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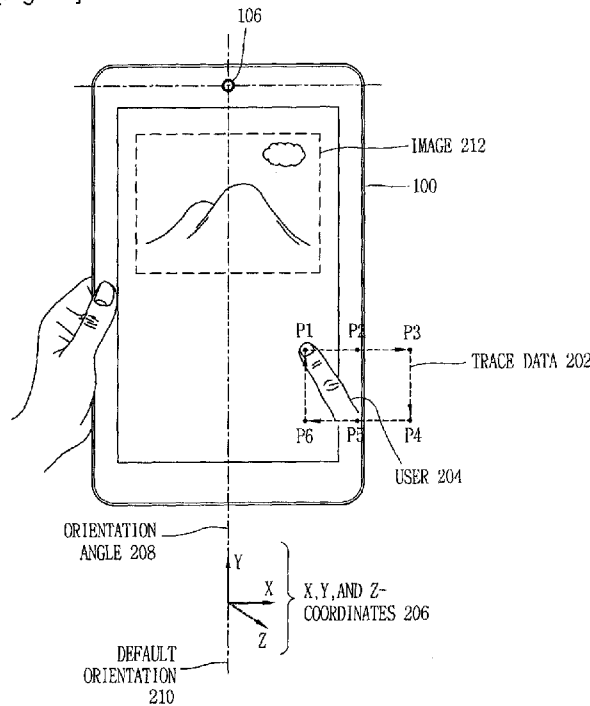
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(54) Title: GESTURE RECOGNITION AGNOSTIC TO DEVICE ORIENTATION

[Fig. 2a]



(57) Abstract: Systems, circuits, and devices for recognizing gestures are disclosed. A mobile device includes a housing, an orientation sensor, a camera implemented on the housing, a memory for storing a lookup table comprising multiple gestures and corresponding commands, and a controller coupled to the orientation sensor, the camera, and the memory. The controller is configured to generate trace data corresponding to a gesture captured by the camera, wherein x, y, and z coordinates of the trace data are applied according to an orientation of the housing during the gesture. The controller is also configured to determine an orientation angle of the housing detected by the orientation sensor. The controller is further configured to recognize the gesture through accessing the lookup table based on the trace data and the orientation angle of the housing.

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## Description

### Title of Invention: GESTURE RECOGNITION AGNOSTIC TO DEVICE ORIENTATION

#### Technical Field

- [1] Embodiments of the disclosure generally relate to the field of electronics, and more particularly to control systems, circuits, and devices.

#### Background Art

- [2] A mobile device is a pocket-sized computing device, typically having a display screen with touch input and/or a miniature keyboard. The input and output of the mobile device are often combined into a touch-screen interface. The mobile device includes many applications and includes a mobile computer, a mobile internet device, a personal digital assistant/enterprise digital assistant, a calculator, a handheld game console, a portable media player, a digital still camera, a digital video camera, a digital camcorder, a mobile phone, a pager, a personal navigation device, etc. Some of the applications of the mobile device include digitizing notes, sending and receiving invoices, asset management, recording signatures, managing parts, scanning barcodes, etc.
- [3] Gesture recognition is a technology which makes it possible for a device to interpret (human) gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Gesture recognition can be seen as a way for computers or machines to understand human body language, thus building a richer bridge between machines and humans than text-based user interfaces or even graphic-based user interfaces which still limit the majority of input to keyboard and mouse.

#### Disclosure of Invention

#### Solution to Problem

- [4] This summary briefly indicates the nature and substance of the invention. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims.
- [5] Systems, circuits, and devices for recognizing gestures are disclosed. In one aspect, a mobile device for recognizing a gesture includes a housing, an orientation sensor, a camera implemented on the housing, a memory for storing a lookup table comprising multiple gestures and corresponding commands, and a controller coupled to the orientation sensor, the camera, and the memory. The controller is configured to generate trace data corresponding to a gesture captured by the camera, where x, y, and z coordinates of the trace data are applied according to an orientation of the housing during

the gesture. The controller is also configured to determine an orientation angle of the housing detected by the orientation sensor. The controller is further configured to recognize the gesture through accessing the lookup table based on the trace data and the orientation angle of the housing.

[6] In another aspect, a mobile device for repositioning a cursor includes a housing, a display unit, an orientation sensor, a camera implemented on the housing, and a controller coupled to the display unit, the orientation sensor, and the camera. The controller is configured to generate a cursor on a unit portion of an image displayed on the display unit in response to a capture by the camera of a remote pointing object pointing to the unit portion on the image on the display unit, where the image is displayed on the display unit according to a first orientation. The controller is also configured to display the image on the display unit according to a second orientation when an orientation of the housing detected by the orientation sensor indicates a shift to the second orientation. The controller is further configured to identify coordinates of the unit portion of the image displayed according to the second orientation and display the cursor on the unit portion of the image based on the coordinates of the unit portion of the image displayed according to the second orientation.

[7] In yet another aspect, a mobile device for repositioning a cursor includes a housing, a display unit, an orientation sensor, a camera implemented on the housing, a controller coupled to the display unit, the orientation sensor, and the camera. The controller is configured to generate a cursor on a first position proximate to an image displayed on the display unit in response to a capture by the camera of a remote pointing object pointing to the first position on the display unit, where the image is displayed on the display unit according to a first orientation. The controller is also configured to measure distances between the first position and each of two or more unit portions on the image, and display the image on the display unit according to a second orientation when an orientation of the housing detected by the orientation sensor indicates a shift to the second orientation. The controller is further configured to identify coordinates of the two or more unit portions of the image displayed according to the second orientation and display the cursor on a second position proximate to the image based on the coordinates of the two or more unit portions of the image displayed according to the second orientation and the distances between the first position and each of the two or more unit portions.

[8] Other features of the embodiments will be apparent from the accompanying drawings and from the detailed description that follows.

### **Brief Description of Drawings**

[9] Example embodiments are illustrated by way of example and not limitation in the

figures of the accompanying drawings, in which like references indicate similar elements and in which:

- [10] FIG. 1 is an exemplary block diagram of a mobile device for recognizing a gesture and/or for repositioning a cursor upon a shift in the orientation of the mobile device, according to one embodiment.
- [11] FIGs. 2a and 2b illustrate an exemplary view of the mobile device of FIG. 1 in a first orientation for recognizing a gesture, according to one embodiment.
- [12] FIGs. 3a and 3b illustrate an exemplary view of the mobile device of FIG. 1 in a second orientation for recognizing a gesture, according to one embodiment.
- [13] FIG. 4 illustrates an exemplary view of the trace data in FIG. 2a captured by the mobile device of FIG. 1, according to one embodiment.
- [14] FIG. 5 illustrates an exemplary view of the mobile device of FIG. 1 in two different orientations displaying an image accordingly, according to one embodiment.
- [15] FIG. 6 illustrates an exemplary process of the mobile device in FIG. 1 for recognizing the gesture, according to one embodiment.
- [16] FIG. 7 illustrates another exemplary process of the mobile device in FIG. 1 for recognizing the gesture, according to one embodiment.
- [17] FIG. 8 illustrates a process flow chart of an exemplary process performed by the mobile device in FIG. 1 for recognizing a gesture, according to one embodiment.
- [18] FIGs. 9a-9d illustrate an exemplary view of the mobile device of FIG. 1 for repositioning a cursor in response to a shift in the orientation of the mobile device, according to one embodiment.
- [19] FIGs. 10a-10d illustrate an exemplary view of a mobile device in a different configuration than the mobile device of FIG. 1 for repositioning a cursor in response to a shift in the orientation of the mobile device, according to one embodiment.
- [20] FIG. 11 illustrates a process flow chart of an exemplary process performed by the mobile device in FIG. 1 for repositioning a cursor, according to one embodiment.
- [21] FIGs. 12a-12e illustrate another exemplary view of the mobile device of FIG. 1 for repositioning a cursor in response to a shift in the orientation of the mobile device, according to one embodiment.
- [22] FIG. 13 illustrates an exemplary view of the mobile device of FIG. 1 in different orientations repositioning a cursor in response to a shift in the orientation of the mobile device, according to one embodiment.
- [23] FIG. 14 illustrates an exemplary view of a cursor being repositioned on the display unit in response to a shift in the orientation of the mobile device in FIG. 1, according to one embodiment.
- [24] FIG. 15 illustrates a process flow chart of another exemplary process performed by the mobile device in FIG. 1 for repositioning a cursor, according to one embodiment.

[25] FIG. 16 illustrates an exemplary view of the mobile device of FIG. 1 in different orientations maintaining the absolute position of a cursor in response to a shift in the orientation of the mobile device, according to one embodiment.

[26] Other features of the present embodiments will be apparent from the accompanying drawings and from the detailed description that follows. Further, the drawings described herein are for illustration purposes only and are not intended to limit the scope of the present disclosure in any way.

### **Mode for the Invention**

[27] A method, device and/or system are disclosed that recognize a gesture agnostic to device orientation. According to embodiments of the present disclosure, the mobile device (e.g., a tablet PC, a smart phone, etc.) may interpret a gesture applied to the mobile device in the same manner regardless of the orientation of the mobile terminal (e.g., a portrait orientation or a landscape orientation) during the gesture. As the conventional mobile device can be tilted and display an image in multiple (e.g., two) different orientations, the same gesture applied to the conventional mobile device may be interpreted differently depending on its orientation during the gesture. That is, the gesture applied to the mobile in the portrait orientation (e.g., the upright position) may be interpreted different from the same gesture applied to the mobile device in the landscape position (e.g., inclined ninety (90) degrees to the right from the upright position).

[28] In order to solve this problem, according to various embodiments of the present disclosure, the mobile device of the present disclosure is configured to generate trace data by capturing a gesture with a camera of the mobile device, determine an orientation angle or tilt angle of the mobile device using an orientation sensor of the mobile device, and recognize the gesture based on the trace data and the orientation angle, where the trace data and orientation angle may be compared with a set of reference data (e.g., shapes of candidate gestures, orientation angles, etc.) stored in a memory of the mobile device.

[29] Further, as the mobile device may be tilted freely, a cursor based on a gesture (e.g., a finger pointing to the cursor position) may be lost when the mobile device shifts its orientation. This is especially so since the user may not be able to accurately reposition the cursor as the image on the mobile device is displayed in the shifted orientation (e.g., from the portrait orientation to the landscape orientation). In order to solve this problem, according to various embodiments of this disclosure, the mobile device is configured to generate a cursor on a particular position of an image displayed on the display unit when the camera captures a remote pointing object (e.g., a finger) pointing to the position on the image in a first orientation (e.g., the portrait orientation).

- [30] The mobile device then displays the image on the display unit according to a second orientation when the mobile device shifts to the second orientation (e.g., the landscape orientation). As the shift in the orientation of the mobile device is carried out, the particular position of the image may be flagged or tagged with metadata indicating the position of the cursor relative to the area of the image displayed on the mobile device in the first orientation. The mobile device further identifies coordinates of the unit portion of the image displayed according to the second orientation, and display the cursor on the unit portion of the image based on the coordinates of the unit portion of the image displayed according to the second orientation.
- [31] Reference will now be made in detail to the embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the embodiments, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the disclosure is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention. Furthermore, in the detailed description, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. However, it will be obvious to one of ordinary skill in the art that the present disclosure may be practiced without these specific details. In other instances, well known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the present invention.
- [32] FIG. 1 is an exemplary block diagram of a mobile device 100 for recognizing a gesture and/or for repositioning a cursor upon an orientation shift, according to one embodiment. In FIG. 1, the mobile device 100 comprises a housing 102, an orientation sensor 104, a camera 106 implemented on the housing 102, a memory 108 for storing a lookup table comprising multiple gestures and corresponding commands, and a controller 110 coupled to the orientation sensor 104, the camera 106, and the memory 108. In one example implementation, the orientation sensor 104 is an accelerometer, a gyroscope, or a magnetometer. In one example implementation, the camera 106 is a depth-aware camera, a stereo camera, or a digital camera.
- [33] In one embodiment, which will be illustrated in FIG. 2a through FIG. 8, the controller 110 is configured to recognize a gesture by tracking a target object, such as a hand, a finger, a stylus, etc., moving in a vicinity of the mobile device 100 using the camera 106 regardless of the orientation of the mobile device 100.
- [34] In one embodiment, which will be illustrated in FIG. 9a through FIG. 11, the controller 110 is configured to reposition a cursor on the same portion of an image when the image is displayed in a different configuration or orientation according to a shift in the orientation of the mobile device 100.
- [35] In one embodiment, which will be illustrated in FIG. 12a through FIG. 15, the

controller 110 is configured to reposition a cursor on the same position with respect to an image in a vicinity of the cursor when the image is displayed in a different configuration or orientation according to a shift in the orientation of the mobile device 100.

