

【DESCRIPTION】

【Title of Invention】

ELECTRONIC DEVICE COMPRISING SPEAKER STRUCTURE

【Technical Field】

[1] Various embodiments disclosed herein relate to an electronic device including a speaker structure.

【Background Art】

[2] The supply of electronic devices is constantly increasing. In addition to the existing bar-type electronic devices, various types of electronic devices, such as foldable electronic devices and rollable electronic devices, are being released.

[3] The electronic device may be provided with dual speakers which are installed on both upper and lower ends of a portable electronic device.

[4] The electronic device may include a front camera in addition to a rear camera.

【Disclosure of Invention】

【Technical Problem】

[5] For aesthetics of an electronic device, sound holes for radiating sound output from a speaker to the outside of the electronic device may be symmetrically disposed in a housing of the electronic device.

[6] For example, an upper sound hole and a lower sound hole may be disposed at the upper central portion and at the lower central portion of the electronic device, respectively, to be symmetrical to each other, and a speaker module connected to the upper sound hole and a speaker module connected to the lower sound hole may also be disposed at the upper central portion and at the lower central portion of the housing, respectively. For aesthetics, a camera module may be disposed at the center of the upper end of the electronic device so that a camera hole is located at the upper central portion of the display.

[7] In this case, overlap between the camera module and the upper speaker module may occur.

[8] When the volume of a conduit configured to guide sound of a speaker module is

reduced, sound quality may be deteriorated.

[9] Various embodiments disclosed herein may provide an electronic device including a speaker module that solves or improves the above problems.

【Solution to Problem】

[10] An electronic device according to various embodiments disclosed herein may include a first housing, a display module positioned on the front surface of the first housing, a camera module disposed at the upper end of the first housing, a speaker module disposed in the first housing to be adjacent to the camera module, a sound hole disposed in a lateral surface of the first housing such that sound generated from the speaker module is emitted to the outside of the electronic device, a conduit including a first conduit disposed in the first housing to extend from the speaker module toward the sound hole, and a second conduit extending in a direction perpendicular to the extension direction of the first conduit to be disposed in the first housing, and an expansion portion disposed in at least a portion of the conduit to expand the volume of the conduit.

[11] An electronic device according to various embodiments disclosed herein may include a first housing, a display module positioned on the front surface of the first housing, a camera module disposed at the upper end of the first housing, an upper speaker module disposed at the upper end of the first housing to be adjacent to the camera module, a lower speaker module disposed on the lower end of the first housing, an upper sound hole disposed in the upper lateral surface of the first housing, a lower sound hole disposed in a lateral surface of the lower end of the first housing, an upper conduit including a first conduit extending from the upper speaker module toward the upper sound hole, and a second conduit extending in a direction perpendicular to the extension direction of the first conduit, a lower conduit extending from the lower speaker module toward the lower sound hole, and an expansion portion disposed in at least a portion of the upper conduit to expand the volume of the upper conduit.

【Advantageous Effects of Invention】

[12] Various embodiments disclosed herein may provide a structure in which a speaker module and a camera module are located on the central portion of an electronic device, in

consideration of the aesthetics of the electronic device.

[13] In addition, the sound quality problem due to the adjacent arrangement of the speaker module and the camera module may be solved by changing the shape of a conduit of the speaker module.

【Brief Description of Drawings】

[14] In connection with the description of the drawings, the same or similar reference numerals may be used for the same or similar elements.

[15] FIG. 1 is a block diagram of an electronic device in a network environment according to various embodiments.

[16] FIG. 2A illustrates an unfolded state of an electronic device according to various embodiments of the disclosure.

[17] FIG. 2B illustrates a folded state of the electronic device of FIG. 2A according to various embodiments of the disclosure.

[18] FIG. 3 is an exploded perspective view of an electronic device according to various embodiments of the disclosure.

[19] FIG. 4A illustrates the front surface of a housing and a peripheral component thereof according to various embodiments disclosed herein.

[20] FIG. 4B is a top plan view illustrating the upper end of the front surface of a housing according to various embodiments disclosed herein.

[21] FIG. 4C is a cross-sectional view taken along line B-B of FIG. 4B.

[22] FIG. 4D is a cross-sectional view taken along line C-C of FIG. 4B.

[23] FIG. 5A is a rear perspective view of a housing according to various embodiments disclosed herein.

[24] FIG. 5B is a cross-sectional view taken along line A-A of the housing of FIG. 4A.

[25] FIG. 5C is a plan view of a soundproofing material attached to an expansion portion according to various embodiments disclosed herein.

[26] FIG. 5D is a cross-sectional view taken along line D-D of the soundproofing material shown in FIG. 5C.

[27] FIG. 6 is a plan view of a bar-shaped electronic device according to various embodiments disclosed herein.

【Mode for the Invention】

[28] 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.

[29] 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.

[30] 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.

[31] 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).

[32] 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.

[33] 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.

[34] 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.

[35] 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.

[36] 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).

[37] 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.

[38] 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.

[39] 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.

[40] 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.

[41] 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.

[42] 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).

[43] 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.

[44] 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.

[45] 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).

[46] 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.

[47] 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 BluetoothTM, 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.

[48] 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.,

20Gbps or more) for implementing eMBB, loss coverage (e.g., 164dB or less) for implementing mMTC, or U-plane latency (e.g., 0.5ms or less for each of downlink (DL) and uplink (UL), or a round trip of 1ms or less) for implementing URLLC.

[49] 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.

[50] 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.

[51] 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)).

[52] 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.

[53] FIG. 2A is a diagram illustrating an unfolded state of an electronic device 200 according to various embodiments of the disclosure. FIG. 2B is a diagram illustrating a folded state of the electronic device 200 of FIG. 2A according to various embodiments of the disclosure.

[54] Referring to FIGS. 2A and 2B, the electronic device 200 may include a pair of

housings 210 and 220 (e.g., foldable housing) rotatably coupled based on a folding axis A through a hinge device (e.g., a hinge device 264 of FIG. 3) to be foldable with respect to each other, a first display 230 (e.g., flexible display, foldable display, or main display) disposed through the pair of housings 210 and 220, and/or a second display 400 (e.g., sub-display) disposed through the second housing 220. According to certain embodiments, at least a portion (e.g., hinge devices 320 and 320-1 of FIG. 3) of the hinge device (e.g., the hinge device 264 of FIG. 3) may be disposed to not be visible from the outside through the first housing 210 and the second housing 220 and disposed to not be visible from the outside through a hinge cover 265 covering a foldable portion in an unfolded state. In this document, a surface in which the first display 230 is disposed may be defined as a front surface of the electronic device 200, and an opposite surface of the front surface may be defined as a rear surface of the electronic device 200. Further, a surface enclosing a space between the front surface and the rear surface may be defined as a side surface of the electronic device 200.

[55] According to various embodiments, the pair of housings 210 and 220 may include a first housing 210 and second housing 220 disposed to be foldable with respect to each other through the hinge device (e.g., the hinge device 264 of FIG. 3). According to certain embodiments, the pair of housings 210 and 220 are not limited to the shape and coupling illustrated in FIGS. 2A and 2B, and may be implemented by a combination and/or coupling of other shapes or parts. According to certain embodiments, the first housing 210 and the second housing 220 may be disposed at both sides based on the folding axis A, and have an overall symmetrical shape with respect to the folding axis A. According to some embodiments, the first housing 210 and the second housing 220 may be folded asymmetrically based on the folding axis A. According to certain embodiments, the first housing 210 and the second housing 220 may have different angles or distances from each other according to whether the electronic device 200 is in an unfolded state, a folded state, or an intermediate state.

