1) geschaltet ist.

17. EKG-Patch (100) nach Anspruch 16, wobei die ersten und zweiten Kondensatoren (132, 135) jeweils die gleichen Kapazitäten aufweisen, und die ersten bis vierten Widerstände (131, 133, 134, 136) jeweils die gleichen Widerstände aufweisen.

18. EKG-Patch (100) nach Anspruch 16 oder 17, wobei die Signalverarbeitungseinheit (120) aufweist:

einen Spannungsregler (125), der mit einem dritten Pad von der Signalverarbeitungseinheit (120) verbunden ist und so konfiguriert ist, dass er eine Betriebsspannung über das dritte Pad empfängt und die Betriebsspannung reguliert, wobei das dritte Pad mit einem zweiten Draht (W2) verbunden ist;
einen Spannungsteiler (127), der so konfiguriert ist, dass er die Spannung teilt, die durch den Spannungserzeuger reguliert worden ist, um eine Antriebsspannung zu erzeugen; und
einen Treiber (129), der so konfiguriert ist, dass er die Antriebsspannung antreibt und die Antriebsspannung dem Hochpassfilter (130) durch das fünfte Pad bereitstellt.

Revendications

1. Pastille d'électrocardiographe (ECG) (100), comprenant :

une première électrode (112) ;
une seconde électrode (152) ;
un filtre passe-haut (130) configuré pour recevoir une tension de polarisation ;
une unité de traitement de signaux (120) configurée pour générer la tension de polarisation et fournir la tension de polarisation au filtre passe-haut (130)
caractérisé en ce que
le filtre passe-haut est configuré pour fournir la tension de polarisation à la première électrode (112) et à la seconde électrode (152).

2. Pastille D'ECG (100) selon la revendication 1, dans laquelle l'unité de traitement de signaux (120) comprend :

un régulateur de tension (125) configuré pour recevoir une tension de fonctionnement ;
un diviseur de tension (127) configuré pour diviser la tension qui a été régulée par le régulateur de tension (125) afin de générer la tension de polarisation ; et
un circuit d'entraînement (129) configuré pour entraîner la tension de polarisation dans le filtre passe-haut (130).

3. Pastille D'ECG (100) selon la revendication 2, dans laquelle le circuit d'entraînement (129) est un circuit d'entraînement de courant.

4. Pastille D'ECG (100) selon la revendication 2 ou 3, dans laquelle la tension de fonctionnement est fournie par une batterie (154) au régulateur de tension (125).

5. Pastille D'ECG (100) selon l'une quelconque des revendications 1 à 4, dans laquelle le filtre passe-haut (130) est un filtre passe-haut flottant (130).

6. Pastille d'électrocardiographe (ECG) (100) selon l'une quelconque des revendications 1 à 5, comprenant une première pastille (110) et une seconde pastille (150),
dans laquelle la première électrode, le filtre passe-haut et l'unité de traitement de signal ECG sont agencés dans la première pastille (110),
dans laquelle la seconde électrode (152) et une batterie (154) sont agencées dans la seconde pastille (150) ; et
dans laquelle un câble (170) est prévu, incluant un premier fil (W1) pour fournir une tension de polarisation de la première pastille (110) à la seconde électrode (152), un deuxième fil (W2) pour fournir une tension de fonctionnement à la seconde pastille (150) et un troisième fil (W3) pour fournir une tension de masse à la seconde pastille (150).

7. Pastille D'ECG (100) selon la revendication 6, dans laquelle le filtre passe-haut (130) est configuré pour recevoir la tension de polarisation provenant de l'unité de traitement de signaux ECG (120), fournir la tension de polarisation à la première électrode (112) et fournir la tension de polarisation à la seconde électrode (152) via le premier fil (W1).

8. Pastille D'ECG (100) selon l'une quelconque des revendications 6 à 7, dans laquelle le filtre passe-haut (130) est configuré pour effectuer un filtrage passe-haut sur un premier signal ECG détecté par la première électrode (112) afin de générer un premier signal passe-haut (ECG_P) et effectuer un filtrage passe-haut sur un second signal ECG détecté par la seconde électrode (152) pour générer un second signal passe-haut (ECG_N), et
dans laquelle l'unité de traitement de signaux ECG (120) est configurée pour générer un signal de sortie ECG sur la base d'une différence entre le premier signal ECG filtré passe-haut (ECG_P) et le second signal ECG filtré passe-haut (ECG_N).

9. ECG selon l'une quelconque des revendications 6 à 8, dans laquelle la première pastille (110) comprend une carte de circuit imprimé ayant une pluralité de couches, et dans laquelle l'unité de traitement de signaux ECG (120) est disposée au niveau d'une première couche de la pluralité de couches et le filtre passe-haut (130) est disposé au niveau d'une dernière couche de la pluralité de couches.

10. ECG selon la revendication 9, dans lequel l'unité de traitement de signaux ECG (120) et le filtre passe-haut (130) sont disposés en regard l'un de l'autre.

11. ECG selon la revendication 9 ou 10, dans lequel une ligne de transmission (210) destinée à transmettre une tension de masse est configurée pour protéger une ligne de transmission destinée à transmettre un premier signal filtré passe-haut.

12. ECG selon la revendication 11, dans lequel une couche de protection (220) est disposée entre le filtre passe-haut (130) et les lignes de signal de l'unité de traitement de signaux ECG (120).