- [36] In one embodiment, which will be illustrated in FIG. 16, the controller 110 is configured to maintain a cursor at the same position on the display unit irrespective of a shift in the orientation of the mobile device 100.
- [37] FIGs. 2a and 2b illustrate an exemplary view of the mobile device 100 of FIG. 1 in a first orientation for recognizing a gesture, according to one embodiment. In FIG. 2a, the controller 110 of FIG. 1 is configured to generate trace data 202 which correspond to a gesture forming a rectangle when the gesture is captured by the camera 106 as a user 204 of the mobile device 100 moves the user's finger to form the rectangle. During the generation of the trace data 202, x, y, and z coordinates 206 of the trace data 202 are applied according to an orientation of the housing 102 (not shown) during the gesture. In FIG. 2a, the y-coordinate of the trace data 202 is formed along the line crossing the camera 106 in lengthwise direction (e.g., the North-South direction) of the mobile device 100. It is appreciated that although six data points P1 through P6 are presented as the trace data 202, there could be more or less than the six data points forming the trace data 202.
- [38] Then, the controller 110 is configured to determine an orientation angle 208 of the housing 102 detected by the orientation sensor 104 (not shown), where the orientation angle 208 is obtained by measuring the angle between the line crossing the camera 106 in lengthwise direction of the housing 102 in the orientation taken by the mobile device 100 during the gesture and a straight line crossing the camera 106 in lengthwise direction of the housing 202 in a default orientation 210 (e.g., the portrait orientation where the camera 106 is located at the top center of the mobile device 100). Thus, in FIG. 2a, the orientation angle 208 of zero (0) degree is obtained. Then, the controller 110 is configured to recognize the gesture through accessing a lookup table stored in the memory 108 (not shown) of the mobile device 100 based on the trace data 202 and the orientation angle 208 of the housing 102.
- [39] FIG. 2b illustrates a table 250 listing exemplary coordinates of the trace data 202 in FIG. 2a. In the table 250, x-coordinate 252 and y-coordinate 254 of P1, P2, P3, P4, P5, and P6 are listed as (8, 5), (11, 5), (13, 5), (13, 3), (11, 3), and (8, 3), respectively, thus forming a shape of a rectangle with its length extending along the widthwise direction of the mobile device 100 and its width extending along the lengthwise direction of the mobile device 100, and being interpreted by the controller 110 as the gesture of forming a rectangle with the length of the rectangle extending along the x-axis of the x, y and z-coordinates 206.

- [40] FIGs. 3a and 3b illustrate an exemplary view of the mobile device 100 of FIG. 1 in a second orientation for recognizing a gesture, according to one embodiment. In FIG. 3a, the controller 110 of FIG. 1 is configured to generate trace data 302 which correspond to a gesture forming a rectangle when the gesture is captured by the camera 106 as the user 204 of the mobile device 100 moves the user's finger to form the rectangle. During the generation of the trace data 302, x, y, and z coordinates 304 of the trace data 302 are applied according to an orientation of the housing 102 (not shown) during the gesture. In FIG. 3a, the y-coordinate of the trace data 302 is formed along the line crossing the camera 106 in lengthwise direction of the mobile device 100. It is appreciated that although six data points Q1 through Q6 are presented as the trace data 302, there could be more or less than the six data points forming the trace data 302.
- [41] Then, the controller 110 is configured to determine an orientation angle 306 of the housing 102 detected by the orientation sensor 104 (not shown), where the orientation angle 306 is obtained by measuring the angle between the line crossing the camera 106 in lengthwise direction of the housing 102 (not shown) in the orientation taken by the mobile device 100 during the gesture and a straight line crossing the camera 106 in the lengthwise direction of the housing 102 in the default orientation 210 (e.g., the portrait orientation where the camera 106 is located at the top center of the mobile device 100 as in FIG. 2a). Thus, in FIG. 3a, the orientation angle 306 of ninety (90) degrees is obtained. Then, the controller 110 is configured to recognize the gesture through accessing the lookup table stored in the memory 108 (not shown) of the mobile device 100 based on the trace data 302 and the orientation angle 306 of the housing 102 (not shown).
- [42] FIG. 3b illustrates a table 350 listing exemplary coordinates of the trace data 302 in FIG. 3a. In the table 350, x-coordinate 352 and y-coordinate 354 of Q1, Q2, Q3, Q4, Q5, and Q6 are listed as (9, 9), (9, 11), (9, 13), (11, 13), (11, 11), and (11, 9), respectively, thus forming a shape of a rectangle with its length extending along the lengthwise direction of the mobile device 100 and its width extending along the widthwise direction of the mobile device 100, and being interpreted as a gesture of forming a rectangle with the length of the rectangle extending along the y-axis of the x, y, and z-coordinates 304. Therefore, the rectangle or the trace data 302 formed in FIG. 3a is interpreted different from the rectangle or the trace data 202 formed in FIG. 2a if the interpretation is based solely on the trace data 202 or 302 according to the different coordinates (e.g., the x, y, z-coordinates 206 for the mobile device 100 in the portrait orientation and the x, y, z-coordinates 304 for the mobile device 100 in the landscape orientation) employed by the mobile device in the different orientations, although the user 204 may use the same gesture to form the trace data 202 and the trace data 302.
- [43] FIG. 4 illustrates an exemplary view of the trace data 202 in FIG. 2a captured by the

mobile device 100 of FIG. 1, according to one embodiment. In FIG. 4, the trace data 202 may be generated by the camera 106 by capturing multiple frames 402A through 402G from an initial instance of the gesture to a final instance of the gesture. The multiple frames 402A through 402G may represent positions of the finger in the x, y, z-coordinates 206 captured along a time line 404, where P1 represents a position of the user's finger at the initial instance of the capture by the camera 106 and P7 represents a position of the user's finger at the final instance of the capture by the camera 106. It is appreciated that P7 may coincide with the coordinates of P1 to complete the formation of the rectangle.

[44] As the trace data 202 are captured by the camera 106, the x, y, and z-coordinates of the trace data 202 may be determined by the controller 110. For example, as illustrated in FIG. 2b, (8, 5), (11, 5), (13, 5), (13, 3), (11, 3), and (8, 3) may be identified as the x, y, and z coordinates of P1 or P7, P2, P3, P4, P5, and P6, respectively.

[45] FIG. 5 illustrates an exemplary view of the mobile device 100 of FIG. 1 in two different orientations displaying an image accordingly, according to one embodiment. In FIG. 5, the image 212 is displayed on the display unit 112 of the mobile device 100 in a portrait orientation so long as the orientation angle of the housing 102 or the mobile device 100 is less than a threshold angle 502, whereas image 212 is displayed on the display unit 112 in a landscape orientation when the orientation angle of the housing is greater than the threshold angle.

[46] More particularly, in FIG. 5, the orientation angle of the mobile device 100 in the first, second, and third instance is less than the threshold angle 502 (e.g., 15 degrees), so the mobile device 100 maintains its portrait orientation for each of the three instances. Accordingly, the image 212 is displayed on the display unit 112 in the portrait orientation. Conversely, when the orientation angle of the mobile device 100 in the fourth instance is detected by the orientation sensor 104 to be greater than the threshold angle 502, the mobile device 100 shifts to the landscape orientation. Accordingly, the image 308 is displayed on the display unit 112 in the landscape orientation.

[47] FIG. 6 illustrates an exemplary process of the mobile device 100 in FIG. 1 for recognizing the gesture, according to one embodiment. In step 602, the trace data 302 and the orientation angle of ninety (90) degrees are processed, where the length of the shape of the trace data 302, i.e., the rectangle, is along the y-axis of the x, y, and z-coordinates 304. However, in step 604, the controller 110 of the mobile device 100 generates a trace data 608 through applying ninety (90) degrees of the orientation angle associated with the trace data 302.

[48] As a result, the gesture, which generates the trace data 608, i.e., the trace data 302 applied with the ninety degree orientation angle, are interpreted by the controller 110

as the gesture which corresponds to the command for displaying a menu horizontally. The identification of the gesture is performed by accessing a lookup table 610 which include multiple gestures 612 and respective commands 614. Thus, from the lookup table 610, the trace data 302 and the ninety degree orientation angle are processed to identify the gesture in a shape of a rectangle with its length 'c' extending horizontally, rather than the gesture in a shape of a rectangle with its length 'e' extending vertically.

[49] FIG. 7 illustrates another exemplary process of the mobile device 100 in FIG. 1 for recognizing the gesture, according to one embodiment. As illustrated in FIG. 1, the memory 108 may include a lookup table 702 which may be accessed to identify the gesture associated with the trace data 202 or the trace data 302. In FIG. 7, the lookup table 702 comprises multiple combinations of a trace data 704 and an orientation angle 706 and a gesture 708 associated with each combination as well as a command 710 which corresponds to the gesture 708.

[50] In FIG. 2a, the gesture performed to the mobile device 100 in the portrait orientation results in the trace data 202, i.e., a shape of a rectangle with its length 'a' extending horizontally, and the zero (0) degree orientation angle. Through accessing the lookup table 702 based on the trace data 202 and the zero degree orientation angle, the gesture in the shape of a rectangle with its length 'e' extending horizontally is obtained, and the command is executed to 'display a main menu horizontally.'

[51] In FIG. 3a, the gesture performed to the mobile device 100 in the landscape orientation results in the trace data 302, i.e., a shape of a rectangle with its length 'a' extending vertically, and the ninety (90) degree orientation angle. Through accessing the lookup table 702 based on the trace data 302 and the ninety degree orientation angle, the gesture in the shape of a rectangle with its length 'e' extending horizontally is obtained, and the command is executed to 'display a main menu horizontally.' Thus, the same gesture applied to the mobile device 100 in the two different orientations, as in FIG. 2a and FIG. 3a, is interpreted in the same manner by the mobile device 100 regardless of its orientation.

[52] FIG. 8 illustrates a process flow chart of an exemplary process performed by the mobile device 100 in FIG. 1 for recognizing a gesture, according to one embodiment. In keeping with the previous examples, particular components described with respect to FIG. 1 through FIG. 7 are referenced as performing the process in FIG. 8. It should be noted that the components that are referred to as performing the process are for illustrative purposes only. In some implementations, other components, or a different combination of components within a system or device, may instead perform the process in FIG. 8.

[53] In operation 802, as illustrated in FIG. 2a and FIG. 3a, the trace data 202 or 302 corresponding to a gesture captured by the camera 106 of the mobile device 100 are

generated. In one embodiment, the image data 212 is displayed on the display unit 112 in the portrait orientation when the orientation angle 208 of the housing 102 is less than the threshold angle, whereas the image data 308 is displayed on the display unit 112 in the landscape orientation when the orientation angle 306 of the housing 102 is greater than the threshold angle. In one embodiment, the trace data 202 or 302 is generated by capturing multiple frames 402A through 402G from the initial instance of the gesture to the final instance of the gesture using the camera 106 and determining the x, y, and z coordinates of the trace data 202 or 302 from the frames 402A through 402G.

