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(71) Applicant: **BOE TECHNOLOGY GROUP CO., LTD.** [CN/CN]; No.10 Jiuxianqiao Rd., Chaoyang District, Beijing 100015 (CN).

(72) Inventor: **LI, Xin**; No.9 Dize Rd., BDA, Beijing 100176 (CN).

(74) Agent: **TEE&HOWE INTELLECTUAL PROPERTY ATTORNEYS**; Yuan CHEN, 10th Floor, Tower D, Minsheng Financial Center, 28 Jianguomennei Avenue, Dongcheng District, Beijing 100005 (CN).

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(54) Title: DISPLAY APPARATUS AND DISPLAY METHOD

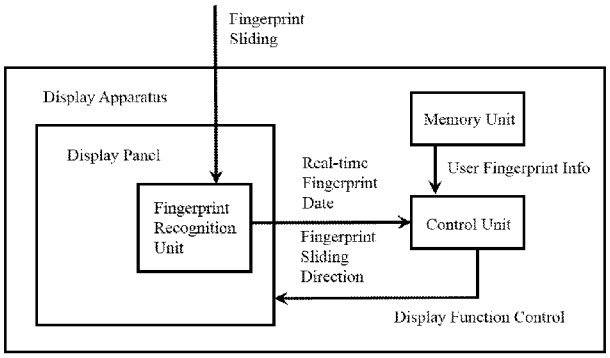

FIG. 1

(57) Abstract: A display apparatus and a related display method are provided. The display apparatus comprises: a display panel; a memory unit for storing user fingerprint information; a fingerprint recognition unit embedded in the display panel for recognizing current fingerprint data of a finger when the finger is sliding on the display panel, and determining a sliding direction of the finger; and a control unit for comparing the current fingerprint data of the finger with the user fingerprint information, and upon matching, controlling a display on the display panel based on the sliding direction of the finger.

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DISPLAY APPARATUS AND DISPLAY METHOD

CROSS-REFERENCES TO RELATED APPLICATIONS

[001] This PCT patent application claims priority of Chinese Patent Application No. 201510437915.3 filed on July 23, 2015, the entire content of which is incorporated by reference herein.

TECHNICAL FIELD

[002] The disclosed subject matter generally relates to fingerprint recognition technologies and, more particularly, relates to a display apparatus, and a related display method.

BACKGROUND

[003] In the existing mobile phones and other smart display devices, a fingerprint recognition module is sometimes installed for identifying a fingerprint of a user to authenticating a display unlock operation or a start operation of the display device. However, such a fingerprint recognition operation is only used for a single on-off function, which is not well developed to associate with other functions of the display device.

[004] Accordingly, it is desirable to provide a display apparatus, and a display method to at least partially alleviate one or more problems set forth above and to solve other problems in the art.

BRIEF SUMMARY

[005] In accordance with some embodiments of the disclosed subject matter, a display apparatus, and a related display method are provided.

[006] An aspect of the present disclosure provides a display apparatus. In some embodiments, the display apparatus comprises: a display panel; a memory unit for storing

user fingerprint information; a fingerprint recognition unit embedded in the display panel for recognizing current fingerprint data of a finger when the finger is sliding on the display panel, and determining a sliding direction of the finger; and a control unit for comparing the current fingerprint data of the finger with the user fingerprint information, and upon matching, controlling a display on the display panel based on the sliding direction of the finger.

[007] In some embodiments, the control unit is configured for controlling the display panel in a first display form when the sliding direction of the finger is a first direction; and the control unit is configured for controlling the display panel in a second display form when the sliding direction of the finger is a second direction.

[008] In some embodiments, the display panel comprises a length side and a width side; the first display form comprises displaying in a wide-screen display type by using the length side of the display panel as a bottom side; and the second display form comprises displaying in a narrow-screen display type by using the width side of the display panel as a bottom side.

[009] In some embodiments, the first display form comprises displaying a first content item; and the second display form comprises displaying a second content item that is different from the first content item.

[0010] In some embodiments, the first content item comprises at least one video type application; and the second content item comprises at least one document type application.

[0011] In some embodiments, the first direction is substantially parallel to the length side of the display panel; and the second direction is substantially parallel to the width side of the display panel.