13. Pastille d'électrocardiographe (ECG) (100) selon l'une quelconque des revendications 1 à 12,
dans laquelle la première électrode (112) est configurée pour détecter un premier signal ECG ;
dans laquelle la seconde électrode (152) est configurée pour détecter un second signal ECG ;
dans laquelle le filtre passe-haut (130) est configuré pour effectuer un filtrage passe-haut sur le premier signal ECG afin de générer un premier signal filtré passe-haut (ECG_P), et pour effectuer un filtrage passe-haut sur le second signal ECG afin de générer un second signal filtré passe-haut (ECG_N) ; et
dans laquelle l'unité de traitement de signaux (120) est configurée pour générer un signal de sortie ECG sur la base d'une différence entre le premier signal ECG et le second signal ECG,
dans laquelle le filtre passe-haut (130) est en outre configuré pour générer une première tension de polarisation sur la base d'une tension d'entraînement et fournir la première tension de polarisation à la première électrode (112), et pour générer une seconde tension de polarisation sur la base de la tension d'entraînement et fournir la seconde tension de polarisation à la seconde électrode (152).

14. Pastille D'ECG (100) selon la revendication 13, dans laquelle la première tension de polarisation et la seconde tension de polarisation ont le même niveau.

15. Pastille D'ECG (100) selon la revendication 13 ou 14, dans laquelle le premier signal ECG est détecté lorsque la première tension de polarisation est appliquée au corps d'une personne et le second signal ECG est détecté lorsque la seconde tension de polarisation est appliquée au corps de la personne.

16. Pastille D'ECG (100) selon l'une quelconque des revendications 13 à 15, dans laquelle le filtre passe-haut (130) comprend :

un premier condensateur (132) connecté entre une première ligne de transmission (122-1) et une troisième ligne de transmission (L1), la première ligne de transmission (122-1) étant connectée à une première pastille de l'unité de traitement de signaux (120) ;
un second condensateur (135) connecté entre un premier fil (135) et une deuxième ligne de transmission (122-2), dans laquelle le second condensateur (135) est connecté à une deuxième pastille de l'unité de traitement de signaux (120) ;
une première résistance (131) connectée entre la troisième ligne de transmission (L1) et un premier noeud (ND) connecté à une cinquième pastille de l'unité de traitement de signaux (120) ;
une deuxième résistance (133) connectée entre la première ligne de transmission (122-1) et le premier noeud ;
une troisième résistance (134) connectée entre le premier noeud et la deuxième ligne de transmission (122-2) ; et
une quatrième résistance (136) connectée entre le premier noeud et le premier fil (W1).

17. Pastille D'ECG (100) selon la revendication 16, dans laquelle les premier et second condensateurs (132, 135) ont les mêmes capacités l'un et l'autre et les première à quatrième résistances (131, 133, 134, 136) ont les mêmes résistances les unes que les autres.

18. Pastille D'ECG (100) selon la revendication 16 ou 17, dans laquelle l'unité de traitement de signaux (120) comprend :

un régulateur de tension (125) connecté à une troisième pastille de l'unité de traitement de signaux (120) et configuré pour recevoir une tension de fonctionnement via la troisième pastille et réguler la tension de fonctionnement, la troisième pastille étant connectée à un deuxième fil (W2) ;
un diviseur de tension (127) configuré pour diviser la tension qui a été régulée par le générateur de tension afin de générer une tension d'entraînement ; et
un circuit d'entraînement (129) configuré pour entraîner la tension d'entraînement et fournir la tension d'entraînement au filtre passe-haut (130) à travers la cinquième pastille.

