EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent: 27.12.2017 Bulletin 2017/52

(21) Application number: 13857145.0

(22) Date of filing: 18.06.2013

(51) Int Cl.: H04M 1/00 (2006.01) G06F 3/0488 (2013.01)

(86) International application number: PCT/JP2013/003789

(87) International publication number: WO 2014/080546 (30.05.2014 Gazette 2014/22)

(54) PORTABLE ELECTRONIC DEVICE, METHOD FOR CONTROLLING SAME, AND PROGRAM
TRAGBARE ELEKTRONISCHE VORRICHTUNG, VERFAHREN ZUR STEUERUNG DAVON UND PROGRAMM
DISPOSITIF ÉLECTRONIQUE PORTATIF, SON PROCÉDÉ DE COMMANDE ET PROGRAMME

(84) Designated Contracting States: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR


(43) Date of publication of application: 30.09.2015 Bulletin 2015/40

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The present invention relates to a portable electronic device, a method for controlling same, and a program, and particularly relates to a multifunctional-type portable electronic device, a method for controlling same, and a program.

BACKGROUND ART

[0002] Today, portable phones called smartphones have been widely used as multifunctional-type portable electronic devices. One characteristic of the smartphones is user-friendliness in incorporating (installing) applications. More specifically, One characteristic of the smartphones is that, although basic applications have been installed therein in advance, the smartphone users (hereinafter, users) can download applications they want to use anytime they want from a network and freely use them.

[0003] However, this characteristic on the other hand causes a disadvantage in that an operation for executing an application takes time. This is because the number of applications to be installed in a smartphone is significantly increased (at least several tens and sometimes up to more than a hundred), whereby an application desired to be executed cannot be easily found.

[0004] Generally, the management of applications in a smartphone is performed by objects for activating the applications called icons being arranged on a plurality of menu screens called home screens. In many cases, about 20 icons are arranged on one home screen. Also, if requested, an arbitrary icon is provided in a folder format, and several icons can be collectively arranged in the folder.

[0005] In such application management, when executing a desired application, the user performs operations of sequentially opening the home screens, finding the icon of the desired application, and touching the icon. In a case where the icon of the desired application has been stored in an icon in a folder format, an operation of opening the folder is also required.

[0006] These operations are not particularly bothersome when the number of installed applications (the number of icons) is small. However, when the number of applications especially exceed a hundred, a considerable amount of time and work is inevitably required as a matter of course.

[0007] Accordingly, there is demand from the users to execute a desired application with less effort.


[0009] Patent Document 1 describes a technique where emergency communication is made when a predetermined contact pattern, which is a pattern of three times of long pressing, three times of short pressing, and three times of long pressing (in other words, a pattern imitating a SOS telegraph code of "--- ... ---") onto a touch panel in the document is detected.

[0010] According to this, a required application (in this case, an application for emergency communication) can be executed by a particular touch operation without finding the corresponding icon every time from home screens.

[0011] As a similar technique, Patent Document 2 describes a technique where "the manner of patting" a robot is detected and a user of the robot is identified from the result of the detection. "The manner of patting", which is detected by a pressure sensor provided in a head part, chin, etc. of the robot, corresponds to the predetermined contact pattern of Patent Document 1.

[0012] Patent Document 3 describes a technique where one vibration generating section and four vibration receiving sections are provided in the housing of a portable electronic device, vibrations from the thumb of a hand holding the housing are transmitted to the other four fingers, and individual authentication is performed based on the transmission pattern of the vibrations.

[0013] Patent Document 4 describes a technique where contact patterns (in the document, one-point contact, two-point contact, or three-point contact) are registered in advance in association with incoming groups of e-mails and phones, and a notification is given by vibrations when an incoming call or e-mail is received. When an actual contact pattern matches a stored contact pattern, a notification notifying that it is an incoming call or e-mail from the registered group is given by the vibrations being stopped.


[0015] US 2009/0139778 A1 relates to a device enabling a user to interact with software running on the device through gestures made in an area adjacent to the device.

[0016] US 2006/0197750 A1 relates to a hand held electronic device with multiple touch sensing devices which can be selected from touch panels, touch screens or touch sensitive housings.

SUMMARY OF INVENTION

Problem to be Solved by the Invention

[0017] However, the technique of Patent Document 1 can be applied only to a particular internal operation (carrying out emergency communication) and has a problem in that versatility is low. Similarly, the technique of Patent Document 2 can be applied only to a particular internal operation (identification of a user) and has a problem in that versatility is low.

[0018] The technique of Patent Document 3 requires a single vibration generating section and four vibration receiving sections, and therefore has a problem in that
The technique of Patent Document 4 can support only particular contact patterns such as one-point contact, two-point contact, or three-point contact and therefore has a problem in that versatility is low.

Accordingly, an object of the present invention is to provide a portable electronic device capable of performing highly versatile contact pattern judgment without increasing cost, a method for controlling the same, and a program.

Means for Solving the Problem

The present invention provides a portable electronic device as defined in the appended independent claim 1, a method as defined in the appended independent claim 7, and a program as defined in the appended independent claim 8. Further embodiments are defined in the appended dependent claims.

