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(12) **Reissued Patent**
Yamada

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(54) **INFORMATION PROCESSING APPARATUS**

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(51) **Int. Cl.**
G06F 3/041 (2006.01)
G09G 5/10 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G06F 1/1626*** (2013.01); ***G06F 3/0412*** (2013.01); ***G06F 3/0488*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC G06F 3/041; G06F 21/31; G09G 5/10
See application file for complete search history.

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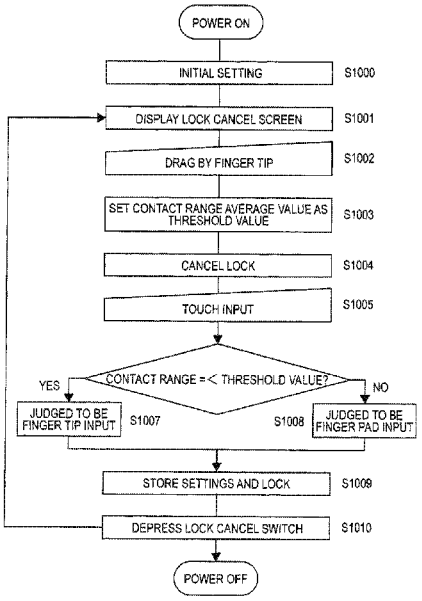
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(Continued)

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(57) **ABSTRACT**

An information processing apparatus includes a touch panel which displays pieces of identification information including letters, figures, and symbols and detects a contact of the panel with a finger of a user or other object. When the touch panel detects the contact of the panel, a detection unit specifies identification information of one or more of the multiple pieces of identification information displayed on the touch panel, indicated by a position at which the contact in question occurred. The detection unit also detects an area of part of the panel where the contact occurred. A storage unit stores reference identification information and a reference area range. A control unit performs particular processing upon matching of the detected identification information with the stored reference identification information and the area of the contact detected by the detection unit falling within the stored reference area range.

5 Claims, 17 Drawing Sheets



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G06F 3/0484	(2013.01)
G06F 3/0488	(2013.01)
G06F 21/31	(2013.01)

(52) **U.S. Cl.**

CPC ***G06F 3/04842*** (2013.01); ***G06F 21/31*** (2013.01); *G06F 2221/2109* (2013.01); *G06F 2221/2117* (2013.01)