[54] Then, in operation 804, the orientation angle 208 or 306 of the mobile device 100 is detected by the orientation sensor 104 of the mobile device 100. In addition, in operation 806, the gesture is recognized (e.g., identified) based on the lookup table 610 or 702 stored in the memory 108 of the mobile device 100. In one embodiment, a shape of the trace data 202 or 302 is generated by connecting the trace data 202 or 302 according to temporal data of the trace data 202 or 302, rotating the shape of the trace data 202 or 302 by the orientation angle 208 or 306, and locating the gesture when there is a match between the shape of the trace data 202 or 302 and one of the gestures in the lookup table 610 or 702. Further, in operation 808, a command which corresponds to the gesture is executed through accessing the lookup table 610 or 702.

[55] It is appreciated that the methods disclosed in FIG. 8 may be implemented in a form of a machine-readable medium embodying a set of instructions that, when executed by a machine, cause the machine to perform any of the operations disclosed herein.

[56] FIGs. 9a-9d illustrate an exemplary view of the mobile device 100 of FIG. 1 for repositioning a cursor 902 in response to a shift in the orientation of the mobile device 100, according to one embodiment. In FIGs. 9a-9d, the mobile device 100 comprises the housing 102, the display unit 112, the orientation sensor 104 (not shown), the camera 106 implemented on the housing 102, and the controller 110 (not shown) coupled to the display unit 112, the orientation sensor 104, and the camera 106.

[57] In FIG. 9a, the cursor 902 is placed on a unit portion 904 of the image 212 displayed on the display unit 112 in response to a capture by the camera 106 of a remote pointing object 906 (e.g., a finger) pointing to the unit portion 904 on the image 212 on the display unit 112, where the image 212 is displayed on the display unit 112 according to a first orientation (e.g., the portrait orientation). In FIG. 9b, the image 308 is displayed on the display unit 112 according to a second orientation (e.g., the landscape orientation) when the orientation of the housing 102 detected by the orientation sensor 104 indicates a shift to the second orientation by the mobile device 100.

[58] In one embodiment, the unit portion 904 of the image 212 may be flagged or tagged with metadata immediately prior to the shift of the orientation of the mobile device 100

from the first orientation to the second orientation. In one exemplary implementation, the unit portion 904 of the image 212 may be flagged or tagged with metadata indicating the position of the cursor 902 on the image 212 which coincides with the unit portion 904 if any inclination by the mobile device 100 beyond a threshold value (e.g., an inclination angle beyond which indicates the start of an operation shifting the orientation of the mobile device 100, such as five (5) degrees) is detected by the orientation sensor 104. In one exemplary implementation, the mobile device 100 may not recognize or process any input (e.g., the remote pointing object 906) while the mobile device 100 is in transition from the portrait orientation to the landscape orientation, thus reducing any error which may occur during the transition.

[59] Once the mobile device 100 completes the transition to the landscape orientation, the metadata (e.g., the flag, tag, etc.) indicating the position of the cursor 902, which previously pointed to the unit portion 904 on the image 212, is accessed and located. Then, in FIG. 9c, new coordinates of the unit portion 908 are obtained based on the metadata. Then, in FIG. 9d, the cursor 902 pointing to the same unit portion 904 of the image 212 is repositioned and displayed on the image 308. It is appreciated that the size of the image 308 and the proportion of the length and width for the image 212 may differ from the size of the image 212 and the proportion of its length and width, respectively. Accordingly, the cursor in FIG. 9d may be repositioned according to the modification of the image 308 from the image 212.

[60] FIGs. 10a-10d illustrate an exemplary view of a mobile device 1002 in different configuration than the mobile device 100 of FIG. 1 for repositioning a cursor 1010 in response to a shift of its orientation, according to one embodiment. In FIGs. 10a-10d, the mobile device 1002 comprises a housing 1004, a camera 1006, a display unit 1008, an orientation sensor (not shown), and a controller (not shown) coupled to the display unit 1008, the orientation sensor, and the camera 1006.

[61] In FIG. 10a, the cursor 1010 is placed on a unit portion 1012 of the image 308 displayed on the display unit 1008 in response to a capture by the camera 1006 of a remote pointing object 1014 (e.g., a finger) pointing to the unit portion 1012 on the image 308 on the display unit 1008, where the image 308 is displayed on the display unit 1008 according to a first orientation (e.g., the landscape orientation). It is appreciated that for the mobile device 1002 with its camera implemented at the center of the mobile device 1002 along its length, the landscape orientation is set as the default orientation.

[62] In FIG. 10b, the image 212 is displayed on the display unit 1008 according to a second orientation (e.g., the portrait orientation) when the orientation of the housing 1004 detected by the orientation sensor indicates a shift to the second orientation by the mobile device 1002. In one embodiment, the unit portion 1012 of the image 308

may be flagged or tagged with metadata immediately prior to the shift of the orientation of the mobile device 1002 from the first orientation to the second orientation. In one exemplary implementation, the unit portion 1012 of the image 308 may be flagged or tagged with metadata indicating the position of the cursor 1010 on the image 308 if any inclination by the mobile device 1002 beyond a threshold value (e.g., five (5) degrees) is detected by the orientation sensor. In one exemplary implementation, the mobile device 1002 may not recognize or process any input (e.g., the remote pointing object 1014) while the mobile device 1002 is in transition from the portrait orientation to the landscape orientation.

[63] Once the mobile device 1002 completes the transition to the portrait orientation, the metadata (e.g., the flag, tag, etc.) indicating the position of the cursor 1010, which previously pointed to the unit portion 1012 on the image 308, is accessed and located. Then, in FIG. 10c, new coordinates of the unit portion 1016 are obtained based on the metadata. Then, in FIG. 10d, the cursor 1010 pointing to the same unit portion 1012 of the image 308 is repositioned and displayed on the image 212. It is appreciated that the size of the image 308 and the proportion of its length and width may differ from the size of the image 212 and the proportion of the length and width of the image 212, respectively. Accordingly, the cursor in FIG. 10d may be repositioned according to the modification of the image 212 from the image 308.

[64] FIG. 11 illustrates a process flow chart of an exemplary process performed by the mobile device 100 in FIG. 1 for positioning a cursor, according to one embodiment. In keeping with the previous examples, particular components described with respect to FIG. 9a through FIG. 10d are referenced as performing the process in FIG. 11. It should be noted that the components that are referred to as performing the process are for illustrative purposes only. In some implementations, other components, or a different combination of components within a system or device, may instead perform the process in FIG. 11.

[65] In operation 1102, as illustrated in FIG. 9a, the cursor 902 on the unit portion 904 of the image 212 is displayed on the mobile device 100 in the first orientation (e.g., the portrait orientation). In FIG. 10a, the cursor 1010 on the unit portion 1012 of the image 308 is displayed on the mobile device 1002 in the first orientation (e.g., the landscape orientation). Then, in operation 1104, as illustrated in FIG. 9b, the image 308 according to the second orientation (i.e., the landscape orientation) is displayed when the mobile device 100 shifts to the second orientation. In one embodiment, the unit portion 904 of the image 212 may be flagged or tagged with metadata immediately prior to the shift of the orientation of the mobile device 100 from the first orientation to the second orientation. In one exemplary implementation, the unit portion 904 of the image 212 may be flagged or tagged with metadata indicating the position of the cursor

902 on the image 212 if any inclination by the mobile device 100 beyond a threshold value (e.g., five (5) degrees) is detected by the orientation sensor 104. In one exemplary implementation, the mobile device 100 may not recognize or process any input (e.g., the remote pointing object 906) while the mobile device 100 is in transition from the portrait orientation to the landscape orientation.

[66] In FIG. 10b, the image 212 according to the second orientation (i.e., the portrait orientation) is displayed when the mobile device 1002 shifts to the second orientation. In one embodiment, the unit portion 1012 of the image 308 may be flagged or tagged with metadata immediately prior to the shift of the orientation of the mobile device 1002 from the first orientation to the second orientation. In one exemplary implementation, the unit portion 1012 of the image 308 may be flagged or tagged with metadata indicating the position of the cursor 1010 on the image 308 if any inclination by the mobile device 1002 beyond a threshold value (e.g., five (5) degrees) is detected by the orientation sensor 104. In one exemplary implementation, the mobile device 1002 may not recognize or process any input (e.g., the remote pointing object 1014) while the mobile device 1002 is in transition from the portrait orientation to the landscape orientation.

[67] In addition, in operation 1106, as illustrated in FIG. 9c, the coordinates of the unit portion 908 of the image 308 are displayed according to the second orientation. In FIG. 10c, the coordinates of the unit portion 1016 of the image 212 are displayed according to the second orientation. In operation 1108, as illustrated in FIG. 9d, the cursor 902 is displayed on the unit portion 904 of the image 308 based on the coordinates of the unit portion 908 of the image 308 displayed according to the second orientation. In FIG. 10d, the cursor 1010 is displayed on the unit portion 1012 of the image 212 based on the coordinates of the unit portion 1016 of the image 212 displayed according to the second orientation.

[68] It is appreciated that the methods disclosed in FIG. 11 may be implemented in a form of a machine-readable medium embodying a set of instructions that, when executed by a machine, cause the machine to perform any of the operations disclosed herein.

[69] FIGs. 12a-12e illustrate another exemplary view of the mobile device 100 of FIG. 1 for repositioning a cursor 1202 in response to a shift in the orientation of the mobile device 100, according to one embodiment. In FIGs. 12a-12e, the mobile device 100 comprises the housing 102, the orientation sensor 104 (not shown), the camera 106 implemented on the housing 102, the display unit 112, and the controller 110 (not shown) coupled to the orientation sensor 104, and the camera 106, and the display unit 112.

[70] In FIG. 12a, the cursor 1202 on a first position 1204 proximate to the image 212 displayed on the display unit 112 is generated in response to a capture by the camera 106 of the remote pointing object 906 pointing to the first position 1204 on the display

unit 112, where the image 212 is displayed on the display unit 112 according to a first orientation (e.g., the portrait orientation).

[71] In FIG. 12b, a first distance 1208 between the first position 1204 and a first unit portion 1206 on the image 212 and a second distance 1212 between the first position 1204 and a second unit portion 1210 are measured. It is appreciated that the process of flagging or tagging metadata to each of the first unit portion 1206 and the second unit portion 1210 is similar to the process described for flagging or tagging the metadata to the unit portion 904 in FIG. 9b or 1012 in FIG. 10b. It is also appreciated that more than two distances may be measured, although the measurements of the two distances are illustrated in FIG. 12b. In FIG. 12c, the image 308 is displayed on the display unit 112 according to a second orientation (e.g., the landscape orientation) when the orientation of the housing 102 detected by the orientation sensor 104 (not shown) indicates a shift to the second orientation by the mobile device 100. In one embodiment, the first unit portion 1206 and the second unit portion 1210 of the image 212 may be flagged or tagged with metadata immediately prior to the shift of the orientation of the mobile device 100 from the first orientation to the second orientation. In one exemplary implementation, the first unit portion 1206 and the second unit portion 1210 of the image 212 may be flagged or tagged with metadata indicating their positions with respect to the whole area of the image 212 if any inclination by the mobile device 100 beyond a threshold value (e.g., five (5) degrees) is detected by the orientation sensor 104 (not shown). Further, the first distance 1208 and the second distance 1212 may be stored in the memory 108 (not shown) of the mobile device 100. In one exemplary implementation, the mobile device 100 may not recognize or process any input (e.g., the remote pointing object 906) while the mobile device 100 is in transition from the first orientation to the second orientation.

