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United States Patent	12388169
Kind Code	B2
Date of Patent	August 12, 2025
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Electronic device including antenna and method therefor

Abstract

An electronic device includes: a conductive housing; a main circuit board; and a biometric circuit board configured to measure body information, wherein the biometric circuit board may include: a first connection point at which a first conductive connection member contacts the biometric circuit board, the first conductive connection member being configured to electrically connect the conductive housing and the biometric circuit board; a second connection point at which a second conductive connection member contacts the biometric circuit board, the second conductive connection member being configured to electrically connect a biometric button and the biometric circuit board; and a third connection point at which a third conductive connection member contacts the biometric circuit board, the third conductive connection member being configured to electrically connect the main circuit board and the biometric circuit board, and the conductive housing may include a first shorting point electrically connected to the biometric circuit board and the main circuit board to provide an antenna path.

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Appl. No.: 18/224906

Filed: July 21, 2023

Prior Publication Data

Document Identifier	Publication Date
US 20230361453 A1	Nov. 09, 2023

Foreign Application Priority Data

Related U.S. Application Data

continuation parent-doc WO PCT/KR2022/003127 20220304 PENDING child-doc US 18224906

Publication Classification

Int. Cl.: H01Q1/27 (20060101); A61B5/00 (20060101); H01Q1/52 (20060101)

U.S. Cl.:

CPC H01Q1/273 (20130101); H01Q1/52 (20130101); A61B5/681 (20130101)

Field of Classification Search

CPC: H01Q (1/273); H01Q (1/52); H01Q (1/243); A61B (5/681)

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a by-pass continuation application of International Application No. PCT/KR2022/003127, filed on Mar. 4, 2022, which is based on and claims priority to Korean Patent Application No. 10-2021-0036884, filed on Mar. 22, 2021, in the Korean Intellectual Property Office, the disclosures of which are incorporated by reference herein their entireties.

BACKGROUND

1. Field

(1) The disclosure relates to an electronic device, and more particularly, to an electronic device including an antenna and a method thereof.

2. Description of Related Art

(2) An antenna may form a loop through a shorting point between a metal housing and a main board. The loop may vary based on a position of the shorting point; thus, a length of the antenna may vary.

(3) In related art, the number of shorting points for adjusting a length of the antenna may be limited by an area of an internal structure of an electronic device. More antenna space may be needed to implement more shorting points. However, this may not be appropriate for the current trend of miniaturization of electronic devices.

SUMMARY

(4) According to an aspect of the disclosure, an electronic device may include: a conductive housing; a main circuit board; and a biometric circuit board configured to measure body information, wherein the biometric circuit board may include: a first connection point at which a first conductive connection member contacts the biometric circuit board, the first conductive

connection member being configured to electrically connect the conductive housing and the biometric circuit board; a second connection point at which a second conductive connection member contacts the biometric circuit board, the second conductive connection member being configured to electrically connect a biometric button and the biometric circuit board; and a third connection point at which a third conductive connection member contacts the biometric circuit board, the third conductive connection member being configured to electrically connect the main circuit board and the biometric circuit board, and the conductive housing may include a first shorting point electrically connected to the biometric circuit board and the main circuit board to provide an antenna path.

(5) The biometric button may be provided at a surface of the conductive housing and electrically isolated from the conductive housing.

(6) The first shorting point may be provided at the conductive housing and the first shorting point may be connected to the first connection point through the first conductive connection member.

(7) The biometric circuit board may be connected to the biometric button of the conductive housing to transmit or receive biometric information and biometric button signals.

(8) The biometric circuit board further may include a first capacitor configured to block biosignal interference between the first connection point and the third connection point.

(9) The biometric circuit board further may include a first inductor configured to block radio frequency (RF) signal interference between the second connection point and the third connection point.

(10) The main circuit board may include: an antenna circuit configured to transmit or receive a radio frequency (RF) signal; a biometric sensor configured to transmit or receive a biosignal; and a fourth connection point connected to the third connection point through the third conductive connection member, and provided between the antenna circuit and the biometric sensor.

(11) The main circuit board further may include a second capacitor configured to block biosignal interference between the fourth connection point and the antenna circuit.

(12) The main circuit board may further include a second inductor configured to block RF signal interference between the fourth connection point and the biometric sensor.

(13) The biometric circuit board may include a flexible printed circuit board, and each of the first, second, and third conductive connection members may include a c-clip.

(14) The electronic device may further include: a feeding point; a second shorting point generated through a contact between the conductive housing and the main circuit board; and a processor configured to control whether an antenna is used and whether a radio frequency (RF) signal is transmitted or received.

(15) In the antenna, a high resonant frequency may move to a high band as a distance between the feeding point and the second shorting point decreases, and a low resonant frequency may move to a lower band as a distance between the feeding point and the second shorting point increases.

(16) The electronic device may further include a first switch, the first switch may be switched to connect the feeding point and the first shorting point or the first switch may be switched to connect the feeding point and the second shorting point, and the processor may be further configured to control a switching of a path of the RF signal of the first switch.

(17) Based on the feeding point and the first shorting point that are switched to be connected, a first resonant frequency of the antenna may be determined based on a distance between the feeding point and the first shorting point, and based on the feeding point and the second shorting point that are switched to be connected, a second resonant frequency of the antenna may be determined based on a distance between the feeding point and the second shorting point.

(18) The electronic device may further include: a processor; an antenna circuit; a biometric sensor; a first switch; and a bioswitch, the processor may be configured to control a transmission or a reception of a radio frequency (RF) signal through the first switch connected to the antenna circuit, and the biometric sensor may be configured to control a transmission or a reception of a biosignal

through the bioswitch.

(19) According to one or more embodiments, by adding a contact point or a connection point with a metal housing to a biometric function application structure of an electronic device, a shorting point between an antenna and a main board can be increased through less space utilization.

(20) According to one or more embodiments, by variously adjusting a length of the antenna through the added shorting point, a performance of the antenna can be improved.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The above and other aspects, features, and advantages of certain embodiments of the disclosure will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:

(2) FIG. 1 is a block diagram illustrating an electronic device in a network environment according to one or more embodiments;

(3) FIG. 2 is a perspective view illustrating a front surface of an electronic device according to one or more embodiments;

(4) FIG. 3 is a perspective view illustrating a back surface of an electronic device according to one or more embodiments;

(5) FIG. 4 is a block diagram illustrating a constitution of an electronic device according to one or more embodiments;

(6) FIGS. 5 and 6 illustrate an internal structure of an electronic device according to one or more embodiments;

(7) FIGS. 7 and 8 are exploded views illustrating an internal structure of an electronic device according to one or more embodiments;

(8) FIG. 9 is a top plan view illustrating an electronic device according to one or more embodiments; and

(9) FIG. 10 illustrates three-dimensionally a shape in which a shorting point and a loop structure of an antenna are formed according to one or more embodiments.

DETAILED DESCRIPTION

(10) FIG. 1 is a block diagram illustrating an electronic device **101** in a network environment **100** according to various embodiments. Referring to FIG. 1, the electronic device **101** in the network environment **100** may communicate with an electronic device **102** via a first network **198** (e.g., a short-range wireless communication network), or at least one of an electronic device **104** or a server **108** via a second network **199** (e.g., a long-range wireless communication network).

According to an embodiment, the electronic device **101** may communicate with the electronic device **104** via the server **108**. According to an embodiment, the electronic device **101** may include a processor **120**, memory **130**, an input module **150**, a sound output module **155**, a display module **160**, an audio module **170**, a sensor module **176**, an interface **177**, a connecting terminal **178**, a haptic module **179**, a camera module **180**, a power management module **188**, a battery **189**, a communication module **190**, a subscriber identification module (SIM) **196**, or an antenna module **197**. In some embodiments, at least one of the components (e.g., the connecting terminal **178**) may be omitted from the electronic device **101**, or one or more other components may be added in the electronic device **101**. In some embodiments, some of the components (e.g., the sensor module **176**, the camera module **180**, or the antenna module **197**) may be implemented as a single component (e.g., the display module **160**).