[56] According to various embodiments, when the electronic device 200 is in an unfolded state, the first housing 210 may include a first surface 211 connected to the hinge device (e.g., the hinge device 264 of FIG. 3) and disposed to face the front of the electronic device 200, a

second surface 212 facing in a direction opposite to that of the first surface 211, and/or a first side member 213 enclosing at least a portion of a first space between the first surface 211 and the second surface 212. According to certain embodiments, when the electronic device 200 is in an unfolded state, the second housing 220 may include a third surface 221 connected to the hinge device (e.g., the hinge device 264 of FIG. 3), and disposed to face the front of the electronic device 200, a fourth surface 222 facing in a direction opposite that of the third surface 221, and/or a second side member 223 enclosing at least a portion of a second space between the third surface 221 and the fourth surface 222. According to certain embodiments, the first surface 211 may face in substantially the same direction as that of the third surface 221 when the electronic device is in an unfolded state and at least partially face the third surface 221 when the electronic device is in a folded state. According to certain embodiments, the electronic device 200 may include a recess 201 formed to receive the first display 230 through structural coupling of the first housing 210 and the second housing 220. According to certain embodiments, the recess 201 may have substantially the same size as that of the first display 230.

[57] According to various embodiments, the hinge cover 265 (e.g., hinge cover) may be disposed between the first housing 210 and the second housing 220 and be disposed to cover a hinge device (e.g.: the hinge device s 320 and 320-1 of FIG. 3) disposed in the hinge cover 265. According to certain embodiments, the hinge cover 265 may be covered by a part of the first housing 210 and the second housing 220 or may be exposed to the outside according to an unfolded state, a folded state, or an intermediate state of the electronic device 200. For example, when the electronic device 200 is in an unfolded state, at least a portion of the hinge cover 265 may be covered by the first housing 210 and the second housing 220 to not be substantially exposed. According to certain embodiments, when the electronic device 200 is in a folded state, at least a portion of the hinge cover 265 may be exposed to the outside between the first housing 210 and the second housing 220. According to certain embodiments, when the first housing 210 and the second housing 220 are in an intermediate state folded with a certain angle, the hinge cover 265 may be at least partially exposed to the outside of the electronic device 200

between the first housing 210 and the second housing 220. For example, an area in which the hinge cover 265 is exposed to the outside may be smaller than that in a fully folded state. According to certain embodiments, the hinge cover 265 may include a curved surface.

[58] According to various embodiments, when the electronic device 200 is in an unfolded state (e.g., the state of FIG. 2A), the first housing 210 and the second housing 220 form an angle of approximately 180 degrees, and a first area 230a, a folding area 230c, and a second area 230b of the first display 230 may form the same flat surface and be disposed to face in substantially the same direction. In another embodiment, when the electronic device 200 is in an unfolded state, the first housing 210 may rotate at an angle of approximately 360 degrees with respect to the second housing 220 so that the second surface 212 and the fourth surface 222 may be reversely folded to face each other (out-folding method).

[59] According to various embodiments, when the electronic device 200 is in the folded state (e.g., the state of FIG. 2B), the first surface 211 of the first housing 210 and the third surface 221 of the second housing 220 may be disposed to face each other. In this case, the first area 230a and the second area 230b of the first display 230 may form a narrow angle (e.g., a range of 0 degree to approximately 10 degree) each other through the folding area 230c and be disposed to face each other. According to certain embodiments, at least a portion of the folding area 230c may be transformed into a curved shape having a predetermined curvature. According to certain embodiments, when the electronic device 200 is in an intermediate state, the first housing 210 and the second housing 220 may be disposed at a certain angle to each other. In this case, the first area 230a and the second area 230b of the first display 230 may form an angle larger than the folded state and smaller than the unfolded state, and a curvature of the folding area 230c may be smaller than that of the folded state and be larger than that of the unfolded state. In some embodiments, the first housing 210 and the second housing 220 may form an angle that may stop at a specified folding angle between the folded state and the unfolded state through the hinge device (e.g., the hinge device 264 of FIG. 3) (free stop function). In some embodiments, the first housing 210 and the second housing 220 may be operated while being pressurized in an unfolding direction or a folding direction based on a

specified inflection angle through the hinge device (e.g., the hinge device 264 of FIG. 3).

[60] According to various embodiments, the electronic device 200 may include at least one of at least one display 230 and 400, an input device 215, sound output devices 227 and 228, sensor modules 217a, 217b, and 226, camera modules 216a, 216b, and 225, a key input device 219, an indicator, or a connector port 229 disposed in the first housing 210 and/or the second housing 220. In some embodiments, the electronic device 200 may omit at least one of the components or may additionally include at least one other component.

[61] According to various embodiments, the at least one display 230 and 400 may include a first display 230 (e.g., flexible display) disposed to receive support from the third surface 221 of the second housing 220 through the hinge device (e.g., the hinge device 264 of FIG. 3) from the first surface 211 of the first housing 210, and a second display 400 disposed to be visible at least partially from the outside through the fourth surface 222 in an inner space of the second housing 220. As another example, the second display 400 may be disposed to be visible from the outside through the second surface 212 in an inner space of the first housing 210. According to certain embodiments, the first display 230 may be mainly used in an unfolded state of the electronic device 200, and the second display 400 may be mainly used in a folded state of the electronic device 200. According to certain embodiments, when the electronic device 200 is in an intermediate state, the electronic device 200 may control the first display 230 and/or the second display 400 to be usable based on a folding angle of the first housing 210 and the second housing 220.

[62] According to various embodiments, the first display 230 may be disposed in a receiving space formed by a pair of housings 210 and 220. For example, the first display 230 may be disposed in the recess 201 formed by the pair of housings 210 and 220, and when the electronic device 200 is in an unfolded state, the first display 230 may be disposed to occupy substantially most of the front surface of the electronic device 200. According to certain embodiments, the first display 230 may include a flexible display whose at least a partial area may be transformed into a flat surface or a curved surface. According to certain embodiments, the first display 230 may include a first area 230a facing the first housing 210, a second area

230b facing the second housing 220, and a folding area 230c connecting the first area 230a and the second area 230b and facing the hinge device (e.g., the hinge device 264 of FIG. 3). According to certain embodiments, area division of the first display 230 is an exemplary physical division by a pair of housings 210 and 220 and the hinge device (e.g., the hinge device 264 of FIG. 3), and the first display 230 may be displayed as a substantially seamless single full screen through the pair of housings 210 and 220 and the hinge device (e.g., the hinge device 264 of FIG. 3). According to certain embodiments, the first area 230a and the second area 230b may have an overall symmetrical shape or a partially asymmetrical shape based on the folding area 230c.

[63] According to various embodiments, the electronic device 200 may include a first rear cover 240 disposed at the second surface 212 of the first housing 210 and a second rear cover 250 disposed at the fourth surface 222 of the second housing 220. In some embodiments, at least a portion of the first rear cover 240 may be integrally formed with the first side member 213. In some embodiments, at least a portion of the second rear cover 250 may be integrally formed with the second side member 223. According to certain embodiments, at least one cover of the first rear cover 240 and the second rear cover 250 may be formed with a substantially transparent plate (e.g., a polymer plate or a glass plate including various coating layers) or an opaque plate. According to certain embodiments, the first rear cover 240 may be formed by an opaque plate such as, 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. According to certain embodiments, the second rear cover 250 may be formed through a substantially transparent plate such as glass or polymer, for example. Accordingly, the second display 400 may be disposed to be visible from the outside through the second rear cover 250 in an inner space of the second housing 220.