Effect of the Invention

According to the present invention, a portable electronic device capable of performing highly versatile contact pattern judgment without increasing cost, a method for controlling the same, and a program can be provided.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1(a) and 1(b) are front and back external views of a portable phone according to the embodiment. Fig. 2(a), 2(b) and 2(c) are conceptual diagrams showing contact patterns of a hand. Fig. 3 is an internal block diagram of the portable phone. Fig. 4 is a diagram showing a conceptual storage configuration of a PROM. Fig. 5(a) and 5(b) are configuration schematic diagrams of prescribed contact pattern information and learned contact pattern information respectively. Fig. 6 is a diagram showing a brief flow of a control program. Fig. 7(a) and 7(b) are conceptual diagrams of contact pattern judgment. Fig. 8 is a judgment conceptual diagram of Step S3 of Fig. 6. Fig. 9 is a configuration diagram of Supplementary Note 1.

DESCRIPTION OF EMBODIMENTS

Hereinafter, an embodiment of the present invention will be described with reference to the drawings by taking the application of a multifunctional portable phone called smartphone as an example.

FIGS. 1(a) and 1(b) are front and back external views of a portable phone according to the embodiment. A portable phone 10 in this diagram is structured such that a display section 12 such as a liquid crystal panel is arranged on a main surface 17 (operation target surface) of a housing 11 having a shape (for example, tablet shape) that can be hand-held and one or a plurality of (in this case, three as an example) physical key(s) 14 to 16 are arranged within a frame 13 on the lower end side of the display section 12.

The uses of the physical keys 14 to 16 are not particularly limited. For example, according to a general example, the left-side physical key 14 may be used for a menu, the central physical key 15 may be used for returning to a home screen, and the right-side physical key 16 may be used for returning to an immediately-previous screen. Also, although omitted in the drawings, a power switch may be provided on an arbitrary screen of the housing 11 and, if needed, slots for storage media such as an SD card, a connector for both of charging and an external interface, etc. may be provided at arbitrary positions of an arbitrary surface.

As described above, the housing 11 has the shape that can be hand-held, and is provided with a detection means for detecting a contact pattern of a contact object such as a human body when being hand-held or when operated while being hand-held.

Here, the contact pattern of a contact object (signifying a hand [holding hand and operating fingers]) refers to information indicating the manner of holding or the manner of operating the housing 11 when being held by a hand or when some sort of operation is being performed on the portable phone 10 with the housing 11 being held by a hand. More specifically, the contact pattern refers to various information regarding a contact area of a holding hand or operating finger(s) with respect to each surface of the housing 11, such as information quantitatively indicating position (location) of an area and the area size, shape, etc.

In the present embodiment, targets whose contact patterns are detected are four surfaces, which are the main surface 17, a back surface 18, a left lateral surface 19, and a right lateral surface 20 of the housing 11. However, this is an example showing the most desirable best mode. Namely, when the tablet-shaped housing 11 is to be held by one hand such as the right hand, generally, the ball of the thumb (bulge at the base of the thumb) of the right hand comes in contact with the right lateral surface 20, the palm of the right hand comes in contact with the back surface 18, and inside parts of three fingers or four fingers excluding the thumb of the right hand come in contact with the left lateral surface 19. In addition, when a touch operation on the display section 11 is carried out in this state, the operating finger(s) (for example, the thumb of the holding hand or the forefinger or the middle finger of the unused hand) come in contact with the main
surface 17.

[0030] By four surfaces being set as target surfaces for detecting contact patterns, contact patterns caused by the above-described contacts can be fully detected, which is desirable in practice. However, the detection target surfaces can be reduced to be less than four surfaces in principle. For example, the three surfaces, i.e., the main surface 17, the left lateral surface 19, and the right lateral surface 20 excluding the back surface 18 of the housing 11 may be the detection target surfaces. In the case of the three surfaces, although detection accuracy for contact patterns is reduced, cost can be reduced. Whether to use the four surfaces or the three surfaces may be appropriately selected in consideration of the balance of detection accuracy and cost. Alternatively, the detection target surfaces may be two surfaces, i.e., the left lateral surface 19 and the right lateral surface 20. However, since many portable electronic devices are provided with a touch-panel-equipped display section on a main surface, an embodiment using only two surfaces is not realistic. In practice, three surfaces or four surfaces including the touch panel of the display section should be used.

[0031] The means for detecting contact patterns can be structured by a plurality of flat-surface-type contact sensors provided on the respective surfaces of the housing 11. In the present embodiment, in accordance with the above-described best mode, a total of four contact sensors are provided respectively on the main surface 17, the back surface 18, the left lateral surface 19, and the right lateral surface 20 of the housing 11. Hereinafter, the contact sensor provided on the main surface 11 will be referred to as a main surface contact sensor 21, the contact sensor provided on the back surface 18 will be referred to as a back surface contact sensor 22, the contact sensor provided on the left lateral surface 19 will be referred to as a left lateral surface contact sensor 23, and the contact sensor provided on the right lateral surface 20 will be referred to as a right lateral surface contact sensor 24.

[0032] The main surface contact sensor 21 also serves as a touch panel of the display section 12, and detects contact patterns of a hand of a user with respect to a display screen of the display section 12. The back surface contact sensor 22 detects contact patterns of a hand of the user with respect to the back surface 18 of the housing 11, the left lateral surface contact sensor 23 detects contact patterns of a hand of the user with respect to the left lateral surface 19 of the housing 11, and the right lateral surface contact sensor 24 detects contact patterns of a hand of the user with respect to the right lateral surface 20 of the housing 11.