[72] Once the mobile device 100 completes the transition to the landscape orientation, the metadata (e.g., the flag, tag, etc.) indicating the locations of the first unit portion 1206 and the second unit portion 1210 is accessed and located as well as the first distance 1208 and the second distance 1212 from the memory 108. Then, in FIG. 12d, coordinates of the first unit portion 1214 and coordinates of the second unit portion 1216 on the image 308 are obtained based on the metadata. Further, in FIG. 12e, the cursor 1202 is repositioned and displayed on the image 212 based on the coordinates of the first unit portion 1214 and coordinates of the second unit portion 1216 on the image 308 as well as the first distance 1208 and the second distance 1212. It is appreciated that the size of the image 308 and the proportion of its length and width may differ from the size of the image 212 and the proportion of its length and width, respectively. Accordingly, the cursor in FIG. 12e may be repositioned according to the modification from the image 212 to the image 308.

- [73] FIG. 13 illustrates an exemplary view of the mobile device 100 of FIG. 1 in different orientations repositioning a cursor in response to a shift in the orientation of the mobile device 100, according to one embodiment. In FIG. 13, the image 212 is displayed on the display unit 112 of the mobile device 100 in the portrait orientation so long as the orientation angle of the housing 102 or the mobile device 100 is less than the threshold angle 502, whereas image 212 is displayed on the display unit 112 in the landscape orientation when the orientation angle of the housing is greater than the threshold angle 502.
- [74] More particularly, in FIG. 5, the orientation angle of the mobile device 100 in the first, second, and third instance is less than the threshold angle 502 (e.g., 15 degrees), so the mobile device 100 maintains its portrait orientation for each of the three instances. Accordingly, the image 212 is displayed on the display unit 112 in the portrait orientation. Conversely, when the orientation angle of the mobile device 100 in the fourth and fifth instance is detected by the orientation sensor 104 (not shown) to be greater than the threshold angle 502, the mobile device 100 shifts to the landscape orientation. Accordingly, the image 308 is displayed on the display unit 112 in the landscape orientation. Further, the cursor 1202 is maintained at the same physical position on the display unit 112 (e.g., the top left corner of the mobile device 100) while the mobile device 100 maintains the portrait orientation, but jumps to the new physical position on the display unit 112 (e.g., the bottom left corner of the mobile terminal 100) upon the shifting of the mobile device 100 to the landscape orientation. However, the position of the cursor 1202 is maintained the same with respect to the image displayed on the display unit 112 (e.g., the image 212 from the portrait orientation and the image 308 for the landscape orientation). It is appreciated the details of the operation for repositioning the cursor 1202 is described in details in FIGs. 12a-12e.
- [75] FIG. 14 illustrates an exemplary view of the cursor 902 being repositioned on the display unit 112 in response to a shift of the orientation of the mobile device 100 in FIG. 1, according to one embodiment. In FIG. 14, the cursor 1202 is maintained while the mobile device 100 maintains the portrait orientation, but jumps to the new position upon the shifting of the mobile device 100 to the landscape orientation, as illustrated in a cursor track 1402 in dotted line. It is appreciated the details of the operation for repositioning the cursor 902 (e.g., or the cursor 1202) is described in details in FIGs. 12a-12e.
- [76] FIG. 15 illustrates a process flow chart of another exemplary process performed by the mobile device 100 in FIG. 1 for repositioning a cursor, according to one embodiment. In keeping with the previous examples, particular components described with respect to FIG. 12a through FIG. 14 are referenced as performing the process in FIG. 15. It should be noted that the components that are referred to as performing the

process are for illustrative purposes only. In some implementations, other components, or a different combination of components within a system or device, may instead perform the process in FIG. 15.

[77] In operation 1502, as illustrated in FIG. 12a, the cursor 1202 on the first position 1204 proximate to the image 212 displayed on the display unit 112 is generated and displayed when the camera 106 captures the remote pointing object 906 pointing to the first position 1204 on the display unit 112, where the image 212 is displayed on the display unit 112 in the first orientation (e.g., the portrait orientation). In operation 1504, as illustrated in FIG. 12b, the first distance 1208 between the first position 1204 and the first unit portion 1206 on the image 212 and the second distance 1212 between the first position 1204 and the second unit portion 1210 are measured.

[78] In operation 1506, as illustrated in FIG. 12c, the image 308 is displayed on the display unit 112 according to the second orientation (e.g., the landscape orientation) when the orientation of the housing 102 detected by the orientation sensor 104 indicates a shift to the second orientation by the mobile device 100. In one embodiment, the first unit portion 1206 and the second unit portion 1210 of the image 212 may be flagged or tagged with metadata immediately prior to the shift of the orientation of the mobile device 100 from the first orientation to the second orientation. Once the mobile device 100 completes the transition to the landscape orientation, the metadata (e.g., the flag, tag, etc.) indicating the locations of the first unit portion 1206 and the second unit portion 1210 is accessed and located as well as the first distance 1208 and the second distance 1212 from the memory 108. Then, in operation 1508, as illustrated in FIG. 12d, the coordinates of the first unit portion 1214 and the coordinates of the second unit portion 1216 on the image 308 are obtained based on the metadata. Further, in operation 1510, as illustrated in FIG. 12e, the cursor 1202 is repositioned and displayed on the image 212 based on the coordinates of the first unit portion 1214 and coordinates of the second unit portion 1216 on the image 308 as well as the first distance 1208 and the second distance 1212.

[79] It is appreciated that the methods disclosed in FIG. 15 may be implemented in a form of a machine-readable medium embodying a set of instructions that, when executed by a machine, cause the machine to perform any of the operations disclosed herein.

[80] FIG. 16 illustrates an exemplary view of the mobile device 100 of FIG. 1 in different orientations maintaining the absolute position of a cursor in response to a shift in the orientation of the mobile device 100, according to one embodiment. In FIG. 16, the image 212 is displayed on the display unit 112 of the mobile device 100 in the portrait orientation so long as the orientation angle of the housing 102 or the mobile device 100 is less than the threshold angle 502, whereas image 212 is displayed on the display unit 112 in the landscape orientation when the orientation angle of the housing is greater

than the threshold angle 502. Further, the cursor 1602 is maintained at its original physical position (e.g., the top left corner) even after the mobile device 100 shift from the portrait orientation to the landscape orientation.

[81] In various embodiments, the systems, circuits and devices described in FIG. 1 through FIG. 16 may enable recognition of a gesture in the same manner by a mobile device regardless of the orientation of the mobile device. In one example, the mobile device may interpret a gesture in the same manner whether it be in the portrait orientation or the landscape orientation by tracing data generated from capturing the gesture and the tilt angle of the mobile device. Further, in another example, the mobile device may reposition a cursor to the same position on an image displayed on the mobile device in the first orientation even after the mobile device shifts to the second orientation and display the image according to the second orientation. This may be achieved by associating the cursor position with the unit portion of the image displayed on the mobile device in the first orientation, tracking the position of the unit portion in the image displayed on the mobile device in the second orientation when the mobile device shifts to the second orientation, and then repositioning the cursor to the position which corresponds to the unit portion of the image displayed on the mobile device in the second orientation. Moreover, it is appreciated that conventional control devices (e.g., a wired and/or wireless mechanical, optical, 3D, tactile mice, etc.), systems, and processes which can carry out limited but similar tasks performed by the devices, systems, and methods described in FIG. 1 through FIG. 16 may be used in parallel. For instance, the conventional control devices, system, and/or processes may perform one or more tasks when the gesture based control devices, systems, and/or or processes illustrated in the present disclosure cannot properly carry them out for any unforeseeable reasons, and vice versa.

[82] The various devices, modules, analyzers, generators, etc. described herein may be enabled and operated using hardware circuitry (e.g., complementary metal-oxide-semiconductor (CMOS) based logic circuitry), firmware, software and/or any combination of hardware, firmware, and/or software (e.g., embodied in a machine readable medium). Further, the various electrical structure and methods may be embodied using transistors, logic gates, and/or electrical circuits (e.g., application specific integrated circuit (ASIC)). Although the present embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the various embodiments.

## Claims

- [Claim 1] A mobile device for recognizing a gesture, comprising:  
a housing;  
an orientation sensor;  
a camera implemented on the housing;  
a memory for storing a lookup table comprising a plurality of gestures and corresponding commands; and  
a controller coupled to the orientation sensor, the camera, and the memory, the controller configured to:  
generate trace data corresponding to a gesture captured by the camera, wherein x, y, and z coordinates of the trace data are applied according to an orientation of the housing during the gesture;  
determine an orientation angle of the housing detected by the orientation sensor; and  
recognize the gesture through accessing the lookup table based on the trace data and the orientation angle of the housing.
- [Claim 2] The device of claim 1, wherein the orientation sensor is an accelerometer, a gyroscope, or a magnetometer.
- [Claim 3] The device of claim 1, wherein the camera is a depth-aware camera, a stereo camera, or a digital camera.
- [Claim 4] The device of claim 1, further comprising a display unit for displaying an image in a portrait orientation when the orientation angle of the housing is less than a threshold angle and for displaying the image in a landscape orientation when the orientation angle of the housing is greater than the threshold angle.
- [Claim 5] The device of claim 1, wherein the orientation angle is obtained by measuring an angle between a straight line crossing the camera in a lengthwise direction of the housing in the orientation of the housing taken during the gesture and a straight line crossing the camera in a lengthwise direction of the housing in a default orientation.
- [Claim 6] The device of claim 1, wherein, for generating the trace data, the controller is further configured to:  
capture a plurality of frames from an initial instance of the gesture to a final instance of the gesture using the camera; and  
determine the x, y, and z coordinates of the trace data from the plurality of frames.
- [Claim 7] The device of claim 1, wherein the controller is further configured to

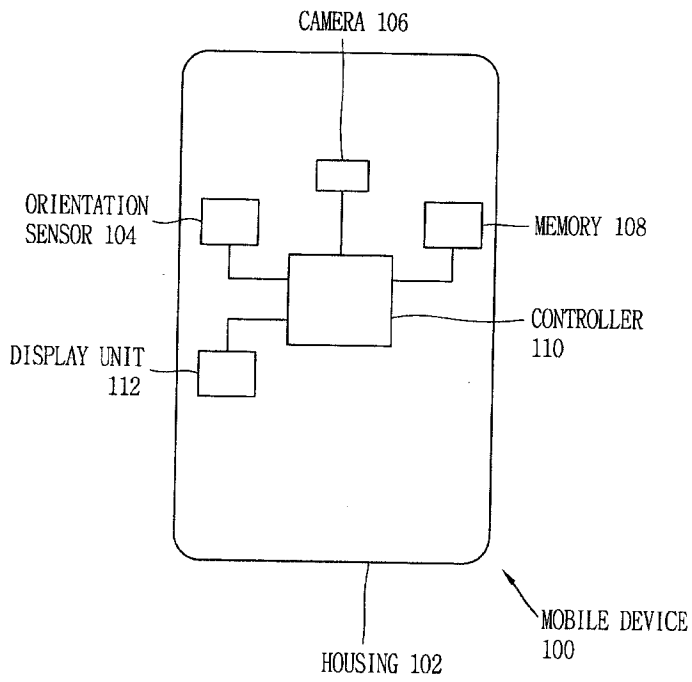
- execute a command which corresponds to the gesture through accessing the lookup table.
- [Claim 8] The device of claim 1, wherein the camera is implemented on a top center of the housing.
- [Claim 9] The device of claim 7, wherein the y-coordinate of the trace data is along a straight line crossing the camera in a lengthwise direction of the housing, and the x-coordinate of the trace data is along a straight line crossing the camera in a widthwise direction of the housing.
- [Claim 10] The device of claim 8, wherein, for recognition of the trace data, the controller is further configured to:  
generate a shape of the trace data by connecting the trace data according to temporal data of the trace data;  
rotate the shape of the trace data by the orientation angle; and  
locate the gesture when there is a match between the shape of the trace data and one of the plurality of gestures in the lookup table.
- [Claim 11] A mobile device for repositioning a cursor, comprising:  
a housing;  
a display unit;  
an orientation sensor;  
a camera implemented on the housing; and  
a controller coupled to the display unit, the orientation sensor and the camera, the controller configured to:  
generate a cursor on a unit portion of an image displayed on the display unit in response to a capture by the camera of a remote pointing object pointing to the unit portion on the image on the display unit, wherein the image is displayed on the display unit according to a first orientation;  
display the image on the display unit according to a second orientation when an orientation of the housing detected by the orientation sensor indicates a shift to the second orientation;  
identify coordinates of the unit portion of the image displayed according to the second orientation; and  
display the cursor on the unit portion of the image based on the coordinates of the unit portion of the image displayed according to the second orientation.
- [Claim 12] The device of claim 11, wherein the first orientation is a portrait ori-

