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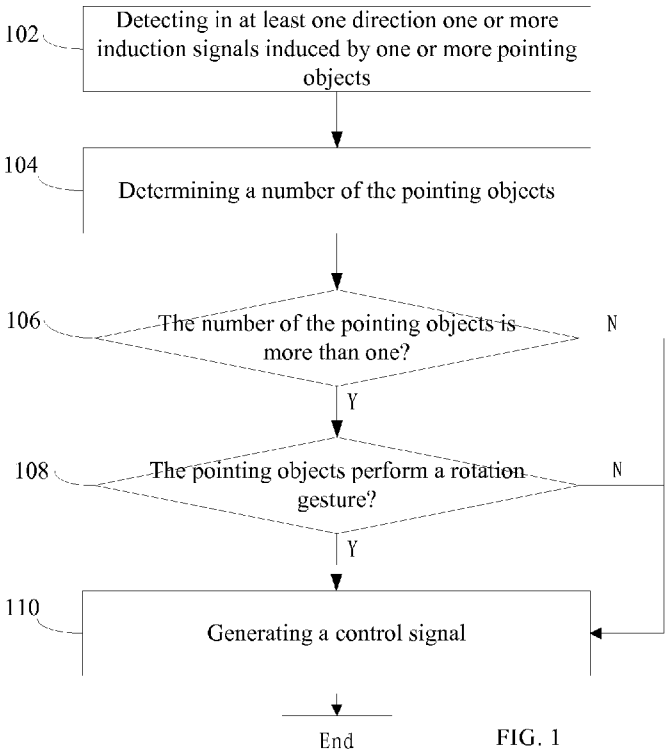


FIG. 1

(57) Abstract: A method of identifying a rotation gesture and a device using the same are provided. The method comprises: detecting in at least one direction one or more induction signals induced by one or more pointing objects that come into contact with a touch-sensitive surface; determining a number of the pointing objects; determining whether the pointing objects perform the rotation gesture if the number of the pointing objects is more than one; and generating a control signal associated with the rotation gesture if the pointing objects perform the rotation gesture.

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METHOD OF IDENTIFYING ROTATION GESTURE AND DEVICE USING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to, and benefits of Chinese Patent Application Serial No. 201110081235.4, filed with the State Intellectual Property Office of P. R. C. on March 31, 2011, the entire contents of which are incorporated herein by reference.

FIELD

The present disclosure relate generally to a method of identifying gestures on a touchpad, and more particularly, to a method of identifying a rotation gesture and a device using the same.

BACKGROUND

Although a keyboard remains a primary input device of a computer, a prevalence of graphical user interfaces (GUIs) may require use of a mouse or other pointing devices such as a trackball, a joystick, a touch device or the like. Due to their compact size, the touch devices have become popular and widely used in various areas of our daily lives, such as mobile phones, media players, navigation systems, digital cameras, digital cameras, digital photo frame, personal digital assistance (PDA), gaming devices, monitors, electrical control and medical equipments.

A touch device features a sensing surface that can translate a motion and a position of a user's fingers to a relative position on its screen. Touch pads operate in several ways. The most common technology includes sensing a capacitive virtual ground effect of a finger, or a capacitance between sensors. For example, by independently measuring a self-capacitance of each X and Y axis electrode on a sensor, a determination of the (X, Y) location of a single touch is provided.

SUMMARY

According to one exemplary embodiment of the present disclosure, a method of identifying multi-touch rotation gesture comprises: detecting in at least one direction one or more induction signals induced by one or more pointing objects that come into contact with a touch-sensitive surface; determining a number of the pointing object; determining whether the pointing objects perform a rotation gesture if the number of the pointing object is more than one; and generating a control signal associated with the rotation gesture if the pointing objects perform the rotation gesture.

The method of identifying a rotation gesture according to an embodiment of the present disclosure, may accurately determine the number of the objects according to the induction signals, and determine whether the objects perform a rotation gesture if the number of the object is more than one, so it may accurately detect a plurality of objects and identify the rotation gesture.

According to one exemplary embodiment of the present disclosure, a device of identifying a rotation gesture comprises: a detecting module, configured to detect in at least one direction one or more induction signals induced by one or more pointing objects that come into contact with a touch-sensitive surface; a determination module, configured to determine a number of pointing objects; a gesture determining module, configured to determine whether the pointing objects perform the rotation gesture; and a signal generation module, configured to generate a control signal associated with the determined rotation gesture.

The device of identifying a rotation gesture according to an embodiment of the present disclosure, may accurately determine the number of the objects according to the induction signals, and determine whether the objects perform a rotation gesture if the number of the object is more than one, so it may accurately detect a plurality of objects and identify the rotation gesture.

Additional aspects and advantages of the embodiments of the present disclosure will be given in part in the following descriptions, become apparent in part from the following descriptions, or be learned from the practice of the embodiments of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Having thus described exemplary embodiments of the present disclosure in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and in which:

FIG. 1 is a flow chart of a method of identifying a rotation gesture according to one exemplary embodiment of the present disclosure;

FIG. 2 illustrates a schematic diagram of inductive lines on a touch-sensitive screen according to one exemplary embodiment of the present disclosure;

FIG. 3 is a sub-flow chart of a method of identifying a rotation gesture according to one exemplary embodiment of the present disclosure;

FIGs. 4-6 illustrate diagrams of a detected induction signal and a reference signal according to exemplary embodiments of the present disclosure;

FIG. 7 illustrates a schematic diagram of a clockwise rotation gesture according to one exemplary embodiment of the present disclosure;

FIG. 8 illustrates a schematic diagram of a clockwise rotation gesture according to one exemplary embodiment of the present disclosure;

FIG. 9 is a flow chart of a method of identifying a rotation gesture according to one exemplary embodiment of the present disclosure;

FIG. 10 is a sub-flow chart of a method of identifying a rotation gesture in FIG. 9.

FIG. 11 is a flow chart of a method of identifying a rotation gesture according to one exemplary embodiment of the present disclosure;

FIG. 12(a) illustrates a schematic diagram of a clockwise rotation gesture according to one exemplary embodiment of the present disclosure;

FIG. 12(b) illustrates a schematic diagram of a counterclockwise rotation gesture according to one exemplary embodiment of the present disclosure;

FIG. 13 is a flow chart of a method of identifying a rotation gesture according to another exemplary embodiment of the present disclosure;

FIG. 14(a) illustrates a schematic diagram of a clockwise rotation gesture according to another exemplary embodiment of the present disclosure;

FIG. 14(b) illustrates a schematic diagram of a counterclockwise rotation gesture according to another exemplary embodiment of the present disclosure;

FIG. 15 illustrates a block diagram of a device of identifying a rotation gesture according to one exemplary embodiment of the present disclosure;

FIG. 16 illustrates a block diagram of a determination module according to one exemplary embodiment of the present disclosure;

FIG. 17 illustrates a block diagram of a gesture determining module according to one exemplary embodiment of the present disclosure; and

FIG. 18 illustrates a schematic diagram of a communication between a device of identifying a rotation gesture and a terminal according to one exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION

The present disclosure now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the disclosure are shown. This disclosure may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. In this regard, although exemplary embodiments may be described herein in the context of a touch screen or touch-screen panel, it should be understood that exemplary embodiments are equally applicable to any of a number of different types of touch-sensitive surfaces, including those with and without an integral display (e.g., touchpad). Also, for example, references may be made herein to axes, directions and orientations including X-axis, Y-axis, vertical, horizontal, diagonal, right and/or left; it should be understood, however, that any direction and orientation references are simply examples and that any particular direction or orientation may depend on the particular object, and/or the orientation of the particular object, with which the direction or orientation reference is made. Like numbers refer to like elements throughout.

FIG. 1 is a flow chart of a method of identifying a rotation gesture according to one exemplary embodiment of the present disclosure. The method of identifying a rotation gesture comprises: step 102, detecting in at least one direction one or more induction signals induced by one or more pointing objects that come into contact with a touch-sensitive surface; step 104, determining a number of the pointing object that come into contact with the touch-sensitive surface; step 106, judging whether the number of the pointing

object is more than one; step 108, determining whether the pointing objects perform the rotation gesture if the number of the pointing object is more than one; and step 110, generating a control signal associated with the determined rotation gesture if the pointing objects perform the rotation gesture.

In some embodiment of the present disclosure, detecting one or more induction signals comprises detecting a change in at least one of electrical current, capacitance, acoustic waves, electrostatic field, optical fields and infrared light. In some embodiment of the present disclosure, detecting one or more induction signals comprises detecting a first induction signal in a first direction; and detecting a second induction signal in a second direction, in which the first direction is at an angle with the second direction.

FIG. 2 illustrates a schematic diagram of inductive lines on a touch-sensitive screen according to one exemplary embodiment of the present disclosure. There are a plurality of inductive lines 11 and 12 on respective X and Y axes. The X and Y axes may be perpendicular to each other, or form other angles. As also shown, F1 and F2 indicate two touch points on the touch-sensitive screen by two pointing objects, in one embodiment. In some embodiment of the present disclosure, the first induction signal is detected in the X axis and the second induction signal is detected in the Y axis. In some embodiment of the present disclosure, the number of the pointing objects is determined according to the number of rising waves or falling waves of the first induction signal or the number of rising waves or falling waves of the second induction signal. In some embodiment of the present disclosure, the inductive lines may include inductive line in other directions.

FIG. 3 is a sub-flow chart of a method of identifying a rotation gesture according to one exemplary embodiment of the present disclosure. Determining the number of the pointing objects comprises: step 300, comparing a value of a first point with a value of a reference signal, and if the value of the first point is larger than the value of the reference signal, going to step 301, else going to step 303; step 301, comparing a value of a second point which is a preceding point of the first point with the value of the reference signal and determining whether the value of the second point is less than or equal to the value of the reference signal, if yes, going to step 302 and determining that the induction signal comprises a rising wave, else going to step 305; step 303, comparing the value of the second point with the value of the reference signal and determining whether the value of the second point is larger than or equal to the value of the reference signal, if yes, going to step 304 and determining that the induction signal comprises a falling wave, else going to step 305; and step 305, determining whether the first point is the last point on the induction signal, if yes, going to step 306 and determining the number of the pointing objects, else going to step 300. In one exemplary embodiment, the number of the pointing objects is determined according to a maximum number of rising waves or falling waves of the first induction signal or a maximum number of rising waves or falling waves of the second induction signal. In one exemplary embodiment, a first initial induction value and a second initial induction value may be predetermined. In the exemplary embodiment as illustrated in FIG. 4, the first initial induction value and the second initial induction value are less than the value of the reference signal. In another exemplary embodiment as illustrated in FIG. 5, the first initial induction value and the second initial induction value are larger than the value of the reference signal. A point where the first initial induction value

appears is preceding the first point of the detected induction signal and the last point of the detected signal is preceding a point where the second initial induction value appears. In this manner, the value of the first point in the detected induction signal may be compared with a predetermined first initial induction value. The last value of the detected signal may be compared with a predetermined second initial induction value and value of the reference signal. In one exemplary embodiment, if the number of the rising waves is not equal to that of the falling waves, the method goes to step 300 and determines the number of the pointing objects again.

FIG. 4 illustrates a diagram of a detected induction signal 400 and a reference signal 401 according to one exemplary embodiment of the present disclosure. In one embodiment in which a pointing object comes into contact with the touch screen at a touch point, the contact at that touch point may induce the induction signal 400. Accordingly, the number of rising waves or the number of falling waves may correspond to the number of the pointing objects that are in contact with the touch-sensitive screen. The rising waves may intersect with the reference signal at points A and C (referred to as "rising point"). The falling waves may intersect with the reference signal at points B and D (referred to as "dropping point"). Due to some unexpected noises, the induction signal may not be induced by a valid contact of a pointing object. To determine whether an induction signal is induced by a valid contact, the distance between a rising point and a subsequent dropping point may be measured and compared with a first predetermined threshold. If the distance is larger than the first predetermined threshold, the induction signal is determined to be induced by a valid touch. For example, the distance between the rising point A and its subsequent dropping point B may be measured and compared with the first predetermined threshold.

