

object. For instance, a user may set or move their fingers in a gestural way on the surface of the touch screen and while over the displayed GUI object. The gestural input may include one or more single gestures that occur consecutively or multiple gestures that occur simultaneously. Each of the gestures generally has a particular sequence, motion, or orientation associated therewith. For example, a gesture may include spreading fingers apart or closing fingers together, rotating the fingers, translating the fingers, and/or the like.

[0100] Following block 304 the touch-based method 300 proceeds to block 306 where the GUI object is modified based on and in unison with the gesture input. By modified, it is meant that the GUI object changes according to the particular gesture or gestures being performed. By in unison, it is meant that the changes occur approximately while the gesture or gestures are being performed. In most cases, there is a one to one relationship between the gesture(s) and the changes occurring at the GUI object and they occur substantially simultaneously. In essence, the GUI object follows the motion of the fingers. For example, spreading of the fingers may simultaneously enlarge the object, closing of the fingers may simultaneously reduce the GUI object, rotating the fingers may simultaneously rotate the object, translating the fingers may allow simultaneous panning or scrolling of the GUI object.

[0101] In one embodiment, block 306 may include determining which GUI object is associated with the gesture being performed, and thereafter locking the displayed object to the fingers disposed over it such that the GUI object changes in accordance with the gestural input. By locking or associating the fingers to the GUI object, the GUI object can continuously adjust itself in accordance to what the fingers are doing on the touch screen. Often the determination and locking occurs at set down, i.e., when the finger is positioned on the touch screen.

[0102] FIG. 10 is a diagram of a zoom gesture method 350, in accordance with one embodiment of the present invention. The zoom gesture may be performed on a multipoint touch screen. The zoom gesture method 350 generally begins at block 352 where the presence of at least a first finger and a second finger are detected on a touch sensitive surface at the same time. The presence of at least two fingers is configured to indicate that the touch is a gestural touch rather than a tracking touch based on one finger. In some cases, the presence of only two fingers indicates that the touch is a gestural touch. In other cases, any number of more than two fingers indicates that the touch is a gestural touch. In fact, the gestural touch may be configured to operate whether two, three, four or more fingers are touching, and even if the numbers change during the gesture, i.e., only need a minimum of two fingers at any time during the gesture.

[0103] Following block 352, the zoom gesture method 350 proceeds to block 354 where the distance between at least the two fingers is compared. The distance may be from finger to finger or from each finger to some other reference point as for example the centroid. If the distance between the two fingers increases (spread apart), a zoom-in signal is generated as shown in block 356. If the distance between two fingers decreases (close together), a zoom-out signal is generated as shown in block 358. In most cases, the set down of the fingers will associate or lock the fingers to a particular

GUI object being displayed. For example, the touch sensitive surface can be a touch screen, and the GUI object can be displayed on the touch screen. This typically occurs when at least one of the fingers is positioned over the GUI object. As a result, when the fingers are moved apart, the zoom-in signal can be used to increase the size of the embedded features in the GUI object and when the fingers are pinched together, the zoom-out signal can be used to decrease the size of embedded features in the object. The zooming typically occurs within a predefined boundary such as the periphery of the display, the periphery of a window, the edge of the GUI object, and/or the like. The embedded features may be formed on a plurality of layers, each of which represents a different level of zoom. In most cases, the amount of zooming varies according to the distance between the two objects. Furthermore, the zooming typically can occur substantially simultaneously with the motion of the objects. For instance, as the fingers spread apart or closes together, the object zooms in or zooms out at the same time. Although this methodology is directed at zooming, it should be noted that it may also be used for enlarging or reducing. The zoom gesture method 350 may be particularly useful in graphical programs such as publishing, photo, and drawing programs. Moreover, zooming may be used to control a peripheral device such as a camera, i.e., when the finger is spread apart, the camera zooms out and when the fingers are closed the camera zooms in.

[0104] FIGS. 11A-11J illustrate a zooming sequence using the method described above. FIG. 11A illustrates a display presenting a GUI object 364 in the form of a map of North America with embedded levels which can be zoomed. In some cases, as shown, the GUI object is positioned inside a window that forms a boundary of the GUI object 364. FIG. 11B illustrates a user positioning their fingers 366 over a region of North America 368, particularly the United States 370 and more particularly California 372. In order to zoom in on California 372, the user starts to spread their fingers 366 apart as shown in FIG. 11C. As the fingers 366 spread apart further (distance increases), the map zooms in further on Northern California 374, then to a particular region of Northern California 374, then to the Bay area 376, then to the peninsula 378 (e.g., the area between San Francisco and San Jose Area), and then to the city of San Carlos 380 located between San Francisco and San Jose as illustrated in FIGS. 11D-11H. In order to zoom out of San Carlos 380 and back to North America 368, the fingers 366 are closed back together following the sequence described above, but in reverse.

[0105] FIG. 12 is a diagram of a pan method 400, in accordance with one embodiment of the present invention. The pan gesture may be performed on a multipoint touch screen. The pan method 400 generally begins at block 402 where the presence of at least a first object and a second object are detected on a touch sensitive surface at the same time. The presence of at least two fingers is configured to indicate that the touch is a gestural touch rather than a tracking touch based on one finger. In some cases, the presence of only two fingers indicates that the touch is a gestural touch. In other cases, any number of more than two fingers indicates that the touch is a gestural touch. In fact, the gestural touch may be configured to operate whether two, three, four or more fingers are touching, and even if the numbers change during the gesture, i.e., only need a minimum of two fingers. Following block 402, the pan method