- entation and the second orientation is a landscape orientation.
- [Claim 13] The device of claim 11, wherein the first orientation is a landscape orientation and the second orientation is a portrait orientation.
- [Claim 14] The device of claim 11, wherein the unit portion on the image is marked with a flag when the cursor placed on the unit portion on the image is captured by the camera.
- [Claim 15] The device of claim 11, wherein the shift of the housing to the second orientation is detected when tilt data generated by the orientation sensor is greater than a threshold angle.
- [Claim 16] A mobile device for repositioning a cursor, comprising:  
a housing;  
a display unit;  
an orientation sensor;  
a camera implemented on the housing; and  
a controller coupled to the display unit, the orientation sensor and the camera, the controller configured to:  
generate a cursor on a first position proximate to an image displayed on the display unit in response to a capture by the camera of a remote pointing object pointing to the first position on the display unit, wherein the image is displayed on the display unit according to a first orientation;  
measure distances between the first position and each of at least two unit portions on the image;  
display the image on the display unit according to a second orientation when an orientation of the housing detected by the orientation sensor indicates a shift to the second orientation;  
identify coordinates of the at least two unit portions of the image displayed according to the second orientation; and  
display the cursor on a second position proximate to the image based on the coordinates of the at least two unit portions of the image displayed according to the second orientation and the distances between the first position and said each of the at least two unit portions.
- [Claim 17] The device of claim 16, wherein the first orientation is a portrait orientation and the second orientation is a landscape orientation.
- [Claim 18] The device of claim 16, wherein the first orientation is a landscape orientation and the second orientation is a portrait orientation.
- [Claim 19] The device of claim 11, wherein said each of the at least two unit portions on the image is arbitrarily selected and marked with a flag

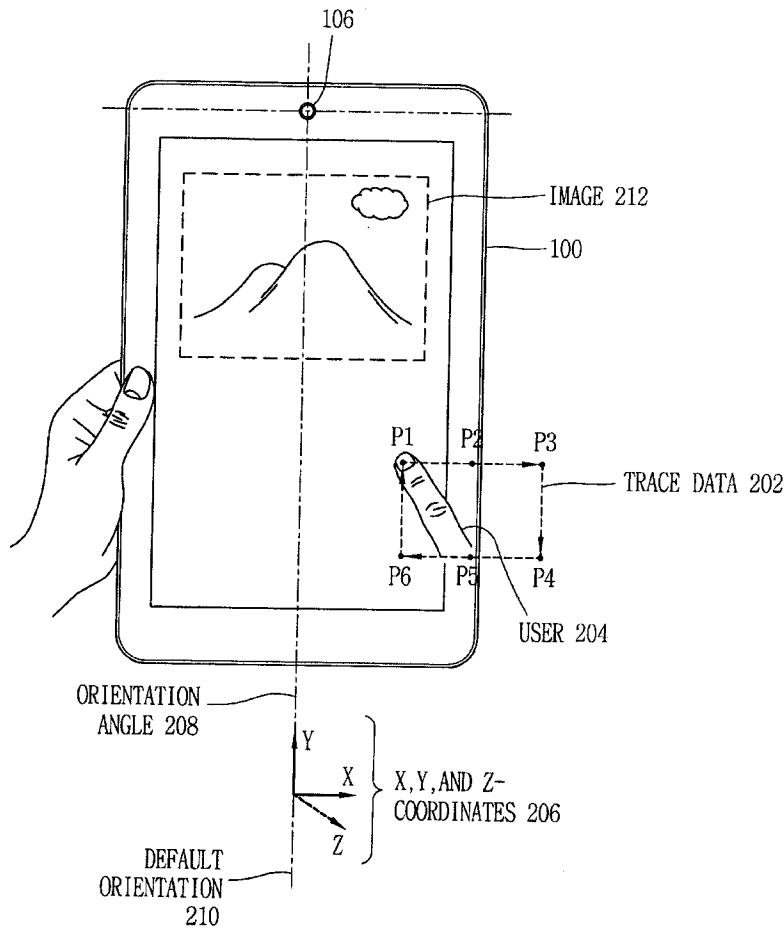
[Claim 20]

when the cursor placed on the first position is captured by the camera.  
The device of claim 11, wherein the shift of the housing to the second orientation is detected when tilt data generated by the orientation sensor is greater than a threshold angle.

[Fig. 1]



[Fig. 2a]

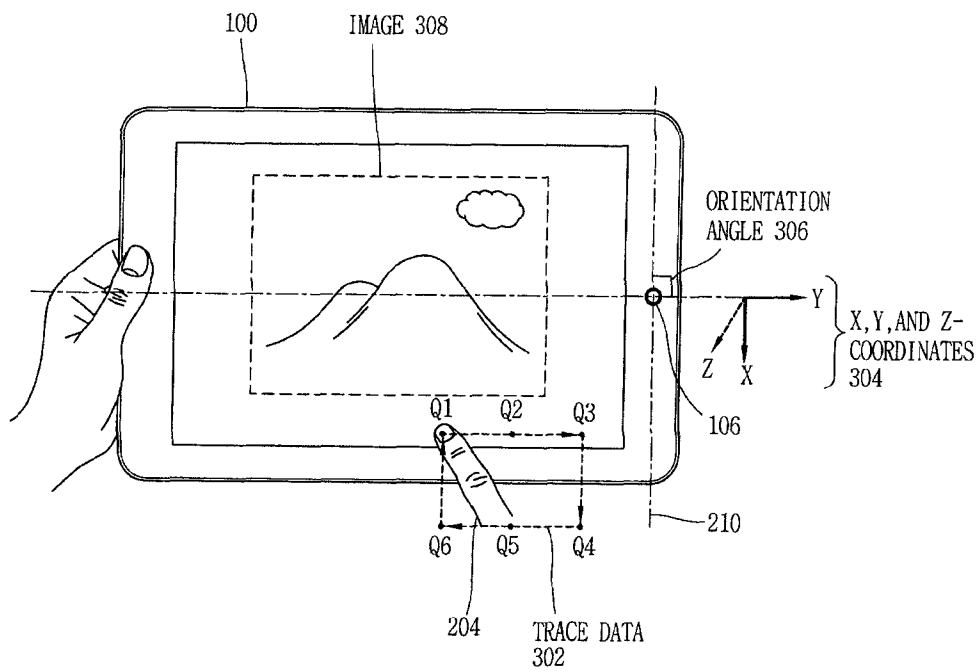


[Fig. 2b]

	X-COORDINATE 252	Y-COORDINATE 254
P1	8	5
P2	11	5
P3	13	5
P4	13	3
P5	11	3
P6	8	3

TABLE 250

[Fig. 3a]

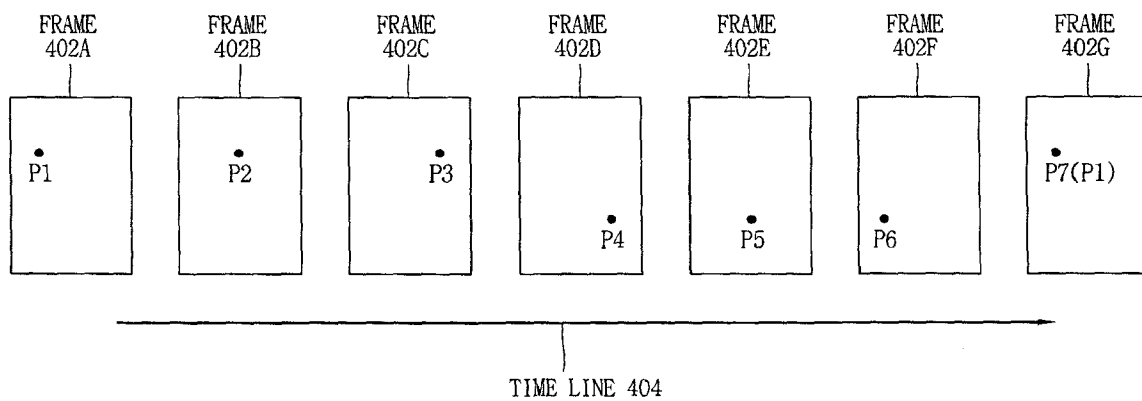


[Fig. 3b]

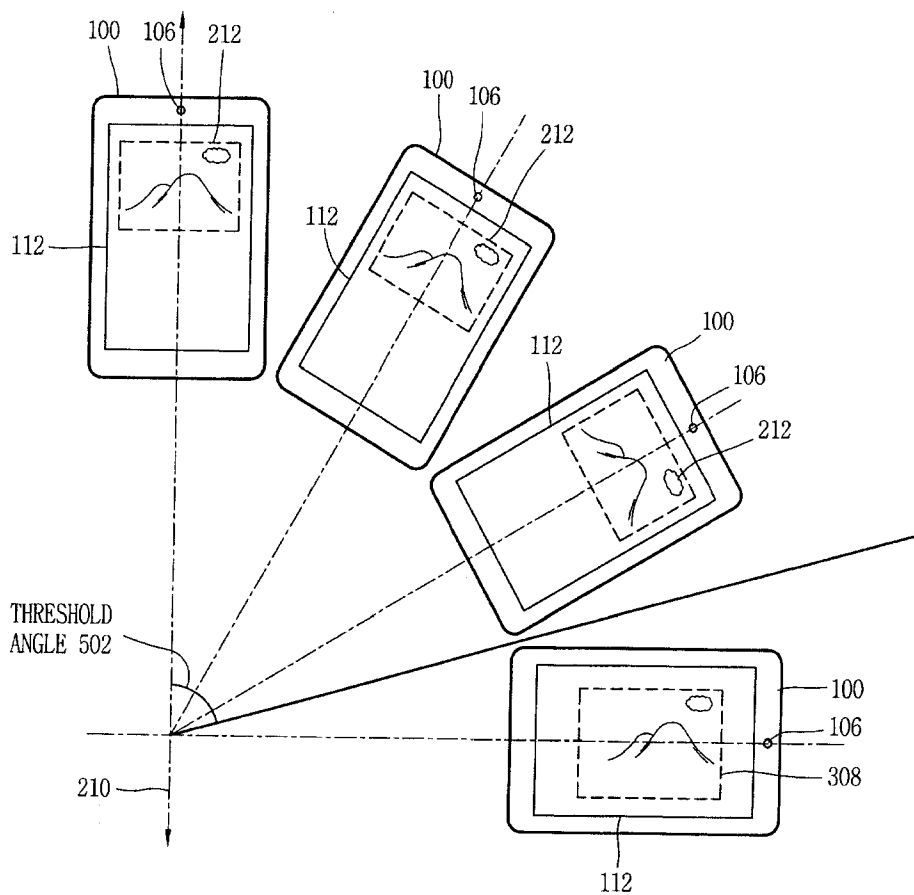
	X-COORDINATE 352	Y-COORDINATE 354
Q1	9	9
Q2	9	11
Q3	9	13
Q4	11	13
Q5	11	11
Q6	11	9