[0033] The four contact sensors (the main surface contact sensor 21, the back surface contact sensor 22, the left lateral surface contact sensor 23, and the right lateral surface contact sensor 24) are used for detecting the contact patterns of a hand as described above. For example, projection-type electrostatic-capacitance touch panels can be used for these contact sensors.

[0034] The principle of the electrostatic-capacitance touch panel is to consider a human body as a predetermined electrostatic capacity body and detect touch positions from changes in the electrostatic capacity of the panel caused by contact with the human body. Especially, an electrostatic-capacitance touch panel of a "projection type" can support multi-touch, or in other words, can detect multipoint contact, and therefore can detect contact points not by pinpoint detection but by range (area) detection. Moreover, the electrostatic-capacitance touch panel of the "projection type" can not only detect the position (location) of the contact area, but also can detect the size, shape, etc. of the contact area. Therefore, the electrostatic-capacitance touch panel of the "projection type" is suitable as the means for detecting the contact pattern of a hand in the present embodiment.

[0035] The electrostatic-capacitance touch panel can detect not only contact of a hand, but approaching of a hand. This is because the electrostatic capacity of the panel is changed when a hand closely approaches the panel. Accordingly, the contact patterns of the present embodiment include the meaning of approach in addition to contact. Note that, although they are hereinafter collectively referred to as contact patterns, this is only for the convenience of explanation, and the contact patterns also include approach in terms of technical ideas.

[0036] Here, in a study by the inventors of the present application, the inventors found corresponding relativity between a certain operation performed on the portable phone 10 by a user and the pattern of contact with the housing 11 (holding manner).

[0037] FIGS. 2 (a), 2(b) and 2(c) are conceptual diagrams showing contact patterns of a hand. For example, when touching an icon 25 positioned at a lower portion of the display section 12 so as to execute an application associated with the icon 25, many of the users naturally hold the vicinity of the lower portion of the housing 11, as shown in Fig. 2(a). Accordingly, a particular contact pattern corresponding to the holding state, in other words, a contact pattern distributed mainly in the vicinity of the lower portion of the housing 11 is detected.

[0038] Alternatively, when touching an icon 26 positioned at a center portion of the display section 12 so as to execute an application associated with the icon 26, many of the users naturally hold the vicinity of the center portion of the housing 11, as shown in Fig. 2(b). Accordingly, a particular contact pattern corresponding to the holding state, in other words, a contact pattern distributed mainly in the vicinity of the center portion of the housing 11 is detected.

[0039] Alternatively, when touching an icon 27 positioned at an upper portion of the display section 12 so as to execute an application associated with the icon 27, many of the users naturally hold the vicinity of the upper portion of the housing 11, as shown in Fig. 2(c). Accordingly, a particular contact pattern corresponding to the holding state, in other words, a contact pattern distributed
mainly in the vicinity of the upper portion of the housing 11 is detected.

[0040] The relativity is not limited to these examples. For example, when performing an operation of vertical scrolling by using the entire screen, many of the users naturally hold a large portion of the housing 11 because they need to hold the housing 11 tight. Therefore, in this case as well, a particular contact pattern corresponding to the holding state, in other words, a contact pattern distributed in a large portion of the housing 11 is detected. Also, when performing an operation of pinch-in or pinch-out, many of the users hold the housing 11 by one hand and perform the operation by the other hand. Therefore, a particular contact pattern which is different from that when the housing 11 is being held simply by one hand is detected.

[0041] These contact patterns are merely examples as a matter of course, and various contact patterns can be detected depending on the habits of users. However, in the study by the inventors of the present application, the inventors found that there is a tendency that, as the users are skilled in the operations, their contact patterns are gradually converged to the contact patterns having the above-described relativity, or in other words, contact patterns having reproducibility.

[0042] A point of the present embodiment is to simplify operations related to the execution of applications by using the relativity of the contact patterns.

[0043] FIG. 3 is an internal block diagram of the portable phone. In this diagram, the portable phone 10 is provided with at least a sensor I/F (interface) section 28 mounted in the housing 11, the display section 12 such as a liquid crystal display, the main surface contact sensor 21 also serving as the touch panel of the display section 12, the back surface contact sensor 22 provided on the back surface of the housing 11, the left lateral surface contact sensor 23 and the right lateral surface contact sensor 24 provided on both of the left/right lateral surfaces of the housing 11, and a main control section 29. This portable phone 10 is configured to input signals from the back surface contact sensor 22, signals from the left lateral surface contact sensor 23, and signals from the right lateral surface contact sensor 24 to the main control section 29 via the sensor I/F section 28, input the display information appropriately generated by the main control section 29 to the display section 12, and input signals from the main surface contact sensor 21 to the main control section 29. As a matter of course, the portable phone 10 is provided with a power supply section such as a battery, a wireless communication section for portable phones, and the like, in addition to the above-described sections.

[0044] The main control section 29 is a control element of a program control type. This main control section 29 loads a control program and/or control data stored in a non-volatile rewritable memory (for example, flash memory; hereinafter, PROM 30) in advance into a high-speed semiconductor memory (hereinafter, RAM 31) and executes it by a computer (hereinafter, CPU 32) so as to actualize various functions necessary for the portable phone 10, such as a function for displaying icons, a function for generating events corresponding to user operations (touch operations) with respect to the icons, and a function for executing applications in response to the events by organic linkage between hardware resources such as the CPU 32 and software resources such as the control program.