[64] According to various embodiments, the input device 215 may include a microphone. In some embodiments, the input device 215 may include a plurality of microphones disposed to detect a direction of a sound. According to certain embodiments, the sound output devices 227 and 228 may include speakers. According to certain embodiments, the sound output

devices 227 and 228 may include a call receiver 227 disposed through the fourth surface 222 of the second housing 220 and an external speaker 228 disposed through at least a portion of the second side member 223 of the second housing 220. In some embodiments, the input device 215, the sound output devices 227 and 228, and the connector 229 may be disposed in spaces of the first housing 210 and/or the second housing 220 and be exposed to an external environment through at least one hole formed in the first housing 210 and/or the second housing 220. In some embodiments, holes formed in the first housing 210 and/or the second housing 220 may be commonly used for the input device 215 and the sound output devices 227 and 228. In some embodiments, the sound output devices 227 and 228 may include a speaker (e.g., piezo speaker) operating while excluding a hole formed in the first housing 210 and/or the second housing 220.

[65] According to various embodiments, the camera modules 216a, 216b, and 225 may include a first camera module 216a disposed at the first surface 211 of the first housing 210, a second camera module 216b disposed at the second surface 212 of the first housing 210, and/or a third camera module 225 disposed at the fourth surface 222 of the second housing 220. According to certain embodiments, the electronic device 200 may include a flash 218 disposed near the second camera module 216b. According to certain embodiments, the flash 218 may include, for example, a light emitting diode or a xenon lamp. According to certain embodiments, the camera modules 216a, 216b, and 225 may include one or a plurality of lenses, an image sensor, and/or an image signal processor. In some embodiments, at least one camera module of the camera modules 216a, 216b, and 225 may include two or more lenses (e.g., wide-angle and telephoto lenses) and image sensors and be disposed together at any one surface of the first housing 210 and/or the second housing 220.

[66] According to various embodiments, the sensor modules 217a, 217b, and 226 may generate an electrical signal or a data value corresponding to an internal operating state of the electronic device 200 or an external environmental state. According to certain embodiments, the sensor modules 217a, 217b, and 226 may include a first sensor module 217a disposed at the first surface 211 of the first housing 210, a second sensor module 217b disposed at the

second surface 212 of the first housing 210, and/or a third sensor module 226 disposed at the fourth surface 222 of the second housing 220. In some embodiments, the sensor modules 217a, 217b, and 226 may include at least one of a gesture sensor, a grip sensor, a color sensor, an infrared (IR) sensor, an illuminance sensor, an ultrasonic sensor, an iris recognition sensor, or a distance detection sensor (e.g., time of flight (TOF) sensor or light detection and ranging (LiDAR)).

[67] According to various embodiments, the electronic device 200 may further include a sensor module, for example, at least one of an atmospheric pressure sensor, a magnetic sensor, a biometric sensor, a temperature sensor, a humidity sensor, or a fingerprint recognition sensor. In some embodiments, the fingerprint recognition sensor may be disposed through at least one of the first side member 213 of the first housing 210 and/or the second side member 223 of the second housing 220.

[68] According to various embodiments, the key input device 219 may be disposed to be exposed to the outside through the first side member 213 of the first housing 210. In some embodiments, the key input device 219 may be disposed to be exposed to the outside through the second side member 223 of the second housing 220. In some embodiments, the electronic device 200 may not include some or all of the key input devices 219, and the non-included key input devices 219 may be implemented into other forms such as soft keys on at least one display 230 and 400. As another embodiment, the key input device 219 may be implemented using a pressure sensor included in at least one display 230 and 400.

[69] According to various embodiments, the connector port 229 may include a connector (e.g., USB connector or interface connector port module (IF module)) for transmitting and receiving power and/or data to and from an external electronic device. In some embodiments, the connector port 229 may further include a separate connector port (e.g., ear jack hole) for performing together a function for transmitting and receiving an audio signal to and from an external electronic device or for performing a function of transmitting and receiving an audio signal.

[70] According to various embodiments, at least one camera module 216a and 225 of the

camera modules 216a, 216b, and 225, at least one sensor module 217a and 226 of the sensor modules 217a, 217b, and 226, and/or the indicator may be disposed to be exposed through at least one display 230 and 400. For example, the at least one camera module 216a and 225, the at least one sensor module 217a and 226, and/or the indicator may be disposed under a display area of the displays 230 and 400 in an interior space of the at least one housing 210 and 220 and be disposed to contact an external environment through an opening or transparent area perforated to a cover member (e.g., a window layer of the first display 230 and/or the second rear cover 250). According to certain embodiments, an area in which the displays 230 and 400 and the at least one camera module 216a and 225 face each other is a part of an area displaying contents and may be formed as a transmission area having predetermined transmittance. According to certain embodiments, the transmission area may be formed to have transmittance in a range from approximately 5% to approximately 20%. Such a transmission area may include an area overlapped with an effective area (e.g., view angle area) of the at least one camera module 216a and 225 through which light for generating an image by an image sensor passes. For example, the transmission area of the displays 230 and 400 may include an area having a lower pixel density than that of a peripheral area thereof. For example, the transmission area may replace the opening. For example, the at least one camera module 216a and 225 may include an under display camera (UDC). In another embodiment, some camera modules or sensor modules 217a and 226 may be disposed to perform functions thereof without being visually exposed through the display. For example, an area facing the camera modules 216a and 225 and/or the sensor modules 217a and 226 disposed under the displays 230 and 400 (e.g., display panel) has an under display camera (UDC) structure; thus, a perforated opening may be unnecessary.

[71] According to various embodiments, the electronic device 200 may include at least one antenna configured with at least a portion of the first conductive side surface member 213 of the first housing 210. According to an embodiment, the at least one antenna may be disposed in an upper area (e.g., area A) and/or a lower area (e.g., area B) of the first housing 210.

[72] According to exemplary embodiments of the disclosure, at least one antenna may be

additionally implemented by using the second conductive side surface member 223 of the second housing 220 including the second display 400. According to an embodiment, at least one antenna may be additionally disposed in the upper area (area C) and/or the lower area (area D) of the second conductive side surface member 223. In this case, a conductive sheet of the second display 400 and a peripheral conductive structure (e.g., a substrate or a conductive electrical structure) used as a common ground may be electrically connected (grounded) to each other at at least one predetermined position in the vicinity of a feeding point of an antenna, which may be helpful to prevent deterioration in radiation performance of the antenna using the second side surface member 223.

[73] FIG. 3 is an exploded perspective view illustrating an electronic device 200 according to various embodiments of the disclosure.

[74] Referring to FIG. 3, the electronic device 200 may include a first display 230, a second display 400, a hinge device 264, a support member assembly 260, at least one printed circuit board 270, a first housing 210, a second housing 220, a first rear cover 240, and/or a second rear cover 250.

[75] According to various embodiments, the first display 230 may include a display panel 231 (e.g., flexible display panel) and one or more plates 232 or layers in which the display panel 231 is seated. According to certain embodiments, the display panel 231 may include a first panel area 231a corresponding to the first area (e.g., the first area 230a of FIG. 2A) of the display 230, a second panel area 231b extended from the first panel area and corresponding to the second area (e.g., the second area 230b of FIG. 2A) of the display 230, and a third area 231c connecting the first panel area 231a and the second panel area 231b and corresponding to a folding area (e.g., the folding area 230c of FIG. 2A) of the display 230. According to certain embodiments, the one or more plates 232 may include a conductive plate (e.g., Cu sheet or SUS sheet) disposed between the display panel 231 and the support member assembly 260. According to certain embodiments, the one or more plates 232 may be formed to have substantially the same area as that of the first display 230, and an area facing a folding area (e.g., the folding area 230c of FIG. 2A) of the first display 230 may be formed to be bendable.