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FIG. 1A

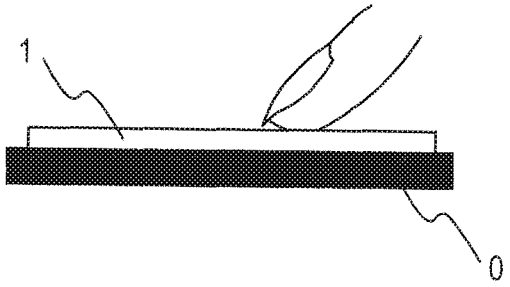


FIG. 1B

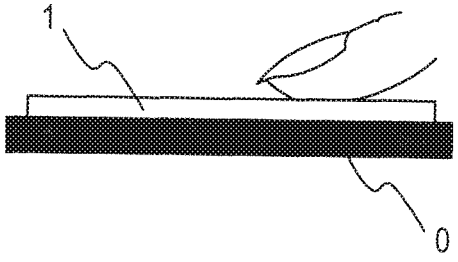


FIG. 2

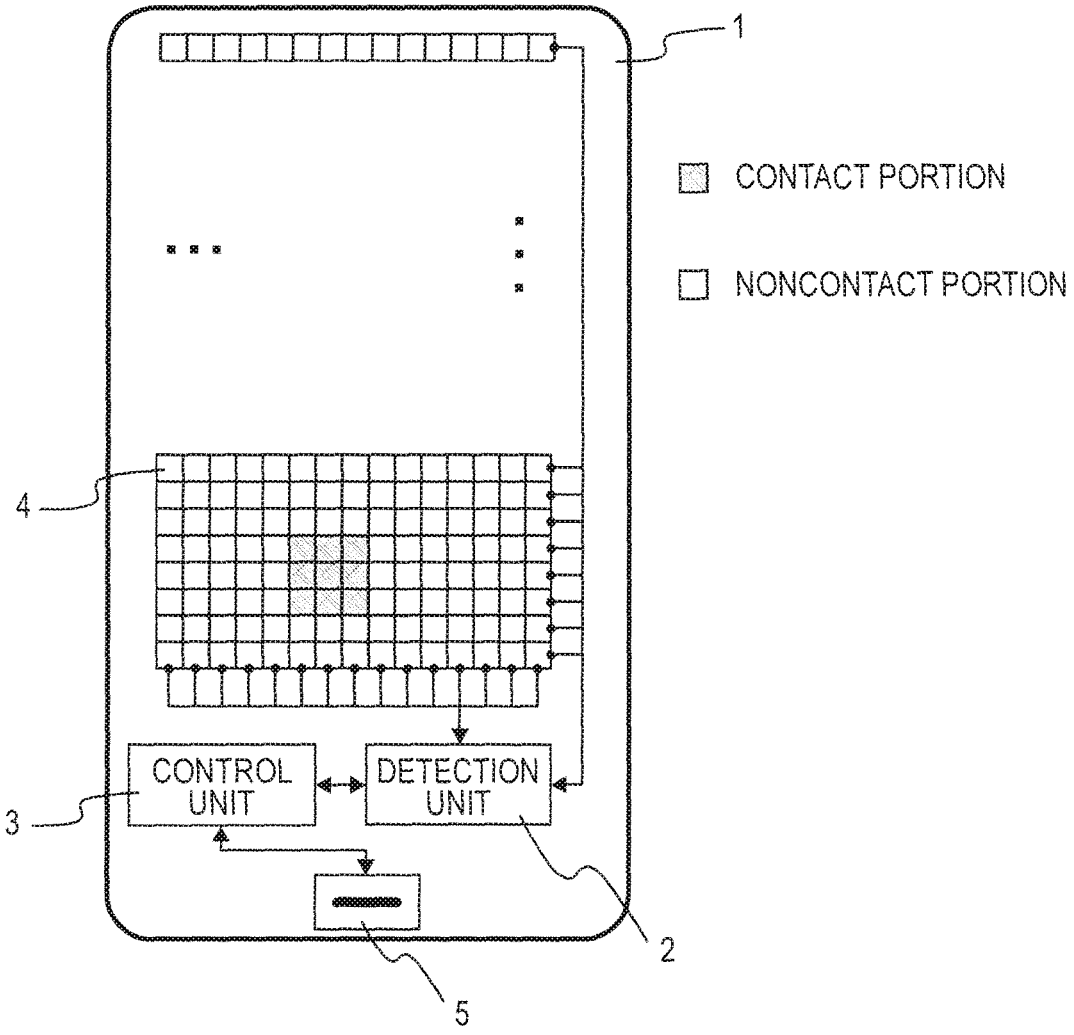

1
CONTACT PORTION
NONCONTACT PORTION
4
CONTROL UNIT
DETECTION UNIT
3
2
5

FIG. 3

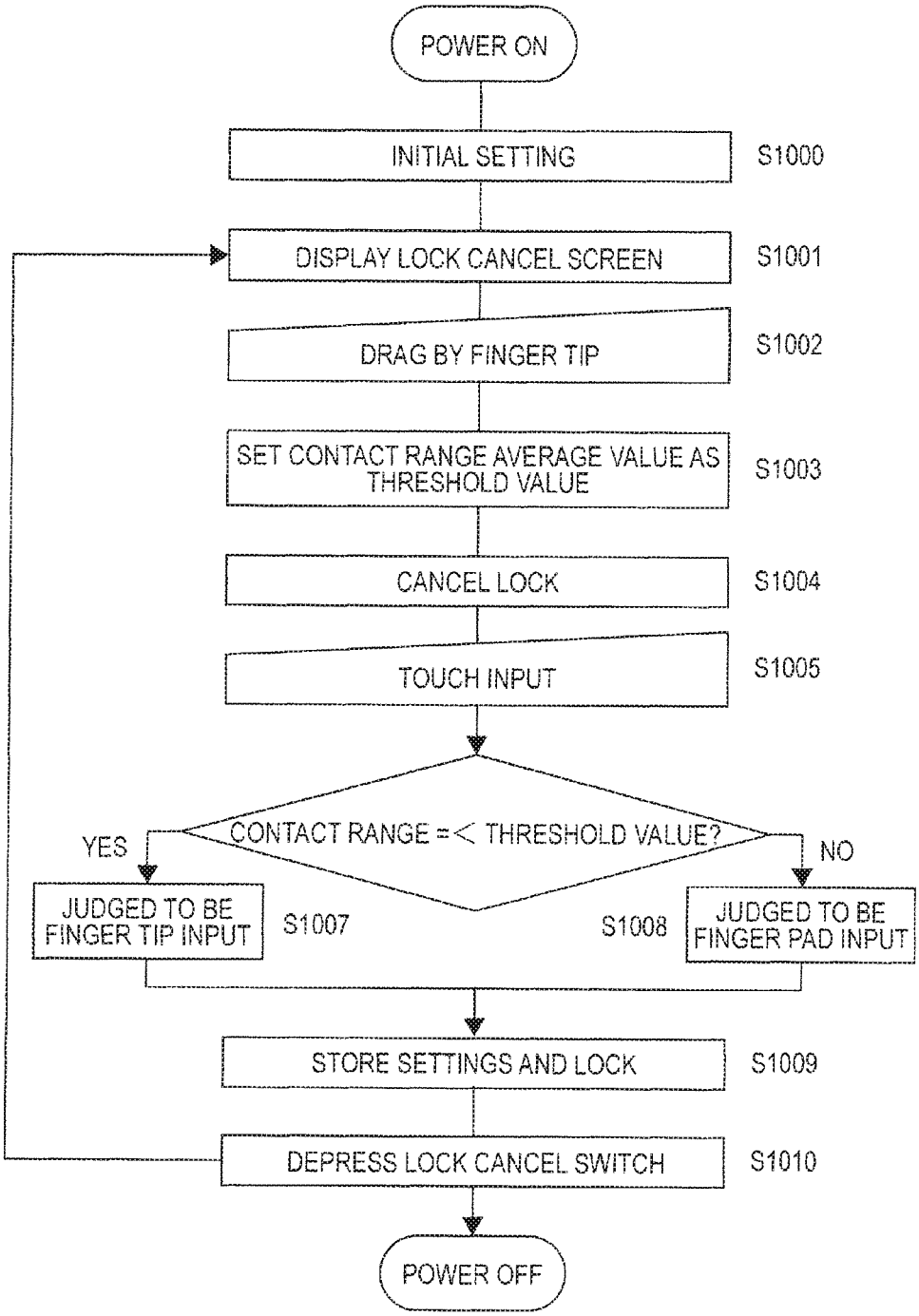

POWER ON
INITIAL SETTING
S1000
DISPLAY LOCK CANCEL SCREEN
S1001
DRAG BY FINGER TIP
S1002
SET CONTACT RANGE AVERAGE VALUE AS THRESHOLD VALUE
S1003
CANCEL LOCK
S1004
TOUCH INPUT
S1005
CONTACT RANGE =< THRESHOLD VALUE?
YES
NO
JUDGED TO BE FINGER TIP INPUT
S1007
S1008
JUDGED TO BE FINGER PAD INPUT
STORE SETTINGS AND LOCK
S1009
DEPRESS LOCK CANCEL SWITCH
S1010
POWER OFF

FIG. 4B

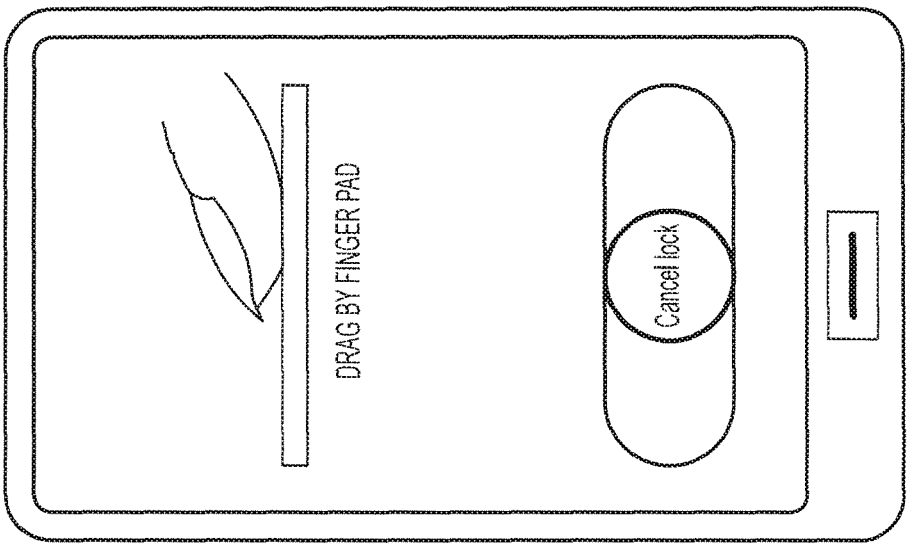

DRAG BY FINGER PAD
Cancel lock

FIG. 4A

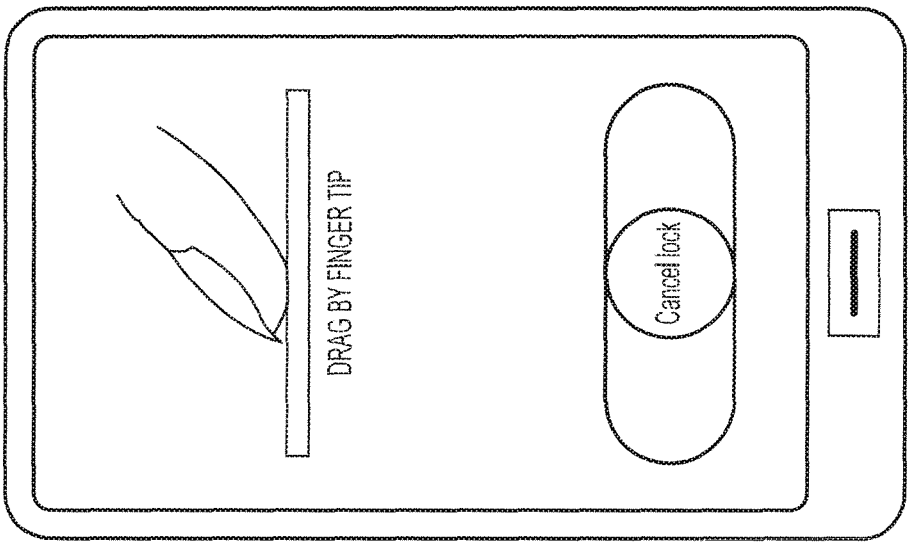

DRAG BY FINGER TIP
Cancel lock

FIG. 5A

FIG. 5B

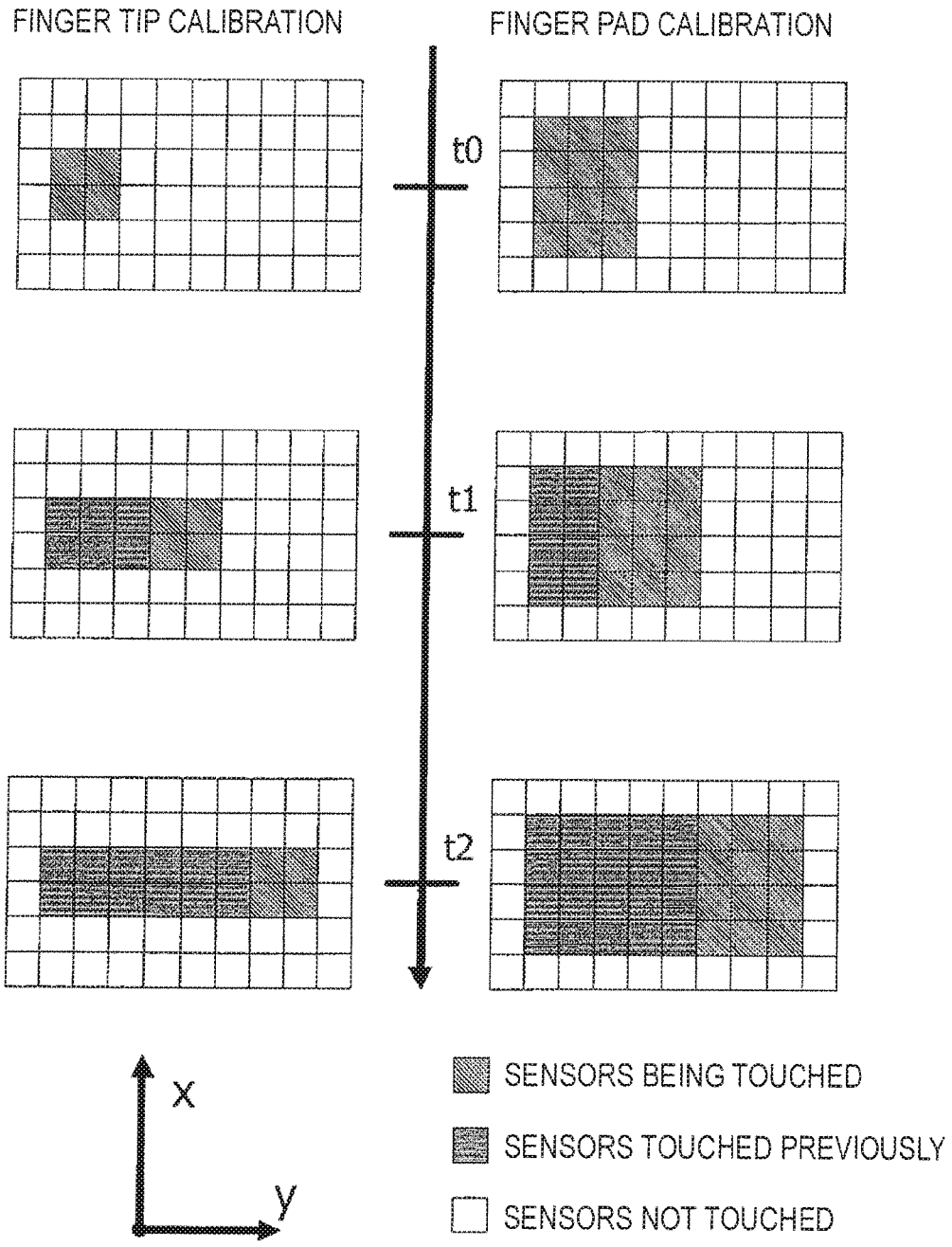

FINGER TIP CALIBRATION
FINGER PAD CALIBRATION
t0
t1
t2
x
y
SENSORS BEING TOUCHED
SENSORS TOUCHED PREVIOUSLY
SENSORS NOT TOUCHED

