(19) Korean Intellectual Property Office (KR)

(12) Registered Patent Gazette (B1)

(45) Publication Date 2020.02.24
(11) Registration Number: 10-2080747
(24) Unex. Pub. Date 2020.02.18

(51) International Patent Classification (Int. Cl.)
H04W 12/06 (2009.01) ***H04W 88/02*** (2009.01)
(21) Application Number **10-2014-0037156**
(22) Filing Date **2014.03.28**
Examination Request Date **2019.03.26**
(65) Publication Number **10-2015-0112621**
(43) Publication Date **2015.10.07**
(56) Prior Art Documents
KR1020130028570 A
US20120096188 A1
US20140068744 A1
Total Number of Claims: 18

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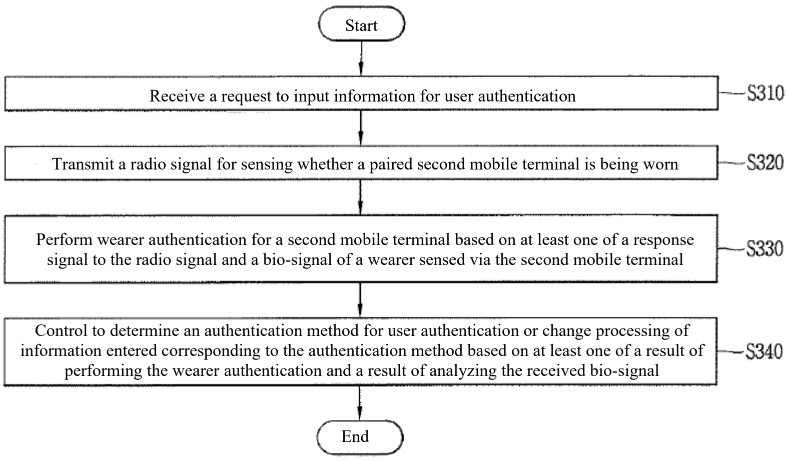
(54) Title of Invention **MOBILE TERMINAL AND CONTROL METHOD THEREOF**

(57) ABSTRACT

Disclosed herein are a mobile terminal and a control method thereof. Exemplary embodiments of the present disclosure provide a mobile terminal, including: a body; a wireless communication part receiving a request to input information for user authentication from an external server connected to the body; and a controller, in response to the request, transmitting a radio signal that detects whether a second mobile terminal is being worn to the second mobile terminal paired with the body and wearable on a specific part of a human body. The controller is capable of performing wearer authentication for the second mobile terminal in response to receiving at least one of a response signal to the radio signal from the second mobile terminal and a bio-signal of a wearer detected via the second mobile terminal, and controlling to determine an authentication method of the user authentication or change processing of information entered corresponding to the authentication method based on at least one of a result of performing the wearer authentication and a result of analyzing the received bio-signal.

MAIN DRAWING - FIG. 3



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APPLICATION

WHAT IS CLAIMED IS:

Claim 1

A mobile terminal comprising:

a body;

a wireless communication part receiving a request to input information for user authentication from an external server connected to the body; and

a controller, in response to the request, transmitting a radio signal that detects whether a second mobile terminal is being worn to the second mobile terminal paired with the body and wearable on a specific part of a human body,

wherein the controller

performs wearer authentication for the second mobile terminal in response to receiving at least one of a response signal to the radio signal from the second mobile terminal and a bio-signal of a wearer detected via the second mobile terminal,

controls to determine an authentication method of the user authentication or change processing of information entered corresponding to the authentication method based on at least one of a result of performing the wearer authentication and a result of analyzing the received bio-signal, and

if a change due to wearing or unwearing of the second mobile terminal is detected after a first user interface corresponding to the determined authentication method is output, based on the change,

changes the first user interface to a second user interface corresponding to a different authentication method or transmits at least a portion of visual information related to the first user interface to the second mobile terminal.

Claim 2

The mobile terminal of claim 1,

wherein the authentication method comprises at least one of fingerprint authentication, face authentication, voice authentication, biometric authentication, signature authentication, handwriting authentication, password authentication, and gesture authentication of a user, using at least one sensor provided in the body, and

the processing of information entered corresponding to the authentication method is changed depending on the psychological state of the wearer as determined by an analysis result of the bio-signal.

Claim 3

The mobile terminal of claim 1,

further comprising a display that outputs visual information corresponding to the request to input information for user authentication,

wherein the controller

changes the output visual information so that a user interface corresponding to the determined authentication method appears on the display or the second mobile terminal after wearer authentication for the second mobile terminal is completed.

Claim 4

The mobile terminal of claim 3,

wherein the controller

enables a bio-signal sensing function in response to a touch to a working area of the display while the second mobile terminal is being worn, and

outputs a screen change corresponding to enabling the bio-signal sensing function to the display.

Claim 5

The mobile terminal of claim 4,

wherein the controller

compares a first bio-signal detected by enabling the bio-signal sensing function with a second bio-signal received from the second mobile terminal, and determines whether the two signals are from the same person based on the comparison result.

Claim 6

The mobile terminal of claim 3,

wherein the controller

analyzes the received bio-signal to determine whether the wearer is awake and the psychological state of the wearer and,

if the wearer is determined to be awake and in a psychological state satisfying a pre-set normal condition, matches the received bio-signal with pre-stored user information and outputs a user interface corresponding to an authentication method determined based on the matching result on the display.

Claim 7

The mobile terminal of claim 3,

wherein the controller

analyzes the received bio-signal to determine whether the wearer is awake and the psychological state of the wearer and,

if the wearer is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition, outputs a second user interface corresponding to a different authentication method after outputting a first user interface corresponding to a pre-set authentication method on the display, or outputs a third user interface corresponding to an authentication method with a higher security level on the display instead of the first user interface.

Claim 8

The mobile terminal of claim 3,

wherein the controller

analyzes the received bio-signal to determine whether the wearer is awake and the psychological state of the wearer and,

if the wearer is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition, controls to output a user interface corresponding to a pre-set authentication method on the display and synthesize an interference signal to the input information entered by the output user interface.

Claim 9

The mobile terminal of claim 7,

wherein the controller,

if the psychological state of the wearer satisfying a pre-set abnormal condition exceeds the threshold, when a pre-set period has elapsed or an input is detected for at least one of the first and second user interfaces, stops a process related to user authentication and provides a warning message to the display or the external server.

Claim 10

The mobile terminal of claim 3,

wherein the controller,

after wearer authentication for the second mobile terminal is completed and a user gesture is detected while the second mobile terminal is being worn,

changes the determined authentication method to perform user authentication using an authentication method corresponding to the detected user gesture.

Claim 11

The mobile terminal of claim 1,

wherein the controller

matches a bio-signal received from the second mobile terminal with pre-stored user information to perform wearer authentication for the second mobile terminal and

controls to change a pre-set authentication method or additionally request an input corresponding to a different authentication method, if the received bio-signal does not match the pre-stored user information.

Claim 12

The mobile terminal of claim 11,

wherein the controller

controls the wireless communication part so that the changed authentication method or visual information related to the different authentication method are not transmitted to the second mobile terminal, if the received bio-signal does not match the pre-stored user information.

Claim 13

The mobile terminal of claim 1,

wherein the wireless communication part further performs Bluetooth Low Energy (BLE) with the second mobile terminal, and

wherein the controller

detects a distance between the body and the second mobile terminal using Bluetooth Low Energy (BLE) and determines a device to provide an input screen corresponding to the determined authentication method based on the detected distance.

Claim 14

The mobile terminal of claim 13,

wherein the controller

controls to provide an input corresponding to the determined authentication method using the body and the second mobile terminal, if the detected distance falls into a pre-set range, and

controls to provide an input corresponding to the determined authentication method using only one of the body and the second mobile terminal, if the detected distance does not fall into a pre-set range.

Claim 15

The mobile terminal of claim 1,

wherein the controller

outputs a message inducing wearing of the second mobile terminal, if the response signal is not received or the received response signal indicates that the second mobile terminal is detected as not being worn.

Claim 16

Deleted

Claim 17

A mobile terminal comprising:

a body wearable on a specific part of a human body;

a detection part that detects whether the body is being worn, and detects a bio-signal of a wearer of the body, in response to a request to input information for user authentication from an external server connected to the body; and

a controller that determines whether the wearer is awake and the psychological state of the wearer based on the detected bio-signal, and controls to determine an authentication method for the user authentication or change processing of information entered corresponding to the authentication method,

wherein the controller,

if the wearer is determined to be awake and in a psychological state satisfying a pre-set normal condition based on the detected bio-signal,

controls to output a corresponding notification by after matching the detected bio-signal with pre-stored user information and perform user authentication by an authentication method determined based on the matching result.

Claim 18

The mobile terminal of claim 17,

wherein the controller,

if the wearer is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition based on the detected bio-signal,

synthesizes a pre-set interference signal to the input information corresponding to the authentication method.

Claim 19

The mobile terminal of claim 17,

wherein the controller,

if the wearer is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition based on the detected bio-signal,

controls to change a pre-set authentication method or additionally request an input corresponding to a different authentication method.

Claim 20

Deleted

DESCRIPTION OF THE INVENTION

TECHNICAL FIELD

[0001] The present disclosure relates to a mobile terminal that is wearable on a specific part of a human body and a control method thereof.

RELATED ART

[0002] Terminals can be divided into mobile/portable terminals and stationary terminals depending on whether they can be moved. Mobile terminals can be divided into handheld terminals and vehicle mount terminals depending on whether they can be carried directly.

[0003] The functions of mobile terminals are being diversified. For example, there are functions for data and voice communication, taking pictures and videos using a camera, recording voice, playing music files via a speaker system, and displaying images or videos on a display. Some terminals also have functions for playing games or multimedia content. In particular, recent mobile terminals can receive multicast signals that provide visual content such as broadcasts, videos, or television programs.

[0004] With the functions being diversified, such terminals are implemented as multimedia players with complex functions such as taking pictures or videos, playing music or video files, playing games, and receiving broadcasts.

[0005] With such improvements, terminals are being improved into various designs. Specifically, by becoming lighter and more miniaturized, terminals are being developed in forms that can be in contact with parts of the user's body, such as eyeglasses, watches, necklaces, bracelets, and rings, and even in forms that can be mounted on the user's clothing.

[0006] When the terminal is used while being mounted on various parts of the wearer's body depending on the user's purpose or intention, various functions can be performed by naturally sensing the wearer's movements or bio-signals.

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED

[0007] The present disclosure provides a mobile terminal that enables smooth and convenient user authentication using a wearable terminal on a specific part of the human body and a control method thereof.

[0008] In addition, the present disclosure provides a mobile terminal that maintains security when input for user authentication is performed without the user’s intention by using bio-signals of the terminal wearer, and a control method thereof.

MEANS FOR SOLVING PROBLEMS

[0009] A mobile terminal according to an exemplary embodiment of the present disclosure may include: a body; a wireless communication part receiving a request to input information for user authentication from an external server connected to the body; and a controller, in response to the request, transmitting a radio signal that detects whether a second mobile terminal is being worn to the second mobile terminal paired with the body and wearable on a specific part of a human body. The controller may perform wearer authentication for the second mobile terminal in response to receiving at least one of a response signal to the radio signal from the second mobile terminal and a bio-signal of a wearer detected via the second mobile terminal, and control to determine an authentication method of the user authentication or change processing of information entered corresponding to the authentication method based on at least one of a result of performing the wearer authentication and a result of analyzing the received bio-signal.

[0010] The authentication method may include at least one of fingerprint authentication, face authentication, voice authentication, biometric authentication, signature authentication, handwriting authentication, password authentication, and gesture authentication of a user, using at least one sensor provided in the body, and the processing of information input corresponding to the authentication method may be changed depending on the psychological state of the wearer as determined by an analysis result of the bio-signal.

[0011] The mobile terminal may further include a display that outputs visual information corresponding to the request to input information for user authentication, and the controller may change the output visual information so that a user interface corresponding to the determined authentication method appears on the display or the second mobile terminal after wearer authentication for the second mobile terminal is completed.

[0012] The controller may enable a bio-signal sensing function in response to a touch to a working area of the display while the second mobile terminal is being worn and output a screen change corresponding to enabling the bio-signal sensing function to the display.

[0013] The controller may compare a first bio-signal detected by enabling the bio-signal sensing function with a second bio-signal received from the second mobile terminal, and determine whether the two signals are from the same person based on the comparison result.

[0014] The controller, if the wearer is determined to be awake and in a psychological state satisfying a pre-set normal condition, may match the received bio-signal with pre-stored user information and output a user interface corresponding to an authentication method determined based on the matching result on the display.

[0015] The controller, if the wearer is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition, may output a second user interface corresponding to a different authentication method after outputting a first user interface corresponding to a pre-set authentication method on the display, or output a third user interface corresponding to an authentication method with a higher security level on the display instead of the first user interface.

[0016] The controller, if the wearer is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition, may control to output a user interface corresponding to a pre-set authentication method on the display and synthesize an interference signal to the input information entered by the output user interface.

[0017] The controller, if the psychological state of the wearer satisfying a pre-set abnormal condition exceeds the threshold, when a pre-set period has elapsed or an input is detected for at least one of the first and second user interfaces, may stop a process related to user authentication and provides a warning message to the display or the external server.

[0018] The controller, after wearer authentication for the second mobile terminal is completed and a user gesture is detected while the second mobile terminal is being worn, may change the determined authentication method to perform user authentication using an authentication method corresponding to the detected user gesture.

[0019] The controller may match a bio-signal received from the second mobile terminal with pre-stored user information to perform wearer authentication for the second mobile terminal and control to change a pre-set authentication method or additionally request an input corresponding to a different authentication method if the received bio-signal does not match the pre-stored user information.

[0020] The controller may control the wireless communication part so that the changed authentication method or visual information related to the different authentication method are not transmitted to the second mobile terminal, if the received bio-signal does not match the pre-stored user information.

[0021] The wireless communication part may further perform Bluetooth Low Energy (BLE) with the second mobile terminal, and the controller may detect a distance between the body and the second mobile terminal using Bluetooth Low Energy (BLE) and determine a device to provide an input screen corresponding to the determined authentication method based on the detected distance.

[0022] The controller may control to provide an input corresponding to the determined authentication method using the body and the second mobile terminal, if the detected distance falls into a pre-set range, and control to provide an input corresponding to the determined authentication method using only one of the body and the second mobile terminal, if the detected distance does not fall into a pre-set range.

[0023] The controller may output a message inducing wearing of the second mobile terminal, if the response signal is not received or the received response signal indicates that the second mobile terminal is detected as not being worn.

[0024] The controller, if a change due to wearing or unwearing of the second mobile terminal is detected after a first user interface corresponding to the determined authentication method is output, based on the change, may change the first user interface to a second user interface corresponding to a different authentication method or transmit at least a portion of visual information related to the first user interface to the second mobile terminal.

[0025] A mobile terminal according to an exemplary embodiment of the present disclosure may include: a body wearable on a specific part of a human body; a detection part that detects whether the body is being worn and detects a bio-signal of a wearer of the body in response to a request to input information for user authentication from an external server connected to the body; and a controller that determines whether the wearer is awake and the psychological state of the wearer based on the detected bio-signal, and controls to determine an authentication method of user authentication or change processing of information entered corresponding to the authentication method.

[0026] The controller, if the wearer is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition based on the detected bio-signal, may synthesize a pre-set interference signal to the input information corresponding to the authentication method.

[0027] The controller, if the wearer is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition based on the detected bio-signal, may control to change a pre-set authentication method or additionally request an input corresponding to a different authentication method.

[0028] The controller, if the wearer is determined to be awake and in a psychological state satisfying a pre-set normal condition based on the detected bio-signal, may control to output a corresponding notification by after matching the detected bio-signal with pre-stored user information and perform user authentication by an authentication method determined based on the matching result.

EFFECT

[0029] A mobile terminal according to an exemplary embodiment of the present disclosure can allow users to wear a wearable terminal on specific parts of bodies and provide different authentication methods depending on whether the user is wearing them or not, thereby having an effect of performing user authentication in a smooth and convenient manner. Accordingly,

[0030] In addition, a mobile terminal according to an exemplary embodiment of the present disclosure can detect the bio-signals of the terminal wearer when entering information for user authentication and determine whether the wearer is awake and a psychological state of the wearer, thereby preventing user authentication in advance from being performed without the user’s intention. For example, the security of user authentication may be qualitatively increased by preventing authentication from being processed if it is determined that the user entered information under threat or coercion, or someone else entered information without the user's knowledge while the user was sleeping.

[0031] In the following detailed description, further scope of applicability of the present disclosure will become apparent. Various modifications and revisions within the spirit and scope of the present disclosure may be clearly understood by those skilled in the art, therefore, the detailed description and preferable embodiments shall be considered to be practical exemplary embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] FIG. 1 is a schematic view illustrating a mobile terminal according to an exemplary embodiment of the present disclosure communicating with an external server and a second mobile terminal.