(11) The processor **120** may execute, for example, software (e.g., a program **140**) to control at least one other component (e.g., a hardware or software component) of the electronic device **101** coupled with the processor **120**, and may perform various data processing or computation.

According to one embodiment, as at least part of the data processing or computation, the processor **120** may store a command or data received from another component (e.g., the sensor module **176** or the communication module **190**) in volatile memory **132**, process the command or the data stored in the volatile memory **132**, and store resulting data in non-volatile memory **134**. According to an embodiment, the processor **120** may include a main processor **121** (e.g., a central processing unit (CPU) or an application processor (AP)), or an auxiliary processor **123** (e.g., a graphics processing unit (GPU), a neural processing unit (NPU), an image signal processor (ISP), a sensor hub processor, or a communication processor (CP)) that is operable independently from, or in conjunction with, the main processor **121**. For example, when the electronic device **101** includes the main processor **121** and the auxiliary processor **123**, the auxiliary processor **123** may be adapted to consume less power than the main processor **121**, or to be specific to a specified function. The auxiliary processor **123** may be implemented as separate from, or as part of the main processor **121**.

(12) The auxiliary processor **123** may control at least some of functions or states related to at least one component (e.g., the display module **160**, the sensor module **176**, or the communication module **190**) among the components of the electronic device **101**, instead of the main processor **121** while the main processor **121** is in an inactive (e.g., sleep) state, or together with the main processor **121** while the main processor **121** is in an active state (e.g., executing an application). According to an embodiment, the auxiliary processor **123** (e.g., an image signal processor or a communication processor) may be implemented as part of another component (e.g., the camera module **180** or the communication module **190**) functionally related to the auxiliary processor **123**. According to an embodiment, the auxiliary processor **123** (e.g., the neural processing unit) may include a hardware structure specified for artificial intelligence model processing. An artificial intelligence model may be generated by machine learning. Such learning may be performed, e.g., by the electronic device **101** where the artificial intelligence is performed or via a separate server (e.g., the server **108**). Learning algorithms may include, but are not limited to, e.g., supervised learning, unsupervised learning, semi-supervised learning, or reinforcement learning. The artificial intelligence model may include a plurality of artificial neural network layers. The artificial neural network may be a deep neural network (DNN), a convolutional neural network (CNN), a recurrent neural network (RNN), a restricted Boltzmann machine (RBM), a deep belief network (DBN), a bidirectional recurrent deep neural network (BRDNN), deep Q-network or a combination of two or more thereof but is not limited thereto. The artificial intelligence model may, additionally or alternatively, include a software structure other than the hardware structure.

(13) The memory **130** may store various data used by at least one component (e.g., the processor **120** or the sensor module **176**) of the electronic device **101**. The various data may include, for example, software (e.g., the program **140**) and input data or output data for a command related thereto. The memory **130** may include the volatile memory **132** or the non-volatile memory **134**.

(14) The program **140** may be stored in the memory **130** as software, and may include, for example, an operating system (OS) **142**, middleware **144**, or an application **146**.

(15) The input module **150** may receive a command or data to be used by another component (e.g., the processor **120**) of the electronic device **101**, from the outside (e.g., a user) of the electronic device **101**. The input module **150** may include, for example, a microphone, a mouse, a keyboard, a key (e.g., a button), or a digital pen (e.g., a stylus pen).

(16) The sound output module **155** may output sound signals to the outside of the electronic device **101**. The sound output module **155** may include, for example, a speaker or a receiver. The speaker may be used for general purposes, such as playing multimedia or playing record. The receiver may be used for receiving incoming calls. According to an embodiment, the receiver may be implemented as separate from, or as part of the speaker.

(17) The display module **160** may visually provide information to the outside (e.g., a user) of the electronic device **101**. The display module **160** may include, for example, a display, a hologram

device, or a projector and control circuitry to control a corresponding one of the display, hologram device, and projector. According to an embodiment, the display module **160** may include a touch sensor adapted to detect a touch, or a pressure sensor adapted to measure the intensity of force incurred by the touch.

(18) The audio module **170** may convert a sound into an electrical signal and vice versa. According to an embodiment, the audio module **170** may obtain the sound via the input module **150**, or output the sound via the sound output module **155** or a headphone of an external electronic device (e.g., an electronic device **102**) directly (e.g., wiredly) or wirelessly coupled with the electronic device **101**.

(19) The sensor module **176** may detect an operational state (e.g., power or temperature) of the electronic device **101** or an environmental state (e.g., a state of a user) external to the electronic device **101**, and then generate an electrical signal or data value corresponding to the detected state. According to an embodiment, the sensor module **176** may include, for example, a gesture sensor, a gyro sensor, an atmospheric pressure sensor, a magnetic sensor, an acceleration sensor, a grip sensor, a proximity sensor, a color sensor, an infrared (IR) sensor, a biometric sensor, a temperature sensor, a humidity sensor, or an illuminance sensor.

(20) The interface **177** may support one or more specified protocols to be used for the electronic device **101** to be coupled with the external electronic device (e.g., the electronic device **102**) directly (e.g., wiredly) or wirelessly. According to an embodiment, the interface **177** may include, for example, a high definition multimedia interface (HDMI), a universal serial bus (USB) interface, a secure digital (SD) card interface, or an audio interface.

(21) A connecting terminal **178** may include a connector via which the electronic device **101** may be physically connected with the external electronic device (e.g., the electronic device **102**). According to an embodiment, the connecting terminal **178** may include, for example, a HDMI connector, a USB connector, a SD card connector, or an audio connector (e.g., a headphone connector).

(22) The haptic module **179** may convert an electrical signal into a mechanical stimulus (e.g., a vibration or a movement) or electrical stimulus which may be recognized by a user via his tactile sensation or kinesthetic sensation. According to an embodiment, the haptic module **179** may include, for example, a motor, a piezoelectric element, or an electric stimulator.

(23) The camera module **180** may capture a still image or moving images. According to an embodiment, the camera module **180** may include one or more lenses, image sensors, image signal processors, or flashes.

(24) The power management module **188** may manage power supplied to the electronic device **101**. According to one embodiment, the power management module **188** may be implemented as at least part of, for example, a power management integrated circuit (PMIC).

(25) The battery **189** may supply power to at least one component of the electronic device **101**. According to an embodiment, the battery **189** may include, for example, a primary cell which is not rechargeable, a secondary cell which is rechargeable, or a fuel cell.

(26) The communication module **190** may support establishing a direct (e.g., wired) communication channel or a wireless communication channel between the electronic device **101** and the external electronic device (e.g., the electronic device **102**, the electronic device **104**, or the server **108**) and performing communication via the established communication channel. The communication module **190** may include one or more communication processors that are operable independently from the processor **120** (e.g., the application processor (AP)) and supports a direct (e.g., wired) communication or a wireless communication. According to an embodiment, the communication module **190** may include a wireless communication module **192** (e.g., a cellular communication module, a short-range wireless communication module, or a global navigation satellite system (GNSS) communication module) or a wired communication module **194** (e.g., a local area network (LAN) communication module or a power line communication (PLC) module). A corresponding one of these communication modules may communicate with the external

electronic device via the first network **198** (e.g., a short-range communication network, such as Bluetooth™, wireless-fidelity (Wi-Fi) direct, or infrared data association (IrDA)) or the second network **199** (e.g., a long-range communication network, such as a legacy cellular network, a 5G network, a next-generation communication network, the Internet, or a computer network (e.g., LAN or wide area network (WAN))). These various types of communication modules may be implemented as a single component (e.g., a single chip), or may be implemented as multi components (e.g., multi chips) separate from each other. The wireless communication module **192** may identify and authenticate the electronic device **101** in a communication network, such as the first network **198** or the second network **199**, using subscriber information (e.g., international mobile subscriber identity (IMSI)) stored in the subscriber identification module **196**.

