US008207832B2

(12) **United States Patent**
Yun et al.

(10) **Patent No.: US 8,207,832 B2**
(45) **Date of Patent: Jun. 26, 2012**

(54) **HAPTIC EFFECT PROVISIONING FOR A MOBILE COMMUNICATION TERMINAL**

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(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 432 days.

(21) Appl. No.: **12/436,068**

(22) Filed: **May 5, 2009**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Jun. 25, 2008 (KR) 10-2008-0060358

(51) **Int. Cl.**
G08B 6/00 (2006.01)

(52) **U.S. Cl.** **340/407.2**; 340/407.1; 345/173; 345/165; 715/702; 715/701

(58) **Field of Classification Search** 340/407.2, 340/407.1; 345/173, 165; 715/700–702
See application file for complete search history.

(56) **References Cited**

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2008/0024459	A1 *	1/2008	Poupyrev et al.	345/173
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2010/0102941	A1 *	4/2010	Richter et al.	340/407.2

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EP	1548549	6/2005
WO	2004081776	9/2004

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E. Hoggan et al., "Investigating the Effectiveness of Tactile Feedback for Mobile Touchscreens," CHI Conference Proceedings—Tactile and Haptic User Interfaces, pp. 1573-1582, Apr. 2008, XP-002525519.

* cited by examiner

Primary Examiner — Jennifer Mehmood
Assistant Examiner — Hongmin Fan
(74) *Attorney, Agent, or Firm* — Lee, Hong, Degerman, Kang & Waimey

(57) **ABSTRACT**

A mobile terminal and a method of controlling the mobile terminal are provided. The method includes displaying at least one object, which is divided into a plurality of haptic regions, on a touch screen; receiving a touch signal for any one of the haptic regions of the object; and outputting a control signal for controlling a haptic module to generate a haptic effect. Therefore, it is possible for a user to easily determine which of the haptic regions of the object has been touched with the sense of touch.

18 Claims, 45 Drawing Sheets

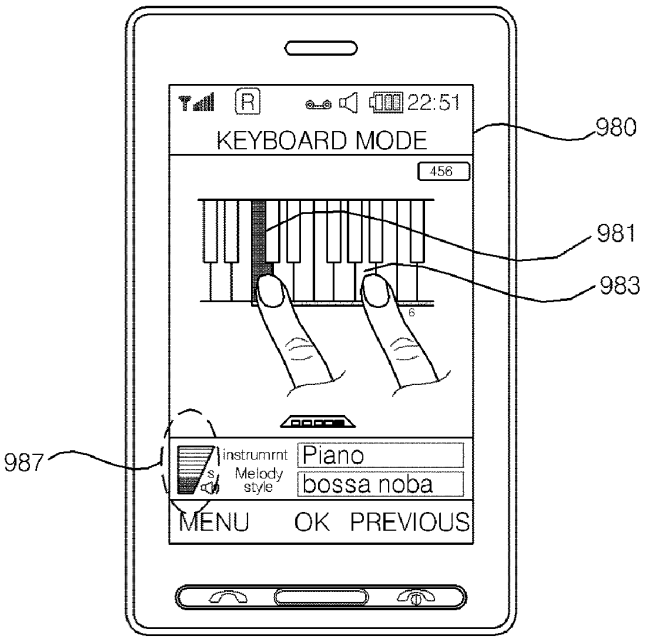


FIG. 1

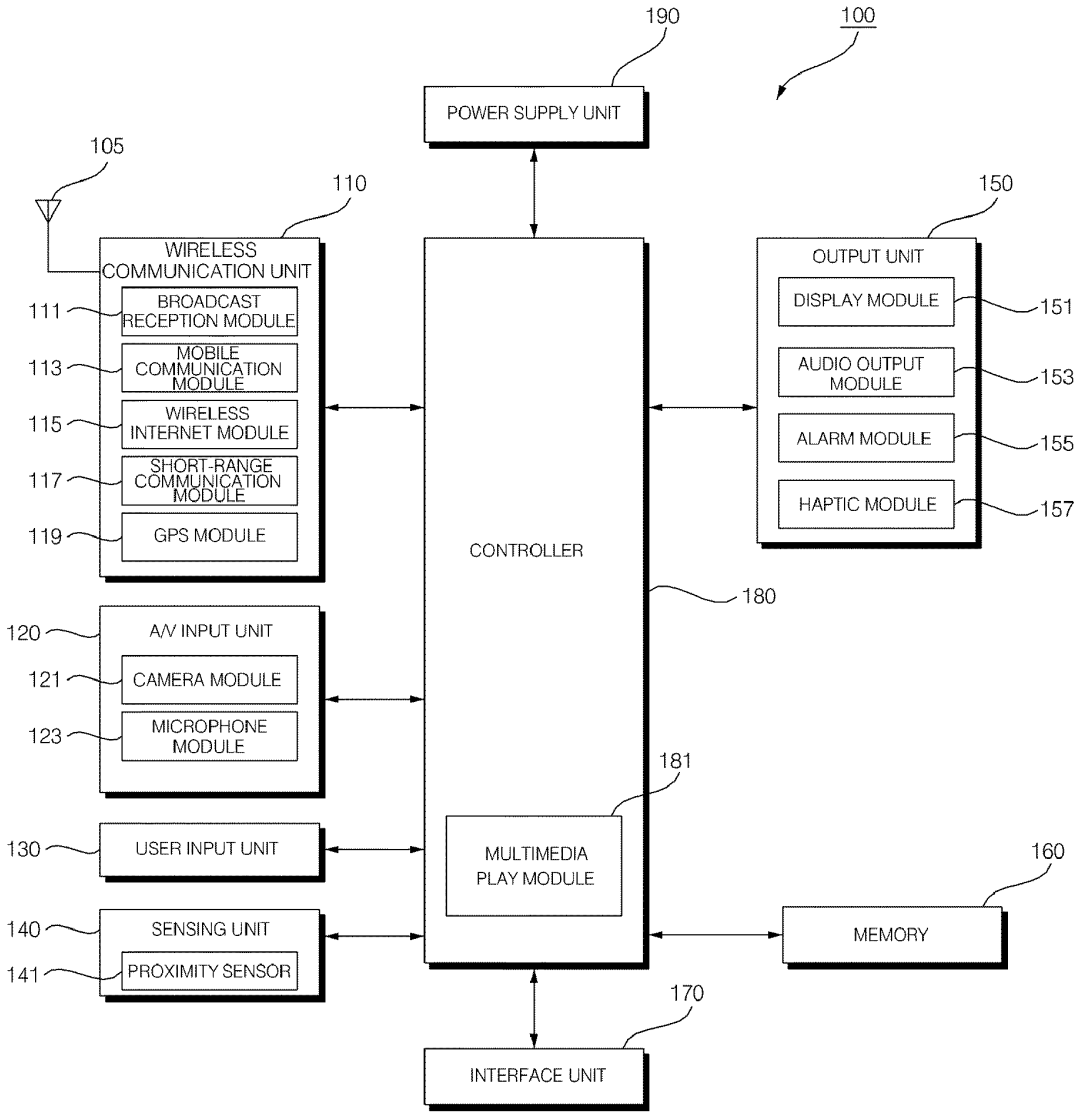

190
100
POWER SUPPLY UNIT
105
110
150
WIRELESS COMMUNICATION UNIT
111
BROADCAST RECEPTION MODULE
113
MOBILE COMMUNICATION MODULE
115
WIRELESS INTERNET MODULE
117
SHORT-RANGE COMMUNICATION MODULE
119
GPS MODULE
CONTROLLER
OUTPUT UNIT
DISPLAY MODULE
151
AUDIO OUTPUT MODULE
153
ALARM MODULE
155
HAPTIC MODULE
157
180
120
A/V INPUT UNIT
121
CAMERA MODULE
123
MICROPHONE MODULE
181
130
USER INPUT UNIT
MULTIMEDIA PLAY MODULE
160
140
SENSING UNIT
141
PROXIMITY SENSOR
MEMORY
170
INTERFACE UNIT

FIG. 2

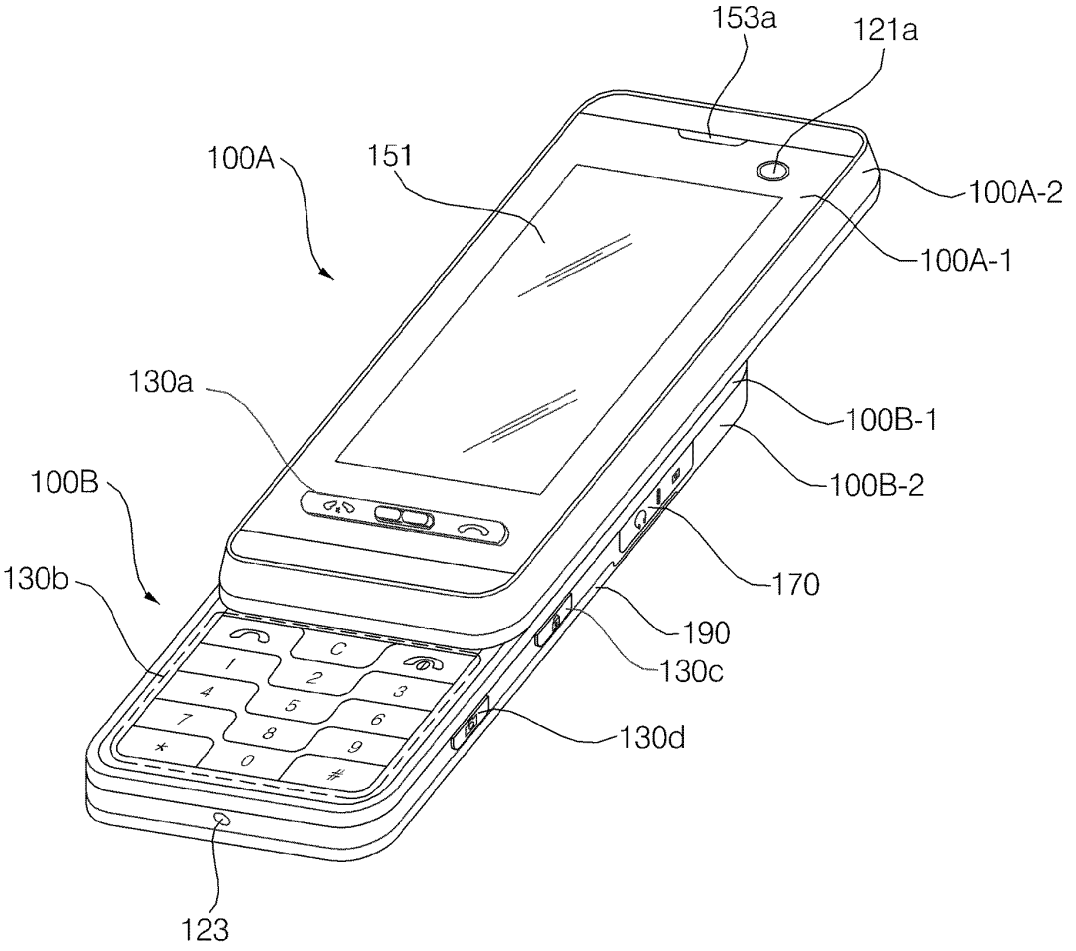

153a
121a
100A
151
100A-2
100A-1
130a
100B-1
100B
100B-2
130b
170
190
130c
130d
123

FIG. 3

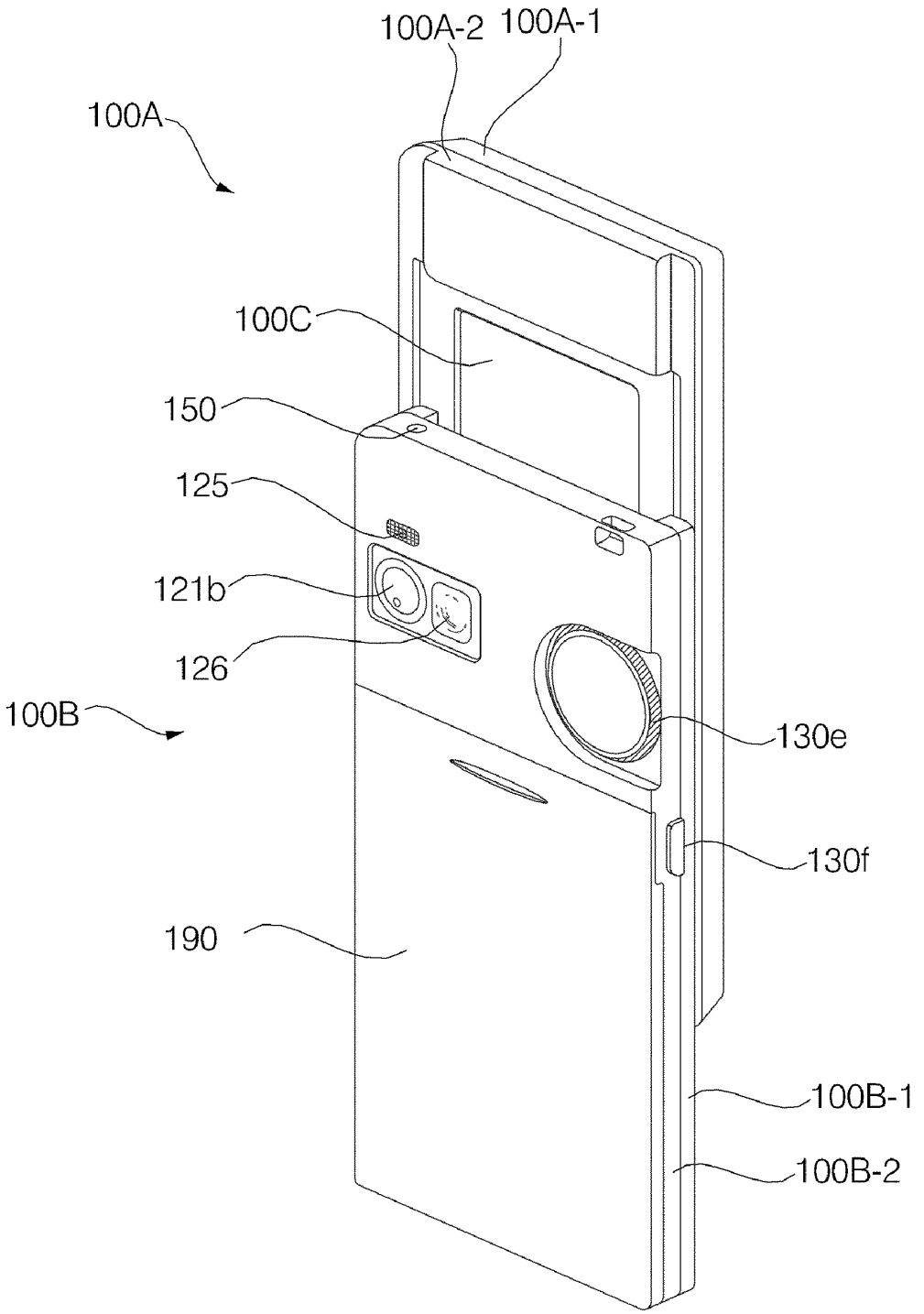

100A-2
100A-1
100A
100C
150
125
121b
126
100B
130e
130f
190
100B-1
100B-2

FIG. 4

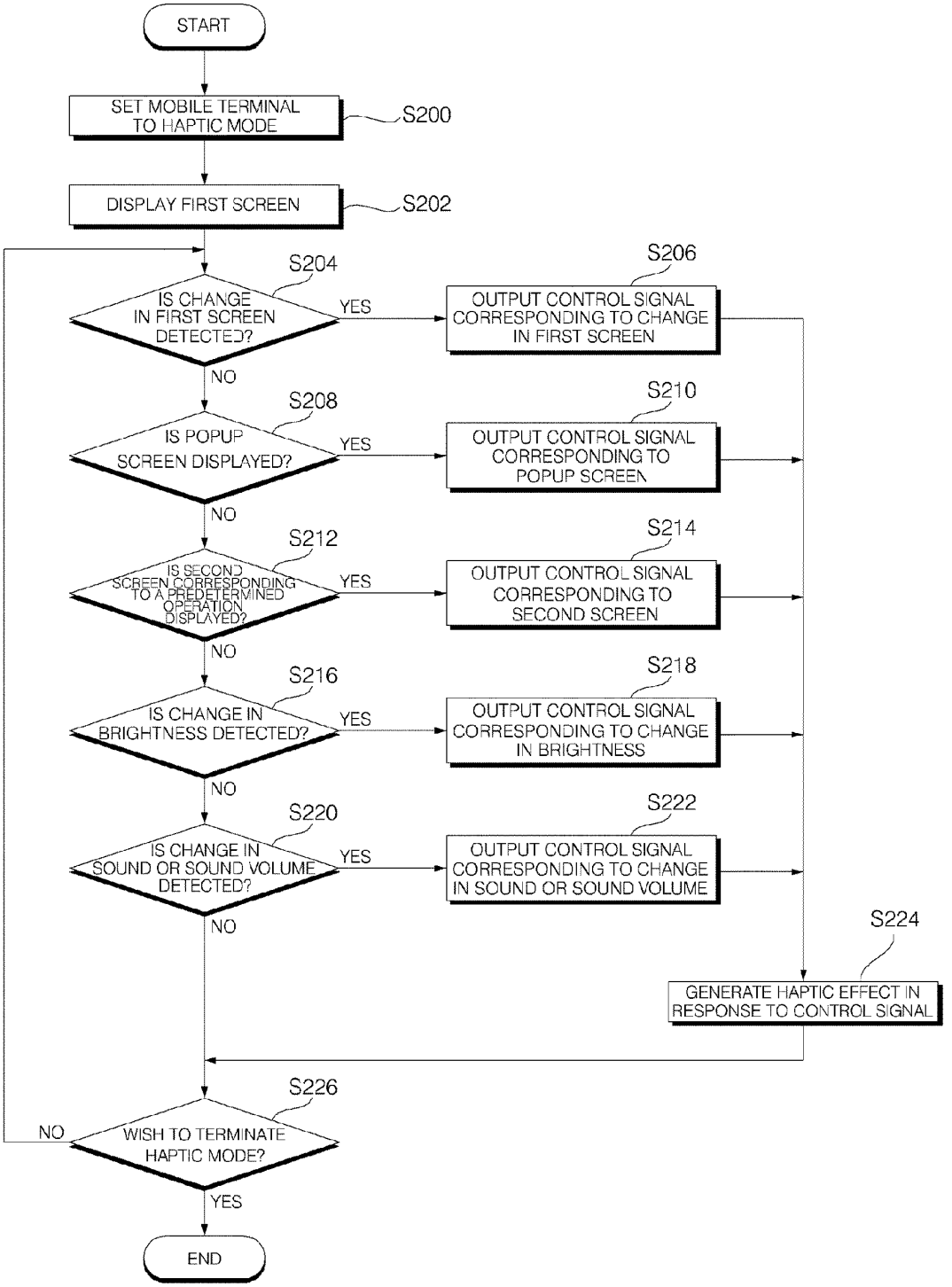

START
SET MOBILE TERMINAL TO HAPTIC MODE
S200
DISPLAY FIRST SCREEN
S202
S204
IS CHANGE IN FIRST SCREEN DETECTED?
YES
NO
S206
OUTPUT CONTROL SIGNAL CORRESPONDING TO CHANGE IN FIRST SCREEN
S208
IS POPUP SCREEN DISPLAYED?
YES
NO
S210
OUTPUT CONTROL SIGNAL CORRESPONDING TO POPUP SCREEN
S212
IS SECOND SCREEN CORRESPONDING TO A PREDETERMINED OPERATION DISPLAYED?
YES
NO
S214
OUTPUT CONTROL SIGNAL CORRESPONDING TO SECOND SCREEN
S216
IS CHANGE IN BRIGHTNESS DETECTED?
YES
NO
S218
OUTPUT CONTROL SIGNAL CORRESPONDING TO CHANGE IN BRIGHTNESS
S220
IS CHANGE IN SOUND OR SOUND VOLUME DETECTED?
YES
NO
S222
OUTPUT CONTROL SIGNAL CORRESPONDING TO CHANGE IN SOUND OR SOUND VOLUME
S224
GENERATE HAPTIC EFFECT IN RESPONSE TO CONTROL SIGNAL
S226
WISH TO TERMINATE HAPTIC MODE?
NO
YES
END

FIG. 5

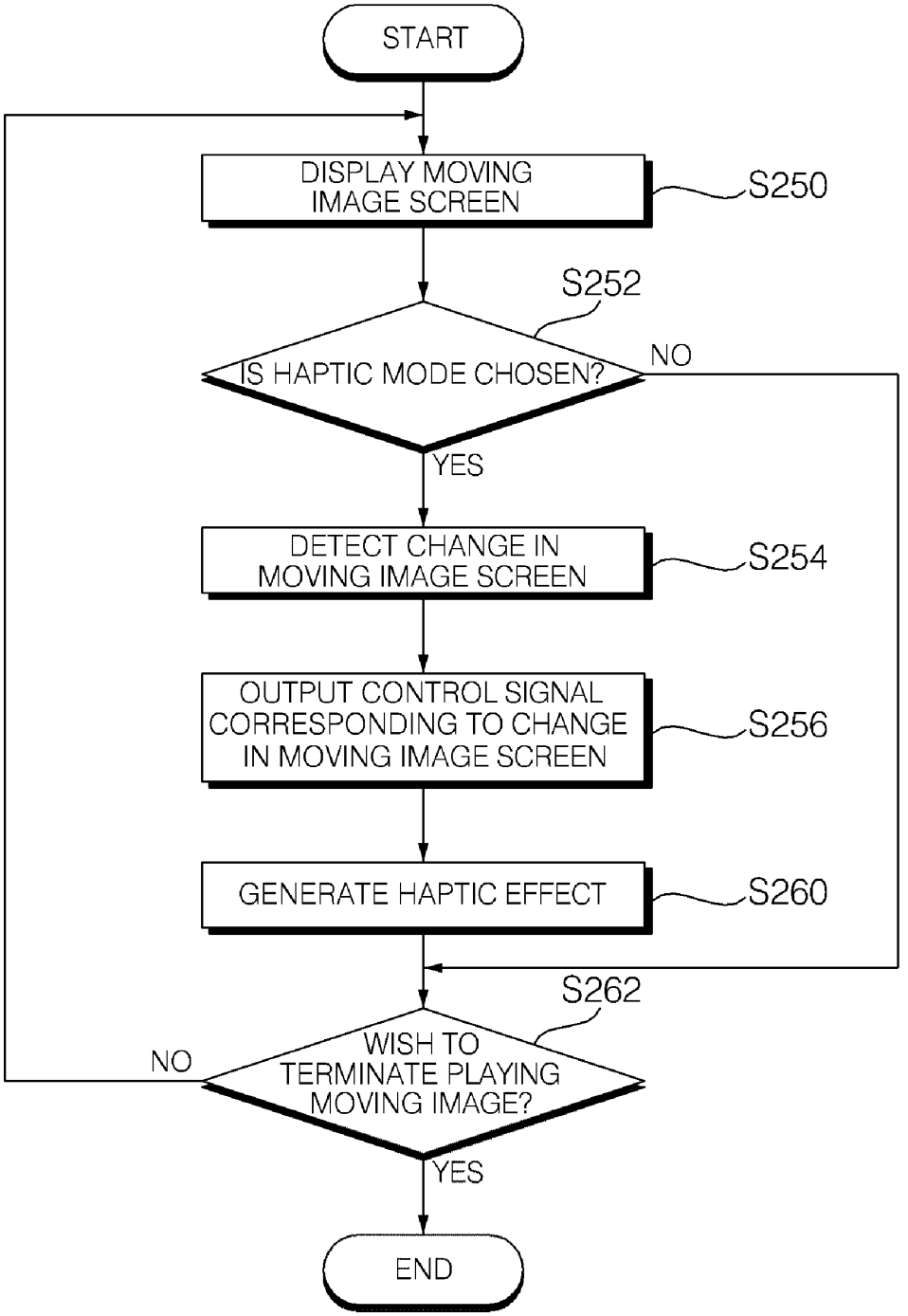

START
DISPLAY MOVING IMAGE SCREEN
S250
S252
IS HAPTIC MODE CHOSEN?
NO
YES
DETECT CHANGE IN MOVING IMAGE SCREEN
S254
OUTPUT CONTROL SIGNAL CORRESPONDING TO CHANGE IN MOVING IMAGE SCREEN
S256
GENERATE HAPTIC EFFECT
S260
S262
WISH TO TERMINATE PLAYING MOVING IMAGE?
NO
YES
END

FIG. 6

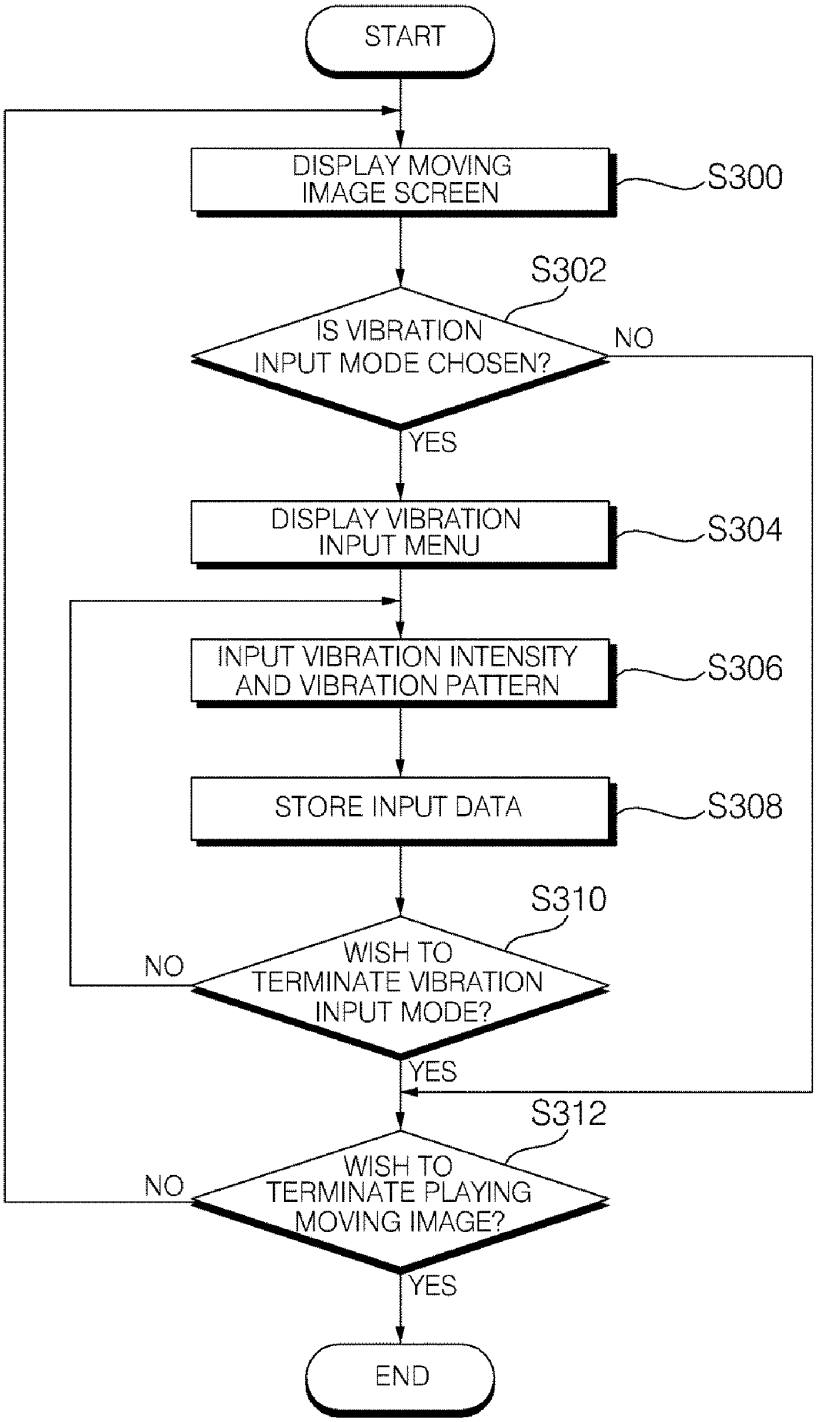

START
DISPLAY MOVING IMAGE SCREEN
S300
S302
IS VIBRATION INPUT MODE CHOSEN?
NO
YES
DISPLAY VIBRATION INPUT MENU
S304
INPUT VIBRATION INTENSITY AND VIBRATION PATTERN
S306
STORE INPUT DATA
S308
S310
WISH TO TERMINATE VIBRATION INPUT MODE?
NO
YES
S312
WISH TO TERMINATE PLAYING MOVING IMAGE?
NO
YES
END