FIG. 2a is a block diagram illustrating a mobile terminal according to an exemplary embodiment of the present disclosure.

FIG. 2b and FIG. 2c are schematic views illustrating a mobile terminal according to an exemplary embodiment of the present disclosure from different directions.

FIG. 2d is a schematic view illustrating an example of a second mobile terminal that is paired with a mobile terminal according to an exemplary embodiment of the present disclosure and is wearable on a specific part of a human body.

FIG. 3 is a flow chart illustrating a control method of a mobile terminal according to an exemplary embodiment of the present disclosure.

FIG. 4 is a schematic view illustrating the flow chart of FIG. 3.

FIG. 5 is a schematic view illustrating how to determine an authentication method for user authentication depending on wearer authentication, according to an exemplary embodiment of the present disclosure.

FIG. 6a is a schematic view illustrating how to change an authentication method for user authentication if a terminal wearer is asleep, according to an exemplary embodiment of the present disclosure.

FIG. 6b is a schematic view illustrating how to process an input corresponding to an authentication method if a terminal wearer is asleep or in a psychological state satisfying an abnormal condition, according to an exemplary embodiment of the present disclosure.

FIG. 7 is a schematic view illustrating how to change an authentication method for user authentication based on a pre-set user gesture after wearer authentication is completed, according to an exemplary embodiment of the present disclosure.

FIG. 8 is a schematic view illustrating how to determine a device to provide an input screen corresponding to an authentication method based on a distance between a mobile terminal according to an exemplary embodiment of the present disclosure and a second mobile terminal.

FIG. 9 and FIG. 10 are schematic views that describe how to provide an authentication method for user authentication if a second mobile terminal is not being worn, according to an exemplary embodiment of the present disclosure.

FIG. 11 is a flow chart illustrating a control method of a mobile terminal according to an exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE INVENTION

[0033] Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. Identical or similar elements are designated with the same reference numerals regardless of the drawing symbols, and repetitive descriptions thereof will be omitted. The suffixes "module" and "part" used for the elements in the description of the specification are given or used interchangeably for convenience and do not have distinct meanings or roles. In addition, when describing the exemplary embodiments disclosed in the specification, if it is determined that a detailed description of a related art may obscure the gist of the exemplary embodiments disclosed in the specification, the detailed description will is omitted. Furthermore, the accompanying drawings are only for easily understanding the exemplary embodiments disclosed in the specification, and the technical spirit disclosed in the specification is not limited by the accompanying drawings.

[0034] Terms including ordinal numbers such as first, second, etc. may be used for elements, but the aforementioned elements are not limited by the aforementioned terms. The aforementioned terms are used only to distinguish one element from another element.

[0035] It will be understood that when an element is “connected to” or “accesses” another component, it can be “directly connected to” or “directly access” the other element or intervening elements may also be present. In contrast, when an element is referred to as being “directly connected to” or “directly accessing” another element, there are no intervening elements present.

[0036] The singular includes the plural unless the context clearly indicates otherwise.

[0037] In the application, it is understood that terms such as “comprise” or “have” only indicate the presence of a feature, number, step, operation, element, component, or combination thereof described in the specification and do not exclude in advance the possibility of the presence or addition of one or more other features, numbers, steps, operations, elements, components, or combinations thereof.

[0038] Mobile terminals described in the specification may include mobile phones, smart phones, laptops, digital broadcasting terminals, personal digital assistants (PDAs), portable multimedia players (PMPs), navigation devices, slate PCs, tablet PCs, ultrabooks, and the like.

[0039] However, it will be apparent to those skilled in the art that the configuration according to the exemplary embodiments described in the specification may also be applied to stationary terminals such as digital TVs, desktop computers, etc., except in cases where it is applicable only to mobile terminals.

[0040] FIG. 1 is a schematic view illustrating a mobile terminal according to an exemplary embodiment of the present disclosure communicating with an external server and a second mobile terminal.

[0041] As illustrated in FIG. 1, a first mobile terminal (100) is connected to an external server (50), thereby receiving predetermined data from the external server (50) or processing the received data to transmit back to the external server (50). Herein, the external server (50) may include any electronic device that requires security authentication to perform a specific function or access specific data, or on which such program is installed or which provides such service. The first mobile terminal (100) may run an application downloaded on the first mobile terminal (100) to access the external server (50).

[0042] Also, as illustrated in FIG. 1, the first mobile terminal (100) may be paired with a second mobile terminal (300). The second mobile terminal (300) is implemented as the mobile terminal (100) that is wearable on a specific part of a human body. The first mobile terminal (100) and the second mobile terminal (300) may perform wireless communication by Bluetooth or Wi-Fi. If the first mobile terminal (100) is paired with the second mobile terminal (300), the second mobile terminal (300), via the first mobile terminal (100), may receive data from the external server (50) and transmit the data processed on the second mobile terminal (300) back to the external server (50).

[0043] In particular, according to an exemplary embodiment of the present disclosure, the first mobile terminal (100) may be requested from the external server (50) to input information for user authentication, to access the external server (50), or perform a specific function or access specific date via the external server (50). The authentication information entered from the first mobile terminal (100) or the second mobile terminal (300) is transmitted back to the external server (50), thereby performing user authentication to confirm that the user is an authorized user himself/herself.

[0044] Furthermore, according to an exemplary embodiment of the present disclosure, the first mobile terminal (100) and/or the second mobile terminal (300) may detect the user's bio-signal in response to a request from the external server (50) to input information for user authentication. The first mobile terminal (100) may determine an appropriate authentication method or change processing of authentication information entered for user authentication based on the detected bio-signal.

[0045] For example, if the user is initially determined as the user himself/herself based on the detected bio-signal, user authentication using a simpler authentication method will not cause security problems. Also, for example, even if the entered information for user authentication matches a pre-registered user information, if such information was entered against the user's intention, user authentication should not be performed with the entered information. Related exemplary embodiments will be described in detail hereinafter with reference to the accompanying drawings.

[0046] FIG. 2a is a block diagram illustrating a mobile terminal according to an exemplary embodiment of the present disclosure.

[0047] As illustrated in FIG. 2a, the mobile terminal (100) may include a wireless communication part (110), an input part (120), a detection part (140), an output part (150), an interface part (160), a memory (170), a controller (180), and a power supply part (190). However, the elements illustrated in FIG. 2a are not essential to implement a mobile terminal, the mobile terminal described in the specification may have more or less than the above-mentioned elements.

[0048] Specifically, the wireless communication part (110) from the elements may include more than one module that enables wireless communication between a mobile terminal (100) and wireless communication system, between a mobile terminal (100) and another mobile terminal (100), or between a mobile terminal (100) and an external server. The wireless communication part (110) may also include more than one module that connects the mobile terminal (100) to more than one network.

[0049] The wireless communication part (110) may include at least one of a broadcast receiver module (111), a mobile communication module (112), a wireless internet module (113), a short-range communication module (114), and a location information module (115).

[0050] Input part (120) may include a camera (121) or an image input for inputting an image signal, a microphone (122) or an audio input for inputting an audio signal, and a user input unit (123) such as a touch key and a mechanical key. Voice data or image data collected from the input part (120) may be analyzed and processed by the user's control commands.

[0051] The detection part (140) may include more than one sensor for sensing at least one of information in the mobile terminal, information about the surrounding environment of the mobile terminal, and user information. For example, the detection part (140) may include at least one of a proximity sensor (141), an illumination sensor (142), a touch sensor, an acceleration sensor, a G-sensor, a gyroscope sensor, a motion sensor, an RGB sensor, an infrared sensor, a fingerprint scan sensor, an ultrasonic sensor, an optical sensor (e.g., a camera (121)), a microphone (122), a battery gauge, an environment sensor (e.g., a barometer, a hygrometer, a thermometer, a radiation sensor, a thermal sensor, and a gas sensor), and a chemistry sensor (e.g., an electronic nose, a healthcare sensor, and a biometric sensor). The mobile terminal disclosed in the specification may combine and use information detected from at least two of such sensors.

[0052] The output part (150) generating output related to vision, hearing, or tactile sensations may include at least one of a display (151), an audio output (152), a haptic module (153), and an optical output (154). The display (151) may have a mutual layer structure or an integrated structure with the touch sensor, thereby implementing a touch screen. Such touch screens may function as the user input unit (123) providing an input interface between the mobile terminal (100) and the user and also provide an output interface between the mobile terminal (100) and the user.

[0053] The interface (160) may perform as a path for the mobile terminal (100) and various external devices connected thereto. Such interface (160) may include at least one of a wired/wireless headset port, an external charging port, a wired/wireless data port, a memory card port, a port connecting a device equipped with an identification module, an audio input/output

(I/O) port, a input/output (I/O) port, and an earphone port. The mobile terminal (100) may perform an appropriate control related to the connected external devices, in response to the connection of the external devices to the interface (160).

[0054] The memory (170) stores data that supports various functions of the mobile terminal (100). The memory (170) may store multiple applications running on the mobile terminal (100) and data and commands for operating the mobile terminal (100). At least some of such applications may be downloaded from an external server via wireless communication. Also, some of such applications may be installed on the mobile terminal (100) from the release for basic functions (e.g., making/receiving phone calls, and sending/receiving messages) of the mobile terminal (100). The applications are stored in the memory (170) and installed on the mobile terminal (100) and may perform, driven by the controller (180), operations (or functions) of the mobile terminal.

[0055] The controller (180) not only controls the operations related to the applications, but also the overall operations of the mobile terminal (100). The controller (180) may process signals, data, and information input or output from the aforementioned elements or run applications stored in the memory (170), thereby providing or processing appropriate information or function for the user.

[0056] The controller (180) may also control at least some of the elements illustrated in FIG. 2a to run the applications stored in the memory (170). Furthermore, the controller (180) may operate at least two or more of the elements of the mobile terminal (100) in combination to run the applications.

[0057] The power supply part (190) receives external and internal powers under the control of the controller (180) and supplies power to each element of the mobile terminal (100). The power supply part (190) includes a battery which may be built-in or replaceable.

[0058] At least some of the elements may operate in a cooperative manner to implement the operation, control, or control method of the mobile terminal according to exemplary embodiments described hereinafter. The operation, control, or control method of the mobile terminal may be implemented by running at least one of the applications stored in the memory (170).

[0059] Before exemplary embodiments implemented with the aforementioned mobile terminal (100) are described, the aforementioned elements will be described in further detail with reference to FIG. 2a.

[0060] First, the broadcast receiver module (111) of the wireless communication part (110) receives broadcast signals and/or broadcast-related information from an external broadcast management server via a broadcast channel. The broadcast channel may include satellite and terrestrial channels. Two or more of the broadcast receiver modules may be provided in the mobile terminal (100) to simultaneously receive or switch at least two broadcast channels.

[0061] The mobile communication module (112) transmits and receives a radio signal with at least one of a base station, an external terminal, and a server in a mobile communication network constructed according to technical standards or communication methods for mobile communication (e.g., Global System for Mobile communication (GSM), Code Division Multi Access (CDMA), Code Division Multi Access 2000 (CDMA2000), Enhanced Voice-Data Optimized or Enhanced Voice-Data Only (EV-DO), Wideband CDMA (WCDMA), High Speed Downlink Packet Access (HSDPA), High Speed Uplink Packet Access (HSUPA), Long Term Evolution (LTE), and Long Term Evolution-Advanced (LTE-A)).

[0062] The radio signal may include a voice call signal, a video call signal, or various types of data according to transmission/reception of a text/multimedia message.

[0063] The wireless internet module (113) is a module for wireless internet connection, and it may be built into or externally mounted on the mobile terminal (100). The wireless internet module (113) transmits and receives radio signals in a communication network using wireless internet technologies.

[0064] The wireless internet technologies include Wireless LAN (WLAN), Wireless-Fidelity (Wi-Fi), Wi-Fi Direct, Digital Living Network Alliance (DLNA), Wireless Broadband (WiBro), World Interoperability for Microwave Access (WiMAX), High Speed Downlink Packet Access (HSDPA), High Speed Uplink Packet Access (HSUPA), Long Term Evolution (LTE), and Long Term Evolution-Advanced (LTE-A), and the wireless internet module (113) transmits and receives data using at least one wireless internet technology, including internet technologies not mentioned above.

[0065] Since wireless Internet access using WiBro, HSDPA, HSUPA, GSM, CDMA, WCDMA, LTE, LTE-A, etc. is performed via a mobile communication network, the wireless internet module (113) that performs wireless internet access via the mobile communication network may be considered a type of the mobile communication module (112).

[0066] The short-range communication module (114) supports short range communication using at least one of Bluetooth™, Radio Frequency Identification (RFID), Infrared Data Association (IrDA), Ultra Wideband (UWB), ZigBee, Near Field Communication (NFC), Wi-Fi, Wi-Fi Direct, and Wireless Universal Serial Bus (Wireless USB). The short-range communication module (114) supports wireless communication between the mobile terminal (100) and a wireless communication system, between the mobile terminal (100) and another mobile terminal (100), or between the mobile terminal (100) and a network in which another mobile terminal (100, or an external server) is located, via a wireless area network. The wireless area network may be a wireless personal area network.

[0067] Herein, another mobile terminal (100) may be a wearable device capable of exchanging (or syncing) data with the mobile terminal (100) of the present disclosure, such as a smartwatch, a smart glass, and a Head Mounted Display (HMD). The short-range communication module (114) may detect (or recognize), around the mobile terminal (100), a wearable device capable of communicating with the mobile terminal (100). Furthermore, if the detected wearable device is a device authenticated to communicate with the mobile terminal (100) of the present disclosure, the controller (180) may transmit at least some of the data processed in the mobile terminal (100) to the wearable device via the short-range communication module (114). Therefore, the user of the wearable device may use the data processed in the mobile terminal (100) using the wearable device. For example, when the mobile terminal (100) receives a phone call or a message, the user may answer the phone call or check the message on the wearable device.

[0068] The location information module (115) obtains the location (or current location) of the mobile terminal, and its representative examples include a Global Positioning System (GPS) module and a Wi-Fi module. For example, the mobile terminal may use the GPS module to obtain its location with a signal transmitted from a GPS satellite. In addition, the mobile terminal may the Wi-Fi module to obtain its location based on information from a wireless Access Point (AP) transmitting and receiving radio signals with the Wi-Fi module. If necessary, the location information module (115) may alternatively or additionally perform any function of the other modules of the wireless communication part (110) to obtain data related to the location of the mobile terminal. The location information module (115) is a module for obtaining the location (or current location) of the mobile terminal, and it is not limited to a module that directly calculates or obtains the location of the mobile terminal.

[0069] The input part (120) inputs image information (or signal), audio information (or signal), data, or information entered by the user, and the mobile terminal (100) may include one or multiple cameras (121) to input image information. The camera (121) processes image frames, such as still images or videos, obtained by an image sensor in video call mode or shooting mode. The processed image frames may be displayed on the display (151) or stored in the memory (170). The multiple cameras (121) of mobile terminal (100) may be arranged in a matrix structure, and multiple image information having various angles or focal points may be input to the mobile terminal (100) using the cameras (121) forming a matrix structure. The multiple cameras (121) may be arranged in a stereo structure to obtain left and right images for producing a stereoscopic image.

[0070] The microphone (122) converts an external sound signal into electric voice data. The converted voice data may be variously utilized depending on the function being performed (or the application in use) in the mobile terminal (100). Various noise removal algorithms may be implemented in the microphone (122) to remove noise generated while receiving an external sound signal.

[0071] The user input unit (123) is for the user to input information; when information is entered from the user input unit (123), the controller (180) may control operations of the mobile terminal (100) to correspond to the input information. The user input unit (123) may include a mechanical input tool (or a mechanical key, e.g., a button located on the front/back/side of the mobile terminal (100), a dome switch, a jog dial, a jog switch, etc.), and a touch input tool. For example, the touch input tool may be a virtual key, a soft key, or a visual key displayed on a touch screen by software processing, or a touch key placed on somewhere other than the touch screen. The virtual key or visual key may be displayed on the touch screen in various forms, such as graphics, text, icons, videos, or a combination thereof.

[0072] The detection part (140) may detect at least one of information in the mobile terminal, information about the surrounding environment of the mobile terminal, and user information, and generate a corresponding sensing signal. The controller (180) signal, based on such sensing signals, may control running or operations of the mobile terminal (100) or perform data processing, functions, or operations related to applications installed in the mobile terminal (100). Hereinafter, among the various sensors that may be included in the sensing unit (140), representative sensors will be described in detail.

[0073] The proximity sensor (141) detects the presence or absence of an object approaching a predetermined detecting surface or an object existing nearby without mechanical contact by using an electromagnetic field or infrared rays. The proximity sensor (141) may be placed in an internal area of the mobile terminal covered by the aforementioned touch screen or near the touch screen.