FIG. 6A

FIG. 6B

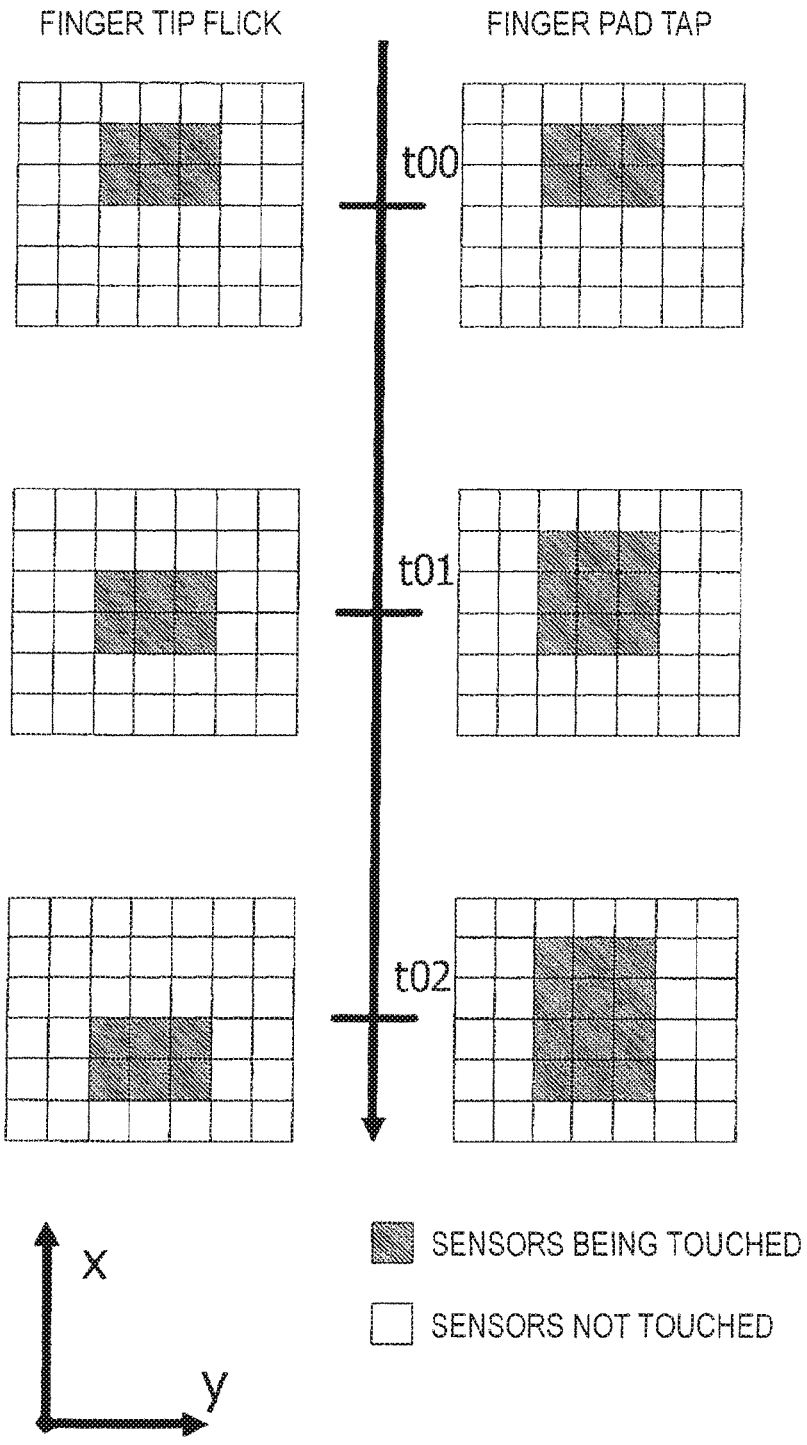

FINGER TIP FLICK
FINGER PAD TAP
t00
t01
t02
x
y
SENSORS BEING TOUCHED
SENSORS NOT TOUCHED

FIG. 7B

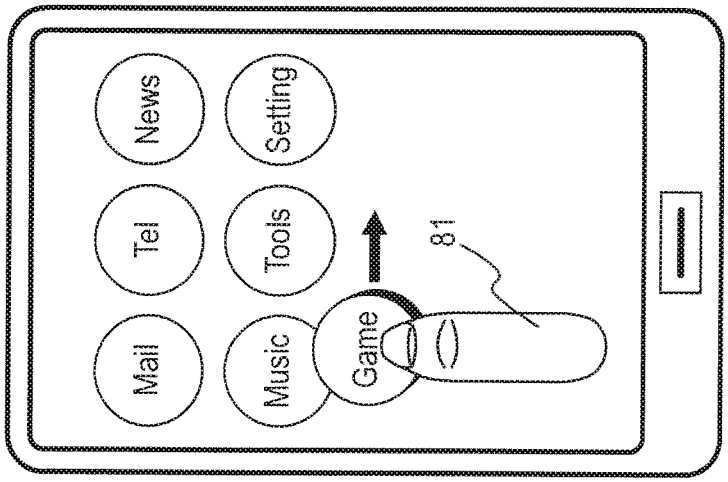

News
Setting
Tel
Tools
Mail
Music
Game
81

FIG. 7A

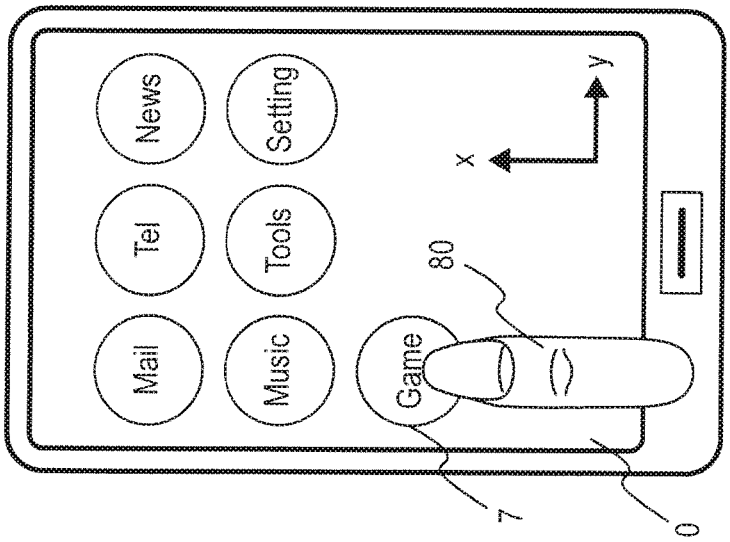

News
Setting
Tel
Tools
Mail
Music
Game
80
x
y
7
0

FIG. 7C

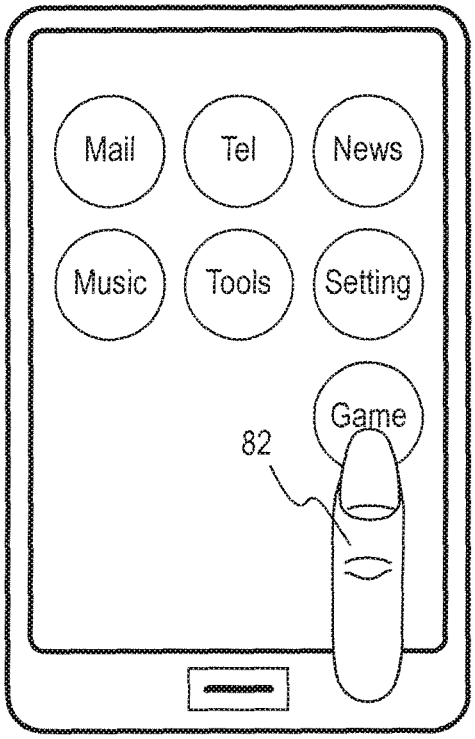


FIG. 8

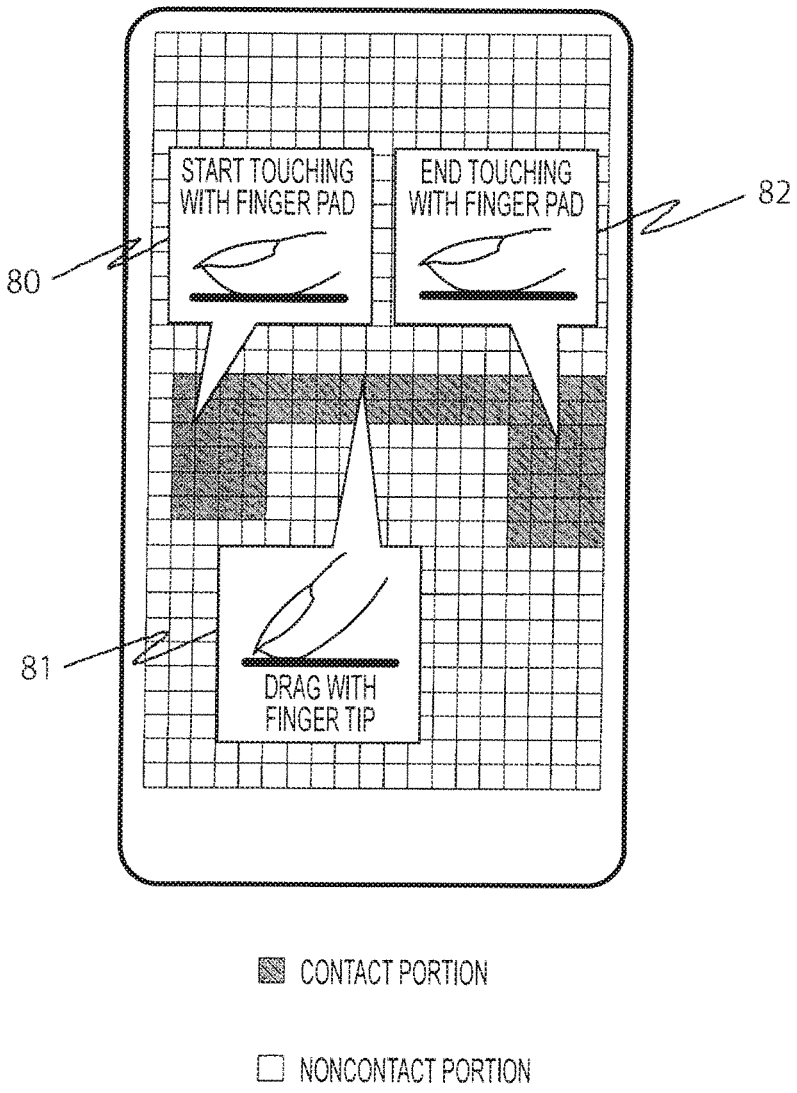

START TOUCHING WITH FINGER PAD
END TOUCHING WITH FINGER PAD
80
82
81
DRAG WITH FINGER TIP
CONTACT PORTION
NONCONTACT PORTION