According to certain embodiments, the one or more plates 232 may include at least one auxiliary material layer (e.g., graphite member) disposed at a rear surface of the display panel 231. According to certain embodiments, the one or more plates 232 may be formed in a shape corresponding to the display panel 231.

[76] According to various embodiments, the second display 400 may be disposed in a space between the second housing 220 and the second rear cover 250. According to certain embodiments, the second display 400 may be disposed to be visible from the outside through substantially the entire area of the second rear cover 250 in a space between the second housing 220 and the second rear cover 250.

[77] According to various embodiments, the support member assembly 260 may include a first support member 261 (e.g., first support plate) and a second support member 262 (e.g., second support plate). According to certain embodiments, the first support member 261 may be foldably coupled to the second support member 262 through the hinge device 264. According to certain embodiments, the electronic device 200 may include at least one wiring member 263 (e.g., flexible printed circuit board (FPCB)) disposed from at least a portion of the first support member 261 across the hinge device 264 to a portion of the second support member 262. According to certain embodiments, the support member assembly 260 may be disposed between one or more plates 232 and at least one printed circuit board 270. According to certain embodiments, the first support member 261 may be disposed between the first area (e.g., the first area 230a of FIG. 2A) of the first display 230 and a first printed circuit board 271. According to certain embodiments, the second support member 262 may be disposed between the second area (e.g., the second area 230b of FIG. 2A) of the first display 230 and a second printed circuit board 272. According to certain embodiments, the at least one wiring member 263 and/or at least a portion of the hinge device 264 may be disposed to be supported through at least a portion of the support member assembly 260. According to certain embodiments, the at least one wiring member 263 may be disposed in a direction (e.g., x-axis direction) crossing the first support member 261 and the second support member 262. According to certain embodiments, the at least one wiring member 263 may be disposed in a

direction (e.g., the x-axis direction) substantially perpendicular to the folding axis (e.g., the y-axis or the folding axis A of FIG. 2A) of the folding area 230c.

[78] According to various embodiments, the at least one printed circuit board 270 may include a first printed circuit board 271 disposed to face the first support member 261 or a second printed circuit board 272 disposed to face the second support member 262. According to certain embodiments, the first printed circuit board 271 and the second printed circuit board 272 may be disposed in an inner space formed by the support member assembly 260, the first housing 210, the second housing 220, and the first rear cover 240, and/or the second rear cover 250. According to certain embodiments, the first printed circuit board 271 and the second printed circuit board 272 may include a plurality of electronic components disposed to implement various functions of the electronic device 200.

[79] According to various embodiments, the electronic device 200 may include a first printed circuit board 271 disposed in a first space of the first housing 210, a first battery 291 disposed at a position facing a first swelling hole 2611 of the first support member 261, at least one camera module 282 (e.g., the first camera module 216a and/or the second camera module 216b of FIG. 2A), or at least one sensor module 281 (e.g., the first sensor module 217a and/or the second sensor module 217b of FIG. 2A). According to certain embodiments, the electronic device 200 may include a second printed circuit board 272 disposed in the second space of the second housing 220 or a second battery 292 disposed in a position facing a second swelling hole 2621 of the second support member 262. According to certain embodiments, the first housing 210 may be integrally formed with the first support member 261. According to certain embodiments, the second housing 220 may be integrally formed with the second support member 262.

[80] According to various embodiments, the first housing 210 may include a first rotation support surface 214, and the second housing 220 may include a second rotation support surface 224 corresponding to the first rotation support surface 214. According to certain embodiments, the first rotation support surface 214 and the second rotation support surface 224 may include curved surfaces corresponding to (naturally connected to) a curved outer surface of the hinge

cover 265. According to certain embodiments, when the electronic device 200 is in an unfolded state, the first rotation support surface 214 and the second rotation support surface 224 may cover the hinge cover 265, thereby not exposing the hinge cover 265 from the rear surface of the electronic device 200 or exposing only a portion thereof. According to certain embodiments, when the electronic device 200 is in a folded state, the first rotation support surface 214 and the second rotation support surface 224 may rotate along the curved outer surface of the hinge cover 265 to expose at least a portion of the hinge cover 265 to the rear surface of the electronic device 200.

[81] FIG. 4A illustrates the front surface of a housing and a peripheral component thereof according to various embodiments disclosed herein. FIG. 4B is a top plan view illustrating the upper end of the front surface of a housing according to various embodiments disclosed herein. FIG. 4C is a cross-sectional view taken along line B-B of FIG. 4B. FIG. 4D is a cross-sectional view taken along line C-C of FIG. 4B. In the following, detailed descriptions of the same or similar components described above are omitted and the same reference numbers are used for components to be described.

[82] According to various embodiments, as shown in FIG. 4A, an upper speaker module 301 (e.g., the sound output module 155 of FIG. 1, the sound output device 228 of FIG. 2A) on the front surface 222 (e.g., the fourth side 222 of FIG. 2A), a lower speaker module 302 (e.g., the sound output module 155 of FIG. 1, the sound output device 228 of FIG. 2A), an upper conduit 305, a lower conduit 306, a camera module 225 (e.g., the camera module 180 of FIG. 1, the third camera module 225 of FIG. 2A), a printed circuit board 272 (e.g., the second printed circuit board 272 of FIG. 3), a battery 292 (e.g., battery 189 of FIG. 1 or second battery 292 of FIG. 3), and a display module 160 (e.g., the display module 160 of FIG. 1, the first display 230 of FIG. 2A or the second display 400 of FIG. 2A) may disposed and formed on the housing 220 (e.g., the second housing 220 of FIG. 2A) that is the body of the electronic device 200 (e.g., the electronic device 101 of FIG. 1 or the electronic device 200 of FIG. 2A). The housing 220 to be described below may include a support member 262 (e.g., the second support member 262 of FIG. 3).

[83] According to various embodiments, various electronic components included in the electronic device 200 may be disposed in the housing 220 of the electronic device 200 and at least a portion thereof may be a generic term for a mechanism constituting the appearance of the electronic device 200. According to an embodiment, the printed circuit board 272, the camera module 225, and the speaker modules 301 and 302 may be disposed in the housing 220. In addition, various electronic components may be disposed in the housing 220.

[84] According to various embodiments, at least one of the electronic components included in the electronic device 200 may be electrically connected to the printed circuit board 272. For example, the speaker modules 301 and 302 and the camera module 225 may be electrically connected to the printed circuit board 272.

[85] According to various embodiments, the upper speaker module 301 and the lower speaker module 302 may be devices disposed in the electronic device 200 to output sound. The upper speaker module 301 and the lower speaker module 302 may output sound according to the execution of an application or function. For example, the upper speaker module 301 and the lower speaker module 302 may receive an audio signal processed through an audio module (e.g., the audio module 170 of FIG. 1) and output the signal as sound.

[86] According to various embodiments, referring to FIG. 2B, the upper speaker module 301 may be used as a receiver 227 for communication. In a call operation, ring sound of an incoming call may be delivered to the user through the upper speaker module 301. In the case of a foldable electronic device 200, the user may fold the electronic device 200 so as to easily hold the electronic device 200 during a call operation. Since the user's ear may come close to the upper center portion of the electronic device 200 in an operation in which the user holds the folded electronic device 200 to make a call, a portion through which the call sound is emitted may be located at the upper center portion of the electronic device 200. For example, a receiver hole (not shown) through which the call sound generated from the upper speaker module 301 is emitted may be disposed at the center of the upper end of the second rear cover 250. Therefore, the upper speaker module 301 connected to the receiver hole may be disposed at the central upper end of the front surface 222 of the housing 220. According to another

embodiment, the receiver 227 and the upper speaker module 301 may be separate parts.