[0012] In some embodiments, the control unit is further used for retrieving user information associated with the user fingerprint information that matches the current fingerprint data, and controlling the display on the display panel based on the sliding direction of the finger and the user information.

[0013] In some embodiments, the user fingerprint information is associated with a plurality of users.

[0014] In some embodiments, the control unit is used for controlling the display panel in a third display form, when the sliding direction of the finger is a third direction.

[0015] In some embodiments, the fingerprint recognition unit comprises a plurality of fingerprint recognition sensors distributed in a plurality of pixels of the display panel.

[0016] In some embodiments, the display apparatus is a handheld display apparatus.

[0017] Another aspect of the present disclosure provides a display method, the method can include: recognizing, using a fingerprint recognition unit embedded in a display panel, current fingerprint data of a finger and determining a sliding direction of the finger when the finger is sliding on the display panel; comparing, using a control unit, the current fingerprint data of the finger with user fingerprint information stored in a memory unit; and controlling, using the control unit, a display on the display panel based on the sliding direction of the finger when the current fingerprint data of the finger matches the user fingerprint information.

[0018] In some embodiments, the display on the display panel is in a first display form when the sliding direction of the finger is a first direction; and the display on the display panel is in a second display form when the sliding direction of the finger is a second direction.

[0019] In some embodiments, the display panel comprises a length side and a width side; the first display form comprises displaying in a wide-screen display type by using the length side of the display panel as a bottom side; and the second display form comprises displaying a narrow-screen display type by using the width side of the display panel as a bottom side.

[0020] In some embodiments, the first display form comprises displaying a first content item; and the second display form comprises displaying a second content item that is different from the first content item.

[0021] In some embodiments, the first content item comprises at least one video type application; and the second content item comprises at least one document type application.

[0022] In some embodiments, the first direction is substantially parallel to the length side of the display panel; and the second direction is substantially parallel to the width side of the display panel.

[0023] In some embodiments, the method further comprises: retrieving, using the control unit, user information associated with the user fingerprint information that matches the

current fingerprint data; and controlling, using the control unit, the display on the display panel based on the sliding direction of the finger and the user information.

[0024] In some embodiments, the user fingerprint information is associated with a plurality of users.

[0025] In some embodiments, the method further comprises controlling, using the control unit, the display panel in a third display form, when the sliding direction of the finger is a third direction.

[0026] In some embodiments, the fingerprint recognition unit comprises a plurality of fingerprint recognition sensors distributed in a plurality of pixels of the display panel.

[0027] In some embodiments, the display apparatus is a handheld display apparatus.

[0028] Other aspects of the present disclosure can be understood by those skilled in the art in light of the description, the claims, and the drawings of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Various objects, features, and advantages of the disclosed subject matter can be more fully appreciated with reference to the following detailed description of the disclosed subject matter when considered in connection with the following drawings, in which like reference numerals identify like elements. It should be noted that the following drawings are merely examples for illustrative purposes according to various disclosed embodiments and are not intended to limit the scope of the present disclosure.

[0030] FIG. 1 is a schematic block-diagram of a display apparatus in accordance with some embodiments of the disclosed subject matter;

[0031] FIG. 2 is a schematic diagram of a display apparatus and a finger of a user that is sliding on the display apparatus along a length direction of the display apparatus in accordance with some embodiments of the disclosed subject matter; and

[0032] FIG. 3 is a schematic diagram of a display apparatus and a finger of a user that is sliding on the display apparatus along a width direction of the display apparatus in accordance with some embodiments of the disclosed subject matter.

DETAILED DESCRIPTION

[0033] For those skilled in the art to better understand the technical solution of the disclosed subject matter, reference will now be made in detail to exemplary embodiments of the disclosed subject matter, which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0034] In accordance with various embodiments, the disclosed subject matter provides a display apparatus, and a related display method.

[0035] FIG. 1 shows a schematic block-diagram of a disclosed display apparatus in accordance with some embodiments of the disclosed subject matter. As illustrated, the display apparatus can include a display panel, a memory unit, a fingerprint recognition unit, and a control unit.

[0036] The display panel is used for operating a display function. For example, the display panel can be a liquid crystal display (LED) panel, an organic light emitting diode (OLED) display panel, or any other suitable display panel.

