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Portable terminal

Abstract

A portable terminal device sets a security level for each application in accordance with position, and stores the level in a memory. The security level determines whether each application is displayed or made executable on a display portion in locked state and unlocked state. A controller refers to the security level and determines the application displayed on the display portion in accordance with position information acquired by a position information acquisition unit (GPS reception unit), and makes executable the application selected by the user. Thus, the portable terminal device offers user-friendliness while ensuring security strength.

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Background/Summary

TECHNICAL FIELD

(1) The present invention relates to a portable terminal device taking security into consideration.

BACKGROUND ART

(2) In recent years, a portable terminal device provided with a touch panel, such as a smartphone or a tablet-type personal computer, is widely prevalent. In order to prevent any third party from illicitly manipulating the portable terminal device, the portable terminal device uses a password authentication in general. In a password authentication, the security strength is enhanced by increasing the length of the character string that is input and by making the character string more complicated. However, when the password is long and complicated, it is necessary for the user to type the keys many times when the user inputs the password, which is reduces the usability for the user himself/herself.

(3) With regard to this issue, Patent Literature 1 indicates that, in order to maintain the balance between the user's usability and the security strength, location information about the portable terminal is obtained with a GPS (Global Positioning System) function provided with the portable terminal device, and the user is authenticated by using a short password when the user is at a location where the user is more likely to be located (e.g., home or workplace), and the user is authenticated by using a long password when the user is at a location where the user is less likely to be located (e.g., places visited in business trip or travel).

(4) Patent Literature 2 indicates that, in order to appropriately arrange, on a terminal screen, an icon of an application corresponding to the location of a terminal, an icon of an application related to a current location is displayed on an upper half portion of the screen, and the icons of the other usual applications are displayed on a lower half portion of the screen.

CITATION LIST

Patent Literature

(5) PATENT LITERATURE 1: JP-A-2004-118456 PATENT LITERATURE 2: JP-A-2013-74499

SUMMARY OF INVENTION

Technical Problem

(6) According to the technique of Patent Literature 1, the length of the password is shortened or the

password is unnecessary at home or the workplace of the user. Therefore, the portable terminal device of the user may be easily operated by a family member or a colleague. Therefore, for example, a security problem remains, i.e., even information that is needed to be secret to a family member or a colleague, such as contents of private emails of the user, may be seen.

(7) According to the technique of Patent Literature 2, an application can be selected smoothly in accordance with the location of the portable terminal device, but the security of the user himself/herself is not taken into consideration.

(8) It is an object of the present invention to provide a portable terminal device providing a high operability for the user while the security strength is ensured.

Solution to Problem

(9) The present invention is a portable terminal device executing an application in accordance with a selection made by a user, the portable terminal device including: a location information obtaining unit obtaining location information about the portable terminal device; a security level setting storage unit setting and storing a security level for each application in accordance with a location; a display unit displaying an application that can be selected by the user; and a control unit controlling a display of the display unit, and executing the application selected by the user. Herein, the security level is defined to display each application on the display unit or allow execution of the application in a locked state and an unlocked state of the portable terminal device, and the control unit refers to the security level stored in the security level setting storage unit to determine an application displayed on the display unit in accordance with the location information obtained by the location information obtaining unit, and causes the application selected by the user to be executed.

Advantageous Effects of Invention

(10) The present invention can provide a portable terminal device providing a high operability for the user while the security strength is ensured.

Description

BRIEF DESCRIPTION OF DRAWINGS

(1) FIG. **1** is a block diagram illustrating an internal configuration of portable terminal device **1** according to a first embodiment.

(2) FIG. **2** is a figure illustrating an example in which a security level is set for each application in accordance with the location.

(3) FIGS. **3**(*a*) to **3**(*d*) are figures illustrating examples of displays of home screens in the setting of FIG. **2**.

(4) FIG. **4** is a flowchart illustrating an operation of portable terminal device **1** according to the first embodiment.

(5) FIG. **5** is a figure illustrating an example in which a security level is set for each application in a second embodiment.

(6) FIGS. **6**(*a*) to **6**(*h*) are figures illustrating examples of displays of home screens in the setting of FIG. **5**.

(7) FIG. **7** is a flowchart illustrating an operation according to the second embodiment.

(8) FIG. **8** is a figure illustrating an example in which a security level is set for each application in a third embodiment.

(9) FIGS. **9**(*a*) to **9**(*h*) are figures illustrating examples of displays of home screens in the setting of FIG. **8**.

(10) FIG. **10** is a flowchart illustrating an operation according to the third embodiment.

(11) FIG. **11** is a figure illustrating an example in which a security level is set for each application in a fourth embodiment.

(12) FIGS. **12**(*a*) to **12**(*j*) are figures illustrating examples of displays of home screens in the setting

of FIG. **11**.

DESCRIPTION OF EMBODIMENTS

(20) Hereinafter, embodiments of the present invention will be explained with reference to drawings.

First Embodiment

(21) FIG. **1** is a block diagram illustrating an internal configuration of portable terminal device **1** according to a first embodiment. In this case, for example, a case of a smartphone will be explained. Portable terminal device **1** is constituted by using, as necessary, control unit **101**, memory **102**, storage **103**, global positioning system (GPS) receiver unit **104**, geomagnetism sensor **105**, acceleration sensor **106**, gyro sensor **107**, imaging unit **108**, image processing unit **109**, microphone **110**, audio processing unit **111**, speaker **112**, external audio output unit **113**, touch panel **114**, operation button **115**, input and output OF **116**, base station communication unit **117**, wireless communication unit **118**, timer unit **119**, user recognition unit **120**, and these constituting units are connected with each other via bus **100**.

(22) Control unit **101** is constituted by a central processing unit (CPU) or the like to control the constituting units and execute various kinds of processing by executing a program stored in memory **102**.

