TOUCH DISPLAY

FIELD OF THE INVENTION

[0001] This invention relates to touch displays. In particular, the invention relates to electroluminescent displays having force-based touch input detection.

BACKGROUND OF THE INVENTION

[0002] Electronic displays are widely used in all aspects of life. Although in the past the use of electronic displays has been primarily limited to computing applications such as desktop computers and notebook computers, as processing power has become more readily available, such capability has been integrated into a wide variety of applications. For example, it is now common to see electronic displays in a wide variety of applications such as teller machines, gaming machines, automotive navigation systems, restaurant management systems, grocery store checkout lines, gas pumps, information kiosks, and hand-held data organizers to name a few.

[0003] In response to the more ubiquitous use of electronic displays, it has been increasingly desired that displays be made compact in size, especially thin. In particular, significant progress has been made in making displays that are relatively large in viewing area with a relatively small border and a thin design. The most common thin display type used today is the liquid crystal display (LCD). For larger display types, for example, displays having a diagonal of greater than 40 inches, plasma displays are commonly used.

[0004] As electronic displays are more widely used there is a greater desire to improve the user input functionality, leading to an increased use of touch sensor user inputs. Touch sensors typically involve some sort of capacitive or resistive type sensor placed in front of the electronic display to determine the location of a touch on the touch sensor, which correlates to a position on the display. The occurrence and location of the touch are then provided to the processor controlling the information presented on the display, which typically performs specified functions in response to the touch and modifies the information displayed on the electronic display.

[0005] As electronic displays coupled with touch sensors are used in a wide variety of applications, it has become increasingly desirable to have a display incorporating touch functionality, a touch display, which can be used in the various new applications as well as providing improved performance in existing applications.

[0006] Thus, there remains a need to find an improved touch display, which is adaptable to a variety of applications, is relatively thin and compact in design, and provides improved performance over existing touch displays.

SUMMARY OF THE INVENTION

[0007] Generally, the present invention relates to touch displays and methods of displaying information and receiving touch input. In accordance with one embodiment, a touch display includes an electroluminescent (EL) display and two or more sensors that are used to sense the location of a force applied to a touch surface. In one embodiment the forces applied to the touch surface pass through the touch surface to the sensors and information from the sensors is used to determine the location of a touch.

[0008] In a particular embodiment, the touch surface is the emitting surface of the EL display itself. In an alternative embodiment, the touch surface may include a transparent touch element that is disposed proximate to the emitting surface of the EL display.

[0009] In various embodiments, the force sensors may be disposed on the emitting surface side of the display or on a side of the EL display opposite to the touch surface. In one embodiment, the force sensors are disposed between an emitting surface of the EL display and a transparent touch element.

[0010] In various embodiments where a transparent touch element is used, additional functionality may be incorporated into the transparent touch element. For example, the transparent touch element may include a contrast enhancement layer such as a circular polarizer or color filter.

[0011] In accordance with one embodiment of the invention, the touch input display is used in environments where inertial forces are applied to the display. In one embodiment, an inertial sensor is disposed within the touch display, and information gathered by the inertial sensor is used in conjunction with the force sensors to determine the occurrence or location of a touch.

[0012] The above summary of the present invention is not intended to describe each disclosed embodiment or every implementation of the present invention. The Figures and the detailed description that follow more particularly exemplify these embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention may be more completely understood in consideration of the following detailed description of various embodiments of the invention in connection with the accompanying drawings, in which:

[0014] **FIG. 1** illustrates a touch display in accordance with one embodiment of the invention;

[0015] **FIG. 2** illustrates a touch display in accordance with another embodiment of the invention;

[0016] **FIG. 3** illustrates an embodiment of a force sensor in accordance with one particular embodiment of the invention;

[0017] **FIG. 4** illustrates a diagram of various components of a touch display in accordance with an embodiment of the invention;

[0018] **FIG. 5** illustrates a fixed touch display application in accordance with an embodiment of the invention; and

[0019] **FIG. 6** illustrates a touch display in a mobile display application.

[0020] While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention.