

and the like), rectilinear shapes (e.g., hexagon, pentagon, octagon, rectangle, square, and the like) or a combination of curvilinear and rectilinear (e.g., dome).

[0105] The various aspects of the inventions described above can be used alone or in various combinations. The invention is preferably implemented by a combination of hardware and software, but can also be implemented in hardware or software. The invention can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that can store data which can thereafter be read by a computer system. Examples of the computer readable medium include read-only memory, random-access memory, CD-ROMs, DVDs, magnetic tape, optical data storage devices, and carrier waves. The computer readable medium can also be distributed over a network coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

[0106] As mentioned above, the touch pad assembly may communicate with the host device via a serial interface. An example of a serial interface will now be described. The serial interface consists of at least four signals including a clock, ATN, DATA-IN, and DATA_OUT. The clock and DATA_OUT are driven by the touch pad assembly. The ATN and DATA_IN are driven by the host device. In most cases, packet transfers are initiated by the touch pad assembly, clocked by the touch pad assembly and done at a time convenient to the touch pad assembly. The host device relies on the touch pad assembly to initiate transfers. The touch pad assembly transfers a packet when it detects a change in button status or touch pad position or if it detects an ATN signal from the host. If the host wishes to send data to the touch pad assembly it asserts the ATN signal and keeps it asserted until after the packet it wants to send has been transferred. The touch pad assembly monitors the ATN signal and initiates a transfer if it sees it asserted.

[0107] There are typically several defined packets types that the touch pad assembly can transmit. In this example, there are at least two kinds of packets: unsolicited packets and packets sent as a response to an ATN signal. The touch pad assembly sends unsolicited packets unless specifically asked by the host to send another type. In the case of unsolicited packets, the unsolicited packets are sent periodically whenever it detects a change in button status or touch pad position. In the case of solicited packets, the touch pad assembly typically only sends one for each request by the host and then reverts back to unsolicited packets. Unsolicited packets generally have a delay between them while response packets may be sent at any time in response to the ATN signal.

[0108] While this invention has been described in terms of several preferred embodiments, there are alterations, permutations, and equivalents, which fall within the scope of this invention. For example, although the invention has been described in terms of an MP3 music player, it should be appreciated that certain features of the invention may also be applied to other types of media players such as video recorders, cameras, and the like. Furthermore, the MP3 music player described herein is not limited to the MP3 music format. Other audio formats such as MP3 VBR (variable bit rate), AIFF and WAV formats may be used. Moreover, certain aspects of the invention are not limited to

handheld devices. For example, the touch pad may also be used in other computing devices such as a portable computer, personal digital assistants (PDA), cellular phones, and the like. The touch pad may also be used a stand alone input device that connects to a desktop or portable computer.

[0109] It should also be noted that there are many alternative ways of implementing the methods and apparatuses of the present invention. For example, although the touch pad has been described in terms of being actuated by a finger, it should be noted that other objects may be used to actuate it in some cases. For example, a stylus or other object may be used in some configurations of the touch pad. It is therefore intended that the following appended claims be interpreted as including all such alterations, permutations, and equivalents as fall within the true spirit and scope of the present invention.

What is claimed is:

1. A touch pad assembly, comprising:

a touch pad having one or more sensors that map the touch pad plane into native sensor coordinates; and

a controller that divides the surface of the touch pad into logical device units, 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, the logical device units representing areas of the touch pad that can be actuated by a user.

2. The touch pad assembly as recited in claim 1 wherein the controller passes the native values of the native sensor coordinates through a filtering process before adjusting the native values into a new value.

3. The touch pad assembly as recited in claim 2 wherein the filtering process includes determining if the native values are based on noise events or actual events.

4. The touch pad assembly as recited in claim 3 wherein the controller filters out the noise events and allows the actual events to pass through.

5. The touch pad assembly as recited in claim 1 wherein the controller further determines if a significant change has been made between the current and last received native values, and only reports the new value when a significant change has been made between the current and last received native values.

6. The touch pad assembly as recited in claim 1 wherein the native sensor coordinates are Cartesian coordinates.

7. The touch pad assembly as recited in claim 1 wherein the native sensor coordinates are Polar coordinates.

8. The touch pad assembly as recited in claim 1 wherein the logical device units are Cartesian coordinates.

9. The touch pad assembly as recited in claim 1 wherein the logical device units are Polar coordinates.

10. The touch pad assembly as recited in claim 1 wherein the new value of the logical device units are reported in an absolute mode.

11. The touch pad assembly as recited in claim 1 wherein the new value of the logical device units are reported in a relative mode.

12. The touch pad assembly as recited in claim 1 wherein the new value of the logical device units are reported in a Cartesian absolute mode, a Cartesian relative mode, a Polar absolute mode or a Polar relative mode.