[87] According to various embodiments, as shown in FIG. 4A, sound holes 303 and 304 may be disposed at the upper end and/or the lower end of the housing 220 of the electronic device 200. The sound holes 303 and 304 may include an upper sound hole 303 disposed in the upper lateral surface (e.g., the +Y direction of FIG. 4A) of the housing 220 and a lower sound hole 304 disposed in the lower lateral surface (e.g., the -Y direction of FIG. 4A) of the housing 220. The upper sound hole 303 and the lower sound hole 304 may be disposed in the center portion of the upper lateral surface of the housing 220 and through the center portion of the lower lateral surface of the housing 220, respectively, to be symmetrical to each other along the X-axis of FIG. 4A. Sounds generated from the speaker modules 301 and 302 may be radiated to the outside of the electronic device 200 through the sound holes 303 and 304.

[88] According to various embodiments, an upper conduit 305 may be connected to the upper speaker module 301 and the upper sound hole 303 and may be a portion of the upper speaker module 301. The upper conduit 305 may guide sound output from the upper speaker module 301 to the upper sound hole 303.

[89] According to various embodiments, a lower conduit 306 may be connected to the lower speaker module 302 and the lower sound hole 304 and may be a portion of the lower speaker module 302. The lower conduit 306 may guide sound output from the lower speaker module 302 to the lower sound hole 304. As shown in FIG. 4A, the lower conduit 306 may extend from the lower speaker module 302 toward the lower sound hole 304 (e.g., the -Y direction of FIG. 4A).

[90] According to various embodiments, the user may take a self-photograph through the camera module 225. In the case of the foldable electronic device 200, the electronic device 200 may be folded to facilitate self-photographing through a specific camera. For example, referring to FIG. 2B, when taking a self-photograph by using the camera module 225, the user may fold the electronic device 200. The lens of the camera module 225 may be placed at the center of the upper end of the display module 160 to allow the user to easily adjust the photographing composition by identifying the user's image previewed on the display module

160 through the camera module 225. In an embodiment, a transparent region through which light may be incident to the lens of the camera module 225 may exist in the display module 160, and the lens may face the transparent region. Disposing the lens at the center of the upper end of the display module 160 may signify that the transparent region of the display module 160 is located at the center of the upper end of the display module 160. In addition to this, the lens may be positioned at the center of the upper end of the display module 160 in various manners. Meanwhile, a symmetrical design may be implemented by disposing the lens of the camera module 225 at the center of the display module 160.

[91] According to various embodiments, as shown in FIGS. 4A and 4B, when the upper speaker module 301 and the camera module 225 are disposed at the central upper end of the front surface 222 of the housing 220, the upper speaker module 301 and the camera module 225 may overlap each other in the Z-axis direction shown in FIG. 4B. To solve this problem, the shape of the upper conduit 305 connected to the upper speaker module 301 may be variable. Details on this are given below.

[92] According to various embodiments, as shown in FIG. 4B, the camera module 225 and the upper speaker module 301 may be disposed at the center of the upper end of the housing 220 to be adjacent to each other.

[93] When the camera module 225 and the upper speaker module 301 are disposed adjacent to each other, the upper speaker module 301 may be disposed in a first direction (e.g., the first direction of FIG. 4B) with respect to a line 310 extending in the longitudinal direction of the housing 220. The camera module 225 may be disposed in a second direction (e.g., the second direction of FIG. 4B) with respect to the line 310 extending in the longitudinal direction of the housing 220.

[94] According to various embodiments, as shown in FIG. 4B, a first conduit 305-1 and a second conduit 305-2 of the upper conduit 305 may be connected. The first conduit 305-1 of the upper conduit 305 may be disposed in the first direction (e.g., the first direction of FIG. 4B) with respect to the line 310 extending in the longitudinal direction of the housing 220. The second conduit 305-2 of the upper conduits 305 may be disposed in the second direction (e.g.,

the second direction of FIG. 4B) with respect to the line 310 extending in the longitudinal direction of the housing 220. The first conduit 305-1 may extend from the upper speaker module 301 toward the upper sound hole 303 (e.g., the +Y direction of FIG. 4B). At least a portion of the second conduit 305-2 may extend in a direction perpendicular to the extension direction of the first conduit 305-1 (e.g., the X-axis direction or the second direction of FIG. 4B).

[95] According to various embodiments, as shown in FIG. 4B, the width (W1) of the first conduit 305-1 and the width (W2) of the second conduit 305-2 may be different from each other. For example, the width (W2) of the second conduit 305-2 may be smaller than the width (W1) of the first conduit 305-1. Here, the width (W1) of the first conduit 305-1 may refer to the length of the first conduit 305-1 in the Y-axis direction, shown in FIG. 4B. In addition, the width (W2) of the second conduit 305-2 may refer to the length of the second conduit 305-2 in the Y-axis direction, shown in FIG. 4B. At least a portion of the camera module 225 may be disposed at a portion of the housing 220 corresponding to the difference between the width (W1) of the first conduit 305-1 and the width (W2) of the second conduit 305-2. Due to the shape of the upper conduit 305, the upper conduit 305 of the upper speaker module 301 and the camera module 225 may be disposed at the central upper end of the front surface 222 of the housing 220 without overlapping each other. For example, as shown in FIGS. 4C and 4D, a portion of the camera module 225 may be disposed at a portion corresponding to the difference between the width (W1) of the first conduit 305-1 and the width (W2) of the second conduit 305-2. Accordingly, a portion of the upper sound hole 303 may be covered by the portion of the camera module 225 when cut along line C-C in FIG. 4B.

[96] According to various embodiments, as shown in FIGS. 4A and 4C, the upper sound hole 303 and the lower sound hole 304 may include at least one hole 303-1 or 304-1.

[97] Sounds generated from the speaker modules 301 and 302 may be radiated to the outside of the electronic device 200 through the holes 303-1 and 304-1. The holes 303-1 and 304-1 may be arranged in a direction parallel to the direction in which the second conduit 305-2 extends (e.g., the X-axis direction of FIG. 4B).

[98] The shape, structure, and location of the housing 220, the upper speaker module 301, the upper conduit 305, the lower speaker module 302, the lower conduit 306, the camera module 225, the upper sound hole 303, the lower sound hole 304 are only examples. The shape, structure, and location of the housing 220, the upper speaker module 301, the upper conduit 305, the lower speaker module 302, the lower conduit 306, the camera module 225, the upper sound hole 303, the lower sound hole 304 are not limited to those shown in FIG. 4A.

[99] The width (W1) of the first conduit 305-1 and the width (W2) of the second conduit 305-2 shown in FIG. 4B are only examples and may be variously changed. In addition, the shapes and numbers of the holes 303-1 and 304-1 shown in FIGS. 4A to 4D are only examples and may be variously changed.

[100] FIG. 5A is a rear perspective view of a housing according to various embodiments disclosed herein. FIG. 5B is a cross-sectional view taken along line A-A of the housing of FIG. 4A. FIG. 5C is a plan view of a soundproofing material attached to an expansion portion according to various embodiments disclosed herein. FIG. 5D is a cross-sectional view taken along line D-D of the soundproofing material shown in FIG. 5C.