[0074] The proximity sensor (141) includes a transmissive photoelectric sensor, a direct reflection photoelectric sensor, a retroreflective photoelectric sensor, a high-frequency oscillation type proximity sensor, a capacitive proximity sensor, a magnetic proximity sensor, an infrared proximity sensor, etc. For a capacitive touch screen, the proximity sensor (141) may be configured to detect the proximity of a conductive object by using a change in electric field when the conductive object approaches. In this case, the touch screen (or the touch sensor) itself may be classified as a proximity sensor.

[0075] For convenience of explanation, "proximity touch" refers to detection of the presence of an object on the screen without direct physical contact of the object on the touch screen, and "contact touch" refers to direct physical contact of the object on the touch screen. A position at which an object is proximity-touched on the touch screen refers to a position at which the object vertically corresponds to the touch screen when the object is proximity-touched. The proximity sensor (141) may detect proximity touch and its patterns such as distance, direction, speed, duration, position, moving status, etc. The controller (180) may process data (or information) corresponding to the movement and pattern of the proximity touch detected by the proximity sensor (141) and further output visual information corresponding to the processed data on the touch screen. Furthermore, the controller (180) may control mobile terminal (100) to process different operations or data (or information) depending whether a touch on the same point on the touch screen is proximity touch or contact touch.

[0076] The touch sensor detects a touch (or touch input) applied to the touch screen (or the display (151)) using at least one of resistive film method, capacitive method, infrared method, ultrasonic method, magnetic field method, etc.

[0077] For example, the touch sensor may be configured to convert changes in pressure or electrostatic capacity on a specific position of the touch screen into an electrical input signal. The touch sensor may be configured to detect the position on the touch sensor, area, pressure at the time of touching, electrostatic capacity at the time of touching, etc. of a touch object that applies a touch on the touch screen. The touch object refer to an object that applies a touch to the touch sensor, and may include a finger, a touch pen, a Stylus pen, etc.

[0078] As described above, when a touch is input to the touch sensor, corresponding signals are transmitted to a touch controller. The touch controller processes the signals and transmit corresponding data to the controller (180). Therefore, the controller (180) may determine which area of the display (151) has been touched, etc. The touch controller may be a separate element from the controller (180) or the controller (180) itself.

[0079] The controller (180) may perform different or the same controls depending on they type of the touch object that touches the touch screen (or a touch key provided separately from the touch screen). It may be determined whether to perform different or the same controls depending on the type of the touch object, based on the current operating status of the mobile terminal (100) or the running application.

[0080] The touch sensor and proximity sensor may detect, separately or in combination, various touch on the touch screen such as short touch (or tap), long touch, multi touch, drag touch, flick touch, pinch-in touch, pinch-out touch, swipe, hover touch, etc.

[0081] The ultrasonic sensor may recognize position information of a touch object using ultrasonic waves. The controller (180) is capable of calculating the position of a wave source from the information detected by the optical sensor and multiple ultrasonic sensors. The position of the wave source may be calculated by using the fact that light is much faster than ultrasound, that is, the time it takes for light to reach the optical sensor is much faster than the time it takes for ultrasonic waves to reach the ultrasonic sensor. More specifically, the position of the wave source may be calculated by using the time difference between the arrival time of ultrasonic waves and that of light, using light as a reference signal.

[0082] The camera (121) composing the input part (120) includes at least one of a camera sensor (e.g., CCD, CMOS, etc.), a photo sensor (or an image sensor), and a laser sensor.

[0083] The camera (121) and the laser sensor may detect, in combination, a touch of a touch object for a 3D stereoscopic image. The photo sensor may be laminated to a display element and configured to scan the movement of a touch object close to the touch screen. More specifically, the photo sensor mounts photo diodes and transistors (TRs) in a matrix and uses electrical signals that change depending on the amount of light applied to the photo diodes, thereby scanning an object placed on the photo sensor. In other words, the photo sensor calculates the coordinates of the touch object according to the amount of change in light to obtain position information of the touch object.

[0084] The display (151) displays (outputs) information processed in the mobile terminal (100). For example, The display (151) may display the running screen of applications of the mobile terminal (100), or user interface (UI) and graphic user interface (GUI) based on the running screen information.

[0085] The display (151) may be configured to be a stereoscopic display that displays stereoscopic images.

[0086] The stereoscopic display may adopt 3D display methods such as stereoscopic method, auto-stereoscopic method, and projection method (holographic method).

[0087] The sound output unit (152) may output audio data received from the wireless communication part (110) or stored in the memory (170) when receiving call signals, or in the call mode, recording mode, voice recognition mode, broadcast reception mode, etc. The sound output unit (152) may also output sound signals related to the functions performed in the mobile terminal (100) such as notification sound for incoming calls, messages, etc. The sound output unit (152) may include a receiver, a speaker, a buzzer, etc.

[0088] A haptic module (153) generates various tactile effects that the user feels. A representative example of the touch effects generated by the haptic module (153) may be vibration. The intensity and pattern of vibration generated by the haptic module (153) may be controlled by the user's choice or the controller setting. For example, the haptic module (153) may output different vibrations in combination or in order.

[0089] In addition to vibration, the haptic module (153) may generate various tactile effects, such as effects caused by stimulation including pin arrays moving vertically to the contact skin surface, air injection or suction force through nozzles or suction ports, strokes against the skin surface, electrode contact, electrostatic force, etc., and effects caused by reproduction of cold and hot sensations using elements that absorb or generate heat.

[0090] The haptic module (153) may not only deliver tactile effects by direct contact, but also implement that the user feels tactile effects by muscle sensation in fingers, arms, etc. Two or more haptic module (153) may be equipped depending on the configuration of the mobile terminal (100).

[0091] The optical output (154) outputs signal to notify the occurrence of an event using light from a light source of the mobile terminal (100). An example of an event occurred from the mobile terminal (100) may include receiving messages, receiving call signals, missed calls, alarms, schedule reminders, receiving emails, receiving information via applications, etc.

[0092] The signal output by the optical output (154) is indicated by a single or multi colored light emitted from the front or back of the mobile terminal. The signal output may be terminated when the mobile terminal detects that the user has acknowledged the event.

[0093] The interface (160) may perform as a path for the mobile terminal (100) and all external devices connected thereto. The interface (160) receives data from the external devices, transmits the supplied power to each element in the mobile terminal (100), and transmits data in the mobile terminal (100) to the external devices. For example, the interface (160) may include at least one of a wired/wireless headset port, an external charging port, a wired/wireless data port, a memory card port, a port connecting a device equipped with an identification module, an audio input/output (I/O) port, a input/output (I/O) port, and an earphone port.

[0094] The identification module is a chip that stores various authentication information for authorizing the use of a mobile terminal (100) and may include a user identity module (UIM), a subscriber identity module (SIM), a universal subscriber identity module (USIM), etc. A device equipped with the identification module (hereinafter, referred to as "identification device") may be made in a smart card format. Therefore, the identification device may be connected with the mobile terminal (100) via the interface (160).

[0095] The interface (160) may work as a path through which power an external cradle is supplied to the mobile terminal (100) when the mobile terminal (100) is connected thereto, or a path through which various command signals input from the cradle by the user are transmitted to the mobile terminal (100). The various command signals input from the cradle or the power may work as a signal for recognizing whether the mobile terminal (100) is properly mounted on the cradle.

[0096] The memory (170) may store a program for the operations of the controller (180) or temporarily store input/output data such as a phone book, messages, still images, videos, etc. The memory (170) may store data on various patterns of vibration and sound output when a touch is input on the touch screen.

[0097] The memory (170) may include at least one type of storage medium such as flash memory type, hard disk type, Solid State Disk (SSD) type, Silicon Disk Drive (SDD) type, multimedia card micro type, memory card type (e.g., SD or XD memory, etc.), random access memory (RAM), static random access memory (SRAM), read-only memory (ROM), electrically erasable programmable read-only memory (EEPROM), programmable read-only memory (PROM), magnetic memory, magnetic disk, and optical disk. The mobile terminal (100) may operate related to a web storage that performs the storage function of the memory (170) on the internet.

[0098] Meanwhile, as described above, the controller (180) controls the operations related to the applications, and the overall operations of the mobile terminal (100). For example, the controller (180) may set or release a lock state that restricts the user's input of control commands for applications when the mobile terminal satisfies the set conditions.

[0099] The controller (180) perform control and processing related to voice calls, data communications, video calls, etc., or process pattern recognition that recognizes handwriting or drawing input on the touch screen as characters and images, respectively. The controller (180) may control one or more of the aforementioned elements in combination to implement the various exemplary embodiments described hereinafter to the mobile terminal (100) of the present disclosure.

[0100] The power supply part (190) supplies power to each element for its operations when the controller (180) controls to turn on external power or internal power. The power supply part (190) may be a chargeable built-in battery and be is detachably assembled to the terminal body for charging, etc.

[0101] The power supply part (190) may be equipped with a connection port, and the connection port may be configured as an example of the interface (160) to which an external charger that supplies power for charging the battery is electrically connected.

[0102] The power supply part (190) may also be configured to charge the battery wirelessly without using the connection port. In this case, the power supply part (190) may receive power from an external wireless power transmission device using at least one of inductive coupling based on a magnetic induction phenomenon, and magnetic resonance coupling based on an electromagnetic resonance phenomenon.

[0103] Hereinafter, various exemplary embodiments may be implemented in a recording medium readable by a computer or computer-like device, using software, hardware or a combination thereof.

[0104] With reference to FIG. 2b and FIG. 2c, the disclosed mobile terminal (100) is equipped with a bar-type terminal body. However, the present disclosure is not limited thereto, and may be applied to various structures such as watch type, clip type, glass type, folder type where two or more bodies move in relation to each other, flip type, slide type, swing type, swivel type, etc. Any description related to a specific type of a mobile terminal may be generally applied to other types of mobile terminals.

[0105] Herein, the terminal body may be understood that the mobile terminal (100) is considered as and referred to at least one aggregate.

[0106] The mobile terminal (100) includes a case (e.g., frame, housing, cover, etc.) forming the exterior. As illustrated, the mobile terminal (100) may include a front case (101) and a rear case (102). Electronic components selected are placed in the internal space formed by the front (101) and the rear case (102) being combined. The front case (101) and the rear case (102) may have at least one additional middle case therebetween.

[0107] Information may be output on the display unit (151) located on the front of the terminal body. As illustrated, a window (151a) of the display (151) may be mounted on the front case (101) to form the front of the terminal body with the front case (101).

[0108] In some cases, electronic components may also be mounted on the rear case (102). The electronic components that may be mounted on the rear case (102) include a detachable battery, an identification module, a memory card, etc. In this case, the rear case (102) may have a rear cover (103) detachably assembled for covering the mounted electronic components. Therefore, if the rear cover (103) is detached from the rear case (102), electronic components mounted on the rear case (102) will be exposed to the outside.

[0109] As illustrated, if the rear cover (103) is assembled to the rear case (102), a portion of the side of the rear case (102) may be exposed. In some cases, the rear case (102) may be completely covered by the rear cover (103). The rear cover (103) may have an opening to expose a camera (121b) and a sound output unit (152b) to the outside.

[0110] Such cases (101, 102, 103) may be formed by injection molding synthetic resin, or may be formed from metal such as stainless steel (STS), aluminum (Al), titanium (Ti), etc.

[0111] The mobile terminal (100) may be configured so that a single case forms the internal space, unlike the aforementioned examples in which multiple cases form internal space for accommodating various electronic components. In this case, the mobile terminal (100) may be implemented to have a monocoque body made of synthetic resin or metal extending from the side to the rear.

[0112] The mobile terminal (100) may have a waterproof part (not shown) to prevent water from seeping into the inside of the terminal body. For example, the waterproof part may be placed between a window (151a) and the front case (101), between the front case (101) and the rear case (102), or between the rear case (102) and the rear cover (103), and may include a waterproof member that seals the internal space when such are combined.

[0113] The mobile terminal (100) may be equipped with the display (151), first and second sound output units (152a, 152b), the proximity sensor (141), the illumination sensor (142), the optical output unit (154), first and second cameras (121a, 121b), first and second control units (123a, 123b), the microphone (122), the interface (160), etc.

[0114] Hereinafter, as illustrated in FIG. 2b and FIG. 2c, the mobile terminal (100) will be described in which the display (151), the first sound output unit (152a), the proximity sensor (141), the illumination sensor (142), the optic output part (154), the first camera (121a) and the first control unit (123a) are placed on the front of the terminal body, the second control unit(123b), microphone (122) and the interface (160) are placed on the side of the terminal body, and the second sound output unit (152b) and the second camera (121b) are placed on the rear of the terminal body.

[0115] However, such configurations are not limited to such arrangements. Such configurations may be omitted, replaced, or placed to other surfaces if necessary. For example, the front of the terminal body may not have the first control unit (123a), or the second sound output unit (152b) may be place on the side of the terminal body instead of the rear.

[0116] The display (151) displays (outputs) information processed in the mobile terminal (100). For example, The display (151) may display the running screen of applications of the mobile terminal (100), or user interface (UI) and graphic user interface (GUI) based on the running screen information.

[0117] The display (151) may include at least one of liquid crystal display (LCD), thin film transistor-liquid crystal display (TFT LCD), organic light-emitting diode (OLED), flexible display, 3D display, and e-ink display.

[0118] The display (151) may be two or more depending on the implementation type of the mobile terminal (100). In this case, in the mobile terminal (100), multiple displays may be spaced apart or placed integrally on one surface, or may be placed separately on different surfaces.

[0119] The display (151) may have a touch sensor for detecting a touch on the display (151) to receive a control command by touch. When a touch is applied on the display (151), the touch sensor detects the touch, and based on this, the controller (180) generates a control command corresponding to the touch. The content input by touch may be letters or numbers, or menu items specified or assigned in various modes.

[0120] The touch sensor may be formed in a film format having touch patterns and placed between the window (151a) and a display (now shown) on the back of the window (151a), or may be a metal wire directly patterned on the back of the window (151a). Otherwise, the touch sensor may be formed integrally with the display. For example, the touch sensor may be placed on a display substrate or inside the display.

[0121] The display (151) may form the touch screen combined with the touch sensor, in this case, the touch screen may function as the user input unit (123 shown in FIG. 1a). In some cases, the touch screen may replace at least some functions of the first control unit (123a).

[0122] The first sound output unit (152a) may be implemented a receiver that delivers sound during a call to the user' ears, and the second sound output unit (152b) may be implemented as a loud speaker that outputs notification sounds or multimedia sounds.

[0123] The window (151a) of the display (151) may have an acoustic hole for outputting the sound generated from the first sound output unit (152a). However, the present disclosure is not related thereto, it may be configured that the sound is output along the assembly gap between structures (e.g., the gap between the window (151a) and the front case (101)). In this case, a hole formed separately in the exterior of the mobile terminal (100) to output the sound is hidden or not shown, thereby having a simpler exterior.

[0124] The optical output unit (154) outputs light to notify the occurrence of an event. An example of an event may include receiving messages, receiving call signals, missed calls, alarms, schedule reminders, receiving emails, receiving information via applications, etc. If it is detected that the user has acknowledged the event, the controller (180) may control to the optical output unit (154) to terminate the light output.

[0125] The first camera (121a) processes still images or image frames of videos obtained by the image sensor in shooting mode or video call mode. The processed image frames may be displayed on the display (151) or stored in the memory (170).

[0126] The first and second control units (123a, 123b) are examples of the user input unit (123) that is controlled to receive commands to the operation of the mobile terminal (100), and may be referred to as a manipulating portion. The first and second control units (123a, 123b) may adopt any method that the user controls while feeling tactile sensations such as touch, push, scroll, etc. The first and second control units (123a, 123b) may also adopt a method that the user controls without tactile sensations, using proximity touch, hovering, etc.

[0127] In this drawing, the first control unit (123a) is shown as a touch key, but the present disclosure is not limited thereto. For example, the first control unit (123a) may be a mechanical key, or a combination of a touch key and a mechanical key.

[0128] Various content may be set to be input by the first and second control units (123a, 123b). For example, the first control unit (123a) may receive commands such as menu, home key, cancel, search, etc., and the second control unit (123b) may receive commands such as volume adjustment of the sound from the first or second sound output unit (152a, 152b), switch of the display (151) to touch recognition mode, etc.

[0129] In another example of the user input unit (123), the rear of the terminal body may have a rear input part (not shown). The rear input part receives a command to control the operation of the mobile terminal (100), various content of input may be set. For example, power on/off, start, end, scroll, volume adjustment of the sound output from the first and second sound output units (152a, 152b), switch of the display (151) to touch recognition mode, etc. The rear input part may be implemented that enables input by touch, push, or a combination thereof.

[0130] The rear input part may be placed to overlap the display (151) on the front of the terminal body in the thickness direction of the terminal body. For example, the rear input part may be placed on the upper rear portion of the terminal body so that the user may easily control it using the index finger when holding the terminal body with one hand. However, the present disclosure is not limited thereto, the rear input part may be placed in other surfaces.

[0131] If the rear input part is placed on the rear of the terminal body, a different type of a user interface may be implemented using this. In addition, the aforementioned touch screen or the rear input part may replace at least some functions of the first control unit on the front of the terminal body so that the display (151) may be configured to be larger in size if the first control unit (123a) is not placed on the front of the terminal body.

