

GESTURES FOR TOUCH SENSITIVE INPUT DEVICES

[0001] This application is a continuation of U.S. patent application Ser. No. 10/903,964, filed Jul. 30, 2004, entitled "GESTURES FOR TOUCH SENSITIVE INPUT DEVICES," which is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates generally to gesturing associated with touch sensitive devices.

[0004] 2. Description of the Related Art

[0005] There exist today many styles of input devices for performing operations in a computer system. The operations generally correspond to moving a cursor and making selections on a display screen. The operations may also include paging, scrolling, panning, zooming, etc. By way of example, the input devices may include buttons, switches, keyboards, mice, trackballs, touch pads, joy sticks, touch screens and the like. Each of these devices has advantages and disadvantages that are taken into account when designing the computer system.

[0006] Buttons and switches are generally mechanical in nature and provide limited control with regards to the movement of the cursor and making selections. For example, they are generally dedicated to moving the cursor in a specific direction (e.g., arrow keys) or to making specific selections (e.g., enter, delete, number, etc.).

[0007] In mice, the movement of the input pointer corresponds to the relative movements of the mouse as the user moves the mouse along a surface. In trackballs, the movement of the input pointer corresponds to the relative movements of a ball as the user moves the ball within a housing. Mice and trackballs also include one or more buttons for making selections. Mice may also include scroll wheels that allow a user to move through the GUI by simply rolling the wheel forward or backward.

[0008] With touch pads, the movement of the input pointer corresponds to the relative movements of the user's finger (or stylus) as the finger is moved along a surface of the touch pad. Touch screens, on the other hand, are a type of display screen that has a touch-sensitive transparent panel covering the screen. When using a touch screen, a user makes a selection on the display screen by pointing directly to GUI objects on the screen (usually with a stylus or finger).

[0009] In order to provide additionally functionality, gestures have been implemented with some of these input devices. By way of example, in touch pads, selections may be made when one or more taps are detected on the surface of the touch pad. In some cases, any portion of the touch pad may be tapped, and in other cases a dedicated portion of the touch pad may be tapped. In addition to selections, scrolling may be initiated by using finger motion at the edge of the touch pad.

[0010] U.S. Pat. Nos. 5,612,719 and 5,590,219, assigned to Apple Computer, Inc. describe some other uses of gesturing. U.S. Pat. No. 5,612,719 discloses an onscreen button that is responsive to at least two different button gestures

made on the screen on or near the button. U.S. Pat. No. 5,590,219 discloses a method for recognizing an ellipse-type gesture input on a display screen of a computer system.

[0011] In recent times, more advanced gestures have been implemented. For example, scrolling may be initiated by placing four fingers on the touch pad so that the scrolling gesture is recognized and thereafter moving these fingers on the touch pad to perform scrolling events. The methods for implementing these advanced gestures, however, has several drawbacks. By way of example, once the gesture is set, it cannot be changed until the user resets the gesture state. In touch pads, for example, if four fingers equals scrolling, and the user puts a thumb down after the four fingers are recognized, any action associated with the new gesture including four fingers and the thumb will not be performed until the entire hand is lifted off the touch pad and put back down again (e.g., reset). Simply put, the user cannot change gesture states midstream. Along a similar vein, only one gesture may be performed at any given time. That is, multiple gestures cannot be performed simultaneously.

[0012] Based on the above, there is a need for improvements in the way gestures are performed on touch sensitive devices.

SUMMARY OF THE INVENTION

[0013] The invention relates, in one embodiment, to a computer implemented method for processing touch inputs. The method includes reading data from a touch sensitive device having a multipoint capability. The method also includes identifying at least one multipoint gesture based on the data from the touch sensitive device.

[0014] The invention relates, in another embodiment, to a method of invoking a user interface element on a display via a multipoint touch sensitive device of a computing system. The method includes detecting and analyzing the simultaneous presence of two or more objects in contact with the touch sensitive device. The method also includes selecting a user interface tool, from a plurality of available tools, to display on a display for interaction by a user of the computing system based at least in part on the analyzing. The method further includes controlling the interface tool based at least in part on the further movement of the objects in relation to the touch sensitive device.

[0015] The invention relates, in another embodiment, to a computer implemented method for processing touch inputs. The method includes reading data from a touch sensitive device having a multipoint capability. The method also includes converting the data to a collection of features. The method further includes classifying the features. The method additionally includes grouping the features into one or more feature groups. The method further includes calculating key parameters of the feature groups. Moreover, the method includes associating the feature groups to user interface elements on a display.

[0016] The invention relates, in another embodiment, to a method for recognizing a zoom gesture made on a multipoint touch sensitive device. The method includes detecting the relative locations of a first object and a second object at the same time. The method also includes detecting a change in the relative locations of the first and second object. The method further includes generating a zoom signal in response to the detected change.