Different induction signal waves may be obtained due to different analyzing methods or processing methods. FIG. 5 illustrates an induction signal 500 induced by a contact with the touch-sensitive screen and a reference signal 501 according to one exemplary embodiment of the present disclosure. The method of determining a valid contact at a touch point and the number of touch points may be similar to that described above. To determine whether an induction signal is induced by a valid contact, the distance between one drop point and a subsequent rising point may be measured and compared to a predetermined threshold value. If the distance is larger than the predetermined threshold value, the induction signal is determined to be induced by a valid touch.

Touch points may be determined by measuring the attenuation of waves, such as ultrasonic waves, across the surface of the touch-sensitive screen. For instance, a detecting module may comprise a transmitting transducer and a receiving transducer. The transmitting transducer may be powered, convert a first electrical signal into an acoustic signal and emit the acoustic signal. The receiving transducer may receive the acoustic signal from the transmitting transducer, detect a change in the acoustic signal, and convert the acoustic signal into a second electrical signal. When a pointing object touches the touch screen, a part of the acoustic signal may be absorbed and the ultrasonic wave becomes a changed acoustic signal. The receiving transducer may convert the changed acoustic signal into the second electrical signal so as to generate one or more induction signals. When the pointing object touches the touch screen, coordinates of the touch point are then

determined. An attenuated induction signal 601 crossed by a reference signal 600 and two attenuation parts 602 and 603 are illustrated in FIG. 6. The rising waves intersect with the reference signal at points N and F. The falling waves intersect with the reference signal at points M and E. The number of rising waves or falling waves is two and the number of the pointing objects is determined to be two. However, the number of the pointing objects is not limited to two.

FIG. 7 illustrates a schematic diagram of a clockwise rotation gesture according to one exemplary embodiment of the present disclosure. Two pointing objects F1 and F2 perform a rotation gesture on a touch-sensitive screen, and the position information of the two pointing objects is obtained. Coordinates of the pointing object F1 are (x_a, y_a) and coordinates of the pointing object F2 are (x_b, y_b). According to the formula $D^2=(y_b - y_a)^2+(x_b - x_a)^2$, the distance between the pointing object F1 and the pointing object F2 may be calculated. That is, the relative position between the pointing object F1 and the pointing object F2 may be obtained. The relative positions between the two pointing objects at other time may also be obtained. If the relative positions between the two pointing objects are less than a second threshold, it is further be determined whether the two pointing objects perform a rotation gesture based on at least three adjacent positions of the pointing objects.

Referring to FIG. 8, a present equivalent coordinates of the pointing objects are (X_0, Y_0) and are marked as first equivalent coordinates. The preceding equivalent coordinates of the first equivalent coordinates are (X_1, Y_1) and are marked as second equivalent coordinates. The preceding equivalent coordinates of the second equivalent coordinates are (X_2, Y_2) and are marked as third equivalent coordinates. In one embodiment, the first, second and third equivalent coordinates are centroid coordinates of the pointing objects. In another embodiment, the first, second and third equivalent coordinates are location coordinates of one pointing object. A first slope K_1 of a first line defined by the first equivalent coordinates and the second equivalent coordinates and a second slope K_2 of a second line defined by the second equivalent coordinates and the third equivalent coordinates are calculated, where $K_1=(Y_0-Y_1)/(X_0- X_1)$, and $K_2=(Y_1-Y_2)/(X_1- X_2)$. A first angle θ_1 and a second angle θ_2 may be calculated through the arc-tangent functions: $\theta_1= \arctan[(Y_0-Y_1)/(X_0- X_1)]$; and $\theta_2= \arctan[(Y_1-Y_2)/(X_1- X_2)]$. When $X_0 = X_1$ and $Y_0 > Y_1$, θ_1 is 90 degrees. When $X_1 = X_2$ and $Y_1 > Y_2$, θ_2 is 90 degrees. When $X_0 = X_1$ and $Y_0 <Y_1$, θ_1 is -90 degrees. When $X_1 = X_2$ and $Y_1 <Y_2$, θ_2 is -90 degrees. The rotation angle θ of the pointing objects is $\theta_1-\theta_2$. When $\theta>0$, it means that the pointing objects perform a counterclockwise rotation gesture. When $\theta<0$, it means that the pointing objects perform a clockwise rotation gesture.

A flow chart of a method of identifying a rotation gesture is illustrated in FIG. 9. The method comprises: step 92, detecting one or more induction signals induced by one or more pointing objects; step 93, obtaining the number of the rising waves and/or the falling waves in the induction signal; step 94, determining the number of the pointing objects according to the number of the rising waves and/or the falling waves; step 95, if the number of the pointing objects is larger than one, going to step 96, else going to step 97; step 96, determining whether the pointing objects move, if yes, going to step 98, else going to step 97; step 97,

determining whether the pointing objects perform other gestures; and step 98, determining whether the pointing objects perform a rotation gesture.

Referring to FIG. 10, step 98 comprises: step 982, obtaining relative positions between the pointing objects, and comparing the relative positions with a second threshold and determining whether the relative positions are less the second threshold, if yes, going to step 983, else going to step 985; step 983, processing position information of the pointing objects and generating a control signal such as a rotation control signal; and step 984, executing a command such as a rotation command according to the control signal. In one embodiment, the second threshold is determined according to the sensitivity of the touch-sensitive screen.

The position information may be processed as follows and it may be determined whether the pointing objects perform a rotation gesture. In one embodiment, first equivalent coordinates, second equivalent coordinates and third equivalent coordinates of the pointing objects are obtained, in which the first equivalent coordinates are the present equivalent coordinates of the pointing objects, the second equivalent coordinates are the preceding equivalent coordinates of the first equivalent coordinates and the third equivalent coordinates are the preceding equivalent coordinates of the second equivalent coordinates; and it is determined whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture and a rotation rate of the clockwise rotation gesture or the counterclockwise rotation gesture is determined according to a difference between a first slope of a first line defined by the first equivalent coordinates and the second equivalent coordinates and a second slope of a second line defined by the second equivalent coordinates and the third equivalent coordinates. In another embodiment, it is determined whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture and a rotation rate of the clockwise rotation gesture or the counterclockwise rotation gesture is determined according to an angle between the first line defined by the first equivalent coordinates and the second equivalent coordinates and the second line defined by the second equivalent coordinates and the third equivalent coordinates.

Referring to FIG. 11, the method of identifying the rotation gesture according to one embodiment of the present disclosure comprises: step 112, obtaining first equivalent coordinates (X_0, Y_0) of the pointing objects, in which the first equivalent coordinates are the present equivalent coordinates of the pointing objects; step 113, obtaining second equivalent coordinates (X_1, Y_1) and third equivalent coordinates (X_2, Y_2) of the pointing objects, in which the second equivalent coordinates are the preceding equivalent coordinates of the first equivalent coordinates and the third equivalent coordinates are the preceding equivalent coordinates of the second equivalent coordinates; step 114, calculating a first slope K_1 of a first line defined by the first equivalent coordinates and the second equivalent coordinates; step 115, calculating a second slope K_2 of a second line defined by the second equivalent coordinates and the third equivalent coordinates; step 116, determining whether the first slope K_1 is equal to the second slope K_2, if yes, going to step 112, else determining whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture according to the following conditions:

1) when $X_0>X_1>X_2$, if $0<K_1<K_2$, $K_1<K_2<0$ or $K_2>0>K_1$, determining that the pointing objects perform a clockwise rotation gesture; when $X_0>X_1>X_2$, if $0<K_2<K_1$, $K_2<K_1<0$ or $K_2<0<K_1$, determining that the pointing objects perform a counterclockwise rotation gesture;

2) when $X_0<X_1<X_2$, if $0>K_2>K_1$, $K_2>K_1>0$ or $K_2>0>K_1$, determining that the pointing objects perform a clockwise rotation gesture; when $X_0<X_1<X_2$, if $K_1>K_2>0$, $0>K_1>K_2$ or $K_2<0<K_1$, determining that the pointing objects perform a counterclockwise rotation gesture;

3) when $X_0<X_1>X_2$ and $K_1>0>K_2$, or when $X_0>X_1<X_2$ and $K_2<0<K_1$, determining that the pointing objects perform a clockwise rotation gesture; when $X_0<X_1>X_2$ and $K_1<0<K_2$, or when $X_0>X_1<X_2$ or $K_2>0>K_1$, determining that the pointing objects perform a counterclockwise rotation gesture;

4) when $X_0=X_1$ or $X_1=X_2$, if $X_0<X_1$ and $Y_0<Y_1<Y_2$, $X_1>X_2$ and $Y_0<Y_1<Y_2$, $X_0>X_1$ and $Y_0>Y_1>Y_2$, or $X_1<X_2$ and $Y_0>Y_1>Y_2$, determining that the pointing objects perform a clockwise rotation gesture; when $X_0=X_1$ or $X_1=X_2$, if $X_0<X_1$ and $Y_0>Y_1>Y_2$, $X_1>X_2$ and $Y_0>Y_1>Y_2$, $X_0>X_1$ and $Y_0<Y_1<Y_2$, or $X_1<X_2$ and $Y_0<Y_1<Y_2$, determining that the pointing objects perform a counterclockwise rotation gesture; and

step 117, generating a control signal associated with the determined rotation gesture.

FIG. 12(a) illustrates a schematic diagram of a clockwise rotation gesture according to one exemplary embodiment of the present disclosure. FIG. 12(b) illustrates a schematic diagram of a counterclockwise rotation gesture according to one exemplary embodiment of the present disclosure. F1 and F2 are pointing objects. In one embodiment, the method further comprises step 116, determining a rotation rate according to the difference between the first slope K_1 and the second slope K_2.

Referring to FIG. 13, the method of identifying the rotation gesture according to one embodiment of the present disclosure comprises: step 132, obtaining first equivalent coordinates (X_0, Y_0) of the pointing objects, in which the first equivalent coordinates are the present equivalent coordinates of the pointing objects; step 133, obtaining second equivalent coordinates (X_1, Y_1) and third equivalent coordinates (X_2, Y_2) of the pointing objects, in which the second equivalent coordinates are the preceding equivalent coordinates of the first equivalent coordinates and the third equivalent coordinates are the preceding equivalent coordinates of the second equivalent coordinates; step 134, calculating a first slope K_1 of a first line defined by the first equivalent coordinates and the second equivalent coordinates; step 135, calculating a second slope K_2 of a second line defined by the second equivalent coordinates and the third equivalent coordinates; step 136, calculating a first angle θ_1 and a second angle θ_2 through the arc-tangent functions: $\theta_1= \arctan K_1$; and $\theta_2= \arctan K_2$, where when $X_0 = X_1$ and $Y_0 > Y_1$, θ_1 is 90 degrees; when $X_1 = X_2$ and $Y_1 > Y_2$, θ_2 is 90 degrees; when $X_0 = X_1$ and $Y_0 < Y_1$, θ_1 is -90 degrees; and when $X_1 = X_2$ and $Y_1 < Y_2$, θ_2 is -90 degrees; step 137, determining whether θ_1 is equal to θ_2, if yes, going to step 132, else determining whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture according to the following conditions:

1) when $\theta=\theta_1-\theta_2<0$, determining that the pointing objects perform a clockwise rotation gesture;

2) when $\theta=\theta_1-\theta_2>0$, determining that the pointing objects perform a counterclockwise rotation gesture; and

step 138, generating a control signal associated with the determined rotation gesture.

FIG. 14(a) illustrates a schematic diagram of a clockwise rotation gesture according to one exemplary embodiment of the present disclosure. FIG. 14(b) illustrates a schematic diagram of a counterclockwise rotation gesture according to one exemplary embodiment of the present disclosure. F1 and F2 are pointing objects. In one embodiment, the method further comprises step 137, determining a rotation rate according to the angle θ.