[0037] The memory unit can store user fingerprint information. The user fingerprint information can include any suitable information of one or more fingerprints that associated with one or more users of the display apparatus. For example, the user fingerprint information can include one or more images of a fingerprint of a user. As another example, the user fingerprint information can include any feature information of a fingerprint of a user, such as texture data of the fingerprint, shape data of the fingerprint, etc. The memory unit can be any suitable device that has an information storage function.

[0038] Fingerprint recognition unit can be embedded in the display panel. Fingerprint recognition unit is used for recognizing fingerprint data of a finger of a user when the user is sliding the finger on the display panel, and determining a sliding direction of a fingerprint of the finger.

[0039] In some embodiments, the display panel can include fingerprint recognition unit integrated therein. For example, the fingerprint recognition unit can include multiple fingerprint recognition sensors distributed in multiple pixels of the display panel. When a finger is sliding on the display panel, the multiple fingerprint recognition sensors can

collect the fingerprint data (such as texture data of the fingerprint, shape data of the fingerprint, etc.) and can determine a sliding direction of the fingerprint.

[0040] The sliding direction of the fingerprint is determined during the sliding process of the fingerprint. And during the same sliding process of the fingerprint, the fingerprint data can be collected synchronously. Sometimes it is difficult to collect enough fingerprint data for identifying a fingerprint when the fingerprint does not move. This is because the patterns of a human fingerprint is very fine, and one the other hand, the fingerprint recognition sensors integrated in the display panel have relatively limited accuracy. Therefore, when a fingerprint is sliding on the display panel, the same pattern of the fingerprint can be detected multiple times by the multiple fingerprint recognition sensors integrated in the display panel. In this case, more fingerprint data can be collected and the fingerprint can be easily identified.

[0041] The control unit can be used for comparing the collected fingerprint data with the user fingerprint information stored in the memory unit, and for controlling the display panel to perform the display function based on the sliding direction of the finger in response to a matched result when the fingerprint data matches a record of the user fingerprint information.

[0042] The fingerprint recognition unit can send the collected fingerprint data of the sliding fingerprint to the control unit. And the control unit can use the fingerprint data to compare with the user fingerprint information stored in the memory unit.

[0043] The comparison can be implemented using any suitable algorithm to determine if the fingerprint data matches a record of the user fingerprint information. For example, an algorithm can determine if an index of similarity between a pattern of the fingerprint in the collected fingerprint data and a record of one fingerprint pattern in the user fingerprint information reaches a preset threshold value.

[0044] If there is a matched result from the comparison, the control unit can determine that the current user is a valid user of the display apparatus. In response to the matched result, the control unit can control the display panel to perform a display function based on the sliding direction of the finger.

[0045] If there is no matched result from the comparison, the control unit can determine that the current user is an invalid user of the display apparatus. In response to the

unmatched result, the control unit can control the display panel to maintain a non-display state.

[0046] In some embodiments, the display function can include a first display form and a second display form. The control unit can control the display panel to perform the display function in the first display form if the sliding direction of the fingerprint is a first direction, and can control the display panel to perform the display function in the second display form when the sliding direction of the fingerprint is a second direction.

[0047] In some embodiments, two or more sliding directions of the fingerprint can be distinguished, and the two or more sliding directions of the fingerprint can correspond to two or more different display forms.

[0048] In some embodiments, the display panel has a substantially rectangle shape which includes a length side and a width side. The first direction can be substantially parallel to the length side of the display panel, and the second direction can be substantially parallel to the width side of the display panel. The first display form can include displaying in a wide-screen display type by using the length side of the display panel as a bottom side, and the second display form can include displaying in a narrow-screen display type by using the width side of the display panel as a bottom side.

[0049] As illustrated in FIG. 2, a schematic diagram of a display apparatus and a finger of a user that is sliding on the display apparatus along a length direction of the display apparatus is shown in accordance with some embodiments of the disclosed subject matter.

[0050] When the sliding direction of the fingerprint is a first direction, which means the user is sliding his finger along the direction that substantially parallel to the length side of the display panel, the control unit can control the display panel to display in the wide-screen display type by using the length side of the display panel as a bottom side.