[0045] The icons are operation target objects symbolizing and expressing the contents or targets of processing by parts such as small pictures, symbols, or figures in an operation screen of a computer application device. Since the user can directly touch and operate the icons, a user interface excellent in intuitiveness is obtained. Note that the operation target objects are not limited to icons. The icons are only required to be able to generate particular events when they are touched (selected). For example, the icons may be the information (information embedded in character strings, images, etc.) of links to various documents, Internet contents, and the like, or may be menu information and the like.

[0046] Generally, many of these icons are arranged on the home screen of the display section 12 of the portable phone 10. Particularly, the portable phone 10 of a multi-functional type called smartphone is configured to be able to download and freely install arbitrary applications from Internet sites. In this process, the icons of the respective applications are automatically arranged on the home screen. As a result, many icons corresponding to the number of the downloaded applications are arranged on the screen.

[0047] The presence of such many icons makes it difficult to find an application to be executed and deteriorates operability. Therefore, some sort of measure is required. As a measure therefor, in the present embodiment, contact patterns of a hand with respect to the housing 11 are detected, whereby operations for executing applications are simplified.

[0048] FIG. 4 is a diagram showing a conceptual storage structure of the PROM 30. In the diagram, the PROM 30 has at least a control program storage section 30a, an application storage section 30b, and a contact pattern information storage section 30c. The PROM 30 stores a control program to be executed by the CPU 32 in the control program storage section 30a, stores a number of application programs (hereinafter, simply referred to as applications) (in this case, applications A, B, C, ···) in the application storage section 30b, and stores two types of contact pattern information in the contact pattern information storage section 30c.

[0049] One of the two types of contact pattern information is contact pattern information stored as prescribed values (default or initial values) in advance upon factory shipment, which is hereinafter referred to as "prescribed contact pattern information". The other one of the two types of contact pattern information is contact pattern information sequentially accumulated and stored by
learning every time it is used by the user, which is hereinafter referred to as "learned contact pattern information".

[0050] FIGS. 5(a) and 5(b) are configuration schematic diagrams of the prescribed contact pattern information and the learned contact pattern information, respectively. In the diagrams, both of the prescribed contact pattern information and the learned contact pattern information have been configured such that a storage field for contact pattern information and a storage field for an operating state (in this case, executed application name) of the portable phone 10 are associate with one record. For example, application name "A" has been associated with prescribed contact pattern information "K001". Similarly, application name "A" has been associated with learned contact pattern information "G001".

[0051] These diagrams show character strings such as "K001", "K002", ..., "G001", "G002", ... etc. as contact pattern information. However, these character strings are examples for convenience of explanation. In practice, actual contact pattern information detected by the four contact sensors (the main surface contact sensor 21, the back surface contact sensor 22, the left lateral surface contact sensor 23, and the right lateral surface contact sensor 24) is stored.

[0052] As described above, the prescribed contact pattern information is contact pattern information stored as prescribed values in advance upon factory shipment, and the learned contact pattern information is contact pattern information sequentially accumulated and stored every time it is used by the user. Therefore, in the stage of the factory shipment, only the prescribed contact pattern information is present, and the learned contact pattern information is not present (is in a "vacant" state).

[0053] FIG. 6 is a diagram showing a brief flow of the control program. In the diagram, first, the CPU 32 detects a pattern of contact with the housing 11 by using the four contact sensors (the main surface contact sensor 21, the back surface contact sensor 22, the left lateral surface contact sensor 23, and the right lateral surface contact sensor 24) (Step S1). Then, the CPU 32 collates the detected pattern with contact pattern information (prescribed contact pattern information and learned contact pattern information) in the contact pattern information storage section 30c of the PROM 30 (Step S2) and judges whether contact pattern information corresponding to the contact pattern detected at Step S1 is present in the contact pattern information storage section 30c of the PROM 30 or not (Step S3).

[0054] Then, when the corresponding contact pattern information is present, the CPU 32 executes an application associated with the contact pattern information (for example, application "A" when the contact pattern information is "K001" in FIG. 5(a), or application "B" when the contact pattern information is "G002" in FIG. 5(b) (Step S4) and returns to Step S1.

[0055] Conversely, when the corresponding contact pattern information is not present, the CPU 32 judges the presence/absence of an operation for executing an application by the user (Step S5). When judged that an application has not been executed, the CPU 32 returns to Step S1. When judged that an application has been executed, the CPU 32 learns the contact pattern detected at Step S1 and the name of the application judged to have been executed at Step S5, or in other words, stores the contact pattern and the name as "learned contact pattern information" in the contact pattern information storage section 30c of the PROM 30 (Step S6), and returns to Step S1.

[0056] As such, in the present embodiment, the names of applications to be executed are stored in advance in association with patterns of contact with the housing 11, an actual contact pattern with respect to the housing 11 is detected, and whether contact pattern information corresponding to the contact pattern has been stored is judged. When the corresponding contact pattern information has been stored, an application associated with the contact pattern information is executed. As a result of this configuration, a desired application can be immediately executed without its icon being touched every time.

[0057] Thus, a unique effect is acquired in that operability for executing an application of the portable phone 10 particularly having a number of icons can be improved.

[0058] Also, in the present embodiment, some typical prescribed contact pattern information is stored in advance in the stage of factory shipment. Therefore, an effect is acquired that, as long as the user contacts with the housing 11 with the same contact patterns as those of the prescribed contact pattern information, the user can immediately execute a desired application without touching an icon in the same manner.