FIG. 7

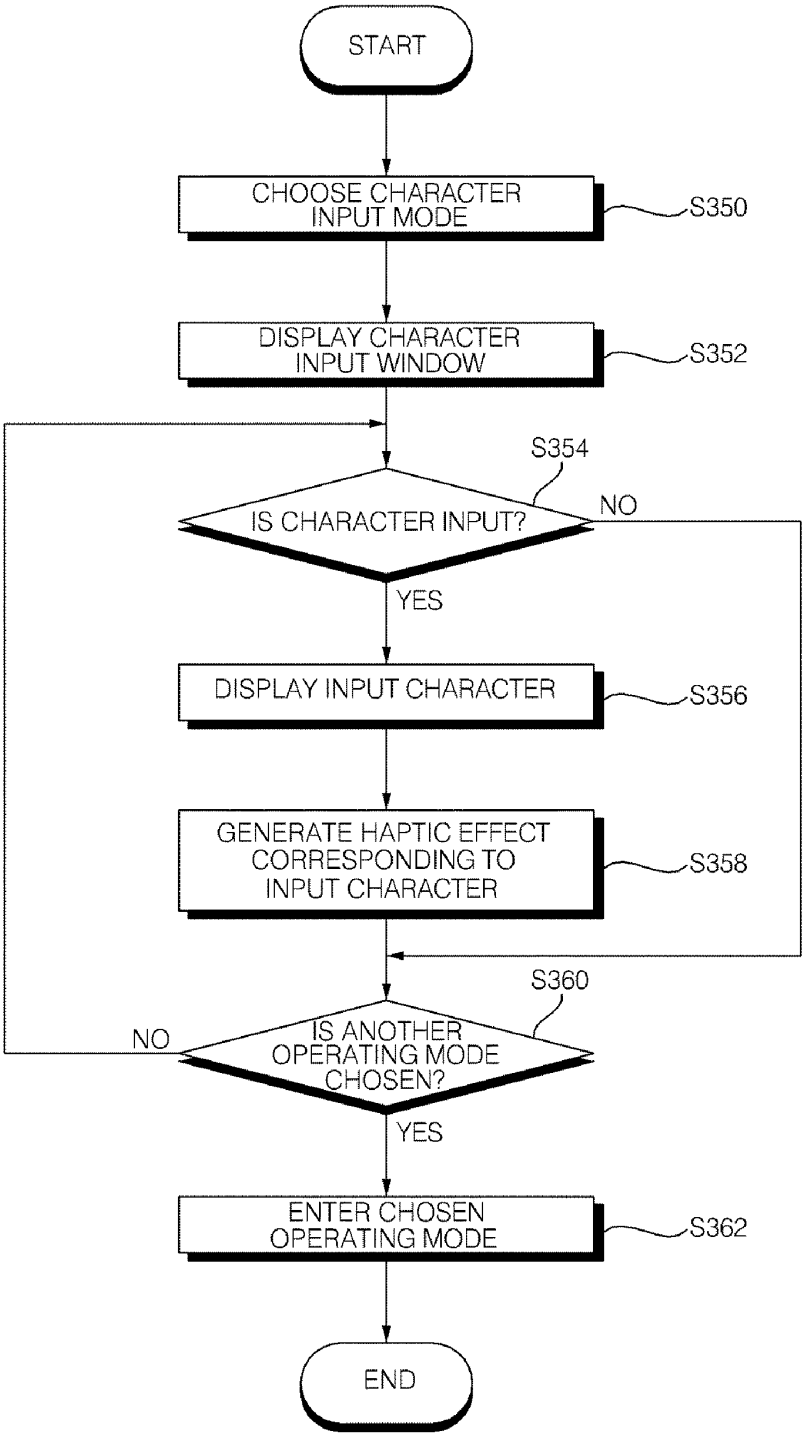

START
CHOOSE CHARACTER INPUT MODE
S350
DISPLAY CHARACTER INPUT WINDOW
S352
S354
IS CHARACTER INPUT?
NO
YES
DISPLAY INPUT CHARACTER
S356
GENERATE HAPTIC EFFECT CORRESPONDING TO INPUT CHARACTER
S358
S360
IS ANOTHER OPERATING MODE CHOSEN?
NO
YES
ENTER CHOSEN OPERATING MODE
S362
END

FIG. 8

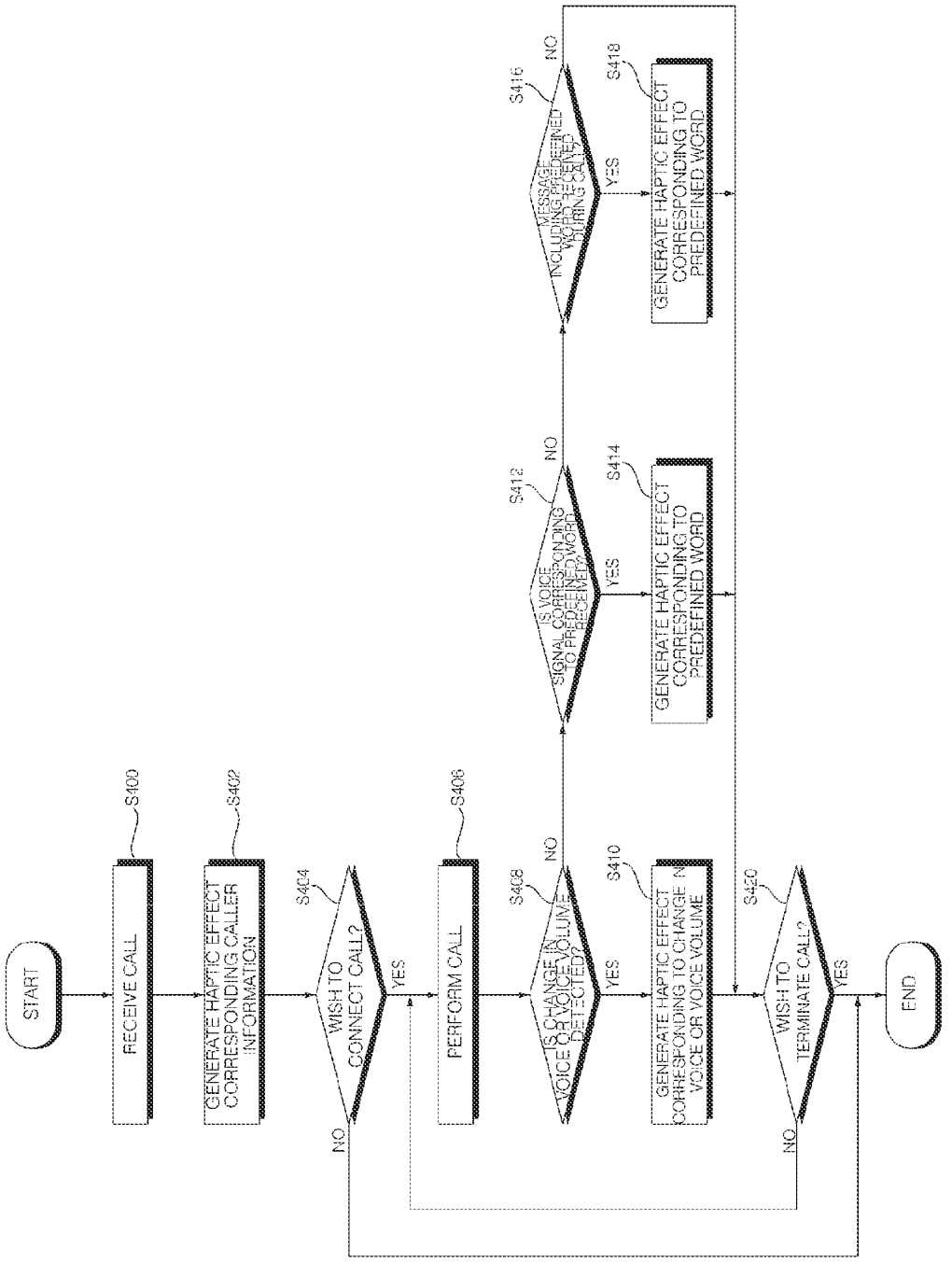

START
RECEIVE CALL
S400
GENERATE HAPTIC EFFECT CORRESPONDING CALLER INFORMATION
S402
S404
WISH TO CONNECT CALL?
YES
NO
PERFORM CALL
S406
S408
IS CHANGE IN VOICE OR VOLUME DETECTED?
YES
NO
S410
GENERATE HAPTIC EFFECT CORRESPONDING TO CHANGE IN VOICE OR VOICE VOLUME
S412
IS VOICE SIGNAL CORRESPONDING TO PREDEFINED WORD RECEIVED?
YES
NO
S414
GENERATE HAPTIC EFFECT CORRESPONDING TO PREDEFINED WORD
S416
MESSAGE INCLUDING PREDEFINED WORD RECEIVED?
YES
NO
S418
GENERATE HAPTIC EFFECT CORRESPONDING TO PREDEFINED WORD
S420
WISH TO TERMINATE CALL?
YES
NO
END

FIG. 9

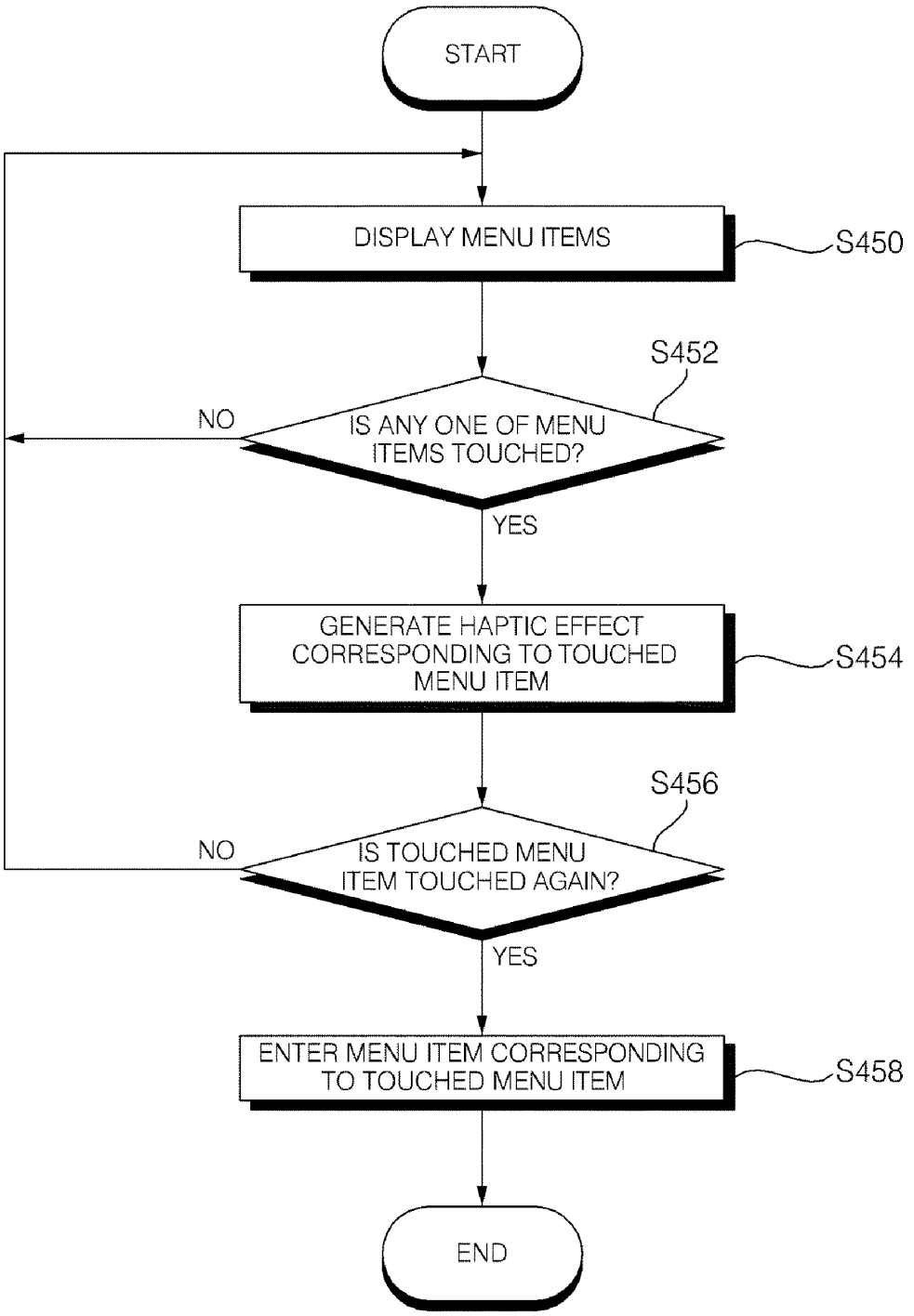

START
DISPLAY MENU ITEMS
S450
S452
IS ANY ONE OF MENU ITEMS TOUCHED?
NO
YES
GENERATE HAPTIC EFFECT CORRESPONDING TO TOUCHED MENU ITEM
S454
S456
IS TOUCHED MENU ITEM TOUCHED AGAIN?
NO
YES
ENTER MENU ITEM CORRESPONDING TO TOUCHED MENU ITEM
S458
END

FIG. 10

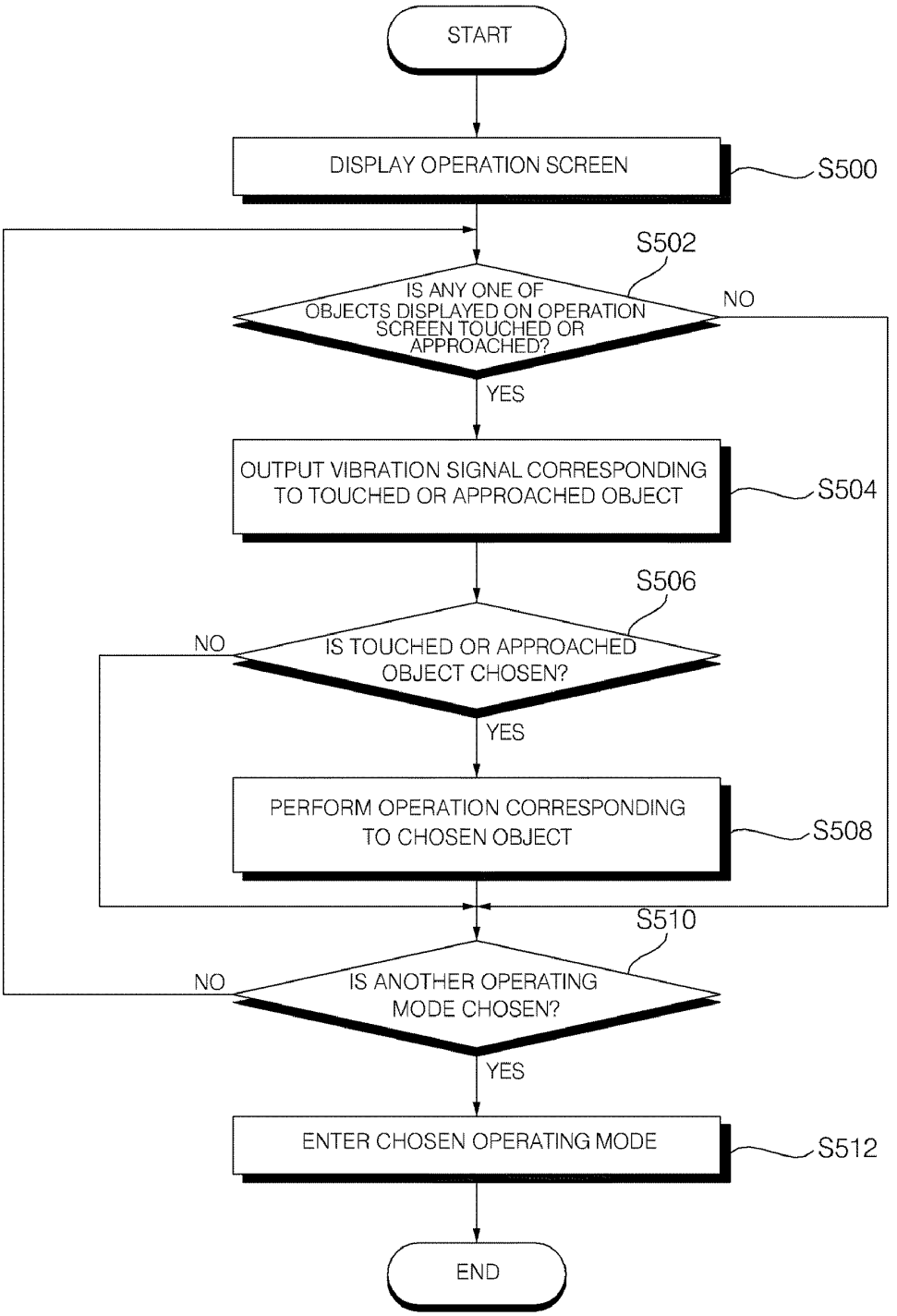

START
DISPLAY OPERATION SCREEN
S500
S502
IS ANY ONE OF OBJECTS DISPLAYED ON OPERATION SCREEN TOUCHED OR APPROACHED?
NO
YES
OUTPUT VIBRATION SIGNAL CORRESPONDING TO TOUCHED OR APPROACHED OBJECT
S504
S506
IS TOUCHED OR APPROACHED OBJECT CHOSEN?
NO
YES
PERFORM OPERATION CORRESPONDING TO CHOSEN OBJECT
S508
S510
IS ANOTHER OPERATING MODE CHOSEN?
NO
YES
ENTER CHOSEN OPERATING MODE
S512
END

FIG. 11

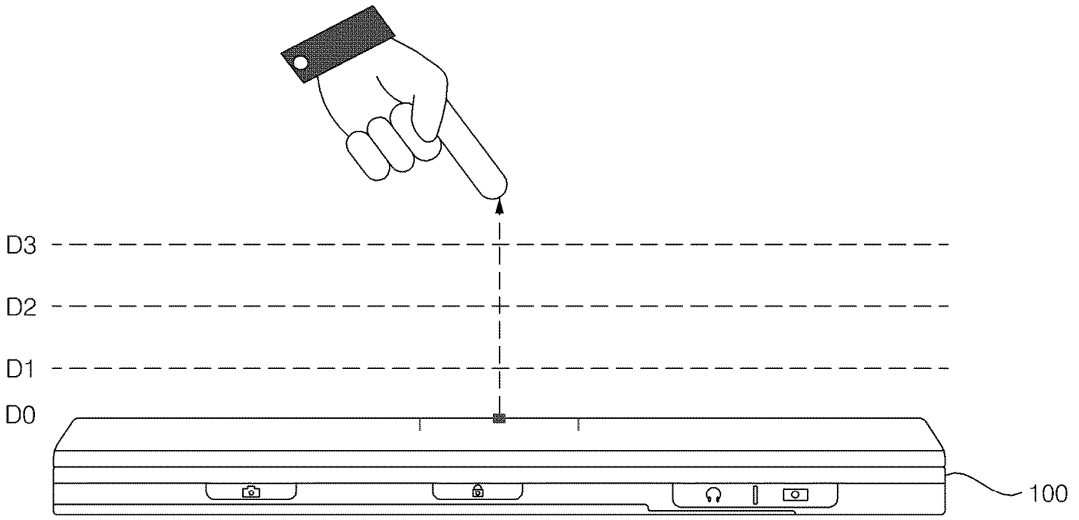


FIG. 12A

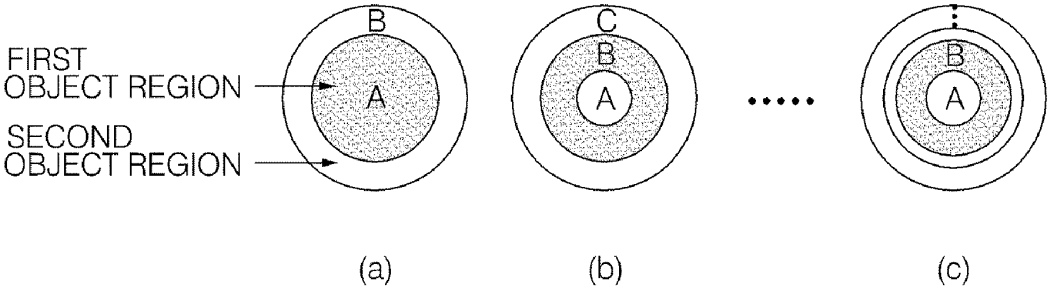


FIG. 12B

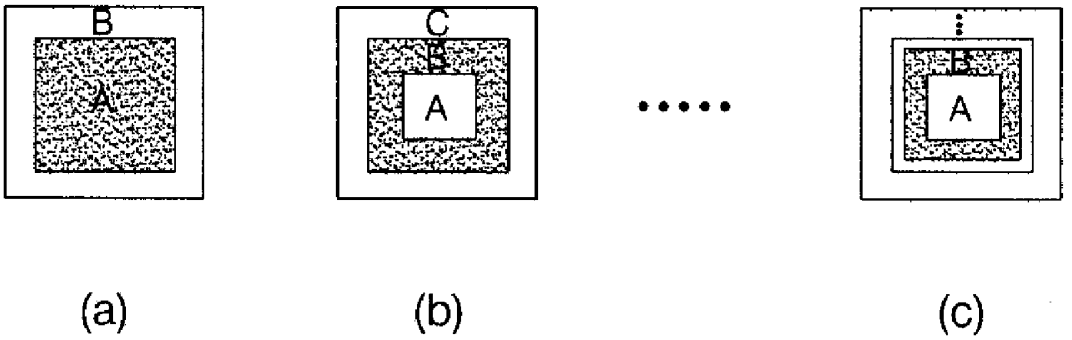


FIG. 12C

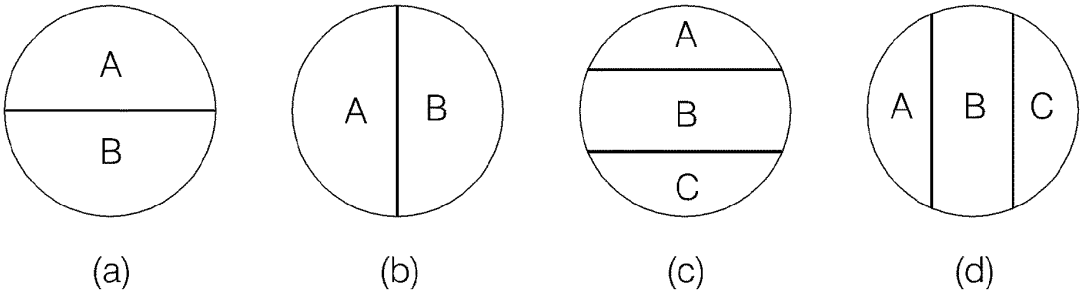


FIG. 12D

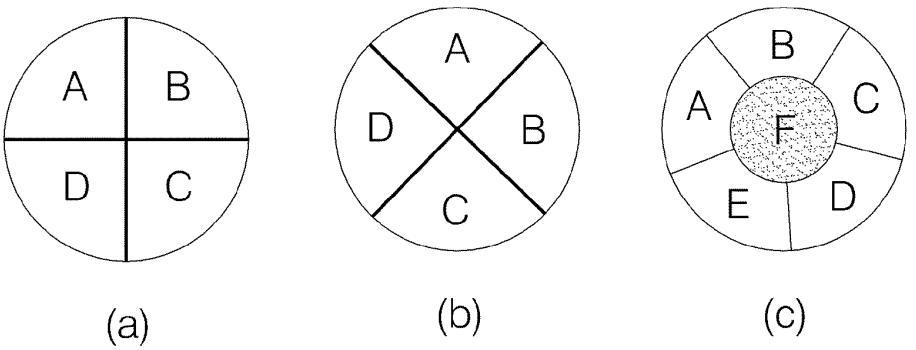


FIG. 13

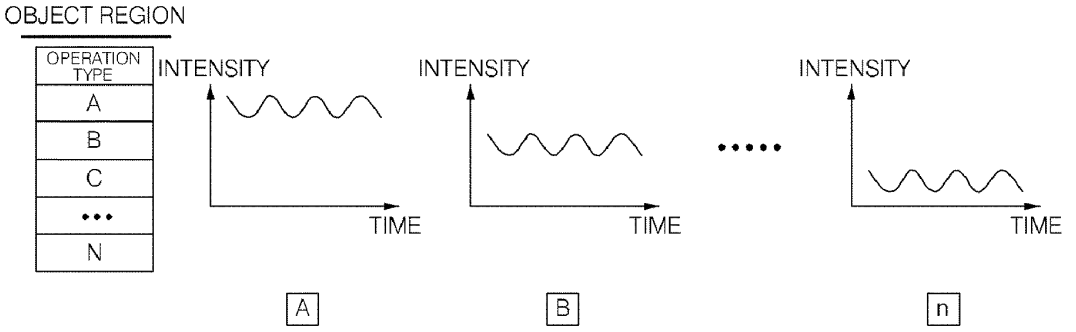

OBJECT REGION
OPERATION TYPE
A
B
C
•••
N
INTENSITY
TIME
INTENSITY
TIME
INTENSITY
TIME
A
B
n

FIG. 14A

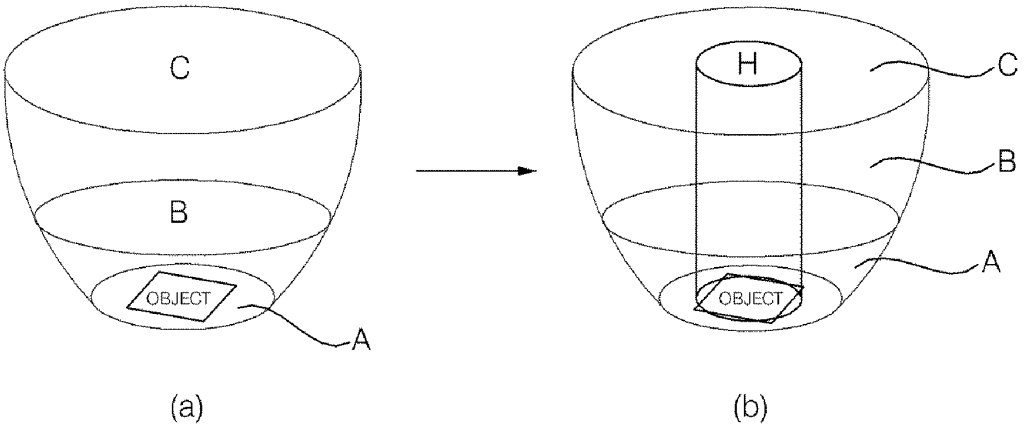


FIG. 14B

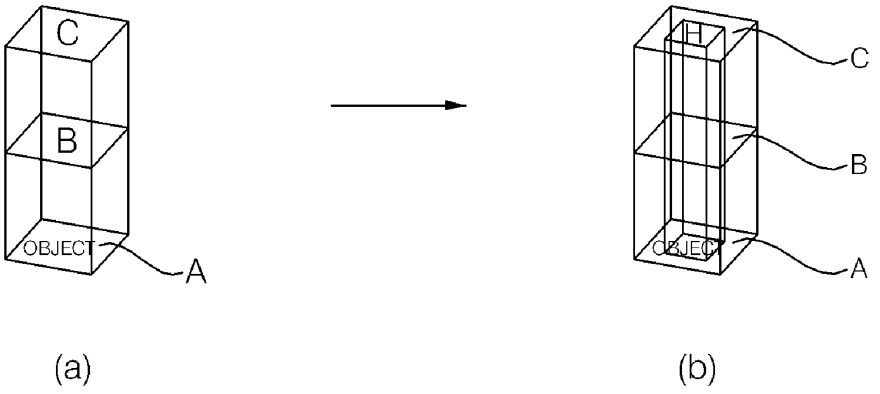


FIG. 15

(a)
BGM
12:34am
(b)
12:34
(c)
13:34
(d)
12:34
(e)
12:34
(f)
12:34am
(g)
12:34am
(h)
12:34am