(23) Memory **102** is a flash memory or the like, and stores programs and data used by control unit **101**. Memory **102** includes user information **102***a* of, e.g., a password, face information, a telephone number, or the like for user authentication, information (location setting information) **102***b* about a location where the user often uses the portable terminal device such as home or a workplace and information about a security level that is set for each application (application setting information) **102***c* or the like in association with the location. Further, portable terminal device **1** includes storage **103** such as a memory card to save data of music, video, and pictures.

(24) GPS receiver unit **104** receives signals from GPS satellites in the sky. Accordingly, the current location of portable terminal device **1** is detected. Geomagnetism sensor **105** detects the direction in which portable terminal device **1** is oriented. Acceleration sensor **106** detects the acceleration of portable terminal device **1**, and gyro sensor **107** detects the angular speed of portable terminal device **1**. With these sensors, the inclination and the motion of portable terminal device **1** can be detected in details.

(25) Imaging unit **108** is a camera or the like, and image processing unit **109** processes a video that is input from imaging unit **108**. Image processing unit **109** processes a video displayed on display unit **114***a* of touch panel **114**.

(26) Microphone **110** inputs external audio, and speaker **112** outputs audio to the outside. External audio output unit **113** is connected to, for example, an earphone (not shown), and outputs audio. Audio processing unit **111** processes audio that is input and output.

(27) Touch panel **114** is constituted by display unit **114***a* and operation input unit **114***b*. Display unit **114***a* is a unit such as an LCD that displays video and an image, and has operation input unit **114***b* on a display surface of display unit **114***a*. Operation input unit **114***b* is input means such as a

capacitance type using a touch pad method, and is configured to detect, as an operation input, a contact operation performed with a finger, a touch pen, or the like. For example, an icon or a menu of an application is displayed on display unit **114***a*. When the user performs an operation for pressing a desired icon or menu with a fingertip for a single time (tap operation), an application corresponding to the icon displayed at the tapped position is executed, or the processing associated with the menu is executed. When the user performs an operation for pressing operation input unit **114***b* with the fingertip and sliding the fingertip in the right or left direction (swipe operation) while the home screen is displayed, processing for switching the home screen is performed.

(28) Operation button **115** is a push button switch or the like, and when it is detected that operation button **115** is pressed, this detection is transmitted to control unit **101**, and an operation corresponding to operation button **115** is executed.

(29) Input and output I/F **116** is, for example, a USB (Universal Serial Bus) or the like, and is an interface for transmitting and receiving data to and from an external device.

(30) Base station communication unit **117** is a communication interface of, e.g., W-CDMA (Wideband Code Division Multiple Access) or LTE (Long Term Evolution) for performing long-range wireless communication with base station **3**. Wireless communication unit **118** is a communication interface that performs wireless communication with wireless communication access point **2** using wireless LAN such as IEEE802.11a/b/n. Accordingly, a connection with external network **4** is made via base station **3** or access point **2**, so that information is transmitted and received. Each of base station communication unit **117** and wireless communication unit **118** is constituted by an antenna, a modulating circuit, a demodulating circuit, or the like.

(31) Timer unit **119** uses, for example, a real time clock (RTC) circuit to output current time information, and connects to a network time protocol (NTP) server via base station communication unit **117** or wireless communication unit **118** to automatically correct the time.

(32) User recognition unit **120** recognizes the user by comparing an image of the user retrieved from imaging unit **108** and processed by image processing unit **109** and face information stored in memory **102** as user information **102***a*.

(33) The program or the data stored in memory **102** or storage **103** may be updated or added as necessary by connecting to external network **4** via base station **3** or the access point **2** using base station communication unit **117** or wireless communication unit **118** and downloading program or data from a not-shown external server or the like. Alternatively, the data, the program, or the like may be updated and added by connecting to an external device such as a personal computer via input and output I/F **116**.

(34) It should be noted that a tablet-type personal computer has substantially the same configuration as the smartphone as illustrated in FIG. **1**, and the explanation thereabout is omitted.

(35) In the present embodiment, a security level is set for each application in accordance with the location of portable terminal device **1** as location setting information **102***b* and application setting information **102***c* in memory **102**. The present embodiment is characterized in that an application of which security level is low can be executed quickly without performing authentication processing, and an application of which security level is high can be executed after predetermined authentication processing is performed.

(36) FIG. **2** is a figure illustrating an example in which a security level is set for each application in accordance with a location. In this example, "home" and "workplace" are registered as the locations (the locations other than these are "unregistered"). In accordance with the location, the security levels of applications such as "email", "setting", or the like are set. These setting informations are stored as location setting information **102***b* and application setting information **102***c* in memory **102**.

(37) The security level "H" denotes an application of which security strength is high and which causes problems when the application is executed by other people. In this case, the application cannot be executed unless the home screen is unlocked. More specifically, on the home screen in

the locked state, icons corresponding to the applications are not displayed, and when the home screen is unlocked, the icons are displayed.

(38) The security level "L" denotes an application of which security strength is low and which does not cause problems when the application is executed by other people. In this case, the application can be executed even in the locked state. More specifically, even on the home screen in the locked state, icons corresponding to the applications are displayed.

(39) In this case, the location is registered by the user himself/herself in accordance with the usage environment of the user, but a location where the frequency of execution is high may be automatically registered from the history of locations where the applications are executed. The security level of each application may be set by the user himself/herself in accordance with the usage environment of the user, but a default setting may be made as an initial value of each application, and thereafter, the user may change settings in accordance with the usage environment of the user.

(40) Although an input screen for setting the above security level is not particularly indicated, it may be incorporated into a part of an initial setting function of a conventional portable terminal device, and the user may make settings (or change settings) while map information (including the size of the setting area) and a list of applications are displayed on the screen.