[0132] The mobile terminal (100) may have the fingerprint scan sensor for recognizing the fingerprint of the user, and the controller (180) may use the fingerprint information detected by the fingerprint scan sensor for authentication. The fingerprint scan sensor may be built inside the display (151) or the user input unit (123).

[0133] The microphone (122) receives voice and other sounds of the user. The microphone (122) may be provided at multiple locations to receive sound in stereo.

[0134] The interface (160) is a path through which the mobile terminal (100) is connected to external devices. For example, the interface (160) may be at least one of a connection terminal for connecting with other devices (e.g., earphones, external speakers), a short-range communication (e.g., IrDA port, Bluetooth port, wireless LAN port), or a power supply terminal for supplying power to the mobile terminal (100). The interface (160) may be implemented in a socket format that accommodates an external card such as a subscriber identity module (SIM), a user identity module (UIM), or a memory card for storing information.

[0135] The second camera (121b) may be placed on the rear of the terminal body. In this case, the second camera (121b) has a shooting direction substantially opposite to that of the first camera (121a).

[0136] The second camera (121b) may include multiple lenses arranged along at least one line. The multiple lenses may be arranged in a matrix. Such camera may be referred to as an array camera. If the second camera (121b) is an array camera, images may be obtained in various ways using multiple lenses, with better quality.

[0137] A flash (124) may be placed near the second camera (121b). The flash (124) flashes light toward the subject when photographing the subject with the second camera (121b).

[0138] The second sound output unit (152b) may be additionally placed on the terminal body. The second sound output unit (152b) may provide a stereo function with the first sound output unit (152a), and implement a speaker phone mode.

[0139] The terminal body may have at least one antenna for wireless communication. The antenna may be built-in the terminal body or placed on the case. For example, an antenna forming part of the broadcast receiver module (111 shown in FIG. 2a) may be configured to be withdrawable from the terminal body. The antenna may be formed in a film and assembled to the inner side of the rear cover (103), a case including conductive material may function as an antenna.

[0140] The terminal body includes the power supply part (190 shown FIG. 2a) to mobile terminal (100). The power supply part (190) may include the battery (191) that is built in the terminal body, or is detachably assembled to the exterior of the terminal body.

[0141] The battery (191) may be configured to be supplied with power via a power cable connected to the interface (160). The battery (191) may be configured to be wirelessly charged using a wireless charging device. The wireless charging may be implemented by magnetic induction or resonance (magnetic resonance).

[0142] This drawing illustrates a configuration that the rear cover (103) is connected with the rear case (102) to cover the battery (191), thereby preventing the battery (191) from being detached and protecting the battery (191) from external impact and foreign substances. If the battery (191) is configured to be detachably assembled to the terminal body, the rear cover (103) may be detachably assembled to the rear case (102).

[0143] The mobile terminal (100) may additionally have accessories that protect its exterior, or assist or expand the functions of the mobile terminal (100). An example of such accessories may be a cover or a pouch that covers or accommodates at least one surface of the mobile terminal (100). The cover or pouch may be configured to be synced with the display (151) to expand the functions of the mobile terminal (100). Another example of such accessories may be a touch pen that assists or expands touch input on the touch screen.

[0144] The mobile terminal may expand, beyond a device that users usually hold in their hands, to become a wearable device worn on the human body. Such wearable devices include a smartwatch, a smart glass, and a Head Mounted Display (HMD), etc. Hereinafter, examples of the mobile terminal that have been expanded to wearable devices will be described.

[0145] The wearable devices may be configured to exchange data or sync with th mobile terminal (100). The short-range communication module (114) may detect (or recognize) a wearable device capable of communicating, around the mobile terminal (100). Furthermore, if the detected wearable device is a device authenticated to communicate with the mobile terminal (100), the controller (180) may transmit at least some of the data processed in the mobile terminal (100) to the wearable device via the short-range communication module (114). Therefore, the user may use the data processed in the mobile terminal (100) using the wearable device. For example, when the mobile terminal (100) receives a phone call or a message, the user may answer the phone call or check the message on the wearable device.

[0146] In this regard, FIG. 2d is a schematic view illustrating an example of a second mobile terminal that is paired with a mobile terminal according to an exemplary embodiment of the present disclosure and is wearable on a specific part of a human body.

[0147] With reference to FIG. 2d, a watch-type mobile terminal (300) includes a body (301) having a display (351) and a band (302) connected to the body (301) that is wearable on the wrist. Generally, the mobile terminal (300) may have features of the mobile terminal (100) in FIG. 1a to FIG. 1c or similar features thereof.

[0148] The body (301) includes a case forming the exterior. As illustrated, the case may include a first case (301a) and a second case (301b) that forms internal space for accommodating various electronic components. However, the present disclosure is not related thereto, a monocoque body type mobile terminal (300) may be implemented with a single case forming the internal space.

[0149] The watch-type mobile terminal (300) is configured to be wirelessly communicable, and have an antenna for the wireless communication on the body (301). The antenna may expand performance thereof using the case. For example, the case including conductive material may be electrically connected with the antenna to expand the ground are or radiating area.

[0150] The display (351) may be configured to be placed on the front of the body (301) to output information, and have a touch sensor to be implemented as a touch screen. As illustrated, the window (351a) of the display (351) is mounted on the first case (301a) thereby forming the front of the terminal body with the first case (301a).

[0151] The body (301) may be equipped with a sound output unit (352), a camera (321), a microphone (322), a user input unit (323), etc. The display (351) may function as the user input unit (323) when implemented as a touch screen, accordingly, the body (301) may have a separate key.

[0152] The band (302) is worn to wrap around the wrist and may be formed of a flexible material to be worn easily The band (302) is worn to wrap around the wrist, and may be formed of a flexible material to be worn easily such as leather, rubber, silicone, synthetic resin, etc. In addition, the band (302) is configured to be detachable from the body (301), and replaceable with different types of bands according to the user’s preference.

[0153] The band (302) may also be used for expanding the antenna’s performance. For example, the band may have a built-in ground extension (not shown) electrically connected to the antenna to expand the ground area.

[0154] The band (302) may have a fastener (302a). The fastener (302a) may be implemented to be as a buckle, a hook capable of snap-fit, a velcro (trademark), etc. and may have a flexible section or material. This drawing illustrates an example of the fastener (302a) that is implemented as a buckle.

[0155] Hereinafter, exemplary embodiments related to a control method that may be implemented in the mobile terminal with such configurations will be described with reference to the accompanying drawings. It is apparent to those skilled in the art that the present disclosure have other specific modifications within the spirit and essential features of the present disclosure.

[0156] The mobile terminal (100, referred to as “first mobile terminal”) according to the present disclosure having at least of the aforementioned configurations may receive a request to input information for user authentication from the external server (50) connected to the body, via the wireless communication part (100). In response to the request, a radio signal for recognizing and detecting whether the second mobile terminal (300) paired with the mobile terminal (100) and wearable on a specific part of a human body is being worn may be transmitted to the second mobile terminal (300).

[0157] The second mobile terminal (300) transits, to the first mobile terminal (100), a response signal for the radio signal sent from the first mobile terminal (100) or a bio-signal of the wearer detected by the sensor equipped in the second mobile terminal (300). Accordingly, the first mobile terminal (100) may recognize the second mobile terminal (300) and perform wearer authentication based on the received response signal or bio-signal. For example, if the second mobile terminal (300) is recognized and a bio-signal is received, the received bio-signal is compared to a pre-registered (or pre-stored) bio-signal to determine whether the wearer of the second mobile terminal (300) is the user of the first mobile terminal (100), and wearer authentication may be performed.

[0158] Based on at least one of a result of performing wearer authentication and a result of analyzing the bio-signal received from the second mobile terminal (300), the first mobile terminal (100) may determine an appropriate authentication method or change processing of information entered for user authentication based on the detected bio-signal.

[0159] For example, base on the result of wearer authentication, the first mobile terminal (100) may be implemented to present different authentication methods depending on whether the wearer of the second mobile terminal (300) is the user of the first mobile terminal (100) or not. Specifically, for example, if the wearer of the second mobile terminal (300) is the user of the first mobile terminal (100), it is considered that an initial determination for user authentication has been made, and an authentication method prioritizing the convenience of entering information over security, such as signature authentication, may be selected and presented. On the other hand, if the wearer of the second mobile terminal (300) is not the user of the first mobile terminal (100), multiple authentication methods with a higher security such as fingerprint authentication, and iris and retina authentication, may be selected and presented.

[0160] In addition, for example, based on the result of wearer authentication, even if it is confirmed that the wearer of the second mobile terminal (300) is the user of the first mobile terminal (100), the first mobile terminal (100) may analyze the wearer's bio-signal received from the second mobile terminal (300), and control to change processing of information entered for the provided authentication method depending on whether the wearer is awake and a psychological state of the wearer. Specifically, for example, if the wearer's bio-signal is analyzed that the wearer is under threat or coercion, or is asleep, even if information that matches a pre-registered user information is entered, authentication may be prevented from being processed.

[0161] The user authentication refers to authentication that the user is the authorized user by using an authentication protocol such as a password. In other words, it refers to a software that reliably verifies whether a user who wants to access the external server (50) or specific data via the external server (50) is a legitimate user with authorization.

[0162] There are various authentication methods for user authentication. Authentication methods may be broadly classified into a knowledge-based authentication method, an ownership-based authentication method, and a feature-based authentication method.

[0163] Specifically, the knowledge-based authentication method is a method of authenticating a user's identity based on a person's knowledge such as ID/password authentication method, passphrase authentication method, pre-registered questionnaire authentication method, i-pin authentication method, etc. Since users set passwords based on personal habits which are easily guessed, the knowledge-based authentication method has relatively low security but is convenient.

[0164] The ownership-based authentication method is a method of authenticating the user's identity by directly providing unique information from a separate storage medium, such as OTP authentication method, security card authentication method, accredited certificate authentication method, HSM authentication method, etc. The ownership-based authentication method may have the risk of losing the media, and of information leakage due to malware.

[0165] The feature-based authentication method is a method of authenticating the user's identity using the user's physical or behavioral characteristics, such as fingerprint authentication method, iris or retina authentication method, hand shape authentication method, face authentication method, voice authentication method, and signature authentication method. The feature-based authentication method is convenient and has high reliability and stability, but is difficult to recognize characteristics when the body is damaged.

[0166] The bio-signal refers to an electrical signal generated from the wearer's body wearing a second mobile terminal (300). For example, the bio-signal may be one of an electrocardiogram (ECG) signal, a photoplethymogram (PPG) signal, or a galvanic skin response (GSR) signal, but not limited thereto, and may include various signals used widely among those skilled in the art for measuring sleep stages.

[0167] More specifically, electrical key measurements from the wearer's body include electroencephalograms, electrocardiograms, electromyograms, ocular conductance, galvanic skin response, etc., and physical key measurements may include blood pressure, heart rate, arrhythmias, pulse, pulse loss, body temperature, respiratory rate, etc. A sensor equipped in the second mobile terminal (300) may detect at least one of the electrical key measurements and physical key measurements.

[0168] Specifically, the electrocardiogram (ECG) signal is an electrical signal that represents the electrical activity of the heart, as measured on the skin surface. The ECG signal may be measured by inducing the activity current within the heart muscle according to the heartbeat to two appropriate locations on the body surface.

[0169] The electromyogram (EMG) signal is an electrical signal that represents muscle contractility, muscle activity and fatigue, as measured on the skin surface. The EMG may detect tendon movements according to movement of the wearer's finger that is detected by wearing the watch-type mobile terminal (300). Specifically, the carpal tunnel of the terminal wearer's wrist has a bundle of flexor tendons that control the movement of each finger. The bundle of flexor tendons contain nine flexor tendons and one median nerve, when fingers are moving, the nine flexor tendons of the flexor tendon bundle move in various combinations. The detection part (140) of the mobile terminal may detect the shape of tendons that are deformed by the finger or wrist movement, and the controller (180) may determine which gesture the fingers are making based on the detected information.

[0170] The electroencephalogram (EEG) signal is an electrical signal that represents concentration or the brain activity in response to external stimulation, as measured on the skin surface. The EEG signal may be measured by inducing electrical potential changes in the human brain, or brain currents caused thereby, on the scalp.

[0171] The galvanic skin reflex (GSR) signal is an electrical signal that represents the skin resistance changes in response to the sympathetic nerve activity, as measured on the skin surface. The GSR signal may be obtained by measuring a phenomenon in which electrical resistance in the skin of a living organism temporarily decreases or action potentials occur due to external stimulation or emotional excitement.

[0172] Meanwhile, an example that the wearer's bio-signal detected by the second mobile terminal (300) is transmitted to the first mobile terminal (100) is described herein, but it is not limited thereto and may be implemented as a configuration in which a bio-signal detected by the user's touch (e.g., if a touch is applied on the display (151) by finger) is directly provided by a sensor equipped in the first mobile terminal (100).

[0173] Hereinafter, with reference to FIG. 3 and FIG. 4, a control method of a mobile terminal according to an exemplary embodiment in the specification will be described. FIG. 3 is a flow chart illustrating a control method of a mobile terminal according to an exemplary embodiment in the specification, and FIG. 4 is a schematic view illustrating the flow chart of FIG. 3.

[0174] With reference to FIG. 3, the first mobile terminal (100) receives a request to input information for user authentication from the external server (50 shown FIG. 1) connected to the body(100), via the wireless communication part (110) (S310).

[0175] Herein, the external server (50) may include any terminal that requires security authentication to perform a specific function or access specific data by wirelessly communicating with the body (100), or on which such program is installed or which provides such service. The external server (50) may perform operations by syncing with the database (not shown) in which user information matching user authentication is stored.

[0176] The user authentication refers to authenticating that a user is an authorized user by using an authentication protocol such as a password, and the information input for user authentication refers to inputting information that matches the pre-registered authentication information to process such user authentication.

[0177] Specifically, if the first mobile terminal (100) transmits a request signal for accessing the external server (50) along with running a specific application, the request to input information for user authentication may be received from the external server (50). Or if the first mobile terminal (100) transmits a request signal for running a specific function or accessing a specific data, the request to input information for user authentication may be received from the external server (50).

[0178] When the request to input information for user authentication is received from the external server (50), as illustrated FIG. 4 (a), a screen information corresponding to the request to put information may be output on the display (151) of the first mobile terminal (100). For example, a message (401) "User authentication will be started" to notify the start of the process may be displayed. Meanwhile, although not shown, when a request to input information is received, a user interface corresponding to a pre-set authentication method such as a user interface for inputting ID/Password may be popped up on the display (151).

[0179] In response to receiving the request to input information, the first mobile terminal (100) transmits a radio signal for detecting whether the second mobile terminal (300 shown in FIG. 1) paired with the body and wearable on a specific part of a human body is being worn (S320).

[0180] Herein, the second mobile terminal (300) is implemented as a watch-type mobile terminal that is wearable on the user's wrist, but may be implemented as a band-type mobile terminal wearable on the user's arm or a glass-type mobile terminal wearable on the user's head.

[0181] When a response signal to the radio signal is received from the second mobile terminal (300) and/or a bio-signal detected by the second mobile terminal (300) is received, the first mobile terminal (100) performs wearer authentication for the second mobile terminal (300) (S330).

[0182] Herein, wearer authentication refers to verifying whether the second mobile terminal (300) is being worn and whether the wears of the second mobile terminal (300) matches the user of the first mobile terminal (100). The second mobile terminal (300) may be equipped with at least one sensor such as PPG sensor, GSR sensor, SKT sensor for detecting the wearer's bio-signals. Also, the sensor equipped in the second mobile terminal (300) is activated when a radio signal is received from the first mobile terminal (100), and may be implemented to collect the wearer's bio-signals in real time.

[0183] The bio-signal refers to an electrical signal generated from the body of the wearer of the second mobile terminal (300), for example, the bio-signal may be one of an electrocardiogram (ECG) signal, a photoplethymogram (PPG) signal, or a galvanic skin response (GSR) signal, but not limited thereto, and may include various signals used widely among those skilled in the art for measuring sleep stages.

[0184] By performing wearer authentication, the first mobile terminal (100) may detect the relative location of the second mobile terminal (300) and whether it is being worn.

[0185] Also, by performing wearer authentication, the first mobile terminal (100) compares the received bio-signal to a bio-signal of pre-registered user information to determine whether the wearer of the second mobile terminal (300) matches the user of the first mobile terminal (100).

[0186] The bio-signal of pre-registered user information may be stored in a general pattern generated based on information accumulated over a certain period of time, and/or in a specific pattern that records bio-signals generated under specific conditions (e.g., during sleep or exercise). The bio-signal of pre-registered user information may be updated periodically.