[0059] However, this prescribed contact pattern information is merely typical contact patterns, and therefore it is possible that contact with the housing 11 with the same contact pattern cannot be made depending on the users. Accordingly, the present embodiment is configured to be able to learn patterns of actual contact by the user(s).

[0060] More specifically, when the corresponding contact pattern information is judged not to be present at Step S3 of FIG. 6 and an application is judged to have been executed at Step S5 of the same diagram, the CPU 32 learns the pattern of the actual contact with the housing 11 (in other words, the contact pattern detected in Step S1) and the name of the application judged to have been executed at Step S5, and stores them in the contact pattern information storage section 30c. Therefore, a preferred characteristic can be acquired in that, as the usage frequency of the user is increased, the accuracy of the collation of detected contact patterns with contact pattern information in the contact pattern information storage section 30c is gradually improved.

[0061] Here, the judgment at Step S3 of FIG. 6 cannot be made by simple binary judgment between conformity/non-conformity. This is because, in many cases, every
contact pattern when the same application is executed by the same user is subtly different.

[0062] Figs. 7 (a) and 7 (b) are conceptual diagrams of the contact pattern judgment. For example, when the shape of the first contact pattern "a" having a horizontally wide elliptical shape for convenience of explanation, and the second contact pattern "b" having a similar horizontally wide elliptical shape, the shapes of these two patterns (a and b) are often subtly different, as shown in Fig. 7(a). Therefore, the judgment cannot be made simply by conformity/non-conformity of the shapes.

[0063] Therefore, in the present embodiment, the judgment at Step S3 of FIG. 6 is made by collecting every contact pattern when the same application is executed by the same user, expressing the degree of the similarity of every contact pattern by a numerical value, and comparing the numerical value with a predetermined judgment threshold value. For example, the value of "set intersection" (referring to a set of entire elements belonging to all sets among the elements of the plurality of sets) can be used as the above-described "numerical value". More specifically, the judgment at Step S3 of FIG. 6 may be made by the value of the set intersection of every contact pattern being calculated and the value of the set intersection being compared with the predetermined judgment threshold value.

[0064] Incidentally, FIG. 7 (b) is a diagram showing the values of the set intersections of the two contact patterns (a and b) of FIG. 7 (a). The value of the set intersection of a portion where the two contact patterns (a and b) do not overlap with each other is "1", and the value of the set intersection of a portion where the two contact patterns overlap with each other is "2". The value of the set intersection of the overlapping portion is gradually increased as the number of times of contact pattern collection when the same application is performed by the same user is increased, and finally becomes a value that exceeds the predetermined judgment threshold value. Accordingly, thereafter, judgment at Step S3 of FIG. 6 can be made with no problem.

[0065] FIG. 8 is a judgment conceptual diagram of Step S3 of FIG. 6. In this diagram, a horizontal axis shows the size of the distribution of contact patterns, and a vertical axis shows the likelihood (probability) of the contact patterns. Pattern a shown by a solid line represents one piece of contact pattern information stored as prescribed values in advance upon factory shipment, and the distribution of this pattern a is narrow and has high likelihood. Judgment using pattern a has advantages that the judgment is highly accurate and erroneous judgment can be avoided while having a disadvantage that contact patterns having mismatched distributions cannot be correctly judged.

[0066] On the other hand, patterns b, c, and d shown by broken lines are actually-learned patterns. The values of the set intersections have been gradually increased from pattern b to pattern c and to pattern d as the degree of learning is advanced. In other words, the likelihood is increased from pattern b to pattern c and to pattern d.

[0067] When the same judgment threshold value (SL) is applied to these patterns a to d, highly accurate judgment can be made with the prescribed pattern a. Meanwhile, contact patterns having mismatched distributions cannot be correctly judged. On the other hand, with the learned patterns b to d, the patterns are below SL at first, and judgment by the contact patterns cannot be made. However, as the learning is advanced, the likelihood is gradually increased to pattern c and pattern d. As a result, judgment can be made at high accuracy equivalent to that of the pattern a. In addition, since the learned pattern c and pattern d have some degree of distribution widths (variations of the values of the set intersections), there is an advantage that, even if a contact pattern having slightly mismatched distribution is detected, judgment can be made in wide ranges La and Lb.

[0068] As a matter of course, the present embodiment is not limited to the above description, and includes various modification examples and advanced examples. For example, the learning results may be configured to be able to be reset (initialized). More specifically, the learned contact pattern information of the contact pattern information storage section 30c may be configured to be erasable at one time by a request from the user. This configuration is preferred because learning can be started from the initial state when, for example, the portable phone 10 is given to another user.

[0069] Also, in the present embodiment, the operating states of the portable phone 10 stored in the contact pattern information storage section 30c of the PROM 30 are "executed application names", or in other words, the application names of activation targets. However, the operating states are not limited thereto, and may be, for example, information of icons representing applications of activation targets, or the names of applications which are being executed (being activated). In addition, it may be operating states other than those of applications such as various touch events (scrolling events, pinch-in or pinch-out events, flick events, etc.) generated by the CPU 32 in response to touch operations on the touch panel (main surface sensor 21) of the display section 12.

[0070] Moreover, in the present embodiment, the contact sensors are used as the detection means for detecting the contact patterns of the housing 11. However the detection means is not limited thereto. For example, other sensors such as image sensors, temperature sensors, illuminance sensors, infrared-ray sensors, etc. may be used, or a combination of sensors including the contact sensors may be used.