(41) FIGS. **3**(*a*) to **3**(*d*) are figures illustrating examples of displays of home screens in a setting of FIG. **2**. FIGS. **3**(*a*) to **3**(*c*) illustrate a locked state, and FIG. **3**(*d*) illustrates an unlocked state. In this case, touch panel **114** of portable terminal device **1** as well as imaging unit **108**, speaker **112**, operation button **115**, and microphone **110** are shown.

(42) FIG. **3**(*a*) is a home screen in a locked state at home, which displays unlock icon **31** and icon group **32** of an application that can be executed even in a locked state. This screen is also referred to as a "lock screen". In this example, icons of applications of "game", "remote controller", "camera", "Map", "search" of which security levels are set to "L" at home are displayed, and the applications can be executed without inputting authentication information for unlocking.

(43) FIG. **3**(*b*) is a home screen in a locked state at a workplace, which displays icons of "Works", "Map", "search" of which security levels are set to "L" at the workplace are displayed as icon group **32**, and the they can be executed without unlocking.

(44) FIG. **3**(*c*) is a home screen in a locked state at a not-registered location other than the home and the workplace, which displays icons of applications of "camera" and "search" of which security levels are set to "L" are displayed as icon group **32**, and the applications can be executed without unlocking.

(45) FIG. **3**(*d*) is a home screen in an unlocked state obtained by selecting icon **31** and inputting authentication information, and displays icon group **33** of applications that can be executed after unlocking. In icon group **33**, the icons of applications which were not displayed on the lock screens shown in FIGS. **3**(*a*) to **3**(*c*) and of which security levels are set to "H" are additionally displayed, and can be executed.

(46) FIG. **4** is a flowchart illustrating an operation of portable terminal device **1** according to the first embodiment. In this case, an operation for unlocking sleep state and selecting a desired application will be explained. The sleep state is unlocked by pressing, for example, operation button **115**, and the series of operations is controlled by control unit **101**.

(47) In S**201**, the current location information about portable terminal device **1** is obtained. In order to obtain the current location information, for example, the location information received by GPS receiver unit **104** is used.

(48) In S**202**, a determination is made as to whether the obtained current location information is within a range of the location of the home, the workplace, or the like registered in advance by referring to location setting information **102***b* and application setting information **102***c* in memory **102**. Then, an icon of an application of which the security level is set to "L", i.e., an application that can be executed without unlocking is read out in accordance with the classification of the

determined current location.

(49) In S**203**, icon group **32** of the application that can be executed without unlocking obtained in S**202** and unlock icon **31** are displayed as a lock screen on display unit **114***a* of touch panel **114**.

(50) In S**204**, the user uses operation input unit **114***b* to select an icon or a menu displayed on display unit **114***a*, or gives an input by pressing operation button **115**. In S**205**, the following branch processing is performed in accordance with a selection input given by the user in S**204**.

(51) In a case where operation button **115** is pressed in the input of S**204**, the flow is branched to "sleep" and goes to S**206**. In S**206**, in order to reduce the power consumption, for example, the display of display unit **114***a* on touch panel **114** is erased, and the processing proceeds to a sleep state, and the processing is terminated.

(52) In the input of S**204**, in a case where the icon of the application displayed on display unit **114***a* is selected by a tap operation performed by the user, the flow is branched to "application", and goes to S**207**. In S**207**, the processing of the application corresponding to the selected icon is executed, and thereafter, return to the processing in S**201**.

(53) In a case where unlock icon **31** displayed on display unit **114***a* is selected by a tap operation performed by the user in the input of S**204**, the flow is branched to "unlock" and goes to S**208**. In S**208**, a screen for inputting authentication information for unlocking is displayed.

(54) In S**209**, the user uses operation input unit **114***b* to input the authentication information, and in S**210**, a determination is made as to whether the input information is valid or not by collating the information with the authentication information registered in user information **102***a*. In a case where the information is determined not to be valid (No), the flow is returned back to S**209**, and the authentication information is input again.

(55) In a case where the information is determined to be valid in S**210** (Yes), the flow goes to S**211**, an unlocked home screen is displayed. On the unlock screen, an icons of applications of which security level are set to "H" for the current location are added, and icon group **33** of executable applications is displayed.

(56) In S**212**, the user uses operation input unit **114***b* to select an icon or a menu displayed on display unit **114***a*, or gives an input by pressing operation button **115** (sleep selection). In S**213**, branch processing is performed in accordance with a selection input given by the user in S**212**.

(57) In a case where operation button **115** is selected for the input in S**212**, the flow is branched to "sleep" and goes to S**206**, and the sleep processing is performed, and then this flow is terminated.

(58) In a case where the icon of the application displayed on display unit **114***a* is selected by a tap operation performed by the user for the input in S**212**, the flow is branched to "application", and goes to S**214**. In S**214**, after the processing of the application corresponding to the selected icon is executed, the flow is returned to the processing in S**211**, and a subsequent selection of the user is waited for.

(59) As described above, in the first embodiment, a security level is set for each application in accordance with the location. More specifically, an application of which security level is set to be low can be executed quickly without performing the authentication processing even in the locked state. On the other hand, an application of which security level is set to be high can be executed after the authentication processing is performed to unlock the lock.

(60) For example, an application of "remote controller" for operating as a remote controller for a television set can be executed without being unlocked at home, and an application of "transit" supporting a passenger to change trains can be executed without being unlocked at a train station, so that the usability can be improved. On the other hand, in order to execute an application that may cause a problem when it is seen by other people such as "email", it is necessary to unlock the home screen by performing the authentication, so that the security can be ensured. More specifically, it is difficult for a person other than the user to unlock the home screen by performing the authentication, so that the security for such application can be ensured.