FIG. 1

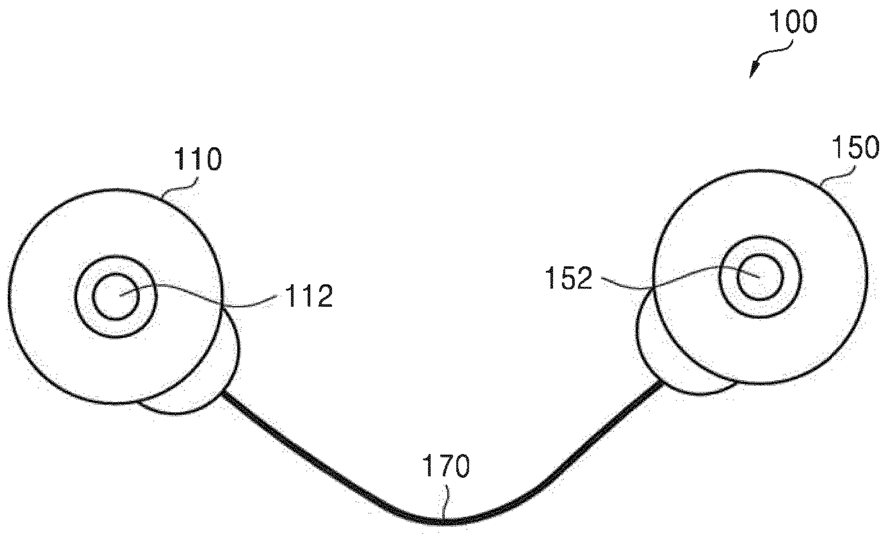


FIG. 2

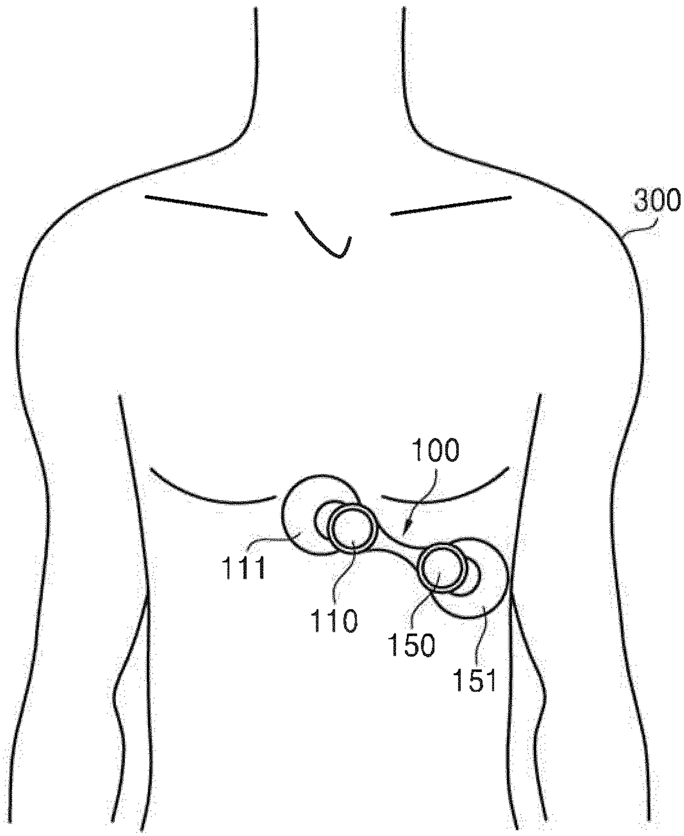


FIG. 3

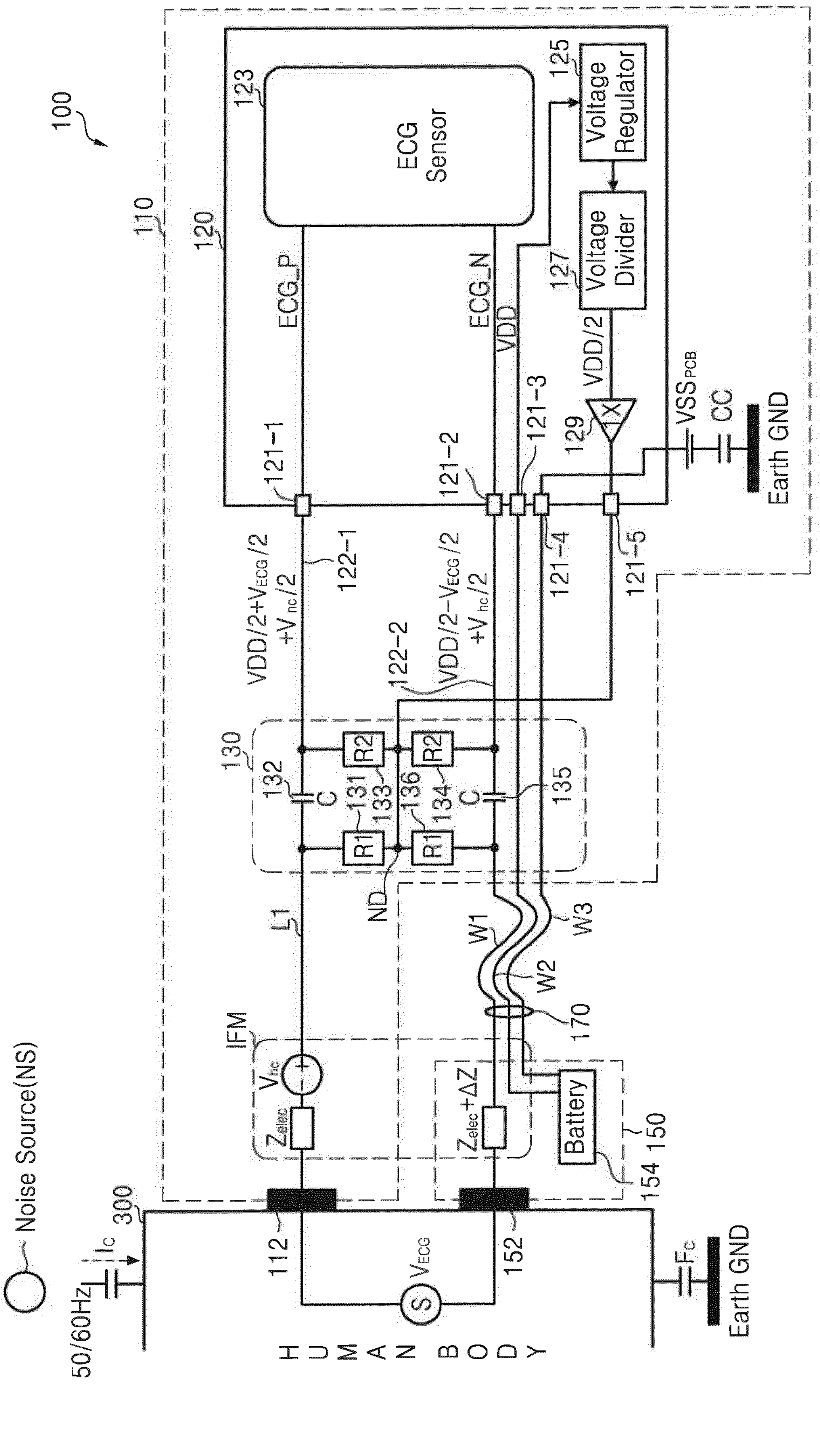

100
110
120
123
ECG Sensor
125
Voltage Regulator
127
Voltage Divider
ECG_P
ECG_N
VDD
VDD/2
129
X
VSS_PCB
CC
Earth GND
121-1
121-2
121-3
121-4
121-5
122-1
122-2
VDD/2+V_ECG/2 +V_hc/2
VDD/2−V_ECG/2 +V_hc/2
130
131
132
133
134
135
136
C
R1
R2
ND
L1
W1
W2
W3
170
IFM
Z_elec
V_hc
Z_elec+ΔZ
Battery
150
154
Noise Source(NS)
50/60Hz
I_C
300
112
152
V_ECG
S
F_C
Earth GND
HUMAN BODY