[0071] Furthermore, in the present embodiment, contact pattern collection is performed every time at Step S2 of FIG. 6. However, depending on the situation, this collection may be omitted. For example, when the degree of reliability of contact pattern information stored in the contact pattern information storage section 30c of the PROM 30 is low, the above-described collection may be omitted,
whereby unnecessary collation can be avoided and processing efficiency can be improved.

[0072] Still further, in the embodiment, contact pattern information is stored (learned) every time the user uses the portable phone 10. However, at the beginning, only contact pattern information having low accuracy is stored. Then, the accuracy of contact pattern information is gradually improved as the learning is advanced and, in the end, practically usable and highly reliable contact pattern information is stored. Whether the reliability is high enough for practical use may be judged based on, for example, the "likelihood" (see FIG. 8) of the contact pattern information. The CPU 32 may be configured not to carry out the above-described collation if the likelihood is below the judgment threshold value (SL) and to carry out the above-described collation if the likelihood is exceeding the judgment threshold value.

[0073] Instead of the above-described likelihood, the operation type of the portable phone 10, the operation position, the number of stored contact patterns associated with the states of the device, statistical values representing variations of a plurality of contact patterns, accuracy information obtained therefrom, etc. may be used. The statistical values representing variations are values representing the degrees of mismatching of respective contact patterns with respect to an average area of the plurality of stored contact patterns and are, for example, differences from a standard deviation or differences between a minimum value and a maximum value. When the number of the stored contact patterns is large, the characteristics of the contact patterns can be more precisely captured, whereby the accuracy becomes higher. Even if the number is not sufficiently large, when the variations are small, the accuracy becomes higher. The CPU 32 performs the collation at Step S2 of FIG. 6 when the accuracy is high and does not perform the collation when the accuracy is low.

[0074] The case where the accuracy is low refers to a case where appropriate accuracy set for every usage scene cannot be obtained because the number of the contact patterns is small or the number and the variations are large. In this case, the judgment may be made by using another means other than the detection means for detecting contact patterns. For example, as another means, a judgment means for judging passwords (personal identification numbers), a judgment means for fingerprint authentication or face authentication, etc. can be devised. The detection means for detecting contact patterns is extremely usable when the accuracy is sufficient, but adversely causes erroneous operations and is inconvenient when the accuracy is not sufficient. Therefore, although it is more cumbersome, the detection means may be switched to the above-described another means having high reliability. In this configuration where the another means is used in combination, if the detection means for detecting contact patterns is used, as a matter of course, the CPU 32 does not perform judgment by the above-described another means.

[0075] Also, a configuration may be adopted in which the method of the collation at Step S2 of FIG. 6 is changed depending on the state of the portable phone 10. For example, it is preferable that, when the portable phone 10 is in a state where locking is about to be released, the collation is performed with high accuracy. This is because the unlocking is to change the portable phone 10 from an unusable state to a usable state and requires more precise contact pattern judgment. Accordingly, for example, a configuration may be adopted in which a range sufficiently narrow with respect to variation ranges of a plurality of stored contact patterns is the collation range.

[0076] Also, a configuration may be adopted in which the collation is performed with high accuracy when an operation to access individual information such as mails and photos is performed. This is because this case also requires more precise contact pattern judgment as in the case of unlocking. In some cases, the collation may be performed with low accuracy. Examples of this case include a case where an operation of taking photos or capturing moving images is performed. This is because it is desirable to have a characteristic to put importance on the speed so as not to miss imaging timing. For this purpose, a configuration may be adopted in which a range sufficiently large with respect to variation ranges of a plurality of stored contact patterns is the collation range.


DEscription of Reference Numerals

[0077] 10 portable telephone
11 housing
30 PROM
32 CPU
100 housing
101 detection means
102 portable electronic device
103 storage means
104 judgment means
105 control means
106 learning means

Claims

1. A portable electronic device (102) comprising:

   a detection means (101) for detecting a contact pattern of a contact object to a housing (100) of the portable electronic device (102);

   a storage means (103) capable of storing a plurality of operating states of the portable electronic device (102) in association with a plurality of different contact patterns, respectively;
a judgment means (104) for judging if a contact pattern corresponding to the contact pattern detected by the detection means (101) has been stored in the storage means (103);
a control means (105) for controlling the portable electronic device (102) to enter an operating state stored in the storage means (103) in association with the corresponding contact pattern when the judgment means (104) judges that the corresponding contact pattern has been stored in the storage means (103); and
the portable electronic device being further characterised by comprising:
a learning means (106) for, when the judgment means (104) judges that a contact pattern corresponding to the contact pattern detected by the detection means (101) has not been stored in the storage means (103), storing, in the storage means (103), the contact pattern detected by the detection means (101) in association with an operating state of the portable electronic device (102) executed by a user when or immediately after the contact pattern is detected.

2. The portable electronic device (102) according to claim 1 characterized in that the operating state is related to an application activated in the portable electronic device (102).

3. The portable electronic device (102) according to claim 1 characterized in that the operating state is related to an application serving as an activation target in the portable electronic device (102).

4. The portable electronic device (102) according to claim 1 characterized in that the operating state is related to a scrolling event.

5. The portable electronic device (102) according to claim 1 characterized in that the operating state is related to a pinch-in or pinch-out event.

6. The portable electronic device (102) according to claim 1, characterized in that the operating state is related to a flick event.