[0187] Meanwhile, when wearer authentication for the second mobile terminal (200) is completed, the first mobile terminal (100) may recognize that an initial determination for user authentication has been made. In other words, when the second mobile terminal (300) is being worn, it may be determined whether its wearer matches the user of the first mobile terminal (100). Also, since the first and second mobile terminals (100, 300) need to exist within a certain distance range for paring, it is possible to check whether the user is carrying both devices.

[0188] When wearer authentication for the second mobile terminal (300) is completed, the controller (180) of the first mobile terminal (100) may control to display a user interface corresponding to an authentication method accordingly, on the display (151) of the body (100) or the display (351) of the second mobile terminal (300).

[0189] For example, by performing wearer authentication, as illustrated in FIG. 4 (b), a screen information corresponding to the wearer authentication result may be output on the display (151) of the first mobile terminal (100). For example, a notice message (402) “Wearer authentication has been completed” may be displayed. Also, although not shown, when the wearer authentication is completed, at least one of the first and second mobile terminals (100, 300) may output a sound (e.g., a 'beep' sound) corresponding to the completion of wearer authentication.

[0190] Based on at least one of a result of performing the wearer authentication and a result of analyzing the bio-signal, the first mobile terminal (100) may control to determine an authentication method of the user authentication or change processing of information entered corresponding to the authentication method (S340).

[0191] Specifically, by performing the wearer authentication, if the user of the first mobile terminal (100) matches the wearer of the second mobile terminal (300), since an initial determination for user authentication has been made, a user interface corresponding an authentication method with high convenience may be output. In contrast, by performing the wearer authentication, if the first mobile terminal (100) does not match the second mobile terminal (300), a user interface corresponding to a pre-registered authentication method or an authentication method with a higher security may be output. In other words, if an initial determination for user authentication has been made, it may be controlled to select a more convenient authentication method for user input, and if an initial determination for user authentication has not been made, it may be controlled to select an authentication method with a higher security.

[0192] For this, the first mobile terminal (100) may provide the initial authentication result to the external server (50), or provide information related to the authentication method (or multiple selectable authentication methods) selected according to the initial authentication result to the external server (50). The external server (50) may also transmit a user interface corresponding to the authentication method selected according to the provided information to the first mobile terminal (100) or the second mobile terminal (300).

[0193] For example, if the user of the first mobile terminal (100) matches the wearer of the second mobile terminal (300) in FIG. 4 (b), a user interface screen (403) corresponding to a fingerprint authentication method may be output on the display (151) of the first mobile terminal (100), as shown in FIG. 4 (c). Meanwhile, although not shown, if the wearer of the second mobile terminal (300) is not determined to match the user of the first mobile terminal (100) in FIG. 4, user interface corresponding to an authentication method with a higher security such as iris and retina authentication may be output.

[0194] Also, based on the result of analyzing the bio-signal received from the second mobile terminal (300), the first mobile terminal (100) may change processing of information entered corresponding to the authentication method.

[0195] For this, the first mobile terminal (100) may determine the wearer’s status such as whether the wearer is awake and a psychological state of the wearer by analyzing the bio-signal received from the second mobile terminal (300). The first mobile terminal (100) may control to change processing of information entered to the user interface corresponding the presented authentication method depending on the wearer’s current status that has been determined. For example, if it is recognized that information is being entered against the user's intention while the wearer is sleeping or under coercion, threat, or tension, it may be implemented to prevent authentication for such information input from being performed or to provide a different authentication method.

[0196] For example, in FIG. 4 (c), even if fingerprint information entered in the user interface screen (403) corresponding the fingerprint authentication method output on the display (151) of the first mobile terminal (100) is the user’s fingerprint, if the bio-signals detected by the second mobile terminal (300) are analyzed that the psychological state of the user is abnormal (e.g., excessively excited or nervous) or the user is sleeping, user authentication using the external server (50) as in FIG. 4 (d) may be prevented. In contrast, in FIG. 4 (c), while the fingerprint information is being entered in the user interface screen (403), if the bio-signals detected by the second mobile terminal (300) are analyzed that the psychological state of the user is normal (e.g., tension index, etc. are within the normal range) and the user is awake, the entered fingerprint information will be transmitted directly to the external server (50).

[0197] Meanwhile, based on the initial determination, if it is detected that a response signal has not been received from the second mobile terminal (300) or the second mobile terminal (300) is not being worn, the sensor equipped in the second mobile terminal (100) may be enabled to detect the user's bio-signals. In this case, the first mobile terminal may determine whether the user is awake and a psychological state of the user by analyzing the bio-signals detected from the first mobile terminal (100). Therefore, it may change processing of information entered corresponding to the authentication method provided based on the determined information.

[0198] The authentication information entered from the first mobile terminal (100) and/or second mobile terminal (300) may be transmitted to the external server (50) for matching for user authentication. Therefore, the secondary authentication for user authentication is performed in the external server (50) or an authentication server (not shown) connected to the external server (50).

[0199] While the secondary authentication is being performed, as illustrated in FIG. 4 (d), screen information indicating that user authentication is being performed such as a message (404) "Authenticating user..." may be output on the display (151) of the first mobile terminal (100).

[0200] As described above, according to the exemplary embodiments of the present disclosure, user convenience may be obtained by providing different authentication methods depending on whether the user is wearing them or not. In addition, when entering information for user authentication, the bio-signals of the terminal wearer are detected to determine whether the wearer is awake and a psychological state of the wearer, thereby preventing user authentication from being performed without the user's intention. Therefore, the security of user authentication may be qualitatively increased

[0201] The FIG. 5 is a schematic view illustrating how to determine an authentication method for user authentication depending on wearer authentication for the second mobile terminal (300 shown in FIG. 1), according to an exemplary embodiment of the present disclosure.

[0202] According to an exemplary embodiment of the present disclosure, the authentication method may include at least one of fingerprint authentication (e.g., fingerprint scan sensor), face authentication (e.g., camera), voice authentication (e.g., microphone), biometric authentication, signature authentication, handwriting authentication, password authentication, and gesture authentication of a user, using a sensor equipped in at least one of the first mobile terminal (100) and the second mobile terminal (200). According to an exemplary embodiment of the present disclosure, multiple authentication method may be selected for user authentication.

[0203] Also, according to an exemplary embodiment of the present disclosure, the information entered corresponding to the presented authentication method may be processed differently depending on the wearer's psychological state determined based on the bio-signal analysis result of the first mobile terminal (100). For this, the first mobile terminal (100) may receive the wearer's bio-signals from the second mobile terminal (300).

[0204] Based on the initial authentication described above, if it is detected that the second mobile terminal (300) is not being worn or the wearer of the second mobile terminal (300) does not match the user of the first mobile terminal (100), the user's bio-signals may be detected by using the sensor equipped in the first mobile terminal (100).

[0205] Also, the first mobile terminal (100) may detect the wearer's specific part of the body (e.g., wearer's hand) with the second mobile terminal (300) being worn is in contact with the display (151) of the first mobile terminal (100), and determine whether the wearer of the second mobile terminal (300) matches the person who applies a touch on the display (151) of the first mobile terminal (100) and the user of the first mobile terminal (100). In this case, it may be verified more clearly whether the user carries both the first mobile terminal (100) and the second mobile terminal (300) and whether the user is the wearer.

[0206] Specifically, the controller (180) of the first mobile terminal (100) may enable the bio-signal sensing function, in response to a touch to a working area of the display (151) of the first mobile terminal (100) while the second mobile terminal (300) is being worn. Also, the controller (180) may control the display (151) to changes the screen corresponding to the activation of the bio-signal sensing function.

[0207] For example, in user authentication mode, if the wearer of the watch-type mobile terminal (300) uses the hand wearing the mobile terminal (300) and applies a touch on the display (151) of the paired bar-type mobile terminal (100), as illustrated in FIG. 5 (a), the screen information indicating that a bio-signal is being detected such as a text and an image (501) will be output on the display (151).

[0208] Then, the controller (180) of the first mobile terminal (100) compares the first bio-signal detected by enabling the bio-signal sensing function to the second bio-signal received from the second mobile terminal (300) to determine whether the user is the wearer. As illustrated in FIG. 5 (b), the screen information (502) indicating that it is being confirmed whether the user and the wearer are the same person may be output on the display (151).

[0209] Also, the controller (180) may analyze the received or detected bio-signal to determine whether the wearer is awake and a psychological state of the wearer. If the wearer of the second mobile terminal (200) is determined to be awake and in a psychological state satisfying a pre-set normal condition, the controller (180) matches the he received or detected bio-signal with user information pre-stored in the first mobile terminal (100), and outputs to the display (151) a user interface corresponding to the authentication method determined based on the matching result.

[0210] Determining whether the wearer is awake based on thebio-signals refers to determining whether the user is in a non-REM (NREM) state or in a REM state that is easy to wake up from, or has been already awake (i.e., an awake state) based on the wearer's bio-signals (e.g., heartbeat, ECG). For this, an algorithm for determining a sleep state may be stored in advance in the memory (160) of the first mobile terminal (100). The controller (180) may set the threshold value of the algorithm for determining whether the wearer is sleeping or awake based on the bio-signals.

[0211] Herein, the psychological state satisfying a pre-set normal condition refers to a case where only stimulation signals below a pre-set threshold are detected or the wearer's tension or excitement index corresponding to changes in bio-signals satisfies the conditions below a pre-set threshold, based on the bio-signal analysis results.

[0212] Meanwhile, if it is unclear whether the psychological state determined by analyzing the bio-signals satisfies the normal condition, other sensors equipped in the first mobile terminal (100) or the second mobile terminal (300) may be used as auxiliary data to determine the wearer's psychological state. For example, if the wearer's tension index corresponding to the bio-signal changes is near the threshold, the camera (321) of the second mobile terminal (200) may be enabled to collect the wearer's face date such as facial expressions, blinking, smile, frowning, side glances, eyebrow movements, head movements. The collected face data may be transmitted to the controller (180) of the first mobile terminal (100) for determining the wearer's psychological state.

[0213] Thus, if it is determined that the wearer of the second mobile terminal (300) matches the user of the first mobile terminal (100) and the wearer is awake and in a psychological state satisfying a pre-set normal condition based on the wearer's bio-signals, an authentication method with high convenience may be selected. For example, as illustrated in FIG. 5 (c), it is shown that the user interface screen (503) corresponding the signature authentication method may be output. In other words, if the user of the first mobile terminal (100) is determined to be the wearer of the second mobile terminal (300), it is considered that an initial determination has been made, and user authentication with a simpler authentication method may be performed. If signature information is entered to the output user interface screen (503), the first mobile terminal (100) transmits the input signature information to the external server (50) to determine whether it matches a pre-registered user information. Until the result is output, the display (151) of the first mobile terminal (100) may display a message (504) indicating that the user is being authenticated.

[0214] Meanwhile, after matching the received bio-signal from the second mobile terminal (300) with the pre-registered user information (wearer authentication), if the wearer of the second mobile terminal (300) does not match the user of the first mobile terminal (100), the controller (180) may control to perform user authentication with an authentication method with a higher security.

[0215] Specifically, if the wearer of the second mobile terminal (300) does not match the user of the first mobile terminal (100), the controller (180) may control to change a pre-set authentication method or put an additional request for an input corresponding to a different authentication method, thereby increasing the security level of the user authentication required from the external server (50).

[0216] Also, if the wearer of the second mobile terminal (300) does not match the user of the first mobile terminal (100), the controller (180) may control visual information related to the changed authentication method or visual information related to different authentication methods not to be transmitted to the second mobile terminal (300). In other words, if the wearer of the second mobile terminal (300) does not match the user of the first mobile terminal (100), a private mode may be automatically enabled.

[0217] Hereinafter, a process of user authentication will be described for a case where the wearer is asleep or in a psychological state satisfying an abnormal condition based on the bio-signals of the wearer of the second mobile terminal (300) or the user of the first mobile terminal (100).

[0218] Related to this, FIG. 6a is a schematic view illustrating how to change an authentication method for user authentication if a terminal wearer is asleep, according to an exemplary embodiment of the present disclosure. FIG. 6b is a schematic view illustrating how to change an authentication method for user authentication if a terminal wearer is asleep, according to an exemplary embodiment of the present disclosure.

[0219] The controller (180) of the first mobile terminal (100) may determine whether the wearer (or the user) is awake and the psychological state by analyzing the received (or detected) bio-signals.

[0220] If the wearer (or the user) is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition, the controller (180) may output a first user interface corresponding to a pre-set authentication method, and after the information entered from the first user interface is transmitted to the external server (50), may output a second user interface corresponding to a different authentication method to the display (151).

[0221] Herein, determining whether the wearer (or the user) is awake based on the bio-signals refers to determining whether the user is in a NREM state or in a REM state that is easy to wake up from, or has been already awake (i.e., an awake state) based on the wearer (or the user)'s bio-signals (e.g., heartbeat, ECG). An algorithm for determining a sleep state may be stored in advance in the memory (160).

[0222] Also, the wearer's (or the user's) psychological state satisfying a pre-set abnormal condition refers to a case where only stimulation signals exceeding a pre-set threshold are detected or the wearer's tension or excitement index corresponding to changes in bio-signals satisfies the conditions exceeding a pre-set threshold, based on the bio-signal analysis results. Meanwhile, as described above, if it is unclear whether the psychological state determined by analyzing the bio-signals satisfies the abnormal condition, other sensors equipped in the first mobile terminal (100) or the second mobile terminal (200) may be used as auxiliary data to determine the wearer (or the user)'s psychological state.

[0223] Also, if the wearer (or the user) is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition, the controller (180) may output a third user interface corresponding to an authentication method with a higher security level on the display (151) instead of the first user interface corresponding to a pre-set authentication method.

[0224] For example, with reference to FIG. 6a, even if the wearer of the second mobile terminal (300) is determined to be the person who applied a touch on the display (151) of the first mobile terminal (100) (a), if the wearer is determined to be asleep based on the bio-signal analysis result, a message (602) notifying that the wearer's status such as "User is sleeping" may be output on the display (151) of the first mobile terminal (100) (b). Also, a user interface screen (603) corresponding to a different authentication method (e.g., password authentication method) instead of a pre-set authentication method (e.g., fingerprint authentication method) may be output. In other words, since it is difficult to consider that the user performs user authentication while sleeping, it is preferable to exclude an authentication method using the user's physical characteristics (e.g., fingerprint authentication method, face authentication method, hand shape authentication method) from the different authentication methods.

[0225] Also, after analyzing the received bio-signals to determine whether the wearer (of the user) is awake and a psychological state of the wearer, if the wearer (or the user) is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition, the controller (180) may synthesize an interference signal to the input information entered by the user interface output on the display (151).

[0226] For example, even if it is confirmed that the wearer of the second mobile terminal (300) matches the person who applies a touch to the display (151) of the first mobile terminal (100), and fingerprint information is entered accordingly as illustrated in FIG. 6b (a), if the detected bio-signals are analyzed that the wearer of the second mobile terminal (300) is asleep or in a psychological state satisfying an abnormal condition, a pre-set interference signal may be synthesized to the input information before transmitted to the external server (50), as illustrated in FIG. 6b Accordingly, a message (604) such as "Fingerprint authentication was failed" may be output to the display (151) of the first mobile terminal (100). Thus, if an interference signal is synthesized to the fingerprint information, it fails to match user information.

[0227] Also, although not shown, the controller (180) may determine whether if the psychological state of the wearer satisfying a pre-set abnormal condition exceeds the threshold by analyzing the received bio-signals. Herein, the pre-set threshold refers to an extreme degree of psychological state that satisfies the abnormal conditions, meaning that the wearer is in a state of extreme excitement, tension, or anger for a certain period of time.

[0228] Thus, if a psychological state satisfying a pre-set abnormal condition is maintained beyond the pre-set threshold longer than a pre-set period of time, or in such state, information input to at least one of the first and second user interfaces corresponding to the presented authentication method is detected, the controller (180) may stop the process for user authentication and provide a warning message to the display (151) or the external server (50). In other words, from the initial authentication is performed until the final user authentication is completed, the wearer's sleep and psychological state may be continuously monitored.

[0229] Meanwhile, according to an exemplary embodiment of the present disclosure, an authentication method for user authentication may be changed by the wearer of the second mobile terminal (300)'s simple inputs (e.g., pre-set user gestures, voice commands, pre-set number of touches) for user convenience.

[0230] For example, FIG. 7 is a schematic view illustrating how to change an authentication method for user authentication based on a pre-set user gesture after wearer authentication for the second mobile terminal (300) is completed.

[0231] Specifically, when the wearer authentication for the second mobile terminal (300) is completed and a pre-set user gesture is detected while second mobile terminal (300) is being worn, the controller (180) of the first mobile terminal (100) may change the determined authentication method to perform user authentication according to an authentication method corresponding to the detected user gesture. Also, such change in the authentication method includes a case where a device to which an user interface corresponding to the determined authentication method is output changes.