(27) The wireless communication module **192** may support a 5G network, after a 4G network, and next-generation communication technology, e.g., new radio (NR) access technology. The NR access technology may support enhanced mobile broadband (eMBB), massive machine type communications (mMTC), or ultra-reliable and low-latency communications (URLLC). The wireless communication module **192** may support a high-frequency band (e.g., the mmWave band) to achieve, e.g., a high data transmission rate. The wireless communication module **192** may support various technologies for securing performance on a high-frequency band, such as, e.g., beamforming, massive multiple-input and multiple-output (massive MIMO), full dimensional MIMO (FD-MIMO), array antenna, analog beam-forming, or large scale antenna. The wireless communication module **192** may support various requirements specified in the electronic device **101**, an external electronic device (e.g., the electronic device **104**), or a network system (e.g., the second network **199**). According to an embodiment, the wireless communication module **192** may support a peak data rate (e.g., 20 Gbps or more) for implementing eMBB, loss coverage (e.g., 164 dB or less) for implementing mMTC, or U-plane latency (e.g., 0.5 ms or less for each of downlink (DL) and uplink (UL), or a round trip of 1 ms or less) for implementing URLLC.

(28) The antenna module **197** may transmit or receive a signal or power to or from the outside (e.g., the external electronic device) of the electronic device **101**. According to an embodiment, the antenna module **197** may include an antenna including a radiating element composed of a conductive material or a conductive pattern formed in or on a substrate (e.g., a printed circuit board (PCB)). According to an embodiment, the antenna module **197** may include a plurality of antennas (e.g., array antennas). In such a case, at least one antenna appropriate for a communication scheme used in the communication network, such as the first network **198** or the second network **199**, may be selected, for example, by the communication module **190** (e.g., the wireless communication module **192**) from the plurality of antennas. The signal or the power may then be transmitted or received between the communication module **190** and the external electronic device via the selected at least one antenna. According to an embodiment, another component (e.g., a radio frequency integrated circuit (RFIC)) other than the radiating element may be additionally formed as part of the antenna module **197**.

(29) According to various embodiments, the antenna module **197** may form a mmWave antenna module. According to an embodiment, the mmWave antenna module may include a printed circuit board, a RFIC disposed on a first surface (e.g., the bottom surface) of the printed circuit board, or adjacent to the first surface and capable of supporting a designated high-frequency band (e.g., the mmWave band), and a plurality of antennas (e.g., array antennas) disposed on a second surface (e.g., the top or a side surface) of the printed circuit board, or adjacent to the second surface and capable of transmitting or receiving signals of the designated high-frequency band.

(30) At least some of the above-described components may be coupled mutually and communicate signals (e.g., commands or data) therebetween via an inter-peripheral communication scheme (e.g., a bus, general purpose input and output (GPIO), serial peripheral interface (SPI), or mobile industry processor interface (MIPI)).

(31) According to an embodiment, commands or data may be transmitted or received between the

electronic device **101** and the external electronic device **104** via the server **108** coupled with the second network **199**. Each of the electronic devices **102** or **104** may be a device of a same type as, or a different type, from the electronic device **101**. According to an embodiment, all or some of operations to be executed at the electronic device **101** may be executed at one or more of the external electronic devices **102**, **104**, or **108**. For example, if the electronic device **101** should perform a function or a service automatically, or in response to a request from a user or another device, the electronic device **101**, instead of, or in addition to, executing the function or the service, may request the one or more external electronic devices to perform at least part of the function or the service. The one or more external electronic devices receiving the request may perform the at least part of the function or the service requested, or an additional function or an additional service related to the request, and transfer an outcome of the performing to the electronic device **101**. The electronic device **101** may provide the outcome, with or without further processing of the outcome, as at least part of a reply to the request. To that end, a cloud computing, distributed computing, mobile edge computing (MEC), or client-server computing technology may be used, for example. The electronic device **101** may provide ultra low-latency services using, e.g., distributed computing or mobile edge computing. In another embodiment, the external electronic device **104** may include an internet-of-things (IoT) device. The server **108** may be an intelligent server using machine learning and/or a neural network. According to an embodiment, the external electronic device **104** or the server **108** may be included in the second network **199**. The electronic device **101** may be applied to intelligent services (e.g., smart home, smart city, smart car, or healthcare) based on 5G communication technology or IoT-related technology.

(32) The electronic device according to various embodiments may be one of various types of electronic devices. The electronic devices may include, for example, a portable communication device (e.g., a smartphone), a computer device, a portable multimedia device, a portable medical device, a camera, a wearable device, or a home appliance. According to an embodiment of the disclosure, the electronic devices are not limited to those described above.

(33) It should be appreciated that various embodiments of the present disclosure and the terms used therein are not intended to limit the technological features set forth herein to particular embodiments and include various changes, equivalents, or replacements for a corresponding embodiment. With regard to the description of the drawings, similar reference numerals may be used to refer to similar or related elements. It is to be understood that a singular form of a noun corresponding to an item may include one or more of the things, unless the relevant context clearly indicates otherwise. As used herein, each of such phrases as “A or B,” “at least one of A and B,” “at least one of A or B,” “A, B, or C,” “at least one of A, B, and C,” and “at least one of A, B, or C,” may include any one of, or all possible combinations of the items enumerated together in a corresponding one of the phrases. As used herein, such terms as “1st” and “2nd,” or “first” and “second” may be used to simply distinguish a corresponding component from another, and does not limit the components in other aspect (e.g., importance or order). It is to be understood that if an element (e.g., a first element) is referred to, with or without the term “operatively” or “communicatively”, as “coupled with,” “coupled to,” “connected with,” or “connected to” another element (e.g., a second element), it means that the element may be coupled with the other element directly (e.g., wiredly), wirelessly, or via a third element.

(34) As used in connection with various embodiments of the disclosure, the term “module” may include a unit implemented in hardware, software, or firmware, and may interchangeably be used with other terms, for example, “logic,” “logic block,” “part,” or “circuitry”. A module may be a single integral component, or a minimum unit or part thereof, adapted to perform one or more functions. For example, according to an embodiment, the module may be implemented in a form of an application-specific integrated circuit (ASIC).

(35) Various embodiments as set forth herein may be implemented as software (e.g., the program **140**) including one or more instructions that are stored in a storage medium (e.g., internal memory

136 or external memory **138**) that is readable by a machine (e.g., the electronic device **101**). For example, a processor (e.g., the processor **120**) of the machine (e.g., the electronic device **101**) may invoke at least one of the one or more instructions stored in the storage medium, and execute it, with or without using one or more other components under the control of the processor. This allows the machine to be operated to perform at least one function according to the at least one instruction invoked. The one or more instructions may include a code generated by a compiler or a code executable by an interpreter. The machine-readable storage medium may be provided in the form of a non-transitory storage medium. Wherein, the term “non-transitory” simply means that the storage medium is a tangible device, and does not include a signal (e.g., an electromagnetic wave), but this term does not differentiate between where data is semi-permanently stored in the storage medium and where the data is temporarily stored in the storage medium.

(36) According to an embodiment, a method according to various embodiments of the disclosure may be included and provided in a computer program product. The computer program product may be traded as a product between a seller and a buyer. The computer program product may be distributed in the form of a machine-readable storage medium (e.g., compact disc read only memory (CD-ROM)), or be distributed (e.g., downloaded or uploaded) online via an application store (e.g., PlayStore™), or between two user devices (e.g., smart phones) directly. If distributed online, at least part of the computer program product may be temporarily generated or at least temporarily stored in the machine-readable storage medium, such as memory of the manufacturer's server, a server of the application store, or a relay server.