[0051] As illustrated in FIG. 3, a schematic diagram of a display apparatus and a finger of a user that is sliding on the display apparatus along a width direction of the display apparatus is shown in accordance with some embodiments of the disclosed subject matter. When the sliding direction of the fingerprint is a second direction, which means the user is sliding his finger along the direction that substantially parallel to the width side of the display panel, the control unit can control the display panel to display in the narrow-screen display type by using the width side of the display panel as a bottom side.

[0052] In some embodiments, the first display form can include displaying a first content item, and the second display form can include displaying a second content item that is different from the first content item. In some embodiments, the first content item includes at least one video type application, and the second content item includes at least one document type application.

[0053] That is, in different display type, the content displayed in the display panel can be different. When the display panel is displaying in the wide-screen display type, at least one video type application, such as a Youtube application, a Media Player application, etc. can be displayed. When the display panel is displaying in the narrow-screen display type, at least one document type application, such as a Word application, an Ebook Reader application, etc. can be displayed. It should be understood that, the applications mentioned herein can include not only one or more icons of the applications, but also application user interfaces, such as video pages, web pages, etc.

[0054] In some embodiments, the control unit can retrieve user information associated with the fingerprint record, and control the display panel to perform the display function based on the sliding direction of the finger and the user information associated with the fingerprint record. The user information can include any suitable information that is related to the fingerprint record, such as a user account, a user preference setting, etc. In this case, the control unit can log in different user accounts based on different identified fingerprints. For example, if the control unit determined a fingerprint of user A is sling along a length direction of the display panel, a Youtube application can be displayed on the display panel. As another example, the control unit determined a fingerprint of user B is sling along a width direction of the display panel, a Word application can be displayed on the display panel. A user preference setting includes one or more association with different sling directions and different applications can be preset by a user.

[0055] In some embodiments, the disclosed display apparatus is a handheld display apparatus, such as a mobile phone, an electrical paper, an electrical book, a tablet computer, a digital frame, a navigator, etc. A handheld display apparatus is small and convenient to be carried by a user, and it is a suitable example of the display apparatus in accordance with the disclosed subject matter.

[0056] Another aspect of the disclosed subject matter provides a related display method. The method can include: recognizing, by a fingerprint recognition unit embedded in a display panel, current fingerprint data of a finger and determining a sliding direction of the finger when it is detected that the finger is sliding on the display panel; comparing, by a control unit, the fingerprint data of the finger with user fingerprint information stored in a memory unit; and controlling, by the control unit, the display panel to perform a display function based on the sliding direction of the finger in response to a matched result when the fingerprint data of the finger is consistent with a record of the user fingerprint information.

[0057] In some embodiments, the display function is performed in a first display form when it is determined that the sliding direction of the finger is a first direction, and the display function is performed in a second display form when it is determined that the sliding direction of the finger is a second direction.

[0058] In some embodiments, the display method can also include using the control unit to retrieve user information associated with a first user based on the fingerprint data of the finger, and using the control unit to control the display panel to perform the display function based on the sliding direction of the finger and the user information associated with the first user. The user fingerprint information is associated with a plurality of users. The plurality of user may include the first user associated with the record of the user fingerprint information.

[0059] The disclosed display method can be implemented by the disclosed display apparatus.

[0060] The provision of the examples described herein (as well as clauses phrased as "such as," "e.g.," "including," and the like) should not be interpreted as limiting the claimed subject matter to the specific examples; rather, the examples are intended to illustrate only some of many possible aspects.

[0061] Accordingly, a display apparatus and a related display method are provided.

[0062] Although the disclosed subject matter has been described and illustrated in the foregoing illustrative embodiments, it is understood that the present disclosure has been made only by way of example, and that numerous changes in the details of embodiment of the disclosed subject matter can be made without departing from the spirit

and scope of the disclosed subject matter, which is only limited by the claims which follow. Features of the disclosed embodiments can be combined and rearranged in various ways. Without departing from the spirit and scope of the disclosed subject matter, modifications, equivalents, or improvements to the disclosed subject matter are understandable to those skilled in the art and are intended to be encompassed within the scope of the present disclosure.

What is claimed is:

1. A display apparatus, comprising:

a display panel;

a memory unit for storing user fingerprint information;

a fingerprint recognition unit embedded in the display panel for recognizing current fingerprint data of a finger when the finger is sliding on the display panel, and determining a sliding direction of the finger; and

a control unit for comparing the current fingerprint data of the finger with the user fingerprint information, and upon matching, controlling a display on the display panel based on the sliding direction of the finger.