7. A method for controlling a portable electronic device (102) including:
a detection step of detecting a contact pattern of a contact object to a housing (100) of the portable electronic device (102); a storage step capable of storing a plurality of operating states of the portable electronic device (102) in a storage means (103) in association with a plurality of different contact patterns,

respectively;
a judgment step of judging if a contact pattern corresponding to the contact pattern detected in the detection step has been stored in the storage means (103); a control step of controlling the portable electronic device (102) to enter an operating state stored in the storage means (103) in association with the corresponding contact pattern when the corresponding contact pattern is judged to have been stored in the storage means (103) in the judgment step; and the method being further characterised by including:
a learning step of, when the judgment step judges that a contact pattern corresponding to the contact pattern detected by the detection step has not been stored in the storage means (103), storing, in the storage means (103), the contact pattern detected in the detection step in association with an operating state of the portable electronic device (102) executed by a user when or immediately after the contact pattern is detected.

8. A program comprising instructions to cause the device according to claims 1 to 6 to execute the steps of the method of claim 7.

Patentansprüche

1. Tragbare elektronische Vorrichtung (102) mit:
einem Detektionsmittel (101) zur Detektion eines Kontaktmusters eines Kontaktobjekts mit einem Gehäuse (100) der tragbaren elektronischen Vorrichtung (102); einem Speichermittel (103), das zum Speichern einer Vielzahl von Betriebszuständen der tragbaren elektronischen Vorrichtung (102) in Verbindung mit jeweils einer Vielzahl von unterschiedlichen Kontaktmustern imstande ist; einem Entscheidungsmittel (104) zum Entscheiden, ob ein Kontaktmuster, das dem Kontaktmuster entspricht, das durch das Detektionsmittel (101) detektiert wird, im Speichermittel (103) gespeichert worden ist; einem Steuermittel (105) zum Steuern der tragbaren elektronischen Vorrichtung (102), in einen Betriebszustand einzutreten, der im Speichermittel (103) in Verbindung mit dem entsprechenden Kontaktmuster gespeichert ist, wenn das Entscheidungsmittel (104) entscheidet, dass das entsprechende Kontaktmuster im Speichermittel (103) gespeichert worden ist; und wobei die tragbare elektronische Vorrichtung
ferner **dadurch gekennzeichnet ist, dass** sie aufweist:

- ein Lernmittel (106) zum Speichern im Speichermittel (103), wenn das Entscheidungsmittel (104) entscheidet, dass ein Kontaktmuster, das dem Kontaktmuster entspricht, das durch das Detektionssmittel (101) detektiert wird, nicht im Speichermittel (103) gespeichert worden ist, des durch das Detektionssmittel (101) detektierten Kontaktmustern in Verbindung mit einem Betriebszustand der tragbaren elektronischen Vorrichtung (102), der durch einen Benutzer ausgeführt wird, wenn oder unmittelbar nachdem das Kontaktmuster detektiert wird.

2. Tragbare elektronische Vorrichtung (102) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Betriebszustand mit einer Anwendung in Beziehung steht, die in der tragbaren elektronischen Vorrichtung (102) aktiviert wird.

3. Tragbare elektronische Vorrichtung (102) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Betriebszustand mit einer Anwendung in Beziehung steht, die als ein Aktivierungsziel in der tragbaren elektronischen Vorrichtung (102) dient.

4. Tragbare elektronische Vorrichtung (102) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Betriebszustand mit einem Scrollereignis in Beziehung steht.

5. Tragbare elektronische Vorrichtung (102) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Betriebszustand mit einem Ereignis des Zusammenführens oder Auseinanderziehens zweier Finger in Beziehung steht.

6. Tragbare elektronische Vorrichtung (102) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Betriebszustand mit einem Wischereignis in Beziehung steht.

7. Verfahren zum Steuern einer tragbaren elektronischen Vorrichtung (102), das umfasst:

- einen Detektionsschritt zur Detektion eines Kontaktmusters eines Kontaktobjekts mit einem Gehäuse (100) der tragbaren elektronischen Vorrichtung (102);
- einen Speicherschritt, der zum Speichern einer Vielzahl von Betriebszuständen der tragbaren elektronischen Vorrichtung (102) in einem Speichermittel (103) in Verbindung mit jeweils einer Vielzahl von unterschiedlichen Kontaktmustern imstande ist;
- eine lernende Entscheidung zu den Entscheidungsschritten zum Entscheiden, ob ein Kontaktmuster, das dem Kontaktmuster entspricht, das detektiert wird, im Speichermittel (103) gespeichert worden ist;
- einen Steuerschritt zum Steuern der tragbaren elektronischen Vorrichtung (102), in einen Betriebszustand einzutreten, der im Speichermittel (103) in Verbindung mit dem entsprechenden Kontaktmuster gespeichert ist, wenn im Entscheidungsschritt entschieden wird, dass das entsprechende Kontaktmuster im Speichermittel (103) gespeichert worden ist; und wobei das Verfahren ferner **dadurch gekennzeichnet ist, dass** es aufweist:

- einen Lernschritt zum Speichern im Speichermittel (103), wenn der Entscheidungsschritt entscheidet, dass ein Kontaktmuster, das dem Kontaktmuster entspricht, das detektiert wird, nicht im Speichermittel (103) gespeichert worden ist, des im Detektionsschritt detektierten Kontaktmusters in Verbindung mit einem Betriebszustand der tragbaren elektronischen Vorrichtung (102), der durch einen Benutzer ausgeführt wird, wenn oder unmittelbar nachdem das Kontaktmuster detektiert wird.