FIG. 9

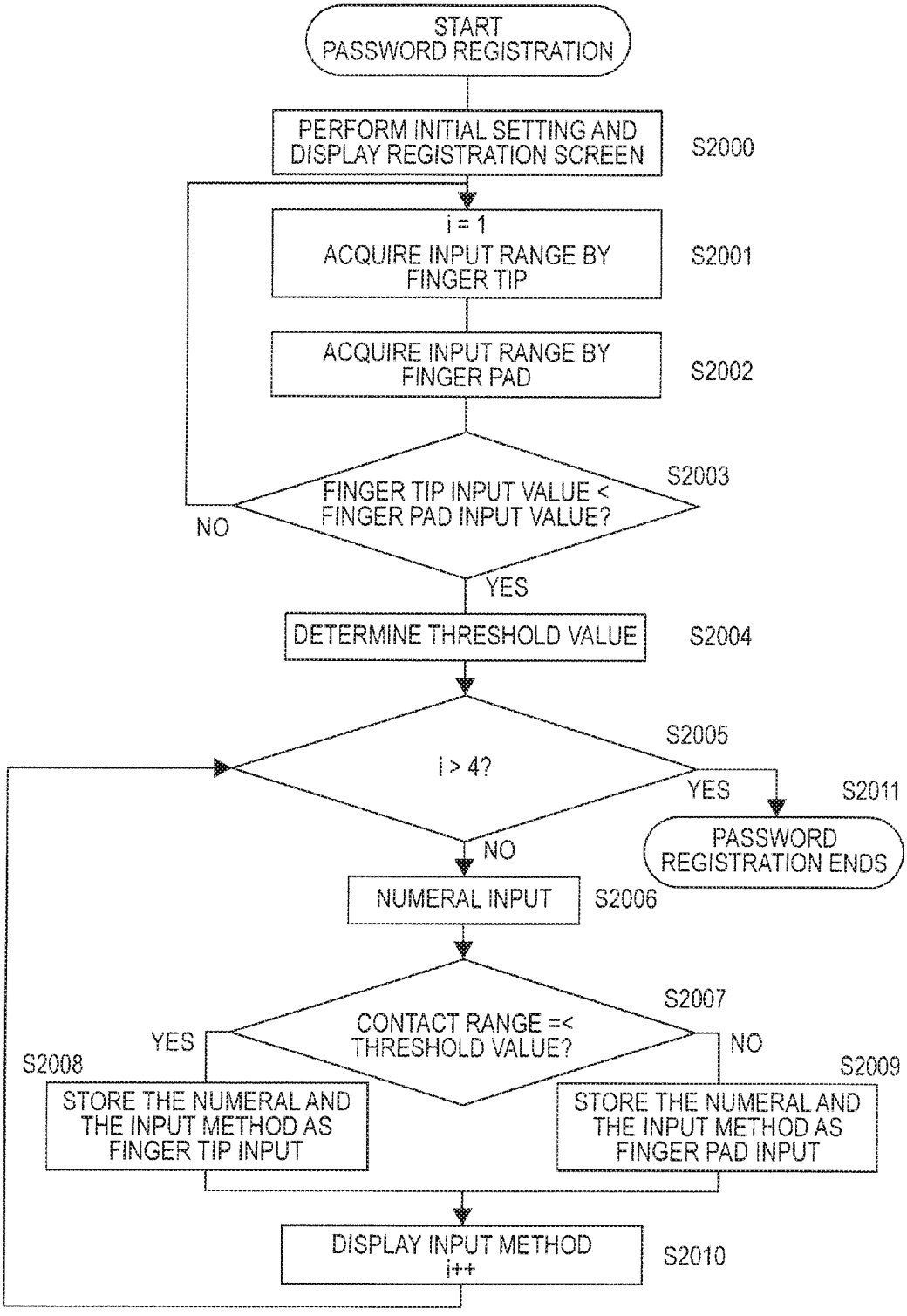

START PASSWORD REGISTRATION
PERFORM INITIAL SETTING AND DISPLAY REGISTRATION SCREEN
S2000
i = 1
ACQUIRE INPUT RANGE BY FINGER TIP
S2001
ACQUIRE INPUT RANGE BY FINGER PAD
S2002
FINGER TIP INPUT VALUE < FINGER PAD INPUT VALUE?
S2003
NO
YES
DETERMINE THRESHOLD VALUE
S2004
i > 4?
S2005
YES
S2011
PASSWORD REGISTRATION ENDS
NO
NUMERAL INPUT
S2006
CONTACT RANGE =< THRESHOLD VALUE?
S2007
YES
NO
S2008
S2009
STORE THE NUMERAL AND THE INPUT METHOD AS FINGER TIP INPUT
STORE THE NUMERAL AND THE INPUT METHOD AS FINGER PAD INPUT
DISPLAY INPUT METHOD
i++
S2010