In some embodiments of the present disclosure, the first equivalent coordinates, the equivalent second coordinates and the third equivalent coordinates are the centroid coordinates of the pointing objects or the physical coordinates of one pointing object. In some embodiments of the present disclosure, the method executes a rotation command in response to the generated control signal. In one embodiment, the rotation command is rotating an icon to the right or left, or adjusting an audio parameter such as a volume.

The method of identifying a rotation gesture according to an embodiment of the present disclosure, may accurately determine the number of the objects according to the induction signals, and determine whether the objects perform a rotation gesture if the number of the object is more than one, so it may accurately detect a plurality of objects and identify the rotation gesture.

FIG. 15 illustrates a block diagram of a device 150 of identifying a rotation gesture according to one exemplary embodiment of the present disclosure ("exemplary" as used herein referring to "serving as an example, instance or illustration"). As explained below, the device 150 may be configured to determine a gesture and generate corresponding control signals based on coordinates of multi-touch points on a touch-sensitive screen. The device 150 may be configured to provide the control signals to a processing unit of a terminal application device to execute the gesture applied to the touch screen. The terminal application device may be any of a number of different processing devices including, for example, a laptop computer, a desktop computer, a server computer, or a portable electronic device such as a portable music player, a mobile telephone, a portable digital assistant (PDA), a tablet or the like. Generally, the terminal application device may include a processing unit, a memory, a user interface (e.g., display and/or user input interface) and/or one or more communication interfaces. The touch screen may be a resistive touch screen, a capacitive touch screen, an infrared touch screen, an optical imaging touch screen, an acoustic pulse touch screen, a surface acoustic touch screen or in any other forms.

As illustrated in FIG. 15, the device 150 may include a detecting module 151 configured to detect in at least one direction one or more induction signals induced by one or more pointing objects that come into contact with a touch-sensitive surface; a determination module 152 configured to determine a number of the pointing objects; a gesture determining module 153 configured to determine whether the pointing objects perform the rotation gesture; and a signal generation module 154 configured to generate a control signal associated with the determined rotation gesture. In some embodiment of the present disclosure, the device

150 may further comprise a processing unit configured to execute a rotation command in response to the generated control signal.

The detecting module 151 may be further configured to add a first initial induction value before an initial value of the induction signal, or add a second initial induction value after a last value of the induction signal. The detecting module 151 may include a transmitting transducer configure to emit an acoustic signal and a receiving transducer configured to receive the acoustic signal. For instance, a first electrical signal may be sent to the transmitting transducer. The transmitting transducer may be powered, convert the first electrical signal into the acoustic signal, and emit the acoustic signal. The receiving transducer may receive the acoustic signal, detect a change in the acoustic signal, and convert the acoustic signal into a second electrical signal. When a pointing object touches the touch screen, a part of the acoustic signal may be absorbed and the ultrasonic wave becomes a changed acoustic signal. The receiving transducer may convert the changed acoustic signal into the second electrical signal so as to generate one or more induction signals. When the pointing object touches the touch screen, coordinates of the touch point are then determined. The detecting module may be configured to detect a change in at least one of electrical current, capacitance, acoustic waves, electrostatic field, optical fields and infrared light.

The determination module 152 may include a comparing unit 1521 configured to compare a value of a first point and a value of a preceding point of the first point on each induction signal with a value of a reference signal to determine the number of rising waves or the number of falling waves; and a number determining unit 1522 configure to determine the number of the pointing objects that generate the induction signals according to the number of the rising wave or the number of the falling wave, as illustrated in FIG. 16. In one embodiment, the comparing unit 1521 is further configured to compare the value of the first point with the value of the reference signal; compare the value of the preceding point with the value of the reference signal; and determine that the induction signal comprises a rising wave if the value of the first point is larger than the value of the reference signal and the value of the preceding point is less than or equal to the value of the reference signal and determine that the induction signal comprises a falling wave if the value of the first point is less than the value of the reference signal and the value of the preceding point is larger than or equal to the value of the reference signal.

In one embodiment, the determination module 152 is configured to identify one or more rising points on the rising wave intercepted by the reference signal; identify one or more dropping points on the falling wave intercepted by the reference signal; and compare a distance between a rising point and a subsequent dropping point with a first predetermined threshold or compare a distance between a dropping point and a subsequent rising point with a first predetermined threshold to determine whether the detected induction signal is induced by a valid contact.

The gesture determining module 153 may include a distance determination unit 1531 configured to obtain coordinates of the pointing objects at different positions and obtain the relative positions between the

pointing objects; and a gesture determination unit 1532 configured to determine whether the pointing objects perform a rotation gesture based on at least three adjacent positions of the pointing objects.

In one embodiment, the distance determination unit 1531 may obtain first equivalent coordinates (X_0, Y_0) of the pointing objects, in which the first equivalent coordinates are the present equivalent coordinates of the pointing objects; and obtain second equivalent coordinates (X_1, Y_1) and third equivalent coordinates (X_2, Y_2) of the pointing objects, in which the second equivalent coordinates are the preceding equivalent coordinates of the first equivalent coordinates and the third equivalent coordinates are the preceding equivalent coordinates of the second equivalent coordinates. The gesture determination unit 1532 may calculate a first slope K_1 of a first line defined by the first equivalent coordinates and the second equivalent coordinates; and calculate a second slope K_2 of a second line defined by the second equivalent coordinates and the third equivalent coordinates. If the first slope K_1 is equal to the second slope K_2, the gesture determination unit 1532 calculates another K_1 and K_2. If the first slope K_1 is not equal to the second slope K_2, the gesture determination unit 1532 determines whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture according to the following conditions:

1) when $X_0>X_1>X_2$, if $0<K_1<K_2$, $K_1<K_2<0$ or $K_2>0>K_1$, determining that the pointing object perform a clockwise rotation gesture; when $X_0>X_1>X_2$, if $0<K_2<K_1$, $K_2<K_1<0$ or $K_2<0<K_1$, determining that the pointing object perform a counterclockwise rotation gesture;

2) when $X_0<X_1<X_2$, if $0>K_2>K_1$, $K_2>K_1>0$ or $K_2>0>K_1$, determining that the pointing objects perform a clockwise rotation gesture; when $X_0<X_1<X_2$, if $K_1>K_2>0$, $0>K_1>K_2$ or $K_2<0<K_1$, determining that the pointing objects perform a counterclockwise rotation gesture;

3) when $X_0<X_1>X_2$ and $K_1>0>K_2$, or when $X_0>X_1<X_2$ and $K_2<0<K_1$, determining that the pointing objects perform a clockwise rotation gesture; when $X_0<X_1>X_2$ and $K_1<0<K_2$, or when $X_0>X_1<X_2$ or $K_2>0>K_1$, determining that the pointing objects perform a counterclockwise rotation gesture; and

4) when $X_0=X_1$ or $X_1=X_2$, if $X_0<X_1$ and $Y_0<Y_1<Y_2$, $X_1>X_2$ and $Y_0<Y_1<Y_2$, $X_0>X_1$ and $Y_0>Y_1>Y_2$, or $X_1<X_2$ and $Y_0>Y_1>Y_2$, determining that the pointing objects perform a clockwise rotation gesture; when $X_0=X_1$ or $X_1=X_2$, if $X_0<X_1$ and $Y_0>Y_1>Y_2$, $X_1>X_2$ and $Y_0>Y_1>Y_2$, $X_0>X_1$ and $Y_0<Y_1<Y_2$, or $X_1<X_2$ and $Y_0<Y_1<Y_2$, determining that the pointing objects perform a counterclockwise rotation gesture.

The gesture determination unit 1532 may further calculate a first angle θ_1 and a second angle θ_2 through the arctangent functions: θ_1= arctanK_1; and θ_2= arctanK_2, where when $X_0 = X_1$ and $Y_0 > Y_1$, θ_1 is 90 degrees; when $X_1 = X_2$ and $Y_1 > Y_2$, θ_2 is 90 degrees; when $X_0 = X_1$ and $Y_0 < Y_1$, θ_1 is -90 degrees; and when $X_1 = X_2$ and $Y_1 < Y_2$, θ_2 is -90 degrees. If $\theta_1=\theta_2$, the gesture determination unit 1532 calculates another θ_1 and θ_2. If $\theta_1 \neq \theta_2$, the gesture determination unit 1532 determines whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture according to the following conditions:

1) when $\theta=\theta_1-\theta_2<0$, determining that the pointing objects perform a clockwise rotation gesture; and

2) when $\theta=\theta_1-\theta_2>0$, determining that the pointing objects perform a counterclockwise rotation gesture.

FIG. 18 illustrates a schematic diagram of a communication between a device of identifying a rotation gesture and a terminal according to one exemplary embodiment of the present disclosure. The terminal may be a touch pad, a touch screen, a PDA (personal digital assistant system), an ATM (automatic teller machine), a GPS (global positioning system), etc.

As described herein, the processing unit 155 is implemented in hardware, alone or in combination with software or firmware. Similarly, the detecting module 151, the determination module 152, the gesture determination module 153 and the signal generation module 154 may each be implemented in hardware, software or firmware, or some combination of hardware, software and/or firmware. As hardware, the respective components may be embodied in a number of different manners, such as one or more CPUs (central processing units), microprocessors, coprocessors, controllers and/or various other hardware devices including integrated circuits such as ASICs (application specification integrated circuits), FPGAs (field programmable gate arrays) or the like. As will be appreciated, the hardware may include or otherwise be configured to communicate with a memory, such as a volatile memory and/or a non-volatile memory, which may store data received or calculated by the hardware, and may also store one or more software or firmware applications, instructions or the like for the hardware to perform functions associated with operation of the device in accordance with exemplary embodiments of the present disclosure.

The device of identifying a rotation gesture according to an embodiment of the present disclosure, may accurately determine the number of the objects according to the induction signals, and determine whether the objects perform a rotation gesture if the number of the object is more than one, so it may accurately detect a plurality of objects and identify the rotation gesture.

It will be understood that each block or step of the flowcharts, and combinations of blocks in the flowcharts, can be implemented by computer program instructions. These computer program instructions may be loaded onto a computer or other programmable apparatus to produce a machine, such that the instructions which execute on the computer or other programmable apparatus create means for implementing the functions specified in the block(s) or step(s) of the flowcharts. These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the function specified in the block(s) or step(s) of the flowcharts. The computer program instructions may also be loaded onto a computer or other programmable apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the block(s) or step(s) of the flowcharts.

Accordingly, blocks or steps of the flowcharts support combinations of means for performing the specified functions, combinations of steps for performing the specified functions and program instruction means for performing the specified functions. It will also be understood that each block or step of the

flowcharts, and combinations of blocks or steps in the flowcharts, can be implemented by special purpose hardware-based computer systems which perform the specified functions or steps, or combinations of special purpose hardware and computer instructions. Also, it will be understood by those skilled in the art that for the purpose of clear explanation, the method of the disclosure is described with reference to the device; however, the method may not rely on the specific device of the disclosure and the device may not need to be used in the specific method of the disclosure.

It will be appreciated by those skilled in the art that changes could be made to the examples described above without departing from the broad inventive concept. It is understood, therefore, that this disclosure is not limited to the particular examples disclosed, but it is intended to cover modifications within the spirit and scope of the present disclosure as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A method of identifying a rotation gesture, comprising:

detecting in at least one direction one or more induction signals induced by one or more pointing objects that come into contact with a touch-sensitive surface;

determining a number of the pointing object;

determining whether the pointing objects perform the rotation gesture if the number of the pointing object is more than one; and

generating a control signal associated with the rotation gesture if the pointing objects perform the rotation gesture.

2. The method of claim 1, wherein determining a number of pointing objects comprises:

comparing a value of a first point and a value of a preceding point of the first point on each induction signal with a value of a reference signal to determine whether the induction signal comprises a rising wave or a falling wave; and

determining a number of rising waves and/or falling waves to determine the number of pointing objects.

3. The method of claim 2, wherein comparing a value of a first point and a value of a preceding point of the first point on each induction signal with a value of a reference signal to determine a rising wave or a falling wave comprises:

comparing the value of the first point with the value of the reference signal; comparing the value of the preceding point with the value of the reference signal; and determining that the induction signal comprises a rising wave if the value of the first point is larger than the value of the reference signal and the value of the preceding point is less than or equal to the value of the reference signal and determining that the induction signal comprises a falling wave if the value of the first point is less than the value of the reference signal and the value of the preceding point is larger than or equal to the value of the reference signal.