(37) According to various embodiments, each component (e.g., a module or a program) of the above-described components may include a single entity or multiple entities, and some of the multiple entities may be separately disposed in different components. According to various embodiments, one or more of the above-described components may be omitted, or one or more other components may be added. Alternatively or additionally, a plurality of components (e.g., modules or programs) may be integrated into a single component. In such a case, according to various embodiments, the integrated component may still perform one or more functions of each of the plurality of components in the same or similar manner as they are performed by a corresponding one of the plurality of components before the integration. According to various embodiments, operations performed by the module, the program, or another component may be carried out sequentially, in parallel, repeatedly, or heuristically, or one or more of the operations may be executed in a different order or omitted, or one or more other operations may be added.

(38) FIG. 2 is a perspective view illustrating a front surface of an electronic device according to one or more embodiments. FIG. 3 is a perspective view illustrating a back surface of the electronic device of FIG. 2.

(39) An electronic device **200** illustrated in FIGS. 2 and 3 may be one of the electronic devices **101** described with reference to FIG. 1. Therefore, even if not described below, the electronic device **200** may include the components described with reference to FIG. 1.

(40) With reference to FIGS. 2 and 3, the electronic device **200** according to an embodiment may include a housing **210** including a first surface (or front surface) **210A**, a second surface (or back surface) **210B**, and a side surface **210C** enclosing a space between the first surface **210A** and the second surface **210B**, and fastening members **250** and **260** connected to at least a portion of the housing **210** and to detachably fasten the electronic device **200** to a user's body part (e.g., wrist, ankle, and the like). In another embodiment, the housing may refer to a structure forming some of the first surface **210A**, the second surface **210B**, and the side surface **210C** of FIGS. 2 and 3.

According to an embodiment, the first surface **210A** may be formed by a front plate **201** (e.g., a glass plate or a polymer plate including various coating layers) at least partially substantially transparent. The second surface **210B** may be formed by a substantially opaque back plate **207**. The back plate **207** may be made of, for example, coated or tinted glass, ceramic, polymer, metal (e.g., aluminum, stainless steel (STS), or magnesium), or a combination of at least two of the above

materials. The side surface **210C** may be coupled to the front plate **201** and the back plate **207** and be formed by a side bezel structure (or “side member”) **206** including metal and/or polymer. In some embodiments, the back plate **207** and the side bezel structure **206** may be integrally formed and include the same material (e.g., a metal material such as aluminum). The fastening members **250** and **260** may be formed with various materials and shapes. Integral and plurality of unit links may be formed to move with each other by woven material, leather, rubber, urethane, metal, ceramic, or a combination of at least two of the above materials.

(41) According to an embodiment, the electronic device **200** may include at least one of a display **210a**, audio modules **205** and **208**, a sensor module **211**, key input devices **202**, **203** and **204**, or a connector hole **209**. In some embodiments, the electronic device **101** may omit at least one (e.g., the key input devices **202**, **203**, and **204**, the connector hole **209**, or the sensor module **211**) of the components or may additionally include other components.

(42) In an embodiment, the display **210a** may be exposed through a significant portion of the front plate **201**. A shape of the display **210a** may be a shape corresponding to that of the front plate **201** and be various shapes such as a circular shape, an elliptical shape, or a polygonal shape. The display **210a** may be coupled to or disposed adjacent to a touch detection circuit, a pressure sensor capable of measuring the intensity (pressure) of a touch, and/or a fingerprint sensor.

(43) In an embodiment, the audio modules **205** and **208** may include a microphone hole **205** and a speaker hole **208**. A microphone for acquiring external sound may be disposed inside the microphone hole **205**, and in some embodiments, a plurality of microphones may be disposed to detect a direction of sound. The speaker hole **208** may be used as an external speaker and a receiver for a call. In some embodiments, the speaker hole **208** and the microphone hole **205** may be implemented into one hole, or a speaker may be included without the speaker hole **208** (e.g., piezo speaker).

(44) In an embodiment, the electronic device **200** may support various frequency bands. For example, the electronic device **200** may support a cellular wireless communication (e.g., 2G, 3G, 4G, 5G) frequency band (e.g., 800 MHz to 2.8 GHz), a GPS communication frequency band (e.g., 1.2 GHz to 1.5 GHz), and/or a short-range wireless communication (e.g., WiFi, NFC, Bluetooth) frequency band (e.g., 2.4 GHz to 5 GHz). The electronic device **200** may include at least one antenna for supporting various frequency bands.

(45) In an embodiment, the sensor module **211** may generate an electrical signal or data value corresponding to an internal operating state of the electronic device **200** or an external environmental state. The sensor module **211** may include, for example, a biometric sensor module **211** (e.g., HRM sensor) disposed at the second surface **210B** of the housing **210**. The electronic device **200** may further include a sensor module, for example, at least one of a gesture sensor, a gyro sensor, a barometric pressure sensor, a magnetic sensor, an acceleration sensor, a grip sensor, a color sensor, an infrared (IR) sensor, a biometric sensor, a temperature sensor, a humidity sensor, or an illuminance sensor.

(46) The outer housing **210** of the electronic device **201** according to one or more embodiments may include a side surface enclosing at least a portion between the front cover and back plate **207**. The side surface may include at least one key input device (e.g., **203**, **204**). For example, at least one key input device may include at least one side key button, a crown, and/or a biosignal key button. The biosignal key button may be, for example, a dummy key that is not be pushed, but it is not limited thereto. The biosignal key button may form a part (e.g., exposure surface) of a biosignal sensor (e.g., biometric sensor). For example, the biosignal key button may be coupled to the side surface of the outer housing **210** as a separate module or may be integrally included in the side surface of the outer housing **210**. The biosignal key button may include at least one electrode for receiving a user's biometric information. The electronic device **201** may determine biometric information (e.g., electrocardiogram signal, heart rate signal, bioelectric impedance analysis (bio) information and skin response (galvanic skin response) information) of the user based on the signal

acquired through the biosignal key button. In some embodiments, the biosignal key button is at least a part of the biometric sensor, but those skilled in the art will easily understand that a type of the biometric sensor is not limited thereto.

(47) In an embodiment, the sensor module **211** may include electrodes (or electrode areas) **301** and **302** forming a part of the surface of the electronic device **200** and a biosignal detection circuit electrically (or operatively) connected to the electrodes **301** and **302**. For example, the electrodes **301** and **302** may include a first electrode **301** and a second electrode **302** disposed at the second surface **210B** of the housing **210**. The sensor module **211** may be constituted such that the electrodes **301** and **302** may acquire an electrical signal from a part of the user's body and that the biosignal detection circuit detects the user's biometric information based on the electrical signal.

(48) In an embodiment, the electronic device **200** may include a plurality of electrodes that may contact the user's body. The plurality of electrodes may include, for example, electrodes **301** and **302** disposed at the second surface **210B** of the electronic device, as illustrated in FIG. 3, and an electrode disposed at the first surface **210A** and/or the side surface **210C** of the electronic device. A plurality of electrodes may be connected to each other as a circuit, but parts functioning as electrodes may be segmented from each other. For example, the electrodes may be composed of three electrodes including the electrodes **301** and **302** disposed at the second surface **210B** and an electrode disposed at the side surface **210C**. Various biometric information of the user may be detected through a plurality of electrodes. In an embodiment, information related to the user's electrocardiogram may be measured using a plurality of electrodes. Electrocardiogram measurement may be performed in various ways. For example, in the electrocardiogram measurement, the plurality of electrodes described above may include an INP (positive) electrode (e.g., electrode **301**), an INM (negative) electrode, and a right-leg drive (RLD) electrode (e.g., electrode **302**). Electrocardiogram measurement may be performed through the INP electrode and the RLD electrode. Here, the RLD electrode may be a connection point used for increasing an electrocardiogram measurement performance by reducing a signal having the same phase in an electrode that is in contact with the body.