FIG. 4

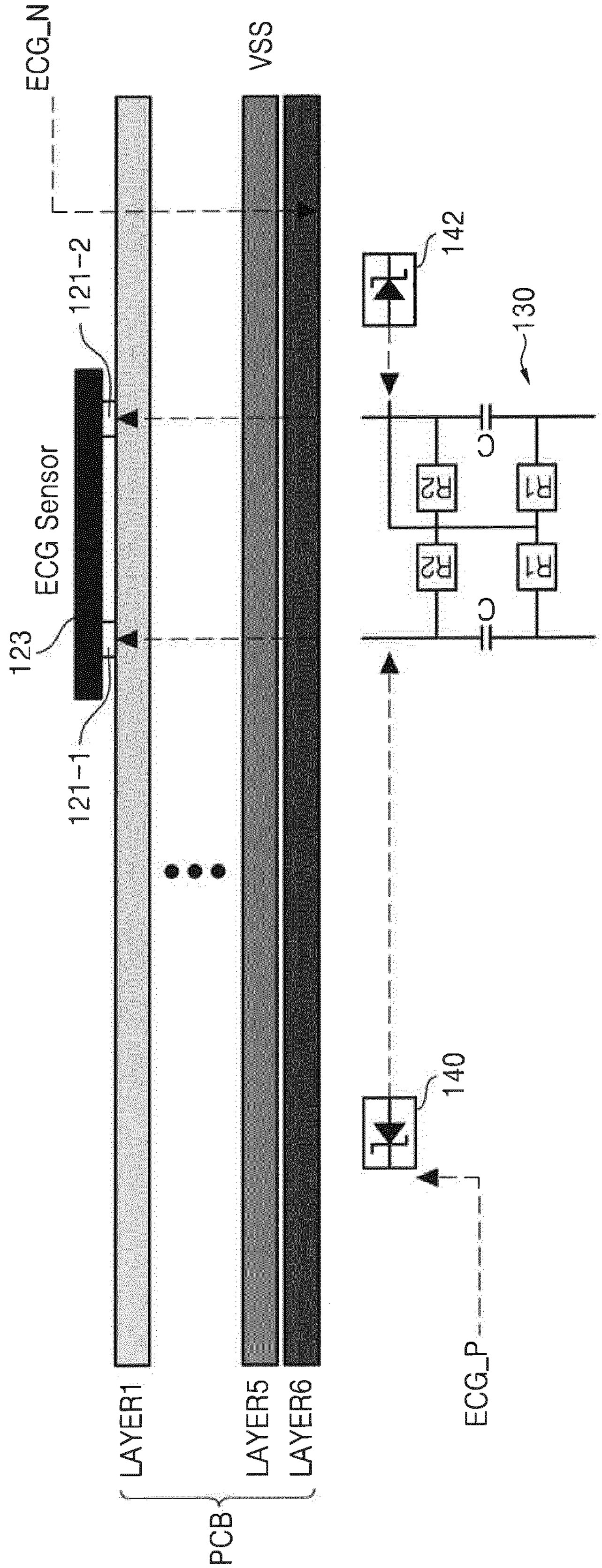

ECG_N
VSS
121-2
ECG Sensor
123
121-1
142
130
C
R2
R2
R1
R1
C
140
LAYER1
LAYER5
LAYER6
PCB
ECG_P

FIG. 5

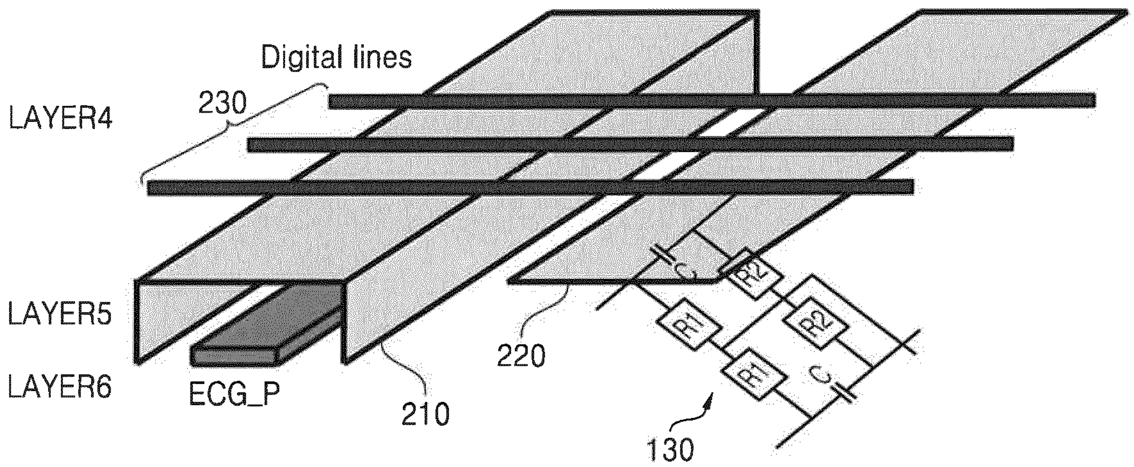

Digital lines
230
LAYER4
LAYER5
LAYER6
ECG_P
210
220
C
R2
R1
R2
R1
C
130

FIG. 6

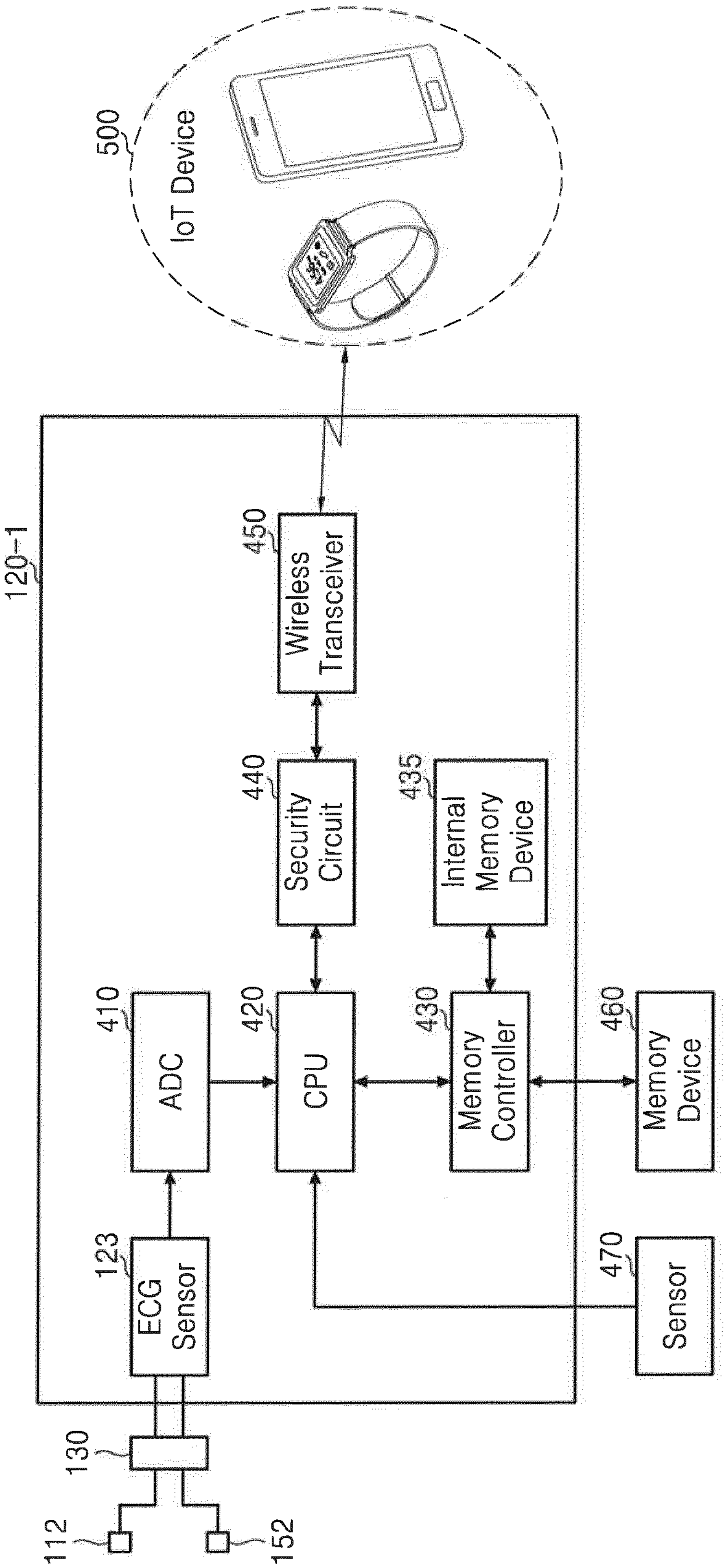

500
IoT Device
120-1
450
Wireless Transceiver
440
Security Circuit
435
Internal Memory Device
410
ADC
420
CPU
430
Memory Controller
460
Memory Device
123
ECG Sensor
470
Sensor
130
112
152