FIG. 10B

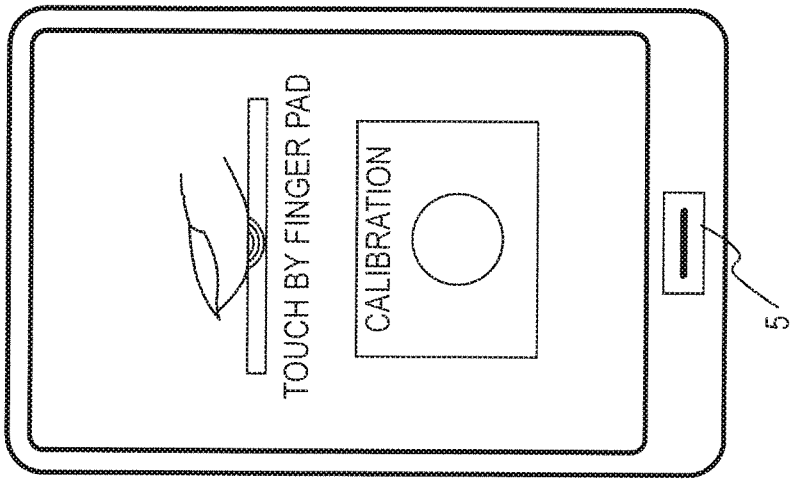


FIG. 10A

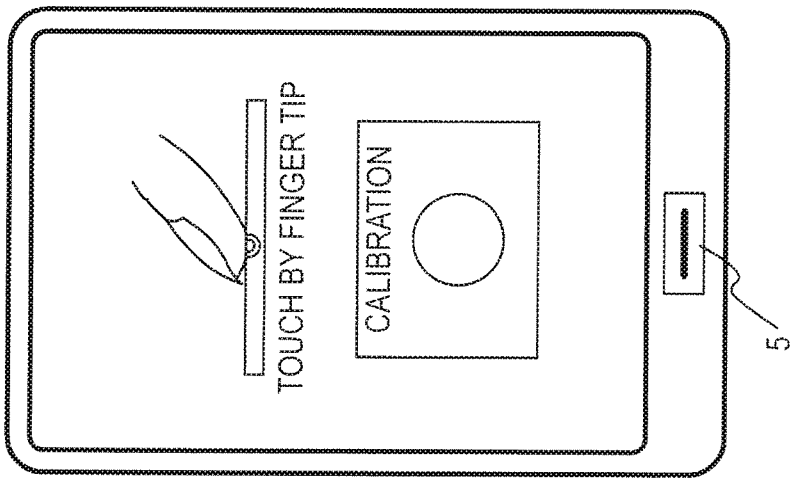


FIG. 11A

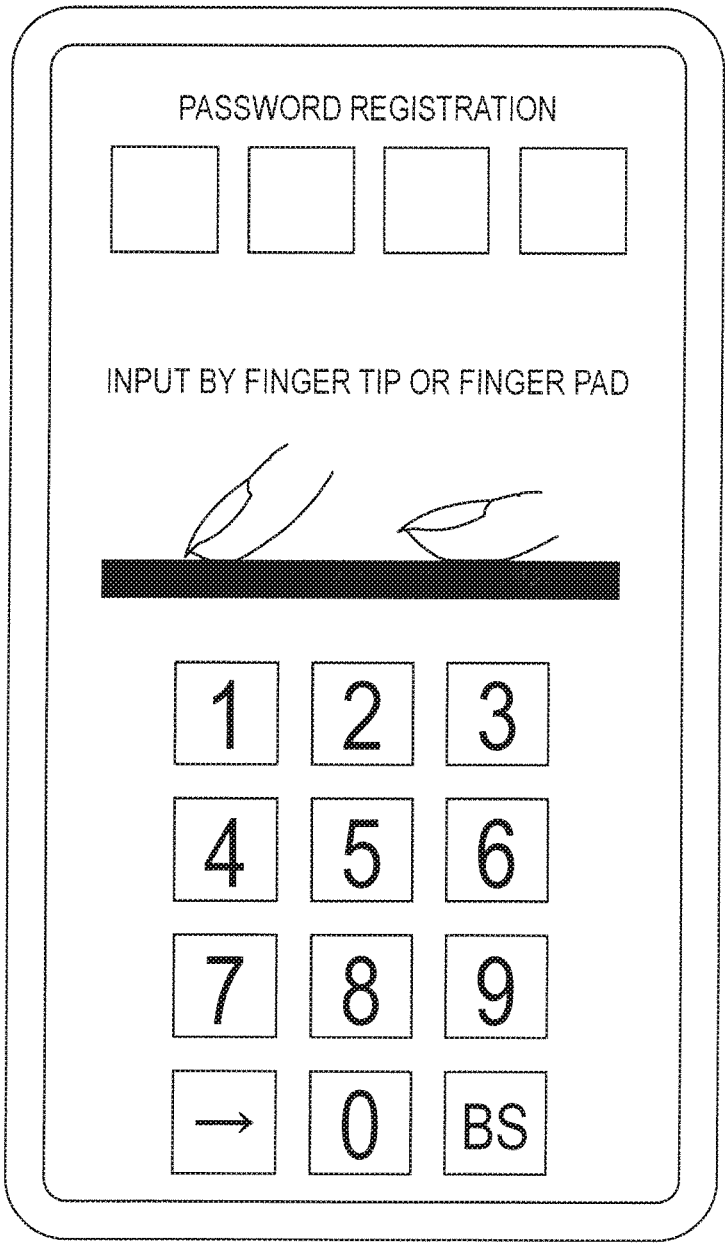

PASSWORD REGISTRATION
INPUT BY FINGER TIP OR FINGER PAD
1
2
3
4
5
6
7
8
9
→
0
BS

FIG. 11B

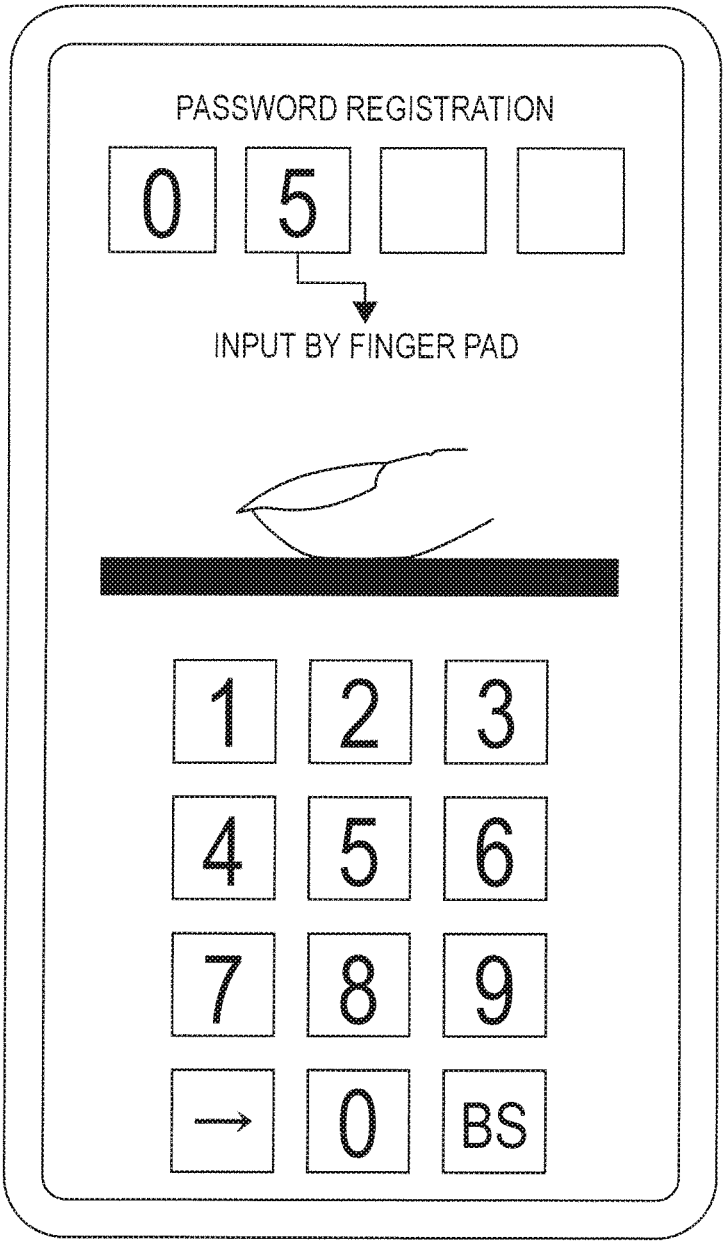

PASSWORD REGISTRATION
0
5
INPUT BY FINGER PAD
1
2
3
4
5
6
7
8
9
→
0
BS

FIG. 11C

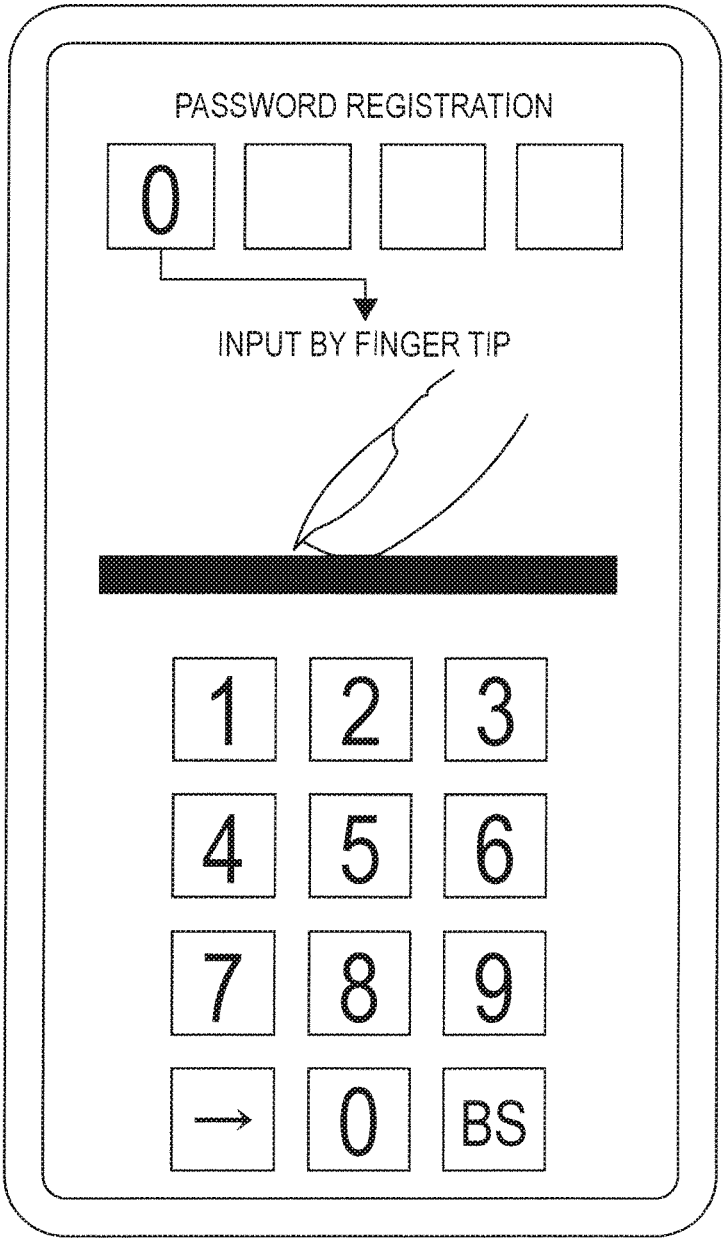


FIG. 12A

DIGIT	1	2	3	4
PASSWORD	0	5	2	8
INPUT METHOD	FINGER TIP	FINGER PAD	FINGER PAD	FINGER PAD

FIG. 12B

DIGIT		1	2	3	4	OPERATION
PASSWORD		0	5	2	8	—
INPUT METHOD	1	FINGER TIP	FINGER PAD	FINGER PAD	FINGER PAD	WAITING SCREEN
	2	FINGER TIP	FINGER TIP	FINGER TIP	FINGER TIP	MAIL CREATING SCREEN
	3	FINGER PAD	FINGER TIP	FINGER PAD	FINGER TIP	APPLICATION STARTING