2. The display apparatus of claim 1, wherein:

the control unit is configured for controlling the display panel in a first display form when the sliding direction of the finger is a first direction; and

the control unit is configured for controlling the display panel in a second display form when the sliding direction of the finger is a second direction.

3. The display apparatus of claim 2, wherein:

the display panel comprises a length side and a width side;

the first display form comprises displaying in a wide-screen display type by using the length side of the display panel as a bottom side; and

the second display form comprises displaying in a narrow-screen display type by using the width side of the display panel as a bottom side.

4. The display apparatus of claim 3, wherein:

the first display form comprises displaying a first content item; and

the second display form comprises displaying a second content item that is different from the first content item.

5. The display apparatus of claim 4, wherein:

the first content item comprises at least one video type application; and

the second content item comprises at least one document type application.

6. The display apparatus of claim 3, wherein:

the first direction is substantially parallel to the length side of the display panel; and

the second direction is substantially parallel to the width side of the display panel.

7. The display apparatus of claim 1, wherein:

the control unit is further configured for retrieving user information associated with the user fingerprint information that matches the current fingerprint data, and controlling the display on the display panel based on the sliding direction of the finger and the user information.

8. The display apparatus of claim 1, wherein the user fingerprint information is associated with a plurality of users.

9. The display apparatus of claim 2, wherein the control unit is configured for controlling the display panel in a third display form, when the sliding direction of the finger is a third direction.

10. The display apparatus of claim 1, wherein the fingerprint recognition unit comprises a plurality of fingerprint recognition sensors distributed in a plurality of pixels of the display panel.

11. The display apparatus of any one of claims 1-10, wherein the display apparatus is a handheld display apparatus.

12. A display method, comprising:

recognizing, using a fingerprint recognition unit embedded in a display panel, current fingerprint data of a finger and determining a sliding direction of the finger when the finger is sliding on the display panel;

comparing, using a control unit, the current fingerprint data of the finger with user fingerprint information stored in a memory unit; and

controlling, using the control unit, a display on the display panel based on the sliding direction of the finger when the current fingerprint data of the finger matches the user fingerprint information.

13. The method of claim 12, wherein:

the display on the display panel is in a first display form when the sliding direction of the finger is a first direction; and

the display on the display panel is in a second display form when the sliding direction of the finger is a second direction.

14. The method of claim 13, wherein:

the display panel comprises a length side and a width side;

the first display form comprises displaying in a wide-screen display type by using the length side of the display panel as a bottom side; and

the second display form comprises displaying a narrow-screen display type by using the width side of the display panel as a bottom side.

15. The method of claim 14, wherein:

the first display form comprises displaying a first content item; and

the second display form comprises displaying a second content item that is different from the first content item.

16. The method of claim 15, wherein:

the first content item comprises at least one video type application; and

the second content item comprises at least one document type application.

17. The method of claim 13, wherein:

the first direction is substantially parallel to the length side of the display panel; and

the second direction is substantially parallel to the width side of the display panel.

18. The method of claim 12, further comprising:

retrieving, using the control unit, user information associated with the user fingerprint information that matches the current fingerprint data; and

controlling, using the control unit, the display on the display panel based on the sliding direction of the finger and the user information.

19. The method of claim 12, wherein the user fingerprint information is associated with a plurality of users.

20. The method of claim 13, further comprising:

controlling, using the control unit, the display panel in a third display form, when the sliding direction of the finger is a third direction.

21. The method of claim 12, wherein the fingerprint recognition unit comprises a plurality of fingerprint recognition sensors distributed in a plurality of pixels of the display panel.

