

METHOD FOR CONTROLLING DISPLAY OF SCREEN OF MOBILE TERMINAL, AND MOBILE TERMINAL

TECHNICAL FIELD

[0001] The present application relates to the field of computer technologies, and
5 in particular, to a method for controlling display of a screen of a mobile terminal, and
a mobile terminal.

BACKGROUND

[0002] In a conventional technology, when a recognition apparatus is used to
recognize interface content on a screen of a mobile terminal, if the interface content
10 has a strict requirement on a recognition angle, a user usually needs to manually
repeatedly adjust a recognition angle of the recognition apparatus. For example, when
a code scanning gun is used to recognize a barcode on the screen of the mobile
terminal, the code scanning gun can recognize the barcode only when the code
scanning gun and the barcode face each other and rotation angles of the code scanning
15 gun and the barcode are similar. Therefore, the user needs to manually and repeatedly
adjust a recognition angle of the code scanning gun, which affects efficiency of
recognizing the interface content, and brings poor experience to the user.

SUMMARY

[0003] The present application describes a method for controlling display of a
20 screen of a mobile terminal, and a mobile terminal, to improve efficiency of
recognizing interface content.

[0004] According to a first aspect, a method for controlling display of a screen of
a mobile terminal is provided, including: detecting, by a mobile terminal, a first beam;
determining whether the detected first beam is in an inclined state, where the inclined
25 state indicates that the first beam has an inclination angle that is greater than a first
threshold in a predetermined direction, and the predetermined direction is determined
based on a display direction of interface content on a screen of the mobile terminal;

and when the detected first beam is in the inclined state, adjusting the display direction of the interface content on the screen of the mobile terminal based on the inclined state of the first beam.

[0005] According to a second aspect, a mobile terminal is provided, and the mobile terminal includes: a detection unit, configured to detect a first beam; a determining unit, configured to determine whether the first beam detected by the detection unit is in an inclined state, where the inclined state indicates that the first beam has an inclination angle that is greater than a first threshold in a predetermined direction, and the predetermined direction is determined based on a display direction of interface content on a screen of the mobile terminal; and an adjustment unit, configured to: when the determining unit determines that the detected first beam is in the inclined state, adjust the display direction of the interface content on the screen of the mobile terminal based on the inclined state of the first beam.

[0006] According to the method for controlling the display of the screen of the mobile terminal, and the mobile terminal provided in the present application, the mobile terminal can detect whether a beam emitted by a recognition apparatus arrives. When the mobile terminal detects that a beam arrives, the mobile terminal can determine whether the detected beam is in an inclined state. Once the mobile terminal detects that the beam is in the inclined state, the mobile terminal can adjust the display direction of the interface content on the screen of the mobile terminal based on the inclined state of the beam. Therefore, efficiency of recognizing the interface content on the screen of the mobile terminal is improved.

BRIEF DESCRIPTION OF DRAWINGS

[0007] To describe the technical solutions in the implementations of the present disclosure more clearly, the following briefly describes the accompanying drawings needed for describing the implementations. Apparently, the accompanying drawings in the following description show merely some implementations of the present disclosure, and a person of ordinary skill in the art can still derive other drawings from these accompanying drawings without creative efforts.

[0008] FIG. 1 is a flowchart illustrating a method for controlling display of a screen of a mobile terminal, according to an implementation of the present application;

[0009] FIG. 2 is a schematic diagram illustrating a first beam, according to the present application;

[0010] FIG. 3a is a first schematic diagram illustrating an angle between a first beam and interface content, according to the present application;

5 [0011] FIG. 3b is a first schematic diagram illustrating interface content on a screen of a mobile terminal, according to the present application;

[0012] FIG. 4a is a second schematic diagram illustrating an angle between a first beam and interface content, according to the present application;

10 [0013] FIG. 4b is a second schematic diagram illustrating interface content on a screen of a mobile terminal, according to the present application; and

[0014] FIG. 5 is a schematic diagram illustrating a mobile terminal, according to an implementation of the present application.

DESCRIPTION OF IMPLEMENTATIONS

15 [0015] The following describes implementations of the present disclosure with reference to accompanying drawings.