(49) In an embodiment, the key input devices **202**, **203**, and **204** may include a wheel key **202** disposed at the first surface **210A** of the housing **210** and rotatable in at least one direction, and/or side key buttons **203** and **204** disposed at the side surface **210C** of the housing **210**. The wheel key **202** may have a shape corresponding to the shape of the front plate **201**. In another embodiment, the electronic device **200** may not include some or all of the above-described key input devices **202**, **203**, and **204**, and the key input devices **202**, **203**, and **204** that are not included may be implemented in other forms such as soft keys on the display **210a**. The connector hole **209** may receive a connector (e.g., USB connector) for transmitting and receiving power and/or data to and from an external electronic device, and the electronic device **200** may include another connector hole that may receive a connector for transmitting and receiving an audio signal to and from an external electronic device. The electronic device **200** may further include, for example, a connector cover that covers at least a portion of the connector hole **209** and that blocks external foreign substances from entering the connector hole.

(50) As another example, a separate window of the electronic device **201** may have a size substantially corresponding to a through hole of the housing **210** and be coupled (e.g., fitted) to the through hole of the housing **210**. In this case, the display module **210a** may be visually exposed (e.g., the first surface (display) **210a**) through the through hole of the external housing **210**. The window may be made of a transparent material. According to an embodiment, at least a partial surface (e.g., a surface exposed to the outside through a through hole) of the display module **210a** may form the first surface (display) **210a** of the electronic device **201**.

(51) For example, a shielding layer may provide a shielding function against electromagnetic waves generated in at least one electronic component (e.g., display driver IC (DDI) and display panel) included in or connected to the first surface (display) **210a**. For example, a heat dissipation

layer may provide a heat conduction function capable of reducing a heat generated by the electronic device **201** by transferring a heat generated in the at least one component to the outside. For example, the shielding layer and/or the heat dissipation layer may have a shape corresponding to a surface of a printed circuit board and/or at least one electronic component through a flat form (e.g., sheet, plate) or pre-forming. The shielding layer and the heat dissipation layer may be made of, for example, a steel use stainless (SUS) material, but it is not limited thereto. The shielding layer and the heat dissipation layer may be separately included or integrally included in the electronic device **101**.

(52) In an embodiment, the fastening members **250** and **260** may be detachably fastened to at least a partial area of the housing **210** using locking members **251** and **261**. The fastening members **250** and **260** may include one or more of a fixing member **252**, a fixing member fastening hole **253**, a band guide member **254**, and a band fixing ring **255**.

(53) In an embodiment, the fixing member **252** may fix the housing **210** and the fastening members **250** and **260** to a user's body part (e.g., wrist, ankle, and the like). The fixing member fastening hole **253** may fix the housing **210** and the fastening members **250** and **260** to a part of the user's body corresponding to the fixing member **252**. The band guide member **254** may limit a movement range of the fixing member **252** when the fixing member **252** is fastened with the fixing member fastening hole **253**; thus, the fastening members **250** and **260** may be attached to tightly contact a part of the user's body. The band fixing ring **255** may limit a movement range of the fastening members **250** and **260** in a state in which the fixing member **252** and the fixing member fastening hole **253** are fastened.

(54) In an embodiment, the back plate **207** may be made of, for example, coated or tinted glass, ceramic, polymer, metal (e.g., aluminum, stainless steel (STS), or magnesium), or a combination of at least two of the above material.

(55) FIG. **4** is a block diagram illustrating a constitution of an electronic device according to one or more embodiments.

(56) According to one or more embodiments, an electronic device **401** may include a main circuit board **410**, a biometric circuit board **420**, a conductive housing **430**, and a processor **450**. Further, the electronic device **401** may further include a feeding point **440** and a second shorting point **442** generated through a contact between the conductive housing **430** and the main circuit board **410**. The main circuit board **410** and the conductive housing **430** may contact each other to form two short points, which may correspond to the feeding point **440** and the second shorting point **442**. In the antenna, a high resonant frequency may move to a higher band as a distance between the feeding point and the shorting point decreases, and the resonant frequency may move to a lower band as a distance between the feeding point and the shorting point increases. An embodiment for this will be described in detail with reference to FIG. **10**.

(57) According to one or more embodiments, a contact area between the main circuit board **410** and the conductive housing **430** may include one feeding point and a shorting point in a structure of the electronic device **401**. In this case, it may be difficult to adjust a length of the antenna corresponding to an increase in the number of frequency bands (e.g., cellular wireless communication frequency bands and short-distance wireless communication frequency bands) supported by the electronic device **401**. In the case that it is difficult to adjust the length of the antenna, it may be difficult to optimize a radiation performance for each band. In other words, shorting points between the main circuit board **410** and the conductive housing **430** may be further required to variously adjust the length of the antenna.

(58) According to one or more embodiments, the electronic device **401** may add the biometric circuit board **420** to add a shorting point between the main circuit board **410** and the conductive housing **430**. Hereinafter, an embodiment of such an electronic device **401** will be described in more detail.

(59) According to one or more embodiments, the biometric circuit board **420** may be positioned

between the conductive housing **430** and the main circuit board **410**. The biometric circuit board **420** may form two contact points with the conductive housing **430**, which may include a first connection point **421** and a second connection point **422**. The biometric circuit board **420** may form one contact point with the main circuit board **410**, which may include a third connection point **423**. In summary, the biometric circuit board **420** may include a first connection point **421**, a second connection point **422**, and a third connection point **423**.

(60) According to one or more embodiments, the first connection point **421** of the biometric circuit board **420** may be connected to a first shorting point **431** of the conductive housing **430** through a first conductive connection member. The second connection point **422** of the biometric circuit board **420** may be connected to a biosignal key button **432** (e.g., BIA key button) through the conductive connection member. The biosignal key button **432** is an electrode component for measuring biosignals and has been described as an element including a key button that moves in the case that an external force is applied to the biosignal key button **432**, but it is not limited thereto and may include various structures of electrodes for measuring biosignals.

(61) For example, the biosignal key button **432** is positioned at the conductive housing **430**, but may be electrically insulated from the conductive housing **430** and be electrically insulated from a high frequency band of the antenna signal. Further, a part of the biosignal key button **432** may be exposed to the outside of the conductive housing **430**. The biosignal key button **432** may measure bio-resistance according to the user's body contact to generate a biosignal. The generated biosignal may be transmitted to the main circuit board **410** through a flexible printed circuit board (FPCB) of the biometric circuit board **420**. The third connection point **423** of the biometric circuit board **420** may be connected to a fourth connection point **414** of the main circuit board **410** through the conductive connection member. For example, the main circuit board **410** may form a contact point with the conductive housing **430** through the biometric circuit board, and in this case, the contact point may include a first shorting point **431**.

(62) According to an embodiment, the biometric circuit board **420** may further include a first capacitor **426** between the first connection point **421** and the third connection point **423**. The first capacitor **426** may block interference between an RF signal of the first shorting point **431** transmitted to the first connection point **421** and a biosignal. Further, the biometric circuit board **420** may further include a first inductor **428** between the second connection point **422** and the third connection point **423**. The first inductor **428** may block interference between an RF signal and a biosignal transmitted through the biosignal key button **432**. For example, the biometric circuit board **420** may transmit the RF signal of the antenna and the biosignal to the main circuit board **410** through the first capacitor **426** and the first inductor **428** without mutual interference.

