MULTI TOUCH WITH MULTI HAPTICS

CROSS REFERENCE TO RELATED APPLICATIONS

This patent application takes priority under 35 U.S.C. 119 (e) to U.S. Provisional Application Ser. No. 61/140,519 entitled MULTI TOUCH WITH MULTI HAPTICS by Burrough et al., filed Dec. 23, 2008 which is incorporated by reference in its entirety for all purposes.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to providing multi-touch/multi-haptic systems and methods.

2. Description of the Related Art

Multi-touch devices have advantages over conventional single point sensing touch devices in that they can distinguish more than one object (finger) in contrast to single point devices that are simply incapable of distinguishing multiple objects. In most cases, multi-touch devices monitor a sensing surface for a touch or near touch, and when a touch occurs determines the distinct areas of contact and identifies the contacts via their geometric features and geometric arrangement. Once identified or classified, the contacts are monitored for various motions, actions or events. The contacts and motions thereof are then converted into inputs for controlling some aspect of an electronic device.

Multi-touch devices can be embodied in various forms including but not limit to standard touch pads, large extended palm pads, touch screens, touch sensitive housings, etc. Furthermore, multi-touch devices can be placed in various electronic devices including but not limited to computers such as tablet computers, laptop computers, desktop computers as well as handheld computing devices such as media players (e.g., music, video, games), PDAs, cell phones, cameras, remote controls, and/or the like. The multi-touch devices can also be placed on dedicated input devices such as touch screen monitors, keyboards, navigation pads, tablets, mice, and the like. Essentially, multi-touch devices can be applied to any surface, and can be found in any consumer electronic product that requires inputs.

Since multi-touch devices provide a number of inputting operations at a single location (input surface), inputting with multi-touch devices can be very efficient. The user can maintain their hand(s) at the multi-touch surface without having to move their hand(s) to address other input devices. For example, conventional systems typically include a keyboard and a separate mouse. In order to use the mouse, the user must move their hand from the keyboard and onto the mouse. In order to keyboard efficiently (both hands), the user must move their hand from the mouse to the keyboard. This inputting sequence is very inefficient. For one, only one device can be used effectively at a given time. For another, there is wasted time between each inputting step. In contrast, with multi-touch surfaces the user can generate both static commands (e.g., keyboarding) and manipulative commands (e.g., tracking) from the same location and at the same time. The user therefore does not have to move their hands to perform different inputting tasks. The user simply provides different chords or finger motions to generate a number of inputs either sequentially or simultaneously. In one example, the user can provide key commands with taps at specific locations of the multi-touch surface while allowing tracking from all locations of the multi-touch surface.

However, research has shown that providing the multi-touch surface with the ability to provide physical (haptic) feedback makes the multi-touch experience even more efficient and realistic to the user. For example, physical keyboards provide a physical indication (a bump, for example) indicative of the home key. This physical sensation can not be provided by a conventional multi-touch system thereby forcing the user to visually locate the home key thereby making keyboard use less efficient and fatiguing. However, by providing a physical facsimile of the home key bump using an actuator that provides a physical sensation to the user providing an approximate representation of the bump, the user's experience of the MT keyboard (and any multi-touch system for that matter) can be more realistic and therefore more enjoyable.

Therefore, a system that enhances the multi-touch experience by incorporating a corresponding physical response(s) is described.

SUMMARY OF THE INVENTION

The invention relates, in one embodiment, to an apparatus and method for providing multi-touch haptic feedback. The apparatus includes, at least, a touch pad having a touch sensitive surface arranged to receive a user provided multi-touch event associated with at least two different locations on the touch sensitive surface, a multi-touch detection mechanism operatively coupled to the touch sensitive surface that detects the multi-touch event and generates a corresponding a multi-touch signal, and a plurality of haptic feedback devices operatively coupled to the multi-touch detection mechanism and the touch sensitive surface cooperatively arranged to concurrently provide tactile feedback at each of the at least two different locations on the touch sensitive surface in response to the multi-touch signal wherein the tactile feedback at each of the at least two different locations are discreet from one another. When the multi-touch signal indicates that the multi-touch event is a dynamic multi-touch event indicating a change in the multi-touch event, then the tactile feedback at each of the at least two different locations is updated to reflect the change in the multi-touch event.

It should be noted that in some cases the tactile feedback event can be different for each of the at least two different locations.

The invention relates, in another embodiment, to a multi-touch haptic mechanism. The multi-touch haptic mechanism includes, at least, a touch pad having a touch sensitive surface arranged to detect a user touch event at substantially any location on the touch sensitive surface and a plurality of independent haptic devices operatively coupled to the touch sensitive surface each providing a corresponding type of tactile feedback thereby providing a tactile feedback at substantially any location on the touch sensitive surface at which the user touch event has occurred, wherein each of the plurality of independent haptic devices only responds to the user touch event in one or more associated regions of the touch sensitive surface. When at least two of the plurality of independent haptic devices cooperate to provide a type of haptic response that is different than that type provided by either of the at least two independent haptic devices separately.

The invention relates, in another embodiment, to an integrated device arranged to act as both a force sensing device and a haptic feedback device. The device includes, at least, a touch sensitive surface, a controller unit, and a mechanical actuator coupled with the controller unit and the touch sensitive surface. The integrated device acts as the force sensing device by generating an output voltage in direct proportion to