4. The method of claim 3, further comprising:

identifying one or more rising points on the rising wave intercepted by the reference signal;

identifying one or more dropping points on the falling wave intercepted by the reference signal; and

comparing a distance between a rising point and a subsequent dropping point with a first predetermined threshold or comparing a distance between a dropping point and a subsequent rising point with a first predetermined threshold to determine whether the induction signal is induced by a valid contact.

5. The method of claim 4, wherein detecting in at least one direction one or more induction signals comprises:

detecting a first induction signal in a first direction; and

detecting a second induction signal in a second direction, in which the first direction is at an angle with the second direction.

6. The method of claim 4, wherein determining a number of rising waves and/or falling waves to determine the number of pointing objects comprises:

determining the number of the pointing objects according to a maximum number of rising waves or falling waves of the first induction signal or a maximum number of rising waves or falling waves of the second induction signal.

7. The method of claim 1, wherein the pointing objects come into contact with the touch-sensitive surface at respective touch points, and wherein determining whether the pointing objects perform the rotation gesture comprises:

obtaining relative positions between the pointing objects;

comparing the relative positions with a second threshold; and

when the relative positions are less than the second threshold, determining whether the pointing objects perform the rotation gesture based on at least three adjacent positions of the pointing objects.

8. The method of claim 7, determining whether the pointing objects perform the rotation gesture based on at least three adjacent positions of the pointing objects comprises:

obtaining first coordinates, second coordinates and third coordinates of the pointing objects, wherein the first coordinates are the present coordinates, the second coordinates are the preceding coordinates of the first coordinates and the third coordinates are the preceding coordinates of the second coordinates; and

determining whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture and determining a rotation rate of the clockwise rotation gesture or of the counterclockwise rotation gesture according to a difference between a first slope of a first line defined by the first coordinates and the second coordinates and a second slope of a second line defined by the second coordinates and the third coordinates.

9. The method of claim 7, determining whether the pointing objects perform the rotation gesture based on at least three adjacent positions of the pointing objects comprises:

obtaining first equivalent coordinates, second equivalent coordinates and third equivalent coordinates of the pointing objects, wherein the first equivalent coordinates are the present equivalent coordinates, the second equivalent coordinates are the preceding equivalent coordinates of the first coordinates and the third equivalent coordinates are the preceding equivalent coordinates of the second equivalent coordinates; and

determining whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture and a rotation rate of the clockwise rotation gesture or of the counterclockwise rotation gesture according to an angle between a first line defined by the first equivalent coordinates and the second equivalent coordinates and a second line defined by the second equivalent coordinates and the third equivalent coordinates.

10. A device of identifying a rotation gesture, comprising:

a detecting module, configured to detect in at least one direction one or more induction signals induced by one or more pointing objects that come into contact with a touch-sensitive surface;

a determination module, configured to determine a number of the pointing objects;

a gesture determining module, configured to determine whether the pointing objects perform the rotation

gesture; and

a signal generation module, configured to generate a control signal associated with the determined rotation gesture.

11. The device of claim 10, wherein the determination module comprises:

a comparing unit, configured to compare a value of a first point and a value of a preceding point of the first point on each induction signal with a value of a reference signal to determine a number of rising waves or a number of falling waves; and

a number determining unit, configure to determine the number of the pointing objects that generate the induction signals according to the number of the rising waves or the number of the falling waves.

12. The device of claim 11, wherein the comparing unit is configured to:

compare the value of the first point with the value of the reference signal;

compare the value of the preceding point with the value of the reference signal; and

determine that the induction signal comprises a rising wave if the value of the first point is larger than the value of the reference signal and the value of the preceding point is less than or equal to the value of the reference signal and determine that the induction signal comprises a falling wave if the value of the first point is less than the value of the reference signal and the value of the preceding point is larger than or equal to the value of the reference signal.

13. The device of claim 10, wherein the determination module is configured to:

identify one or more rising points on the rising wave intercepted by the reference signal;

identify one or more dropping points on the falling wave intercepted by the reference signal; and

compare a distance between a rising point and a subsequent dropping point with a first predetermined threshold or compare a distance between a dropping point and a subsequent rising point with a first predetermined threshold to determine whether the induction signal is induced by a valid contact.

14. The device of claim 10, wherein the detecting module is configured to detect a change in at least one of electrical current, capacitance, acoustic waves, electrostatic field, optical fields and infrared light.

15. The device of claim 10, wherein the detecting module comprises:

a transmitting transducer, configured to be powered, to convert a first electrical signal into an acoustic signal and to emit the acoustic signal; and

a receiving transducer, configured to receive the acoustic signal, to detect a change in the acoustic signal and to convert the changed acoustic signal into a second electrical signal so as to generate one or more induction signals.

16. The device of claim 10, wherein the gesture determining module comprises:

a distance determination unit, configured to obtain coordinates of the pointing objects at different positions and to obtain the relative positions between the pointing objects; and

a gesture determination unit, configured to determine whether the pointing objects perform a rotation gesture based on at least three adjacent positions of the pointing objects.

17. The device of claim 16, wherein the gesture determination unit is configured to:

obtain first equivalent coordinates, second equivalent coordinates and third equivalent coordinates of the pointing objects, wherein the first equivalent coordinates are the present equivalent coordinates, the second equivalent coordinates are the preceding equivalent coordinates of the first equivalent coordinates and the third equivalent coordinates are the preceding equivalent coordinates of the second equivalent coordinates; and

determine whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture and determine a rotation rate of the clockwise rotation gesture or of the counterclockwise rotation gesture according to a difference between a first slope of a first line defined by the first equivalent coordinates and the second equivalent coordinates and a second slope of a second line defined by the second equivalent coordinates and the third equivalent coordinates.

18. The device of claim 16, wherein the gesture determination unit is configured to:

obtain first equivalent coordinates, second equivalent coordinates and third equivalent coordinates of the pointing objects, wherein the first equivalent coordinates are the present equivalent coordinate, the second equivalent coordinates are the preceding equivalent coordinates of the first equivalent coordinates and the third equivalent coordinates are the preceding equivalent coordinates of the second equivalent coordinates; and

determine whether the pointing objects perform a clockwise rotation gesture or a counterclockwise rotation gesture and determine a rotation rate of the clockwise rotation gesture or of the counterclockwise rotation gesture according to an angle between a first line defined by the first equivalent coordinates and the second equivalent coordinates and a second line defined by the second equivalent coordinates and the third equivalent coordinates.

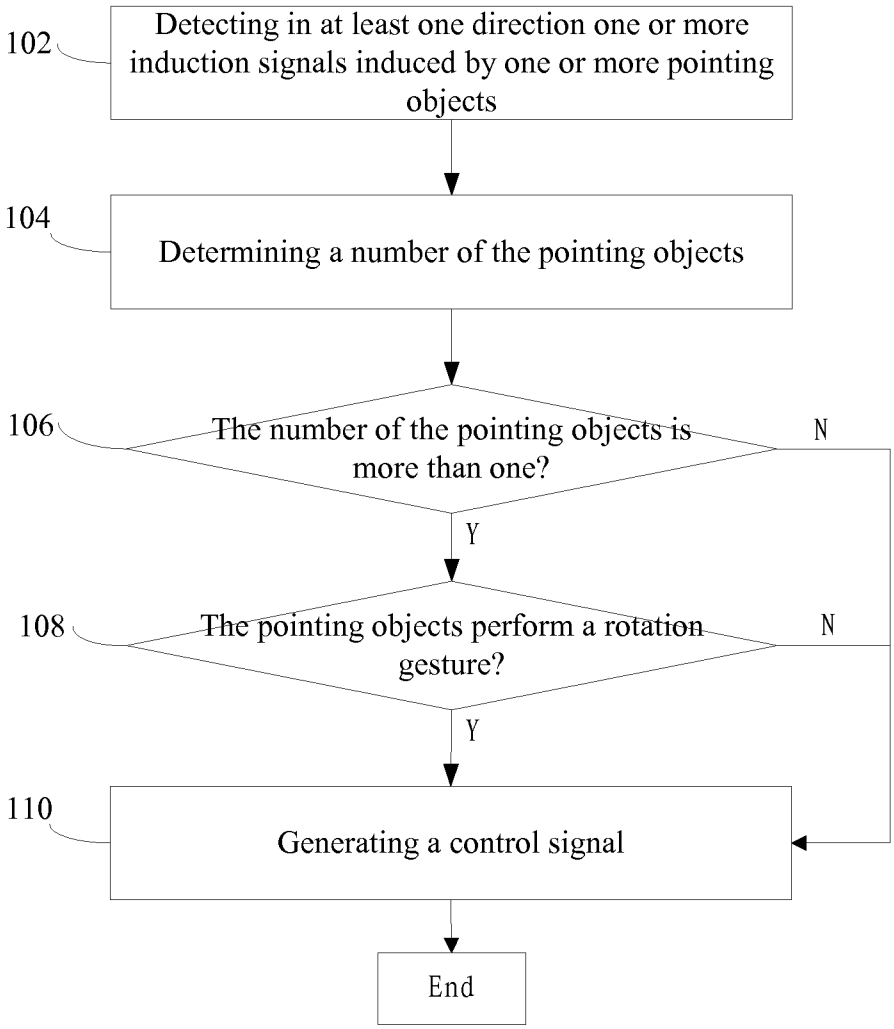

102
Detecting in at least one direction one or more induction signals induced by one or more pointing objects
104
Determining a number of the pointing objects
106
The number of the pointing objects is more than one?
N
Y
108
The pointing objects perform a rotation gesture?
N
Y
110
Generating a control signal
End