Second Embodiment

(61) A second embodiment includes not only the functions of the first embodiment but also a function for limiting the use of a particular application at a particular location. More specifically, the home screen that is displayed is changed for each location.

(62) FIG. **5** is a figure illustrating an example in which a security level is set for each application in accordance with a location. In this example, "home", "workplace", "train station" are registered as the locations. Like the first embodiment (FIG. **2**), the security level "H" is a high security strength, and therefore, it cannot be executed without being unlocked. The security level "L" is a low security strength, and therefore, it can be executed even in the locked state. Further, in the present embodiment, a security level "X" for limiting the use of the application is provided. An icon corresponding to an application that is set to the security level "X" is not displayed on the home screen even in the locked state and in the unlocked state, so that the use of the application is limited. For example, at "home", the application "Works" is set to the security level "X", and the icon is not displayed on the home screen at "home", so that the use is limited.

(63) FIGS. **6**(*a*) to **6**(*h*) are figures illustrating examples of displays of home screens in the setting of FIG. **5**. FIGS. **6**(*a*) to **6**(*d*) illustrate the locked state. FIGS. **6**(*e*) to **6**(*h*) illustrate the unlocked state. In this example, in addition to the first embodiment (FIG. **2**), FIGS. **6**(*c*) and **6**(*g*) are added in a case where the location is "train station". On each home screen, information indicating which location the home screen corresponds to is displayed.

(64) For example, FIG. **6**(*a*) is a lock screen at "home", and displays icon group **32** of "game", "remote controller", "camera", "Map", and "search" of which security levels are "L". FIG. **6**(*e*) is an unlock screen at "home", and displays icon group **33** additionally including "email", "setting" of which security levels are "H". However, an icon of "Works" that is set to the security level "X" is not displayed in any of the screens of FIGS. **6**(*a*) and **6**(*e*). Therefore, the use of the application "Works" is limited.

(65) On the other hand, FIGS. **6**(*b*) and **6**(*f*) are home screens at "workplace", and in FIGS. **6**(*b*) and **6**(*f*), the icon of "Works" of which security level is "L" is displayed in both of the screens. However, the icons such as "remote controller", "camera", or the like of which security level is set to "X" are not displayed even when the home screen is unlocked. As described above, the home screen in the unlocked state is changed in accordance with the location, so that the use of a particular application is limited in accordance with the location.

(66) When the application of which use is limited is to be executed, this can be executed by changing the home screen. For example, when the user wants to execute an application of "Works" at home, the user unlocks the lock with icon **31** and changes the home screen from FIG. **6**(*a*) to FIG. **6**(*e*), and further, the user changes to the home screen shown in FIG. **6**(*f*) corresponding to the work place, so that the user can execute the application of "Works".

(67) FIG. **7** is a flowchart illustrating an operation according to the second embodiment. In the present embodiment, a usage limitation of an application is added to the first embodiment (FIG. **4**). It should be noted that the same steps as those in FIG. **4** will be denoted with the same step numbers, and a repeated portion will be briefly explained.

(68) In S**201**, current location information about portable terminal device **1** is obtained. In S**202**, an icon of an application of which the security level is set to "L" is read out in accordance with the classification of the current location by referring to location setting information **102***b* and application setting information **102***c* in memory **102**.

(69) In S**221**, icon group **32** of applications of which security levels are "L" obtained in S**202** is displayed as the lock screen corresponding to the current location on display unit **114***a* of touch panel **114**. Position information **30** about the home screen is displayed on display unit **114***a*.

(70) In S**204**, the user operates touch panel **114** to select a desired operation. In S**205**, branch processing is performed in accordance with the selection input performed by the user in S**204**.

(71) When "sleep" is selected in S**204**, S**206** is subsequently performed, and accordingly, portable terminal device **1** goes into the sleep state, and terminates the processing.

(72) In a case where the icon of the application displayed on display unit **114***a* is selected in S**204**, S**207** is subsequently performed, and after the processing of the selected application is executed, S**201** is subsequently performed.

(73) In a case where unlock icon **31** displayed on display unit **114***a* is selected in S**204**, S**208** is subsequently performed, and a screen for inputting authentication information for unlocking is displayed.

(74) In S**209**, the user uses operation input unit **114***b* to input the authentication information, and in S**210**, a determination is made as to whether the input information is valid as the authentication information registered in advance. In a case where the information is determined not to be valid (No), the flow is returned back to S**209**, and the authentication information is input again.

(75) In a case where the information is determined to be valid in S**210** (Yes), S**222** is subsequently performed, and an unlocked home screen that is set for each location is displayed. On the unlocked home screen, icon group **33** of executable applications that are set for each location is displayed. This icon group **33** includes icons of which security levels are "H" but does not include icons of which security levels are "X".

(76) In S**223**, the user uses operation input unit **114***b* to select an icon or a menu displayed on display unit **114***a*. Alternatively, the user performs an input by, e.g., pressing operation button **115** (sleep selection) or performing swipe operation (home screen change). In S**224**, branch processing is performed in accordance with a selection input given by the user in S**223**.

(77) In a case where "sleep" is selected in the input of S**223**, S**206** is subsequently performed, and portable terminal device **1** proceeds to the sleep state, and terminates the processing.

(78) In a case where the icon of the application displayed on display unit **114***a* is selected in S**223**, S**214** is subsequently performed, and the processing of the selected application is executed, and thereafter, S**222** is performed again.

(79) In a case where swipe operation performed by the user in the input of S**223** is detected, S**225** is subsequently performed, and portable terminal device **1** changed to the setting of the home screen corresponding to another location. Then, S**222** is performed again, and the home screen corresponding to the changed location is displayed.