TABLE 350

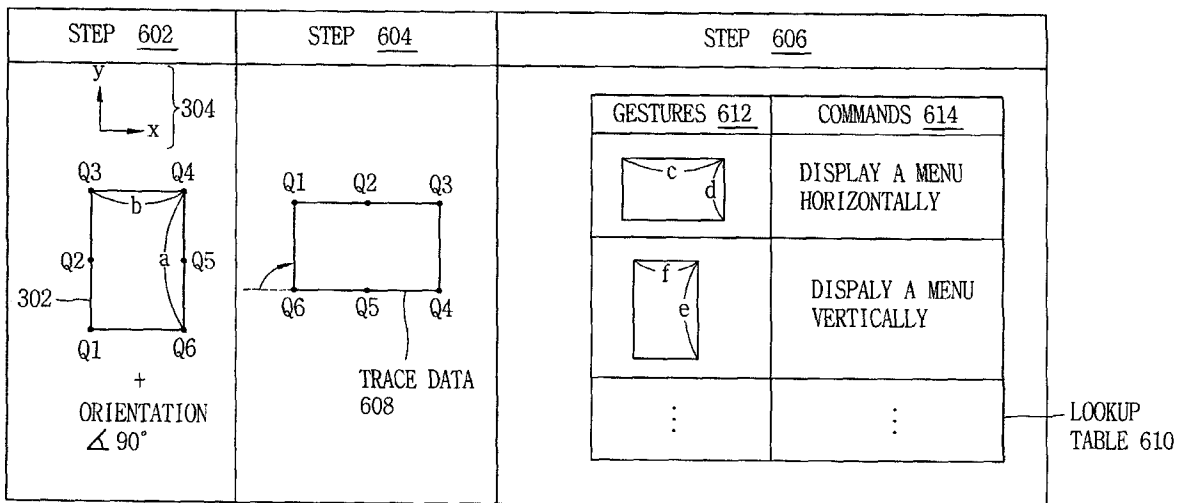
[Fig. 4]



[Fig. 5]



[Fig. 6]



(a > b, c > d & e > f)

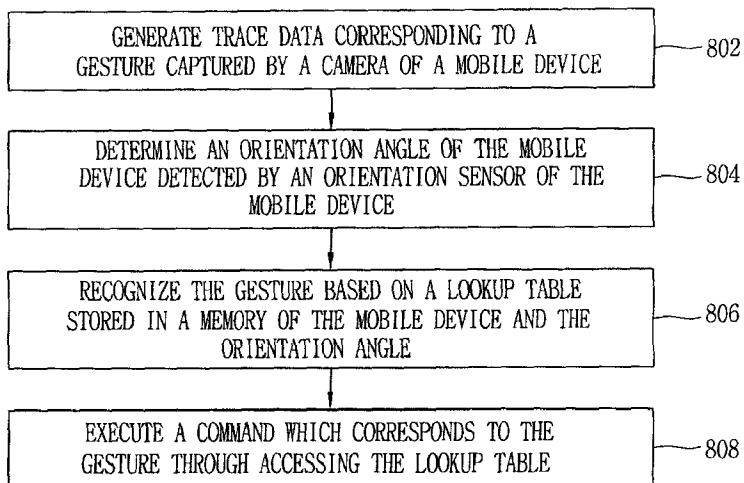
[Fig. 7]

(a > b, c > d & e > f)

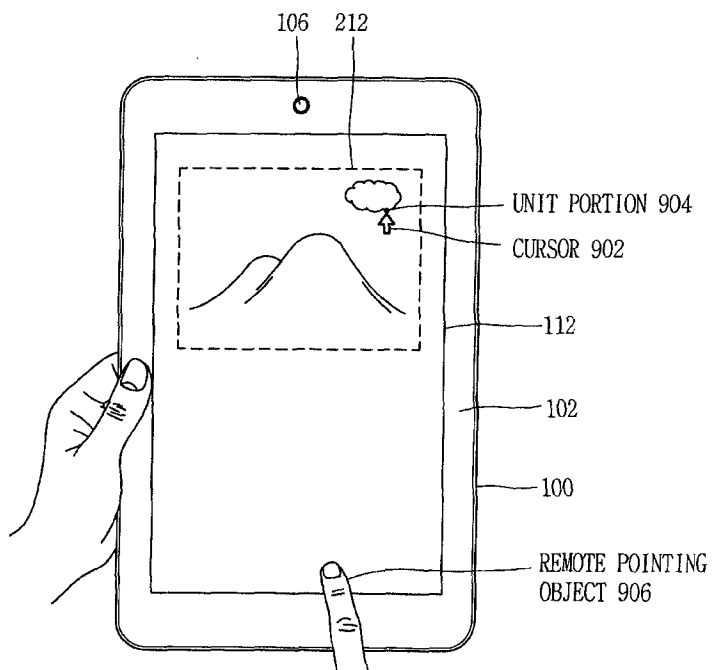
TRACE DATA 704	ORIENTATION ANGLE 706	GESTURE 708	COMMAND 710
	0°		DISPLAY A MAIN MENU HORIZONTALLY
	90°		
	90°		DISPLAY A MAIN MENU VERTICALLY
	0°		
⋮	⋮	⋮	⋮

LOOKUP TABLE 702

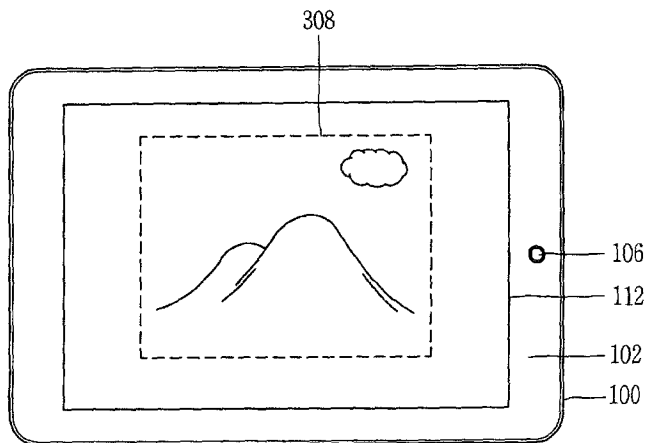
[Fig. 8]



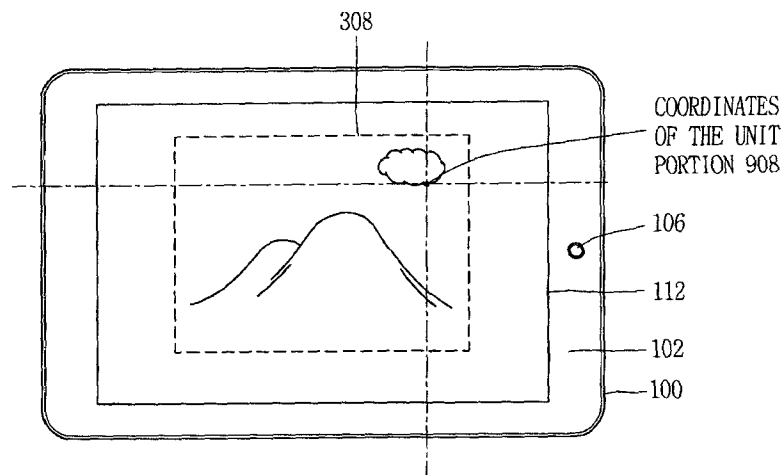
[Fig. 9a]



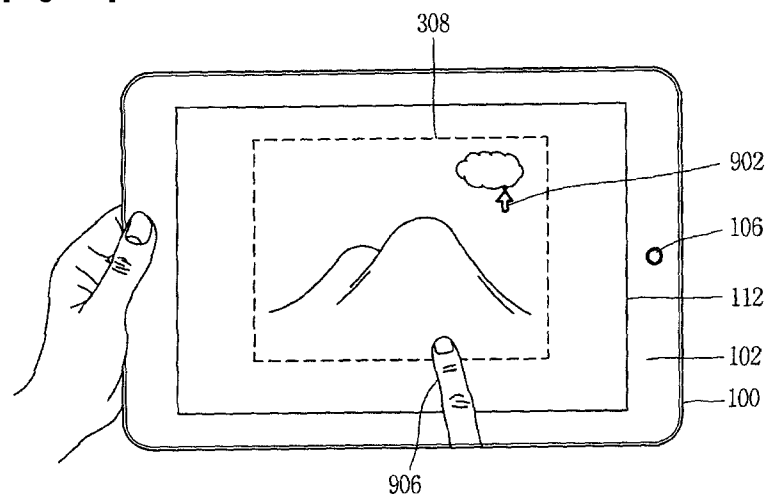
[Fig. 9b]



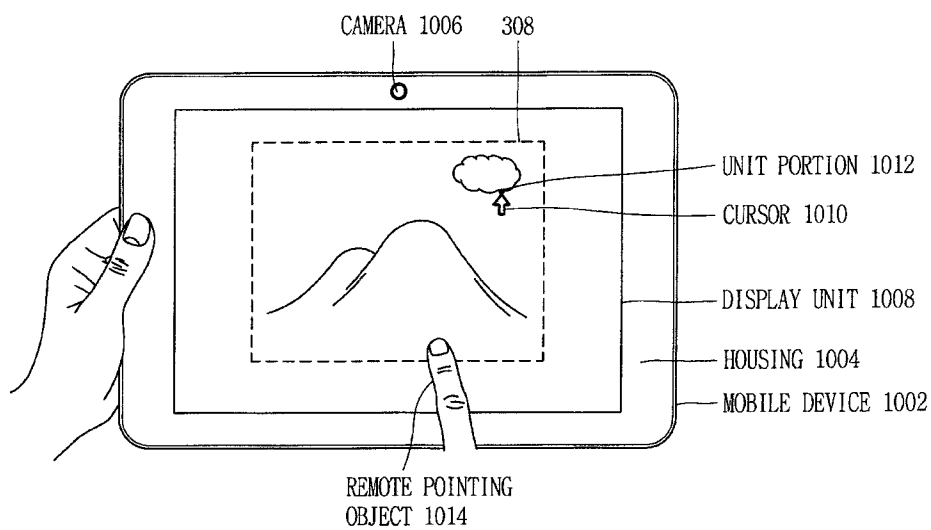
[Fig. 9c]



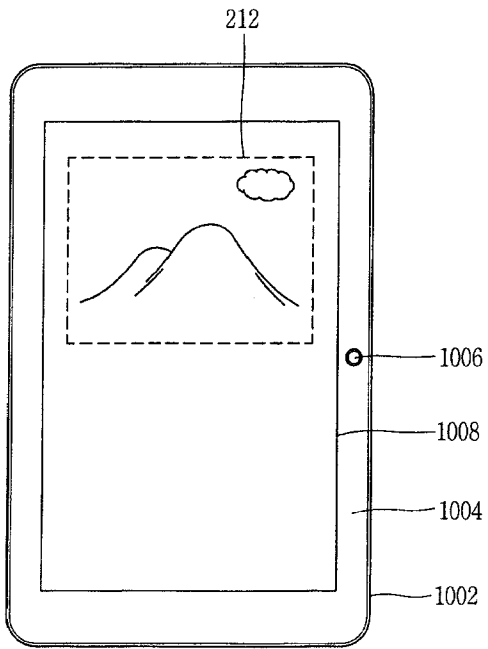
[Fig. 9d]



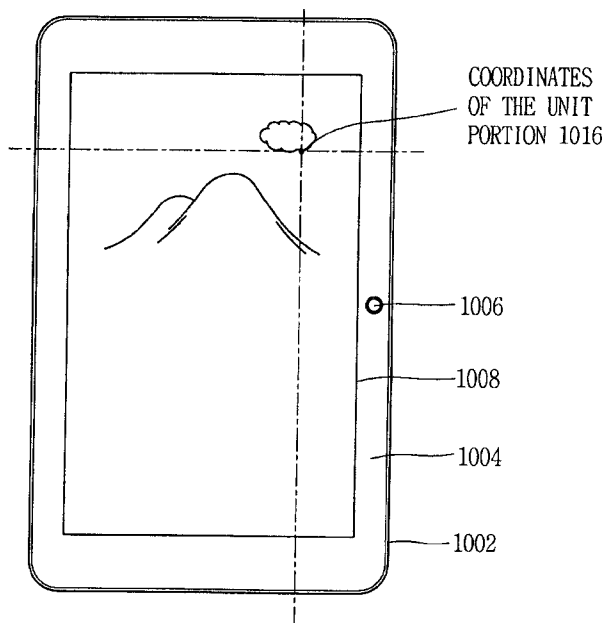
[Fig. 10a]