FIG. 13

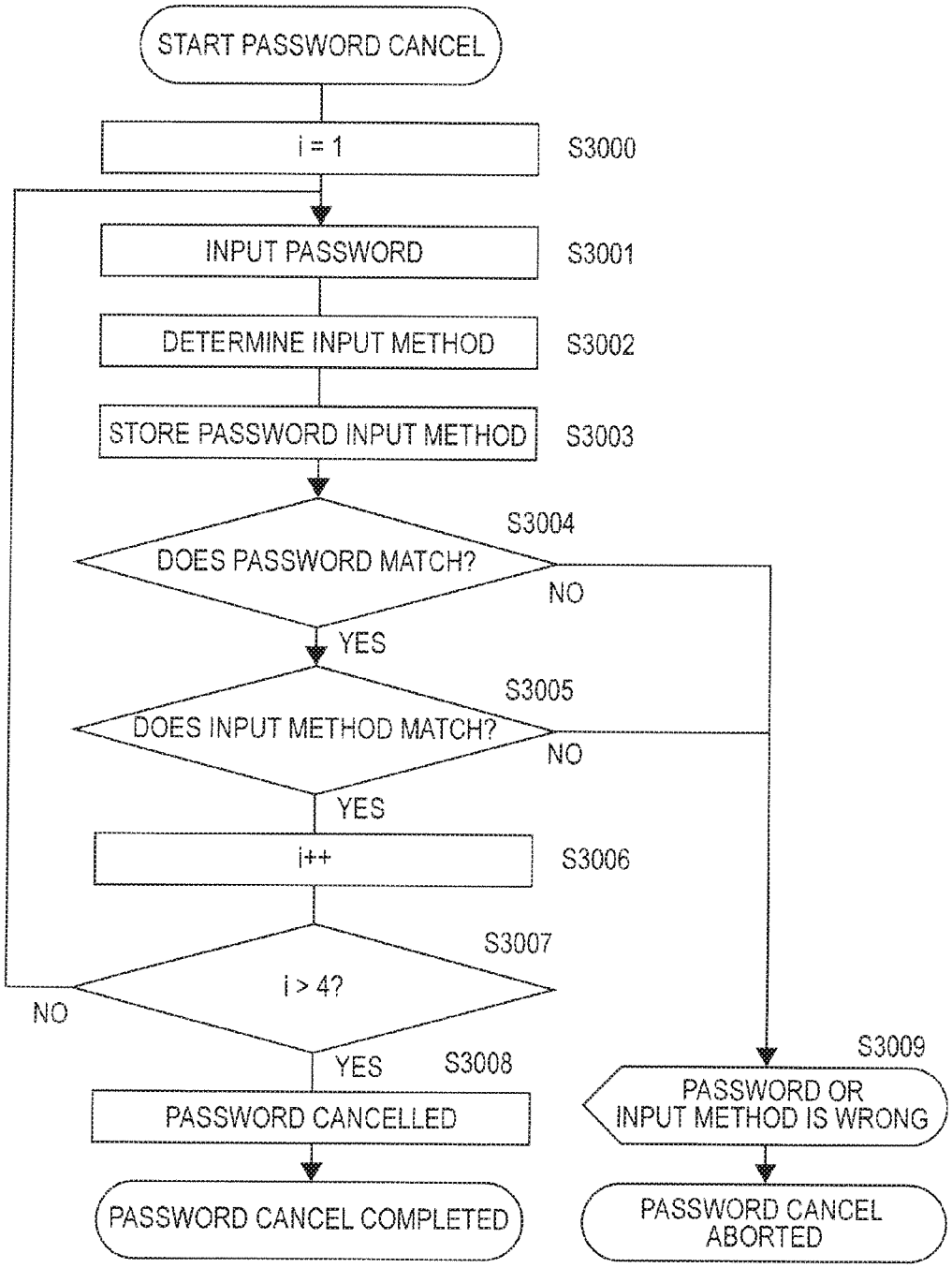
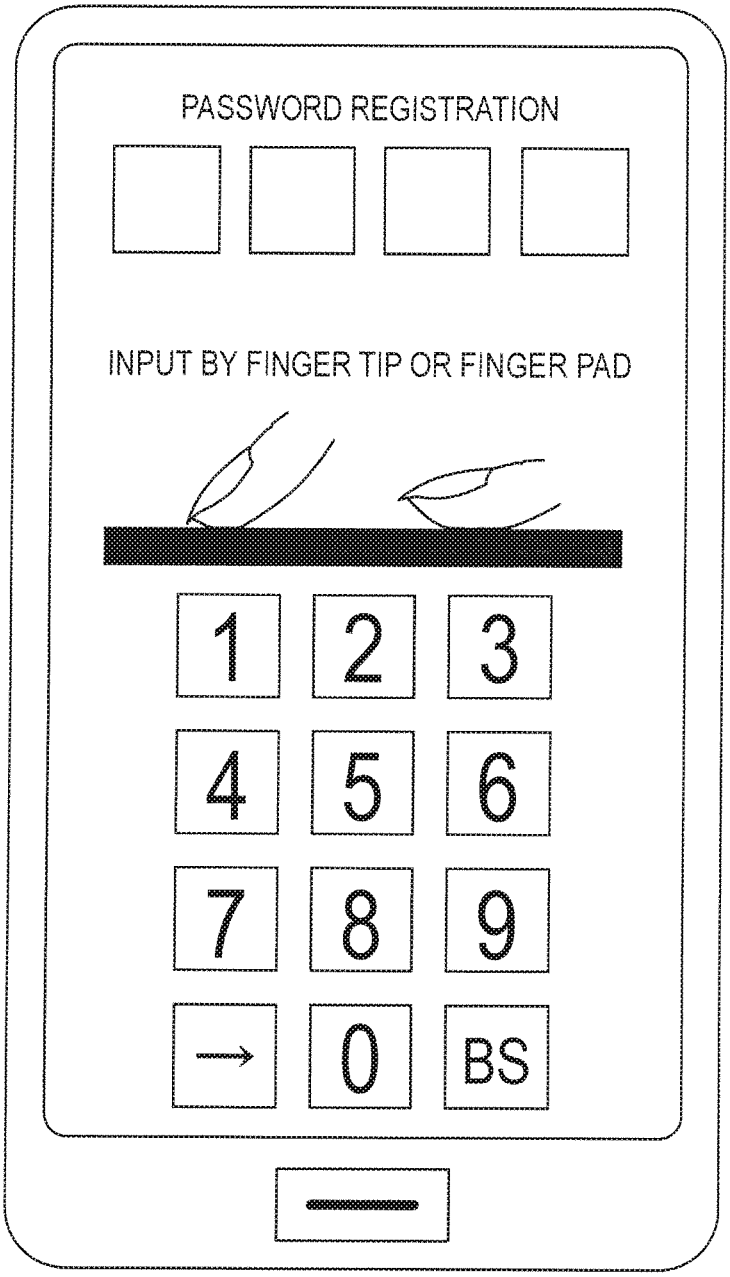

START PASSWORD CANCEL
i = 1
S3000
INPUT PASSWORD
S3001
DETERMINE INPUT METHOD
S3002
STORE PASSWORD INPUT METHOD
S3003
S3004
DOES PASSWORD MATCH?
NO
YES
S3005
DOES INPUT METHOD MATCH?
NO
YES
i++
S3006
S3007
i > 4?
NO
YES
S3008
PASSWORD CANCELLED
PASSWORD CANCEL COMPLETED
S3009
PASSWORD OR INPUT METHOD IS WRONG
PASSWORD CANCEL ABORTED

FIG. 14


PASSWORD REGISTRATION
INPUT BY FINGER TIP OR FINGER PAD
1
2
3
4
5
6
7
8
9
→
0
BS

INFORMATION PROCESSING APPARATUS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CLAIMS OF PRIORITY

The present application *is a reissue application of U.S. Pat. No. 8,654,093 issued on Feb. 18, 2014 from U.S. patent application Ser. No. 13/366,983 filed Feb. 6, 2012, which in turn* claims priority from Japanese patent application serial [no.] *No.* JP2011-025576, filed on Feb. 9, 2011, the [content] *entire contents* of *each of* which [is] *are* hereby incorporated by reference into this application.

BACKGROUND OF THE INVENTION

The present invention elates to information processing apparatuses.

JP-A-05-100809 discloses art related to the technical field of the present invention. The publication describes "An information processing apparatus including a touch panel device at least comprising: a physical type of an object; display position information on a display; file information where a status of the object is set; a display information table 1 storing display data of the object that includes a name of a file in a normal state and a name of the file in a special state (reversed display); and touch panel information 2 including a touch position coordinate and touch pressure information. A physical operation decided by a corresponding relation between physical information indicated by the display information table 1 and physical information indicated by the touch panel information 2 is given to the object to display it."

Recently, information processing apparatuses for portable usage have become multi-functioned and ease of use thereof is particularly required.

An object of the present invention is to provide an information processing apparatus that offers improved convenience to users.

SUMMARY OF THE INVENTION

To solve the foregoing problem, an aspect of the present invention provides an information processing apparatus comprising: a touch panel which [displaies] *displays* a plurality of pieces of identification information including letters, figures, and symbols, and for detecting a contact of the panel with a finger of a user or other objects; a detection unit, when the touch panel detects a contact of the panel with the object, which species identification information indicated by a position of the contact at which the contact in question occurred, of the multiple pieces of identification information displayed on the touch panel, and which detects an area of part where the contact occurred; a storage unit which stores reference identification information and a reference area range; a determination unit which determines whether the identification information detected by the detection unit matches the reference identification information stored in the storage unit and whether the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit; and a control unit which performs particular processing when the determination unit determines that the identification information detected by the detection unit matches the reference identification information stored in the storage unit and the area of the contact detected by the detecting unit falls within the reference area range stored in the storing unit.

By employing such system, an information processing apparatus including a touch panel can be improved in usability.

BRIEF DESCRIPTION OF DRAWINGS

The present invention will be described hereinafter with reference to the accompanying drawings.

FIG. **1**A is a schematic illustration of a user touching a touch panel **1** with a finger tip to make an input.

FIG. **1**B is a schematic illustration of a user touching the touch panel **1** with a finger pad to make an input.

FIG. **2** is an illustration showing an example of the internal configuration of a portable terminal **0** including the touch panel **1**.

FIG. **3** is a flow chart showing a lock cancellation process of the portable terminal **0**.

FIG. **4**A is an illustration showing a typical screen image displayed during when the portable terminal **0** is to be unlocked by dragging with a finger tip.

FIG. **4**B is an illustration showing a typical screen image displayed during when the portable terminal **0** is to be unlocked by dragging with a finger pad.

FIGS. **5**A and **5**B are illustrations showing schematically states of sensors **4** at various timing during lock cancellation.

FIGS. **6**A and **6**B are illustrations showing a method for distinguishing between a finger tip flicking and a finger pad tapping.

FIG. **7**A is an illustration showing one state during an icon being moved; the state before the move has started.

FIG. **7**B is an illustration showing one state during the icon being moved; the state when the icon is being moved.

FIG. **7**C is an illustration showing one state during the icon being moved; the state after the move has finished.

FIG. **8** is an illustration showing schematically the sensors **4** when the icon is moved.

FIG. **9** is a flow chart for password registration.

FIG. **10**A is an illustration showing a typical screen image displayed during calibration to prompt the user to make a finger tip contact.

FIG. **10**B is an illustration showing a typical screen image displayed during calibration to prompt the user to make a finger pad contact.

FIG. **11**A is an illustration showing a screen that prompts the user to register a password.

FIG. **11**B is an illustration showing a screen displayed during password registration to inform the user that a finger pad input has been made.

FIG. **11**C is an illustration showing a screen displayed during password registration to inform the user that a finger tip input has been made.

FIG. **12**A is a table showing data composed of a password and a corresponding input method.

FIG. **12**B is a table showing data composed of one password and a plurality of corresponding input methods.

FIG. **13** is a flow chart for password cancellation.

FIG. **14** is an illustration showing a screen that prompts the user to cancel a password.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[First Embodiment]

Preferred embodiments of the present invention will be described below with reference to the accompanying drawings.

FIGS. **1**A and **1**B are illustrations showing methods by which a user makes a desired input in a portable terminal **0** according to a first preferred embodiment of the present invention. The portable terminal **0** shown in FIGS. **1**A and **1**B includes a touch panel **1** having a touch sensor function. FIG. **1**A is an image of a user making input by touching the touch panel **1** with his or her finger tip. The input using one's finger tip is characterized in that an area of contact (hereinafter referred also to as a "contact range") between the finger of the user and the touch panel **1** is small. This operation by the user will hereinafter be referred to as a finger tip input. FIG. **1**B schematically shows an image of a user making input by touching the touch panel **1** with his or her finger pad. The input using one's finger pad is characterized in that the contact range of the finger and the touch panel **1** is wider than that of the finger tip input. This operation by the user will hereinafter be referred to as a finger pad input.