[0016] A method for controlling display of a screen of a mobile terminal provided in the present application is applicable to a scenario that a mobile terminal automatically adjusts a display direction of interface content on a screen of the mobile terminal based on an inclined state of a beam emitted by a recognition apparatus. The mobile terminal can be a mobile terminal that has a screen, for example, a mobile phone, a tablet, or a personal digital assistant (PDA), and the screen can be a touchscreen. In addition, the mobile terminal can further have a sensor such as a complementary metal-oxide-semiconductor (CMOS) or a charge coupled device (CCD), so that the mobile terminal can detect a beam by using the previous sensor. It is worthwhile to note that the interface content in the present application can include but is not limited to a barcode image, a two-dimensional code image, etc. The interface content can be recognized in a forward direction or a reverse direction, and the forward direction and the reverse direction are two directions with a difference of 180°.

30 [0017] FIG. 1 is a flowchart illustrating a method for controlling display of a screen of a mobile terminal, according to an implementation of the present application. The method can be performed by a mobile terminal. As shown in FIG. 1, the method

can include the following steps.

[0018] Step 110: The mobile terminal detects a first beam.

[0019] The first beam is a beam that can be sensed by a sensor (e.g., a CMOS or a CCD) of the mobile terminal, for example, can be a laser beam, an infrared beam, or a visible beam. A type of the first beam can include a circular beam, a bar beam, etc. It is worthwhile to note that the first beam in the present application can be emitted by a recognition apparatus. For example, when the recognition apparatus is a code scanning gun, a first beam emitted by the code scanning gun can be shown in FIG. 2. In FIG. 2, the first beam is an infrared beam, and a shape of the infrared beam is a bar beam. When the infrared beam emitted by the code scanning gun covers a camera of the mobile terminal, the camera of the mobile terminal can sense the infrared beam, in other words, the mobile terminal can detect the first beam. The camera has a function of a sensor (e.g., a CMOS or a CCD).

[0020] Step 120: Determine whether the detected first beam is in an inclined state.

[0021] The inclined state indicates that the first beam has an inclination angle that is greater than a first threshold in a predetermined direction. For example, a user can incline the recognition apparatus that emits the first beam. The predetermined direction can be determined based on a display direction of interface content on a screen of the mobile terminal. In the present application, the display direction of the interface content can be used as the predetermined direction. In other words, the display direction of the interface content is the same as the predetermined direction. The display direction of the interface content can include an upward direction, a downward direction, a leftward direction, a rightward direction, a left-upward direction, a left-downward direction, a right-upward direction, or a right-downward direction. A reference object of the predetermined direction can include one or more of the following: the mobile terminal, a plane on which a touchscreen of the mobile terminal is located, a horizontal plane, a vertical plane, an X-axis and a Y-axis of the horizontal plane, an X-axis and a Y-axis of the vertical plane, an X-axis and a Y-axis of the plane on which the touchscreen of the mobile terminal is located, etc. The reference object can be selected and understood based on an actual situation. For other parts related to this in the present specification, references can be made to the description here. Details are omitted here for simplicity.

[0022] It is worthwhile to note that the first threshold can be set based on an empirical value. For example, when the recognition apparatus is a code scanning gun

and the interface content is a barcode, the first threshold can be a maximum angle between the code scanning gun and the barcode when the barcode can be recognized by the code scanning gun.

[0023] In step 120, a process that the mobile terminal determines whether the detected first beam is in the inclined state can be as follows: The mobile terminal determines an angle between the first beam and the display direction of the interface content on the screen of the mobile terminal, determines whether the angle is greater than the first threshold, and if the angle is greater than the first threshold, determines that the first beam is in the inclined state. It can be understood that when the predetermined direction is the display direction of the interface content, the angle is the inclination angle.

