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(54) **Title:**
SYSTEM AND METHOD FOR SECURE DATA ENTRY

(57) **Abstract:**
An electronic device comprises a CPU, and a touch-sensitive screen operable to display a plurality of keys. Each of the plurality of keys are associated with and exhibit a predetermined value, where the keys are arranged so that the predetermined values of the keys are displayed in a random manner. The predetermined values of the plurality of keys have different predetermined display characteristics associated therewith so that the plurality of keys have varied appearances.



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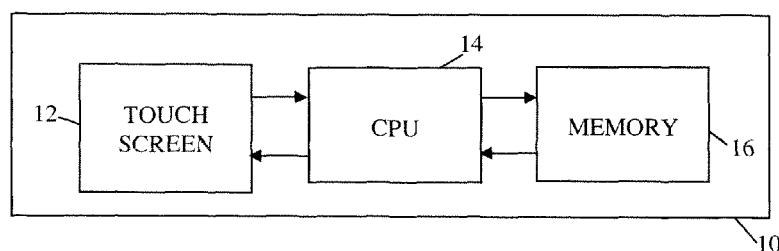


FIG. 1

(57) Abstract: An electronic device comprises a CPU, and a touch-sensitive screen operable to display a plurality of keys. Each of the plurality of keys are associated with and exhibit a predetermined value, where the keys are arranged so that the predetermined values of the keys are displayed in a random manner. The predetermined values of the plurality of keys have different predetermined display characteristics associated therewith so that the plurality of keys have varied appearances.

SYSTEM AND METHOD FOR SECURE DATA ENTRY

FIELD

[0001] The present disclosure relates to system and method for secure data entry
5 on a touch-sensitive screen.

BACKGROUND

[0002] Touch-sensitive screens or touch screens are commonly used in a myriad of
devices as a user interface, such as smartphones, personal digital assistants, tablet
computers, kiosks, ATM terminals, point-of-sale terminals, and other computing devices.
10 A touch screen enables the coupling of data entry with the display so that the user may
enter data and make selections by directly touching displayed elements on the screen. The
use of the touch screen is especially popular with mobile devices because of the
elimination of the keyboard to yield more real estate to a larger display screen.

[0003] The entry of security data such as passwords and PIN data is often required
15 to gain access to certain resources such as websites, financial accounts, shopping accounts,
other protected data, or the use of the device itself. When a keypad is displayed on a touch
screen to enter such security data, the user may unwittingly yield a fingerprint pattern or
finger movement pattern that may be used to decode the security data by malicious
criminals. Accordingly, a need arises for a solution to greatly minimize or eliminate such
20 unauthorized access to confidential and protected data and resources.

SUMMARY

[0004] An electronic device and method have been envisioned to increase the
security of data entry on a touch-sensitive screen.

[0005] An electronic device comprises a CPU, and a touch-sensitive screen operable to display a plurality of keys. Each of the plurality of keys are associated with and exhibit a predetermined value, where the keys are arranged so that the predetermined values of the keys are displayed in a random manner. The predetermined values of the plurality of keys have different predetermined display characteristics associated therewith so that the plurality of keys have varied appearances.

[0006] An electronic device comprises a CPU, and a touch-sensitive screen operable to display a plurality of sequential values arranged in a randomized manner, where the displayed sequential values are operable to be displaced by a user's input to at least one predetermined location on the screen to effect data entry.

[0007] A method for secured data entry on an electronic device comprises displaying a plurality of keys on a touch-sensitive screen, wherein the plurality of keys are displayed such that the keys each shows and is associated with a predetermined value, the keys are arranged so that the predetermined values of the keys are displayed in a random manner, and the keys are each displayed to exhibit a predetermined display characteristic associated with the predetermined value of each key. The method further includes receiving a user input via the plurality of displayed keys.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a simplified block diagram of an exemplary embodiment of an electronic computing device;

[0009] FIG. 2 is a diagram representation of a touch screen displaying exemplarily successively random keypads for receiving user input of security data; and

[0010] FIG. 3 is a diagram representation of a touch screen displaying an exemplarily random keypad using various background patterns for the keys;

[0011] FIG. 4 is a diagram representation of a touch screen displaying an exemplary random keypad using various fonts for the keys;

[0012] FIG. 5 is a diagram representation of a touch screen displaying an exemplary random keypad using various shapes for the keys;

5 [0013] FIG. 6 is a diagram representation of a touch screen displaying an exemplary random keypad using three slidable key arrays;

[0014] FIG. 7 is a diagram representation of a touch screen displaying an exemplary random keypad showing one of the three slidable key arrays in a locked state; and

10 [0015] FIG. 8 is a diagram representation of a touch screen displaying exemplary randomly arranged keys in a wheel format.