22. The method of any one of claims 12-21, wherein the display apparatus is a handheld display apparatus.

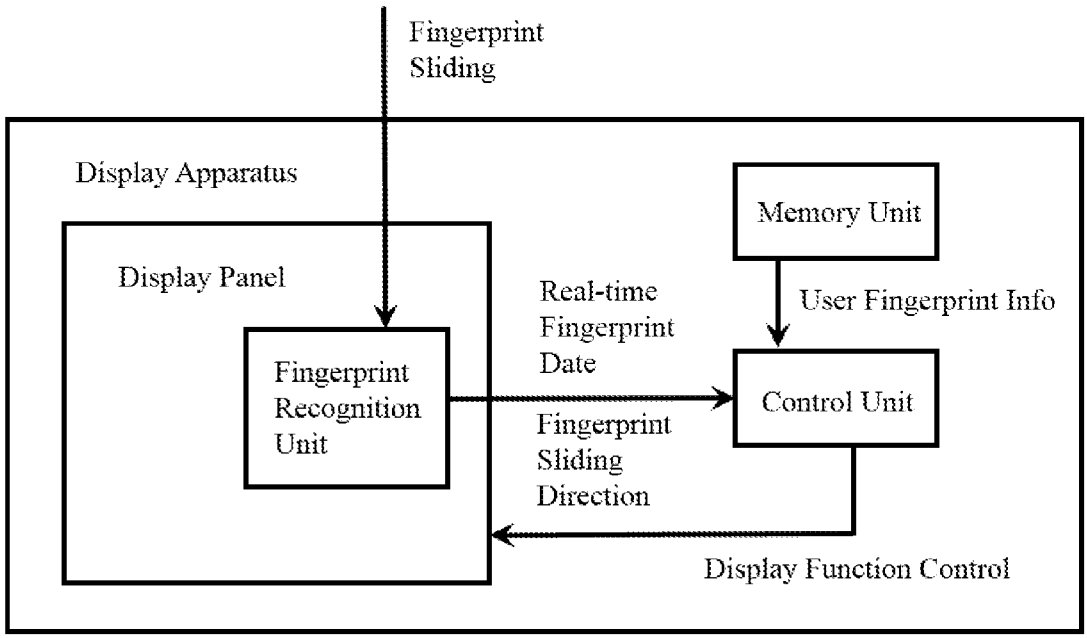
Fingerprint
Sliding
Display Apparatus
Display Panel
Fingerprint
Recognition
Unit
Memory Unit
User Fingerprint Info
Real-time
Fingerprint
Date
Control Unit
Fingerprint
Sliding
Direction
Display Function Control

FIG. 1

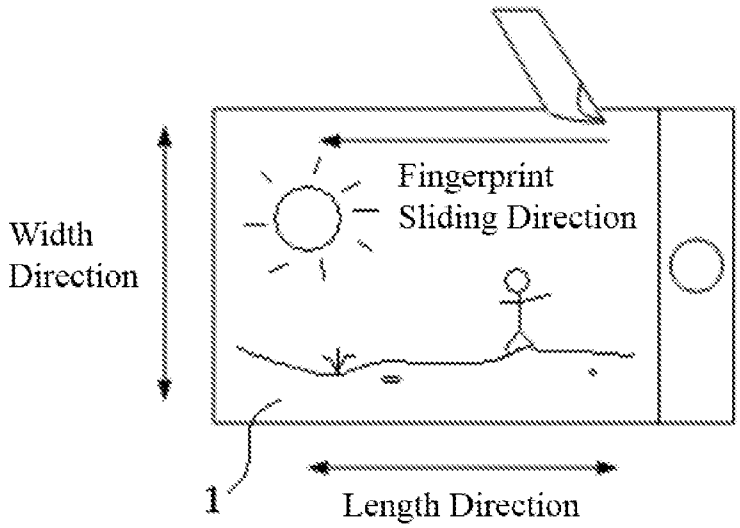
Width
Direction
Fingerprint
Sliding Direction
1
Length Direction