[0024] In an implementation, when the first beam is a bar beam, before the previous angle is determined, a characteristic line (namely, a straight line that can be used to represent the first beam) of the first beam detected by the mobile terminal can be first determined, and then the angle between the first beam and the display direction of the interface content on the screen of the mobile terminal is determined based on an angle between the characteristic line and the display direction of the interface content on the screen of the mobile terminal. FIG. 3a is used as an example. The interface content on the screen of the mobile terminal can be a barcode image, and a is a display direction (namely, a horizontally rightward direction) of the barcode image. In addition, b is a characteristic line of the first beam, in other words, the first beam does not have a direction. Therefore, α_1 and α_2 are angles between the first beam and the display direction of the barcode image. In other words, there are two angles, and the two angles are supplementary angles. It can be seen from FIG. 3a that value ranges of both α_1 and α_2 are $[0, 180^\circ]$. It is worthwhile to note that only when both α_1 and α_2 are greater than the first threshold, it can be determined that the first beam is in the inclined state. It can be understood that if either angle (α_1 or α_2) is not greater than the first threshold, the first beam is not in the inclined state.

[0025] Step 130: When the detected first beam is in the inclined state, adjust a display direction of interface content on a screen of the mobile terminal based on the inclined state of the first beam.

[0026] The interface content can include but is not limited to a barcode image, a two-dimensional code image, etc. The interface content can be recognized in a forward direction or a reverse direction, and the forward direction and the reverse

direction are two directions with a difference of 180° .

[0027] Step 130 can include the following steps.

[0028] Step A: Obtain an inclination angle and an inclination direction of the first beam when the detected first beam is in the inclined state.

5 **[0029]** Specifically, the mobile terminal can obtain the inclination angle and the inclination direction of the first beam when determining that the detected first beam is in the inclined state. The inclination direction can include an upward inclination direction, a downward inclination direction, a leftward inclination direction, a rightward inclination direction, a left-upward inclination direction, a left-downward
10 inclination direction, a right-upward inclination direction, or a right-downward inclination direction. For example, the user can incline upwards, downwards, leftwards, and rightwards the recognition apparatus that emits the first beam, so that the first beam is in the upward, downward, leftward, and rightward inclination directions.

15 **[0030]** FIG. 3a is used as an example. When both α_1 and α_2 are greater than the first threshold, it can be determined that the first beam is in the inclined state. In FIG. 3a, two inclination angles that can be obtained are α_1 and α_2 , an inclination direction corresponding to α_1 is the downward inclination direction, and an inclination direction corresponding to α_2 is the upward inclination direction. It can be understood
20 that the first beam in FIG. 3a is obtained after a beam in the horizontally rightward direction (namely, the display direction of the barcode image) is rotated clockwise by an angle of α_1 , or is obtained after a beam in the horizontally rightward direction (namely, the display direction of the barcode image) is rotated anticlockwise by an angle of α_2 .

25 **[0031]** Step B: Adjust the display direction of the interface content on the screen of the mobile terminal based on the inclination angle and the corresponding inclination direction.

[0032] Step B can include the following: determining a rotation direction and a rotation angle of the interface content based on the inclination direction and the
30 inclination angle; and rotating the interface content by the determined rotation angle in the determined rotation direction.

[0033] In an implementation, when a plurality of inclination angles are determined, a process of determining the rotation direction and the rotation angle of the interface content based on the inclination direction and the inclination angle can

include the following: selecting, from the plurality of inclination angles, a first inclination angle that does not exceed a second threshold; determining the first inclination angle as the rotation angle; and determining that an inclination direction corresponding to the first inclination angle is the rotation direction. It is worthwhile to
 5 note that the first inclination angle that does not exceed the second threshold is an angle that is less than or equal to the second threshold.

[0034] Assume that the second threshold is 90° . In FIG. 3a, because the inclination angle α_1 does not exceed the second threshold, it can be determined that a rotation angle of the barcode image is α_1 and a rotation direction of the barcode image
 10 is a downward inclination direction, namely, the inclination direction corresponding to α_1 . Therefore, a process of adjusting the display direction of the interface content on the screen of the mobile terminal includes the following: rotating the barcode image by the angle of α_1 in the downward inclination direction, in other words, rotating the barcode image clockwise by the angle of α_1 , to obtain a display direction of the
 15 barcode image shown in FIG. 3b. In FIG. 3b, a direction of the first beam is consistent with the display direction of the barcode image. Therefore, it can be convenient for the code scanning gun to recognize the barcode image.