DETAILED DESCRIPTION

[0016] FIG. 1 is a simplified block diagram of an exemplary embodiment of an electronic device 10. The electronic device 10 may be any device or terminal employing a touch-sensitive display screen 12, such as smartphones, personal digital assistants, personal computers, laptop computers, notebook computers, tablet computers, kiosks, ATM terminals, point-of-sale terminals, and other computing devices. Such electronic devices 10 include a CPU (central processing unit) 14 for executing software that performs processing, computing, decision, and communicating functions. A memory 16 in the form of RAM (random access memory), ROM (read-only memory), hard drive, and/or any suitable data storage device is used to store information needed for later retrieval and computation. The electronic device 10 may include other peripheral devices as desired.

[0017] The electronic device 10 may require a security code such as a password or PIN to operate and/or access information, accounts, or other protected resources. For

example, a smartphone, personal digital assistant, or tablet computer may require a password to unlock the device to enable use. As another example, an ATM may require the correct entry of a PIN in order for the user to access a bank account.

[0018] FIG. 2 is a diagram representation of a touch screen displaying exemplary
5 successively randomly arranged keys in a keypad format for receiving user input of security data. The random arrangement referenced by numerals 20-24 represent three separate and successive times in which the user is requested to enter a security code. As shown in FIG. 2, the keys exhibit and are associated with values that are scrambled each time the user accesses the protected resource. Accordingly, because the positions of the
10 security code digits are different each time, the user's finger movements and the fingerprints left on the touch screen are also different each time. These random variations may thwart malicious attempts by criminals to decode the finger movements and/or fingerprints to acquire the security code.

[0019] However, studies show that the use of a random keypad is often confusing
15 to users and causes mis-entry of the security data.

[0020] FIG. 3 is a diagram representation of a touch screen displaying an exemplary random keypad 26 using various different background patterns for the keys. Each key is associated with a particular value, such as a numerical or alphanumeric value, which is in turn associated with a particular background pattern. Therefore as
20 shown in the example in FIG. 3, the numerical value "1" is always displayed with a pattern-less background although its location in the keypad varies each time. Similarly in the example, the numerical value "3" is always displayed with a grid background pattern, the numerical value "7" is always displayed with a series of horizontal dashed lines, the numerical value "2" is always displayed with a dotted background, and so on. When

displayed in this manner, although the positions of the numerical values in the keypad change each time, because the user has come to associate the numerical values with the same background patterns over time, the confusion that leads to mis-entry can be greatly reduced.

5 **[0021]** In a similar manner, variations in other display characteristics such as the background color and/or the foreground color of the keys can also be used to decrease the amount of user confusion. For example, the numerical value “5” is always displayed with a red background color, the numerical value “7” is always displayed with a yellow background color, the numerical value “6” is always displayed with a blue background
10 color, and so on. In another example varying the foreground colors, the numerical value “2” is always displayed with a red foreground color, the numerical value “6” is always displayed with a blue foreground color, the numerical value “8” is always displayed with a green foreground color, and so on. Color combinations of foreground and background colors can also be used effectively in the same manner.

15 **[0022]** FIG. 4 is a diagram representation of a touch screen displaying an exemplary random keypad 28 using various fonts for the keys. As shown in FIG. 4, each key is associated with a particular value, such as a numerical or alphanumeric value, which is in turn associated with a particular font type to further differentiate the keys and reduce confusion.

20 **[0023]** FIG. 5 is a diagram representation of a touch screen displaying an exemplary random keypad 30 using various shapes for the keys. In another embodiment shown in FIG. 5, each key is associated with a particular value, such as a numerical or alphanumeric value, which is in turn associated with a particular shape to further differentiate the keys and reduce user confusion that lead to erroneous entry of security

data. Accordingly as shown in FIG. 5, the numerical value “2” is always displayed with a triangle-shaped key, the numerical value “7” is always displayed with a circular-shaped key, the numerical value “8” is always displayed with a pentagon-shaped key, and so on.

[0024] The various display characteristics including the foreground color, background color, background pattern, font, and shape may be used in combinations to distinguish the appearance of the keys from one another.

[0025] FIG. 6 is a diagram representation of a touch screen displaying an exemplary random keypad using three slidable key arrays 32-36. In the embodiment shown in FIG. 6, each array includes numerical values arranged in a random manner, and the numerical values in the three arrays are arranged in different sequences. Each of the arrays functions as a virtual rotary dial that receives the user’s finger movement along the axis of the array to effect a displacement of the displayed numerical values. For example, the user’s finger movement on the array to the right would cause the displayed numerals to be shifted to the right, and the finger movement on the array to the left would cause the displayed numerals to be shifted to the left. A data entry may thus be achieved by placing or displacing the numerals so that the desired digit is moved to a predetermined location in the array, such as for example, the center point of the arrays marked by the vertical marks 38. Thus, for the example shown in FIG. 6, the three arrays may be used to receive the user’s input of a three-digit security code.

