

immediately taps elsewhere (down and up) with a second finger at an arbitrary second location. Subsequently moving the first finger effectively emulates dragging with the right mouse button depressed. After the second finger has tapped the surface, when the user stops pressing with the first finger, the system will emulate releasing the right mouse button. To emulate a right-click (button pressed and then released), the user simply presses with a first finger at the desired click location, taps briefly with a second finger, and then releases (stops touching) with the first finger. The state diagram for single-clicking and dragging with the right mouse button is shown in FIG. 7. The states are no fingers down **701**, one finger down **702**, and right mouse button mode **703**. The events are left click, right button down **712**, right button up **713**, and dragging with the right button **714**.

[0051] According to an embodiment, to emulate pressing down the middle mouse button, the user presses one finger down on the surface at the desired location, and then immediately taps twice elsewhere (down and up, but twice) with a second finger at an arbitrary second location. Subsequently moving the first finger will effectively emulate dragging with the middle mouse button depressed. After the second finger has tapped the surface twice, when the user stops pressing with the first finger, the system will emulate releasing the middle mouse button. To emulate a middle-click (button pressed and then released), the user simply presses with the first finger at the desired click location, taps briefly twice with the second finger, and then releases (stops touching) with the first finger. The state diagram for single-clicking and dragging with the middle mouse button is shown in FIG. 8. The states are no fingers down **801**, one finger down **802**, pending right or middle button mode **803**, and middle button mode **804**. The events are left click, **811**, middle button down **812**, middle button up **813**, and dragging with middle button **814**.

[0052] According to an embodiment, a user may emulate moving the mouse cursor, i.e. repositioning the mouse cursor with no mouse buttons engaged. To do this, starting, as shown in FIG. 9 in with no fingers down **901**, the user presses down on the surface with two fingers at the same time to enter Precision-Hover mode **902**. This causes the cursor to move to the midpoint of the two fingers **912**. Subsequently moving one or both fingers will cause the cursor to be continually repositioned such that it stays at the midpoint of the two fingers **912**, without any mouse buttons being engaged. While in this mode, tapping with a third finger toggles the state of the left mouse button between being pressed **903** and released **902**. The user may perform typical "left-dragging" operations such as dragging and drawing by moving either or both fingers while the left mouse button is down **903**. The Precision-Hover mode **902** and the partner left-dragging mode **903** are exited when all of the user's fingers stop touching the surface **913**.

[0053] Therefore, FIG. 9 is a state diagram of principle states for emulating repositioning the mouse cursor with no mouse buttons engaged, and for emulating toggling the activation of the left mouse button on a multi-touch sensitive surface according to one embodiment of the invention. The states are no fingers down **901**, Precision-Hover mode **902**, and left mouse button is down mode **903**. The events are left button down **911**, finger movements reposition the cursor **912**, left button up **913**, and dragging with the left mouse button **914**.

[0054] According to this embodiment of the invention, to emulate rotating a mouse wheel, the user presses one fist down on the surface, and then slides that fist up/away or down/closer to emulate scrolling the mouse wheel up or down. This embodiment relies on the fact that the system can determine a size of an area being touched. In this case, the area touched by a fingertip is substantially smaller than an area being touched by a closed fist. The ratio of sliding amount to resultant mouse wheel rotation amount may be configurable. This is shown in FIG. 10. The states are no fingers down **1001**, and mouse wheel mode **1002**. The events are mouse wheel scroll down **1011**, and mouse wheel scroll up **1012**.

[0055] It is to be understood that various other adaptations and modifications may be made within the spirit and scope of the invention. Therefore, it is the object of the appended claims to cover all such variations and modifications as come within the true spirit and scope of the invention.

We claim:

1. A computer implemented method for emulating a mouse with a multi-touch sensitive display surface, comprising the steps of:

sensing a first touching by a first finger at a first location on a multi-touch sensitive display surface;

sensing concurrently a second touching by a second finger at a second location on the multi-touch sensitive display surface; and

displaying a graphic object on the multi-touch display surface at a position dependent on the first location and the second location.

2. The method of claim 1, in which the position is mid-point between the first location and the second location.

3. The method of claim 1, in which the first finger is a middle finger and the second finger is a thumb of the hand.

4. The method of claim 1, in which the first finger is a ring finger and the second finger is a thumb of the hand.

5. The method of claim 1, in which the graphic object is a cursor.

6. The method of claim 1, further comprising:

moving concurrently, the first finger and the second finger while touching the multi-touch display surface to change the first and second locations; and

displaying concurrently the graphic object at moving positions dependent on the moving first and second locations to emulate moving a mouse.

7. The method of claim 1, further comprising:

sensing concurrently a third tapping by a third finger at a third location on the multi-touch sensitive display surface; and

switching between cursor control modes according to the third touching.

8. The method of claim 7, in which the cursor control modes emulate cursor positioning and engagement.

9. The method of claim 7, in which the first finger is a middle finger of a hand, the second finger is a thumb of the hand, and the third finger is an index finger of the hand.

10. The method of claim 7, in which the first finger is a ring finger of a hand, the second finger is a thumb of the hand, and the third finger is an index finger of the hand.