FIG. 16

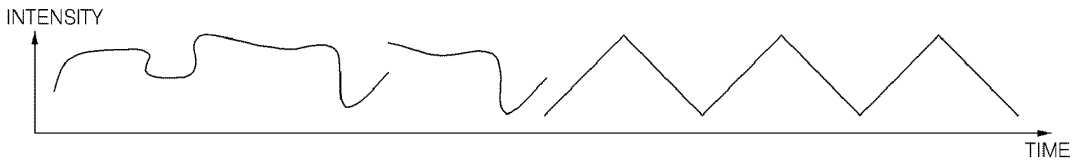

INTENSITY
TIME

FIG. 17

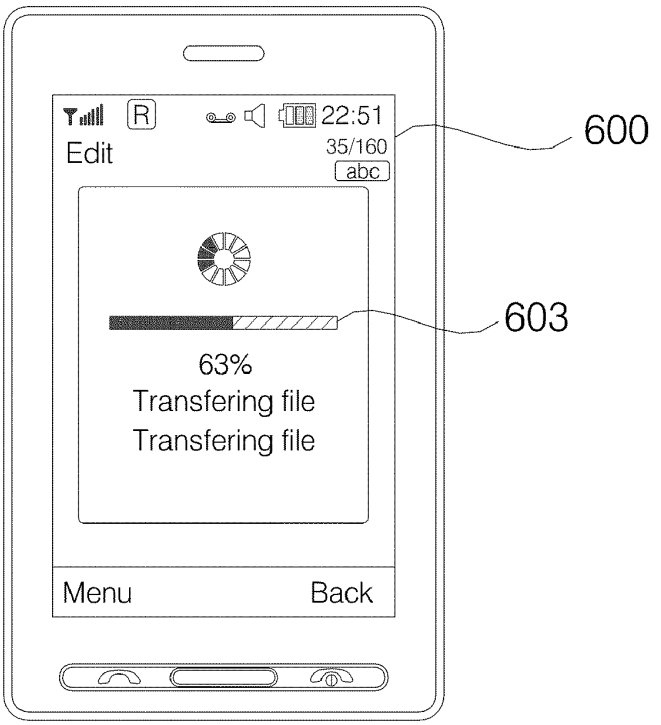

22:51
Edit
35/160
abc
600
603
63%
Transfering file
Transfering file
Menu
Back

FIG. 18

TYPES OF OPERATION

OPERATION TYPE
CONNECTING CALL
CONNECTING BLUETOOTH
RECEIVING FILE
SENDING FILE
•••

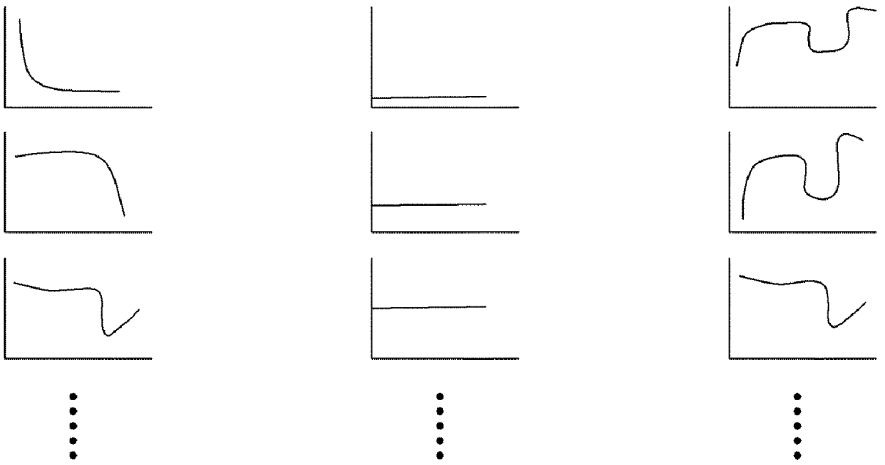
SEEPD OF CHANGE OF AN IMAGE

OPERATION TYPE
1
2
3
4
•••

RATE OF CHANGE OF AN IMAGE

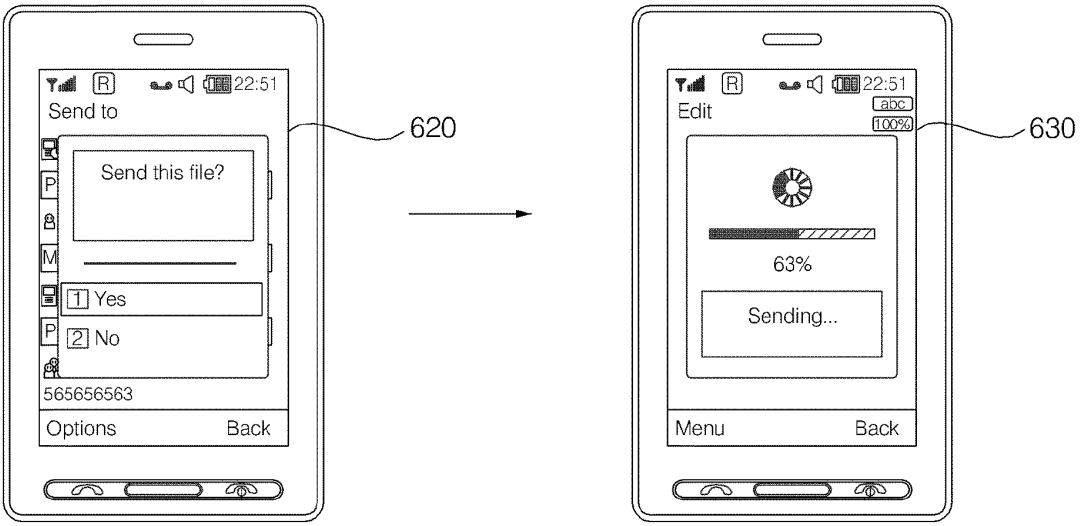
OPERATION TYPE
10%
20%
30%
40%
•••

•••••



(a) (b) (c)

FIG. 19


22:51
Send to
Send this file?
1 Yes
2 No
565656563
Options
Back
620
22:51
Edit
abc
100%
63%
Sending...
Menu
Back
630

(a) (b)

FIG. 20

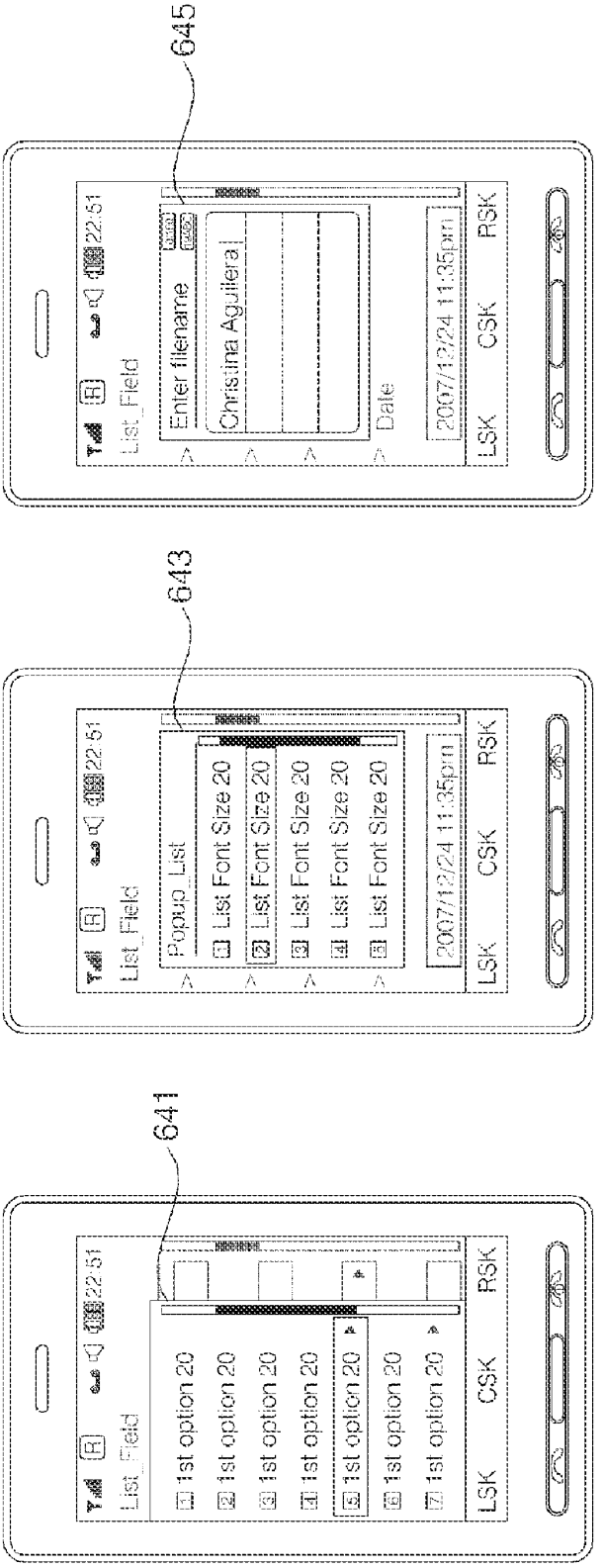

641
643
645
List_Field
22:51
1st option 20
2nd option 20
3rd option 20
4th option 20
5th option 20
6th option 20
7th option 20
LSK
CSK
RSK
Popup_List
List Font Size 20
2007/12/24 11:35pm
Enter filename
Christina Aguilera
Date
(a)
(b)
(c)

FIG. 21

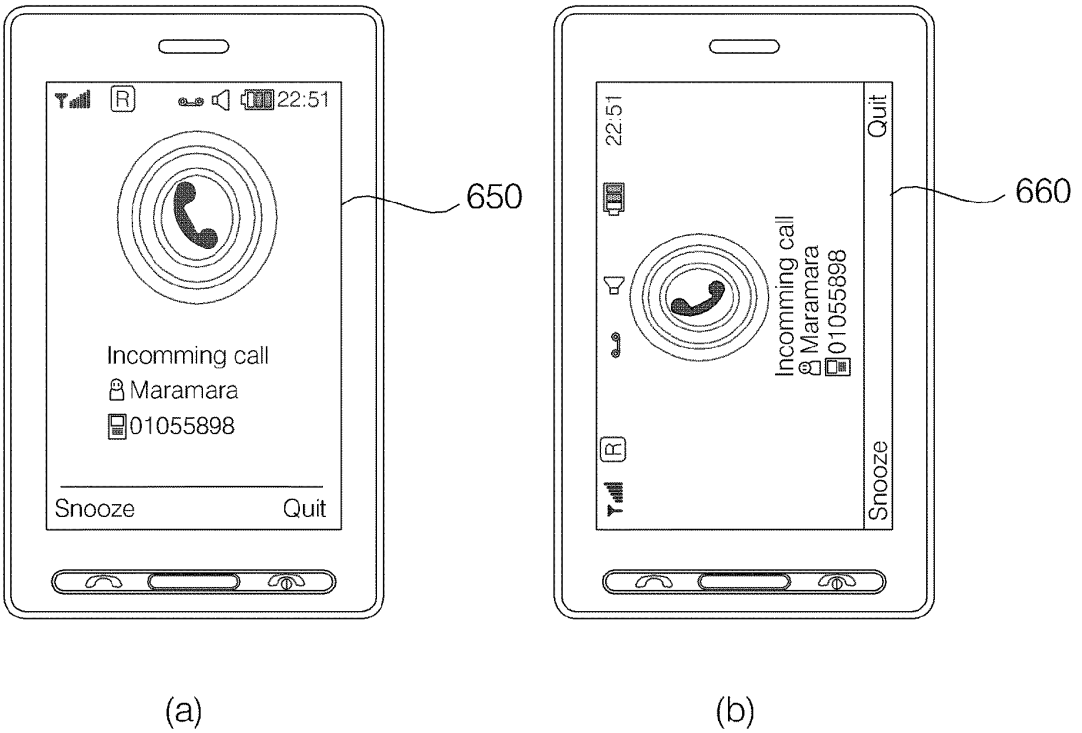

22:51
Incomming call
Maramara
01055898
Snooze
Quit
650
(a)
22:51
Incomming call
Maramara
01055898
Snooze
Quit
660
(b)

FIG. 22

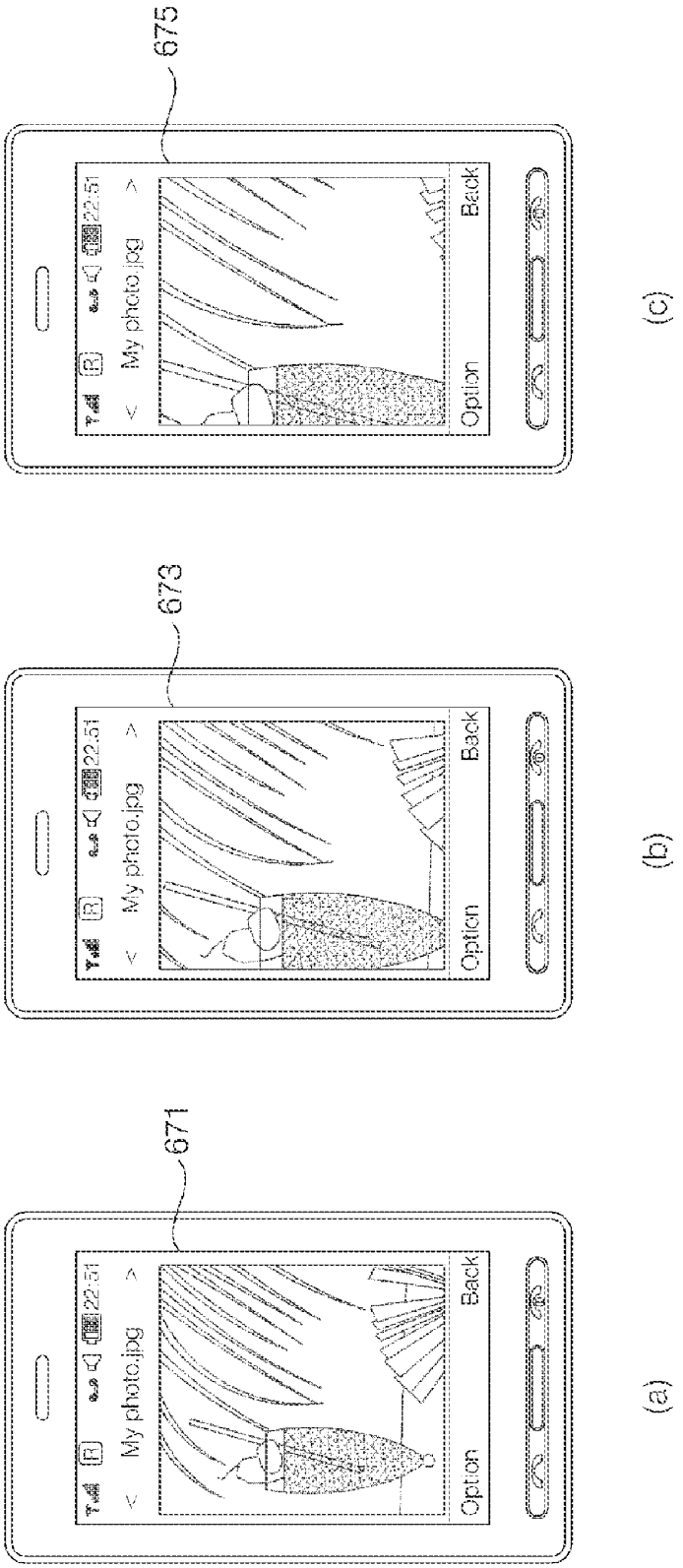


FIG. 23

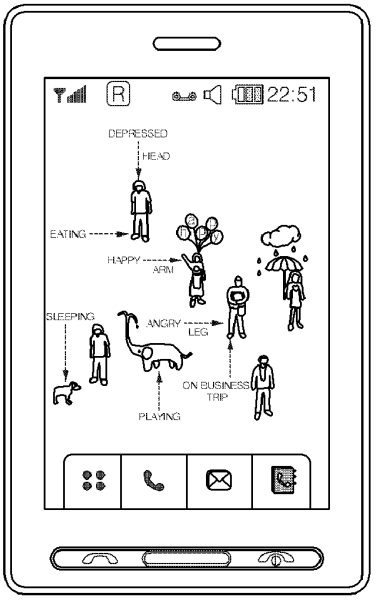

22:51
DEPRESSED
HEAD
EATING
HAPPY
ARM
SLEEPING
ANGRY
LEG
ON BUSINESS TRIP
PLAYING

FIG. 24

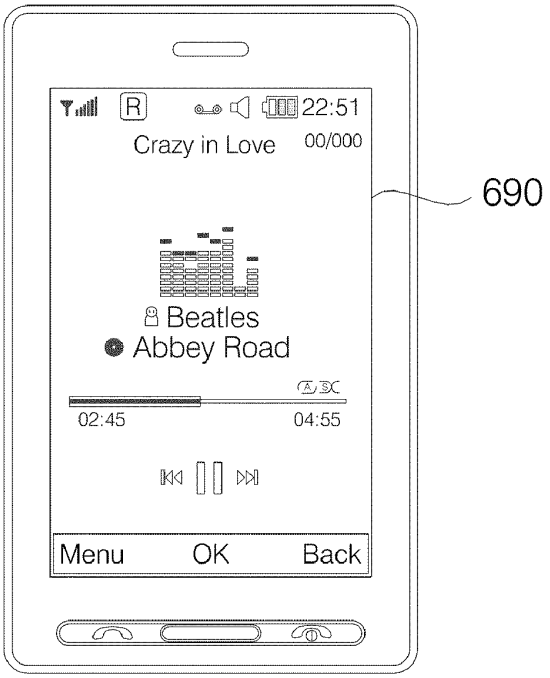

22:51
Crazy in Love
00/000
690
Beatles
Abbey Road
02:45
04:55
Menu
OK
Back

FIG. 25

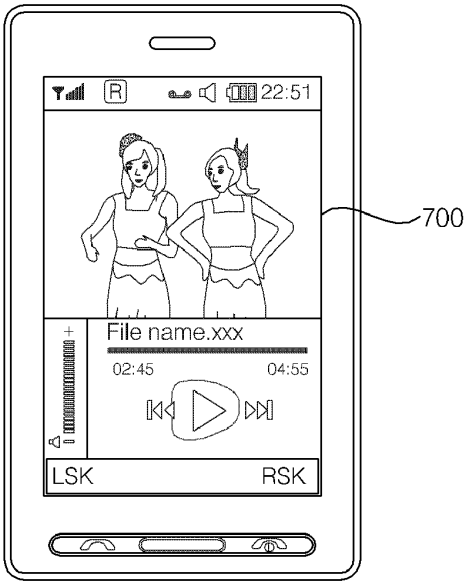


FIG. 26

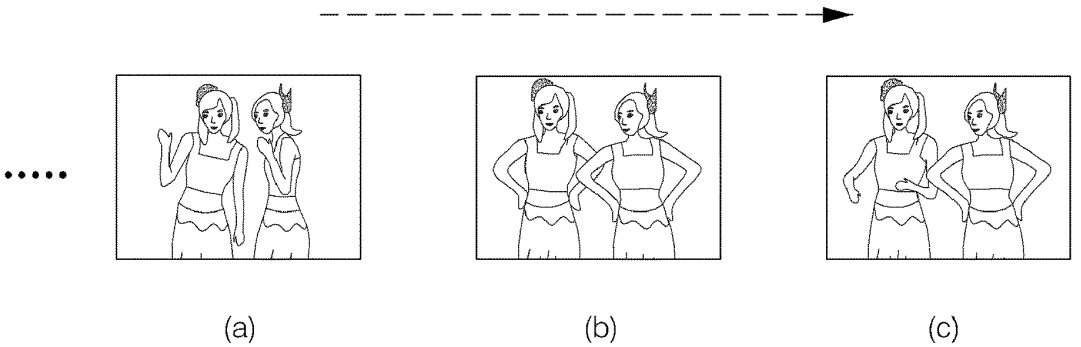
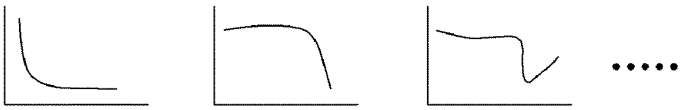