(80) In the above example, change of the home screen (a branch based on the swipe operation) in the selection input of S**223** is permitted, but this may be prohibited. Accordingly, the use of an application that may cause problems can be prohibited in accordance with the location, for example, an execution of an application "camera" for taking a photo is prohibited at the workplace.

(81) In the second embodiment, a security level is set for each application in accordance with a location, so that, like the first embodiment, the portable terminal device ensuring the security and providing high usability for the user can be provided. Furthermore, in the second embodiment, the function for limiting the use of a particular application in accordance with a location is added, so that the security function is further improved.

Third Embodiment

(82) In a third embodiment, in addition to the functions of the second embodiment, a security level for each application is switched and set in accordance with a time.

(83) FIG. **8** is a figure illustrating an example in which a security level is set for each application in accordance with a location and a time. This setting information is registered to application setting information **102***c* in memory **102**. In this example, "school" is registered as a location, and in a period of time from 9 o'clock to 12 o'clock, a security level is changed and set in accordance with a time table of a class. More specifically, the security levels of applications used for the subject of the class are set to "L", and so that the applications can be executed even in the locked state. The security levels of the other applications are set to "H" or "X", so that unless the home screen is unlocked, the applications cannot be executed, or the use of the applications is limited. For example, in a period of time from 9 o'clock to 10 o'clock, only the application of "algebra" which is the subject of the class is set to level "L". During the time zone of the classes, the applications such

as "email", "setting", or the like are set to level "X", so that their usage is limited. In the locations other than "school", the levels of all the applications are set to "H", so that the applications are configured not to be executable unless the home screen is unlocked.

(84) FIGS. **9**(*a*) to **9**(*h*) are figures illustrating examples of displays of home screens in the setting of FIG. **8**. FIGS. **9**(*a*) to **9**(*d*) illustrate the locked state, and FIGS. **9**(*e*) to **9**(*h*) illustrate the unlocked state. In this case, a change of a display in each time zone in the school is added.

(85) FIGS. **9**(*a*) and **9**(*b*) are lock screens in the time zone of the classes in the school, and in FIGS. **9**(*a*) and **9**(*b*), icon group **32** of applications such as "algebra", "Japanese", or the like of which security levels are set to "L" is displayed in accordance with the subjects of the classes. In FIG. **9**(*c*), the icons of all the subjects used in the classes are displayed on the lock screen in a time other than the time zone of the classes of the school. FIG. **9**(*d*) is a lock screen at an unregistered location other than the school, and in FIG. **9**(*d*), none of the icons of the applications are displayed, and only unlock icon **31** is displayed.

(86) FIGS. **9**(*e*) and **9**(*f*) are unlock screens in the time zone of the classes in the school, and in FIGS. **9**(*e*) and **9**(*f*), icon group **33** of all the subjects used in the classes is displayed, but "email", "setting" of which security levels are set to "X" are not displayed. FIG. **9**(*g*) is an unlock screen in a time zone other than the time zone of the classes in the school, and displaying icon group **33** of all the applications. FIG. **9**(*h*) is an unlock screen at an unregistered location other than the school. In FIG. **9**(*h*), like FIG. **9**(*g*), icon group **33** of all the applications is displayed.

(87) FIG. **10** is a flowchart illustrating an operation according to the third embodiment. In the present embodiment, a control according to time information is added to the second embodiment (FIG. **7**). It should be noted that the same steps as those in FIG. **7** will be denoted with the same step numbers, and a repeated portion will be omitted or briefly explained.

(88) In S**231**, current location information and current time information are obtained by using GPS receiver unit **104** and timer unit **119** of portable terminal device **1**.

(89) In S**232**, an icon of an application of which the security level is set to "L" is read out in accordance with the classification of the current location and the current time by referring to location setting information **102***b* and application setting information **102***c* in memory **102**.

(90) In S**233**, icon group **32** of applications of which security levels are "L" obtained in S**232** is displayed as the lock screen corresponding to the current location and the current time on display unit **114***a* of touch panel **114**. Position information **30** about the home screen is displayed on display unit **114***a*.

(91) Step S**204** and subsequent steps are the same as those of the second embodiment (FIG. **7**). However, in S**222**, applications that are set to the security level "H" are added for each of the current locations and the current time, and icon group **33** is displayed on display unit **114***a*.

(92) In the third embodiment, a security level for each application is set in accordance with the location and the time. Therefore, for example, the security level is set in accordance with a time table of classes in the school, so that an application corresponding to a class can be executed quickly without unlocking, and further, an application not related to the class can be prohibited from being used.

(93) In the above explanation, the security level for each application is set in accordance with a combination of the location and the time. Alternatively, the security level for each application can be set in accordance with only "time".

Fourth Embodiment

(94) In a fourth embodiment, in addition to the functions of the second embodiment, the security level of an application is switched and set in accordance with the user.

(95) FIG. **11** is a figure illustrating an example in which a security level is set for each application in accordance with the user and the location. This setting information is registered to application setting information **102***c* in memory **102**. In this example, USR1 and USR2 are registered as the users, and "home" and "workplace" are registered as the locations.

(96) USR1 is assumed to be, for example, a child, and the security levels of "English" and "algebra" used in the classes of the school are set to "L", and "email" and "setting" are set to security level "X" for limiting the usage. The security level "H" that can be executed by unlocking is not set.

(97) USE2 is assumed to be, for example, an employee, and "remote controller" and "game" are set to "L" at home, but "remote controller" and "game" are set to level "X" for limiting the usage at the workplace.

(98) For an unregistered user, the location is also "unregistered", and the security levels of all the applications are set to "H" regardless of the location.

(99) FIGS. **12**(*a*) to **12**(*j*) are figures illustrating examples of displays of home screens in the setting of FIG. **11**, and FIGS. **12**(*a*) and **12**(*b*) are home screens for USR1, and FIGS. **12**(*c*) to **12**(*e*), **12**(*g*) to **12**(*i*) are home screens for USR2, and FIGS. **12**(*f*) and **12**(*j*) are home screens for unregistered users.