[0035] In another example, when an angle between the first beam and the display direction of the barcode image is shown in FIG. 4a, and assume that both angles in
 20 FIG. 4a are greater than the first threshold, it can be determined that the first beam is in the inclined state. Therefore, two inclination angles α_3 and α_4 can be obtained, an inclination direction corresponding to α_3 is the downward inclination direction, and an inclination direction corresponding to α_4 is the upward inclination direction. Because the inclination angle α_4 does not exceed the second threshold, it can be
 25 determined that a rotation angle of the barcode image is α_4 , and a rotation direction of the barcode image is the upward inclination direction, namely, the inclination direction corresponding to α_4 . Therefore, a process of adjusting the display direction of the interface content on the screen of the mobile terminal includes the following: rotating the barcode image by the angle of α_4 in the upward inclination direction, in
 30 other words, rotating the barcode image anticlockwise by the angle of α_4 , to obtain a display direction of the barcode image shown in FIG. 4b. In FIG. 4b, a direction of the first beam is consistent with the display direction of the barcode image. Therefore, it can be convenient for the code scanning gun to recognize the barcode image.

[0036] Certainly, in practice, the predetermined threshold can also be set to

another value. Implementations are not limited in the present application.

[0037] Optionally, a rotation center can be determined before the interface content is rotated by the determined rotation angle in the determined rotation direction. In an example, the rotation center can be determined based on a reference object of the predetermined direction. For example, when the reference object is the mobile terminal, the plane on which the touchscreen of the mobile terminal is located, the X-axis and the Y-axis of the plane on which the touchscreen of the mobile terminal is located, etc., the determined rotation center can be a center of the screen of the mobile terminal. Alternatively, when the reference object is the horizontal plane, the X-axis and the Y-axis of the horizontal plane, etc., the determined rotation center can be a center of the horizontal plane (namely, an intersection point of the X-axis and the Y-axis of the horizontal plane). Alternatively, when the reference object is the vertical plane, the X-axis and the Y-axis of the vertical plane, etc., the determined rotation center can be a center of the vertical plane (namely, an intersection point of the X-axis and the Y-axis of the vertical plane).

[0038] When the rotation center is further determined, the step of rotating the interface content by the determined rotation angle in the determined rotation direction can be replaced with the following: rotating the interface content by the determined rotation angle in the determined rotation direction by using the determined rotation center as a center.

[0039] It is worthwhile to note that when the detected first beam is not in the inclined state, the display direction of the interface content on the screen of the mobile terminal may not be adjusted.

[0040] It can be seen that in the present application, when the first beam emitted by the recognition apparatus is in the inclined state, the mobile terminal automatically adjusts the display direction of the interface content on the screen of the mobile terminal based on the inclined state of the first beam, so that interface content that has a strict requirement on a recognition angle can be recognized easily, further improving user experience.

[0041] When the interface content is a barcode image, the code scanning gun can read a value of the barcode image only when the code scanning gun and the barcode image face each other and rotation angles of the code scanning gun and the barcode image are similar. Therefore, in the present application, according to a method for automatically adjusting the display direction of the barcode image based on an

inclined state of the infrared beam emitted by the code scanning gun, problems of poor user experience that are caused because the user needs to repeatedly adjust a location of the code scanning gun can be alleviated.

5 **[0042]** Corresponding to the previous method for controlling display of a screen of a mobile terminal, an implementation of the present application further provides a mobile terminal. As shown in FIG. 5, the mobile terminal includes a detection unit 501, a determining unit 502, and an adjustment unit 503.

[0043] The detection unit 501 is configured to detect a first beam.

10 **[0044]** The determining unit 502 is configured to determine whether the first beam detected by the detection unit is in an inclined state, where the inclined state indicates that the first beam has an inclination angle that is greater than a first threshold in a predetermined direction, and the predetermined direction is determined based on a display direction of interface content on a screen of the mobile terminal.

