USER INTERFACE SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 61/405,149, filed 20-Oct.-2010, which is incorporated in its entirety by this reference.

[0002] This application is related to U.S. application Ser. No. 11/969,848 filed on 4 Jan. 2008 and entitled "System and Method for Raised Touch Screens", U.S. application Ser. No. 12/319,334 filed on 5 Jan. 2009 and entitled "User Interface System", U.S. application Ser. No. 12/497,622 filed on 3 Jul. 2009 and entitled "User Interface System", and U.S. application number 13/278,125 filed on 20 Oct. 2011 and entitled "User Interface System", which are all incorporated in their entirety by this reference.

TECHNICAL FIELD

[0003] This invention relates generally to touch sensitive user interfaces, and more specifically to a new and useful system and method for selectively raising portions of a touch sensitive display.

BACKGROUND

[0004] Touch-sensitive displays (e.g., touch screens) allow users to input commands and data directly into a display, which is particularly useful in various applications. Such touch screen applications include various consumer products, including cellular telephones and user interfaces for industrial process control. Depending on the specific application, these touch-sensitive displays are commonly used in devices ranging from small handheld PDAs, to medium sized tablet computers, to large industrial implements.

[0005] It is often convenient for a user to input and read data on the same display. Unlike a dedicated input device, such as a keypad with discrete and tactilely distinguishable keys, most touch-sensitive displays generally define a flat and continuous input surface providing no significant tactile guidance to the user. Instead, touch-sensitive displays rely on visual cues (e.g., displayed images) to guide user inputs.

[0006] A serious drawback of touch-sensitive displays is thus the inherent difficulty a user faces when attempting to input data accurately because adjacent buttons are not distinguishable by feel. Improper keystrokes are common, which forces the user to focus both on the keypad (to properly input the next keystroke) and on the text input line (to check for errors); generally, the user is forced to keep his or her eyes on the display in order to minimize input errors. The importance of tactile guidance is readily apparent in the competition between the Apple's iPhone and RIM's BlackBerry 8800. Touch-sensitive displays and physical hard buttons each have benefits and drawbacks, and digital devices generally incorporate one such component or the other, although some devices do include both disparate components, which often makes for either bulkier devices or devices with less operating power due to size constraints.

[0007] As with many touch sensitive displays, nearly any touch on the display surface is registered as an input; this substantially prevents the user from resting a finger or palm on the touch surface while generating proper inputs (such as typing). Furthermore, some touch sensitive displays rely on capacitance changes due to the presence of a finger at a location on the touch surface to indicate a user input, and these devices do not sense user inputs when a barrier exists between a finger of the user and the touch surface, such as when the user is wearing a glove.

[0008] Thus, there is a need in the touch-based interface field to create a new and useful interface that incorporates tactile guidance for one or more control buttons and/or incorporates alternatives to sensing a user input. This invention provides such an interface and associated method.

BRIEF DESCRIPTION OF THE FIGURES

[0009] FIG. **1** includes an cross-sectional elevation and plan view of the user interface system of a preferred embodiment of the invention;

[0010] FIG. **2** is a cross-sectional elevation view illustrating operation of a button array in accordance with the preferred embodiment;

[0011] FIG. **3** is a cross-sectional view of the tactile layer, substrate, first pressure sensor, second pressure sensor, displacement device, processor, and display of the preferred embodiment;

[0012] FIG. **4** is a cross-sectional elevation view of the deformable region, of the preferred embodiment, in the retracted state;

[0013] FIG. **5** is a cross-sectional elevation view of the deformable region, of the preferred embodiment, in the expanded state;

[0014] FIG. **6** is a cross-sectional elevation view of the deformable region, of the preferred embodiment, in the user input state;

[0015] FIG. **7** is an elevation view of a variation of the fluid channel, of the preferred embodiment, with a deformable region in the expanded state;

[0016] FIG. **8** is a plan view of a variation of the fluid channel, the valve, and the first and second pressure sensors of the preferred embodiment;

[0017] FIGS. **9**, **10**, **11**, and **12** are plan and elevation views of, respectively, a button deformation, a slider deformation, a slider ring deformation, a guide deformation, and a pointing stick deformation of a deformable region of the preferred embodiment;

[0018] FIG. **13** is a plan view of a variation of the user interface system of the preferred embodiment of the invention; and

[0019] FIG. **14** is a flowchart of the steps of a method of the preferred embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] The following description of the preferred embodiments of the invention is not intended to limit the invention to these preferred embodiments, but rather to enable any person skilled in the art to make and use this invention.

1. The User Interface System

[0021] As shown in FIG. **1**, the user interface system **100** of the preferred embodiment includes: a volume of fluid **110**; a tactile layer **120**; a substrate **130**; a displacement device **140**; a first pressure sensor **150**; a second pressure sensor **160**; and a processor **170**. The tactile layer **120** defines an outer tactile surface **122** touchable by a user and a back surface **124** opposite the tactile surface **122**; the tactile layer **120** includes an undeformable region **128** and a plurality of deformable regions **126**, wherein the deformable regions **126** are operable