(100) In FIGS. **12**(*a*) and **12**(*b*), icon group **32** of applications that can be executed without unlocking is displayed on home screen for home and locations other than the home for USR1. The unlock icon is not displayed. Therefore, an application that can be used by USR1 is limited to only icon group **32**.

(101) FIGS. **12**(*c*) to **12**(*e*) are lock screens at the home/workplace of USR2 and the locations other than the home/workplace, and in FIGS. **12**(*c*) to **12**(*e*), icon group **32** of applications that can be executed without unlocking at each of the locations is displayed. When the screen is unlocked the home screen is switched to the home screens of FIGS. **12**(*g*) to **12**(*i*), and icon group **33** to which an application of a security level "H" is added is displayed.

(102) FIG. **12**(*f*) home screen shows a locked state for an unregistered user, and in FIG. **12**(*f*), none of the icons of the applications are displayed regardless of the location. When unlocked, the home screen is switched to the screen of FIG. **12**(*j*), and icon group **33** of applications of which security levels are "H" is displayed.

(103) FIG. **13** is a flowchart illustrating an operation according to the fourth embodiment. In the present embodiment, a control according to a user is added to the second embodiment (FIG. **7**). It should be noted that the same steps as those in FIG. **7** will be denoted with the same step numbers, and a repeated portion will be omitted or briefly explained.

(104) In S**241**, a face image of a user is obtained by imaging unit **108** of portable terminal device **1**. In S**242**, a face image obtained by user recognition unit **120** is collated with face information of the user registered in user information **102***a* of memory **102**, and portable terminal device **1** recognizes which of the registered users the face image is.

(105) In S**201**, the current location information is obtained. In S**243**, an icon of an application of which the security level is set to "L" is read out in accordance with the recognized user name and the classification of the current location by referring to location setting information **102***b* and application setting information **102***c* in memory **102**.

(106) In S**244**, icon group **32** of applications of which security levels are "L" obtained in S**243** is displayed as the lock screen corresponding to the user name and the current location on display unit **114***a* of touch panel **114**.

(107) Step S**204** and subsequent steps are the same as those of the second embodiment (FIG. **7**). However, in S**222**, applications of which security levels are set to "H" are added for each of the user names and the current locations, and icon group **33** is displayed on display unit **114***a*. In S**225**, it is permitted to change the home screen to a home screen for another location for the user, but the home screen is prohibited from being changed into a home screen for another user.

(108) In the fourth embodiment, a security level for each application is set in accordance with the user and the location. Accordingly, for example, an application that can be executed by a child without unlocking is restricted, and further, performing unlocking can be restricted.

(109) In the above explanation, a security level for each application is set in accordance with a

combination of the user and the location. Alternatively, the security level for each application can be set in accordance with only "user".

Fifth Embodiment

(110) In a fifth embodiment, a new security level is added to the functions of the second embodiment, and an authentication method is changed in accordance with the security level.

(111) FIG. **14** is a figure illustrating an example in which a security level and an authentication method are set for each application. This setting information is registered to application setting information **102**c in memory **102**. In this example, "home", "workplace", "train station" are registered as the locations, and a security level "M" is added.

(112) Like the security level "H", the added security level "M" indicates that an application has a high security strength and cannot be executed without authentication, but the authentication methods of both are different each other.

(113) As described above, an icon of an application of which security level is "H" is not displayed on home screen in a locked state, and the icon is displayed only after the lock is unlocked with an authentication input. In contrast, an icon of an application of which security level is "M" is displayed even on home screen of a locked state, but it is necessary for the user to perform another authentication input in order to select and execute this icon.

(114) In this example, for example, a simple authentication method A using password authentication and a more confidential authentication method B using face authentication or fingerprint authentication are provided as authentication methods. In the case of the security level "H", the authentication method A is used, and in the case of the security level "M", the authentication method B is used.

(115) For example, when applications of "email" and "setting" are executed at "home" or "workplace", the security level "H" is set, so that the simple authentication method A is used. In contrast, when applications of "email" and "setting" are executed in a place where many unspecified persons are present such as a "train station", the security level is set to "M", and the more confidential authentication method B is used. More specifically, at a location where a password input is easily seen, the face authentication and the fingerprint authentication are used to ensure the security.

(116) FIGS. **15**(*a*) to **15**(*h*) are figures illustrating examples of displays of home screens in the setting of FIG. **14**, and FIGS. **15**(*a*) to **15**(*d*) illustrate the locked state, and FIGS. **15**(*e*) to **15**(*h*) illustrate the unlocked state.

(117) In the screen shown in FIG. **15**(*c*) at the "train station" among the lock screens shown in FIGS. **15**(*a*) to **15**(*d*), icon group **32** of "transit", "Map", "search", and "game" of which security level is "L" as well as an icon group **34** of "email" and "setting" of which security level is "M" are displayed. It should be noted that a color, a shape, or the like of an icon is changed so that the user can find that the security levels of both are different each other. In order to select and execute an application of which security level is "M" included in the icon group **34**, it is necessary to perform authentication according to the authentication method B such as face authentication.

(118) When the user selects unlock icon **31** and performs authentication according to the authentication method A such as a password, the home screen is switched to the unlock screens shown in FIGS. **15**(*e*) to **15**(*h*), and icon group **33** of which security level is "H" application is displayed.

(119) FIG. **16** is a flowchart illustrating an operation according to the fifth embodiment. The present embodiment is different from the second embodiment (FIG. **7**) in that the security level "M" is added and the authentication method is changed. It should be noted that the same steps as those in FIG. **7** will be denoted with the same step numbers, and a repeated portion will be omitted or briefly explained.