(63) According to one or more embodiments, the main circuit board **410** may be physically or electrically connected to the conductive housing **430** through the fourth connection point **414**. In an embodiment, the connection point may be formed by, for example, a C-clip, a conductive gasket, a metal (e.g., aluminum, stainless steel (STS), or magnesium), or a combination of at least two of the above materials.

(64) An RF signal and/or biosignal path may be formed to the main circuit board **410** through the biometric circuit board **420**. Further, conversely, an RF signal may be transmitted from an antenna circuit **411** to the biometric circuit board **420**. A biosignal transmitted to the main circuit board **410** may be transmitted to a biometric sensor. Here, the biosignal may include a signal including user's biometric information or a user's biosignal. Further, conversely, an application signal for acquiring a biosignal may be transmitted from a biometric sensor **412** to the biometric circuit board **420**. In this case, the RF signal and biosignal may be transmitted through the conductive connection member between the fourth connection point **414** and the third connection point **423**. The main circuit board **410** may further include a second capacitor **416** between the antenna circuit **411** and the fourth connection point **414**. The second capacitor **416** may block interference of biosignals or applied signals during RF signal transmission and/or reception. The main circuit board **410** may

further include a second inductor **418** between the biometric sensor **412** and the fourth connection point **414**. The second inductor **418** may block interference of RF signals during transmission and/or reception of biosignals or application signals. Mutual interference between signals may be prevented while transmitting a plurality of signals with one path through the second inductor **418** and the second capacitor **418**.

(65) According to one or more embodiments, the electronic device **401** may include a processor **450**. The processor **450** is a component capable of performing calculations or data processing related to control and/or communication of each component of the electronic device **401**, and may include one or more processors. The processor **450** may include at least some of the components and/or functions of the processor **120** of FIG. 1. Calculations and data processing functions that the processor **450** may implement in the electronic device will not be limited, but hereinafter, features related to control of the switching device will be described in detail. Operations of the processor **450** may be performed by loading instructions stored in a memory.

(66) According to an embodiment, the processor **450** may control transmission and/or reception of an RF signal through a first switch connected to the antenna circuit **411**. Further, the processor **450** may control a switching operation between the first shorting point **431** and the second shorting point **442**. The loop structure of the antenna may be changed according to the switching operation of the processor **450**, and the length of the antenna may be changed according to the change of the loop structure. In the case that the length of the antenna is changed, the resonant frequency of the antenna may also be changed. An embodiment related to the change of the resonant frequency of the antenna according to the control of the switching operation of the processor **450** will be described with reference to FIG. 10.

(67) According to an embodiment, the electronic device **401** may provide bioelectric impedance analysis (BIA) information. Bioelectrical impedance analysis may be performed through the biometric sensor **412**. The electronic device **401** may be worn on a user's body (e.g., wrist). In the case that the user wears the electronic device **401**, the electrode, the heart rate sensor module, and the temperature sensor may contact or come close to the user's body. In this case, in order to provide information on the user's health status, the electronic device **401** may measure the user's biosignal through at least one sensor and/or at least one electrode (e.g., an electrode included in a biometric key button). For example, the electronic device **401** may measure the user's body temperature through a temperature sensor. Further, the electronic device **401** may measure a biosignal (e.g., galvanic skin response (GSR)) for stress and emotion analysis through two electrodes. Further, the electronic device **401** may constantly measure a heart rate, measure changes in blood pressure, and measure blood flow through the heart rate sensor module. Further, the electronic device **401** may measure outdoor visibility (illuminance) and blue light through an RGB sensor. Further, the electronic device **401** may measure ultraviolet rays through the heartbeat sensor module.

(68) According to an embodiment, in the case that a user close touches the heart rate sensor module with a finger of a hand not wearing the electronic device **401**, the electronic device **401** may measure a heart rate and oxygen saturation (saturation pulse oximetry O₂ (SPO₂)) through the heart rate sensor module. Further, in the case that the user touches one of the electrodes with a hand not wearing the electronic device **401**, the electronic device **401** may provide electrocardiogram information based on a biosignal measured through one of the electrodes. Further, in the case that the user touches both electrodes with a hand not wearing the electronic device **401**, the electronic device **401** may provide bioelectrical impedance information based on a biosignal measured through two electrodes. Bio-resistance analysis indicates the degree of tissue hydration and an amount of body fluid, and may enable to know a body composition, fluid balance, and cell health. For example, the electronic device **401** may provide nutritional therapy related to biological age, detoxification state, obesity level, total amount of water in the body, prognosis of critically ill patients (e.g., cancer, renal dialysis patients), early check for lymphedema, and metabolic diseases

(e.g., diabetes, hypertension, stroke, arteriosclerosis) through biometric measurement. Further, in the case that the user close touches one of the electrodes and the heart rate sensor module with a hand not wearing the electronic device **401**, the electronic device **401** may provide blood pressure information based on the measured biosignal.

(69) According to an embodiment, the electronic device **401** may constantly measure at least one of stress, emotion change, heart rate, blood pressure change, or blood flow through the electrode and the heart rate sensor module, and measure at least one of electrocardiogram, bio-resistance analysis, blood pressure, or oxygen saturation, if necessary.

(70) FIGS. **5** and **6** illustrate an internal structure of an electronic device according to one or more embodiments.

(71) With reference to FIG. **5**, the biometric circuit board **420** may have a conductive housing (e.g., the conductive housing **430** of FIG. **4**) and two contact points (e.g., the first shorting point **431** and the second shorting point **442** of FIG. **4**). One contact point is the first shorting point (e.g., the first shorting point **431** of FIG. **4**) of the conductive housing (e.g., the conductive housing **430** of FIG. **4**) and may be connected with the first connection point **421** of the biometric circuit board **420**. Another contact point may include a biosignal key button (e.g., the biosignal key button **432** of FIG. **4**) of the conductive housing **430**, and be connected to the second connection point **422** of the biometric circuit board **420**. However, although the biosignal key button **432** is physically disposed at the conductive housing **430**, the biosignal key button **432** may maintain an electrically insulated state and maintain an electrically insulated state from a high frequency band of the antenna signal. For example, a point where the biometric circuit board **420** and the conductive housing **430** are electrically connected may correspond to only the first shorting point **431**. In this case, the first shorting point **431** of the conductive housing **430** and the first connection point **421** of the biometric circuit board **420** may be connected through the conductive connection member. In this case, the conductive connection member may include a c-clip.

(72) With reference to FIG. **6**, a contact between the biometric circuit board (e.g., the biometric circuit board **420** of FIG. **4**) and the conductive housing (e.g., the conductive housing **430** of FIG. **4**) has been described in detail with reference to FIGS. **4** and **5**. The second connection point (e.g., the second connection point **422** of FIG. **4**) of the biometric circuit board **420** may be connected to the biosignal key button (e.g., a biosignal key button **432** of FIG. **4**) through the conductive connection member. However, although the biosignal key button **432** is positioned at the conductive housing **430**, the biosignal key button **432** may be electrically insulated from the conductive housing **430** or may be electrically insulated from the high frequency band of the antenna signal, as described above with reference to FIG. **5**. For example, the main circuit board **410** may form a shorting point (e.g., the first shorting point **431** of FIG. **4**) with the conductive housing **430** through the biometric circuit board **420**. The shorting point may be used as a path of an antenna signal. The first shorting point **431** of the biosignal key button **432** may be positioned at the conductive housing **430** and be connected to the first connection point **421** through the conductive connection member. An embodiment of a case of newly forming a shorting point will be described with reference to FIG. **10**.

(73) FIGS. **7** and **8** are exploded views illustrating an internal structure of an electronic device according to one or more embodiments.