FIG. 7

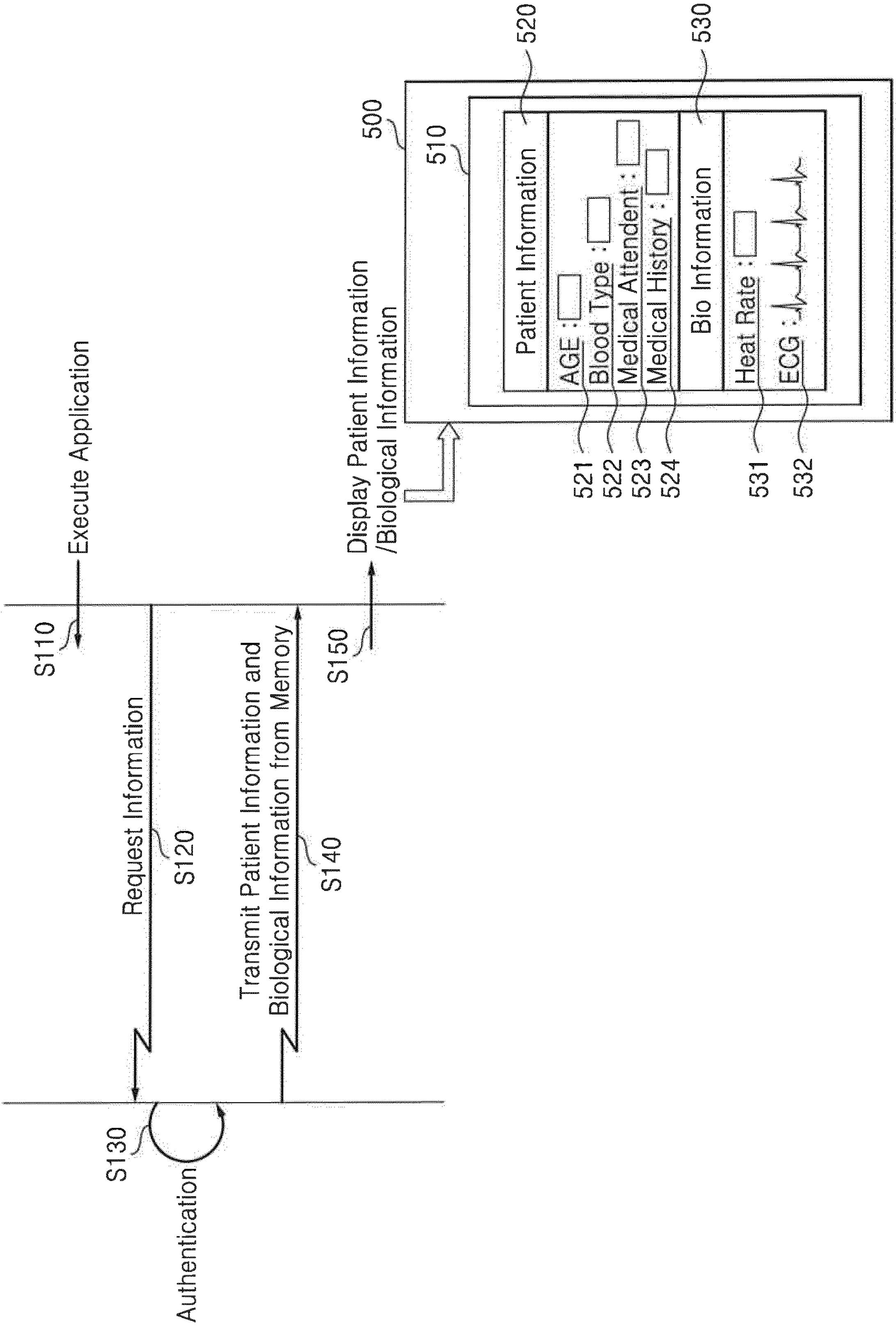

Bio-PROCESSOR (120)
IoT Device(500)
S110
Execute Application
Request Information
S120
S130
Authentication
Transmit Patient Information and
Biological Information from Memory
S140
S150
Display Patient Information
/Biological Information
500
510
520
530
Patient Information
AGE :
Blood Type :
Medical Attendent :
Medical History :
Bio Information
Heat Rate :
ECG :
521
522
523
524
531
532