FIG. 27

RATE OF CHANGE

CLASSIFY
10%
20%
30%
40%
•••



OBJECT SIZE

CLASSIFY
1/N
2/N
3/N
4/N
•••

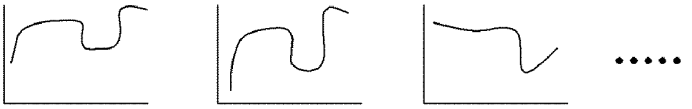


FIG. 28

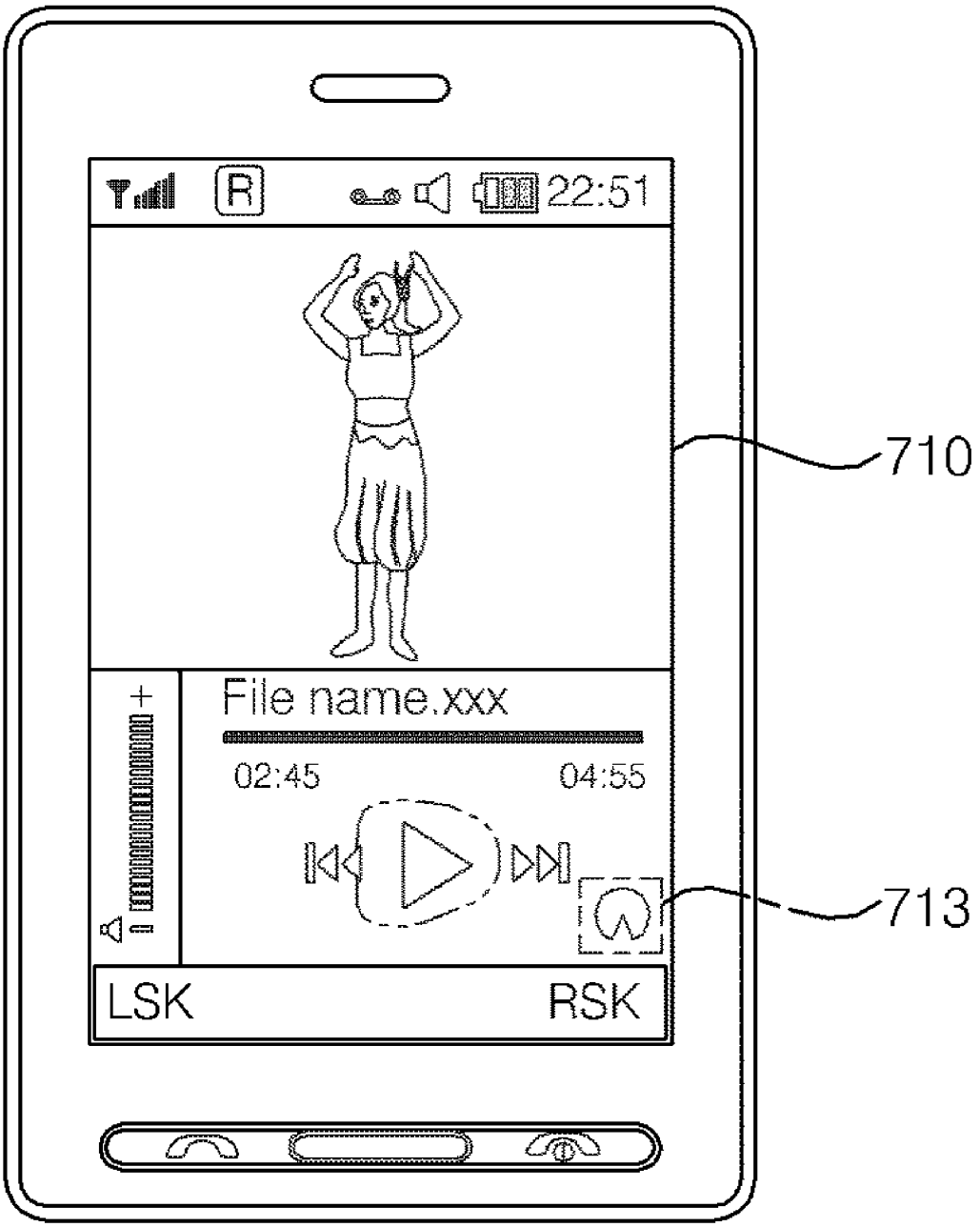


FIG. 29

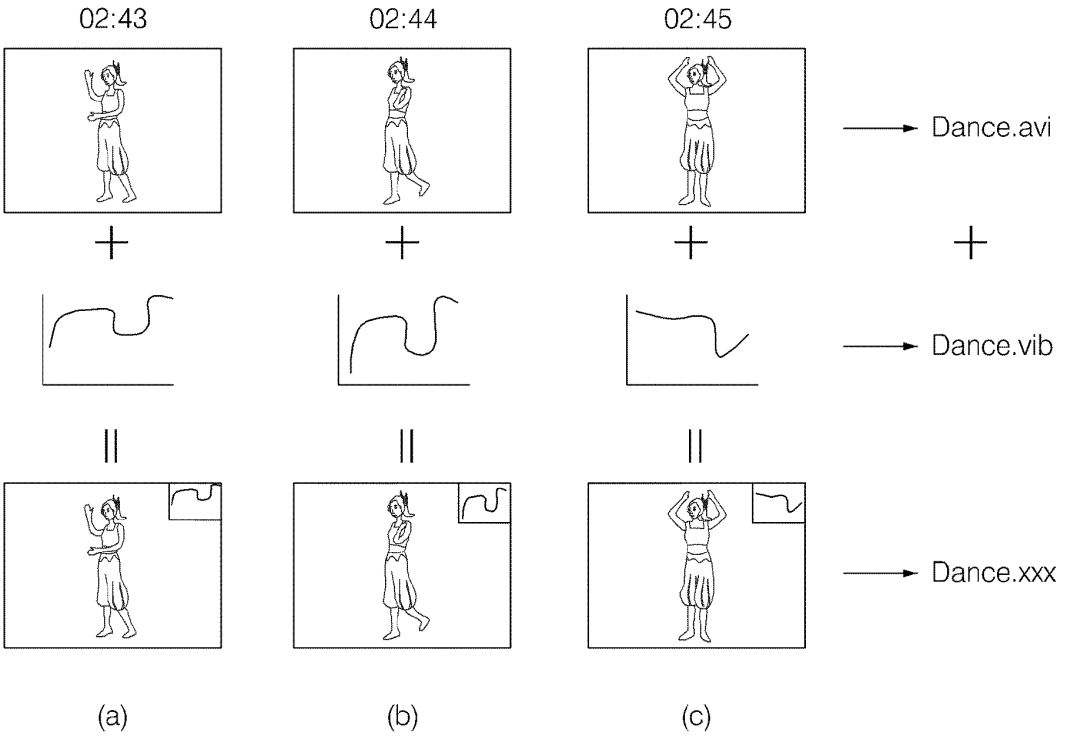


FIG. 30

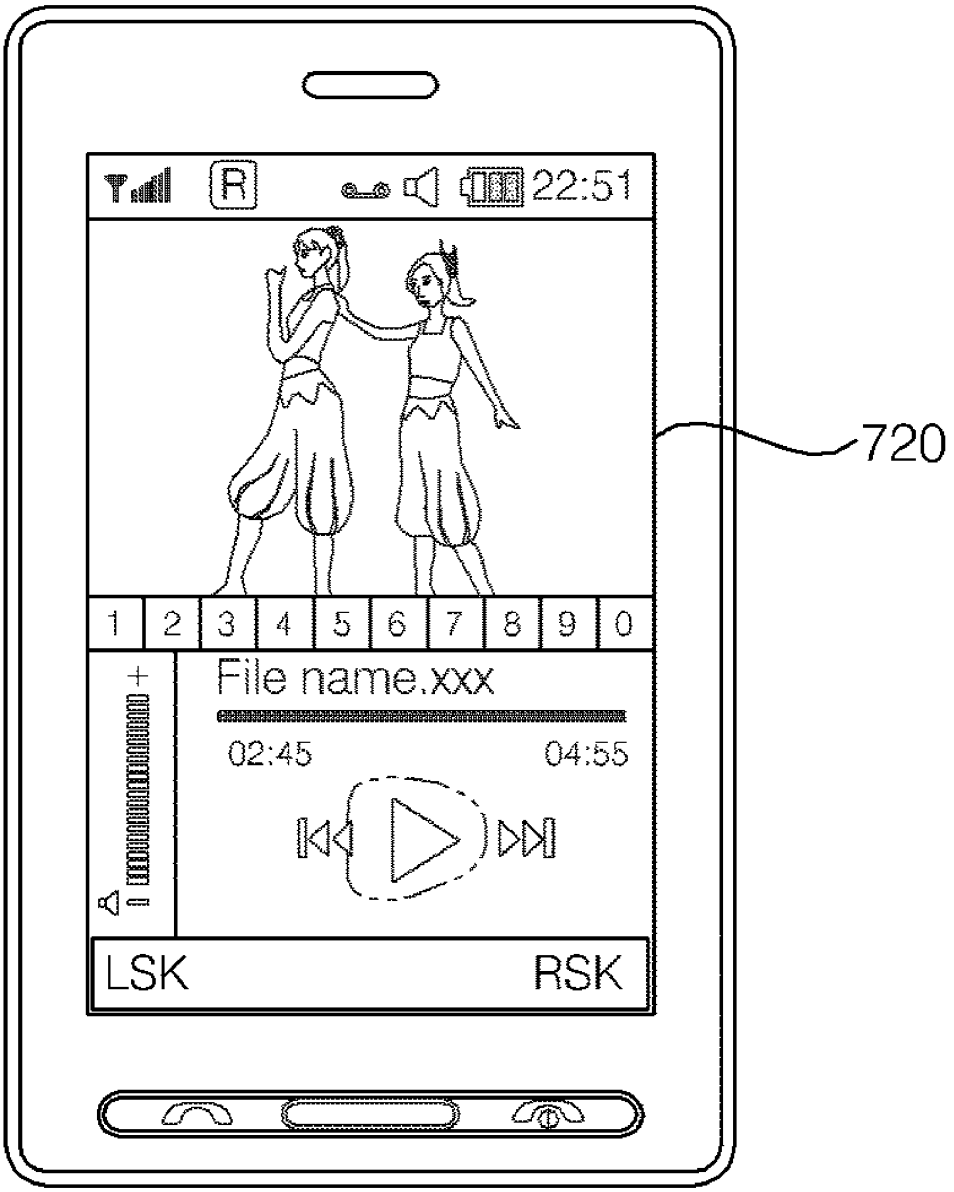


FIG. 31

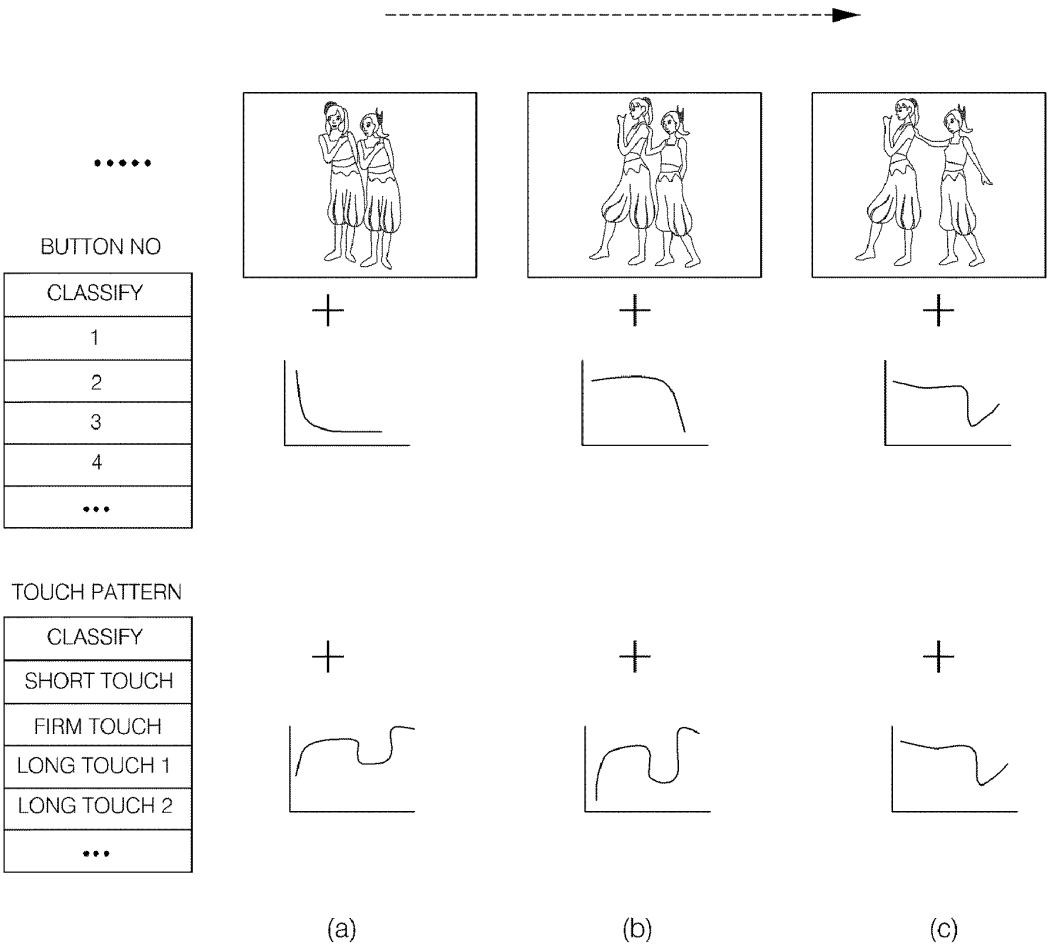

BUTTON NO
CLASSIFY
1
2
3
4
TOUCH PATTERN
CLASSIFY
SHORT TOUCH
FIRM TOUCH
LONG TOUCH 1
LONG TOUCH 2
(a)
(b)
(c)

FIG. 32

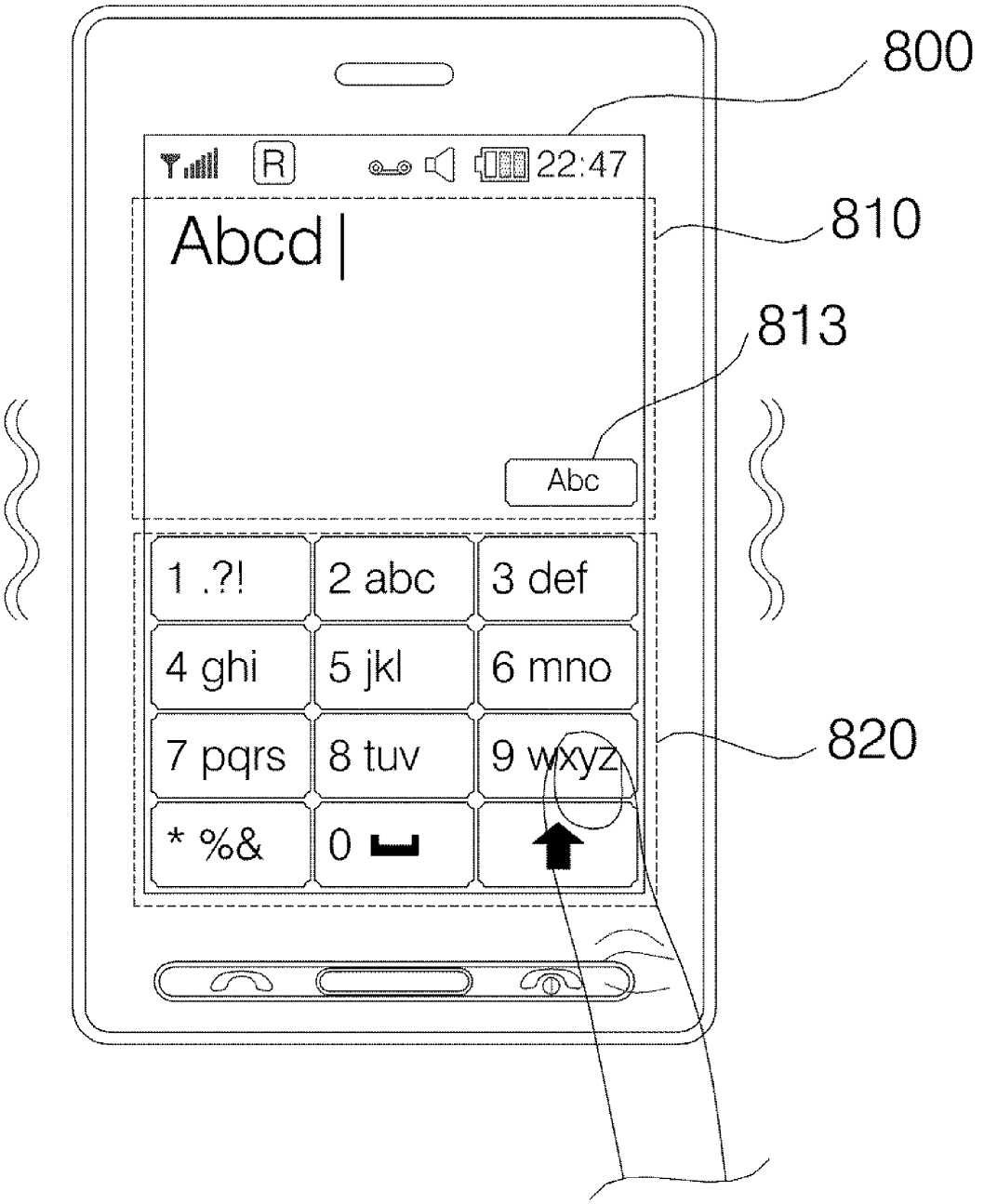

800
22:47
Abcd
810
813
Abc
1 .?!
2 abc
3 def
4 ghi
5 jkl
6 mno
7 pqrs
8 tuv
9 wxyz
* %&
0
820

FIG. 33

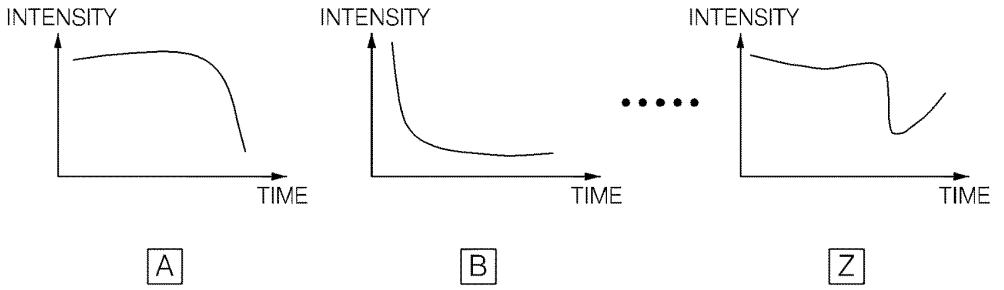

INTENSITY
TIME
A
INTENSITY
TIME
B
INTENSITY
TIME
Z

FIG. 34

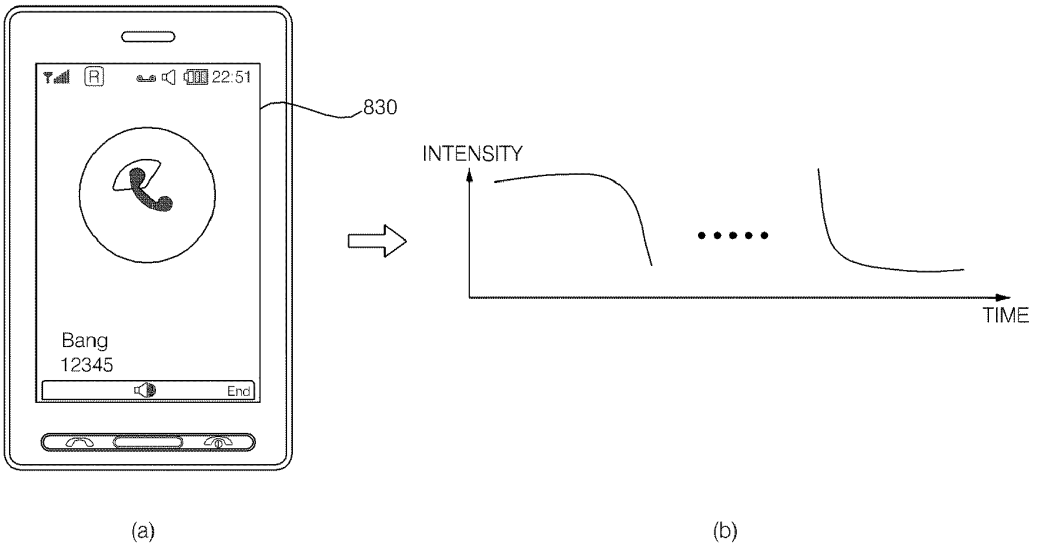

22:51
Bang
12345
End
830
INTENSITY
TIME
(a)
(b)

FIG. 35

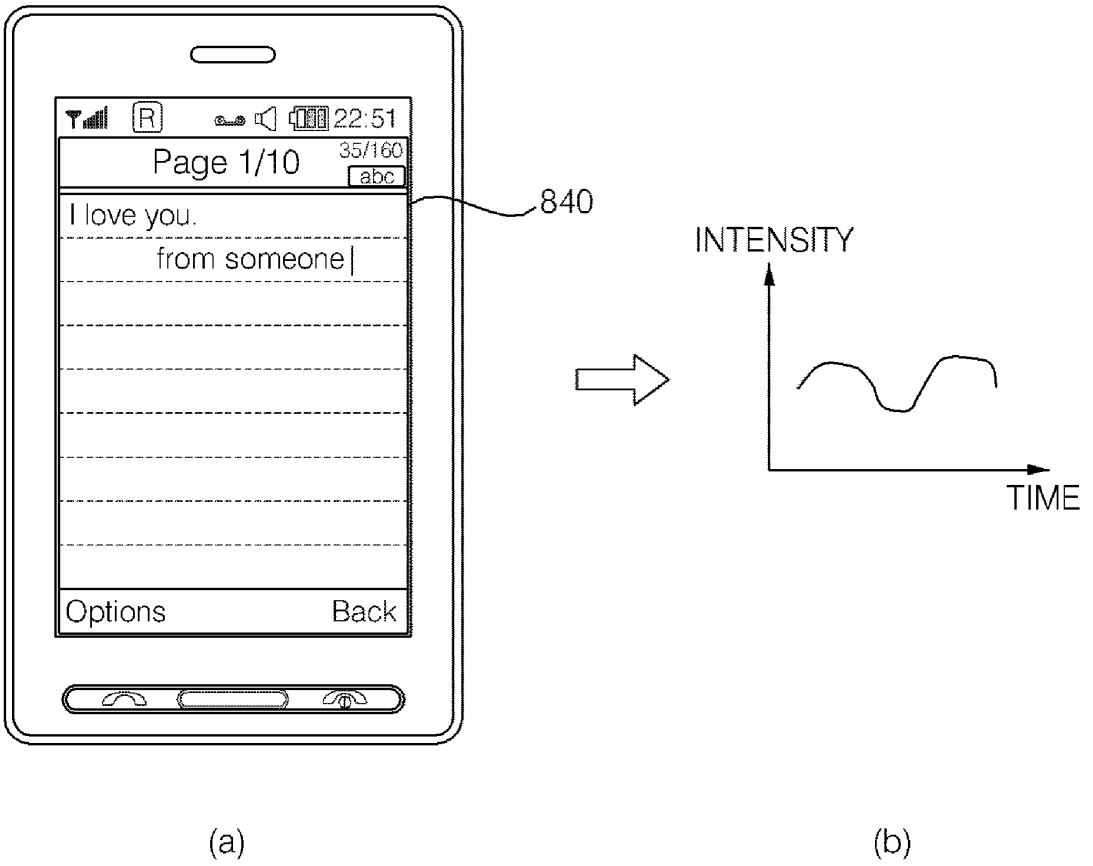
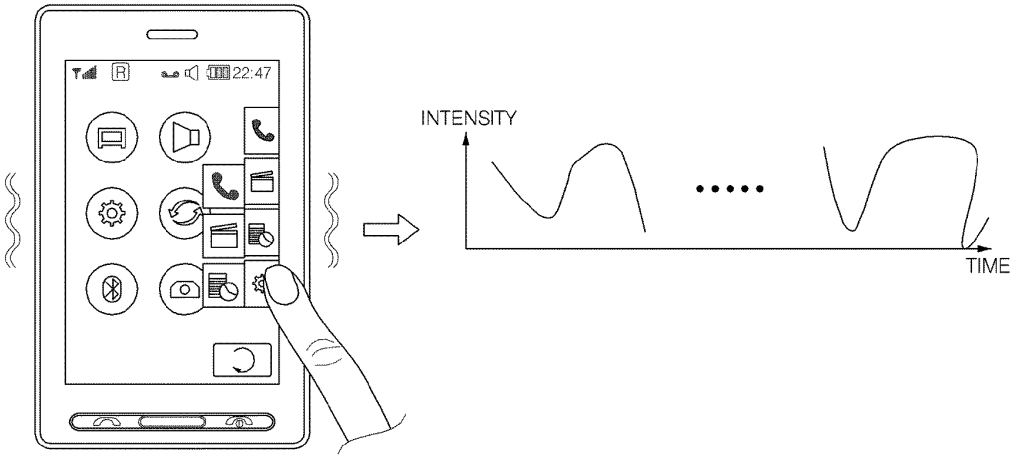
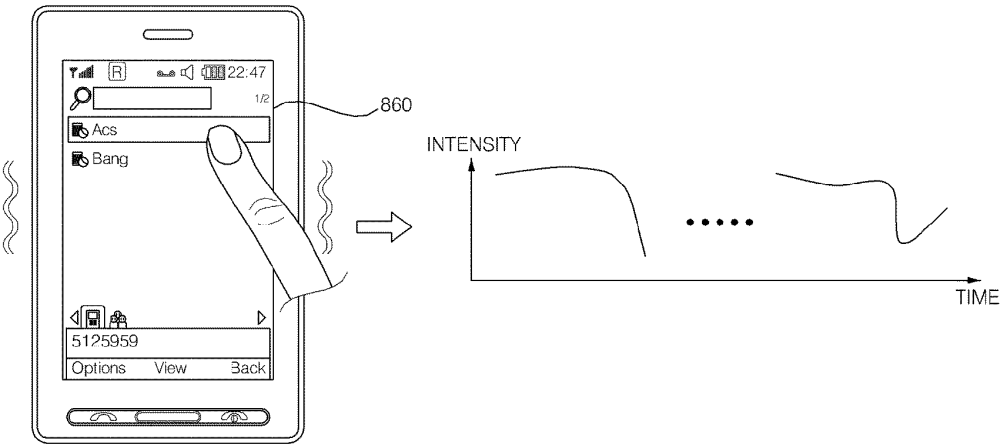

22:51
Page 1/10
35/160
abc
I love you.
from someone
Options
Back
840
INTENSITY
TIME
(a)
(b)

FIG. 36



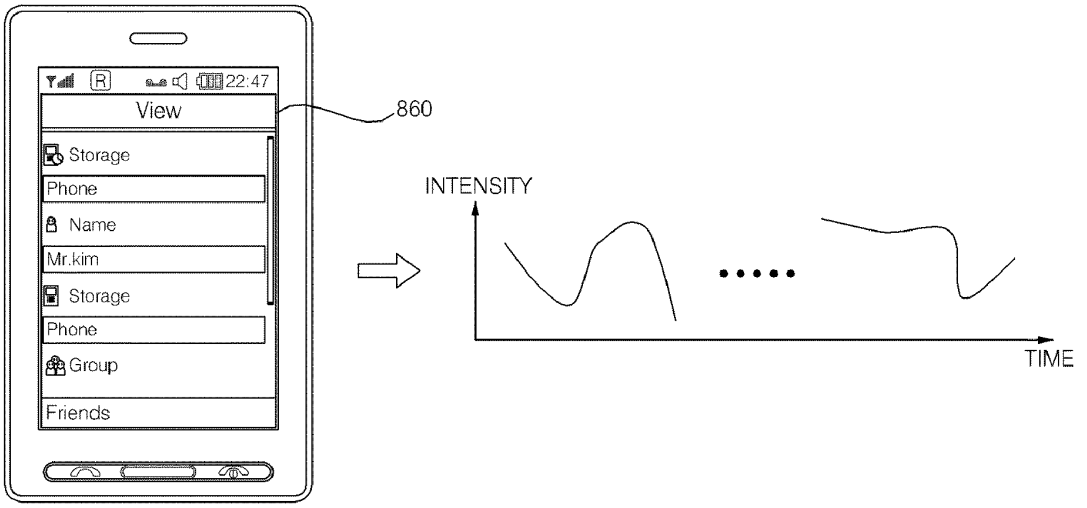
(a) (b)

FIG. 37



(a) (b)

FIG. 38


22:47
View
860
Storage
Phone
Name
Mr.kim
Storage
Phone
Group
Friends
INTENSITY
TIME

(a) (b)