FIG. 1

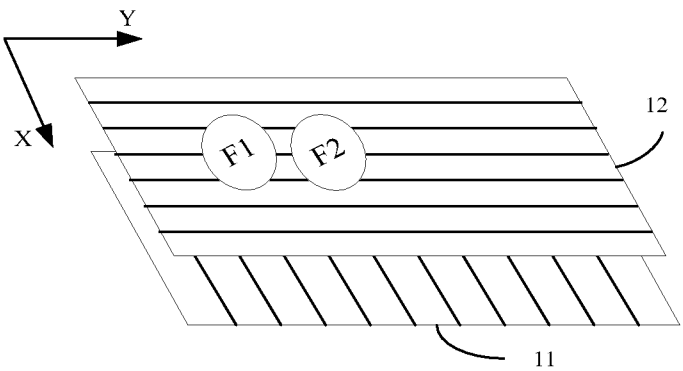

Y
X
F1
F2
12
11

FIG. 2

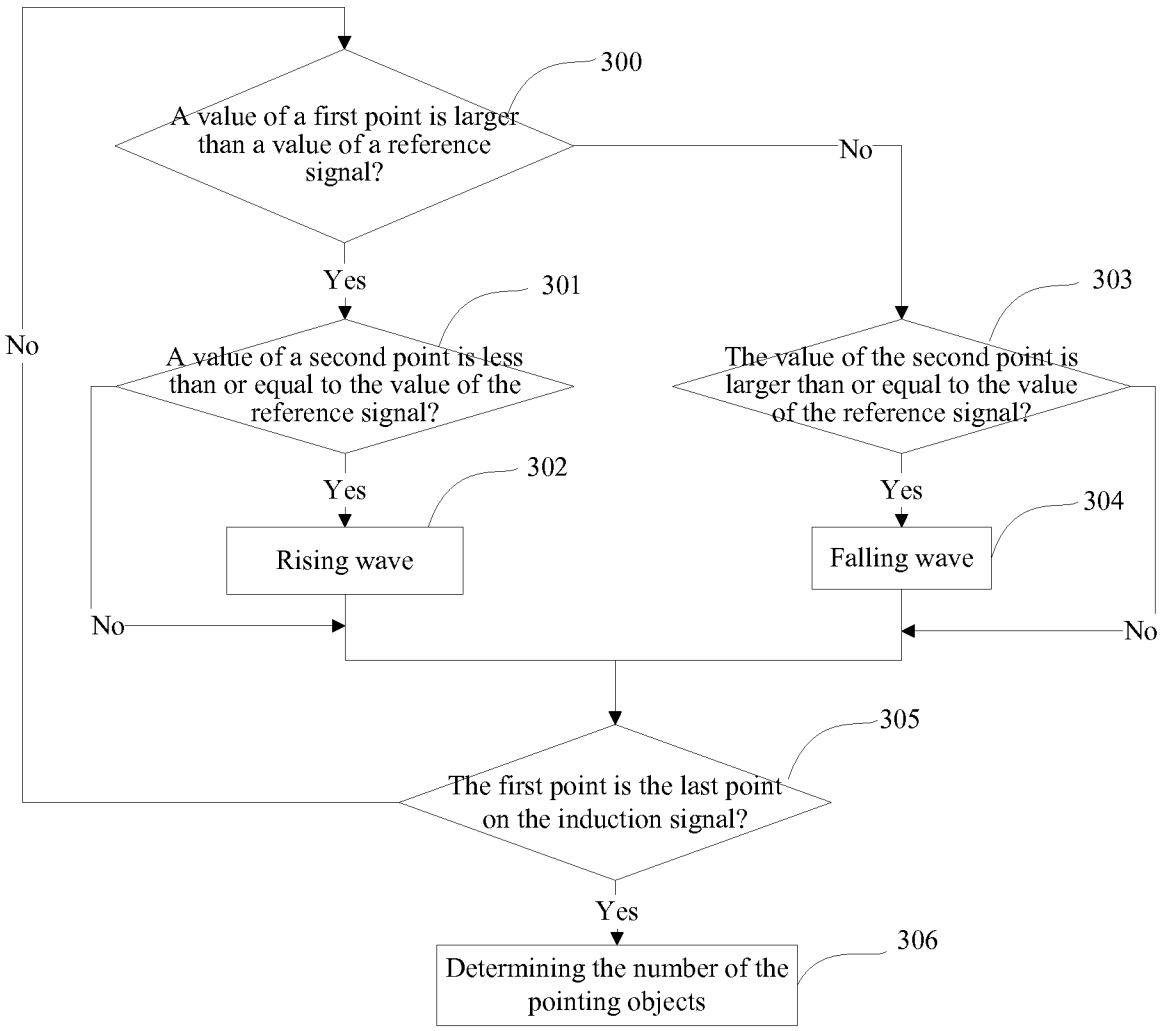

300
A value of a first point is larger than a value of a reference signal?
No
Yes
301
A value of a second point is less than or equal to the value of the reference signal?
No
303
The value of the second point is larger than or equal to the value of the reference signal?
Yes
302
Rising wave
Yes
304
Falling wave
No
No
305
The first point is the last point on the induction signal?
Yes
306
Determining the number of the pointing objects