FIG. **2** is an illustration showing a typical internal arrangement of the portable terminal **0**. Reference numeral **1** denotes a touch panel that includes a group of sensors or a sensor **4**, a liquid crystal panel, and a glass panel. When the user's finger contacts with the touch panel, capacitance of the sensor **4** changes and the sensor **4** outputs a signal according to the change. The liquid crystal panel displays numerals, letters, and the like. The glass panel is for protecting the sensor **4**, etc. Reference numeral **2** denotes a contact range detection unit that detects the position and the contact range of a contact based on the signal output from the sensor **4**. Reference numeral **3** denotes a control unit for controlling elements of the touch panel **1**. The control unit **3** includes an arithmetic section, a counter, a determination unit which determines condition in accordance with input information into the control unit **3**, and a storage unit which stores various types of data. Reference numeral **4** denotes, as mentioned, a group of sensors or a sensor whose capacitance varies upon contact with the user's finger. Portions shaded with diagonal lines represent sensors **4** that are responding to the contact with the finger. The blank portions represent sensors **4** that are not contacting with the finger and not responding. Reference numeral **5** denotes a button switch which the user pushes for various operations such as standby release or returning, advancing.

The way of calibration and the usage method for cancelling the lock or unlocking the portable terminal **0** according to the first embodiment will be described below with reference to FIG. **3** showing a flow chart, FIGS. **4**A and **4**B showing lock cancellation display screens, and FIGS. **5**A and **5**B showing states of the sensor **4** at various timing during lock cancellation.

Among types of operation performed by the user on the portable terminal **0** are tapping, dragging, flicking, and pinching. Tapping is an operation which the user touches one point of the screen with a finger for a moment on the touch panel **1**. Dragging is an operation which the user moves his or her finger over the screen of the touch panel **1** while the finger is in contact therewith. Flicking is an operation which the user quickly slides his or her finger on the screen of the touch panel **1** while touching it. Pinching is an operation which the user touches two points of the screen of the touch panel **1** with two fingers and changes the distance between the two points.

A series of operations from start-up of the portable terminal **0**, calibration, and to turn-off of the portable terminal **0** will be next described. The term calibration used herein refers to an operation of setting a threshold value that is used for determining a contact range.

The power of the portable terminal turns on by pressing the button switch for a certain time. Then, the control unit **3** starts a program, adjusts the sensors, initializes the threshold value, and performs initial settings for screen display and other factors (S**1000**). After the initial setting procedure, the control unit **3** performs control to display lock cancel screen on the touch panel **1** (S**1001**). As can be seen in FIG. **4**A, a lock cancel icon is present in the lock cancel screen which can be dragged in a y direction and a −y direction with a finger tip. The control unit **3** holds until the user drags the lock cancel icon with a finger tip (S**1002**).

FIG. **5**A is a schematic view showing states of the sensor **4** at various timing during when the user drags the icon with a finger tip in the y direction for unlocking. In FIG. **5**A, portions shaded with diagonal lines denote sensors **4** that are responding to the contact with a user's finger and portions shaded with horizontal lines denote sensors **4** that have responded in previous. The blank portions denote sensors **4** that have not been contacted and have not responded. The icon is first touched at time t**0**, and is dragged at time t**1**, and the dragging ends at time t**2** to thus cancel the lock. The control unit **3** calculates the average value '2' of the number of columns of sensors **4** that responded to the contact with the finger and adds a correction value '1' to the average, thereby defining a threshold value '3'. The threshold value is stored in the control unit **3**.

FIG. **4**B shows another method for unlocking the terminal using the finger pad input. As can been seen in FIG. **4**B, a lock cancel icon is displayed in the lock cancel screen that can be dragged in a y direction and a −y direction with a finger pad. FIG. **5**B is a schematic view showing states of the sensor **4** at various timing during when the user drags the icon for cancelling the lock with a finger pad in the y direction for unlocking. The icon is first touched at time t**0**, then dragged at time t**1**, and the dragging ends at time t**2** to thus cancel the lock. The control unit **3** calculates the average value '4' of the number of columns of sensors **4** that responded to the contact with the finger and subtracts a correction value '1' therefrom, thereby defining a threshold value '3'. The threshold value is stored in the control unit **3**.

The threshold value used for determining the contact range is defined as above by using the average value of the number of columns of sensors **4** that responded to the contact with the finger during unlocking (S**1003**). In other words, the threshold value for determining the contact range can be obtained (i.e., calibration can be made), simultaneously with unlocking operation.

The control unit **3** unlocks the portable terminal **0** (S**1004**) and waits until the user makes various inputs by way of the touch panel **1** (S**1005**). Receiving an input with a contact range equal to or narrower than the threshold value (specifically, "3" or less) (S**1006**), the control unit **3** determines that a finger tip input is made (S**1007**). Receiving an input with a contact range wider than the threshold value (specifically, "4" or more) (S**1006**), the control unit **3** determines that a finger pad input is made (S**1008**). After that, various operations are performed following the order of the input.

When no input is made for a predetermined period, several minutes for example, the control unit **3** stores the time and date of calibration, the threshold value, and other

setting values, and then locks the portable terminal **0** (S**1009**). The control unit **3** displays the lock cancel screen (S**1001**) when a lock cancel switch assigned to the button switch **5** is pushed (S**1010**). When the button switch **5** is pressed for a certain time while the power of the portable terminal **0** is on, the power turns off.

As described heretofore, regardless of difference with individuals in contact ranges of finger tip input, the calibration allows accuracy of contact range determination to be improved. The first embodiment of the present invention uses the average of the number of columns of the sensors **4** that responded to the contact with the finger as the threshold value. However, this is not the only possible way for setting the threshold. For example, the threshold value may be corrected by adding an appropriate value to, or subtracting any value from, the average of the number of columns of the sensors **4** that responded to a contact with a finger. The threshold value does not need to be an integer and instead a capacitance value may be used. Further, the threshold value used for determining the contact range may be discarded upon locking, and calibration can be performed to update threshold value every time the terminal is unlocked. Instead of performing calibration upon unlocking, calibration may be performed only at the first time the portable terminal **0** is turned on. It may also be performed by selecting a function for calibration from a setting menu or the like. Furthermore, the first embodiment of the present invention performed calibration on the basis of the contact range of either the finger tip input or the finger pad input. Alternatively, the contact ranges of both the finger tip input and the finger pad input may be obtained to set a plurality of threshold values.

A method for distinguishing the finger tip input and the finger pad input will be described in more details below. FIGS. **6**A and **6**B show a method for distinguishing flicking by finger tip input and tapping by finger pad input. FIG. **6**A shows conditions of sensors **4** responding to a finger tip flicking in a −x direction. FIG. **6**B shows conditions of sensors **4** responding to a finger pad tapping. At time t**00** which is the time a contact starts, the number of sensors responding to the contact is same in FIGS. **6**A and **6**B. The control unit **3** stores the time t**00** at which the contact is started. If the number of sensors responding to the contact range would not change at the subsequent time t**01** and time t**02**, the control unit **3** determines the contact as a finger tip flicking. If the number of sensors responding increases as time elapses as the time t**01** and the time t**02**, the control unit **3** determines the contact as a finger pad tapping. In brief, the control unit **3** distinguishes the finger tip flicking and the finger pad tapping by comparing the number of sensors that responded at the time t**00** to the number of sensors responding at the time t**02**. Since the determination is not done at the instance of a user touching the touch panel **1**, a finger pad input will not be misdetected as a finger tip input even when the initial contact range is narrow.

A way of moving an icon utilizing the difference between contact ranges of the finger tip input and the finger pad input will be described in detail below. FIGS. **7**A to **7**C show states of an icon **7** moved rightwardly (in a y direction) by the user using finger tip input and finger pad input. FIG. **8** is a schematic view showing the sensors **4** that responded during the icon movement and the manner of finger movement. Reference numerals **80** and **82** represent fingers making finger pad input with a wide contact range and reference numeral **81** represents a finger making finger tip input with a narrow contact range. First, a user touches the icon **7** desired to be moved with the finger pad input **80**. When the contact range is equivalent to or larger than the threshold value, the control unit **3** determines that the input is the finger pad input **80** and sets the icon **7** as a moving object (FIG. **7**A). The user then shifts from the finger pad input **80** to the finger tip input **81** while keeping his or her finger in contact with the panel. As the contact range becomes equal to or less than the threshold value, the control unit **3** renders the icon **7** as the moving object movable (FIG. **7**B). The user drags the icon **7** to a desired position and then shifts from the finger tip input **81** to the finger pad input **82**. As the contact range becomes equivalent to or larger than the threshold value, the control unit **3** determines that the input is the finger pad input **82** and validates the position of the icon **7** (FIG. **7**C).

As described above, the first embodiment allows the user to make more intuitive input. The contact range described herein may be the number of sensors responded or the maximum number of the columns of sensors responded. When an application for finger pad input with a wide contact area is not set or applied to the terminal, the process of determining contact area can be omitted and contact operation may be performed uniformly.

[Second Embodiment]

A second embodiment of the present invention relates to a portable terminal **0** using a password. The second embodiment is characterized in that it stores not only a numeric password but also a difference in the contact range with the aim of enhancing security. A description is made for an example of the enhanced security function that incorporates a four-digit password and a difference in the contact range with reference to; FIG. **9** showing a flow chart of password registration, FIGS. **10**A and **10**B showing typical screen images displayed during calibration, FIGS. **11**A to **11**C showing screen images for prompting a user to register a password, and FIGS. **12**A and **12**B showing data consisting of a password and a set of corresponding input method. The portable terminal **0** according to the second embodiment has the same configuration as that of the portable terminal **0** according to the first embodiment unless otherwise specified.