[101] The front surface 222 (e.g., the fourth surface 222 of FIG. 2A) of the housing 220 (e.g., the second housing 220 of FIG. 2A), which is the body of the electronic device 200 (e.g., the electronic device 101 of FIG. 1 or the electronic device 200 of FIG. 2A), may be in the +Z direction in FIG. 5A, and the rear surface 221 (e.g., the third surface 221 in FIG. 2A) may be in the -Z direction in FIG. 5A. In addition, hereinafter, the display module 160 may include the display module 160 of FIG. 1, the first display 230 of FIG. 2A, or the second display 400 of FIG. 2A.

[102] According to various embodiments, the expansion portion 307 may be disposed at the upper end of the housing 220. An opening 307-1, which is a portion of the expansion portion 307, may be disposed at the upper end of the rear surface 221 of the housing 220. The expansion portion 307 may refer to a space in the housing 220 formed from the rear surface 221 to the front surface 222 of the housing 220 (e.g., the +Z direction of FIGS. 5A and 5B) through the opening 307-1. According to an embodiment, the upper conduit 305 may be

formed through the opening 307-1 that is a portion of the expansion portion 307. The expansion 307 may refer to a space connecting the opening 307-1 to the upper conduit 305.

[103] According to various embodiments, as shown in FIGS. 5A and 5B, the expansion 307 may be disposed in the upper conduit 305. As the volume of the upper conduit 305 decreases, the sound quality emitted from the upper sound hole 303 may deteriorate.

[104] According to various embodiments, the upper conduit 305 may be formed through the expansion portion 307. In addition, the volume of the upper conduit 305 may increase by the space formed by the expansion portion 307 according to the connection of the expansion portion 307 to the upper conduit 305, so that the sound quality of the upper conduit 305 may be improved.

[105] According to various embodiments, as shown in FIG. 5B, the guide surfaces 312-1 and 312-2 may be inclined to have a cross-sectional area expanded along the traveling direction of sound (e.g., the +Y direction in FIG. 5B) from an outlet 311 via which the sound generated from the upper speaker module 301 come out. As a result of the cross-sectional area expanded along the traveling direction of the sound, the first conduit 305-1 may secure an additional space.

[106] According to various embodiments, as shown in FIG. 5B, a waterproof member 308 may be attached to a portion of the end of each of the guide surface 312-1 and 312-2. The waterproof member 309 may protect the upper speaker module 301 from liquid introduced through the upper sound hole 303.

[107] According to various embodiments, as shown in FIG. 5B, a soundproofing material 309 may be disposed in the opening 307-1. The soundproofing material 309 may close the opening 307-1. The expansion 307 may be partitioned by the soundproofing material 309. For example, the soundproofing material 309 may be attached to the opening 307-1 to close the opening 307-1. The soundproofing material 309 may prevent sound generated in the speaker module 301 from being emitted through the opening 307-1. In addition to this, the soundproofing material 309 may be disposed in the opening 307-1 in various manners. For example, the soundproofing material 309 may be disposed in the opening 307-1 in a such a

manner by soldering or bolting.

[108] According to various embodiments, as shown in FIG. 5C, the soundproofing material 309 as the shape similar to the upper conduit 305 of FIG. 4A may be manufactured to have a larger area than the upper conduit 305.

[109] According to various embodiments, as shown in FIG. 5D, the soundproofing material 309 may include two or more types of materials. For example, as shown in FIG. 5D, the soundproofing material 309 may include a structure in which an adhesive member 401, an intermediate member 402, and a buffer member 403 are sequentially stacked. One surface 404 of the intermediate member 402 of the soundproofing material 309 may close the opening 307-1 through the adhesive member 401.

[110] According to various embodiments, the adhesive member 401 may also be attached to the other surface 405 of the buffer member 403. The other surface 405 of the buffer member 403 may be attached to the display module 160 through the adhesive member 401. The buffer member 403 may alleviate the shock applied to the display module 160.

[111] According to various embodiments, the other surface 405 of the buffer member 403 may be a rough surface. The adhesive member 401 may be attached to the other surface 405 of the buffer member 403. When the adhesive member 401 is a thin film, surface roughness of a surface thereof attached to the display module 160 may also increase. Therefore, the position of the display module 160 may be fixed and maintained on the other surface 405 of the buffer member 403.

[112] The expansion portion 307, the opening 307-1, and the soundproofing material 309 shown in FIGS. 5A, 5B, and 5C are only examples, and hereinafter, the shape and structure of the expansion portion 307, the opening 307-1, and the soundproofing material 309 are not limited to those shown in FIGS. 5A, 5B and 5C. The degree of inclination of the guide surfaces 312-1 and 321-2 shown in FIG. 5B is an example and the degree of inclination may be variable. The number and types of members constituting the soundproofing material 309 shown in FIG. 5D are examples, and the adhesive member 401, the intermediate member 402, and the buffer member 403 may be variously changed.

[113] FIG. 6 is a plan view of a bar-shaped electronic device according to various embodiments disclosed herein. According to various embodiments, the layout structure of the electronic device and the configuration of electronic components, shown in FIGS. 4A to 6, may also be applied to a bar-shaped electronic device.

[114] According to various embodiments disclosed herein, as shown in FIG. 6, the electronic device 200 (e.g., the electronic device 101 of FIG. 1 and the electronic device 200 of FIG. 2A) may include an upper speaker module 301 (e.g., the sound output module 155 of FIG. 1, the sound output device 228 of FIG. 2A), a lower speaker module 302 (e.g., the sound output module 155 of FIG. 1, a sound output device 228 of FIG. 2A), an upper conduit 305, a lower conduit 306, a camera module 225 (e.g., the camera module 180 of FIG. 1, the third camera module 225 of FIG. 2A), a printed circuit board 272 (e.g., the first printed circuit board 271 or the second printed circuit board 272 of FIG. 3), a battery 292 (e.g., the battery 189 of FIG. 1, the first battery 291 or the second battery 292 of FIG. 3), and a display module 160 (e.g., the display module 160 of FIG. 1, the first display 230 of FIG. 2A, or the second display 400 of FIG. 2A) (not shown), which are disposed on the front surface 222 (e.g., the fourth surface 222 of FIG. 2A) of the housing 220 (e.g., the second housing 220 of FIG. 2A). The housing 220 described below may include a support member 262 (e.g., the second support member 262 of FIG. 3).

[115] According to various embodiments, referring to FIG. 2B, the upper speaker module 301 may be used as a receiver 227 for communication. In a call operation, ring sound of an incoming call may be delivered to the user through the upper speaker module 301.

[116] Since the user's ear may come close to the upper center portion of the electronic device 200 in an operation in which the user holds the electronic device 200 to make a call, a portion through which the call sound is emitted may be located at the upper center portion of the electronic device 200. For example, a receiver hole (not shown) through which the call sound generated from the upper speaker module 301 is emitted may be disposed at the center of the upper end of the second rear cover 250. Therefore, the upper speaker module 301 connected to the receiver hole may be disposed at the center of the upper end of the front surface 222 of

the housing 220. According to another embodiment, the receiver 227 and the upper speaker module 301 may be separate parts.

[117] According to various embodiments, as shown in FIG. 6, sound holes 303 and 304 may be disposed at the upper end and/or the lower end of the housing 220 of the electronic device 200. The sound holes 303 and 304 may include an upper sound hole 303 disposed in the upper lateral surface (e.g., the +Y direction of FIG. 6) of the housing 220 and a lower sound hole 304 disposed in the lower lateral surface (e.g., the -Y direction of FIG. 6) of the housing 220. The upper sound hole 303 and the lower sound hole 304 may be disposed in the center portion of the upper lateral surface of the housing 220 and through the center portion of the lower lateral surface of the housing 220, respectively, to be symmetrical to each other along the X-axis of FIG. 6. Sounds generated from the speaker modules 301 and 302 may be radiated to the outside of the electronic device 200 through the sound holes 303 and 304.