FIG. 3

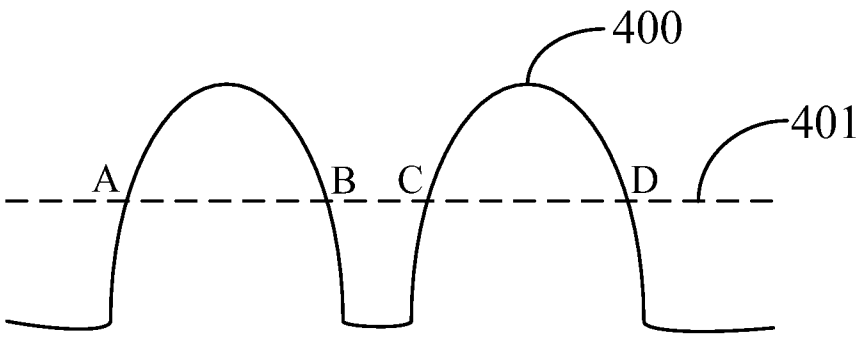

400
401
A
B
C
D

FIG. 4

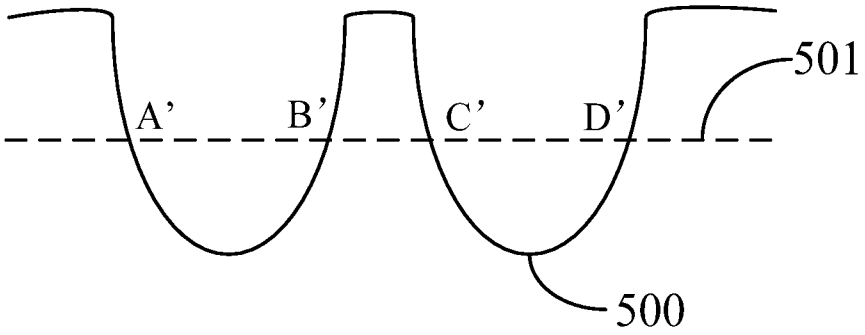


FIG. 5

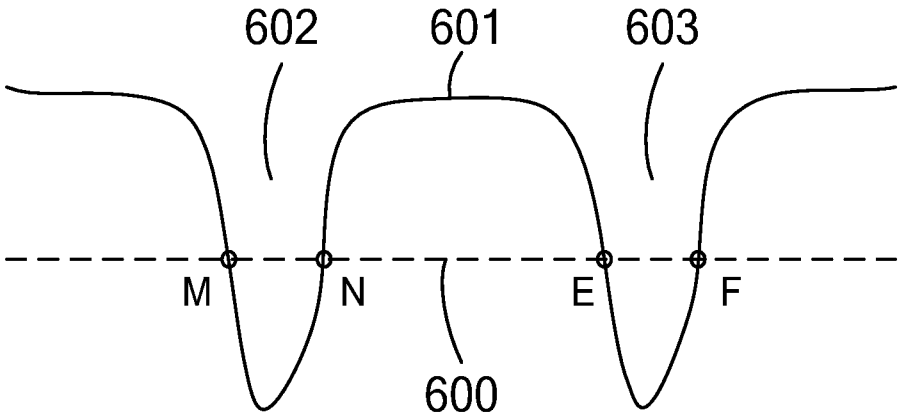


FIG. 6

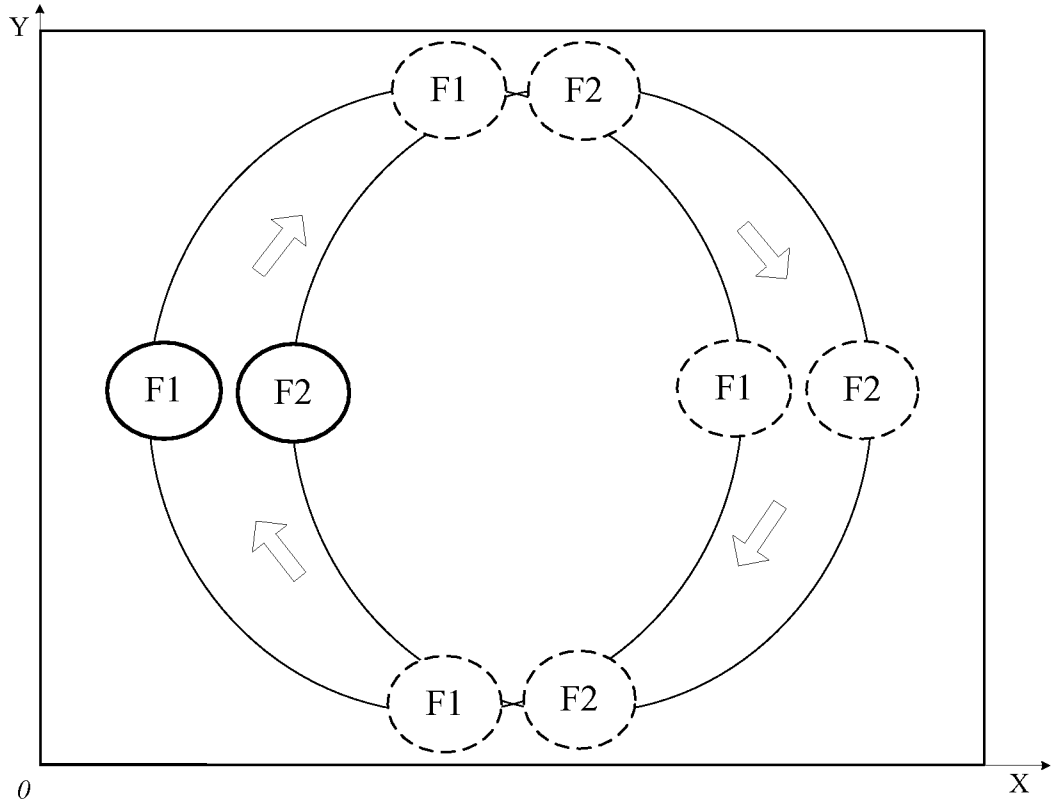


FIG. 7

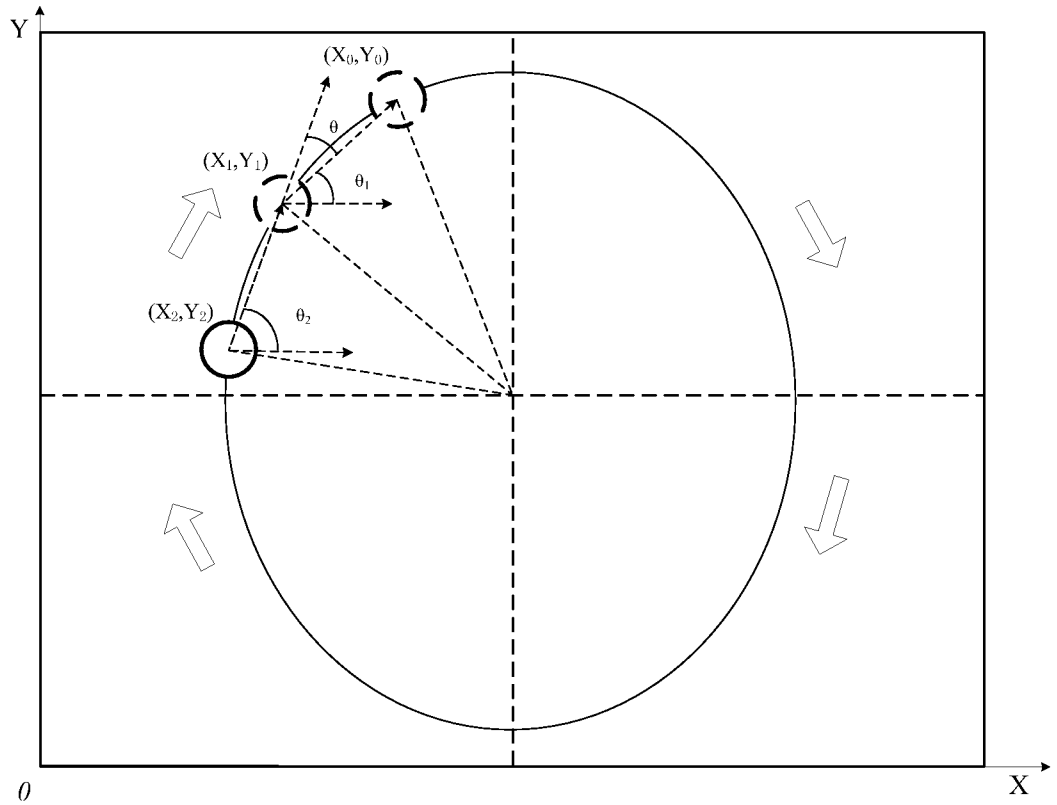


FIG. 8

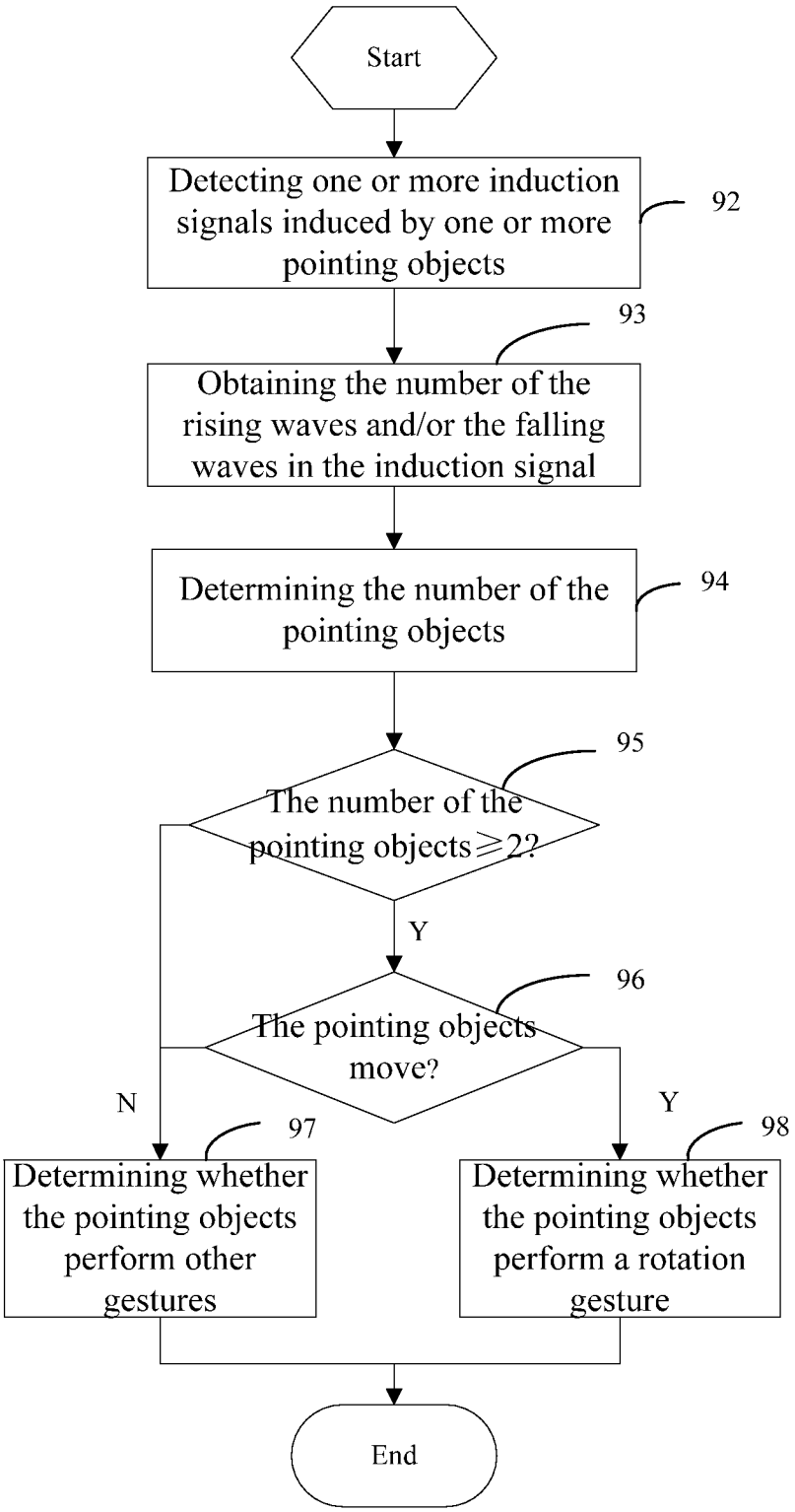

Start
Detecting one or more induction signals induced by one or more pointing objects
92
93
Obtaining the number of the rising waves and/or the falling waves in the induction signal
Determining the number of the pointing objects
94
95
The number of the pointing objects≥2?
Y
96
The pointing objects move?
N
Y
97
98
Determining whether the pointing objects perform other gestures
Determining whether the pointing objects perform a rotation gesture
End

FIG. 9

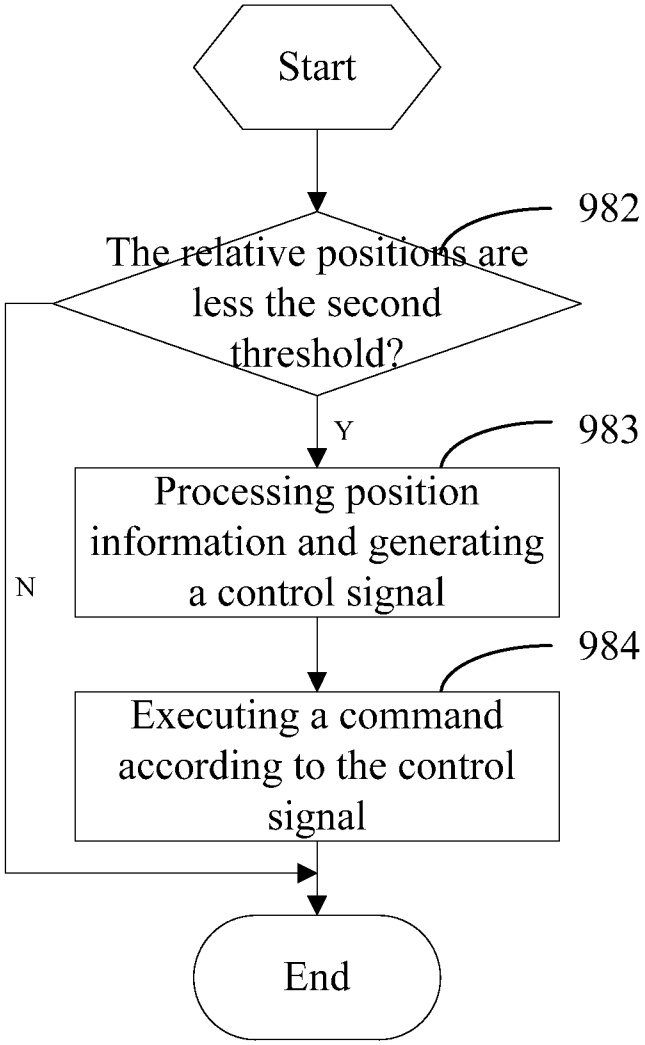

Start
982
The relative positions are less the second threshold?
Y
983
Processing position information and generating a control signal
N
984
Executing a command according to the control signal
End

FIG. 10

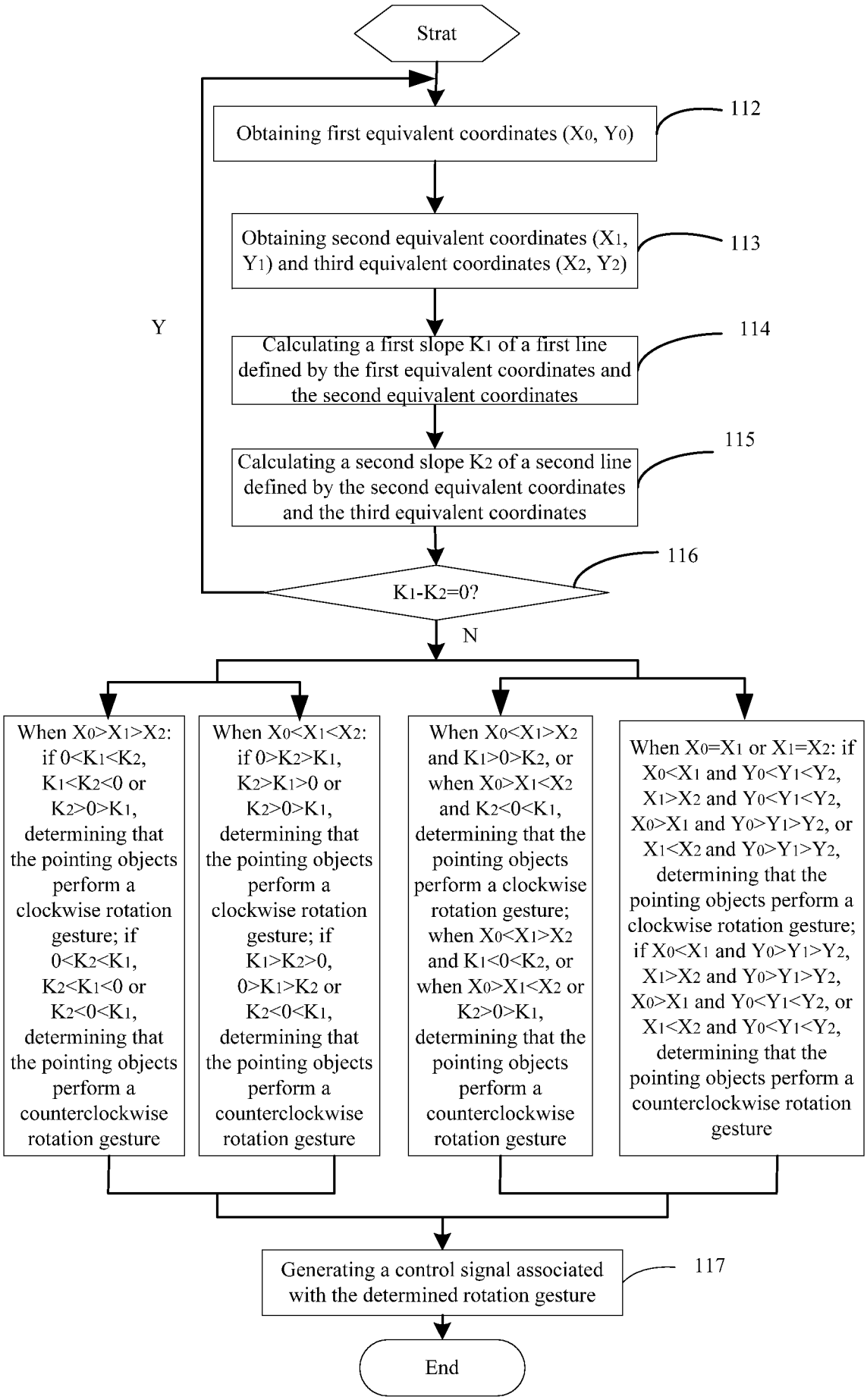

Strat
Obtaining first equivalent coordinates (X0, Y0)
112
Obtaining second equivalent coordinates (X1, Y1) and third equivalent coordinates (X2, Y2)
113
Y
Calculating a first slope K1 of a first line defined by the first equivalent coordinates and the second equivalent coordinates
114
Calculating a second slope K2 of a second line defined by the second equivalent coordinates and the third equivalent coordinates
115
K1-K2=0?
116
N
When X0>X1>X2: if 0<K1<K2, K1<K2<0 or K2>0>K1, determining that the pointing objects perform a clockwise rotation gesture; if 0<K2<K1, K2<K1<0 or K2<0<K1, determining that the pointing objects perform a counterclockwise rotation gesture
When X0<X1<X2: if 0>K2>K1, K2>K1>0 or K2>0>K1, determining that the pointing objects perform a clockwise rotation gesture; if K1>K2>0, 0>K1>K2 or K2<0<K1, determining that the pointing objects perform a counterclockwise rotation gesture
When X0<X1>X2 and K1>0>K2, or when X0>X1<X2 and K2<0<K1, determining that the pointing objects perform a clockwise rotation gesture; when X0<X1>X2 and K1<0<K2, or when X0>X1<X2 or K2>0>K1, determining that the pointing objects perform a counterclockwise rotation gesture
When X0=X1 or X1=X2: if X0<X1 and Y0<Y1<Y2, X1>X2 and Y0<Y1<Y2, X0>X1 and Y0>Y1>Y2, or X1<X2 and Y0>Y1>Y2, determining that the pointing objects perform a clockwise rotation gesture; if X0<X1 and Y0>Y1>Y2, X1>X2 and Y0>Y1>Y2, X0>X1 and Y0<Y1<Y2, or X1<X2 and Y0<Y1<Y2, determining that the pointing objects perform a counterclockwise rotation gesture
Generating a control signal associated with the determined rotation gesture
117
End