FIG. 8

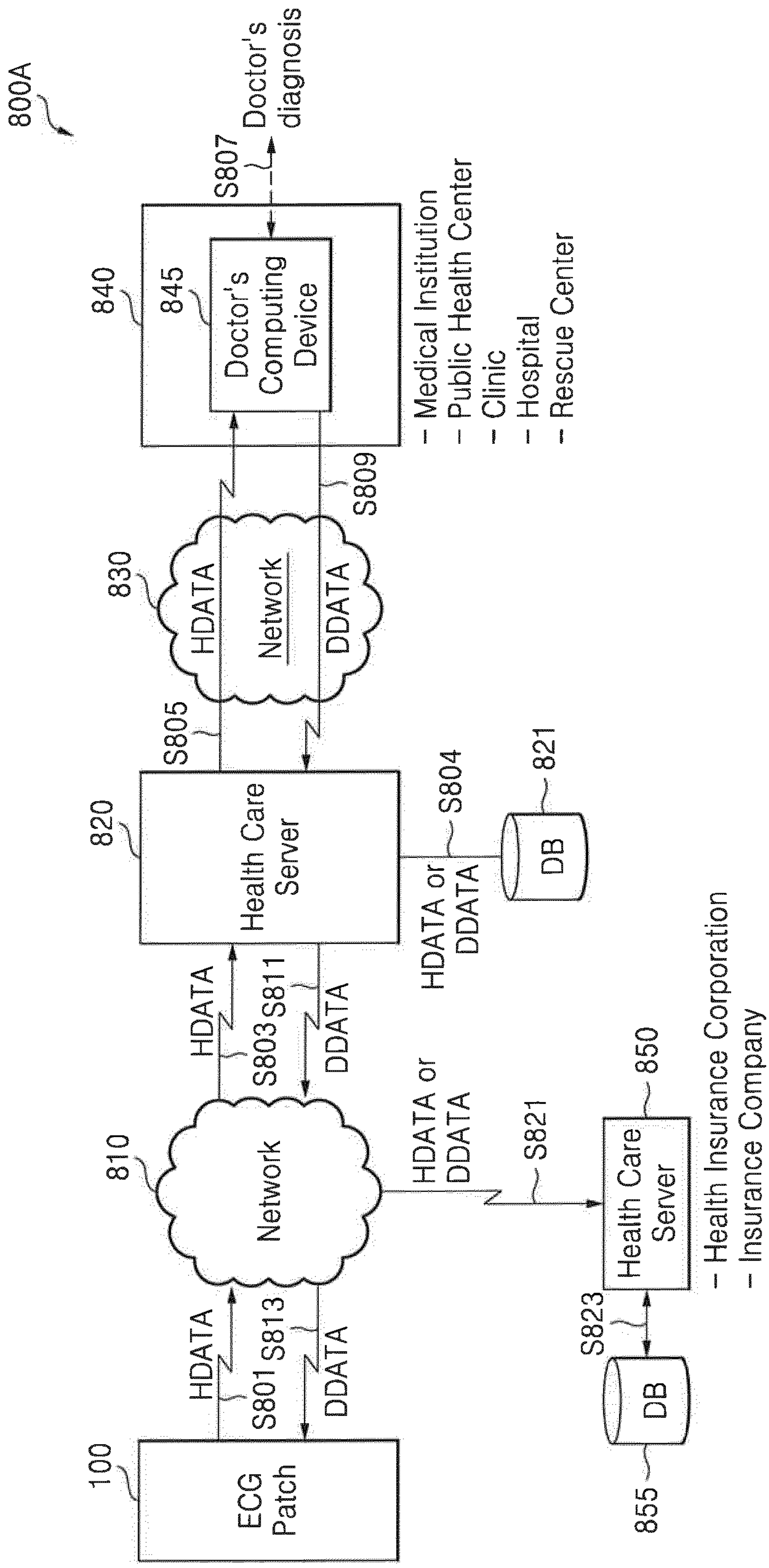

800A
ECG Patch
100
HDATA
S801
S813
DDATA
Network
810
HDATA
S803
S811
DDATA
Health Care Server
820
S804
HDATA or DDATA
DB
821
S805
HDATA
Network
830
DDATA
S809
Doctor's Computing Device
845
840
S807
Doctor's diagnosis