[0232] For example, as illustrated in FIG. 7 (a), after wearer authentication for the second mobile terminal (300) is completed, if a touch tapping the display (351) of the second mobile terminal (300) for certain times is detected as illustrated in FIG. 7 (b), a user interface screen (702) corresponding to the fingerprint authentication method is output to the display (351) of the second mobile terminal (300) that detects the touch, as illustrated in FIG. 7 (c). If the wearer inputs fingerprint information on the display (351) of the second mobile terminal (300), the fingerprint information is transmitted to the external server (50) via the first mobile terminal (100), as illustrated in FIG. 7 (d).

[0233] Meanwhile, even after wearer authentication for the second mobile terminal (100) has been completed, it is preferable that the input for the presented authentication method is performed for user convenience. For example, when authentication information is entered, the user may enter authentication information using one or both of the terminals, depending on a distance between the first mobile terminal (100) and the second mobile terminal (200).

[0234] In other words, if authentication information is entered using both terminals, while it may be easy to constantly verify the user's identity, it is inconvenient to have to use both terminals even when the two are spaced apart (e.g., one of the terminals is in a bag).

[0235] Thus, FIG. 8 illustrates how to determine a device to provide an input screen corresponding to an authentication method based on a distance between a mobile terminal according to an exemplary embodiment of the present disclosure and a second mobile terminal.

[0236] The second mobile terminal (300) paired with the first mobile terminal (100) may detect a distance between two terminals using wireless communication, particularly, BLE. By performing BLE communication, the distance between two terminals may be detected relatively accurately by using wireless communication using low power (e.g., about 1~5% of the power of the Bluetooth communication standard) while maintaining the stability and security of Bluetooth. Such BLE communication may be performed separately from the wireless communication for transmitting/receiving data between the first mobile terminal (100) and the second mobile terminal (300).

[0237] The controller (180) of the first mobile terminal (100) may detect the distance between the body (100) and the second the mobile terminal (300) by BLE communication, and determine which terminal provides an input screen corresponding to the authentication method determined based on the detected distance.

[0238] Specifically, if the detected distance is within a pre-set range, the controller (180) may provide an input corresponding to the authentication method, using the body (100) and the second mobile terminal (300). For example, as illustrated in FIG. 8 (b), it may be controlled to input fingerprint using the hand wearing the second mobile terminal (300) to a user interface screen (802) with the fingerprint authentication method output on the display (151) of the first mobile terminal (100). It may be recognized whether the wearer entered the fingerprint information with the hand wearing the second mobile terminal (300) by analyzing the changes in the bio-signals detected by finger. It may be controlled that authentication is not processed if the wearer enters fingerprint information with the hand not wearing the second mobile terminal (300).

[0239] Meanwhile, if the detected distance is outside a pre-set range, the controller (180) may provide an input corresponding to the authentication method, using only one of the body (100) and the second mobile terminal (300).

[0240] For example, as illustrated in FIG. 8 (b"), a user interface screen (803) corresponding to the fingerprint authentication method may be output only on the second mobile terminal (300) so that the fingerprint information is entered only via the display (351) of the second mobile terminal (300). For this, the first mobile terminal (100) may transmit to the second mobile terminal (300) visual information related to a user interface corresponding to the determined authentication method.

[0241] Hereinafter, when the second mobile terminal (300) is not being worn, a method for providing a user interface corresponding to a user authentication method will be described.

[0242] Related to this, FIG. 9 and FIG. 10 are schematic views that describe how to provide an authentication method for user authentication if a second mobile terminal is not being worn, according to an exemplary embodiment of the present disclosure.

[0243] When a user authentication process is started, the first mobile terminal (100) transmits to the second mobile terminal (300) a radio signal for detecting whether the second mobile terminal is being worn.

[0244] In response to transmitting the radio signal, if it is detected that a response signal has not been received from the second mobile terminal (300) or the second mobile terminal (300) is not being worn by the received response signal, the controller (180) may output a message inducing wearing of the second mobile terminal to the display (151). Meanwhile, the message may be implemented as other types of notifications such as sound, vibration, and guide voice.

[0245] For example, as illustrated in FIG. 9 (a), the first mobile terminal (100) transmits a radio signal to the paired second mobile terminal (300), if the second mobile terminal (300) is detected as not being worn, the first mobile terminal (100) may output to the display (151) a message (902) that induces wearing such as "Wear your watch". Accordingly, if the user wears the second the mobile terminal (300), wearer authentication is performed as illustrated in FIG. 9 (c), after wearer authentication is completed, a user interface screen (904) corresponding to the fingerprint authentication method is output on the display (351) of the second mobile terminal (300) as illustrated in FIG. 9 (d).

[0246] Meanwhile, in another example, user authentication may be performed even if the user is not wearing the second mobile terminal (200). In such a case, the user may wear the second mobile terminal (200) during the authentication, or take off the second mobile terminal (200) before the wearer authentication is completed.

[0247] Specifically, the controller (180) of the first mobile terminal (100) may detect wearing or unwearing of the second mobile terminal by using wireless communication with the second mobile terminal (300), even after the first user interface corresponding to the determined authentication method is output to the screen.

[0248] If such change is detected, the controller (180), based on the detected change, may change the first user interface to the second user interface corresponding to a different authentication method. For example, as illustrated in FIG. 10 (a), if user authentication is started and unwearing of the second mobile terminal (300) is detected, a user interface screen (1002) corresponding to an authentication method such as password authentication method is output only on the first mobile terminal (100), as illustrated in FIG. 10 (b).

[0249] If the user wears the second mobile terminal (300) before entering password is completed on the output user interface screen (1002), wearer authentication is performed, and visual information (1003) corresponding to the wearer authentication is output, as illustrated in FIG. 10 (c). Then, a user interface screen (1004) corresponding to a different authentication method is output on the display (151). Therefore, as illustrated in FIG. 10 (d), the wearer of the second mobile terminal (300) may enter fingerprint information on the changed user interface screen (1004) to process user authentication.

[0250] Also, if wearing or unwearing of the second mobile terminal (300) is detected, the controller (180), based on the detected change, may transmit at least portion of the visual information related to the first user interface that has been output to the second mobile terminal. For example, if the second mobile terminal (300) is worn during the authentication, it is determined that the user intends to enter authentication information on the second mobile terminal (300) instead of the first mobile terminal (100), at least portion of the visual information related to the first user interface that has been may be controlled to be output to the second mobile terminal.

[0251] Meanwhile, if a mobile terminal according to the exemplary embodiment of the present disclosure is implemented to be wearable on a specific part of the human body, it may process user authentication solely without pairing with another mobile terminal.

[0252] Related to this, FIG. 11 is a flow chart illustrating a control method of a mobile terminal according to an exemplary embodiment of the present disclosure. A watch-type mobile terminal is illustrated as an example herein, but a glass-type mobile terminal wearable on the user's head, a necklace-type mobile terminal, or a ring-type mobile terminal may be implemented as well.

[0253] As illustrated in FIG. 11, wearing of the mobile terminal (100 shown in FIG. 2a) wearable on a specific part of the wearer's body may be detected (S1101). For example, it detects that a band equipped to the watch-type mobile terminal (100) wraps around the user's wrist or a fastener is connected to one end of the band, so that wearing of the mobile terminal (100) body may be detected.

[0254] If wearing of the mobile terminal (100) body is detected, in response to a request to input information for user authentication from an external server (50 shown in FIG. 1) connected to the mobile terminal body, the bio-signal of the wearer of the body may be detected (S1103).

[0255] Based on the detected bio-signal, it determines whether the wearer is awake and a psychological state of the wearer (S1104). Until the process related to user authentication is completed, such determination may be continuously performed. Also, based on such determination, the controller (180) of the mobile terminal (100) may control to determine an authentication method for user authentication or change processing of information entered corresponding to the authentication method.

[0256] Specifically, the controller (180) of the mobile terminal (100) matches the detected bio-signal with user information pre-registered in the mobile terminal (100), and may determine an authentication method for user authentication based on the matching result. For example, the detected bio-signal matches the pre-registered user information, it is considered that an initial determination has been made, it may be controlled to perform user authentication by a more convenient authentication method for user input (e.g., fingerprint authentication method). Also, for example, if the detected bio-signal does not match the pre-registered user information, it is considered that a third person is performing user authentication, it may be controlled to select an authentication method with a higher security (e.g., additional input by password authentication method, OPT authentication method) for user authentication.

[0257] The controller (180) of the mobile terminal (100), if the wearer of the mobile terminal (100) is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition based on the detected bio-signal, may synthesize a pre-set interference signal to the input information corresponding to the authentication method. Also, the controller (180), if the wearer of the mobile terminal (100) is determined to be asleep or in a psychological state satisfying a pre-set abnormal condition based on the detected bio-signal, may change a pre-set authentication method or put an additional request for an input corresponding to a different authentication method, thereby increasing the security level.

[0258] As described above, the mobile terminal and the control thereof according to the aforementioned embodiment of the present disclosure allows users to wear a wearable terminal on specific parts of bodies and provides different authentication methods depending on whether the user is wearing them or not, thereby having an effect of performing user authentication in a smooth and convenient manner. In addition, when entering information for user authentication, the bio-signals of the terminal wearer are detected to determine whether the wearer is awake and a psychological state of the wearer, thereby preventing user authentication in advance from being performed without the user’s intention. For example, the security of user authentication may be qualitatively increased by preventing authentication from being processed if it is determined that the user entered information under threat or coercion, or someone else entered information without the user's knowledge while the user was sleeping.

[0259] Also, the present disclosure describe above may be implemented as computer-readable code on a medium in which the program is stored. The computer-readable medium includes any type of storage in which data readable by the computer system is stored. Examples of computer-readable medium include Hard Disk Drive (HDD), Solid State Disk (SSD), Silicon Disk Drive (SDD), ROM, RAM, CD-ROM, magnetic tape, floppy disk, optical data storage devices, and also include those implemented in the form of carrier waves (e.g., transmission over the Internet). Also, the computer may include the controller (180) of the terminal. Therefore, the detailed description of the embodiments shall not be understood restrictively in all aspects, but shall be considered as practical exemplary embodiments. The scope of the present disclosure shall be determined according to a reasonable interpretation of the appended claims, and all modifications within the equivalent scope of the present disclosure shall be included within the scope of the present disclosure.

DRAWINGS

FIG. 1

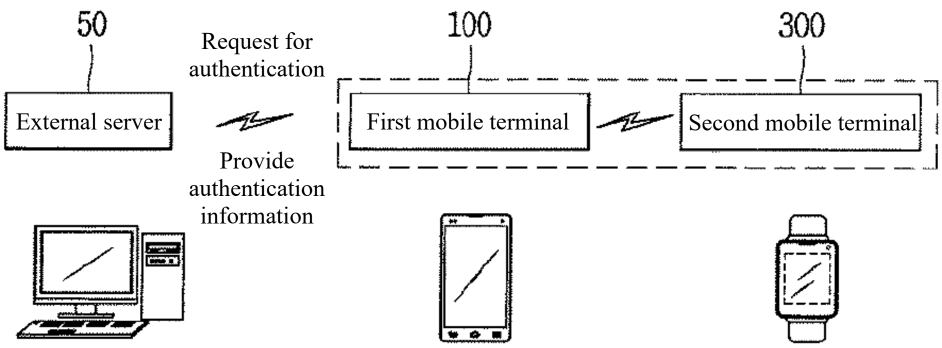


FIG. 2a

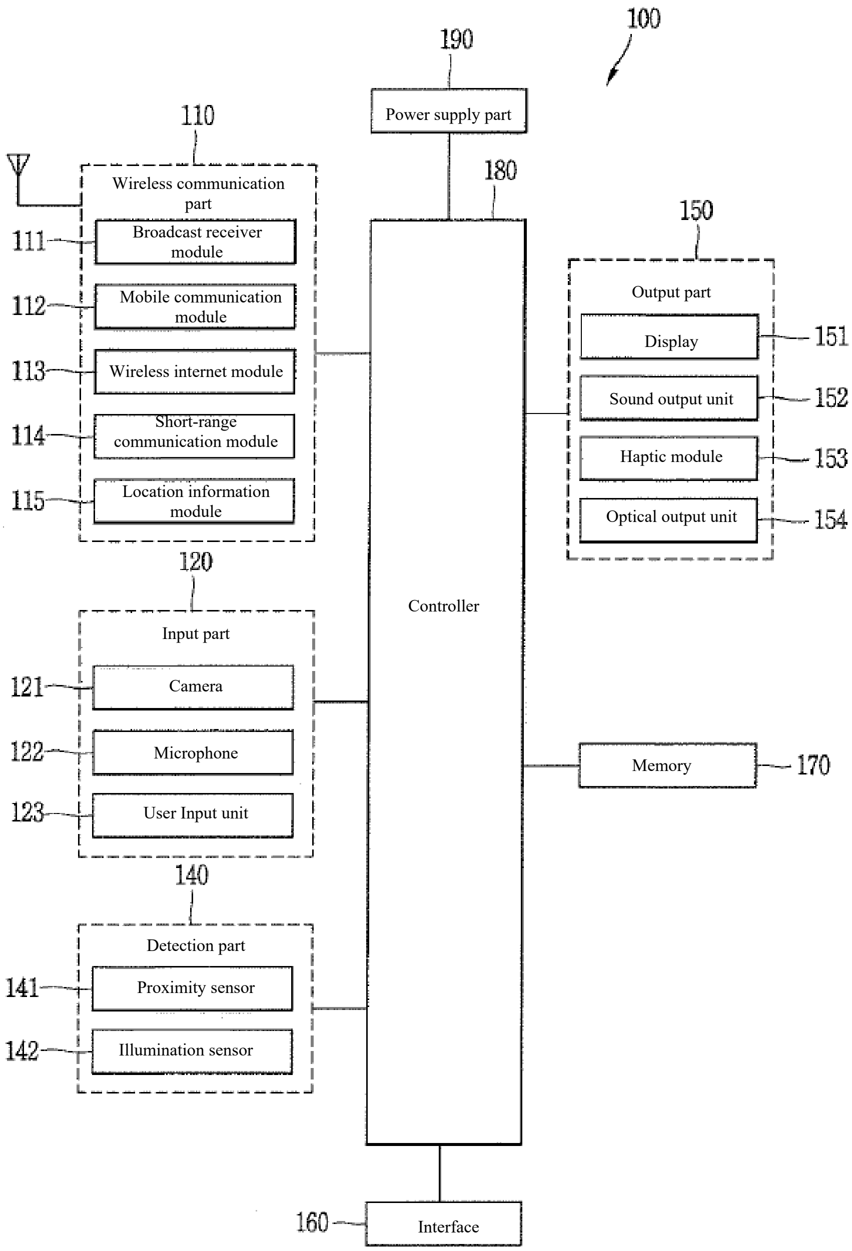

100
190
Power supply part
110
180
Wireless communication part
111
Broadcast receiver module
112
Mobile communication module
113
Wireless internet module
114
Short-range communication module
115
Location information module
150
Output part
Display
151
Sound output unit
152
Haptic module
153
Optical output unit
154
120
Input part
121
Camera
122
Microphone
123
User Input unit
Controller
Memory
170
140
Detection part
141
Proximity sensor
142
Illumination sensor
160
Interface