FIG. 39

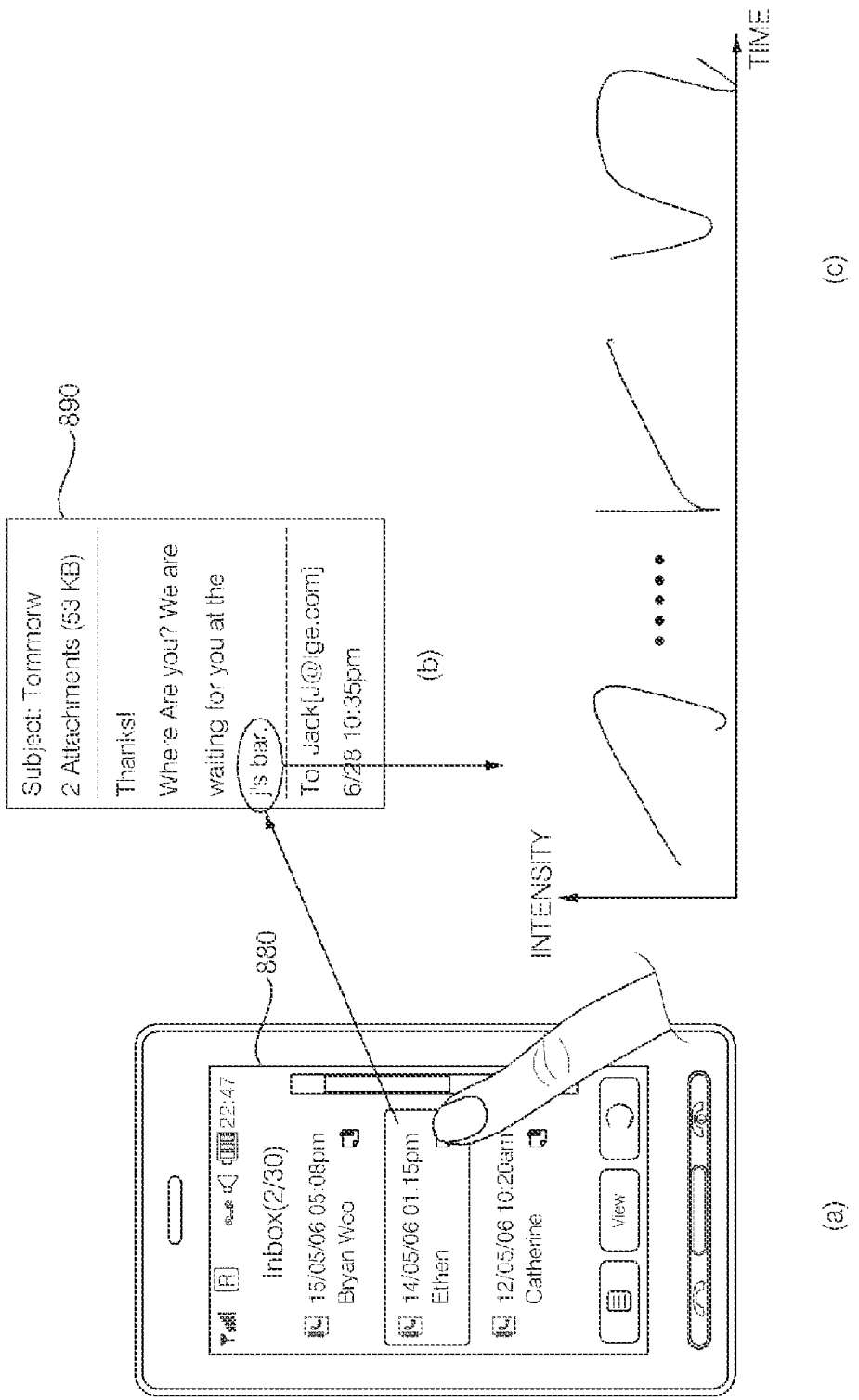

890
Subject: Tommorw
2 Attachments (53 KB)
Thanks!
Where Are you? We are
waiting for you at the
jis bar.
To: Jack[u@ge.com]
6/28 10:35pm
(b)
880
22:47
Inbox(2/30)
15/05/06 05:08pm
Bryan Woo
14/05/06 01:15pm
Ethen
12/05/06 10:20am
Catherine
view
INTENSITY
TIME
(a)
(c)

FIG. 40

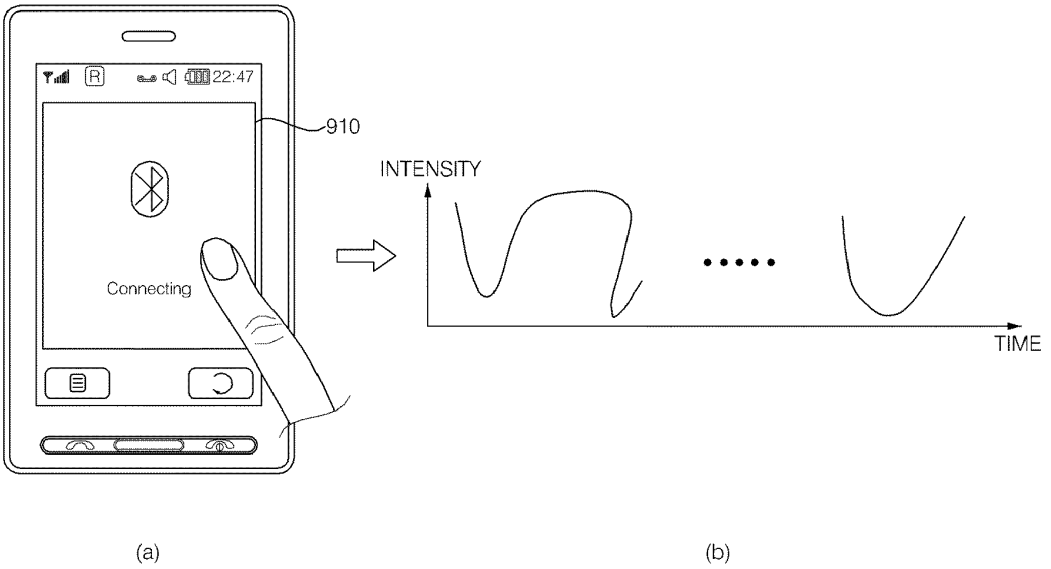

22:47
910
Connecting
INTENSITY
TIME
(a)
(b)

FIG. 41

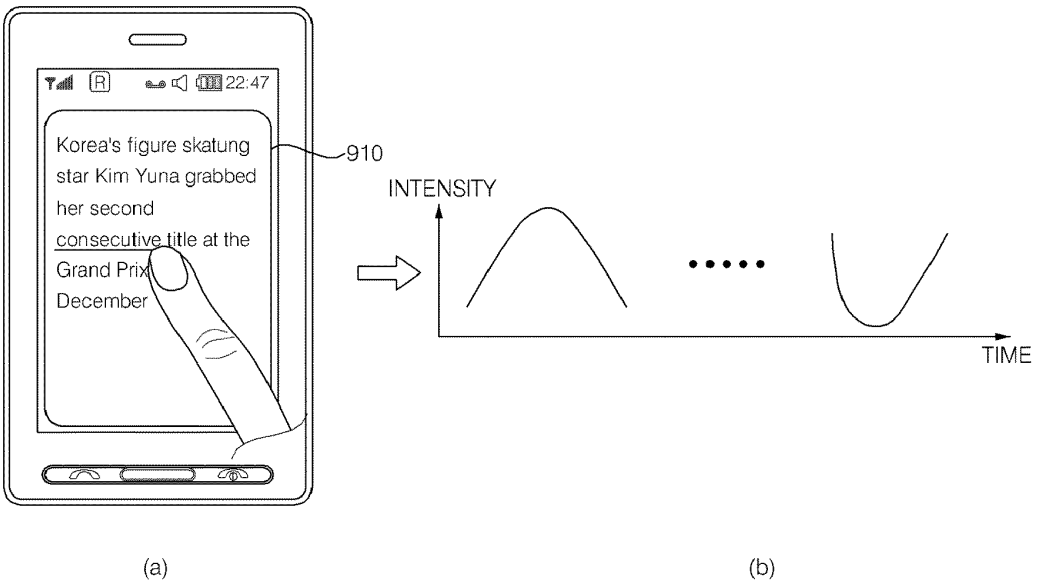

22:47
Korea's figure skatung
star Kim Yuna grabbed
her second
consecutive title at the
Grand Prix
December
910
INTENSITY
TIME
(a)
(b)