The process for password registration will be first described with reference to the flow chart of FIG. **9**. After initial settings such as counter reset is done, an image as shown in FIG. **10**A is displayed to prompt the user to make a fingertip contact (S**2000**). A control unit **3** records the contact range of the finger tip input (S**2001**). Next, an image as shown in FIG. **10**B is displayed to prompt the user to make a finger pad contact. The control unit **3** records the contact range of the finger pad input (S**2002**). Contact ranges are detected at the timing when a button switch **5** is pushed following the contact with finger tip or finger pad. When the contact range of the finger pad input is larger than that of the finger tip input, the control unit **3** authorizes the input as a correct input (S**2003**: Yes). The contact range of the finger tip input is determined as a threshold value and the value is stored (S**2004**). When the contact range of the finger pad input is smaller than that of the finger tip input (S**2003**: No), the control unit **3** prompts the user to make a finger tip input again (S**2001**). Completing the determination of a threshold value, the control unit **3** next checks the counter value. When the counter is 4 or less (S**2005**: No), the control unit **3** displays a message to inform the user that a password can be input by either the finger tip input or the finger pad input (FIG. **11**A). Registration of the numbers is then authorized.

The user selects and touches any numbers among numbers 0 to 9 displayed on a touch panel **1** by either the finger tip input or the finger pad input. The selected numbers are registered as input numerals (S**2006**). Then, the control unit

3 compares the contact range with the threshold value. When the contact range is equal to or smaller than the threshold value (S2007: Yes), the control unit 3 stores the input numeral in association with the finger tip input (S2008). A message as shown in FIG. 11C is displayed to inform the user that the numeral has been registered by finger tip input. When the contact range is larger than the threshold value (S2007: No), the control unit 3 stores the input numeral in association with the finger pad input (S2009).

The control unit 3 displays a message as shown in FIG. 11B to inform the user that the numeral has been registered by finger pad input. The control unit 3 then increments the counter and proceeds to the next password input (S2010). When the counter is greater than 4 (S2005: Yes), a numeric string of four input numerals is registered as the password as shown in FIG. 12A. In addition, the input method of either the finger tip input or the finger pad input corresponding to the numeral is stored for each input numeral. The password registration thus terminates (S2011).

A method for cancelling or unlocking the password will be next described below with reference to FIG. 13 showing a flow chart of a password cancel process and FIG. 14 showing a password cancel screen.

As can be seen in FIG. 14, the control unit 3 displays a password cancel screen including a ten-key pad with a plurality of numerals in order to prompt the user to input a numeral. At the same time, the control unit 3 performs initial settings such as counter reset (S3000). The control unit 3 waits until a user inputs a numeral (S3001). Upon the user touching, the touch panel 1, the control unit 3 specifies the number according to a position of the contact. The contact range of the contact is compared with a threshold value to thereby determine whether the input is a finger tip input or a finger pad input (S3002). The control unit 3 stores the numeral input and the input method used (S3003). When the number of the input and the password registered earlier matches, (S3004: Yes) and the input methods thereof matches as well (S3005: Yes), the control unit 3 increments the counter (S3006). When the counter is not greater than 4 (S3007: No), the control unit 3 proceeds to the step for inputting the next password number. When the counter is greater than 4 (S3007: Yes), the password is authenticated (S3008) and the lock is canceled. Meanwhile, in cases where the number of input and a password do not match (S3004: No), or in cases where the number of input and a password match but their input methods do not match (S3005: No), the control unit 3 displays a message to inform the password or the input method is wrong (S3009). The password cancellation thus terminates.

It is to be noted that a plurality of input methods may be registered for one password. For example, in the case shown in FIG, 12B, three types of input methods are registered for one password and a specific operation is assigned for each of them: input method 1 is for displaying a normal standby screen, input method 2 is for displaying a mail creating screen, and input method 3 is for starting an application. A user can start a desired operation easily by way of unlocking the password, thus contributing to improved convenience. Not to mention, a plurality of input methods may be registered for a plurality of passwords as well.

Using the above system, a user can complicate cancellation of a lock by making a simple input to enhance security. The portable terminal 0 can thus handle user's highly confidential information, which makes the terminal more useful.

Security can be enhanced by only storing, in addition to the password registered, the input method for each of the password numbers. An increase in storage capacity can be sufficiently suppressed.

From the view of a user, the user only needs to remember the input method for each password number to unlock the portable terminal 0. Burdens on the user for memorization can thus be alleviated. It is also advantageous in that when a user has to tell others the way to unlock the portable terminal 0, the user only needs to tell the password numbers and the input method for each of the password numbers.

Although the second embodiment employed a password composed of numerals only, the present invention is not limited to this. The password may be composed of alphabets, symbols, figures, patterns, colors, or other elements, or combinations thereof. In addition, the number of digits of a password is not limited to four and the number may instead be one, two, or a greater numeral.

The process for password registration (FIG. 9) may be started when a predetermined condition is satisfied, such as when the user calls up a particular function from a setting menu.

In the embodiment of the present invention, calibration is performed by a user touching a single point. However, the present invention is not limited to this. For example, the calibration performed during unlocking as described for the first embodiment may be applied. The user may also start calibration by calling up a particular function from the setting menu. Incidentally, during the password cancellation, the message informing the fact that the difference in contact ranges are detected may be not shown (hidden), and when only the numbers are correct, a message may be displayed to inform that the difference in the contact range is also registered. Numerals and input methods may also be hidden and not shown during password input. While a threshold value is used for distinguishing the finger tip input and the finger pad input in the embodiment, the present invention is not limited to this. The determination of an input method may be conducted in a manner such that records both contact ranges of the finger tip input and the finger pad input, and when a input is made, compares the input contact range with the data, whereby selecting the closer one as the method of the particular input.

The operation of distinguishing the difference in the contact range may be omitted in particular situations of input. For example, the system may be adapted so that the classification based on a difference in contact ranges is not performed when the button switch is pressed or when more than two points are touched for multi-touch input.

What is claimed is:

1. An information processing apparatus comprising:

a touch panel which [displaies] *displays* a plurality of pieces of identification information and detecting a contact of the panel with [an object of interest] *a finger of a user*;

a storage unit which stores first information including reference identification information and a reference area range;

a detection unit[,] *which detects second information necessary to identify the user* when the touch panel detects a contact with the [object] *finger of the user*, [which specifies] *wherein detecting the second information includes detecting* (*1*) identification information indicated by a position at which the contact in question occurred, of the multiple pieces of identification information displayed on the panel, and [which detects] (*2*) an area of [part] *contact* where the contact occurred;

a control unit which controls the information processing apparatus to operate at least in an identification mode and a registering mode; and

[a storage unit which stores reference identification information and a reference area range;]

a determination unit which determines [whether] *in the identification mode that the first information matches the second information when* the identification information detected by the detection unit matches the reference identification information stored in the storage unit and [whether] *when* the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit[; and],

[a] *wherein the* control unit [which] performs particular processing on condition the determination unit determines that [the identification information detected by the detection unit matches the reference identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit] *the first information matches the second information in the identification mode,*

wherein the registering mode includes a first registering mode for inputting first input information corresponding to a first portion of the finger and a second registering mode for inputting second input information corresponding to a second portion of the finger,

wherein the reference identification information is generated and stored in the storage unit based on both the first input information and the second input information, the first portion corresponding to a pad of the finger,

wherein the determination unit determines in the identification mode that the first information matches the second information based on the first and second portions of the finger, and

wherein the controller is configured to associate a numeral password with the first information, and the storage unit is configured to store the association between the numeral password and the first information.

2. The information processing apparatus according to claim **1**, wherein:

[the storage unit stores, when a predetermined condition is satisfied,] *the reference identification information and the reference area range stored in the storage unit are based on* the identification information and the area of the contact detected by the detection unit[as the reference identification information and the reference area range, respectively].

3. The information processing apparatus according to claim **1** or **2**, wherein:

the storage unit stores first identification information and a first area range and second identification information and a second area range as the reference identification information and the reference area ranges; and

the determination unit determines, on condition the identification information detected by the detection unit matches the first identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the first area range stored in the storage unit, whether the identification information detected by the detection unit matches the second identification information stored in the storage unit and the area of the contact detected by the detecting unit falls within the second area range stored in the storing unit.

4. The information processing apparatus according to claim **1** or **2**, wherein:

the storage unit stores a threshold value; and

the reference area range stored in the storage unit is defined based on the threshold value.

5. The information processing apparatus according to claim **4**, wherein:

the area of the contact detected by the detection unit is registered as the threshold value when a predetermined condition is satisfied.

[**6**. An information processing apparatus comprising:

a touch panel which displaies a plurality of pieces of identification information and detecting a contact of the panel with an object of interest;

a detection unit for, when the touch panel detects a contact of the panel with the object, which specifies identification information indicated by a position at which the contact in question occurred, of the multiple pieces of identification information displayed on the touch panel, and which detects an area of part where the contact occurred;

a storage unit whish stores a series of identification information and a series of area ranges, the series of area ranges each corresponding to the respective identification information; and

a control unit which performs particular processing on condition that a set of identification information detected by the detection unit matches the series of identification information stored in the storage unit and a series of contact areas detected by the detection unit each falls within the corresponding one of the series of area ranges stored in the storage unit.]

[**7**. The information processing apparatus according to claim **6**, wherein:

the storage unit stores a first set of area ranges and a second set of area ranges as corresponding area ranges of the stored series of identification information; and

first processing is performed on condition that a set of identification information detected by the detecting unit matches the series of identification information stored in the storage unit and the areas of the contact detected by the detecting unit each falls within a corresponding one of the first set of area ranges stored in the storage unit, and second processing is performed on condition that a set of identification information detected by the detecting unit matches the series of identification information stored in the storing unit and the areas of the contact detected by the detecting unit each falls within a corresponding one of the second set of area ranges stored in the storage unit.]

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