(74) With reference to FIGS. **7** and **8**, an electronic device (e.g., the electronic device **401** of FIG. **4**) may include a conductive housing **430** and a biosignal key button **432** at the outside. The main circuit board **410** may be disposed inside the conductive housing **430**. The biometric circuit board **420** may be disposed between the conductive housing **430** and the main circuit board **410**. The biometric circuit board **420** may form a connection point with the conductive housing **430** and the main circuit board **410**, which has been previously described with reference to FIG. **4**.

(75) According to an embodiment, the biometric circuit board **420** may include a first connection point (e.g., the first connection point **421** of FIG. **4**), a second connection point (e.g., the second

connection point **422** of FIG. **4**), and a third connection point (e.g., the third connection point **423** of FIG. **4**). The biometric circuit board **420** may further include a first capacitor (e.g., the first capacitor **426** of FIG. **4**) for blocking biosignal interference between the first connection point **421** and the third connection point **423**. The biometric circuit board **420** may further include a first inductor (e.g., the first inductor **428** of FIG. **4**) for blocking RF signal interference between the second connection point **422** and the third connection point **423**.

(76) According to an embodiment, the main circuit board **410** may further include a fourth connection point **414** connected to the biometric circuit board **420**. The main circuit board **410** may further include an antenna circuit (e.g., the antenna circuit **411** of FIG. **4**) and a biometric sensor (e.g., the biometric sensor **412** of FIG. **4**). The main circuit board **410** may further include a second capacitor (e.g., the second capacitor **416** of FIG. **4**) for blocking biosignal interference between the fourth connection point **414** and the antenna circuit **411**. The main circuit board **410** may further include a second inductor (e.g., the second inductor **418** of FIG. **4**) for blocking RF signal interference between the fourth connection point **414** and the biometric sensor **412**.

(77) According to an embodiment, the biometric circuit board **420** may include an FPCB, and the conductive connection member may include a c-clip.

(78) FIG. **9** is a top plan view illustrating an electronic device according to one or more embodiments.

(79) According to one or more embodiments, an electronic device (e.g., the electronic device **401** of FIG. **4**) may include a main circuit board (e.g., the main circuit board **410** of FIG. **4**), a biometric circuit board **420**, and a conductive housing (e.g., the conductive housing **430** of FIG. **4**). The biometric circuit board **420** may be positioned between the main circuit board **410** and the conductive housing **430**. The biometric circuit board **420** may form two contact points (e.g., the first shorting point **431** and the biosignal key button **432** of FIG. **4**) with the conductive housing **430**. Although the biosignal key button **432** is disposed in the conductive housing **430**, the biosignal key button **432** may be electrically insulated from the conductive housing **430** and be in a state electrically insulated from the high frequency band of the antenna signal. Therefore, an electrical connection point of the antenna signal between the biometric circuit board **420** and the conductive housing **430** may include only the first shorting point **431**, except for the biosignal key button **432**.

(80) According to an embodiment, the biometric circuit board **420** may form one connection path with the main circuit board **410**. The third connection point (e.g., the third connection point **423** of FIG. **4**) of the biometric circuit board **420** and the fourth connection point (e.g., the fourth connection point **414** of FIG. **4**) of the main circuit board **410** may form a connection path through the conductive connection member. A connection path between the main circuit board **410** and the conductive housing **430** may be formed through such a connection path and the connection path of the first shorting point **431** of the conductive housing **430**. Through such a connection path, the main circuit board **410** and the conductive housing **430** may further form one shorting path. A resonant frequency of the antenna may be controlled through the shorting path, and an embodiment of this process will be described with reference to FIG. **10**.

(81) According to an embodiment, the biometric circuit board **420** may include a first connection point **421**, a second connection point **422**, and a third connection point **423**. The biometric circuit board **420** may further include a first capacitor (e.g., the first capacitor **426** of FIG. **4**) for blocking biosignal interference between the first connection point **421** and the third connection point **423**. The biometric circuit board **420** may further include a first inductor (e.g., the first inductor **428** of FIG. **4**) for blocking RF signal interference between the second connection point **422** and the third connection point **423**.

(82) According to an embodiment, the main circuit board **410** may further include a fourth connection point **414** connected to the biometric circuit board **420**. The main circuit board **410** may further include an antenna circuit **411** and a biometric sensor **412**. The main circuit board **410** may

further include a first switch **411a** for connecting the antenna circuit **411** and the fourth connection point **414**. The main circuit board **410** may further include a second switch **412a** for connecting the biometric sensor **412** and the fourth connection point **414**.

(83) According to an embodiment, the processor **450** may control to connect the antenna circuit **411** and the fourth connection point **414** through the first switch **411a**. When the antenna circuit **411** and the fourth connection point **414** are connected, RF signals may be transmitted and/or received between the main circuit board **410** and the biometric circuit board **420**. The processor **450** may control to connect the biometric sensor **412** and the fourth connection point **414** through the second switch **412a**. When the biometric sensor **412** and the fourth connection point **414** are connected, biosignals may be transmitted and/or received between the main circuit board **410** and the biometric circuit board **420**.

(84) According to an embodiment, the main circuit board **410** may further include a second capacitor **416** for blocking biosignal interference between the fourth connection point **414** and the antenna circuit **411**. The main circuit board **410** may further include a second inductor **418** for blocking RF signal interference between the fourth connection point **414** and the biometric sensor **412**.

(85) According to an embodiment, the electronic device **401** may further include a feeding point (e.g., the feeding point **440** of FIG. **4**) and a second shorting point (e.g., the second shorting point **442** of FIG. **4**) generated through a contact between the conductive housing **430** and the main circuit board **410**. In the antenna, as a distance between the feeding point **440** and the second shorting point **442** decreases, a resonance position of the antenna may move to a higher band. Further, in the antenna, as a distance between the feeding point **440** and the second shorting point **442** increases, a resonance position of the antenna may move to a lower band. Hereinafter, in FIG. **10**, an embodiment of adjusting the resonant distance and resonant frequency of the antenna will be described.

(86) FIG. **10** illustrates three-dimensionally formation of a loop structure of an antenna according to one or more embodiments.

(87) According to an embodiment, the electronic device (e.g., the electronic device **401** of FIG. **4**) may form a loop of the antenna through the feeding point **440** and the first shorting point **431** in addition to the feeding point **440** and the second shorting point **442**, as described above with reference to FIGS. **4** to **9**. As described above, the first shorting point **431** may include a shorting point newly formed in a process of adding a biometric sensor (e.g., the biometric sensor **412** of FIG. **4**). A length of the antenna may vary according to a loop formation length, and a frequency of the antenna may vary according to the length of the antenna.

(88) For example, in the case that an antenna loop is formed between the feeding point **440** and the second shorting point **442**, the length of the antenna may be proportional to that of L2 **1020** and/or L3 **1030**. In the case that an antenna loop is formed between the feeding point **440** and the first shorting point **431**, the length of the antenna may be proportional to that of L1 **1010**. In this case, the length of L1 **1010** may be longer than that of L2 **1020**, and the frequency of the antenna may move to a relatively low frequency band. The length of L1 **1010** may be relatively shorter than that of L3 **1030**, and the frequency of the antenna may move to a relatively low frequency band. According to the addition of the biometric sensor **412**, a shorting point may be added at no cost to variously make the frequency band of the antenna, thereby increasing a performance of the antenna.