FIG. 42

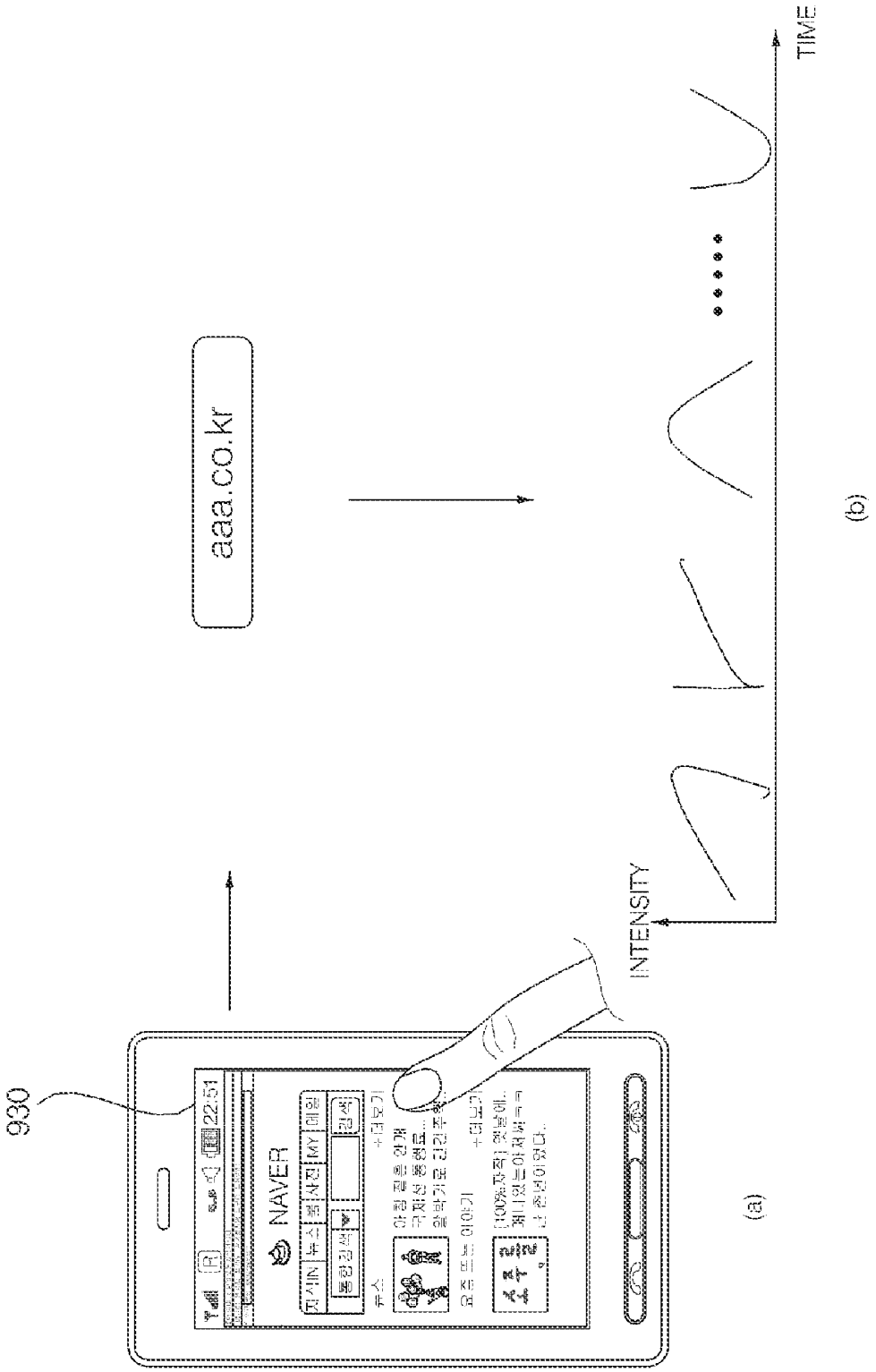


FIG. 43

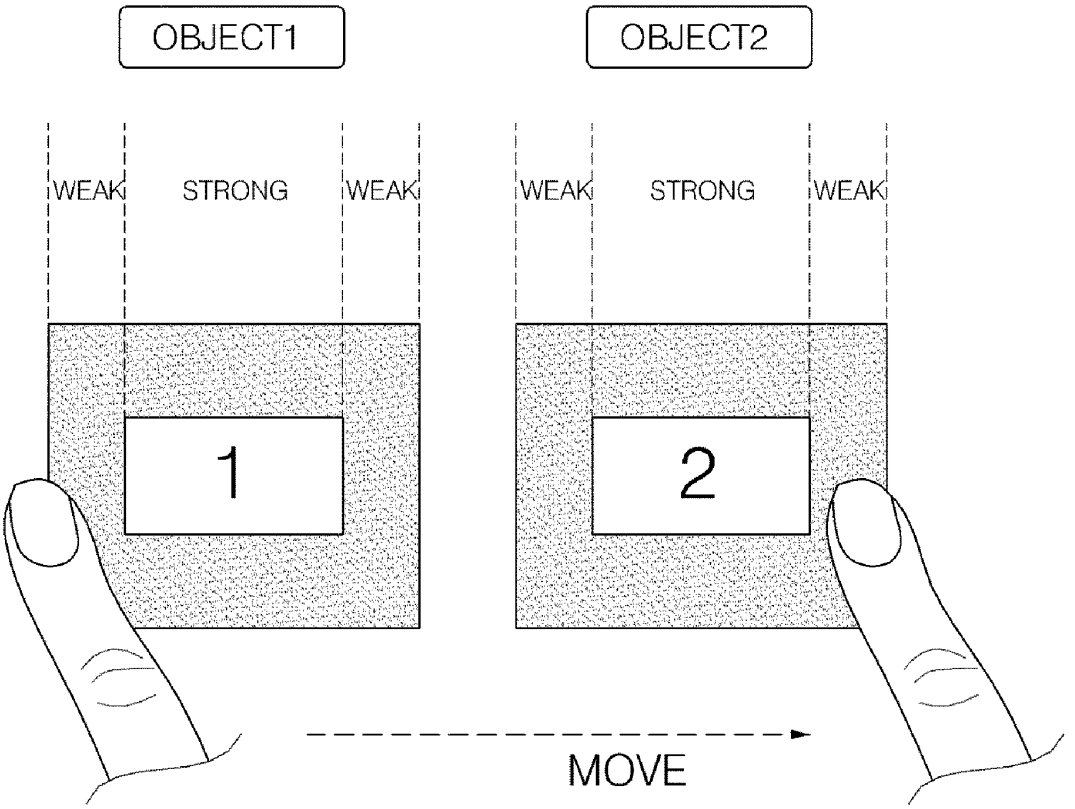


FIG. 44

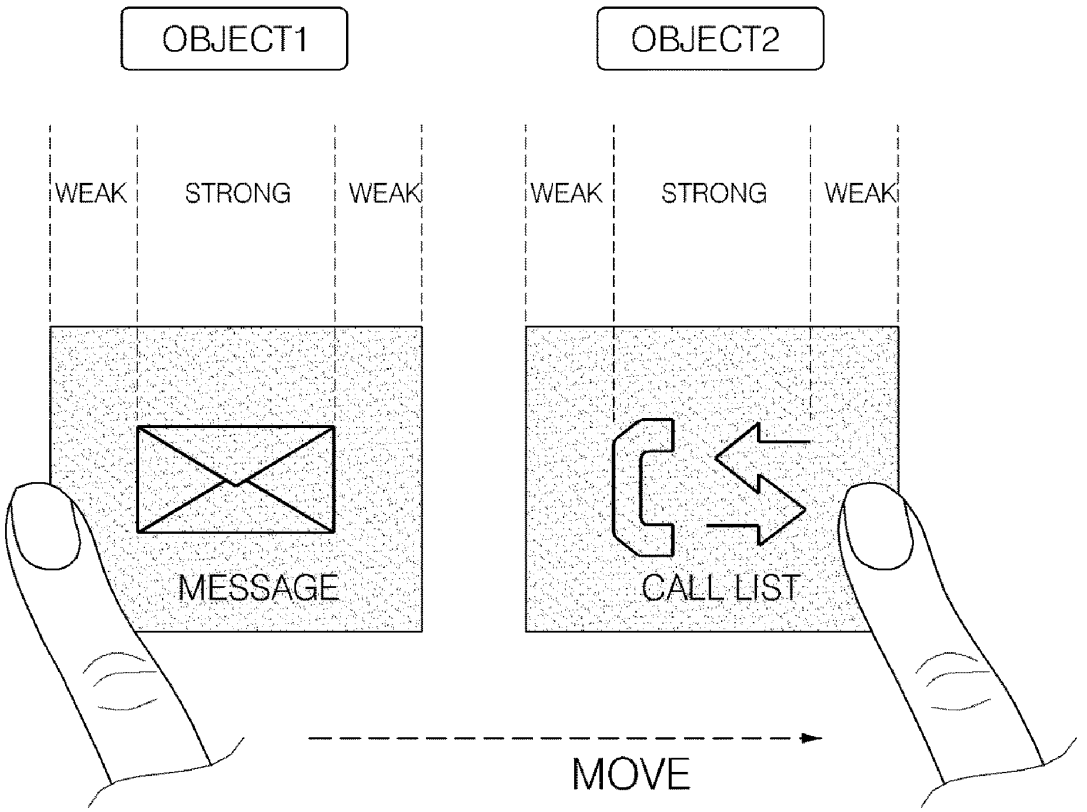

OBJECT1
OBJECT2
WEAK
STRONG
WEAK
WEAK
STRONG
WEAK
MESSAGE
CALL LIST
MOVE

FIG. 45

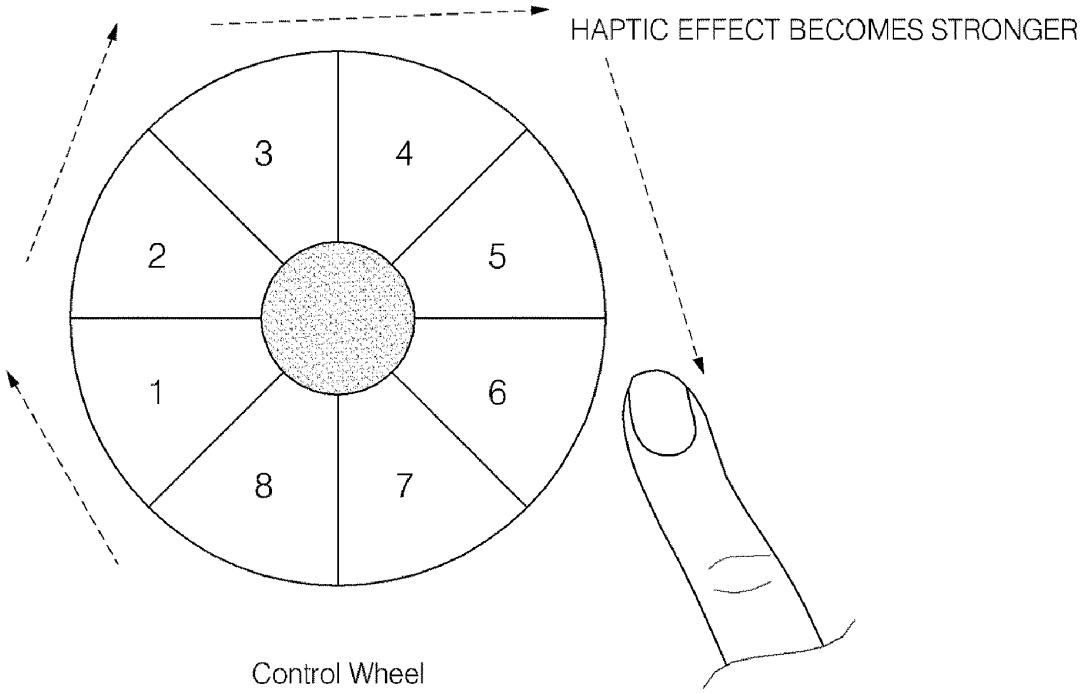


FIG. 46

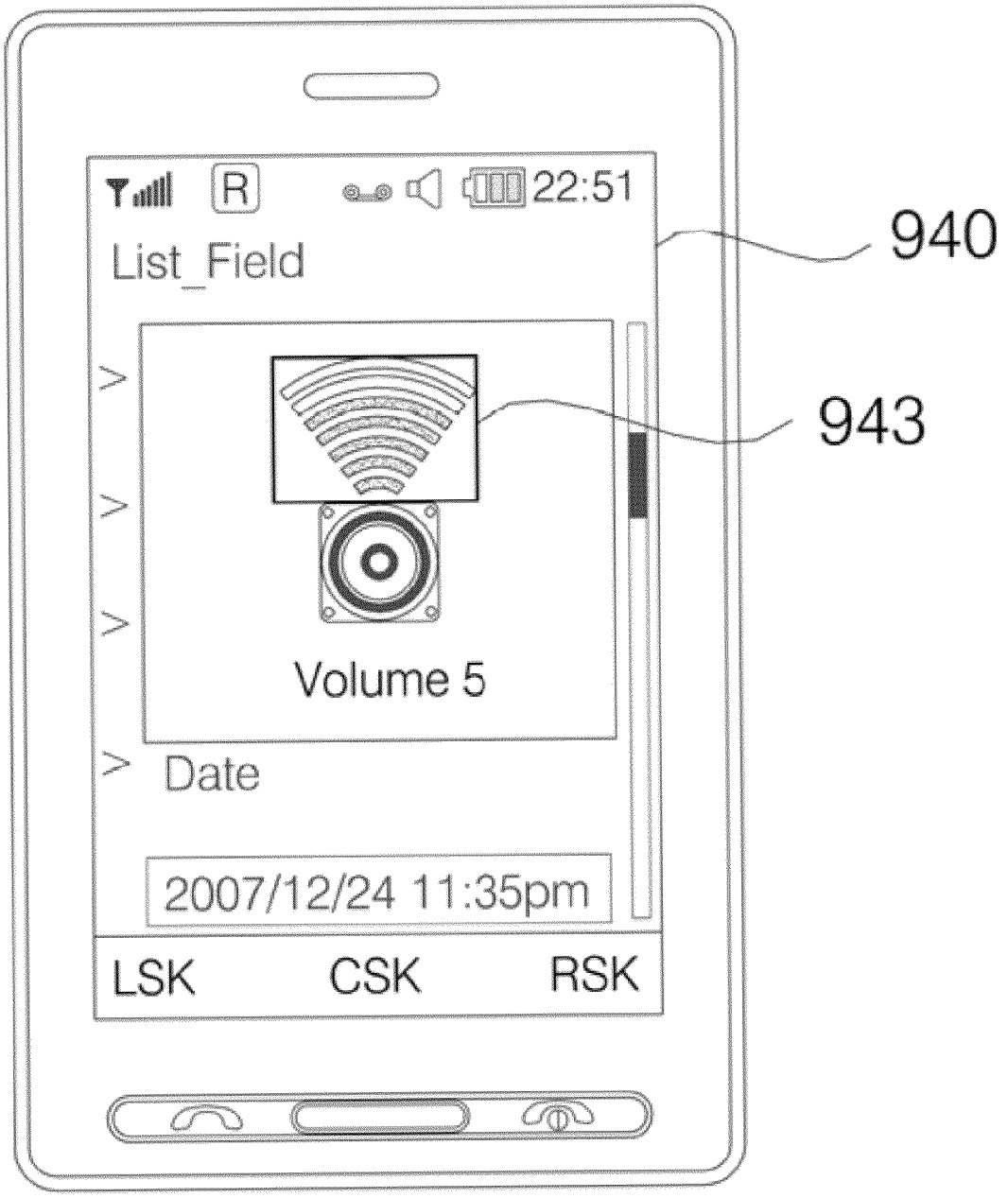

R
22:51
List_Field
940
943
Volume 5
Date
2007/12/24 11:35pm
LSK
CSK
RSK

FIG. 47

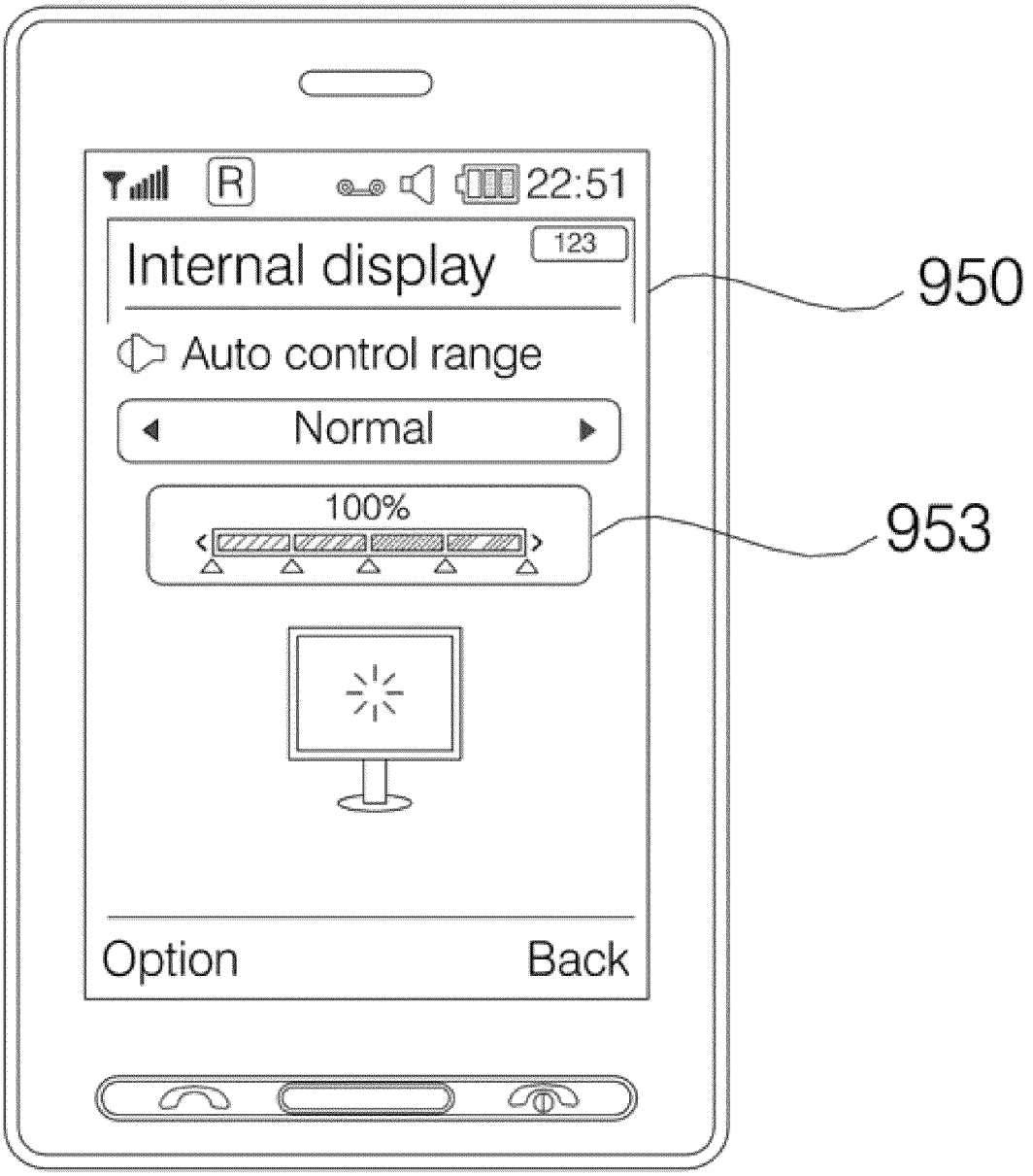

R
22:51
Internal display
123
Auto control range
Normal
100%
Option
Back
950
953

FIG. 48

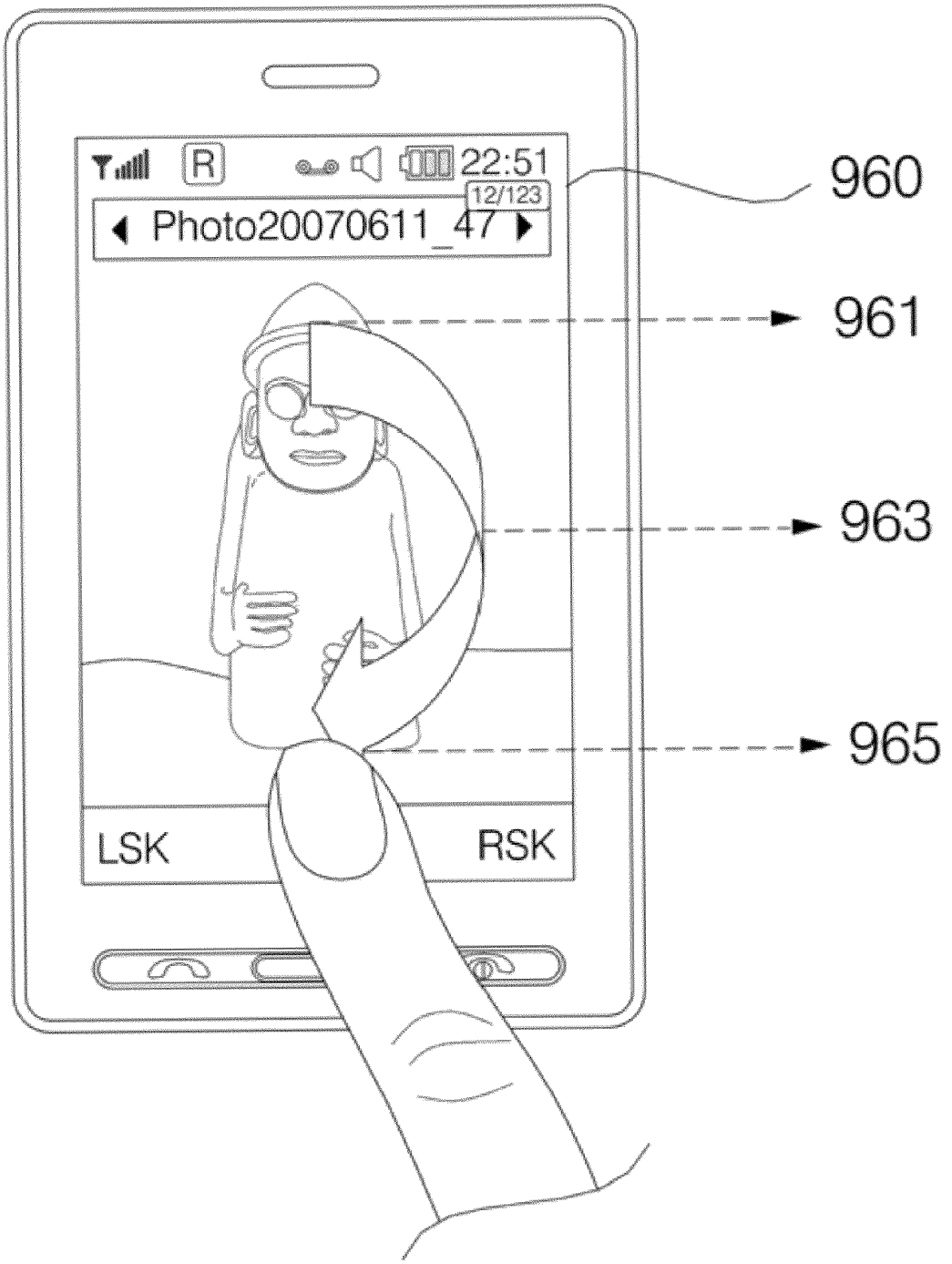


FIG. 49

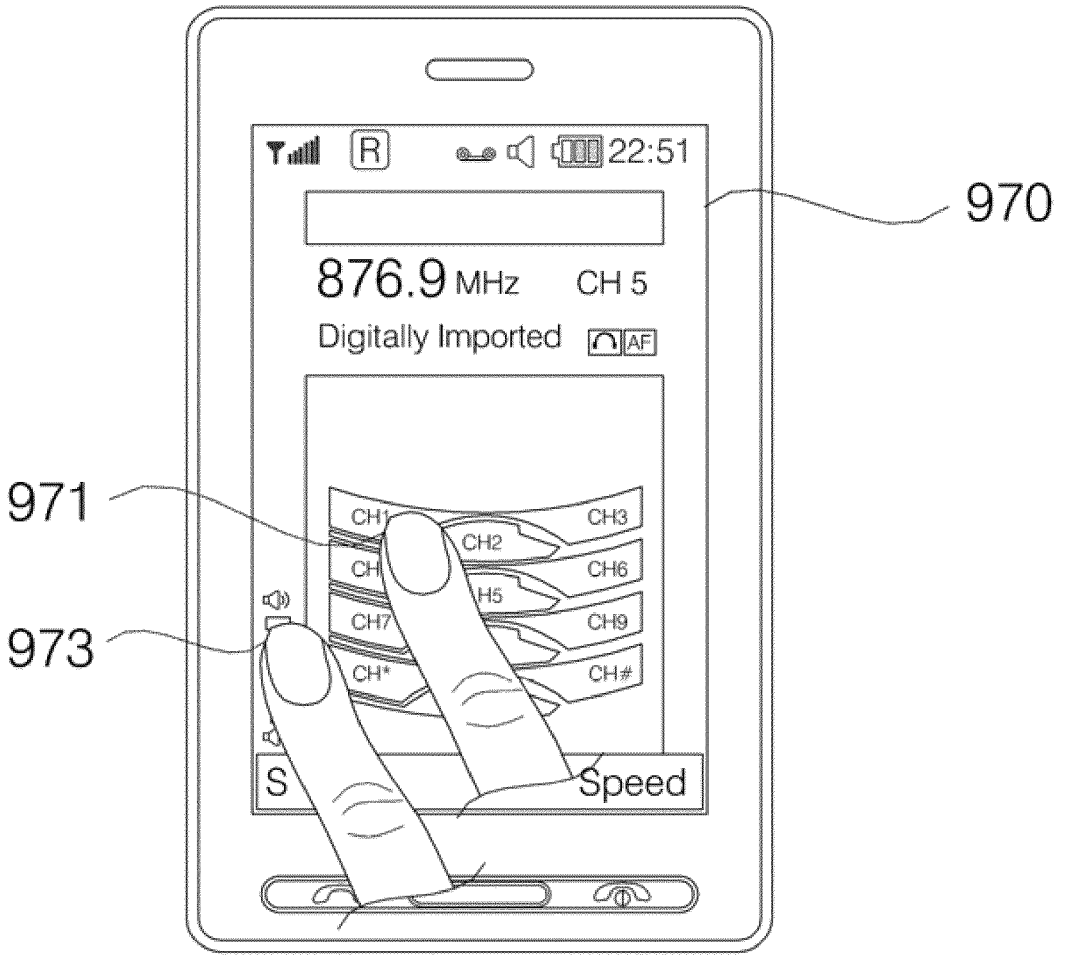
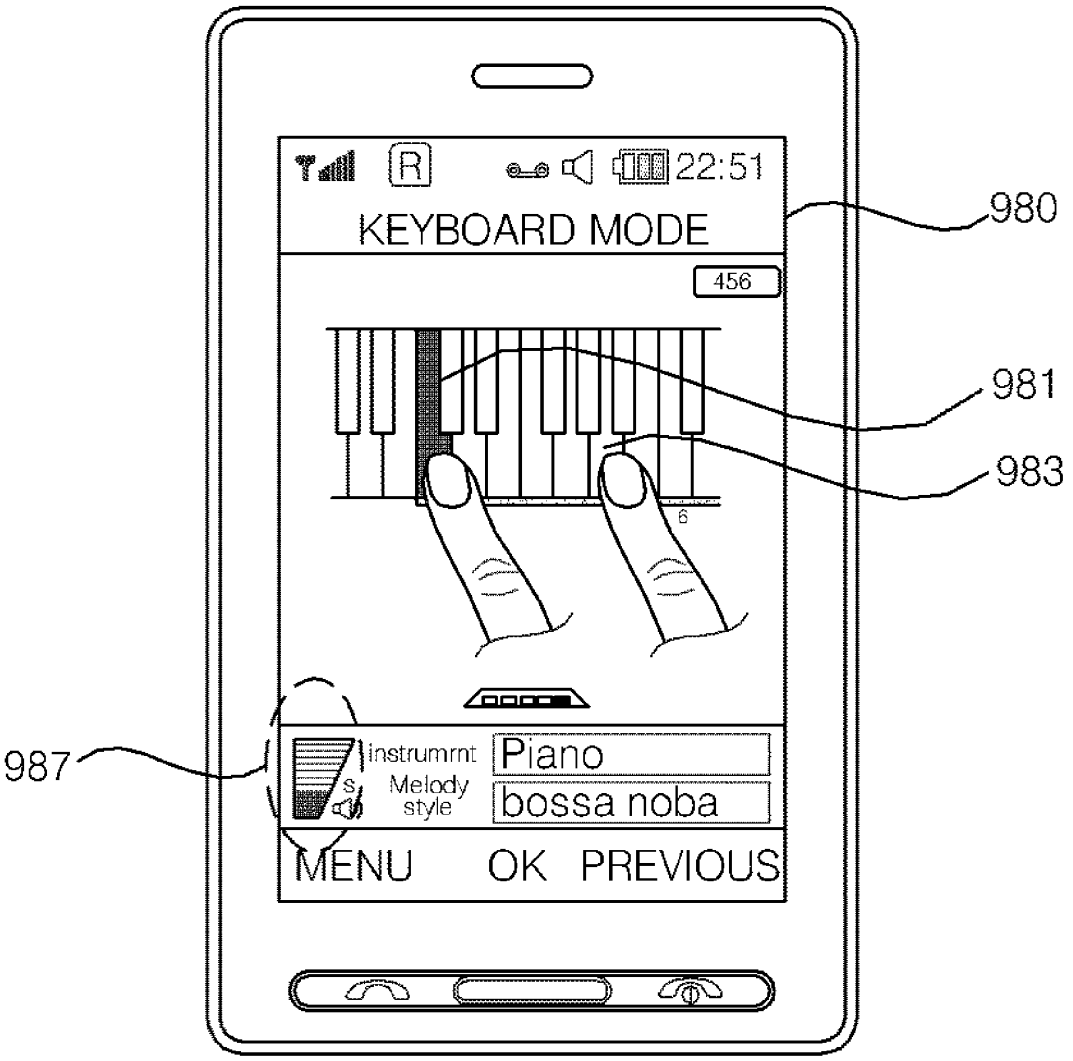

970
971
973
R
22:51
876.9 MHz
CH 5
Digitally Imported
AF
CH1
CH2
CH3
CH
CH6
H5
CH7
CH9
CH*
CH#
S
Speed

FIG. 50


22:51
KEYBOARD MODE
456
980
981
983
987
instrumrnt
Piano
Melody style
bossa noba
MENU
OK
PREVIOUS

HAPTIC EFFECT PROVISIONING FOR A MOBILE COMMUNICATION TERMINAL

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of Korean Patent Application No. 10-2008-0060358, filed on Jun. 25, 2008 in the Korean Intellectual Property Office, the content of which is incorporated herein in entirety.

RELATED FIELDS

The present invention relates to a mobile terminal, which provides various haptic effects according to the content of information displayed by the mobile terminal or the setting state of the mobile terminal, and a method of controlling the mobile terminal.

BACKGROUND

Mobile terminals are portable devices, which can provide users with various services such as a voice calling service, a video calling service, an information input/output service, and a data storage service. As the types of services provided by mobile terminals diversify, an increasing number of mobile terminals have been equipped with various complicated functions such as capturing photos or moving pictures, playing music files or moving image files, providing game programs, receiving broadcast programs and providing wireless Internet services and have thus evolved into multimedia players.

Various user interface (UI) environments, in which users are allowed to easily search for and choose desired functions, have been developed. In addition, the demand for various designs for mobile terminals such as a double-sided liquid crystal display (LCD) or a full touch screen has steadily grown due to a growing tendency of considering mobile terminals as personal items that can represent users' personality.

In a limited display device, such as a mobile communication terminal, there is a restriction in allocating sufficient space for a UI device (such as a display device or a keypad) of a mobile terminal without compromising the mobility and the portability of a mobile terminal. In addition, conventional mobile terminals provide operating state information or respond to user commands merely using a limited UI space or simple sound effects.

Therefore, systems and methods are needed to control the operation of mobile terminals using through an efficient and easy-to-use user interface.

SUMMARY

In accordance with one embodiment, a mobile terminal is provided in which a haptic effect is generated when a certain input or output is detected. A user of the mobile terminal may configure the manner in which the haptic effect is produced. For example, if the haptic effect is generated by way of a vibration mechanism, the user may set the level of vibration to be generated when a certain input is provided to the mobile terminal, or when a certain output is generated by the mobile terminal. The input and output to the mobile terminal is thus monitored so that when, for example, a message including a certain word or a certain output, for example, playback of a moving picture having a certain level of lighting or motion is detected, then a particular haptic effect associated with the

detected input our output is generated. The user may set different levels or types of haptic effects with different levels or types of input and output.

In one embodiment, a mobile terminal comprising an input mechanism and an output mechanism, wherein the input mechanism has a surface such that said surface is virtually divided into at least two separate regions, wherein the two separate regions provide a tactile sensation such that the first region provides a first tactile sensation and the second region provides a second tactile sensation, wherein a user in response to touching the first region and the second region recognizes a difference in the first and second tactile sensations, wherein said difference in sensations allows a user to detect a change in functionality of the mobile terminal or an output generated by the mobile terminal.

In one embodiment, the mobile terminal divides an object (such as an icon or an image for controlling the operation of the mobile terminal) into one or more haptic regions and provides different haptic effects for the haptic regions, and a method of controlling the mobile terminal. A method of controlling a mobile terminal comprises displaying at least one object, which is divided into a plurality of haptic regions, on a touch screen; receiving a touch signal for any one of the haptic regions of the object; and outputting a control signal for controlling a haptic module to generate a haptic effect.

In one embodiment, a mobile terminal comprises a touch screen configured to display at least one object, which is divided into a plurality of haptic regions; a haptic module configured to generate a haptic effect; and a controller which receives a touch signal for any one of the haptic regions of the object and controls the haptic module to generate a haptic effect corresponding to the haptic region for which the touch signal is received.

According to another aspect, a method comprising displaying at least one object, which is divided into a plurality of haptic regions, on a touch screen is provided. The method comprises receiving a touch signal for any one of the haptic regions of the object; and outputting a control signal for controlling a haptic module to generate a haptic effect.

The above and other features and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a block diagram of a mobile terminal according to an exemplary embodiment;

FIG. **2** illustrates a front perspective view of the mobile terminal shown in FIG. **1**;

FIG. **3** illustrates a rear perspective view of the mobile terminal shown in FIG. **1**;

FIG. **4** illustrates a flowchart of a method of controlling a mobile terminal according to an exemplary embodiment;

FIG. **5** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment;

FIG. **6** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment;

FIG. **7** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment;

FIG. **8** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment;

FIG. **9** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment;

FIG. **10** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment;

FIG. **11** illustrates a diagram for explaining the operation of a proximity sensor;

FIGS. **12** through **14** illustrate diagrams for explaining a proximity region and a haptic region;

FIGS. **15** through **24** illustrate diagrams for explaining how to generate a haptic effect in accordance with a change in a screen image displayed by a display unit of the mobile terminal shown in FIG. **1**;

FIGS. **25** through **31** illustrate diagrams for explaining how to generate and store a haptic effect during the play of a moving image file;

FIGS. **32** through **42** illustrate diagrams for explaining how to generate a haptic effect according to the content of information displayed on the screen of the display module of the mobile terminal shown in FIG. **1**; and

FIGS. **43** through **50** illustrate diagrams for explaining how to generate different haptic effects for different object regions.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

The term 'mobile terminal', as used herein, may indicate a mobile phone, a smart phone, a laptop book computer, a digital broadcast receiver, a personal digital assistant (PDA), a portable multimedia player (PMP), or a navigation device. FIG. **1** illustrates a block diagram of a mobile terminal **100** according to an embodiment of the present invention. Referring to FIG. **1**, the mobile terminal **100** may include a wireless communication unit **110**, an audio/video (A/V) input unit **120**, a user input unit **130**, a sensing unit **140**, an output unit **150**, a memory **160**, an interface unit **170**, a controller **180**, and a power supply unit **190**. Two or more of the wireless communication unit **110**, the A/V input unit **120**, the user input unit **130**, the sensing unit **140**, the output unit **150**, the memory **160**, the interface unit **170**, the controller **180**, and the power supply unit **190** may be incorporated into a single unit, or some of the wireless communication unit **110**, the A/V input unit **120**, the user input unit **130**, the sensing unit **140**, the output unit **150**, the memory **160**, the interface unit **170**, the controller **180**, and the power supply unit **190** may be divided into two or more smaller units.

The wireless communication unit **110** may include a broadcast reception module **111**, a mobile communication module **113**, a wireless Internet module **115**, a short-range communication module **117**, and a global positioning system (GPS) module **119**. The broadcast reception module **111** receives a broadcast signal and/or broadcast-related information from an external broadcast management server through a broadcast channel. Examples of the broadcast channel include a satellite channel and a terrestrial channel. The broadcast management server may be a server which generates broadcast signals and/or broadcast-related information and transmits the generated broadcast signals and/or the generated broadcast-related information or a server which receives and then transmits previously-generated broadcast signals and/or previously-generated broadcast-related information.

Examples of the broadcast-related information include broadcast channel information, broadcast program information and broadcast service provider information. Examples of the broadcast signal include a TV broadcast signal, a radio broadcast signal, a data broadcast signal, or the combination of a data broadcast signal and either a TV broadcast signal or a radio broadcast signal. The broadcast-related information may be provided to the mobile terminal **100** through a mobile communication network. In this case, the broadcast-related information may be received by the mobile communication module **113**, rather than by the broadcast reception module **111**. The broadcast-related information may come in various forms, for example, electronic program guide (EPG) of digital multimedia broadcasting (DMB) or electronic service guide (ESG) of digital video broadcast-handheld (DVB-H).

The broadcast reception module **111** may receive the broadcast signal using various broadcasting systems such as digital multimedia broadcasting-terrestrial (DMB-T), digital multimedia broadcasting-satellite (DMB-S), media forward link only (MediaFLO), DVB-H, and integrated services digital broadcast-terrestrial (ISDB-T). In addition, the broadcast reception module **111** may be configured to be suitable for nearly all types of broadcasting systems other than those set forth herein. The broadcast signal and/or the broadcast-related information received by the broadcast reception module **1110** may be stored in the memory **160**.

The mobile communication module **113** transmits wireless signals to or receives wireless signals from at least one of a base station, an external terminal, and a server through a mobile communication network. The wireless signals may include various types of data according to whether the mobile terminal **100** transmits/receives voice call signals, video call signals, or text/multimedia messages. The mobile communication module **113** may be a module for wirelessly accessing the Internet. The mobile communication module **113** may be embedded in the mobile terminal **100** or may be installed in an external device. The short-range communication module **117** may be a module for short-range communication. The short-range communication module **117** may use various short-range communication techniques such as Bluetooth, radio frequency identification (RFID), infrared data association (IrDA), ultra wideband (UWB), and ZigBee.

The GPS module **119** may receive position information from a plurality of GPS satellites. The A/V input unit **120** may be used to receive audio signals or video signals. The A/V input unit **120** may include a camera module **121** and a microphone module **123**. The camera module **121** processes various image frames such as still images or moving images captured by an image sensor during a video call mode or an image capturing mode. The image frames processed by the camera module **121** may be displayed by a display module **151**. The image frames processed by the camera module **121** may be stored in the memory **160** or may be transmitted outside the mobile terminal **100** through the wireless communication unit **110**. The mobile terminal **100** may include two or more camera modules **121**.

The microphone module **123** receives external sound signals during a call mode, a recording mode, or a voice recognition mode with the use of a microphone and converts the sound signals into electrical sound data. In the call mode, the mobile communication module **1130** may convert the electrical sound data into data that can be readily transmitted to a mobile communication base station and then output the data obtained by the conversion. The microphone module **123** may use various noise removal algorithms to remove noise that may be generated during the reception of external sound signals. The user input unit **130** generates key input data based on user input for controlling the operation of the mobile terminal **100**. The user input unit **130** may be implemented as a keypad, a dome switch, a touch pad (either static pressure or

constant electricity), a jog wheel, or a jog switch. In particular, if the user input unit **130** is implemented as a touch pad and forms a mutual layer structure along with the display module **151**, the user input unit **130** and the display module **151** may be collectively referred to as a touch screen.

The sensing unit **140** determines a current state of the mobile terminal **100** such as whether the mobile terminal **100** is opened up or closed, the position of the mobile terminal **100** and whether the mobile terminal **100** is placed in contact with a user, and generates a sensing signal for controlling the operation of the mobile terminal **100**. For example, when the mobile terminal **100** is a slider-type mobile phone, the sensing unit **140** may determine whether the mobile terminal **100** is opened up or closed. In addition, the sensing unit **140** may determine whether the mobile terminal **100** is powered by the power supply unit **190** and whether the interface unit **170** is connected to an external device.

The sensing unit **140** may include a proximity sensor **141**. The proximity sensor **141** may determine whether there is an entity nearby and approaching the mobile terminal **100** without any mechanical contact with the entity. More specifically, the proximity sensor **141** may detect an entity that is nearby and approaching by detecting a change in an alternating magnetic field or the rate of change of static capacitance. The sensing unit **140** may include two or more proximity sensors **141**. The output unit **150** may output audio signals, video signals and alarm signals. The output unit **150** may include the display module **151**, an audio output module **153**, an alarm module **155**, and a haptic module **157** incorporating haptic technology.

Haptic technology refers to technology which interfaces to the user via the sense of touch by applying forces, vibrations and/or motions to the user. This mechanical stimulation may be used to assist in the creation of virtual objects (e.g., objects existing in a computing environment), for control of such virtual objects, and to enhance the control of machines and devices (e.g., mobile terminals). For example, haptic technology makes it possible to investigate in detail how the human sense of touch works, by allowing the creation of carefully-controlled haptic virtual objects. These objects may be used to systematically probe human haptic capabilities.

The display module **151** may display various information processed by the mobile terminal **100**. For example, if the mobile terminal **100** is in a call mode, the display module **151** may display a user interface (UI) or a graphic user interface (GUI) for making or receiving a call. If the mobile terminal **100** is in a video call mode or an image capturing mode, the display module **151** may display a UI or a GUI for capturing or receiving images. As described above, if the display module **151** and the user input unit **130** form a mutual layer structure and are thus implemented as a touch screen, the display module **151** may be used not only as an output device but also as an input device. The display module **151** may include at least one of a liquid crystal display (LCD), a thin film transistor (TFT)-LCD, an organic light-emitting diode (OLED), a flexible display, and a three-dimensional (3D) display. The mobile terminal **100** may include two or more display modules **151**. For example, the mobile terminal **100** may include an external display module (not shown) and an internal display module (not shown).

The audio output module **153** may output audio data received by the wireless communication unit **110** during a call reception mode, a call mode, a recording mode, a voice recognition mode, or a broadcast reception mode or may output audio data present in the memory **160**. In addition, the audio output module **153** may output various sound signals associated with the functions of the mobile terminal **100** such as receiving a call or a message. The audio output module **153** may include a speaker and a buzzer.

The alarm module **155** may output an alarm signal indicating the occurrence of an event in the mobile terminal **100**. Examples of the event include receiving a call signal, receiving a message, and receiving a key signal. Examples of the alarm signal output by the alarm module **155** include an audio signal, a video signal and a vibration signal. The alarm module **155** may output a signal upon receiving a call signal or a message. In addition, the alarm module **155** may receive a key signal and may output a signal as feedback to the key signal. Once a signal is output by the alarm unit, the user may recognize that an event has occurred. A signal for notifying the user of the occurrence of an event may be output by the display module **151** or the audio output module **153**.

The haptic module **157** may provide various haptic effects (such as vibrations) that can be perceived by the user. If the haptic module **157** generates vibration as a haptic effect, the intensity and the pattern of vibration generated by the haptic module **157** may be altered in various manners. The haptic module **157** may synthesize different vibration effects and may output the result of the synthesization. Alternatively, the haptic module **157** may sequentially output different vibration effects.

The haptic module **157** may provide various haptic effects, other than vibration, such as a haptic effect obtained using a pin array that moves perpendicularly to a contact skin surface, a haptic effect obtained by injecting or sucking in air through an injection hole or a suction hole, a haptic effect obtained by giving a stimulus to the surface of the skin, a haptic effect obtained through contact with an electrode, a haptic effect obtained using an electrostatic force, and a haptic effect obtained by realizing the sense of heat or cold using a device capable of absorbing heat or generating heat. The haptic module **157** may be configured to enable the user to recognize a haptic effect using the kinesthetic sense of the fingers or the arms. The mobile terminal **100** may include two or more haptic modules **157**.

The memory **160** may store various programs necessary for the operation of the controller **180**. In addition, the memory **160** may temporarily store various data such as a phonebook, messages, still images, or moving images. The memory **160** may include at least one of a flash memory type storage medium, a hard disk type storage medium, a multimedia card micro type storage medium, a card type memory (e.g., a secure digital (SD) or extreme digital (XD) memory), a random access memory (RAM), and a read-only memory (ROM). The mobile terminal **100** may operate a web storage, which performs the functions of the memory **160** on the Internet.

The interface unit **170** may interface with an external device that can be connected to the mobile terminal **100**. The interface unit **170** may be a wired/wireless headset, an external battery charger, a wired/wireless data port, a card socket for, for example, a memory card) or a subscriber identification module (SIM)/user identity module (UIM) card, an audio input/output (I/O) terminal, a video I/O terminal, or an earphone. The interface unit **170** may receive data from an external device or may be powered by an external device. The interface unit **170** may transmit data provided by an external device to other components in the mobile terminal **100** or may transmit data provided by other components in the mobile terminal **100** to an external device.

If the mobile terminal **100** is connected to an external cradle, power may be supplied from the external cradle to the mobile terminal through the interface unit **170**, and various command signals may be transmitted from the external cradle

to the mobile terminal through the interface unit **170**. The controller **180** may control the general operation of the mobile terminal **100**. For example, the controller **180** may perform various control operations regarding making/receiving a voice call, transmitting/receiving data, or making/receiving a video call. The controller **180** may include a multimedia play module **181**, which plays multimedia data. The multimedia play module **181** may be implemented as a hardware device and may be installed in the controller **180**. Alternatively, the multimedia play module **181** may be implemented as a software program.