[0026] FIG. 7 is a diagram representation of a touch screen displaying an exemplary random keypad showing one of the three slidable key arrays 32-36 in a locked state. As shown in FIG. 7, the array 32 displays a predetermined character, such as an asterisk, “*”, that indicate the entry for the first digit of the security data has been received and locked in place. In this way, inadvertent brushing on the touch screen would not alter

the first digit that has already been entered correctly. Once locked, the user may still change the entered digit by some other predetermined entry, such as by tapping on the displayed asterisk, for example.

[0027] FIG. 8 is a diagram representation of a touch screen displaying exemplary
5 randomly arranged keys in a wheel format 42. Similar to the array format in FIGS. 6 and
7, data entry on the wheel may be performed by “sliding” the keys bearing the numerical
values. For example, the user’s finger movement on a selected key toward the center 44
of the wheel 42 would cause the entry of that numeral displayed on the displaced key.
Asterisks or another suitable symbol may be displayed to indicate how many digits have
10 been entered. As shown in the example of FIG. 8, one digit of the security code has been
entered and there are three remaining digits to be entered.

[0028] As described above, a security code needed to unlock a device or gain
access to a resource may be entered on a touch screen in a more secure way, without
revealing telltale finger movements or fingerprints that may be used to determine the
15 security code.

[0029] The features of the present invention which are believed to be novel are
set forth below with particularity in the appended claims. However, modifications,
variations, and changes to the exemplary embodiments described above will be apparent to
those skilled in the art, and the electronic device and secure data entry method thus
20 encompass such modifications, variations, and changes and are not limited to the specific
embodiments described herein.

1. An electronic device comprising:

a CPU; and

a touch-sensitive screen operable to display a plurality of keys, each of the
5 plurality of keys being associated with and exhibiting a predetermined value, the keys
being arranged so that the predetermined values of the keys are displayed in a random
manner, and the predetermined values of the plurality of keys having different
predetermined display characteristics associated therewith so that the plurality of keys
have varied appearances.

10

2. The electronic device of claim 1, wherein the different predetermined
display characteristics of the keys is selected from the group consisting of foreground
color, background color, background pattern, shape, and font.

15

3. The electronic device of claim 1, wherein each of the plurality of keys have
predetermined fixed numerical value characteristic associated with a predetermined fixed
display characteristic, so that a particular numerical value key is displayed with a fixed
display characteristic.

20

4. The electronic device of claim 1, wherein each of the plurality of keys have
predetermined fixed alphanumeric value characteristic associated with a predetermined
fixed display characteristic, so that a particular alphanumeric value key is displayed with
a fixed display characteristic.

5. The electronic device of claim 1, further comprising a memory operable to store the predetermined fixed value characteristics and associated display characteristics of the keys.

5 6. The electronic device of claim 1, wherein the CPU is operable to randomize the arrangement of the keys in a keypad format.

7. An electronic device comprising:

a CPU; and

10 a touch-sensitive screen operable to display a plurality of sequential values arranged in a randomized manner, the displayed sequential values operable to be displaced by a user's input to at least one predetermined location on the screen to effect data entry.

15 8. The electronic device of claim 7, wherein the sequential values are displayed in arrays.

9. The electronic device of claim 7, wherein the sequential values are displayed in a matrix.

20 10. The electronic device of claim 7, wherein the sequential values are displayed in a wheel format.

11. The electronic device of claim 7, wherein the sequential values are displayed with different background colors.

12. The electronic device of claim 7, wherein the sequential values are displayed with different background patterns.

5 13. The electronic device of claim 7, wherein the sequential values are displayed with different shapes.

14. The electronic device of claim 7, wherein the sequential values are displayed with different fonts.

10

15. The electronic device of claim 7, wherein the sequential values are displayed in a plurality of arrays, and each array being operable to be locked from additional input once a user input is received.

15 16. A method for secured data entry on an electronic device comprising:
displaying a plurality of keys on a touch-sensitive screen, wherein the plurality of keys are displayed such that:

the keys each show and is associated with a predetermined value;

20 the keys are arranged so that the predetermined values of the keys are displayed in a random manner; and

the keys are each displayed to exhibit a predetermined display characteristic associated with the predetermined value of each key;

receiving a user input via the plurality of displayed keys.

17. The method of claim 16, wherein the keys are arranged in a random manner in a keypad format.

18. The method of claim 16, wherein the keys are arranged in a random manner
5 in a wheel format.

19. The method of claim 16, wherein the user input touches the randomly arranged keys to effect data entry.

10 20. The method of claim 16, wherein the user input displaces the randomly arranged keys to effect data entry.

21. The method of claim 16, wherein the predetermined display characteristics of the keys is selected from a group consisting of foreground color, background color,
15 background pattern, shape, and font.

20