(89) According to one or more embodiments, an electronic device (e.g., the electronic device **401** of FIG. **4**) may include a conductive housing (e.g., the conductive housing **430** of FIG. **4**) including a body measurement area; a main circuit board (e.g., the electronic device **401** of FIG. **4**); and a biometric circuit board (e.g., the biometric circuit board **420** of FIG. **4**) configured to measure body information. The biometric circuit board **420** may include a first connection point (e.g., the first connection point **421** of FIG. **4**), which is a point at which a first conductive connection member

configured to electrically connect the conductive housing **430** and the biometric circuit board **420** contacts the biometric circuit board **420**; a second connection point (e.g., the second connection point **422** of FIG. **4**), which is a point at which a second conductive connection member configured to electrically connect a biometric button (e.g., the biosignal key button **432** of FIG. **4**) and the biometric circuit board **420** contacts the biometric circuit board **420**; and a third connection point (e.g., the third connection point **423** of FIG. **4**), which is a point at which a third conductive connection member configured to electrically connect the main circuit board **410** and the biometric circuit board **420** contacts the biometric circuit board **420**, wherein the conductive housing **430** may include a first shorting point physically/electrically (or operatively) connected to the biometric circuit board **420** and the main circuit board **410** to form an antenna path.

(90) According to one or more embodiments, the biometric key button **432** may be positioned at a surface of the conductive housing **430** and be electrically isolated from the conductive housing **430**.

(91) According to one or more embodiments, the first shorting point (e.g., the first shorting point **431** of FIG. **4**) may be positioned at the conductive housing and be connected to the first connection point through a first conductive connection member.

(92) According to one or more embodiments, the biometric circuit board may be connected to the biometric button of the conductive housing to transmit and/or receive biometric information and biometric button signals.

(93) According to one or more embodiments, the biometric circuit board may further include a first capacitor (e.g., the first capacitor **426** of FIG. **4**) configured to block biosignal interference between the first connection point and the third connection point.

(94) According to one or more embodiments, the biometric circuit board may further include a first inductor (e.g., the first inductor **428** of FIG. **4**) configured to block RF signal interference between the second connection point and the third connection point.

(95) According to one or more embodiments, the main circuit board may include an antenna circuit for transmitting and/or receiving RF signals, a biometric sensor configured to transmit and/or receive biosignals, and a fourth connection point (e.g., the fourth connection point **414** of FIG. **4**). The fourth connection point **414** may exist at the main circuit board, be connected to the third connection point through a third conductive connection member, and be positioned between the antenna circuit and the biometric sensor.

(96) According to one or more embodiments, the main circuit board may further include a second capacitor (e.g., the second capacitor **416** of FIG. **4**) configured to block biosignal interference between the fourth connection point and the antenna circuit.

(97) According to one or more embodiments, the main circuit board may further include a second inductor (e.g., the second inductor **418** of FIG. **4**) configured to block RF signal interference between the fourth connection point and the biometric sensor.

(98) According to one or more embodiments, the biometric circuit board may include a flexible printed circuit board (FPCB), and the conductive connection member may include a c-clip.

(99) According to one or more embodiments, the electronic device may further include a feeding point (e.g., the feeding point **440** of FIG. **4**) and a second shorting point (e.g., the second shorting point **442** of FIG. **4**) generated through a contact between the conductive housing and the main circuit board, and a processor. The processor may control whether an antenna is used and whether an RF signal is transmitted and/or received.

(100) According to one or more embodiments, in the antenna, as a distance between the feeding point and the shorting point decreases, a high resonant frequency may move to a higher band, and as a distance between the feeding point and the shorting point increases, a low resonant frequency may move to a lower band.

(101) According to one or more embodiments, the electronic device may further include a first switch (e.g., the first switch **411a** of FIG. **10**), and the first switch may be switched to connect the feeding point and the first shorting point or may be switched to connect the feeding point and the

second shorting point. The processor may control feeding path switching of the first switch. (102) According to one or more embodiments, in the case that the feeding point and the first shorting point are switched to be connected, a first resonant frequency of the antenna may be determined based on the distance between the feeding point and the first shorting point, in the case that the feeding point and the second shorting point are switched to be connected, a second resonant frequency of the antenna may be determined based on the distance between the feeding point and the second shorting point.

(103) According to one or more embodiments, the electronic device may further include a processor, a biometric sensor, a first switch, and a biological switch (e.g., the biological switch **412a** of FIG. **10**). The processor may control transmission and/or reception of an RF signal through the first switch connected to the antenna circuit, and the biometric sensor may control transmission and/or reception of a biosignal through a bioswitch connected thereto.

Claims

1. An electronic device comprising: a conductive housing; a main circuit board; and a biometric circuit board configured to measure body information, wherein the biometric circuit board comprises: a first connection point at which a first conductive connection member contacts the biometric circuit board, the first conductive connection member being configured to electrically connect the conductive housing and the biometric circuit board; a second connection point at which a second conductive connection member contacts the biometric circuit board, the second conductive connection member being configured to electrically connect a biometric button and the biometric circuit board; and a third connection point at which a third conductive connection member contacts the biometric circuit board, the third conductive connection member being configured to electrically connect the main circuit board and the biometric circuit board, and wherein the conductive housing comprises a first shorting point electrically connected to the biometric circuit board and the main circuit board to provide an antenna path.
2. The electronic device of claim 1, wherein the biometric button is provided at a surface of the conductive housing and electrically isolated from the conductive housing.
3. The electronic device of claim 1, wherein the first shorting point is provided at the conductive housing and the first shorting point is connected to the first connection point through the first conductive connection member.
4. The electronic device of claim 1, wherein the biometric circuit board is connected to the biometric button of the conductive housing to transmit or receive biometric information and biometric button signals.
5. The electronic device of claim 1, wherein the biometric circuit board further comprises a first capacitor configured to block biosignal interference between the first connection point and the third connection point.
6. The electronic device of claim 1, wherein the biometric circuit board further comprises a first inductor configured to block radio frequency (RF) signal interference between the second connection point and the third connection point.
7. The electronic device of claim 1, wherein the main circuit board comprises: an antenna circuit configured to transmit or receive a radio frequency (RF) signal; a biometric sensor configured to transmit or receive a biosignal; and a fourth connection point connected to the third connection point through the third conductive connection member, and provided between the antenna circuit and the biometric sensor.
8. The electronic device of claim 7, wherein the main circuit board further comprises a second capacitor configured to block biosignal interference between the fourth connection point and the antenna circuit.
9. The electronic device of claim 7, wherein the main circuit board further comprises a second

inductor configured to block RF signal interference between the fourth connection point and the biometric sensor.

10. The electronic device of claim 1, wherein the biometric circuit board comprises a flexible printed circuit board, and wherein each of the first, second, and third conductive connection members comprises a c-clip.

11. The electronic device of claim 1, further comprising: a feeding point; a second shorting point generated through a contact between the conductive housing and the main circuit board; and a processor configured to control whether an antenna is used and whether a radio frequency (RF) signal is transmitted or received.

12. The electronic device of claim 11, wherein, in the antenna, a high resonant frequency moves to a high band as a distance between the feeding point and the second shorting point decreases, and a low resonant frequency moves to a lower band as a distance between the feeding point and the second shorting point increases.

13. The electronic device of claim 11, further comprising a first switch, wherein the first switch is switched to connect the feeding point and the first shorting point or the first switch is switched to connect the feeding point and the second shorting point, and wherein the processor is further configured to control a switching of a path of the RF signal of the first switch.

14. The electronic device of claim 13, wherein, based on the feeding point and the first shorting point that are switched to be connected, a first resonant frequency of the antenna is determined based on a distance between the feeding point and the first shorting point, and wherein, based on the feeding point and the second shorting point that are switched to be connected, a second resonant frequency of the antenna is determined based on a distance between the feeding point and the second shorting point.

15. The electronic device of claim 1, further comprising: a processor; an antenna circuit; a biometric sensor; a first switch; and a bioswitch, wherein the processor is configured to control a transmission or a reception of a radio frequency (RF) signal through the first switch connected to the antenna circuit, and wherein the biometric sensor is configured to control a transmission or a reception of a biosignal through the bioswitch.