FIG. 2

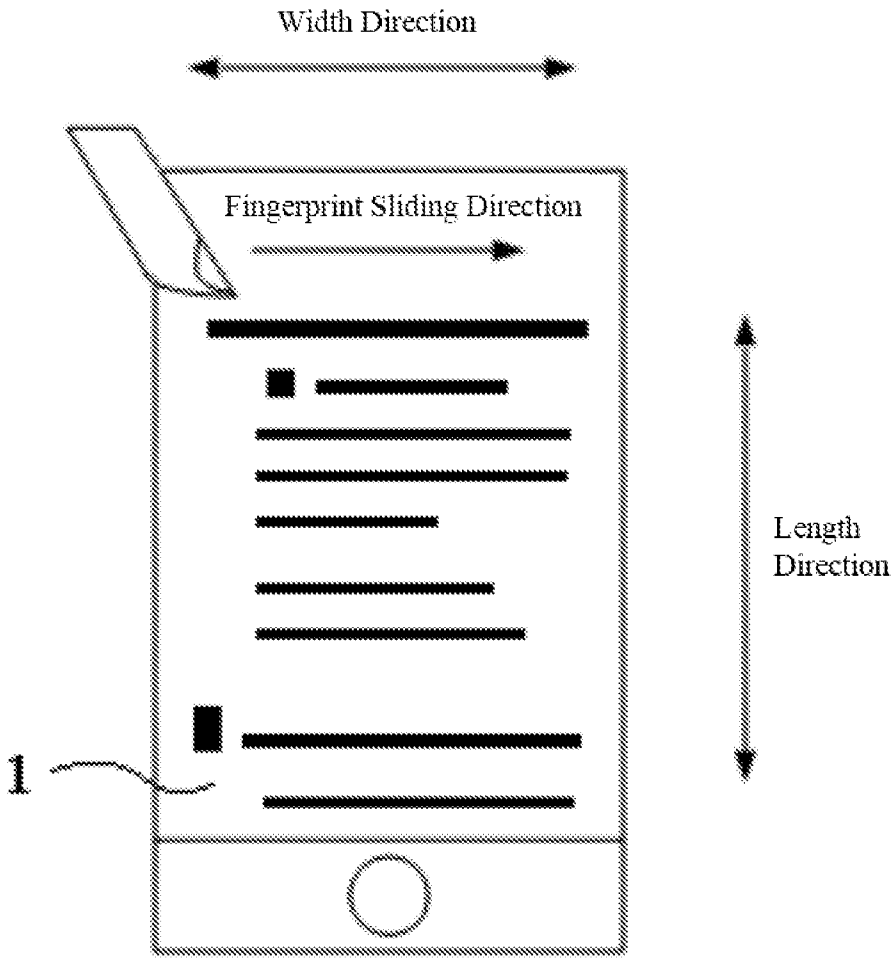
Width Direction
Fingerprint Sliding Direction
Length Direction
1

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/099129

A. CLASSIFICATION OF SUBJECT MATTER

G06F 3/0484(2013.01)i; G06F 21/32(2013.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, CNKI, WPI, EPODOC: fingerprint?, finger d mark, recognit+ or identif+, direction?, orientat+, match+, length, width or short, wide, narrow, display+, revolut+ or rotat+, document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 105094611 A (BOE TECHNOLOGY GROUP CO., LTD.) 25 November 2015 (2015-11-25) claims 1-10 and description, paragraphs 26-55	1-22
X	CN 104035721 A (NANCHANG OUFEI BIOMETRIC TECHNOLOGY CO., LTD. ET AL.) 10 September 2014 (2014-09-10) description, paragraphs 65-75 and figures 1-7	1-2, 7-9, 11-13, 18-20, 22
Y	CN 104035721 A (NANCHANG OUFEI BIOMETRIC TECHNOLOGY CO., LTD. ET AL.) 10 September 2014 (2014-09-10) description, paragraphs 65-75 and figures 1-7	3-6, 10, 14-17, 21
Y	CN 103076960 A (HUAWEI DEVICE CO., LTD.) 01 May 2013 (2013-05-01) description, paragraphs 45-84 and figures 2-11	3-6, 10, 14-17, 21
A	CN 101506760 A (SHARP K.K.) 12 August 2009 (2009-08-12) the whole document	1-22
A	CN 104700016 A (SHANGHAI YUDE COMMUNICATION TECHNOLOGY) 10 June 2015 (2015-06-10) the whole document	1-22

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search	Date of mailing of the international search report
30 March 2016	**26 April 2016**

Name and mailing address of the ISA/CN	Authorized officer
STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China**	**LI,Guochen**
Facsimile No. **(86-10)62019451**	Telephone No. **(86-10)61648463**

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2015054764 A1 (SAMSUNG ELECTRONICS CO., LTD.) 26 February 2015 (2015-02-26) the whole document	1-22
A	WO 2015088166 A1 (LG ELECTRONICS INC.) 18 June 2015 (2015-06-18) the whole document	1-22

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/099129

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	105094611	A	25 November 2015	None			
CN	104035721	A	10 September 2014	None			
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