(120) S**201** to S**204** are the same as those in FIG. **7**, and in S**202**, icons of applications of which the security levels are set to "L" and "M" is read out in accordance with the classification of the current

location by referring to application setting information **102**c. Then, icon groups **32**, **34** of which the security levels are set to "L" and "M" and which have been read out are distinguished from each other and displayed on the lock screen in S**221**.

(121) After the branch processing of S**205**, the processing for the security level "M" is added to the processing described in FIG. **7**.

(122) In a case where the icon of the application displayed on display unit **114**a is elected in S**204**, S**251** is subsequently performed, and the security level of the selected application is determined.

(123) In a case where the security level setting is determined to be "L" in the determination of S**251**, S**207** is subsequently performed, and the processing of the application corresponding to the selected icon is executed, and thereafter, S**201** is performed again.

(124) In a case where the security level setting is determined to be "M" in the determination of S**251**, S**252** is subsequently performed, and the input screen of the authentication method B is displayed. For example, face authentication based on user recognition unit **120** and fingerprint authentication based on fingerprint sensor (not shown) are used as the authentication method B. In S**253**, the user inputs authentication information corresponding to the authentication method, and in S**254**, a determination is made as to whether the input information is valid or not by collating the input information with user information **102**a registered in advance. In a case where the input information is determined not to be valid (No), S**253** is subsequently performed, and the authentication information is input again. In a case where the input information is determined to be valid (Yes), S**207** is subsequently performed, and the processing of the application corresponding to the selected icon is executed, and thereafter, S**201** is performed again.

(125) In a case where unlock icon **31** displayed on display unit **114**a is selected in S**204**, S**208** is subsequently performed, and a screen for inputting authentication information for unlocking is displayed. On this screen, the authentication method A based on a password or the like is used. In the branch processing of S**213**, the change of the home screen is deleted, but it may be added as shown in S**225**.

(126) In the fifth embodiment, a security level for each application is set in accordance with the location, and the authentication method is changed in accordance with the security level, so that the security strength during the authentication input can be enhanced in accordance with the location.

Sixth Embodiment

(127) In a sixth embodiment, the authentication method of unlocking is changed in accordance with the location as compared with the second embodiment.

(128) FIG. **17** is a figure illustrating an example in which the security level for each application and the authentication method of unlocking are set in accordance with the location. This setting information is registered to application setting information **102**c in memory **102**. In this example, "home", "workplace", and "train station" are registered as the locations, and the authentication method is switched at each location. More specifically, at the locations of "home", "workplace", and "unregistered", a simple authentication method A based on a password authentication or the like is set, and at "train station", a highly confidential authentication method B based on face authentication, fingerprint authentication, or the like is set. Therefore, in a location where many unspecified persons are present and a password input is likely to be seen such as a "train station", the security strength can be enhanced by using the face authentication and the fingerprint authentication.

(129) FIGS. **18**(a) to **18**(h) are figures illustrating examples of displays of home screens in the setting of FIG. **17**, and FIGS. **18**(a) to **18**(d) illustrate the locked state, and FIGS. **18**(e) to **18**(h) illustrate the unlocked state.

(130) In the screen at the unregistered location other than the home and the workplace among the lock screens shown in FIGS. **15**(a) to **15**(d), unlock icon **31**A according to the authentication method A is displayed, and at the train station, unlock icon **31**B based on the authentication method B is displayed. In this case, the unlock icon preferably has a different color or shape in accordance

with the authentication method.

(131) When unlock icon **31**A or **31**B is selected in each screen, and the authentication is performed in accordance with the authentication method A or the authentication method B, the home screen is switched to the unlock screens as shown in FIGS. **15**(*e*) to **15**(*h*), and icon group **33** additionally including the application of which security level is "H" is displayed. FIG. **19** is a flowchart illustrating an operation according to the sixth embodiment.

(132) In the present embodiment, the authentication method of unlocking is changed in accordance with the location as compared with the second embodiment (FIG. **7**). It should be noted that the same steps as those in FIG. **7** will be denoted with the same step numbers, and a repeated portion will be omitted or briefly explained.

(133) S**201** to S**204** are the same as those in FIG. **7**, and the steps that are changed in the branch processing after S**205** are S**261** and subsequent steps. In a case where unlock icon **31**A or **31**B displayed on display unit **114***a* is selected in S**204**, S**261** is subsequently performed, and the authentication method for unlocking that is set in accordance with the location is determined.

(134) As a result of the determination of S**261**, in a case of the authentication method A, the input screen corresponding to the authentication method A is displayed S**208**. In S**209**, the user inputs the authentication information corresponding to the authentication method A, and in S**210**, a determination is made as to whether the input information is valid or not by collating the input information with user information **102***a* registered in advance. In a case where the input information is determined not to be valid (No), S**209** is subsequently performed, and the authentication information is input again. In a case where the input information is determined to be valid (Yes), S**222** is subsequently performed, and the unlocked home screen is displayed.

(135) As a result of the determination in S**261**, in a case of the authentication method B, the input screen corresponding to the authentication method B is displayed in S**262**. In S**263**, the user inputs authentication information corresponding to the authentication method B, and in S**264**, a determination is made as to whether the input information is valid or not by collating the input information with user information **102***a* registered in advance. In a case where the input information is determined not to be valid (No), S**263** is subsequently performed, and the authentication information is input again. In a case where the input information is determined to be valid (Yes), S**222** is subsequently performed, and the unlocked home screen is displayed. The processing in S**222** and subsequent steps are the same as those in FIG. **7**.

(136) In the sixth embodiment, the authentication method for unlocking is changed in accordance with the location, so that, like the fifth embodiment, the security strength can be enhanced in accordance with the location where portable terminal device **1** is used.