[118] According to various embodiments, the user may take a self-photograph through the camera module 225. The lens of the camera module 225 may be placed at the center of the upper end of the display module 160 to allow the user to easily adjust the photographing composition by identifying the user's image previewed on the display module 160 through the camera module 225. In an embodiment, a transparent region through which light may be incident to the lens of the camera module 225 may exist in the display module 160, and the lens may face the transparent region. Disposing the lens at the center of the upper end of the display module 160 may signify that the transparent region of the display module 160 is located at the center of the upper end of the display module 160. In addition to this, the lens may be positioned at the center of the upper end of the display module 160 in various manners. Meanwhile, a symmetrical design may be implemented by disposing the lens of the camera module 225 at the center of the display module 160.

[119] According to various embodiments, as shown in FIG. 6, when the upper speaker module 301 and the camera module 225 are disposed at the central upper end of the front surface 222 of the housing 220, the upper speaker module 301 and the camera module 225 may overlap each other in the Z-axis direction shown in FIG. 4B. To solve this problem, the shape

of the upper conduit 305 connected to the upper speaker module 301 may be variable. Details on this are given below.

[120] According to various embodiments, as shown in FIG. 6, the width (W2) of the second conduit 305-2 may be smaller than the width (W1) of the first conduit 305-1. Here, the width (W1) of the first conduit 305-1 may refer to the length of the first conduit 305-1 in the Y-axis direction, shown in FIG. 6. In addition, the width (W2) of the second conduit 305-2 may refer to the length of the second conduit 305-2 in the Y-axis direction, shown in FIG. 6. At least a portion of the camera module 225 may be disposed at a portion of the housing 220 corresponding to the difference between the width (W1) of the first conduit 305-1 and the width (W2) of the second conduit 305-2. Due to the shape of the upper conduit 305, the upper conduit 305 and the camera module 225 may be disposed at the upper central portion of the housing 220 without overlapping each other.

[121] According to various embodiments, the expansion portion 307 may be disposed at the upper end of the housing 220. As shown in FIG. 5A, an opening 307-1, which is a portion of the expansion portion 307, may be disposed at the upper end of the rear surface 221 of the housing 220. The expansion portion 307 may refer to a space in the housing 220 formed from the rear surface 221 to the front surface 222 of the housing 220 (e.g., the +Z direction of FIGS. 5A and 5B) through the opening 307-1. In another embodiment, the opening 307-1 may be disposed at the upper end of the front surface 222 of the housing 220. The upper conduit 305 may be formed through the opening 307-1 that is a portion of the expansion portion 307. The expansion 307 may refer to a space connecting the opening 307-1 to the upper conduit 305.

[122] According to various embodiments, as shown in FIGS. 5A and 5B, the expansion 307 may be disposed in the upper conduit 305. As the volume of the upper conduit 305 decreases, the sound quality emitted from the upper sound hole 303 may deteriorate.

[123] According to various embodiments, the upper conduit 305 may be formed through the expansion portion 307. In addition, the volume of the upper conduit 305 may increase by the space formed by the expansion portion 307 according to the connection of the expansion portion 307 to the upper conduit 305, so that the sound quality of the upper conduit 305 may

be improved.

[124] According to various embodiments, as shown in FIG. 5B, guide surfaces 312-1 and 312-2 may be inclined to have a cross-sectional area expanded along the traveling direction of sound (e.g., the +Y direction in FIG. 5B) from an outlet 311 via which the sound generated from the upper speaker module 301 come out. As a result of the cross-sectional area expanded along the traveling direction of the sound, the first conduit 305-1 may secure an additional space.

[125] According to various embodiments, as shown in FIG. 5B, a waterproof member 308 may be attached to a portion of the end of each of the guide surfaces 312-1 and 312-2. The waterproof member 309 may protect the upper speaker module 301 from liquid introduced through the upper sound hole 303.

[126] According to various embodiments, the opening 307-1 of FIG. 5B may be disposed on the rear surface 221 of the housing 220 of FIG. 5A and may be connected to the expansion portion 307. In another embodiment, the opening 307-1 may be disposed on the front surface 222 of the housing 220 and may be connected to the expansion portion 307. The opening 307-1 may be closed through the soundproofing material 309 of FIG. 5A. Therefore, the soundproofing material 309 may prevent sound generated in the speaker module 301 from being emitted through the opening 307-1.

[127] According to various embodiments, as shown in FIG. 5D, the soundproofing material 309 may include two or more types of materials. For example, as shown in FIG. 5D, the soundproofing material 309 may include a structure in which an adhesive member 401, an intermediate member 402, and a buffer member 403 are sequentially stacked. One surface 404 of the intermediate member 402 of the soundproofing material 309 may close the opening 307-1 through the adhesive member 401.

[128] According to various embodiments, the adhesive member 401 shown in FIG. 5D may also be attached to the other surface 405 of the buffer member 403. The other surface 405 of the buffer member 403 may be attached to the display module 160 through the adhesive member 401. The buffer member 403 may alleviate the shock applied to the display module

160.

[129] According to various embodiments, the other surface 405 of the buffer member 403 may be a rough surface. The adhesive member 401 may be attached to the other surface 405 of the buffer member 403. When the adhesive member 401 is a thin film, surface roughness of a surface thereof attached to the display module 160 may also increase. Therefore, the position of the display module 160 may be fixed and maintained on the other surface 405 of the buffer member 403.

[130] An electronic device (e.g., the electronic device 200 of FIG. 2A) according to various embodiments disclosed herein may include a first housing (e.g., the second housing 220 of FIG. 2A), a display module (e.g., the first display 230 of FIG. 2A or the second display 400 of FIG. 2A) positioned on the front surface (e.g., the front surface 222 of FIG. 4A) of the first housing, a camera module (e.g., the camera module 225 of FIG. 4A) disposed at the upper end of the first housing, a speaker module (e.g., the upper speaker module 301 of FIG. 4A) disposed in the first housing to be adjacent to the camera module, a sound hole (e.g., the upper sound hole 303 of FIG. 4A) disposed in a lateral surface of the first housing such that sound generated from the speaker module is emitted to the outside of the electronic device, a conduit including a first conduit (e.g., the first conduit 305-1 of FIG. 4B) extending from the speaker module toward the sound hole, and a second conduit (e.g., the second conduit 305-2 of FIG. 4B) extending in a direction perpendicular to the extension direction of the first conduit, and an expansion portion (e.g., the expansion portion 307 of FIG. 5A) disposed in at least a portion of the conduit to expand the volume of the conduit.

[131] In addition, the speaker module may be disposed in the first housing in a first direction (e.g., the first direction of FIG. 4B) with respect to a straight line passing through the sound hole and extending in the longitudinal direction of the display module, and the camera module may be disposed in the first housing in a second direction (e.g., the second direction of FIG. 4B) opposite to the first direction with respect to the straight line.

[132] In addition, the first conduit of the conduit may be positioned in the first direction with respect to the straight line, and the second conduit of the conduit may be positioned in the

second direction with respect to the straight line.

[133] In addition, the second conduit may include a relatively narrow conduit compared to the first conduit.

[134] In addition, the sound hole may include at least one hole (e.g., the hole 303-1 of FIG. 4A), and at least one hole of the sound hole may be arranged in a direction parallel to a direction in which the second conduit extends.

[135] In addition, the first conduit may include a structure inclined with respect to a radiation direction of the sound hole (e.g., the guide surfaces 312-1 and 312-2 of FIG. 5B).

[136] In addition, the electronic device may further include a second housing (e.g., the first housing 210 of FIG. 2A), and the first housing may be foldably connected to the second housing.