8. Programm, das Befehle aufweist, um die Vorrichtung nach Anspruch 1 bis 6 zu veranlassen, die Schritte des Verfahrens nach Anspruch 7 auszuführen.

**Revendications**

1. Dispositif électronique portatif (102), comprenant :

- une unité de détection (101) permettant de détecter un motif de contact d’un objet de contact avec un boîtier (100) du dispositif électronique portatif (102) ;
- une unité de mémoire (103) apte à mémoriser une pluralité d’états de fonctionnement du dispositif électronique portatif (102) en relation avec une pluralité de motifs de contact différents respectifs ;
- une unité d’évaluation (104) permettant d’évaluer si un motif de contact correspondant au motif de contact détecté par l’unité de détection (101) a été stocké dans l’unité de mémoire (103) ;
- une unité de commande (105) permettant de commander le passage du dispositif électronique portatif (102) vers un état de fonctionnement stocké dans l’unité de mémoire (103) en relation
avec le motif de contact correspondant quand l'unité d'évaluation (104) estime que le motif de contact correspondant a été stocké dans l'unité de mémoire (103) ; et ledit dispositif électronique portatif étant en outre caractérisé en ce qu'il comprend :

une unité d'apprentissage (106) permettant de mémoriser dans l'unité de mémoire (103), quand l'unité d'évaluation (104) estime qu'un motif de contact correspondant au motif de contact détecté par l'unité de détection (101) n'a pas été stocké dans l'unité de mémoire (103), le motif de contact détecté par l'unité de détection (101) en relation avec un état de fonctionnement du dispositif électronique portatif (102) exécuté par un utilisateur, quand le motif de contact est détecté ou immédiatement après cette détection.

2. Dispositif électronique portatif (102) selon la revendication 1, caractérisé en ce que l'état de fonctionnement est relatif à une application activée dans ledit dispositif électronique portatif (102).

3. Dispositif électronique portatif (102) selon la revendication 1, caractérisé en ce que l'état de fonctionnement est relatif à une application servant de cible d'activation dans ledit dispositif électronique portatif (102).

4. Dispositif électronique portatif (102) selon la revendication 1, caractérisé en ce que l'état de fonctionnement est relatif à une action de défilement.

5. Dispositif électronique portatif (102) selon la revendication 1, caractérisé en ce que l'état de fonctionnement est relatif à une action de pincement ou d'écartement des doigts.

6. Dispositif électronique portatif (102) selon la revendication 1, caractérisé en ce que l'état de fonctionnement est relatif à une action de chiquenaude.

7. Procédé de commande d'un dispositif électronique portatif (102), comprenant :

une étape de détection d'un motif de contact d'un objet de contact avec un boîtier (100) du dispositif électronique portatif (102) ;

une étape de mémorisation d'une pluralité d'états de fonctionnement du dispositif électronique portatif (102) dans une unité de mémoire (103) en relation avec une pluralité de motifs de contact différents respectifs ;

une étape d'évaluation si un motif de contact correspondant au motif de contact détecté lors de l'étape de détection a été stocké dans l'unité de mémoire (103) ;

une étape de commande de passage du dispositif électronique portatif (102) vers un état de fonctionnement stocké dans l'unité de mémoire (103) en relation avec le motif de contact correspondant quand le motif de contact correspondant est estimé avoir été stocké dans l'unité de mémoire (103) lors de l'étape d'évaluation ; et

ledit procédé étant en outre caractérisé en ce qu'il comprend :

une étape d'apprentissage, mémorisant dans l'unité de mémoire (103), si l'étape d'évaluation estime qu'un motif de contact correspondant au motif de contact détecté lors de l'étape de détection n'a pas été stocké dans l'unité de mémoire (103), le motif de contact détecté lors de l'étape de détection en relation avec un état de fonctionnement du dispositif électronique portatif (102) exécuté par un utilisateur, quand le motif de contact est détecté ou immédiatement après cette détection.

8. Programme, comprenant des instructions entraînant l'exécution des étapes de procédé selon la revendication 7 par le dispositif selon les revendications 1 à 6.
**FIG. 5**

**[PRESCRIBED CONTACT PATTERN INFORMATION]**

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**[LEARNED CONTACT PATTERN INFORMATION]**

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</table>
FIG. 6

START

S1 DETECT CONTACT PATTERN

S2 COLLATE WITH STORED CONTACT PATTERN INFORMATION

S3 IS CORRESPONDING CONTACT PATTERN INFORMATION PRESENT?

S4 EXECUTE APPLICATION ASSOCIATED WITH CONTACT PATTERN INFORMATION

S5 HAS APPLICATION BEEN EXECUTED?

S6 LEARN DETECTED CONTACT PATTERN AND EXECUTED APPLICATION IN ASSOCIATION WITH EACH OTHER
FIG. 7

(a)

(b)

VALUE OF SET INTERSECTION = "1"
VALUE OF SET INTERSECTION = "2"
FIG. 9

100: HOUSING
102: PORTABLE ELECTRONIC DEVICE

101

DETECTION MEANS

104

JUDGMENT MEANS

105

CONTROL MEANS

103

STORAGE MEANS

106

LEARNING MEANS

OPERATING STATE
REFERENCES CITED IN THE DESCRIPTION

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