The power supply unit **190** is supplied with power by an external power source or an internal power source and supplies power to other components in the mobile terminal **100**. The mobile terminal **100** may include a wired/wireless communication system and a satellite-based communication system. The mobile terminal **100** may be configured to be able to operate in a communication system transmitting data as frames or packets. The exterior of the mobile terminal **100** will hereinafter be described in detail with reference to FIGS. **2** and **3**. For convenience, assume that the mobile terminal **100** is a slider-type mobile phone. However, the present invention is not restricted to a slider-type mobile phone. Rather, the present invention can be applied to various mobile phones, other than a slider-type mobile phone.

FIG. **2** illustrates a front perspective view of the mobile terminal **100** shown in FIG. **1**. Referring to FIG. **2**, the mobile terminal **100** includes a first body **100***a* and a second body **100***b* configured to be able to slide in at least one direction along the first body **100**A. When the first body **100**A overlaps the second body **100**B, the mobile terminal **100** is determined to be closed. When the first body **100**A exposes at least part of the second body **100**B, the mobile terminal **100** is determined to be opened up. When the mobile terminal **100** is closed, the mobile terminal **100** generally operates in a standby mode, and may be manually released from the standby mode by a user. When the mobile terminal **100** is opened up, the mobile terminal **100** generally operates in a call mode, and may be placed in a standby mode either manually by a user or automatically after the lapse of a predetermined amount of time.

The first body **100**A may include a first front case **100**A-**1** and a first rear case **100**A-**2**, which form the exterior of the first body **100**A. Various electronic products may be installed in the empty space between the first front case **100**A-**1** and the first rear case **100**A-**2**. At least one intermediate case may be additionally disposed between the first front case **100**A-**1** and the first rear case **100**A-**2**. The first front case **100**A-**1** and the first rear case **100**A-**2** may be formed of a synthetic resin through injection molding. Alternatively, the first front case **100**A-**1** and the first rear case **100**A-**2** may be formed of a metal such as stainless steel (STS) or titanium (Ti). The display module **151**, a first audio output module **153***a*, a first camera **121***a* and a first user input module **130***a* may be disposed in the first body **100**A, and particularly, in the first front case **100**A-**1**.

The display module **151** may include an LCD or an OLED, which visually represents information. Since a touch pad is configured to overlap the display module **151** and thus to realize a layer structure, the display module **151** may serve as a touch screen. Thus, it is possible for a user to input information to the display module **151** simply by touching the display module **151**. The first audio output module **153***a* may be implemented as a receiver or a speaker. The first camera **121***a* may be configured to capture a still image or a moving image of a user. The second body **100**B may include a second front case **100**B-**1** and a second rear case **100**B-**2**, which form the exterior of the second body **100**B.

A second user input module **130***b* may be disposed at the front of the second body **100**B, and particularly, at the front of the second front case **100**B-**1**. Third and fourth user input modules **130***c* and **130***d*, the microphone **123** and the interface unit **170** may be disposed in the second front case **100**B-**1** or the second rear case **100**B-**2**. The first through fourth user input modules **130***a* through **130***d* may be collectively referred to as the user input unit **130**. The user input unit **130** may adopt various manipulation methods as long as it can offer tactile feedback to a user. For example, the user input unit **130** may be implemented as a dome switch or a touch pad which receives a command or information upon being pushed or touched by a user. Alternatively, the user input unit **130** may be implemented as a wheel, a jog dial, or a joystick.

The first user input module **130***a* may allow a user to input such commands as 'start', 'end', and 'scroll'. The second user input module **130***b* may allow a user to input numbers, characters or symbols. The third and fourth user input modules **130***c* and **130***d* may serve as hot keys for activating certain functions of the mobile terminal **100**. The microphone **123** may be configured to be able to receive the voice of a user or other sounds. The interface unit **170** may serve as a path for allowing the mobile terminal **100** to exchange data with an external device. For example, the interface unit **170** may be a connection terminal for connecting an earphone to the mobile terminal **100** in a wired or wireless manner, a port for short-range communication or a power supply terminal for supplying power to the mobile terminal **100**.

The interface unit **170** may be a SIM or a UIM or may be a card socket for an exterior-type card such as a memory card for storing data. The power supply unit **190** may be inserted in the second rear case **100**B-**2**. The power supply unit **190** may be a rechargeable battery and may be coupled to the second body **100**B so as to be able to be attached to or detached from the second body **100**B. FIG. **3** illustrates a rear perspective view of the mobile terminal **100** shown in FIG. **2**. Referring to FIG. **3**, a fifth user input module **130***e* and a second camera **121***b* may be disposed at the rear of the second rear case **100**B-**2** of the second body **100**B. The fifth user input module **130***e* may be of a wheel type. In addition, a sixth user input module **130***f* may be disposed on a lateral side of the second body **100**B. The second camera **121***b* may have a different photographing direction from that of the first camera **121***a* shown in FIG. **2**. In addition, the number of pixels of the second camera **121***b* may be different from the number of pixels of the first camera **121***a*.

For example, the first camera **121***a* may be used to capture an image of the face of a user and then readily transmit the captured image during a video call. Thus, a low-pixel camera module may be used as the first camera **121***a*. The second camera **121***b* may be used to capture an image of an ordinary subject. Given that images captured by the second camera **121***b* generally do not need to be transmitted, a high-pixel camera module may be used as the second camera **121***b*. A camera flash **125** and a mirror **126** may be disposed near the second camera **121***b*. The camera flash **125** illuminates a subject when the second camera **121***b* captures an image of the subject. The user may look in the mirror **126** for taking a self shot. A second sound output module (not shown) may be additionally provided in the second rear case **100**B-**2**. The second sound output module may realize a stereo function along with the first audio output module **153***a*. The second sound output module may also be used during a speaker-phone mode.

An antenna (not shown) for receiving a broadcast signal may be disposed on one side of the second rear case **100**B-**2**. The antenna may be installed so as to be able to be pulled out

from the second body **100**B-**2**. A slider module **100**C may be disposed on the first rear case **100**A-**2** of the first body **100**A. The slider module **100**C may couple the first body **100**A and the second body **100**B so that the first body **100**A can slide along the second body **100**B. The slider module **100**C may be partially exposed by the second front case **100**B-**1**. The second camera **121***b* is illustrated in FIG. **3** as being disposed on the second body **100**B, but the present invention is not restricted to this.

For example, at least one of the antenna, the second camera **121***b* and the camera flash **125** may be mounted on the first body **100**A, and particularly, the first rear case **100**A-**2** of the first body **100**A. In this case, whichever of the antenna, the second camera **121***b* and the camera flash **125** is mounted on the first rear case **100**A-**2** may be protected by the second body **100**B when the mobile terminal **100** is closed. The first camera **121***a* may be able to rotate and thus to cover the photographing direction of the second camera **121***a*. In this case, the second camera **121***b* may be optional.

FIG. **4** illustrates a flowchart of a method of controlling a mobile terminal according to an exemplary embodiment of the present invention. Referring to FIG. **1**, the mobile terminal **100** may be placed in a haptic mode (such as a vibration output mode) in response to a user command (S**200**). The mobile terminal **100** may be placed in the haptic mode through default setting or user setting. In addition, an additional menu for placing the mobile terminal **100** in or releasing the mobile terminal **100** from the haptic mode may be provided.

Thereafter, the controller **180** may display a first screen corresponding to a menu or operation chosen by a user on the screen of the display module **151** (S**202**). Thereafter, the controller **180** may determine whether the first screen has changed (S**204**). If a change in the first screen is detected, the controller **180** may output a control signal corresponding to the change in the first screen (S**206**). The control signal output by the controller **180** may be a signal for controlling the haptic module **157** to generate a haptic effect corresponding to the change in the first screen.

The first screen may vary in accordance with a change in the operating state of the mobile terminal **100**. Examples of the change in the first screen include the appearance of a new icon on the first screen or the disappearance of an existing icon from the first screen, a change in the shape of an icon displayed on the first screen, a change in the scale of the first screen, the rotation of the first screen, and a change in the shape of an image displayed on the first screen. The control signal output by the controller **180** may be transmitted to the haptic module **157**. The haptic module **157** may generate a haptic effect corresponding to the control signal output by the controller **180** (S**224**).

If a popup window is displayed on the first screen (S**208**), the controller **180** may output a control signal corresponding to the popup screen (S**210**), and the haptic module **157** may generate a haptic effect corresponding to the display of the popup window in response to the control signal (S**224**). If the display module **151** displays a second screen corresponding to a predetermined operation, instead of the first screen, under the control of the controller **180** (S**212**), the controller **180** may output a control signal corresponding to the second screen (S**214**), and the haptic module **157** may generate a haptic effect corresponding to the display of the second screen under the control of the controller **180** (S**224**).

If a change in the brightness of a screen currently being displayed by the display module **151** is detected (S**216**), the controller **180** may output a control signal corresponding to the change in the brightness of the screen (S**218**), and the haptic module **157** may generate a haptic effect corresponding to the change in the brightness of the screen under the control of the controller **180** (S**224**). If a change in sound or sound volume is detected (S**220**), the controller **180** may output a control signal corresponding to the sound change or the sound volume change (S**222**), and the haptic module **157** may generate a haptic effect corresponding to the sound change or the sound volume change under the control of the controller **180**.

The haptic module **157** may also generate a haptic effect according to a brightness value or a sound volume value set using a menu for setting brightness or sound volume. For example, as the brightness of the screen currently being displayed by the display module **151** increases, the intensity of vibration generated by the haptic module **157** may gradually increase. On the other hand, as the brightness of the screen currently being displayed by the display module **151** decreases, the intensity of vibration generated by the haptic module **157** may gradually decrease. The haptic module **157** may be configured to generate a haptic effect upon detecting a change in the operating state of the mobile terminal **100**.

Operations S**204** through S**224** may be repeatedly performed until the mobile terminal **100** is released from the haptic mode (S**226**). In this exemplary embodiment, it is possible to generate different haptic effects for different types of changes in the operating state of the mobile terminal **100** such as changes in a screen or changes in a popup screen. Thus, it is possible for the user to recognize changes in the operating state of the mobile terminal **100** using the sense of touch. FIG. **5** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment. The generation of a tactile effect upon detecting a variation in a moving image screen will hereinafter be described in detail with reference to FIG. **5**.

Referring to FIG. **5**, if a menu for playing a multimedia file is called in response to a user command and a moving image file to be played is chosen, the controller **180** may display a moving image screen for playing the chosen moving image file on the screen of the display module **151** (S**250**). If a haptic mode is chosen (S**252**), the controller **180** may detect a change in the moving image screen (S**254**). Examples of the change in the moving image screen include a considerable change of the moving image screen between previous and current frames and a considerable change of a predetermined object in the moving image screen between the previous and current frames. A user may determine the type of change in the moving image screen that the haptic module **157** should respond to.

The controller **180** may output a control signal corresponding to the change in the moving image screen (S**256**). Then, the haptic module **157** may generate a haptic effect corresponding to the change in the moving image screen in response to the control signal output by the controller **180** (S**260**). Operations S**250** through S**260** may be repeatedly performed until the play of the chosen moving image file is terminated (S**262**). In this manner, it is possible to generate various haptic effects upon detecting a change in a moving image screen by placing the mobile terminal **100** in the haptic mode during the play of a moving image file.

FIG. **6** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment. The generation of a haptic effect desired by a user for a moving image screen will hereinafter be described in detail with reference to FIG. **6**. Referring to FIG. **6**, if a menu for playing a multimedia file is called in response to a user command and a moving image file to be played is chosen, the controller **180** may display a moving image screen for playing

the chosen moving image file on a touch screen, i.e., the screen of the display module **151** (S**300**).

If a vibration input mode is chosen in response to a touch input (S**302**), the controller **180** may display a vibration input menu for inputting a vibration signal on the screen of the display module **151** (S**304**). If vibration data such as the intensity and the pattern of vibration for the moving image screen is received from the vibration input menu (S**306**), the controller **180** may link the vibration data to the chosen moving image file and may store the vibration data linked to the chosen moving image file (S**308**). The controller **180** may also store synchronization data for synchronizing the vibration data with the chosen moving image file.

Operations S**300** through S**308** may be repeatedly performed until the mobile terminal **100** is released from the vibration input mode (S**310**). If the mobile terminal **100** is released from the vibration input mode, the controller **180** may determine whether a user wishes to terminate the play of a moving image file (S**312**). If the user wishes not to terminate the play of a moving image file, the method returns to operation S**300**. In this exemplary embodiment, vibration data may be stored in advance in connection with a moving image file chosen by the user. Thus, during the play of the moving image file, vibration may be generated according to the vibration data. In this exemplary embodiment, vibration may be generated as a haptic effect. However, the present invention is not restricted to this. That is, various haptic effects, other than vibration, may be generated during the play of a moving image file.

FIG. **7** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment. The generation of a haptic effect (particularly, a vibration effect) in response to the input of a touch key will hereinafter be described in detail with reference to FIG. **7**. Referring to FIG. **7**, if a character input mode for making a call, sending a message, or searching for a phone number or a file is chosen in response to a user command (S**350**), the controller **180** may display a character input window on a touch screen, i.e., the screen of the display module **151** (S**352**). Thereafter, the controller **180** may determine whether a character or a string of characters has been input to the character input window through touch input (S**354**).

If a character or a string of characters has been input to the character input window, the controller **180** may display the input character or the input character string in a predetermined area on the screen of the display module **151** (S**356**). However, the controller **180** may perform an operation, other than displaying the input character or the input character string on the screen of the display module **151**, according to the type of application. The controller **180** may analyze the input character or the input character string and may output a control signal corresponding to the input character or the input character string based on the results of the analysis.

In one embodiment, the haptic module **157** may generate a haptic effect corresponding to the input character or the input character string under the control of the controller **180** (S**358**). That is, the haptic module **157** may output various types of vibrations according to the configuration of the input character or the configuration of each character in the input character string. A user may determine in advance the intensity and pattern of vibration to be output for the input character or the input character string. If an operating mode, other than the character input mode, is chosen (S**360**), the controller **180** may control the mobile terminal **100** to be placed in the operating mode (S**362**). If no other operating mode is chosen, the method returns to operation S**354**.

In this manner, various types of vibrations may be output according to the configuration of the input character or the configuration of each character in the input character string. Thus, the user may easily identify the input character or the input character string based on the intensity and the pattern of vibration output by the haptic module **157**. For this, the input character or each character in the input character string may be divided into an initial consonant, a medial vowel and a final consonant. Then, three types of vibrations, i.e., a vibration corresponding to initial consonants, a vibration corresponding to medial vowels, and a vibration corresponding to final consonants, may be output according to the configuration of the input character or the configuration of each character in the input character string.

If a character string 'test' is input, a first vibration corresponding to initial consonants, a second vibration corresponding to medial vowels and a third vibration corresponding to final consonants may be sequentially output according to the configuration of each character in the character string 'test'. Alternatively, the first, second and third vibrations may be synthesized, and the result of the synthesization may be output according to the configuration of each character in the character string 'test'. Alternatively, the input character or each character in the input character string may be divided into one or more vowels and one or more consonants, and two types of vibrations, i.e., a vibration corresponding to vowels and a vibration corresponding to consonants, may be output according to the configuration of the input character or the configuration of each character in the character string.

For example, if a character string 'test**2**' is input, a fourth vibration corresponding to consonants 't', 's', and 't' and a fifth vibration corresponding to a vowel 'e' may be sequentially output according to the configuration of each character in the character string 'test**2**'. Alternatively, the fourth and fifth vibrations may be synthesized, and the result of the synthesization may be output according to the configuration of each character in the character string 'test**2**'.

In one embodiment, different types of vibrations may be output for different syllables, different morphemes, different parts of speech, or different words in an input character string. If the input character string includes one or more numerals, a vibration corresponding to each of the numerals may also be output. If the input character string includes an emoticon such as '^^', a frequently-used phrase such as 'I am in conference now', or a special character such as '☆' or '♥', a vibration corresponding to the emoticon, the frequently-used phrase, or the special character may also be output. In addition, different types of vibrations may be output for different types of character input modes such as a Korean input mode, an English input mode, a numeral input mode, a key pad input mode and an italic input mode. In this exemplary embodiment, vibration is provided as a haptic effect. However, the present invention is not restricted to this. That is, the present invention can be applied to various haptic effects, other than vibration.

FIG. **8** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment. Referring to FIG. **8**, if a call such as a voice call or a video call is received (S**400**), the controller **180** may display caller information on the screen of the display module **151** and may control the haptic module **157** to analyze the caller information and thus to generate a haptic effect such as vibration based on the results of the analysis (S**402**). Thereafter, if a user chooses to connect the call, the controller **180** may control the call to be performed (S**408**).

If a variation in the voice or the voice volume of a caller or a callee is detected, the controller **180** may control the haptic module **157** to generate a haptic effect corresponding to the

detected voice or voice volume variation (S**410**). If a voice signal corresponding to a predefined word is received during a call with the caller or the callee (S**412**), the controller **180** may control the haptic module **157** to generate a haptic effect corresponding to the predefined word (S**414**). If a message including a predetermined word is received during the call with the caller or the callee (S**416**), the controller **180** may also control the haptic module **157** to generate a haptic effect corresponding to the predetermined word (S**418**). If another call is requested during the call with the caller or the callee, the controller **180** may control the haptic module **157** to analyze caller information and thus to generate a haptic effect corresponding to the requested call. In addition, if a predefined event occurs during the call with the caller or the callee, the controller **180** may control the haptic module **157** to generate a haptic effect corresponding to the predefined event.

Operations S**404** through S**418** may be repeatedly performed until the user chooses to terminate the call (S**420**). In this manner, it is possible for the user to easily identify an event that occurs during the call with the caller or the callee by using the sense of touch. FIG. **9** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment. Referring to FIG. **9**, if a menu is chosen, the controller **180** may display a number of menu items of the chosen menu on the screen of the display module **151**, e.g., on a touch screen (S**450**). If one of the menu items is touched and thus chosen by a user (S**452**), the controller **180** may control the haptic module **157** to generate a haptic effect corresponding to the chosen menu item (S**454**). If one of the menu items is approached by, for example, the user's finger, the controller **180** may also control the haptic module **157** to generate a haptic effect corresponding to the approached menu item.

If the chosen menu item is touched again, the controller **180** may control an application corresponding to the chosen menu item to be executed (S**458**). On the other hand, if a menu item other than the chosen menu item is touched, the controller **180** may control the haptic module **157** to generate a haptic effect corresponding to the touched menu item. Alternatively, if any one of the menu items is touched for longer than a predefined amount of time, the controller **180** may control an application corresponding to the touched menu item to be executed. In this manner, it is possible to generate different haptic effects for different menu items. Thus, it is possible for a user to easily determine which of the menu items has been touched or approached by using the sense of touch.

FIG. **10** illustrates a flowchart of a method of controlling a mobile terminal according to another exemplary embodiment. Referring to FIG. **10**, the controller **180** may display an operation screen corresponding to a menu or an operation chosen by a user on the screen of the display module **151** (S**500**). Thereafter, the controller **180** may determine whether any one of a plurality of objects displayed on the operation screen has been touched or approached by the user (S**502**). Examples of the objects include menu icons, control icons, touch keys or images for controlling the operation of the mobile terminal **100**. Each of the objects may be divided into one or more haptic regions, and the controller **180** may control the haptic module **157** to provide different haptic effects for the haptic regions of each of the objects.

If one of the objects is touched or approached, the controller **180** may determine which of the haptic regions of the touched or approached object has been touched or approached and may control the haptic module **157** to generate a haptic effect corresponding to the touched or approached haptic region of the touched or approached object (S**504**). The touched or approached object may be displayed differently from the other objects so as to be able to be easily recognized. If the touched or approached object is touched again and thus chosen, the controller **180** may control an operation corresponding to the chosen object to be performed (S**508**). Operations S**502** through S**508** may be repeatedly performed until another operating mode is chosen (S**510**). If another operating mode is chosen (S**510**), the controller **180** may control the mobile terminal **100** to be placed in the chosen operating mode (S**512**).

FIG. **11** illustrates a diagram for explaining the operation of the proximity sensor **141** shown in FIG. **1**. Referring to FIG. **11**, if an object, for example, a user's finger, is approaching and nearby the display module **151**, the proximity sensor **141** may detect the user's finger and may output a proximity signal. The proximity sensor **141** may output different proximity signals according to the distance to the user's finger. For example, a proximity signal output by the proximity sensor **141** when the user's finger is located at position D**3** may be different from a proximity signal output by the proximity sensor **141** when the user's finger is located at position D**2** or D**1**. More than one proximity sensor **141** having different detection ranges may be provided. In this case, it is possible to determine how close the user's finger is to the mobile terminal **100** by comparing a plurality of proximity signals respectively output by the proximity sensors **141**.

Alternatively, more than one proximity sensor **141** may be disposed in different regions in the display module **151**. In this case, it is possible to determine which part of the display module **151** is touched or approached by the user's finger and/or whether the user's finger moves within a close range of the display module **151** by determining which of the proximity sensor **141** outputs a proximity sensor. Therefore, the controller **180** may perform various operation control operations according to the degree to which the user's finger is close to the display module **151** and the position on the display module **151** touched or approached by the user's finger.

FIGS. **12**A through **12**D illustrate diagrams for explaining a proximity region from which a proximity signal is output and a haptic region for which a haptic effect is generated. More specifically, FIG. **12**A illustrates diagrams of circular objects. Examples of the circular objects include menu icons, control icons, touch keys and items for controlling the operation of the mobile terminal **100**. Referring to FIG. **12**A(a), a circular object may be divided into a first object region A in the middle of the circular object and a second object region B surrounding the first object region A. In this case, the haptic module **157** may be configured to generate different types of haptic effects, i.e., haptic effects having different intensities or different patterns, for the first and second object regions A and B. For example, if the second object region B is touched, the haptic module **157** may output a first vibration. On the other hand, if the first object region A is touched, the haptic module **157** may output a second vibration having a higher intensity than that of the first vibration.

A proximity region and a haptic region may both be set in an object. In this case, the area of the proximity region may be different from the area of the haptic region. That is, the area of the haptic region may be less than the area of the proximity region or vice versa. For example, referring to FIG. **12**A(a), the whole object may be designated as a proximity region, and the first object region A may be designated as a haptic region. Alternatively, the object may be divided into three object regions, i.e., first, second and third object regions A, B and C, as illustrated in FIG. **12**A(b). Still alternatively, the object may be divided into N object regions, and the haptic

module **157** may be configured to generate different types of haptic effects for the N object regions. Even in the case when the object is divided into three or more object regions, a haptic region and a proximity region may both be set in various manners according to the environment of use of the mobile terminal **100**.

An object may be rendered in various shapes, other than a circular shape. For example, an object may be rendered as a rectangle, as illustrated in FIG. **12**B. An object may be divided into a number of concentric object regions, as illustrated in FIG. **12**A. Alternatively, an object may be divided into various manners, other than the concentric manner. For example, an object may be divided into a number of horizontal object regions, a number of vertical object regions, a number of fan-shaped object regions or a combination thereof, as illustrated in FIGS. **12**C and **12**D. FIG. **13** illustrates diagrams for explaining how to set different haptic effects for different object regions. Referring to FIG. **13**, a user may decide how to divide an object into a number of object regions and may choose a haptic effect to be generated for each of the object regions.

The area of a proximity region may vary according to the distance from the display module **151**. That is, referring to FIG. **14**A(a), the area of a proximity region may gradually decrease from C to B and from B to A according to the distance from the display module **151**. Alternatively, the area of a proximity region may gradually increase according to the distance from the display module **151**. However, the area of a haptic region may be uniformly maintained regardless of the distance from the display module **151**, as indicated by reference character H of FIG. **14**A(b). Still alternatively, referring to FIG. **14**B(a), the area of a proximity region may be uniformly maintained regardless of the distance from the display module **151**. In this case, the area of a haptic region may be set to be less than the area of the proximity region, as indicated by reference character H of FIG. **14**B(b).

FIGS. **15** through **44** illustrate diagrams for explaining the methods shown in FIGS. **4** through **10**. For convenience, assume that the mobile terminal **100** generates vibration as a haptic effect. However, the present invention is not restricted to this. That is, the mobile terminal **100** may generate various haptic effects, other than vibration. FIGS. **15** through **24** illustrate diagrams for explaining how to generate a haptic effect in accordance with a change in a screen image displayed by the display module **151**. More specifically, FIG. **15** illustrates diagrams for explaining how to generate a haptic effect in accordance with a change in an indicator region in which a plurality of indicator icons are displayed. Referring to FIG. **15**(*a*), a plurality of indicator icons indicating received signal strength, remaining battery power, current time information and various states of the mobile terminal **100** such as whether the mobile terminal **100** is receiving or making a voice call, whether an alarm function or a morning call function is set, and whether there are unchecked new messages may be displayed.

The indicator icons may appear on or disappear from the screen of the display module **151** according to the settings or the operating state of the mobile terminal **100**. A haptic effect may be generated in accordance with a change in an indicator region in which the indicator icons are displayed. For example, a haptic effect may be generated in accordance with the lapse of time, as illustrated in FIGS. **15**(*b*) and **15**(*c*), or in accordance with a change in a level bar indicating remaining battery power, as illustrated in FIGS. **15**(*d*) and **15**(*e*). In addition, a haptic effect may be generated whenever a new indicator icon appears in an indicator region or whenever an existing indicator icon disappears from the indicator region, as illustrated in FIGS. **15**(*f*) through **15**(*h*).

It is necessary sometimes to output a plurality of vibration effects or a plurality of non-vibration haptic effects according to the type or the state of an indicator icon. For this, referring to FIG. **16**, the vibration effects or the non-vibration haptic effects may be sequentially generated in order of priority. FIG. **17** illustrates a diagram of a file transmission screen **600**. Referring to FIG. **17**, if a user chooses to transmit a file, the file transmission screen **600** may be displayed. The file transmission screen **600** includes a progress bar **603**, which indicates how much of the transmission of a file has been done. A haptic effect may be generated in accordance with a change in the progress bar **603** or a change in an image or an animated image. Different haptic effects may be generated for different types of images or animated images.

FIG. **18** illustrates diagrams for explaining how to generate different haptic effects having different patterns or different intensities for different types of operations, different speeds of change of an image or for different rates of change of an image. Referring to FIG. **18**, the intensity and the pattern of vibration may be set for each desired item. FIG. **19** illustrates diagrams for explaining how to generate a haptic effect in accordance with the progress in an operation. If a user chooses to send a file from a screen **620** for sending a file, as illustrated in FIG. **19**(*a*), a file transmission screen **630** may be displayed, as illustrated in FIG. **19**(*b*). Thereafter, a haptic effect may be generated in accordance with the progress in the transmission of a file.