FIG. 11

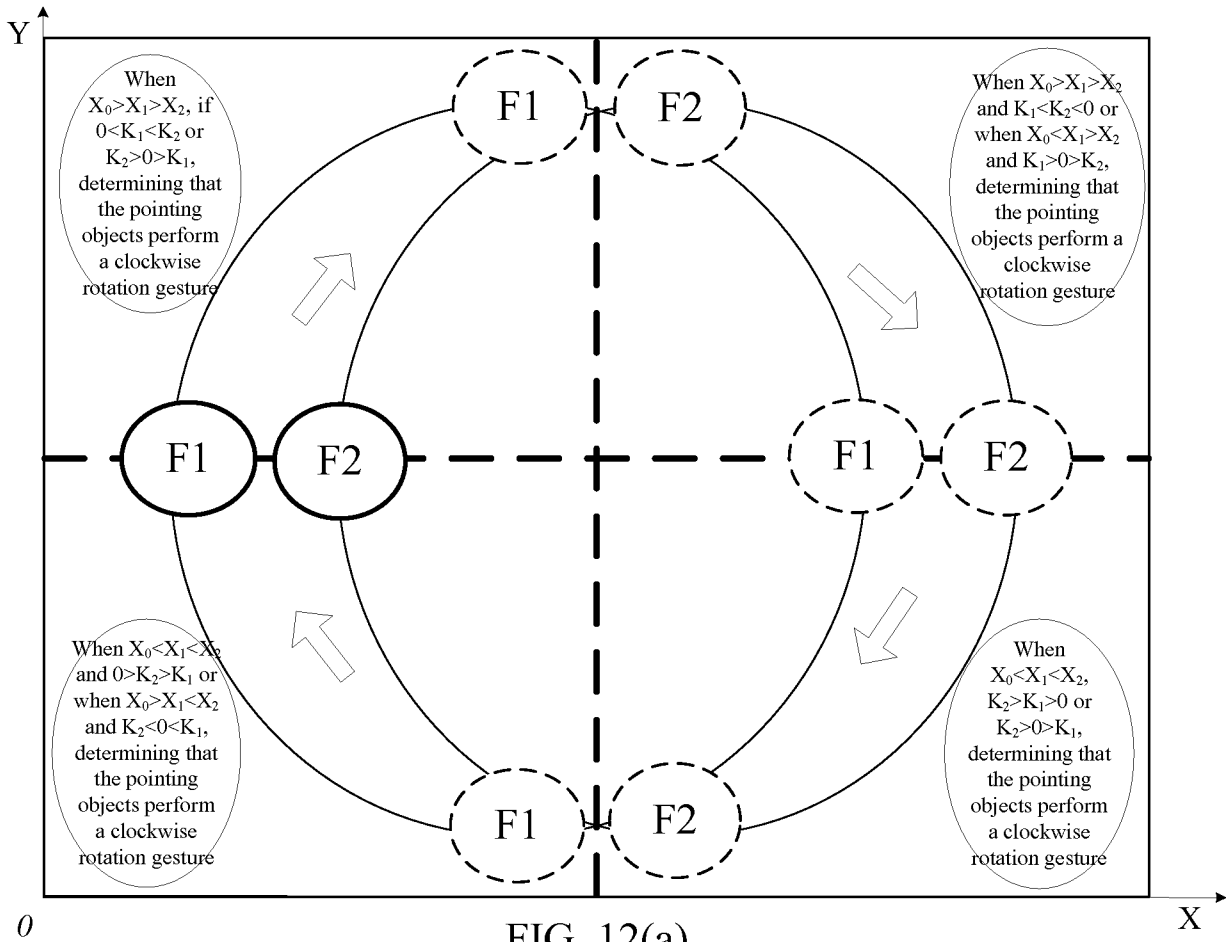


FIG. 12(a)

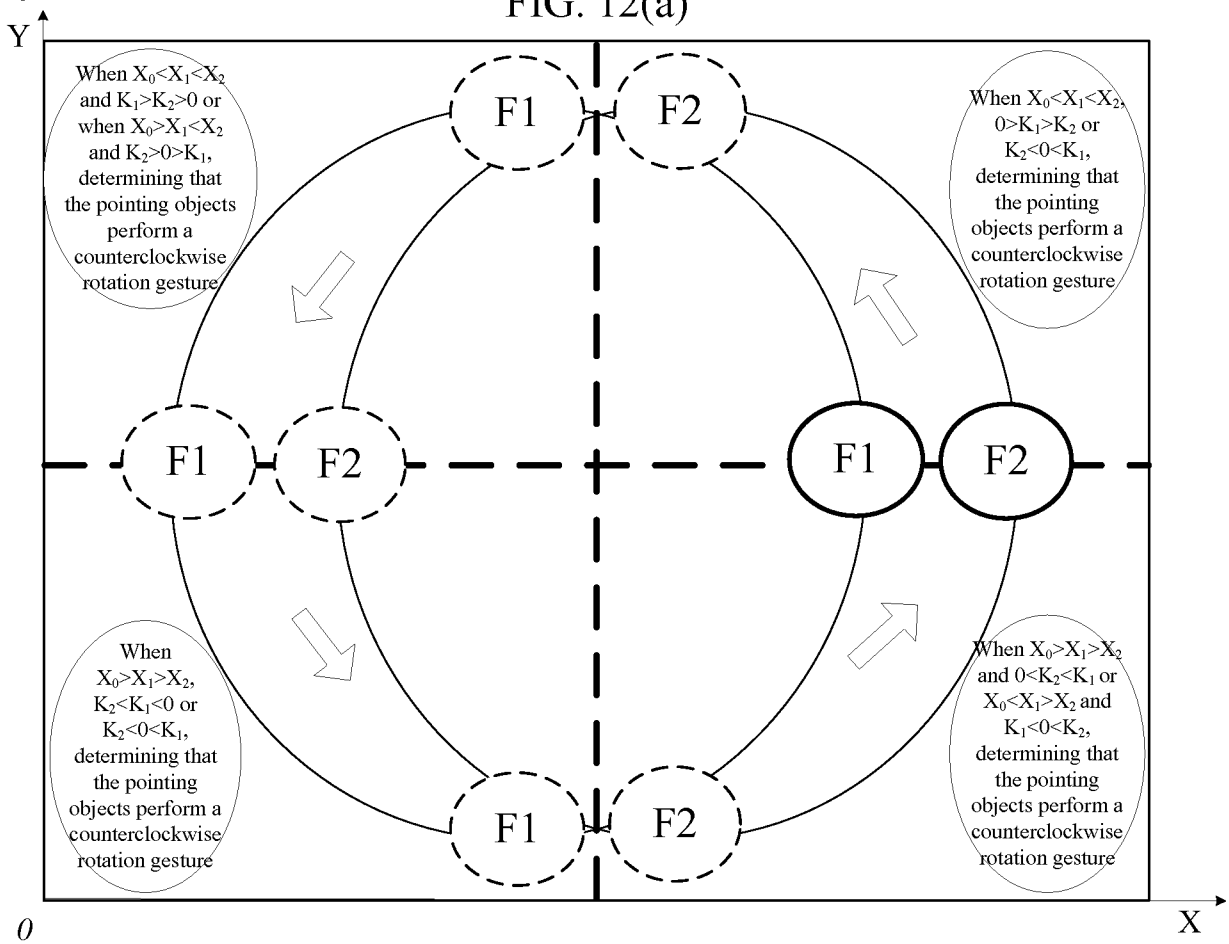


FIG. 12(b)

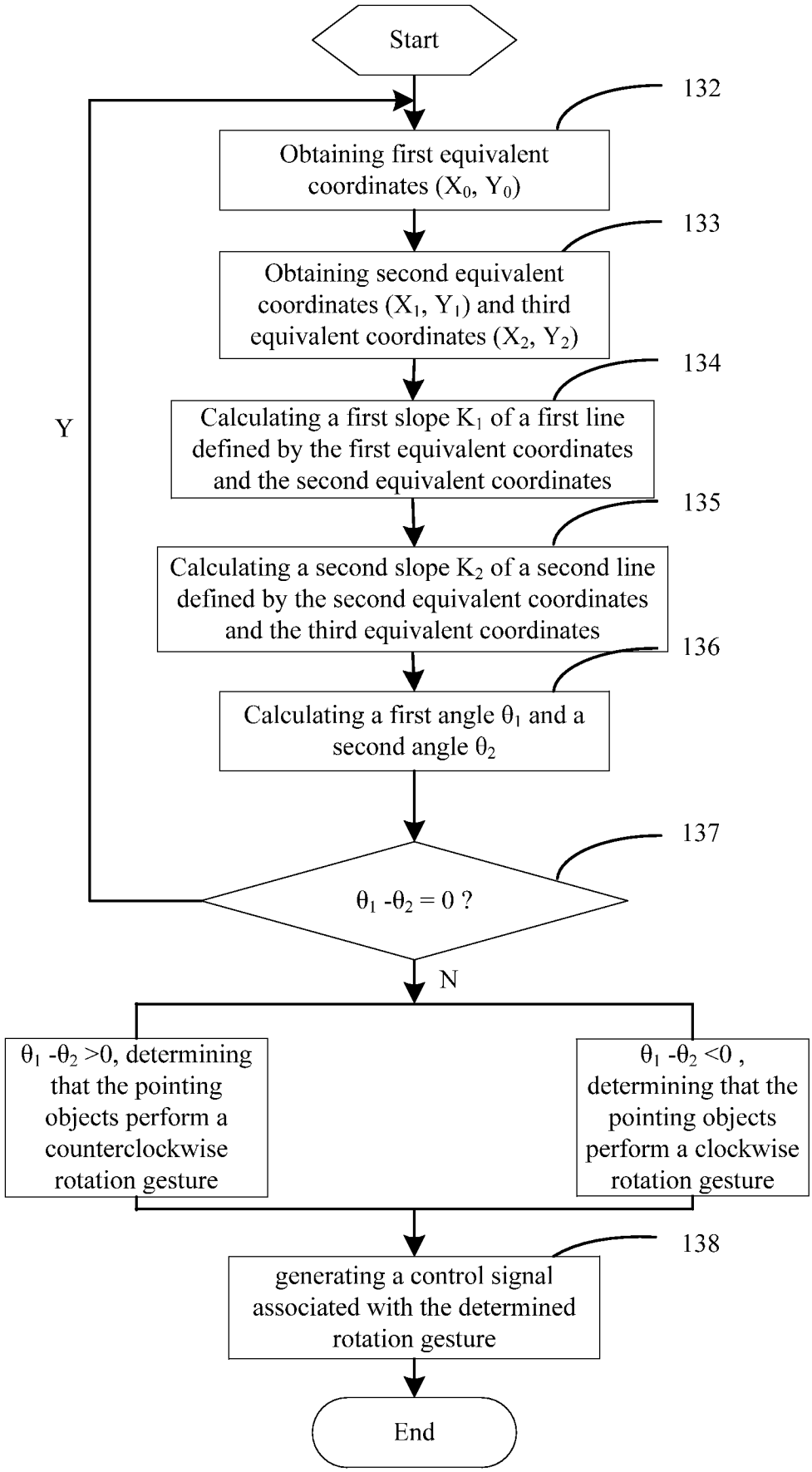

Start
132
Obtaining first equivalent coordinates (X_0, Y_0)
133
Obtaining second equivalent coordinates (X_1, Y_1) and third equivalent coordinates (X_2, Y_2)
134
Calculating a first slope K_1 of a first line defined by the first equivalent coordinates and the second equivalent coordinates
135
Calculating a second slope K_2 of a second line defined by the second equivalent coordinates and the third equivalent coordinates
136
Calculating a first angle θ_1 and a second angle θ_2
137
$\theta_1 - \theta_2 = 0$?
Y
N
$\theta_1 - \theta_2 > 0$, determining that the pointing objects perform a counterclockwise rotation gesture
$\theta_1 - \theta_2 < 0$, determining that the pointing objects perform a clockwise rotation gesture
138
generating a control signal associated with the determined rotation gesture
End

