RAW DATA TRACK PAD DEVICE AND SYSTEM

BACKGROUND

[0001] The invention relates generally to computer input devices and more particularly to a track pad input device that generates and transmits measured (raw) sensor data to a host computer system. Software executing on the host computer system analyzes the raw sensor data to determine the user's action.

[0002] A track pad is a touch-sensing planar digitizer input device used instead of, or in conjunction with, a mouse or trackball. During use, an operator places a finger on the track pad and moves the finger along the touch-sensing planar surface. The track pad detects the movement of the finger and in response provides location and/or motion signals to a computer. There are two common types of track pad sensor devices: resistive and capacitive. A resistive track pad sensor is a mechanical sensor that uses two layers of material that are typically separated by air. Pressure from a finger pushes the top layer (generally a thin, clear polyester film) so that it touches the bottom layer (generally glass). The voltage at the contact point is measured and the finger's location and/or motion is computed and transmitted to a host computer system. After the finger is removed, the top layer "bounces back" to its original configuration. A capacitive track or touch pad sensor, in contrast, is a solid-state sensor made using printed circuit board ("PCB") or flex circuit technology. A finger on, or in close proximity to, a top grid of conductive traces changes the capacitive coupling between adjacent traces or the self-capacitance of each trace. This change in capacitance is measured and the finger's location and/or motion is computed and transmitted to a host computer system.

[0003] Referring to **FIG. 1**, prior art computer system **100** includes track pad device **105** coupled to host computer module **110** via communication path **115**. Track pad device **105** comprises sensor **120**, data acquisition circuit **125**, processor **130**, memory **135** and transmit circuit **140**. In the case of a capacitive track pad device, as a user's finger(s) is (are) moved over the surface of sensor **120**, data acquisition circuit **125** measures changes in the capacitive coupling between adjacent sensor elements (or the self-capacitance of a given sensor element). Processor **130**, in conjunction with memory **135**, processes the acquired capacitance signals to compute a signal indicating the user's finger position on sensor **120** (e.g., a Δx and Δy signal). In some prior art track pad devices, processor **130** may also determine if multiple fingers are activating sensor **120** and whether certain predetermined finger motions (often referred to as "gestures") are being made—e.g., "select,""drag,""file open" and "file close" operations. At specified intervals (e.g., 50 times per second), the user's finger location and/or motion as determined by processor **130** is transmitted to host computer module **110** via communication path **115**. At host computer module **110**, receive circuit **145** receives the transmitted track pad signal and passes it's information to driver application **150**. Driver application **150**, in turn, makes the computed sensor information available to other applications such as, for example, window display subsystem application **155**. Thus, prior art system **100** utilizes a dedicated processor for measuring and analyzing raw track pad sensor data to generate a signal that indicates a user's action.

[0004] One of ordinary skill in the art will recognize that processor **130** may be embodied in a general purpose processor (e.g., a microprocessor), a microcontroller or a special purpose or custom designed processor or state machine (e.g., an application specific integrated circuit or a custom designed gate array device). Further, memory **135** is typically used to provide permanent storage for instructions (i.e., firmware) to drive processor **130** and may, optionally, include random access memory and/or register storage. A benefit of the architecture of **FIG. 1** is that host computer module **110** does not need to know about or understand the type of data generated by sensor **120**. A corollary of this feature is that host computer module **110** does not process track pad sensor data.

[0005] It will also be recognized by one of ordinary skill that a drawback to the architecture of **FIG. 1** is that the feature set (i.e., what motions are detectable) provided by track pad device **105** is essentially fixed by its dedicated hardware—processor **130** and associated firmware (memory **135**). Another drawback to the architecture of **FIG. 1** is that each manufactured device **105** includes the cost of processor **130** and associated firmware memory **135**. Thus, it would be beneficial to provide a track pad device that overcomes these inherent drawbacks.

SUMMARY

[0006] In one embodiment the invention provides a track pad input device that includes a track pad sensor element that generates output signals representing a track pad sensor characteristic (i.e., capacitance or resistance), a data acquisition circuit that measures a (digital) value encoding the track pad sensor's characteristic and a communication circuit that transmits the measured track pad sensor values to a general purpose processor for analysis, the general purpose processor is also responsible for executing user and other system level tasks or applications. In one specific embodiment, the track pad sensor is a capacitive track pad sensor so that measured values comprise raw track pad sensor values and the general purpose processor corresponds to a host computer system's central processing unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] **FIG. 1** shows, in block diagram form, a track pad-computer system architecture in accordance with the prior art.

[0008] **FIG. 2** shows, in block diagram form, a track pad-computer system architecture in accordance with one embodiment of the invention.

[0009] **FIG. 3** shows, in block diagram form, a track pad device and host computer system in accordance with one embodiment of the invention.

[0010] **FIG. 4** shows, in block diagram form, a track pad sensor data acquisition system in accordance with one embodiment of the invention.

[0011] **FIG. 5** shows, in flowchart form, a data acquisition method in accordance with one embodiment of the invention.

DETAILED DESCRIPTION

[0012] Referring first to **FIG. 2**, the general architecture of a system incorporating a track pad device in accordance with the invention is illustrated. As shown, system **200** includes