15 **[0045]** The predetermined direction can include an upward direction, a downward direction, a leftward direction, a rightward direction, a left-upward direction, a left-downward direction, a right-upward direction, or a right-downward direction.

20 **[0046]** The adjustment unit 503 is configured to: when the determining unit 502 determines that the detected first beam is in the inclined state, adjust the display direction of the interface content on the screen of the mobile terminal based on the inclined state of the first beam.

25 **[0047]** Optionally, the adjustment unit 503 can be configured to: obtain an inclination angle of the first beam and a corresponding inclination direction based on the inclined state of the first beam; and adjust the display direction of the interface content on the screen of the mobile terminal based on the inclination angle and the corresponding inclination direction.

[0048] Optionally, the adjustment unit 503 can be further configured to: determine a rotation angle of the interface content and a corresponding rotation direction based on the inclination angle and the corresponding inclination direction; and rotate the interface content by the rotation angle in the determined rotation direction.

30 **[0049]** Optionally, when there are a plurality of inclination angles, the adjustment unit 503 can be further configured to: select, from the plurality of inclination angles, a first inclination angle that does not exceed a second threshold; determine the first inclination angle as the rotation angle; and determine that an inclination direction corresponding to the first inclination angle is the rotation direction.

[0050] Functions of function modules of the apparatus in the present implementation of the present application can be implemented by performing the steps in the previous method implementation. Therefore, a specific working process of the apparatus provided in the present application is omitted here.

5 **[0051]** According to the mobile terminal provided in the present application, the detection unit 501 detects the first beam. The determining unit 502 determines whether the detected first beam is in the inclined state. When the detected first beam is in the inclined state, the adjustment unit 503 adjusts the display direction of the interface content on the screen of the mobile terminal based on the inclined state of
10 the first beam. Therefore, efficiency of recognizing the interface content on the screen of the mobile terminal is improved.

[0052] A person skilled in the art should be aware that in the previous one or more examples, functions described in the present disclosure can be implemented by hardware, software, firmware, or any combination thereof. When the functions are
15 implemented by software, the functions can be stored in a computer readable medium or transmitted as one or more instructions or code in the computer readable medium.

[0053] The objectives, technical solutions, and benefits of the present disclosure are further described in detail in the previous specific implementations. It should be understood that the previous descriptions are merely specific implementations of the
20 present disclosure, but are not intended to limit the protection scope of the present disclosure. Any modification, equivalent replacement, improvement, etc. made based on the technical solutions of the present disclosure shall fall within the protection scope of the present disclosure.

CLAIMS

1. A computer-implemented method for controlling display of a screen of a mobile terminal comprising:

detecting, by the mobile terminal, a beam, wherein the beam is emitted by a recognition apparatus for scanning a code displayed on the screen;

determining whether the beam is in an inclined state, wherein the inclined state indicates that the beam has an inclination angle that is greater than a first threshold in a predetermined direction, and wherein the predetermined direction is determined based on a display direction of an interface content on the screen of the mobile terminal, wherein the interface content is an image of the code suitable for being scanned and recognized by the recognition apparatus; and

in response to determining that the beam is in the inclined state, adjusting the display direction of the interface content on the screen of the mobile terminal based on the inclined state of the beam.

2. The computer-implemented method of claim 1, wherein adjusting the display direction comprises:

obtaining the inclination angle of the beam and a corresponding inclination direction based on the inclined state of the beam; and

adjusting the display direction of the interface content on the screen of the mobile terminal based on the inclination angle and the corresponding inclination direction.

3. The computer-implemented method of claim 2, wherein adjusting the display direction comprises:

determining a rotation angle of the interface content and a rotation direction based on the inclination angle and the corresponding inclination direction; and

rotating the interface content by the rotation angle in the rotation direction.

4. The computer-implemented method of claim 3, further comprising:

determining whether the inclination angle comprises a plurality of inclination angles.

5. The computer-implemented method of claim 4, wherein in response to determining that the inclination angle comprises the plurality of inclination angles, determining the rotation angle comprises:

selecting, from the plurality of inclination angles, a first inclination angle that does not exceed a second threshold;

determining the first inclination angle as the rotation angle; and

determining that an inclination direction corresponding to the first inclination angle is the rotation direction.