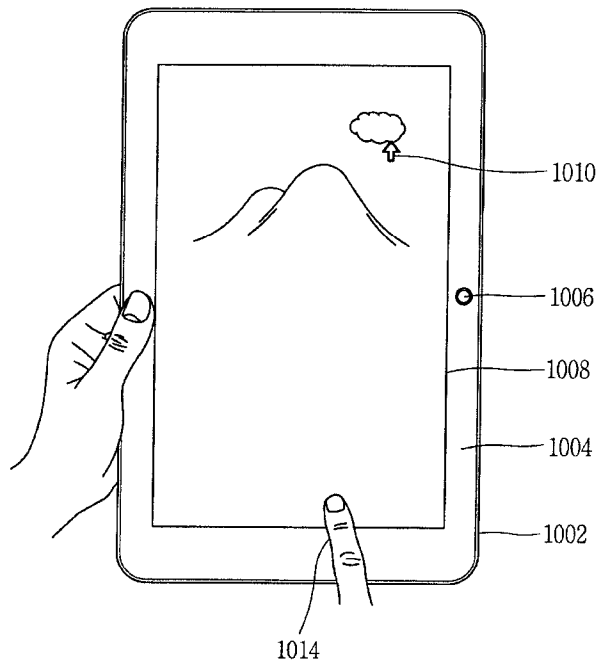
[Fig. 10b]



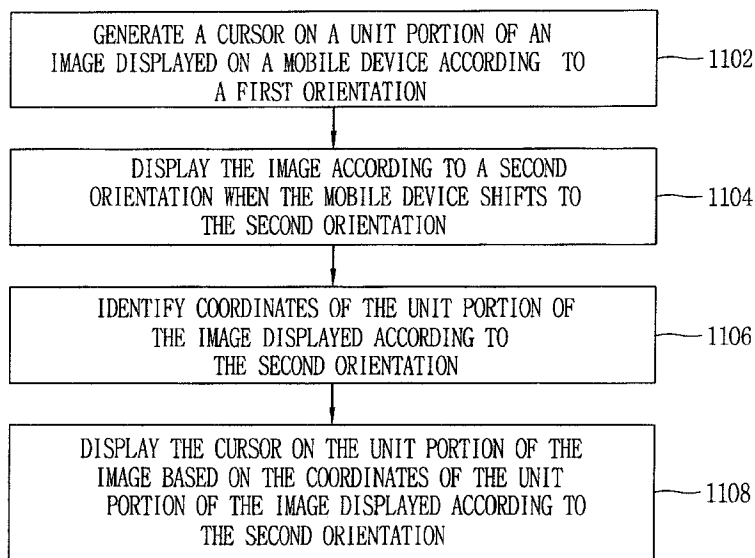
[Fig. 10c]



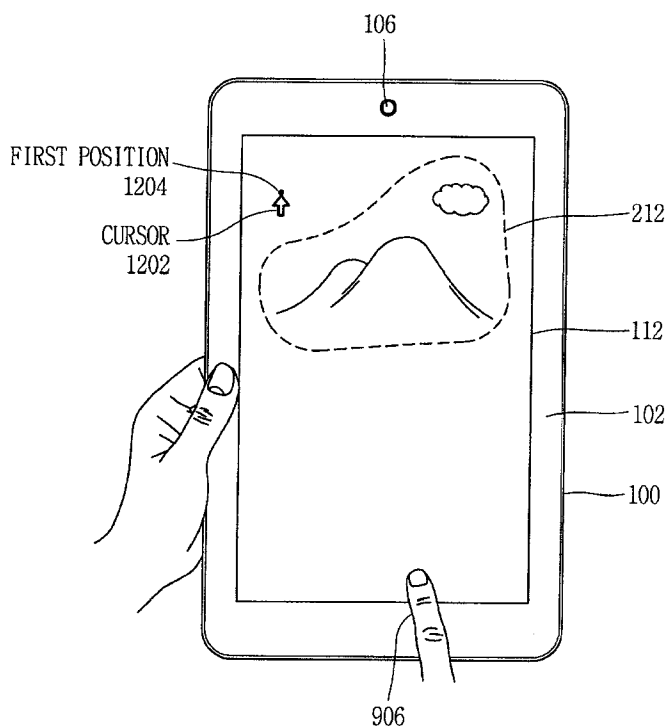
[Fig. 10d]



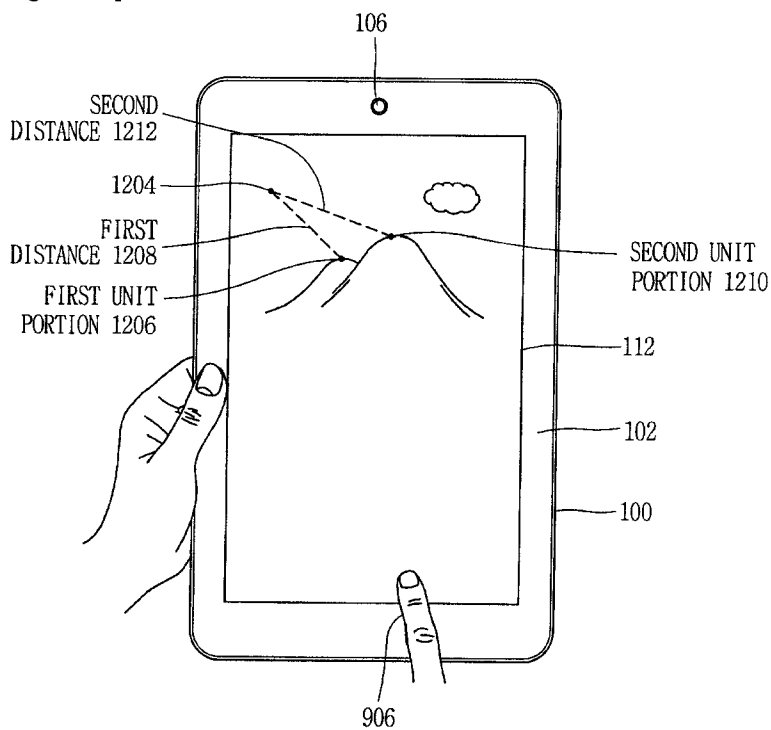
[Fig. 11]



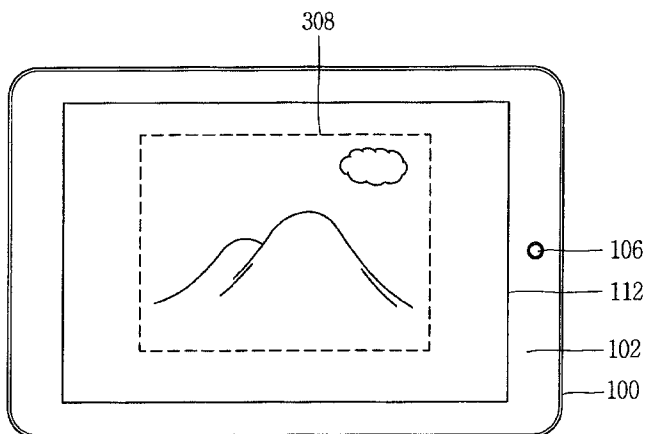
[Fig. 12a]



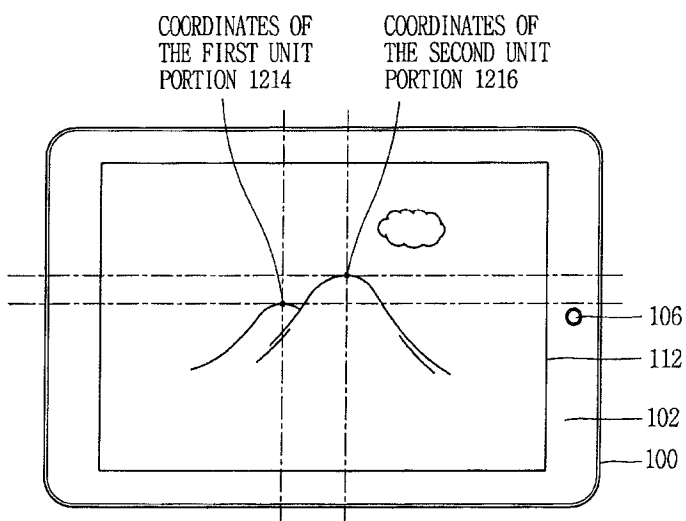
[Fig. 12b]



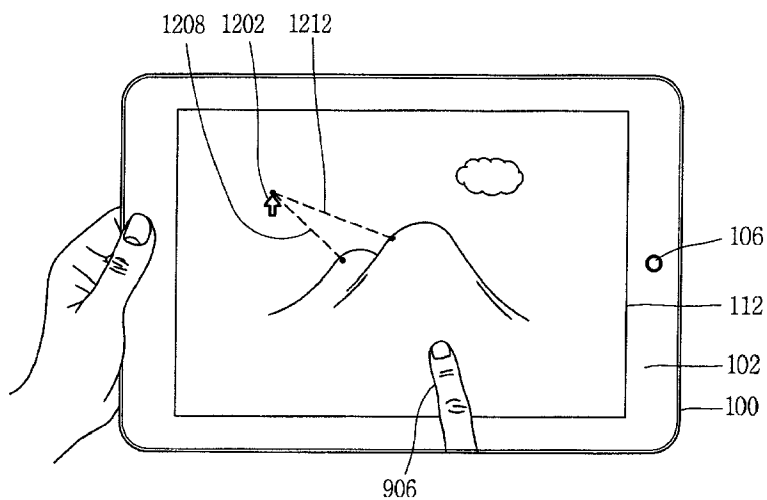
[Fig. 12c]



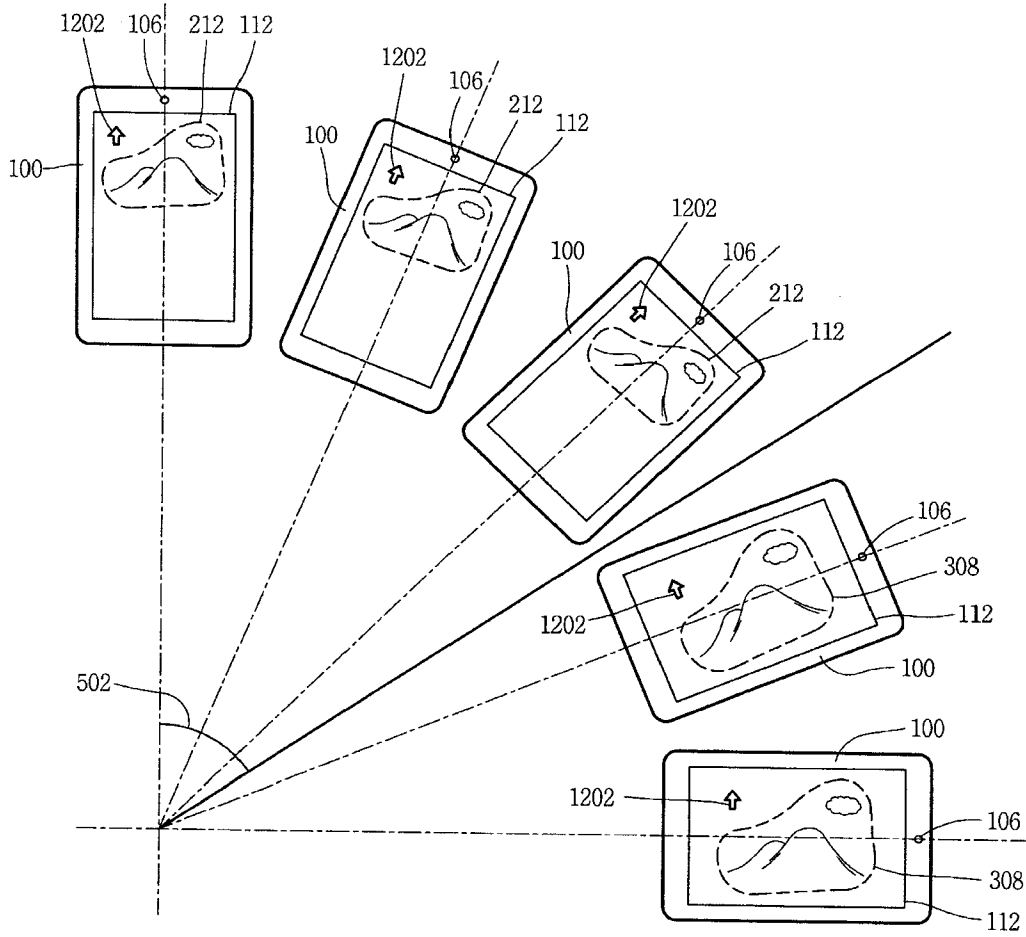
[Fig. 12d]



