

example, the sensing electronics may be adapted to detect the change in capacitance at each of the electrodes as the finger passes over the grid. The sensing electronics are generally located on the backside of the circuit board. By way of example, the sensing electronics may include an application specific integrated circuit (ASIC) that is configured to measure the amount of capacitance in each of the electrodes and to compute the position of finger movement based on the capacitance in each of the electrodes. The ASIC may also be configured to report this information to the computing device.

[0014] Referring to **FIG. 1**, a touch pad **2** will be described in greater detail. The touch pad **2** is generally a small rectangular area that includes a protective shield **4** and a plurality of electrodes **6** disposed underneath the protective shield layer **4**. For ease of discussion, a portion of the protective shield layer **4** has been removed to show the electrodes **6**. Each of the electrodes **6** represents a different x, y position. In one configuration, as a finger **8** approaches the electrode grid **6**, a tiny capacitance forms between the finger **8** and the electrodes **6** proximate the finger **8**. The circuit board/sensing electronics measures capacitance and produces an x, y input signal **10** corresponding to the active electrodes **6**. The x, y input signal **10** is sent to a host device **12** having a display screen **14**. The x, y input signal **10** is used to control the movement of a cursor **16** on the display screen **14**. As shown, the input pointer moves in a similar x, y direction as the detected x, y finger motion.

SUMMARY OF THE INVENTION

[0015] The invention relates, in one embodiment, to a touch pad assembly. The touch pad assembly includes a touch pad having one or more sensors that map the touch pad plane into native sensor coordinates. The touch pad assembly also includes a controller that divides the surface of the touch pad into logical device units that represent areas of the touch pad that can be actuated by a user, receives the native values of the native sensor coordinates from the sensors, adjusts the native values of the native sensor coordinates into a new value associated with the logical device units and reports the new value of the logical device units to a host device.

[0016] The invention relates, in another embodiment, to a method for a touch pad. The method includes mapping the touch pad into native sensor coordinates. The method also includes producing native values of the native sensor coordinates when events occur on the touch pad. The method further includes filtering the native values of the native sensor coordinates based on the type of events that occur on the touch pad. The method additionally includes generating a control signal based on the native values of the native sensor coordinates when a desired event occurs on the touch pad.

[0017] The invention relates, in another embodiment, to a signal processing method. The method includes receiving a current user location. The method also includes determining the difference in user location by comparing the current user location to a last user location. The method further includes only outputting the current user location when the difference in user location is larger than a threshold value. The method additionally includes converting the outputted current user location into a logical device unit. Moreover, the method

includes generating a message for a host device. The message including the more logical user location. The more logical user location being used by the host device to move a control object in a specified manner.

[0018] The invention relates, in another embodiment, to a message from a touch pad assembly to a host device in a computer system that facilitates bidirectional communications between the touch pad assembly and the host device. The message includes an event field identifying whether the message is a touch pad event or a button event. The message also includes an event identifier field identifying at least one event parameter, each event parameter having an event value, the event value for a touch pad event parameter indicating an absolute position, the event value for a button event parameter indicating button status.

[0019] The invention relates, in another embodiment, to a touch pad assembly capable of transforming a user action into motion onto a display screen, the touch pad system including a touch pad having a plurality of independent and spatially distinct button zones each of which represents a different movement direction on the display screen so as to enable joystick implementations, multiple dimensional menu selection or photo image panning.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

[0021] **FIG. 1** is a simplified diagram of a touch pad and display.

[0022] **FIG. 2** is a diagram of a computing system, in accordance with one embodiment of the present invention.

[0023] **FIG. 3** is a flow diagram of signal processing, in accordance with one embodiment of the invention.

[0024] **FIG. 4** is a flow diagram of touch pad processing, in accordance with one embodiment of the invention.

[0025] **FIG. 5** is a flow diagram of a touch pad processing, in accordance with one embodiment of the invention.

[0026] **FIG. 6** is a diagram of a communication protocol, in accordance with one embodiment of the present invention.

[0027] **FIG. 7** is a diagram of a message format, in accordance with one embodiment of the present invention.

[0028] **FIG. 8** is a perspective view of a media player, in accordance with one embodiment of the invention.

[0029] **FIG. 9** is a front view of a media player, in accordance with one embodiment of the present invention.

[0030] **FIG. 10** is a front view of a media player, in accordance with one embodiment of the present invention.

[0031] **FIGS. 11A-11D** are top views of a media player in use, in accordance with one embodiment of the present invention.

[0032] **FIG. 12** is a partially broken away perspective view of an annular capacitive touch pad, in accordance with one embodiment of the present invention.