FIG. 2b

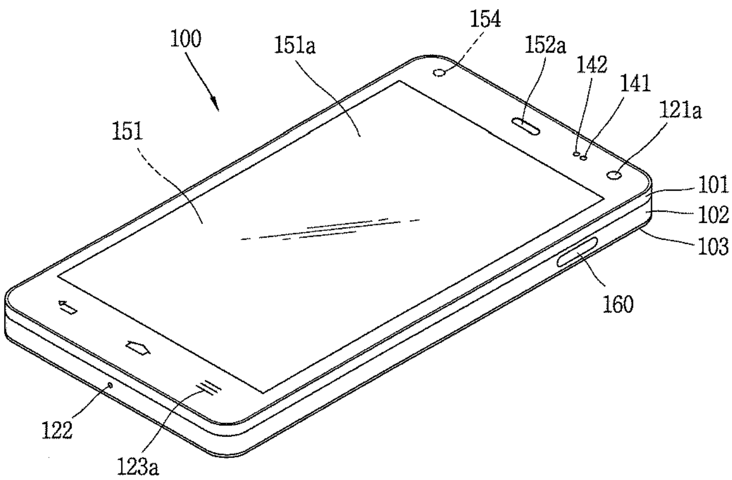

100
151a
154
152a
142
141
121a
151
101
102
103
160
122
123a

FIG. 2c

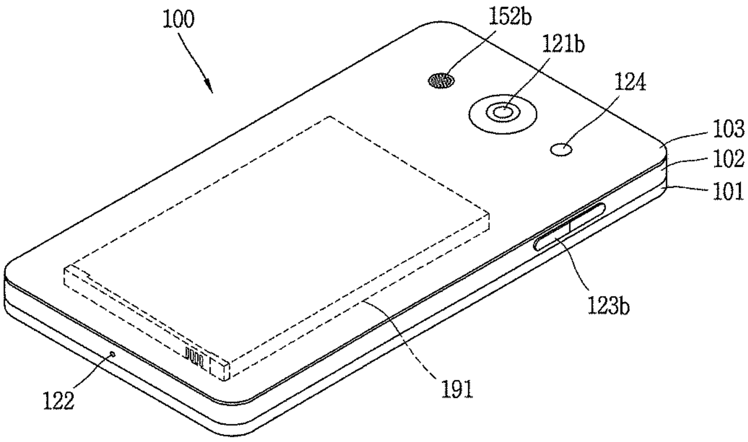

100
152b
121b
124
103
102
101
123b
122
191

FIG. 2d

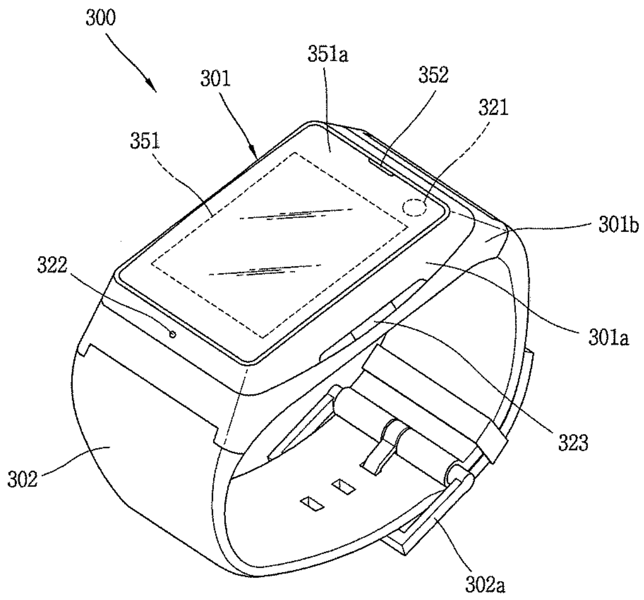

300
301
351a
352
321
351
301b
322
301a
323
302
302a

FIG. 3

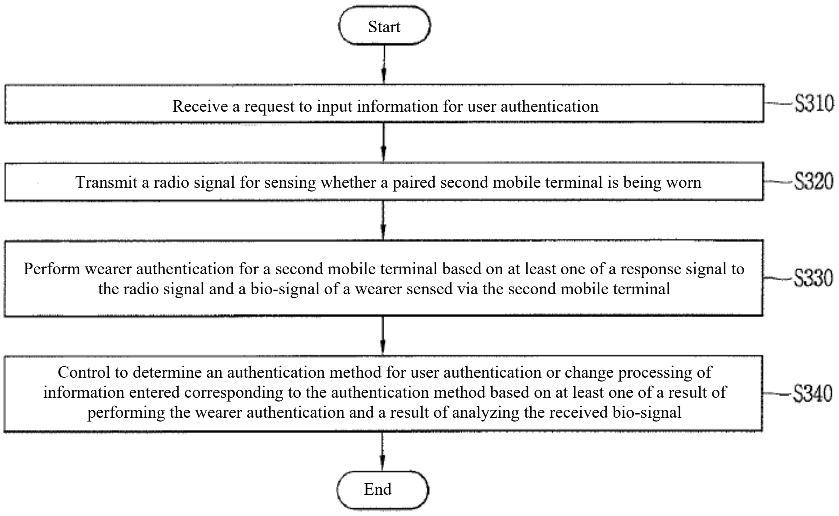

Start
Receive a request to input information for user authentication
S310
Transmit a radio signal for sensing whether a paired second mobile terminal is being worn
S320
Perform wearer authentication for a second mobile terminal based on at least one of a response signal to the radio signal and a bio-signal of a wearer sensed via the second mobile terminal
S330
Control to determine an authentication method for user authentication or change processing of information entered corresponding to the authentication method based on at least one of a result of performing the wearer authentication and a result of analyzing the received bio-signal
S340
End

FIG. 4

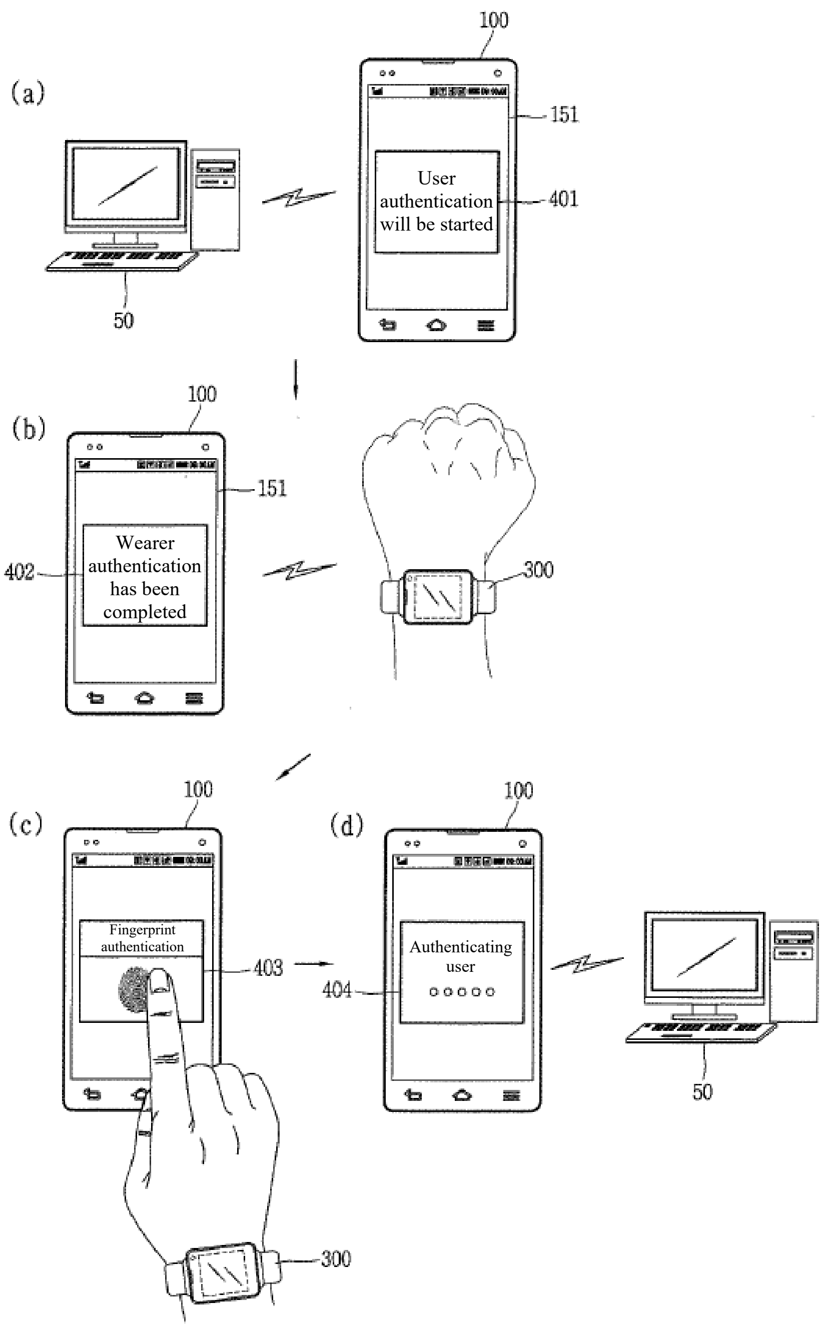

(a)
100
151
User authentication will be started
401
50
(b)
100
151
402
Wearer authentication has been completed
300
(c)
100
Fingerprint authentication
403
300
(d)
100
Authenticating user
404
50

FIG. 5

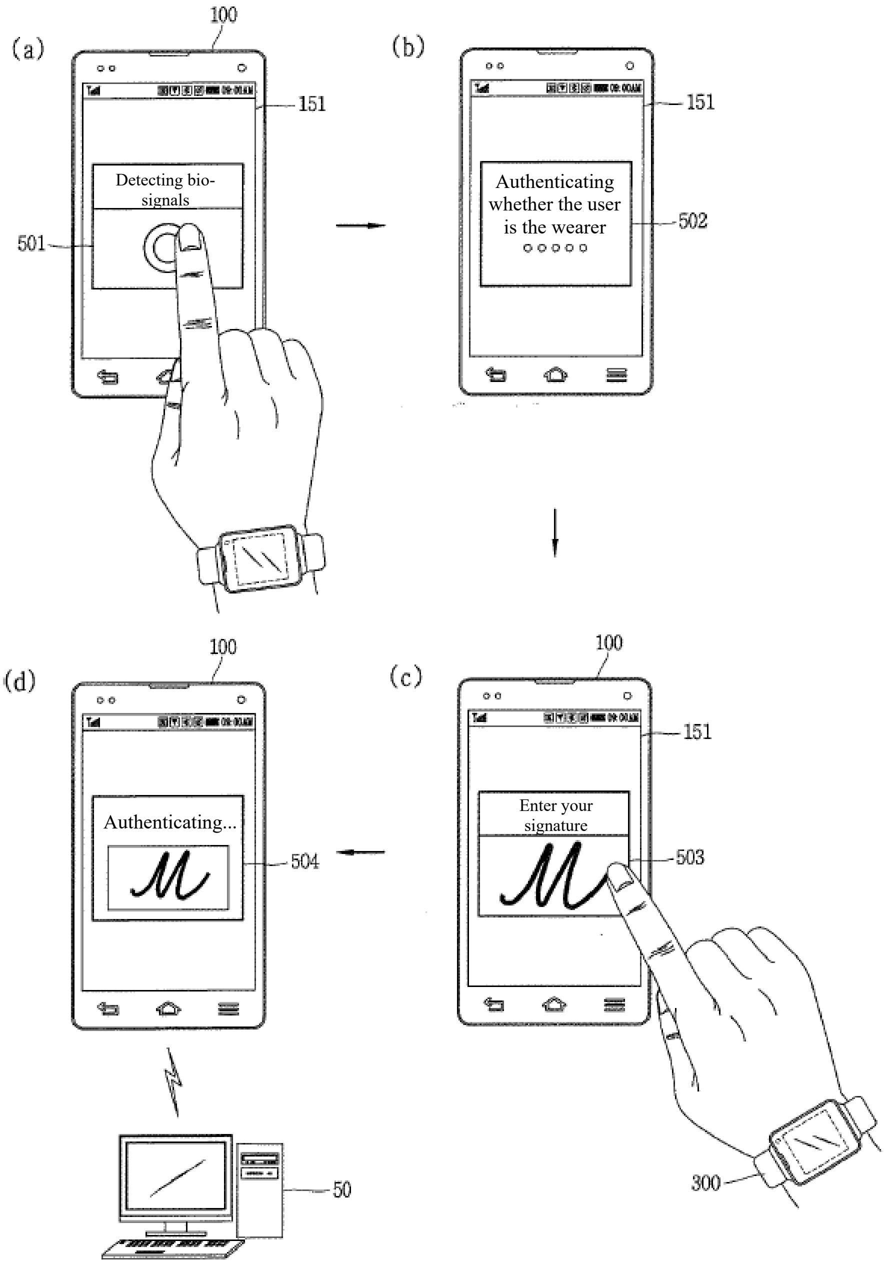

(a)
100
151
Detecting bio-signals
501
(b)
151
Authenticating whether the user is the wearer
502
(d)
100
Authenticating...
504
50
(c)
100
151
Enter your signature
503
300

FIG. 6a

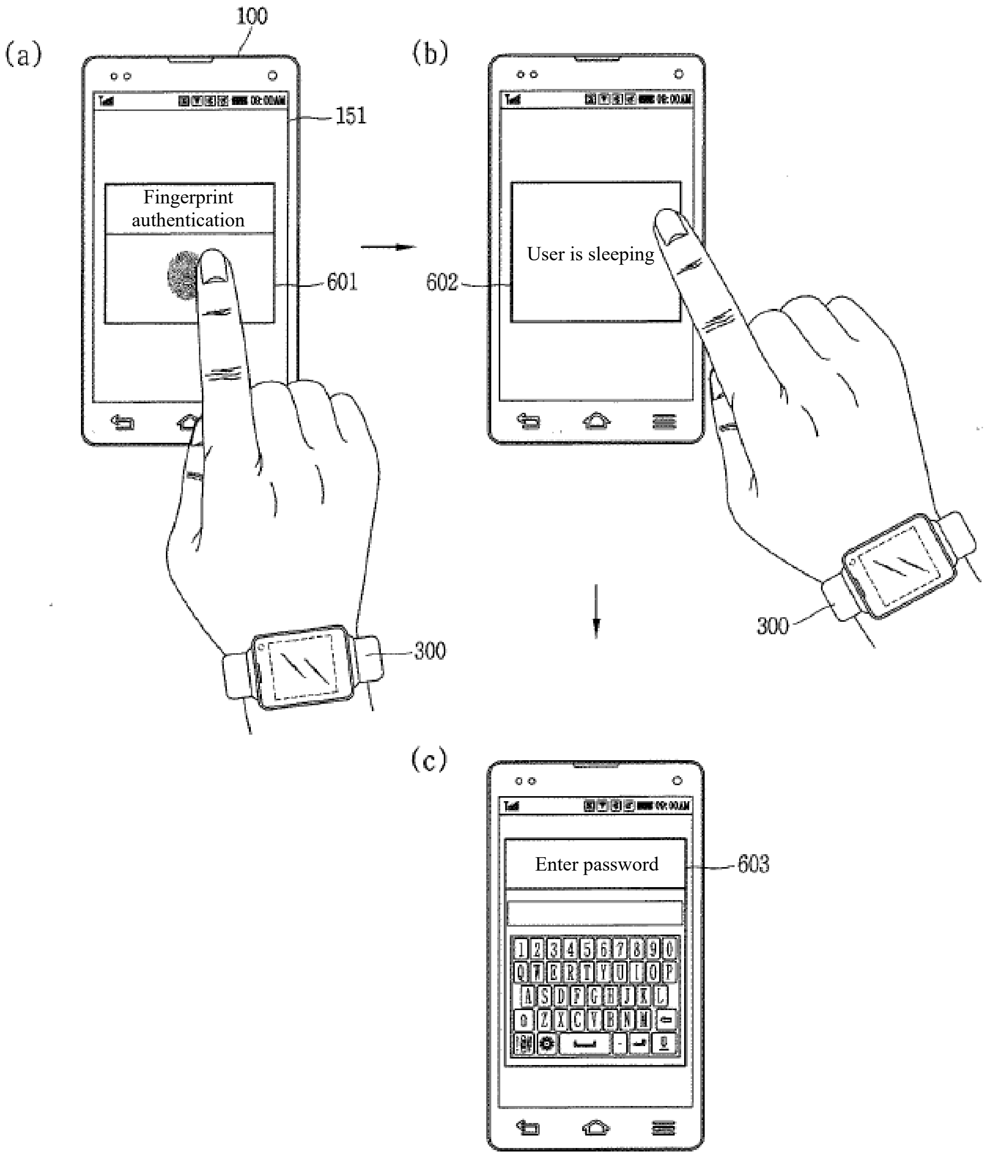

100
(a)
151
Fingerprint
authentication
601
(b)
602
User is sleeping
300
300
(c)
Enter password
603

FIG. 6b

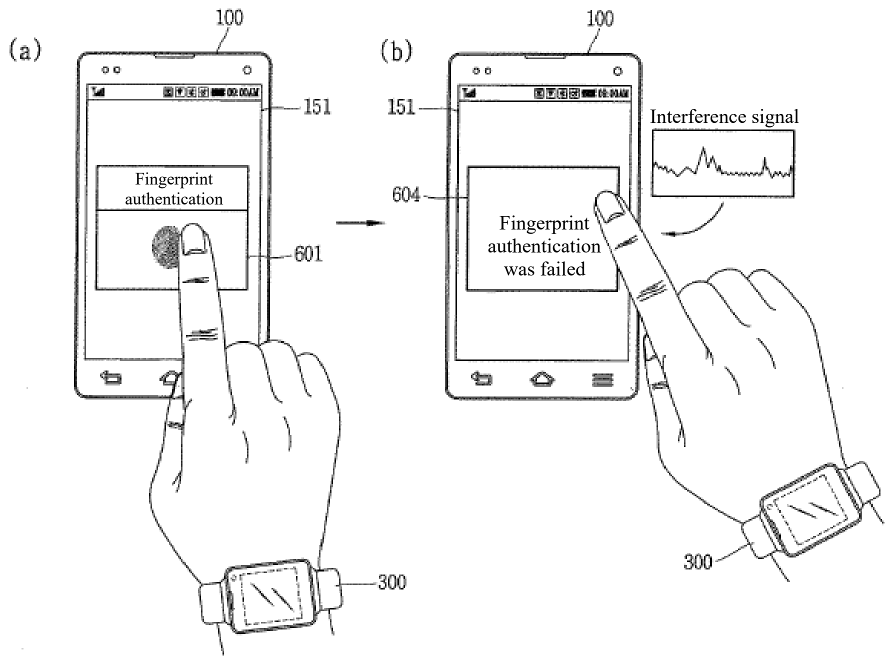

(a)
100
151
Fingerprint authentication
601
300
(b)
100
151
604
Fingerprint authentication was failed
Interference signal
300