More specifically, the configuration of an operation execution screen may change in various manners for various operating states of the mobile terminal **100** such as at the beginning of an operation, in the middle of the operation, at the end of the operation, upon the occurrence of an error at the beginning of the operation, upon the occurrence of an error during the operation, or upon the occurrence of an error at the end of the operation. A haptic effect may be generated in accordance with a change in the configuration of the operation execution screen, and the type of the haptic effect may vary according to the type of operation, the type of animated image, or the progression rate of an operation.

FIG. **20** illustrates diagrams of various popup screens. Referring to FIG. **20**, when a button or a predetermined position on the screen of the display module **151** is touched, a popup screen **641**, **643** or **645** including a menu or a number of icons may be displayed, and a haptic effect corresponding to the popup screen **641**, **643** or **645** may be generated. In this case, the type of the haptic effect may vary according to the number of popup screens displayed by the display module **151**, the relative position of each of the popup screens to a whole screen, the types of the popup screens, and the ratio of the area of each of the popup screens to the area of the whole screen.

FIG. **21** illustrates diagrams for explaining the rotation of a screen image. If the mobile terminal **100** is rotated by 90° when a screen image **650** is displayed, as illustrated in FIG. **21**(*a*), a screen image **660** obtained by rotating the screen image **650** by 90° may be displayed, as illustrated in FIG. **21**(*b*), and a haptic effect indicating the rotation of the screen image **650** may be generated. FIG. **22** illustrates diagrams for explaining the enlargement or the reduction of a screen image. If a user chooses to enlarge or reduce a current screen image when a screen image **673** is displayed, as illustrated in FIG. **22**(*b*), an enlarged screen image **675** or a reduced screen image **671** of the screen image **671** may be displayed, as illustrated in FIG. **22**(*c*) or **22**(*a*), and a haptic effect corresponding to the enlargement or the reduction of the screen

image **673** may be generated. In this case, the type of the haptic effect may vary according to the rate or the speed of enlargement or reduction of the screen image **673**.

FIG. **23** illustrates a diagram of an idle avatar screen **680**. Referring to FIG. **23**, if an avatar mode is chosen from a menu for decorating an idle screen, the idle avatar screen **680** may be displayed. If a communication event such as making/receiving a call or the transmission/reception of messages occurs, a number of avatar images representing the parties who engage in the communication event may be displayed on the idle avatar screen **680**, and the shapes of the avatar images may be altered according to the progress in the communication event. In addition, the states of the parties who engage in the communication event, date information, time information may be simple text messages may also be displayed on the idle avatar screen **680**. Different avatar images may be designated for different groups registered in a phone book.

If any one of the avatar images displayed on the idle avatar screen **680** is touched, the configuration of the idle avatar screen **680** may change. In this case, a haptic effect corresponding to the change in the configuration of the idle avatar screen **680** may be generated. The type of the haptic effect may vary according to which of the avatar images displayed on the idle avatar screen **680** has been touched and which part of the touched avatar images has been touched.

FIG. **24** illustrates a diagram of a music file play screen **690**. Referring to FIG. **24**, a haptic effect may be generated in accordance with a change in voice/sound, pitch, frequency or amplitude by using the music file play screen **690**. For example, an equalizer showing changes in sound in each frequency band may be displayed on the music file play screen **690**. The equalizer may include a plurality of bars respectively representing a plurality of frequency bands, and the size of each of the bars of the equalizer may vary in accordance with a change in sound in a corresponding frequency band. A haptic effect may be generated in accordance with a change in the size of each of the bars of the equalizer. The pattern and the intensity of vibration may vary according to the rate of change of the size of each of the bars of the equalizer.

FIGS. **25** through **31** illustrate diagrams for explaining how to generate and store a haptic effect during the reproduction of a moving image file. More specifically, FIG. **25** illustrates a diagram of a moving image reproduction screen **700**. Referring to FIG. **25**, various haptic effects may be generated for various changes in the moving image reproduction screen **700**. For example, assuming that frames shown in FIGS. **26**(*a*) and **26**(*b*) are previous frames and a frame shown in FIG. **26**(*c*) is a current frame, various vibration effects having different patterns and/or different intensities may be generated according to the rate of change of an image between the previous frames and the current frame. For this, one of a plurality of previous frames stored in advance may be chosen, and the chosen previous frame may be compared with the current frame.

A number of objects included in a frame may be recognized by their size. Thus, a haptic effect corresponding to whichever of the objects changes most considerably may be generated. FIG. **27** shows how to set different vibration effects or different non-vibration haptic effects for different rates of change of an image or for objects having different sizes. Referring to FIG. **27**, a user may set different haptic effects for different rates of change of an image or for objects having different sizes.

FIG. **28** illustrates a diagram for explaining how to set a haptic effect with the use of a moving image screen **710**. Referring to FIG. **28**, if a user chooses to reproduce a moving image file, the moving image screen **710** may be displayed. The moving image screen **710** may include an icon **713** for setting a haptic effect such as vibration. If the user chooses the icon **713**, the user may set a haptic effect for each desired frame of the moving image file, as illustrated in FIG. **26**.

If the user sets a vibration effect for a moving image file, vibration data corresponding to the vibration effect may be stored along with synchronization information so as to be synchronized with the moving image file. Referring to FIG. **28**, if the moving image file is 'Dance.avi', the vibration data may be stored as 'Dance.vib'. That is, the vibration data may be stored as a file sharing the same file name as that of the moving image file but having a different extension from that of the moving image file. Therefore, if there is a vibration data file having the same file name as that of a moving image file, the moving image file may be reproduced along with the vibration data file. On the other hand, if there is no vibration data file having the same file name as that of a moving image file, only the moving image file may be reproduced. This exemplary embodiment may be applied not only to moving image files but also to music files.

If a number of number icons or menu icons are displayed at a lower portion of a moving image screen **720**, as illustrated in FIG. **30**, vibration may be generated in various manners according to which of the number icons or the menu icons is chosen. More specifically, referring to FIG. **31**, various vibration effects may be set using the moving image screen **720** so that the pattern and the intensity of vibration can vary according to which of a plurality of icons displayed on the moving image screen **720** has been chosen and how the chosen icon has been touched, i.e., whether the chosen icon has been touched for a short time or for a long time and whether the chosen icon has been touched lightly or firmly.

FIGS. **32** through **42** illustrate diagrams for explaining how to generate a haptic effect according to the content of information displayed on the screen of the display module **151**. More specifically, FIG. **32** illustrates a diagram of a character input window **820**. Referring to FIG. **32**, the character input window **820** and a display window **810** may be displayed on a screen **800** of the display module **151**. The character input window **820** may include a plurality of touch keys for inputting numerals to the screen **800** during a call mode. The display window **810** may display a number of numerals input through the character input window **820**.

Different haptic effects may be generated for different characters mapped to each of the touch keys of the character input window **820**. If a character is input using the character input window **820**, a haptic effect may be generated in consideration of the configuration of the input character. More specifically, if vibration is output in response to a touch input for each of the touch keys of the character input window **820**, different vibration effects may be designated for different characters mapped to each of the touch keys of the character input window **820**. In this manner, a user may be able to easily recognize a character input by himself/herself based on the pattern and the intensity of vibration output by the mobile terminal **100** without the need to look at the screen of the mobile terminal **100**.

FIG. **34** illustrates a diagram of a call reception screen **830**. Referring to FIG. **34**, if a request for a call connection is issued, the call reception screen **830** may be displayed. In this case, caller information regarding a caller who has issued the request may be analyzed, and a haptic effect corresponding to the caller may be generated. In addition, if another call or a message is received during a call with the caller, caller information corresponding to the received call or the received message may be analyzed. If the received call or message is

associated with any one of a plurality of phone numbers registered in a phone book, a haptic effect corresponding to the caller of the received call or message may be generated. On the other hand, if the received call or message is not associated with any one of the registered phone numbers, a haptic effect corresponding to the phone number of the received call or message may be generated.

FIG. **35** illustrates a diagram of a message reception screen **840**. Referring to FIG. **35**, if a message is received during a call, a predetermined word may be parsed from the received message, and a haptic effect corresponding to the parsed word may be generated. The predefined word may be chosen in advance by a user. If vibration is generated as a haptic effect, the intensity and the pattern of vibration to be generated for the predefined word may be set and altered by the user.

If a message is received, the content of the received message may be analyzed. If the results of the analysis indicate that the received message includes a predefined word for which a haptic effect is to be generated, a haptic effect corresponding to the predefined word may be generated. The predefined word may be chosen in advance by the user, and the pattern and the intensity of the haptic effect may be set by the user.

During a call with a caller or a callee, the speech of the caller or the callee may be analyzed. If the speech of the caller or the callee includes a predefined word, a haptic effect corresponding to the predefined word may be generated. The predefined word may be chosen in advance by the user. If the voice of the caller or the callee is stored in a database, a haptic effect corresponding to the voice of the caller or the callee may be generated. In addition, if a change in the voice or the voice volume of the caller or the callee is detected during the call with the caller or the callee, a haptic effect corresponding to the voice change or the voice volume change may be generated.

FIG. **36** illustrates a diagram of a screen image **860** including a plurality of menu icons. Referring to FIG. **36**, if a user touches or approaches and thus chooses one of the menu icons, the name of the chosen menu icon may be analyzed, and a haptic effect corresponding to the name of the chosen menu icon may be generated. For example, if the user chooses a menu icon 'setting', haptic effects (such as vibration effects) respectively corresponding to alphabet letters 's', 'e', 't', 't', 'i', 'n', and 'g' may be sequentially output. Alternatively, the user may set a haptic effect for the word 'setting' in advance. In this case, the haptic effect corresponding to the word 'setting' may be generated.

In order to enter a menu corresponding to the chosen menu icon, the chosen menu icon may be touched. In this case, a haptic effect corresponding to the menu may be generated. If a menu icon other than the chosen menu icon is chosen during the generation of a haptic effect corresponding to the chosen menu icon, the generation of the haptic effect corresponding to the previously-chosen menu icon may be terminated, and a haptic effect corresponding to the newly-chosen menu icon may be generated. In this manner, the user may easily recognize a menu icon chosen by himself/herself based on a haptic effect generated by the mobile terminal **100**.

FIG. **37** illustrates a diagram of a phone book list screen **860**. Referring to FIG. **37**, if a user touches and thus chooses one of a plurality of items displayed on the phone book list screen **960**, the name of a person corresponding to the chosen item may be analyzed, and a haptic effect may be generated according to the results of the analysis. If the user looks someone up in a phone book by inputting a character or a string of characters to the phone book list screen **860**, the input character or the input character string may be analyzed, and a haptic effect corresponding to the input character or the input character string may be generated.

FIG. **38** illustrates a diagram of a screen image **870** displayed when one of the items of the phone book list screen **860** is chosen. Referring to FIG. **38**, if one of the items of the phone book list screen **860** is chosen, a group information string corresponding to the chosen item may be analyzed, and a haptic effect may be generated according to the results of the analysis. Alternatively, a haptic effect corresponding to various information, other than group information, may be generated. For example, a haptic effect corresponding to a phone number or a memo stored in a phone book may be generated, or a haptic effect indicating whether an image or an avatar is registered may be generated.

FIG. **39** illustrates a diagram of a message list screen **880**. Referring to FIG. **39**, if a user chooses to view a list of received messages or sent messages, the message list screen **880** may be displayed. If the user touches one of a plurality of items displayed on the message list screen **880**, a message **890** corresponding to the chosen item may be parsed. If the results of the parsing indicate that the message **890** includes a predefined word, a haptic effect corresponding to the predefined word may be generated.

If a message has a file attached thereto, a haptic effect corresponding to the type of the attached file may be generated. That is, the attached file may be classified into, for example, a music file, a game file, or a moving image file, according to the extension of the attached file, and a haptic effect corresponding to the type of the attached file may be generated. In this manner, different haptic effects may be generated for different types of attached files.

For example, if a message has a game file attached thereto, a haptic effect corresponding to game files may be generated. If a haptic effect is yet to be designated for game files, a haptic effect corresponding to a string of alphabet letters 'g', 'a', 'm', and 'e' may be generated. If a message has an image file or a music file attached thereto, a haptic effect may be generated in the above-described manner.

FIG. **40** illustrates a diagram of a short-range communication connection screen **910**. Referring to FIG. **40**, if the mobile terminal **100** is within a short range of a communication device and can thus communicate with the communication device using a short-range communication method such as Bluetooth, the short-range communication connection screen **910** may be displayed. In this case, a haptic effect corresponding to the communication device or a haptic effect indicating that a short-range communication channel has been established between the mobile terminal **100** and the communication device may be generated.

If the mobile terminal **100** receives a file from the communication device through short-range communication, a haptic effect corresponding to the type of the received file may be generated. That is, the received file may be classified into, for example, an image file, a music file, or a game file, and a haptic effect corresponding to the type of the received file may be generated. For example, if the received file is an image file, a haptic effect corresponding to image files may be generated. If a haptic effect is yet to be designated for image files, a haptic effect corresponding to a string of alphabet letters 'i', 'm', 'a', 'g', and 'e' may be generated. In this manner, a user may easily recognize the type of the received file based on a haptic effect generated by the mobile terminal **100** without the need to open the received file.

FIG. **41** illustrates a diagram of a document viewer screen **920**. Referring to FIG. **41**, if a predetermined word included in a document displayed on the document viewer screen **920** is touched and thus chosen, the chosen word may be analyzed,

and a haptic effect corresponding to the chosen word may be generated. That is, if the chosen word is registered in a wordbook, a user's dictionary or a recent search list database, a haptic effect corresponding to the chosen word may be generated. If the chosen word is touched again during the generation of the haptic effect corresponding to the chosen word, a wordbook or dictionary screen may be displayed.

FIG. **42** illustrates a diagram of a web page screen **930**. Referring to FIG. **42**, if a uniform resource locator (URL) displayed on the web page screen **930** is touched, a vibration effect or a non-vibration haptic effect corresponding to the character pattern of the URL may be generated. If the URL is touched again during the generation of the haptic effect corresponding to the character pattern of the URL or the URL is touched for more than a predefined amount of time, a web page corresponding to the URL may be displayed.

If a web browser is executed and a link corresponding to a URL registered as Favorites is touched, the character pattern of the URL may be analyzed, and a haptic effect corresponding to the character pattern of the URL may be generated. In this case, if the URL is touched again during the generation of the haptic effect corresponding to the character pattern of the URL, a web page corresponding to the touched link may be displayed.

FIGS. **43** through **50** illustrate diagrams for explaining how to generate different haptic effects for different object regions. More specifically, FIG. **43** illustrates a diagram for explaining how to generate different haptic effects for different object regions of a touch key displayed in a touch keypad input window. Referring to FIG. **43**, when objects **1** and **2** correspond to soft keys **1** and **2**, respectively, displayed in a keypad input window, the intensity of a haptic effect generated when a central portion of each of objects **1** and **2** is touched or approached may be higher than the intensity of a haptic effect generated when a boundary portion of each of objects **1** and **2** are touched or approached. No haptic effect may be generated when the area between objects **1** and **2** is touched or approached. In this manner, a user may easily recognize the boundary between objects **1** and **2** by using the sense of touch.

Each of objects **1** and **2** may be divided into two haptic regions, as illustrated in FIG. **43**. Alternatively, each of objects **1** and **2** may be divided into two or more haptic regions. FIG. **44** illustrates a diagram for explaining how to generate different haptic effects for different object regions of a menu icon. Referring to FIG. **44**, if a central portion of a menu icon is touched or approached, a strong haptic effect may be generated. On the other hand, if a boundary portion of a menu icon is touched or approached, a weak haptic effect may be generated. That is, different haptic effects may be generated for different haptic regions in each object. In the exemplary embodiment of FIG. **44**, like in the exemplary embodiment of FIG. **43**, no haptic effect may be generated when the area between a pair of adjacent objects is touched or approached. Thus, a user may easily recognize the boundary between the pair of adjacent objects by using the sense of touch.

FIG. **45** illustrates a diagram of a wheel-type control icon. Referring to FIG. **45**, the wheel-type control icon may be used to adjust sound volume or brightness. More specifically, the wheel-type control icon may be rotated by being touched and dragged. Then, sound volume or brightness may be adjusted in stages by the amount by which the wheel-type control icon is rotated. In this case, a haptic effect may be generated according to the amount by which the wheel-type control icon is rotated.

FIG. **46** illustrates a diagram of a sound volume control screen **940**. Referring to FIG. **46**, if a sound volume control icon **943** displayed on the sound volume control screen **940** is touched and dragged, sound volume may be adjusted by the amount by which the sound volume control icon **943** is dragged. In this case, a haptic effect may be generated according to the amount by which the sound volume control icon **943** is dragged. The volume control icon **943** may be divided into a number of haptic regions. The intensity of the haptic effect may increase proportionally to sound volume.

FIG. **47** illustrates a diagram of a brightness control screen **950** for adjusting the brightness of the display module **151**. Referring to FIG. **47**, if a brightness control icon **953** displayed on the brightness control screen **950** is touched and dragged, the brightness of the display module **151** may be adjusted by the amount by which the brightness control icon **953** is dragged. In this case, if a portion of the brightness control icon **953** for increasing the brightness of the display module **151** is touched or approached, a strong haptic effect may be generated. On the other hand, if a portion of the brightness control icon **953** for lowering the brightness of the display module **151** is touched or approached, a weak haptic effect may be generated. If a user changes the color of a screen image, a haptic effect may be generated. In this case, different haptic effects may be generated for different colors or shades. For example, a haptic effect generated for a light color may be weaker than a haptic effect generated for a deep color.

FIG. **48** illustrates a diagram of an image rotation screen **960**. Referring to FIG. **48**, different haptic effects may be generated for different image rotation angles of 0° (**961**), 90° (**963**), and 180° (**965**). For example, a haptic effect generated for the image rotation angle of 0° may be weakest, and a haptic effect generated for the image rotation angle of 180° may be strongest. Alternatively, the haptic effect generated for the image rotation angle of 0° may be strongest, and the haptic effect generated for the image rotation angle of 180° may be weakest.

FIG. **49** illustrates a diagram of a channel selection screen **970**. Referring to FIG. **49**, a user may choose one of a plurality of icons **971** respectively representing a plurality of channels from the channel selection screen **970** in order to watch a broadcast program or listen to the radio. In this case, a haptic effect may be generated. A haptic effect generated when a boundary portion of each of the icons **971** is touched by the user may be weaker than a haptic effect generated when a central portion of each of the icons **971**. In addition, no haptic effect may be generated when the areas between the icons **971** are touched. Thus, the user may easily recognize the boundaries between the icons **971** by using the sense of touch. This exemplary embodiment may be directly applied to an icon **973** for adjusting sound volume.

FIG. **50** illustrates a diagram of a melody-playing screen **980**. Referring to FIG. **50**, a keyboard including a plurality of piano keys may be displayed on the melody-playing screen **980**. A haptic effect generated when a boundary portion of each of the piano keys is touched may be different from a haptic effect generated when a central portion of each of the piano keys is touched. The melody-playing screen **980** is illustrated in FIG. **50** as being a keyboard-playing screen, but the present invention is not restricted to this. That is, the present invention may be directly applied to various instrument-playing screens, other than a keyboard-playing screen.

If a sound volume control icon **987** is provided on the melody-playing screen **980**, a haptic effect may be generated according to sound volume.

In addition, if a list is displayed on the melody-playing screen **980**, different haptic effects may be generated for

different items in the list. In this case, a haptic effect generated for the uppermost item in the list may be weakest, and a haptic effect generated for the lowermost item in the list may be strongest. Alternatively, the haptic effect generated for the uppermost item in the list may be weakest, and the haptic effect generated for the lowermost item in the list may be strongest.

In the case of a multi-viewer screen, different haptic effects may be generated for different images displayed on the multi-viewer screen. In this case, a haptic effect generated when a boundary portion of each of the images displayed on the multi-viewer screen may be different from a haptic effect generated when a central portion of each of the images displayed on the multi-viewer screen. In addition, no haptic effect may be generated when the areas among the images displayed on the multi-viewer screen are touched. Thus, a user may easily recognize the boundaries between the images displayed on the multi-viewer screen by using the sense of touch. This exemplary embodiment may be directly applied to a music-playing screen, and particularly, to the selection of a section to be played or the control of sound volume.

The mobile terminal according to the present invention and the method of controlling a mobile terminal according to the present invention are not restricted to the exemplary embodiments set forth herein. Therefore, variations and combinations of the exemplary embodiments set forth herein may fall within the scope of the present invention. The present invention can be realized as computer-readable code written on a computer-readable recording medium. The computer-readable recording medium may be any type of recording device in which data is stored in a computer-readable manner. Examples of the computer-readable recording medium include a ROM, a RAM, a CD-ROM, a magnetic tape, a floppy disc, an optical data storage, and a carrier wave (e.g., data transmission through the Internet). The computer-readable recording medium can be distributed over a plurality of computer systems connected to a network so that computer-readable code is written thereto and executed therefrom in a decentralized manner. Functional programs, code, and code segments needed for realizing the present invention can be easily construed by one of ordinary skill in the art.

As described above, according to the present invention, it is possible to generate different haptic effects having different intensities and/or different patterns for different haptic regions of an object such as a menu icon, a control icon, a touch key and an image for controlling the operation of a mobile terminal. Thus, it is possible for a user to easily determine whether the object has been touched or approached by using the sense of touch, rather than using the sense of vision. Therefore, it is possible to easily control the operation of a mobile terminal.

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

What is claimed is:

1. A method of controlling a mobile terminal, the method comprising:

controlling a touch screen of the mobile terminal, via a controller of the mobile terminal, to display at least one object, wherein each of the at least one object is divided into a plurality of haptic regions;

receiving an initial touch input, via the touch screen, of one haptic region of the plurality of haptic regions of one of the at least one object;

outputting a control signal, via the controller, for controlling a haptic module of the mobile terminal to generate a haptic effect based on the received initial touch input;

generating the haptic effect, via the haptic module, in response to the output control signal, the generated haptic effect corresponding to the one haptic region that received the initial touch input;

receiving another touch input, via the touch screen, during generation of the haptic effect, wherein the another touch input is received away from the one of the at least one object that includes the one haptic region that received the initial touch input; and

ceasing the generation of the haptic effect based on receipt of the another touch input,

wherein the plurality of haptic regions of each of the at least one object includes at least a first haptic region and a second haptic region,

wherein the output control signal controls the haptic module to generate the haptic effect corresponding to the first haptic region of the one of the at least one object when the initial touch input is received at the first haptic region of the one of the at least one object,

wherein the output control signal controls the haptic module to generate the haptic effect corresponding to the second haptic region of the one of the at least one object when the initial touch input is received at the second haptic region of the one of the at least one object, and

wherein the haptic effect corresponding to the first haptic region of the one of the at least one object is different from the haptic effect corresponding to the second haptic region of the one of the at least one object.

2. The method of claim **1**, wherein:

each of the at least one object comprises a menu icon, a control icon, a touch key or an image; and

each of the at least one object is associated with control of an operation of the mobile terminal.

3. The method of claim **1**, wherein controlling the touch screen to display the at least one object comprises controlling the touch screen to display each of the at least one object such that it is distinguished from other of the at least one object.

4. The method of claim **1**, further comprising performing, under control of the controller, a predetermined operation corresponding to the one of the at least one object that includes the one haptic region that received the initial touch input.

5. The method of claim **4**, further comprising outputting a control signal, via the controller, for controlling the haptic module to generate a haptic effect corresponding to the predetermined operation during the performance of the predetermined operation.

6. The method of claim **1**, wherein at least one of the generated haptic effects is vibration.

7. The method of claim **1**, further comprising controlling the touch screen, via the controller, to display an image corresponding to at least one of the generated haptic effects.

8. The method of claim **1**, further comprising controlling the touch screen, via the controller, to display a menu for setting the plurality of haptic regions.

9. The method of claim **1**, further comprising:

controlling the touch screen, via the controller, to display a menu for setting a type, intensity or pattern of a haptic effect for each of the plurality of haptic regions of the at least one object.

10. The method of claim **1**, further comprising:

generating a proximity signal, via a proximity sensor of the mobile terminal, indicating that an entity is approaching

the one haptic region of the plurality of haptic regions of the one of the at least one object; and

outputting a control signal, via the controller, for controlling the haptic module to generate the haptic effect corresponding to the haptic region approached by the entity in response to the proximity signal.

11. A mobile terminal, comprising:

a touch screen configured to:

display at least one object, wherein each of the at least one object is divided into a plurality of haptic regions;

receive an initial touch input at one haptic region of the plurality of haptic regions of one of the at least one object; and

receive another touch input away from the one of the at least one object that includes the one haptic region that received the initial touch input;

a haptic module configured to generate a haptic effect; and

a controller configured to output a control signal for controlling the haptic module to:

generate the haptic effect based on the received initial touch input; and

cease the generation of the haptic effect based on receipt of the another touch input,

wherein the plurality of haptic regions of each of the at least one object includes at least a first haptic region and a second haptic region,

wherein the output control signal controls the haptic module to generate the haptic effect corresponding to the first haptic region of the one of the at least one object when the initial touch input is received at the first haptic region of the one of the at least one object, and controls the haptic module to generate the haptic effect corresponding to the second haptic region of the one of the at least one object when the initial touch input is received at the second haptic region of the one of the at least one object, and

wherein the haptic effect corresponding to the first haptic region of the one of the at least one object is different from the haptic effect corresponding to the second haptic region of the one of the at least one object.

12. The mobile terminal of claim **11**, wherein:

each of the at least one object comprises a menu icon, a control icon, a touch key or an image; and

each of the at least one object is associated with the control of an operation of the mobile terminal.

13. The mobile terminal of claim **11**, wherein the controller is further configured to control the touch screen to display each of the at least one object such that it is distinguished from other of the at least one object.

14. The mobile terminal of claim **11**, wherein at least one of the generated haptic effects is vibration.

15. The mobile terminal of claim **11**, wherein the controller is further configured to control the touch screen to display an image corresponding to one of the generated haptic effects.

16. The mobile terminal of claim **11**, wherein the controller is further configured to control the touch screen to display a menu for setting the plurality of haptic regions.

17. The mobile terminal of claim **11**, wherein the controller is further configured to control the touch screen to display a menu for setting a type, intensity or pattern of a haptic effect for each of the plurality of haptic regions of the at least one object.

18. The mobile terminal of claim **11**, further comprising:

a proximity sensor configured to determine whether an entity approaches the one haptic region of the plurality of haptic regions of the one of the at least one object and to generate a proximity signal indicating which haptic region is approached by the entity and the degree of proximity between the approaching entity and the approached haptic region,

wherein the controller is further configured to control the haptic module to generate the haptic effect corresponding to the approached haptic region in response to the proximity signal.

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