FIG. 13

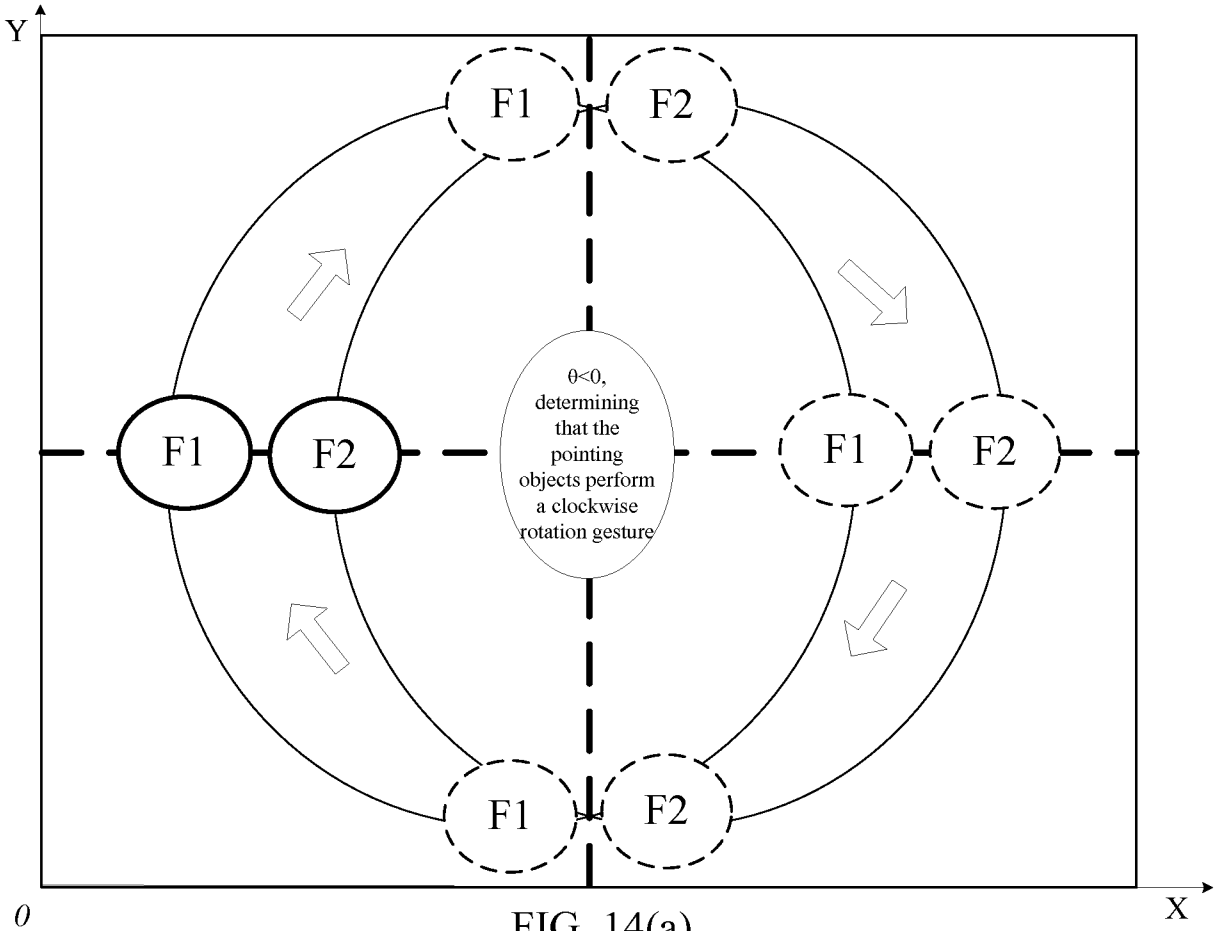


FIG. 14(a)

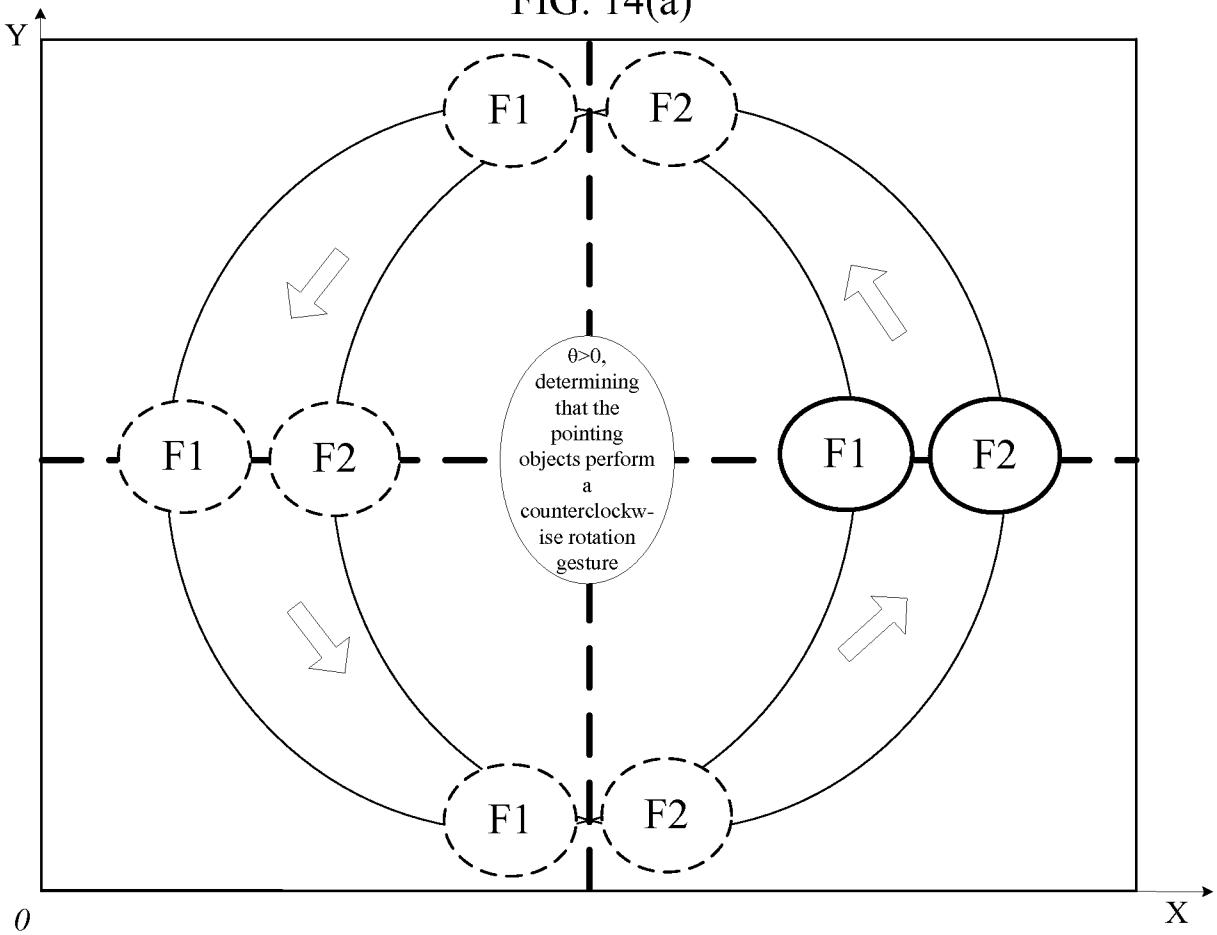


FIG. 14(b)

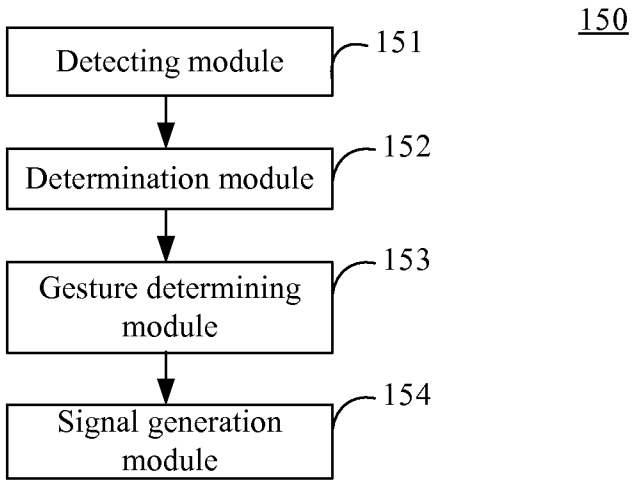


FIG. 15

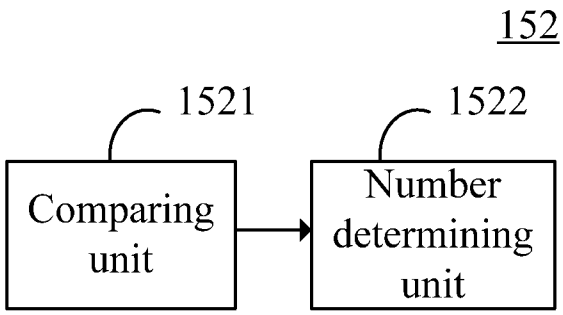


FIG. 16

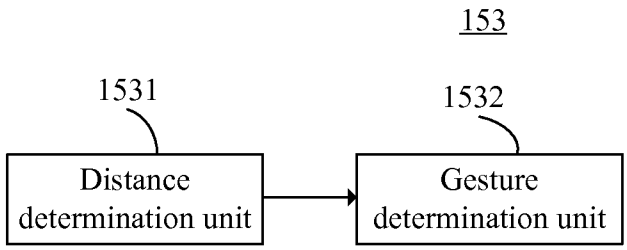


FIG. 17

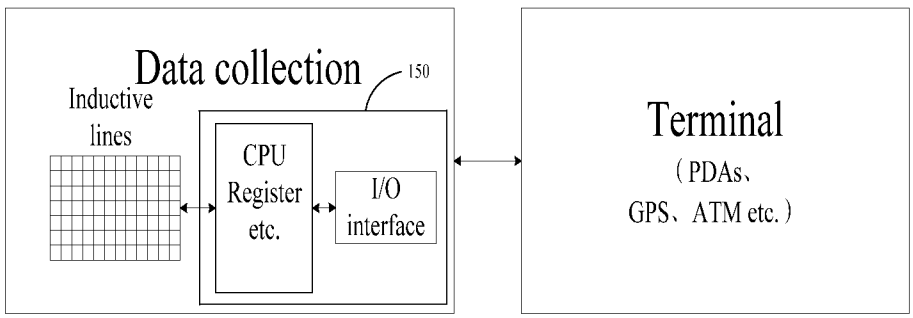


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/070458

A. CLASSIFICATION OF SUBJECT MATTER

G06F 3/041 (2006.01) 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)

IPC: G06F 3/-; G09G 5/-

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, CNTXT, USTXT, WPI, EPODOC: touch, rotat?, gesture, two fingers, coordinate?, clockwise, counterclockwise, distance, wave, summit, valley, angle, point

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN101840295A (FOCALTECH SYSTEMS CO., LTD.) 22 Sep. 2010 (22.09.2010) Description paragraphs 0002-0006, 0019, 0033-0046, 0060, figures 3, 4.1, 8a, 8b	1-6,10-15
Y		7-9,16-18
Y	US2009278812A1 (SYNAPTICS INC) 12 Nov. 2009 (12.11.2009) Description paragraph 0080, figures 11a,11b	7-9,16-18
A	CN101984396A (ZTE CORP) 09 Mar. 2011 (09.03.2011) The whole document	1-18
A	US5825352A (LOGITECH INC) 20 Oct. 1998 (20.10.1998) The whole document	1-18

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

* Special categories of cited documents:

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"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 Mar. 2012 (16.03.2012)	**03 May 2012 (03.05.2012)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer ZHENG, Jiaqing Telephone No. (86-10)62411684

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/070458

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN101840295A	22.09.2010	NONE	
US2009278812A1	12.11.2009	US2010177053A2	15.07.2010
CN101984396A	09.03.2011	NONE	
US5825352A	20.10.1998	NONE	