FIG. 7

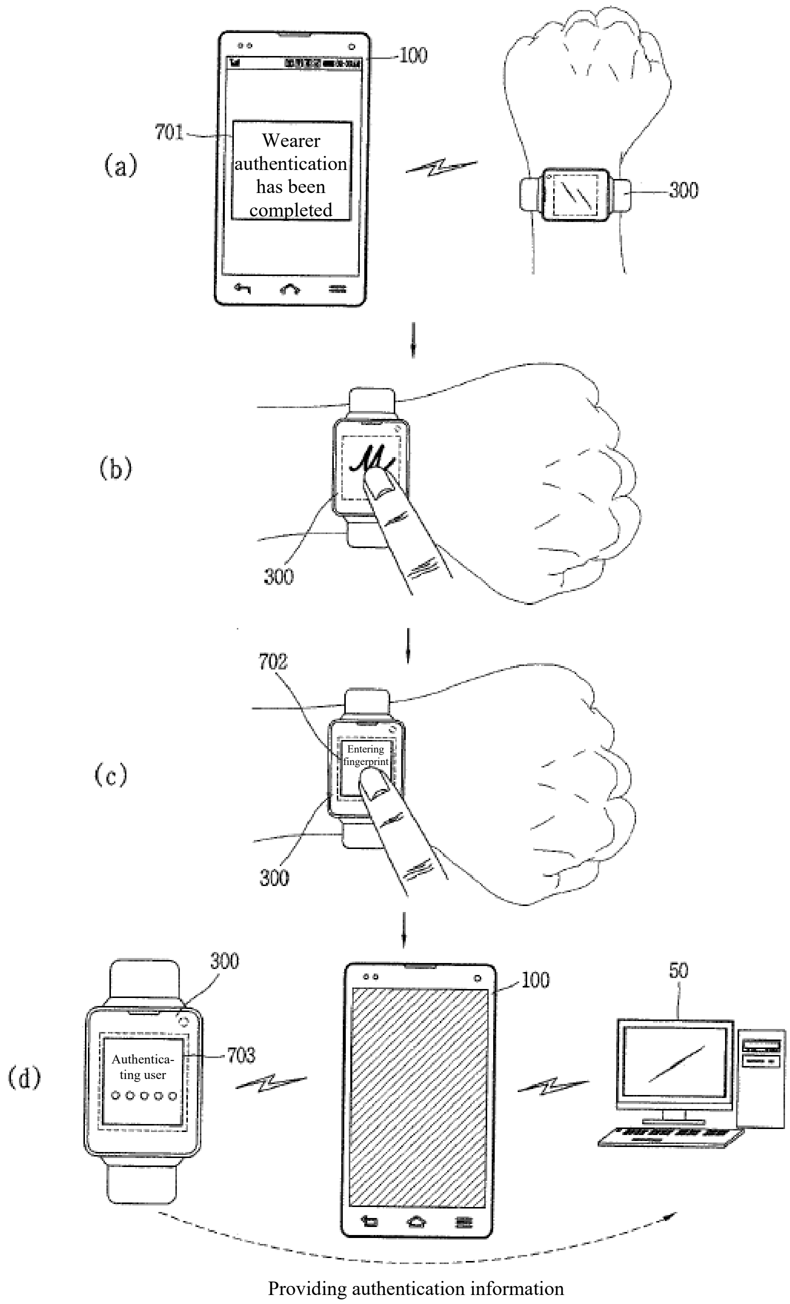

100
701
(a)
Wearer authentication has been completed
300
(b)
300
702
(c)
Entering fingerprint
300
300
(d)
703
Authentica-ting user
100
50
Providing authentication information

FIG. 8

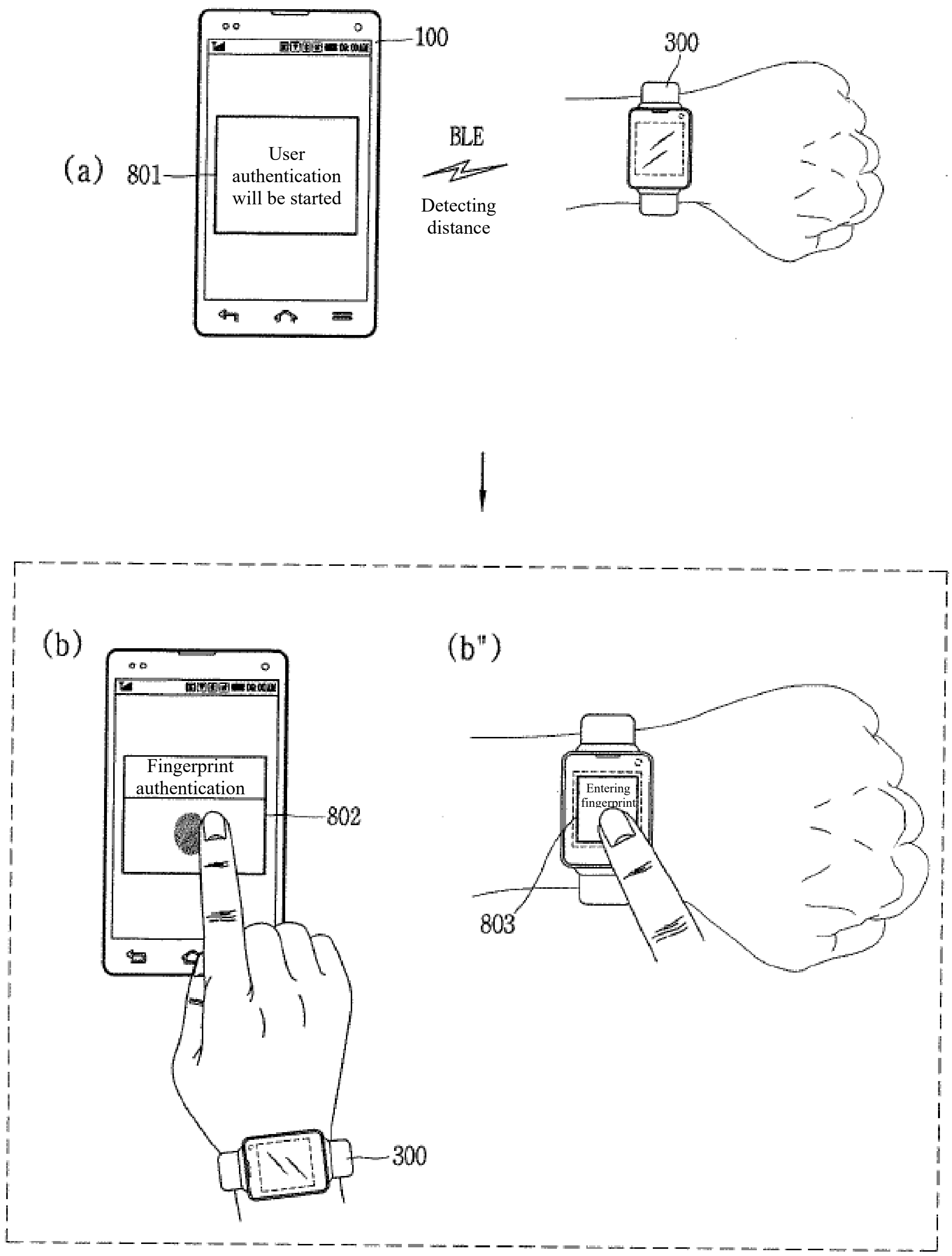

(a)
801
User authentication will be started
100
BLE
Detecting distance
300
(b)
Fingerprint authentication
802
300
(b")
Entering fingerprint
803

FIG. 9

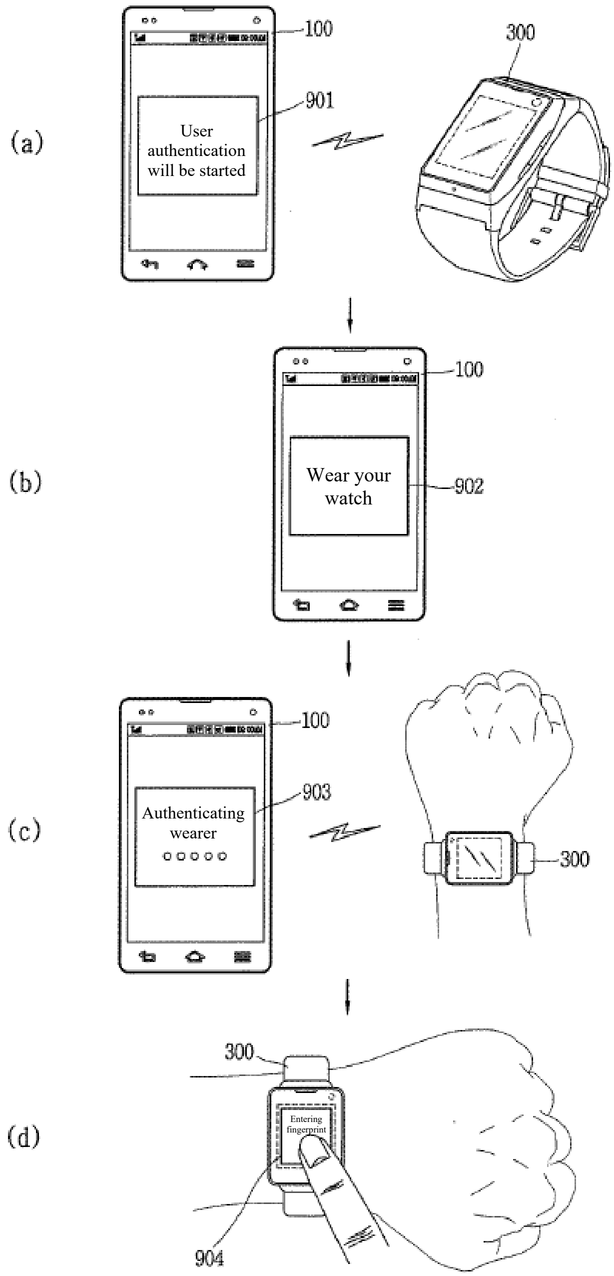

(a)
100
300
901
User authentication will be started
(b)
100
Wear your watch
902
(c)
100
903
Authenticating wearer
○○○○○
300
(d)
300
Entering fingerprint
904

FIG. 10

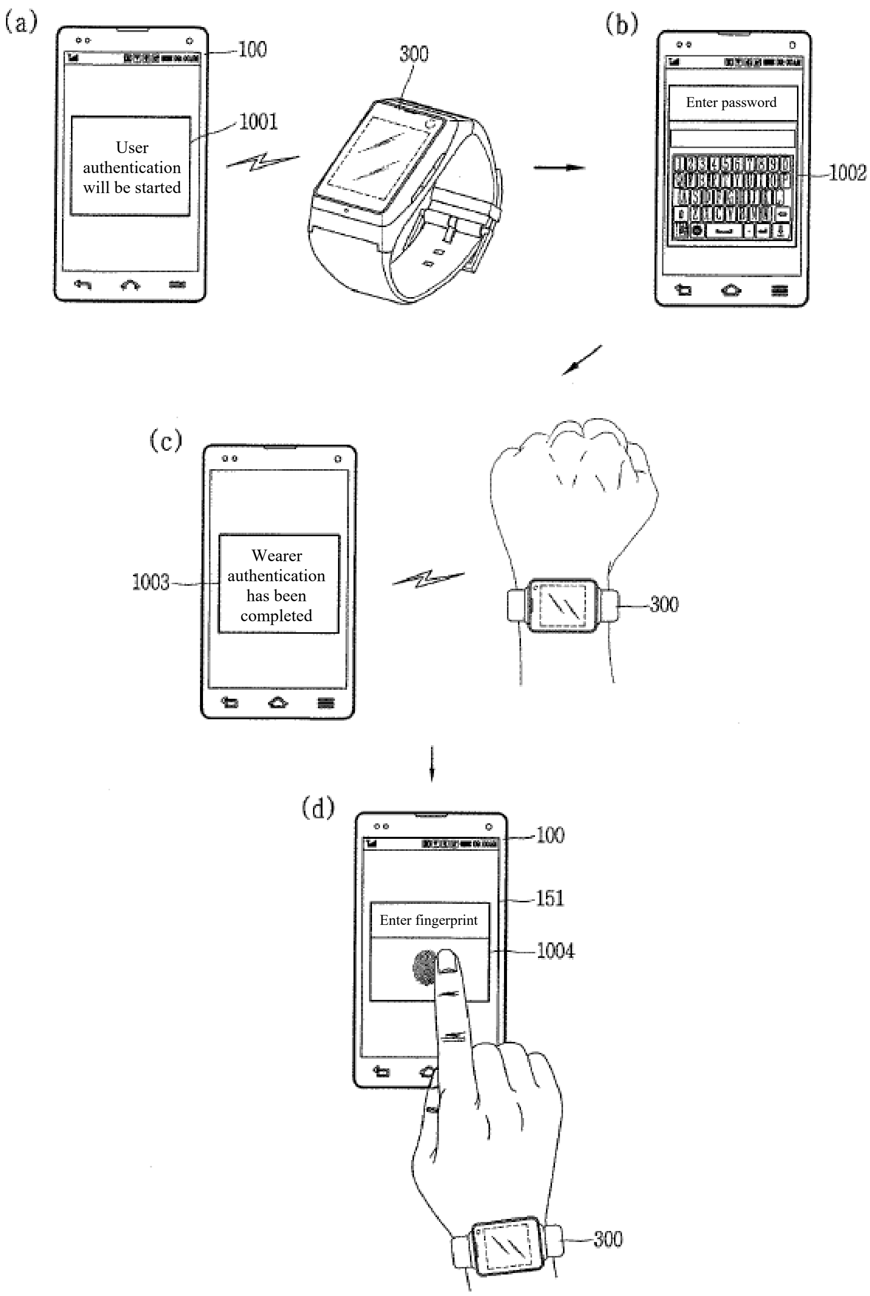
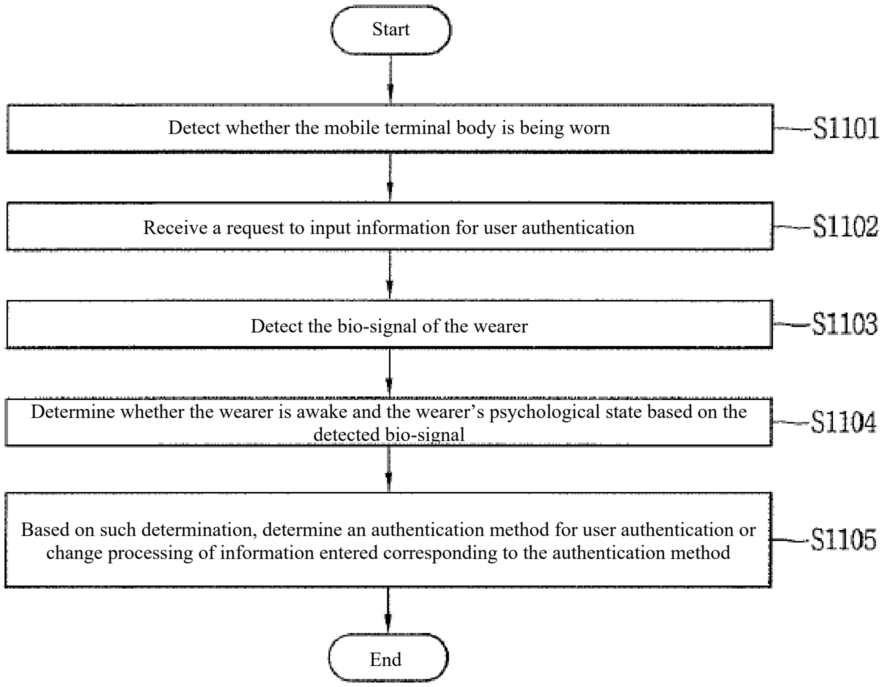

(a)
100
1001
User authentication will be started
300
(b)
Enter password
1002
(c)
1003
Wearer authentication has been completed
300
(d)
100
151
Enter fingerprint
1004
300

FIG. 11


Start
Detect whether the mobile terminal body is being worn
S1101
Receive a request to input information for user authentication
S1102
Detect the bio-signal of the wearer
S1103
Determine whether the wearer is awake and the wearer's psychological state based on the detected bio-signal
S1104
Based on such determination, determine an authentication method for user authentication or change processing of information entered corresponding to the authentication method
S1105
End

MORNINGSIDE
A Questel Company

TRANSLATION CERTIFICATION

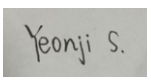
Date: August 1, 2025

To whom it may concern:

I, Yeonji S., a translator fluent in the Korean and English languages, on behalf of Morningside, do solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of the document(s) listed below in a form that best reflects the intention and meaning of the original text.

The document is designated as:

- KR102080747B1 (Hong).pdf



Signature

[Yeonji S.]

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