- Medical Institution
- Public Health Center
- Clinic
- Hospital
- Rescue Center
HDATA or DDATA
S821
Health Care Server
850
- Health Insurance Corporation
- Insurance Company
S823
DB
855

FIG. 9

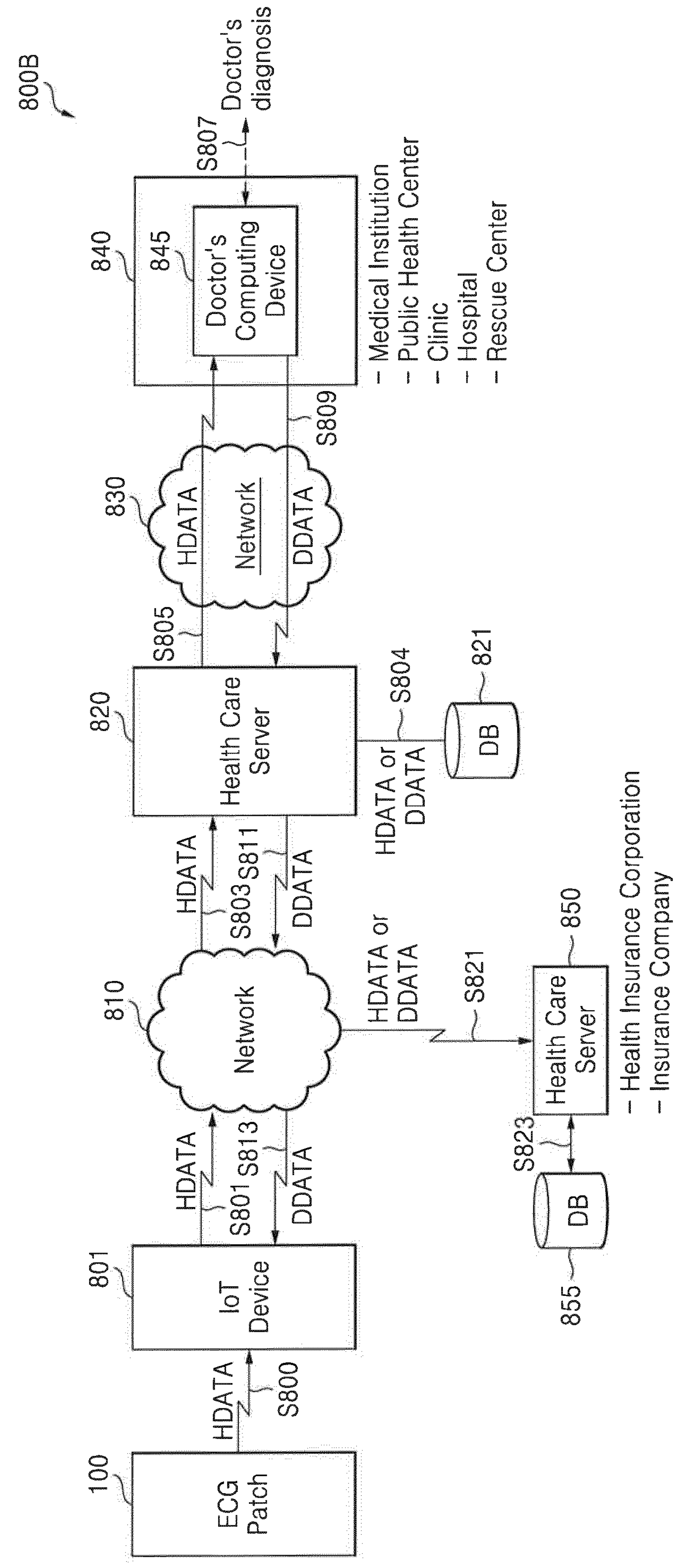
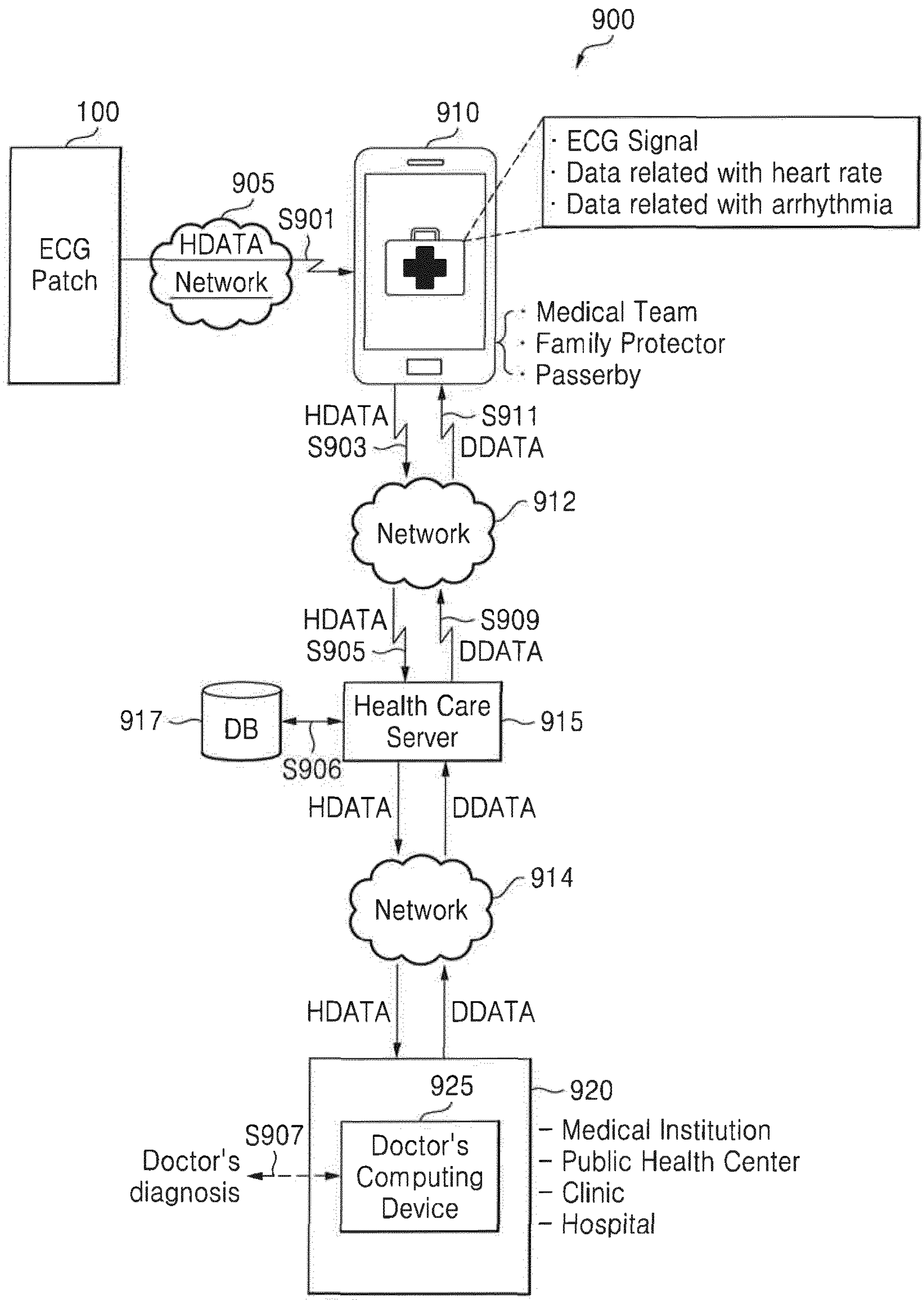