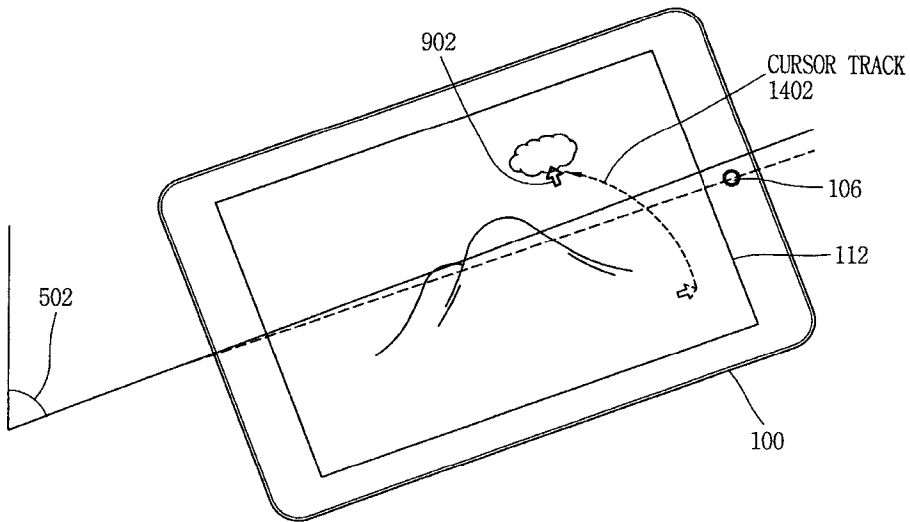
[Fig. 12e]



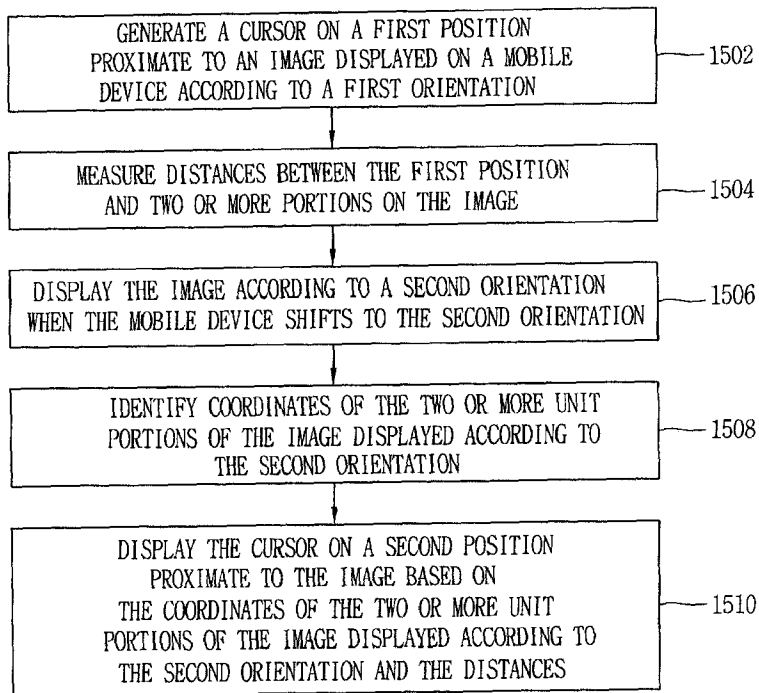
[Fig. 13]



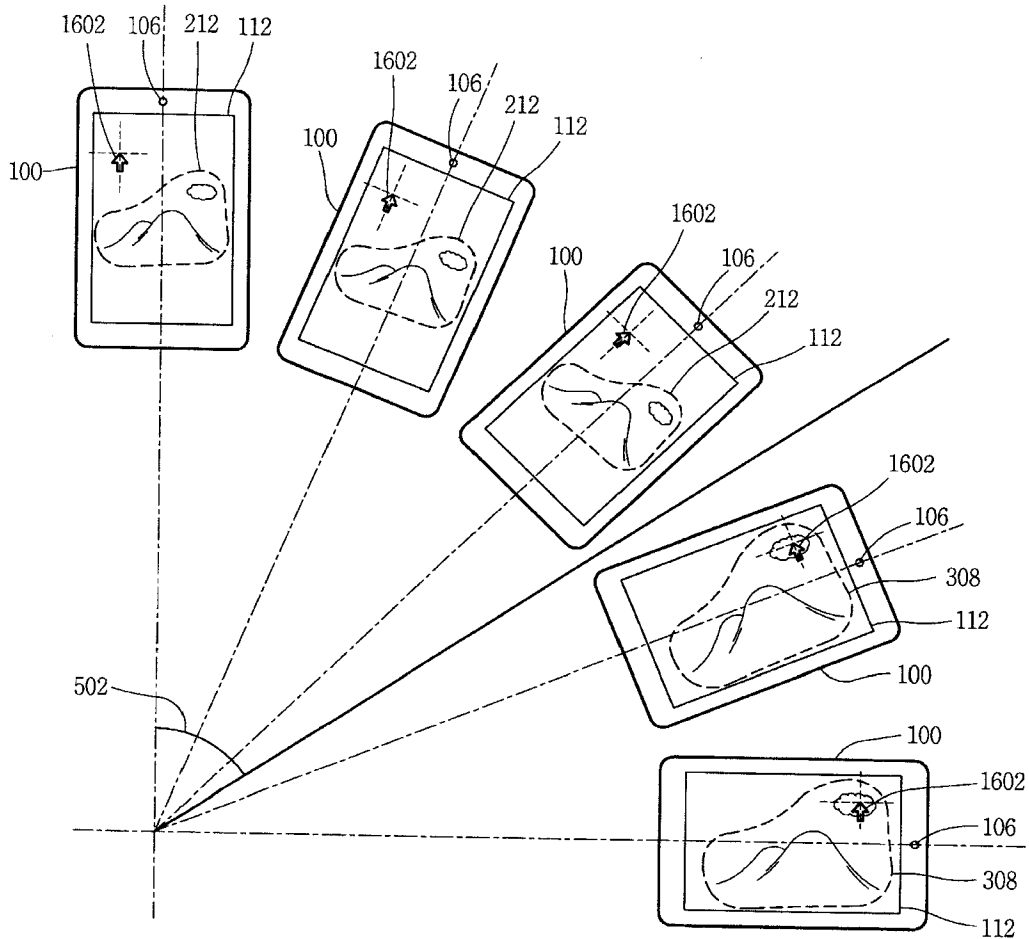
[Fig. 14]



[Fig. 15]



[Fig. 16]



**A. CLASSIFICATION OF SUBJECT MATTER****G06F 3/03(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)

G06F 3/03; G06F 3/048; G09G 5/08; G06F 3/00; G06F 17/00; H04B 1/38; G06F 3/041

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; Keywords: orientation, way, direction, portrait, landscape, display, coordinate, rotate, recognition, recognize, gesture, trace, camera

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2010-0087230 A1 (PEH PENDRA C. et al.) 08 April 2010 See the abstract, claims 1-6, figures 24-25.	1-20
A	US 2010-0031169 A1 (JANG SE-YOON et al.) 04 February 2010 See the abstract, claims 8-9, figures 11-12.	1-20
A	US 2009-0207138 A1 (THORN OLA KARL) 20 August 2009 See the abstract, claims 1, 9, 20.	1-20
A	US 2009-0228841 A1 (HILDRETH EVAN) 10 September 2009 See the abstract, claims 1-8, paragraphs [0036]-[0042].	1-20
A	US 2010-0060576 A1 (UNDERKOFFLER JOHN S. et al.) 11 March 2010 See the abstract, figures 14-21.	1-20

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

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

27 DECEMBER 2011 (27.12.2011)

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

**PCT/KR2011/002630**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010-0087230 A1	08.04.2010	None	
US 2010-0031169 A1	04.02.2010	CN 101640725 A EP 2151745 A2 KR 10-2010-0012728 A KR20100012728A	03.02.2010 10.02.2010 08.02.2010 08.02.2010
US 2009-0207138 A1	20.08.2009	CN 101939721 A EP 2245525 A2 JP 2011-511379 A JP 2011-511379 T WO 2009-104062 A2 WO 2009-104062 A3	05.01.2011 03.11.2010 07.04.2011 07.04.2011 27.08.2009 27.08.2009
US 2009-0228841 A1	10.09.2009	JP 2011-517357 A WO 2009-111329 A2	02.06.2011 11.09.2009
US 2010-0060576 A1	11.03.2010	CN 101536494 A CN 102047203 A CN 102112945 A EP 1851750 A2 EP 2266016 A2 EP 2304527 A1 EP 2338114 A1 EP 2350774 A1 JP 2008-530661 A JP 2011-523112 A JP 2011-525283 A KR 10-0960577 B1 KR 10-2010-0136993 A KR 10-2011-0022057 A KR 10-2011-0058871 A KR 10-2011-0079839 A US 2006-0187196 A1 US 2008-0271053 A1 US 2009-0231278 A1 US 2009-0278915 A1 US 2010-0053304 A1 US 2010-0060570 A1 US 2010-0066676 A1 US 2010-0090946 A1 US 2010-0090947 A1 US 2010-0127968 A1 US 2010-0128062 A1 US 2010-0131549 A1 US 2010-0280988 A1 US 2010-0281440 A1 US 2011-0018803 A1 US 2011-0025598 A1	16.09.2009 04.05.2011 29.06.2011 07.11.2007 29.12.2010 06.04.2011 29.06.2011 03.08.2011 07.08.2008 04.08.2011 15.09.2011 03.06.2010 29.12.2010 04.03.2011 01.06.2011 08.07.2011 24.08.2006 30.10.2008 17.09.2009 12.11.2009 04.03.2010 11.03.2010 18.03.2010 15.04.2010 15.04.2010 27.05.2010 27.05.2010 27.05.2010 04.11.2010 04.11.2010 27.01.2011 03.02.2011

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/KR2011/002630**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2011-0025603 A1	03.02.2011
		US 7598942 B2	06.10.2009
		WO 2006-086508 A2	17.08.2006
		WO 2006-086508 A3	17.08.2006
		WO 2009-124181 A2	08.10.2009
		WO 2009-155465 A1	23.12.2009
		WO 2010-028176 A1	11.03.2010
		WO 2010-045394 A1	22.04.2010
		WO 2010-129599 A1	11.11.2010
		WO 2010-138743 A2	02.12.2010
		WO 2010-138743 A3	02.12.2010