[137] In addition, the display module may include a first region (e.g., the second region 231b of FIG. 3) disposed in the first housing, a second region (e.g., the first region 231a of FIG. 3) disposed in the second housing, and a third region (e.g., the third region 231c of FIG. 3) connecting the first region and the second region, wherein the third region of the display module may be at least partially foldable by folding of the first housing with respect to the second housing.

[138] In addition, the expansion portion may be connected to an opening (e.g., the opening 307-1 of FIG. 5B) disposed through the rear surface (e.g., the rear surface 221 of FIG. 5A) of the first housing, and the electronic device may further include a soundproofing material (e.g., the soundproofing material 309 of FIG. 5B) disposed to close the opening.

[139] In addition, the soundproofing material may include a buffer member (e.g., the buffer member 403 of FIG. 5D) on at least a portion thereof.

[140] An electronic device (e.g., the electronic device 200 of FIG. 2A) according to various embodiments disclosed herein may include a first housing (e.g., the second housing 220 of FIG. 2A), a display module (e.g., the first display 230 of FIG. 2A or the second display 400 of FIG. 2A) positioned on the front surface (e.g., the front surface 222 of FIG. 4A) of the first housing, a camera module (e.g., the camera module 225 of FIG. 4A) disposed at the upper end

of the first housing, an upper speaker module disposed at the upper end of the first housing to be adjacent to the camera module (e.g., the upper speaker module 301 of FIG. 4A), a lower speaker module (e.g., the lower speaker module 302 of FIG. 4A) disposed on the lower end of the first housing, an upper sound hole (e.g., the upper sound hole 303 of FIG. 4A) disposed in an upper lateral surface of the first housing, a lower sound hole (e.g., the lower sound hole 304 of FIG. 4A) disposed in a lateral surface of the lower end of the first housing, an upper conduit including a first conduit (e.g., the first conduit 305-1 of FIG. 4B) extending from the upper speaker module toward the upper sound hole, and a second conduit (e.g., the second conduit 305-2 of FIG. 4B) extending in a direction perpendicular to the extension direction of the first conduit, a lower conduit (e.g., the lower conduit 306 of FIG. 4A) extending from the lower speaker module toward the lower sound hole, and an expansion portion (e.g., the expansion portion 307 of FIG. 5A) disposed in at least a portion of the upper conduit to expand the volume of the upper conduit.

[141] In addition, the upper speaker module may be disposed in the first housing in a first direction (e.g., the first direction of FIG. 4B) with respect to a straight line passing through the upper sound hole and extending in the longitudinal direction of the display module, and the camera module may be disposed in the first housing in a second direction (e.g., the second direction of FIG. 4B) opposite to the first direction with respect to the straight line.

[142] In addition, the first conduit of the upper conduit may be positioned in the first direction with respect to the straight line, and the second conduit of the upper conduit may be positioned in the second direction with respect to the straight line.

[143] In addition, the second conduit may include a relatively narrow conduit compared to the first conduit.

[144] In addition, each of the upper sound hole and the lower sound hole may include at least one hole, and at least one hole (e.g., the hole 303-1 or 304-1 of FIG. 4A) of the upper sound hole or the lower sound hole may be arranged in a direction parallel to a direction in which the second conduit extends.

[145] In addition, the first conduit may include a structure inclined with respect to a radiation

direction of the upper sound hole (e.g., the guide surfaces 312-1 and 312-2 of FIG. 5B).

[146] In addition, the electronic device may further include a second housing (e.g., the first housing 210 of FIG. 2A), and the first housing may be foldably connected to the second housing.

[147] In addition, the display module may include a first region (e.g., the second region 231b of FIG. 3) disposed in the first housing, a second region (e.g., the first region 231a of FIG. 3) disposed in the second housing, and a third region (e.g., the third region 231c of FIG. 3) connecting the first region and the second region, wherein the third region of the display module may be at least partially foldable by folding of the first housing with respect to the second housing.

[148] In addition, the expansion portion may be connected to an opening (e.g., the opening 307-1 of FIG. 5B) disposed through the rear surface of the first housing, and the electronic device may further include a soundproofing material (e.g., the soundproofing material 309 of FIG. 5B) disposed to close the opening.

[149] In addition, the soundproofing material may include a buffer member (e.g., the buffer member 403 of FIG. 5D) on at least a portion thereof.

[150] The embodiments disclosed in the document provided in the specification and drawings are merely presented as specific examples to easily explain the technical content according to the embodiment disclosed herein and help understanding of the embodiment disclosed herein, and are not intended to limit the scope of the embodiment disclosed herein. Therefore, the scope of various embodiments disclosed herein should be interpreted that, in addition to the embodiments disclosed herein, all changes or modifications derived from the technical ideas of the various embodiments disclosed herein are included in the scope of the various embodiments disclosed herein.

【CLAIMS】

【Claim 1】

An electronic device comprising:

a first housing;

a display module positioned on the front surface of the first housing;

a camera module disposed at an upper end of the first housing;

an upper speaker module disposed at an upper end of the first housing to be adjacent to the camera module;

an upper sound hole disposed in an upper lateral surface of the first housing such that sound generated from the upper speaker module is emitted to the outside of the electronic device;

an upper conduit comprising a first conduit extending from the upper speaker module toward the upper sound hole, and a second conduit extending in a direction perpendicular to an extension direction of the first conduit; and

an expansion portion disposed in at least a portion of the upper conduit to expand the volume of the upper conduit.

【Claim 2】

The electronic device of claim 1, wherein the upper speaker module is disposed in the first housing in a first direction with respect to a straight line passing through the upper sound hole and extending in the longitudinal direction of the display module, and

wherein the camera module is disposed in the first housing in a second direction opposite to the first direction with respect to the straight line.

【Claim 3】

The electronic device of claim 2, wherein the first conduit of the upper conduit is positioned in the first direction with respect to the straight line, and

wherein the second conduit of the upper conduit is positioned in the second direction

with respect to the straight line.

【Claim 4】

The electronic device of claim 3, wherein the second conduit is relatively narrow compared to the first conduit.

【Claim 5】

The electronic device of claim 1, wherein the upper sound hole comprises at least one hole, and

wherein the at least one hole of the upper sound hole is arranged in a direction parallel to a direction in which the second conduit extends.

【Claim 6】

The electronic device of claim 1, wherein the first conduit comprises a structure inclined with respect to a radiation direction of the upper sound hole.

【Claim 7】

The electronic device of claim 1, further comprising a second housing,
wherein the first housing is foldably connected to the second housing.

【Claim 8】

The electronic device of claim 7, wherein the display module comprises a first region disposed in the first housing, a second region disposed in the second housing, and a third region connecting the first region and the second region, and

wherein the third region of the display module is at least partially foldable by folding of the first housing with respect to the second housing.

【Claim 9】

The electronic device of claim 1, wherein the expansion portion is connected to an opening disposed through the rear surface of the first housing, and

wherein the electronic device further comprises a soundproofing material disposed to close the opening.

【Claim 10】

The electronic device of claim 9, wherein the soundproofing material comprises a buffer member on at least a portion thereof.

【Claim 11】

The electronic device of claim 1, further comprising:

a lower speaker module disposed at a lower end of the first housing;

a lower sound hole disposed in a lower lateral surface of the first housing; and

a lower conduit extending from the lower speaker module toward the lower sound hole.

【Claim 12】

The electronic device of claim 11, wherein the lower sound hole comprises at least one hole, and

wherein the at least one hole of the lower sound hole is arranged in a direction parallel to a direction in which the second conduit extends.