800B
ECG Patch
100
HDATA
S800
IoT Device
801
HDATA
S801
S813
DDATA
Network
810
HDATA
S803
S811
DDATA
Health Care Server
820
S804
HDATA or DDATA
DB
821
S805
Network
830
HDATA
DDATA
S809
Doctor's Computing Device
845
840
S807
Doctor's diagnosis
- Medical Institution
- Public Health Center
- Clinic
- Hospital
- Rescue Center
HDATA or DDATA
S821
Health Care Server
850
S823
DB
855
- Health Insurance Corporation
- Insurance Company

FIG. 10


900
100
ECG Patch
905
HDATA
Network
S901
910
· ECG Signal
· Data related with heart rate
· Data related with arrhythmia
· Medical Team
· Family Protector
· Passerby
HDATA
S903
S911
DDATA
Network
912
HDATA
S905
S909
DDATA
917
DB
S906
Health Care Server
915
HDATA
DDATA
Network
914
HDATA
DDATA
925
920
S907
Doctor's diagnosis
Doctor's Computing Device
- Medical Institution
- Public Health Center
- Clinic
- Hospital

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20140221850 A1 **[0003]**
- US 20110009729 A1 **[0003]**

patsnap

专利名称(译)	贴片包括外部浮动高通滤波器和包括其的心电图（ECG）贴片		
公开(公告)号	[EP3170450B1]()	公开(公告)日	2019-05-08
申请号	EP2016199339	申请日	2016-11-17
[标]申请(专利权)人(译)	三星电子株式会社		
申请(专利权)人(译)	SAMSUNG ELECTRONICS CO.，LTD.		
当前申请(专利权)人(译)	SAMSUNG ELECTRONICS CO.，LTD.		
[标]发明人	YAN LONG BAEK MIN GUN JO HEE JAE		
发明人	YAN, LONG BAEK, MIN GUN JO, HEE JAE		
IPC分类号	A61B5/0408 A61B5/0428 A61B5/00 A61B5/04		
CPC分类号	A61B5/04017 A61B5/04085 A61B5/04087 A61B5/0428 A61B5/04282 A61B5/6823 A61B5/6832 A61B5/7203 A61B5/725 A61B2560/0412 A61B2560/0468 A61B2562/222		
优先权	62/256951 2015-11-18 US 1020160028210 2016-03-09 KR		
其他公开文献	EP3170450A1		
外部链接	[Espacenet]()		

摘要(译)

一种心电图（ECG）贴片，包括：第一电极;第二个电极;高通滤波器，被配置为接收偏置电压并向第一电极和第二电极提供偏置电压;信号处理单元，被配置为产生偏置电压并将偏置电压提供给高通滤波器。

FIG. 1