6. The computer-implemented method of claim 1, wherein the predetermined direction comprises an upward direction, a downward direction, a leftward direction, a rightward direction, a left-upward direction, a left-downward direction, a right-upward direction, or a right-downward direction.

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7. The computer-implemented method of claim 1, wherein the mobile terminal comprises a sensor configured to detect the beam.

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8. The computer-implemented method of claim 7, wherein the sensor comprises an active-pixel sensor.

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9. The computer-implemented method of claim 8, wherein the active-pixel sensor comprises a charge-coupled device image sensor or a complementary metal-oxide semiconductor image sensor.

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10. The computer-implemented method of claim 1, wherein the beam comprises a laser beam, an infrared beam, or a visible beam.

11. A mobile terminal, the mobile terminal comprising a screen, at least one processor, and a non-transitory computer readable medium storing one or more instructions executable by the at least one processor to perform operations comprising:

detecting a beam, wherein the beam is emitted by a recognition apparatus for scanning a code displayed on the screen;

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determining whether the beam is in an inclined state, wherein the inclined state indicates that the beam has an inclination angle that is greater than a first threshold in a predetermined direction, and wherein the predetermined direction is determined based on a display direction of an interface content on the screen of the mobile terminal, wherein the interface content is an image of the code suitable for being scanned and recognized by the recognition apparatus; and

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in response to determining that the beam is in the inclined state, adjusting the display direction of the interface content on the screen of the mobile terminal based on the inclined state of the beam.

12. The mobile terminal of claim 11, wherein adjusting the display direction comprises:

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obtaining the inclination angle of the beam and a corresponding inclination direction based on the inclined state of the beam; and

adjusting the display direction of the interface content on the screen of the mobile terminal based on the inclination angle and the corresponding inclination direction.

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13. The mobile terminal of claim 12, wherein adjusting the display direction comprises: determining a rotation angle of the interface content and a rotation direction based on the

inclination angle and the corresponding inclination direction; and
rotating the interface content by the rotation angle in the rotation direction.

14. The mobile terminal of claim 13, further comprising:
determining whether the inclination angle comprises a plurality of inclination angles.

15. The mobile terminal of claim 14, wherein in response to determining that the inclination angle comprises the plurality of inclination angles, determining the rotation angle comprises:
selecting, from the plurality of inclination angles, a first inclination angle that does not exceed a second threshold;
determining the first inclination angle as the rotation angle; and
determining that an inclination direction corresponding to the first inclination angle is the rotation direction.

16. The mobile terminal of claim 11, wherein the predetermined direction comprises an upward direction, a downward direction, a leftward direction, a rightward direction, a left-upward direction, a left-downward direction, a right-upward direction, or a right-downward direction.

17. The mobile terminal of claim 11, wherein the mobile terminal comprises a sensor configured to detect the beam, wherein the sensor comprises an active-pixel sensor.

18. The mobile terminal of claim 17, wherein the active-pixel sensor comprises a charge-coupled device image sensor or a complementary metal-oxide semiconductor image sensor.

19. The mobile terminal of claim 11, wherein the beam comprises a laser beam, an infrared beam, or a visible beam.

20. A computer-implemented system, comprising:
one or more computers; and
one or more computer memory devices interoperably coupled with the one or more computers and having tangible, non-transitory, machine-readable media storing one or more instructions that, when executed by the one or more computers, perform one or more operations comprising:

detecting, by a mobile terminal, a beam, wherein the beam is emitted by a recognition apparatus for scanning a code displayed on a screen;

determining whether the beam is in an inclined state, wherein the inclined state indicates that the beam has an inclination angle that is greater than a first threshold in a predetermined direction, and wherein the predetermined direction is determined based on a display direction of an interface content on the screen of the mobile terminal, wherein the interface content is an

image of the code suitable for being scanned and recognized by the recognition apparatus; and
in response to determining that the beam is in the inclined state, adjusting the display direction of the interface content on the screen of the mobile terminal based on the inclined state of the beam.