(137) Each of the embodiments explained above is explained in details in order to explain the present invention in an easy to understand manner, and the present invention does not necessarily have all the configurations explained above. For example, in the present embodiment, the location information is explained with GPS receiver unit **104**. However, the present invention is not limited thereto. The location information about base station **3** may be obtained via base station communication unit **117**, or the location information about access point **2** of the wireless communication may be obtained via wireless communication unit **118**. As a current time obtaining method, the time information may be obtained by connecting with the Network Time Protocol (NTP) server.

(138) Further, in each of the embodiments, two or three settings are provided as the security level of the application, but the present invention is not limited thereto. Three or more settings may be provided, and with a setting of a security level for each application, the length of the password may be changed or the authentication method may be changed in accordance with the location, the time, or the user.

(139) In the above embodiments, an icon of an application that is frequently used at the registered location is displayed on the home screen in the locked state and the unlocked state, so that a desired

application can be quickly selected and executed even in a state where many applications are installed on the portable terminal device.

(140) On the display of the home screen in the locked state, the unlock icon is displayed and selected, but an operation button for unlocking may be provided separately.

(141) Some of the elements in each embodiment may be added to other elements, or may be deleted or replaced with other elements. A part or all of the configurations, functions, processing units, processing means, or the like may be achieved with hardware by, e.g., designing an integrated circuit. Alternatively, each of the configurations, functions, or the like may be achieved with software by interpreting and executing a program with which a processor achieves each of the functions. Information such as a program, a table, a file, or the like achieving each function may be placed in memory **102** or storage **103**.

(142) Control lines and information lines that are considered to be necessary for explanation are shown, but not all the control lines and information lines required in terms of products are necessarily shown. Substantially almost all the constituent elements may be considered to be connected with each other in reality.

REFERENCE SIGNS LIST

(143) **1** . . . portable terminal device, **30** . . . location information, **31** . . . unlock icon, **32, 33, 34** . . . icon group, **101** . . . control unit, **102** . . . memory, **102**a . . . user information, **102**b . . . location setting information, **102**c . . . application setting information, **104** . . . GPS receiver unit, **108** . . . imaging unit, **114** . . . touch panel, **114**a . . . display unit, **114**b . . . operation input unit, **115** . . . operation button, **119** . . . timer unit, **120** . . . user recognition unit.

Claims

1. A portable terminal comprising: a locator detecting current location information of the portable terminal; a storage storing a setting information including a location related information relating to each of a plurality of icons, the location related information being information relating to a determination of whether the portable terminal is within a predetermined area; a display displaying at least a first grouped icon image of the plurality of icons that are selectable by the user; and a controller controlling the locator, the storage and the display; wherein the setting information stored in the storage is referred to by the controller to determine whether to allow displaying the first grouped icon image in a locked state of the portable terminal, wherein the controller is configured to: based on the setting information and the current location information, determine the first grouped icon image to be displayed with a screen for performing authentication to execute an unlock operation on the display in a condition that the portable terminal is in the locked state, and adjust a position of the first grouped icon image determined to be displayed on the display, and display information relating to an icon selected by the user.

2. The portable terminal according to claim 1, wherein the portable terminal is configured to allow the user to set whether or not the first grouped icon image are displayed on the display in the locked state.

3. The portable terminal according to claim 1, wherein the setting information includes a time related information relating to each of the plurality of icons, wherein the controller is configured to: based on the setting information including the time related information and current time information, determine a third grouped icon image to be displayed on the display and a fourth grouped icon image not to be displayed on the display in a condition that the portable terminal is in the locked state, the third grouped icon image being different from the fourth grouped icon image.

4. The portable terminal according to claim 1, wherein the controller is further configured to: in the locked state, display the first grouped icon image to be displayed in the locked state and a UI object which indicates that the portable terminal is in the locked state, and in the unlocked state, display both the first grouped icon image and the second grouped icon image.

5. The portable terminal according to claim 1, wherein the setting information includes information of an authentication method for unlocking in such a manner that the authentication method is different in accordance with location, and wherein the controller is configured to, based on the setting information, switch the authentication method for unlocking in accordance with the current location information.

6. A method in operating a portable terminal comprising: detecting current location information of the portable terminal; storing setting information including a location related information relating to each of a plurality of icons, the location related information being information relating to a determination of whether the portable terminal is within a predetermined area; displaying on a display at least a first grouped icon image of the plurality of icons that are selectable by the user; wherein the stored setting information is referred to in determining whether to allow displaying the first grouped icon image in a locked state of the portable terminal, and wherein based on the setting information and the current location information, determine the first grouped icon image to be displayed with a screen for performing authentication to execute an unlock operation on the display in a condition that the portable terminal is in the locked state, and adjust a position of the first grouped icon image determined to be displayed on the display, and display information relating to the icon selected by the user.

7. The method according to claim 6, wherein the user of the portable terminal sets whether or not the first grouped icon image is displayed on the display in the locked state.

8. The method according to claim 6, wherein the setting information includes a time related information relating to each of the plurality of icons, and wherein based on the setting information including the time related information and current time information, determine a third grouped icon image to be displayed on the display and a fourth grouped icon image not to be displayed on the display in a condition that the portable terminal is in the locked state, the third grouped icon image being different from the fourth grouped icon image.

9. The method according to claim 6, further comprising in the locked state, displaying the first grouped icon image to be displayed in the locked state and a UI object which indicates that the portable terminal is in the locked state, and in the unlocked state, displaying both the first grouped icon image and the second grouped icon image.

10. The method according to claim 6, wherein the setting information includes information of an authentication method for unlocking in such a manner that the authentication method is different in accordance with location, and wherein, based on the setting information, switching the authentication method for unlocking in accordance with the current location information.