USER INTERFACE SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of prior U.S. application Ser. No. 12/497,622, filed on 03 Jul. 2009, which is a continuation-in-part of prior U.S. application Ser. No. 12/319,334, filed on 05 Jan. 2009, which is a continuation-in-part of prior U.S. application Ser. No. 11/969,848, filed on 04 Jan. 2008, all of which are incorporated in their entirety by this reference. U.S. application Ser. No. 12/497,622 is also a continuation-in-part of prior U.S. application Ser. No. 11/969,848, filed on 04 Jan. 2008.

[0002] This application is also a continuation-in-part of prior U.S. application Ser. No. 13/414,589, filed on 07 Mar. 2012, which is a continuation of U.S. application Ser. No. 12/319,334, filed on 05 Jan. 2009, which is a continuation-in-part of prior U.S. application Ser. No. 11/969,848, filed on 04 Jan. 2008, all of which are incorporated in their entirety by this reference.

[0003] This application is also a continuation-in-part of prior U.S. application Ser. No. 11/969,848, filed on 04 Jan. 2008, which is incorporated in its entirety by this reference.

BACKGROUND

[0004] Static user input interfaces, such as those on a typical television remote control or on a mobile phone, provide users with one user interface that locks the interaction modes available between the device and the user. Devices with a static user input interface that may be used with a variety of applications also become very complicated because the static user input interface must be compatible with each application. In the case of universal remotes, user interaction may become very confusing for the user because of the abundance of buttons available that may either provide dual functionality between devices or are extraneous for any one particular device. In the case of mobile devices, such as a cellular phone with multiple functionalities that uses a static user input interface, adapting the available static user input interface to the plurality of functionalities of the device is also challenging. Additionally, as mobile devices become smaller and more powerful, functionality of the device may be severely hindered by a static user input interface.

[0005] Touch sensitive displays, e.g., touch screens, are able to provide a dynamic user input interface and are very useful in applications where the user interface is applied to a variety of uses, for example, in a universal remote where the user interface may change to adapt to the device that is being controlled by the user or in a cellular phone with multiple functionalities. However, unlike a static user input interface with a dedicated input device, such as a keypad with discrete well-defined keys, most touch sensitive displays are generally flat. As a result, touch sensitive displays do not provide any of the tactile guidance that may be seen in static user interfaces.

[0006] Hence, serious drawbacks exist in current commonly available user interfaces. In the case of a static user input interface, there is the benefit of tactile guidance but the serious drawback of inability to adapt to an application type. In the case of a touch sensitive display, there is the benefit of an adaptable display and dynamic user input interface but the serious drawback of no tactile guidance, resulting in incorrectly entered keystrokes and the need for the user to keep his or her eyes on the display. The importance of tactile guidance is readily apparent in the competition between the Apple iPhone and the Blackberry 8800. Additionally, with many touch sensitive displays, each touch made by the user is registered with the system, preventing the user from resting his or her finger on the surface of the display. In some touch sensitive displays, the reliance on the change in capacitance due to the presence of a finger at a location as the occurrence of a user input results in the inability for the touch sensitive display to detect user inputs when the user is wearing a glove or when other barriers between a finger and the screen are present.

[0007] This invention provides a new and useful user interface that combines many of the advantages of the benefits of a static user input interface and many of the advantages of a dynamic user input interface.

BRIEF DESCRIPTION OF THE FIGURES

[0008] FIG. **1***a* and **1***b* are a top view of the user interface system of a preferred embodiments and a cross-sectional view illustrating the operation of a button array in accordance to the preferred embodiments, respectively.

[0009] FIGS. **2***a*, **2***b*, and **2***c* are cross-sectional views of the retracted, extended, and user input modes of the preferred embodiments, respectively.

[0010] FIG. **3** is a cross-sectional view of the sheet, the cavity, the sensor, and the display of the preferred embodiments.

[0011] FIG. **4** is a cross-sectional view of the sheet split into a layer portion and a substrate portion.

[0012] FIG. **5***a* and **5***b* are cross-sectional views of the sheet, the cavity, the sensor, and a displacement device that modifies the existing fluid in the cavity, with the cavity in a retracted volume setting and an expanded volume setting, respectively.

[0013] FIG. **6** is a schematic view of the sheet, the cavity, the sensor, and a displacement device of a first example that displaces additional fluid into the cavity.

[0014] FIG. **7** is a schematic view of the sheet, the cavity, the sensor, and a displacement device of a second example that displaces additional fluid into the cavity.

[0015] FIGS. **8***a* and **8***b* are schematic views of the sheet, the cavity, the sensor, and a displacement device of a third example that displaces additional fluid into and out of the cavity, with the cavity in a retracted volume setting and an expanded volume setting, respectively.

[0016] FIGS. **9**, **10**, **11**, and **12** are top and side views of a button deformation, a slider deformation, a slider ring deformation, a guide deformation, and a pointing stick deformation, respectively.

[0017] FIG. **13** is a cross-sectional view of a variation of the preferred embodiments with a support structure and a sensor that detects user touch through the support structure.

[0018] FIGS. **14***a*, **14***b*, **14***c*, and **14***d* are schematic views of a first, second, third, and fourth example of a first variation of the sensor as a capacitive sensor, respectively.

[0019] FIGS. **15***a* and **15***c* are schematic representations of a first and second method of measuring capacitance of a first variation of the sensor as a capacitive sensor, respectively.

[0020] FIGS. **16***a*, **16***b*, and **16***c* are schematic views of a first, second, and third example of the placement of the conductors of the sensor as a capacitive sensor, respectively.

[0021] FIGS. **17***a* and **17***b* are schematic views of a first and second example of a second variation of the sensor as a capacitive sensor, respectively.