

[0053] FIG. 45 illustrates an exemplary user interface changing topography at a location of a touch event according to embodiments of the invention.

[0054] FIG. 46 illustrates an exemplary user interface changing topography at a location resulting from a horizontal scroll touch event according to embodiments of the invention.

[0055] FIG. 47 illustrates an exemplary user interface changing topography at a location resulting from a vertical scroll touch event according to embodiments of the invention.

[0056] FIG. 48 illustrates an exemplary user interface changing topography at multiple locations based on multiple touch events according to embodiments of the invention.

[0057] FIG. 49 illustrates an exemplary method for changing the topography of a user interface based on a location of a touch event according to embodiments of the invention.

[0058] FIG. 50 illustrates an exemplary display device having a user interface that can change topography according to embodiments of the invention.

[0059] FIG. 51 illustrates an exemplary display device having a user interface that can change topography by raising a display screen according to embodiments of the invention.

[0060] FIG. 52 illustrates an exemplary user interface that can change topography according to embodiments of the invention.

[0061] FIG. 53 illustrates an exemplary computing system having a user interface that can change topography according to embodiments of the invention.

[0062] FIG. 54 illustrates an exemplary mobile telephone having a user interface that can change topography according to embodiments of the invention.

[0063] FIG. 55 illustrates an exemplary digital media player having a user interface that can change topography according to embodiments of the invention.

[0064] FIG. 56 illustrates an exemplary personal computer having a user interface that can change topography according to embodiments of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0065] In the following description of preferred embodiments, reference is made to the accompanying drawings in which it is shown by way of illustration specific embodiments in which the invention can be practiced. It is to be understood that other embodiments can be used and structural changes can be made without departing from the scope of the embodiments of this invention.

[0066] This relates to a user interface that can physically change topography to create different tactile configurations at the surface. In some embodiments, the user interface can change topography according to a desired user interface state. The user interface state can, for example, be based on a mode of an electronic device in which the user interface is used and/or a particular preference of a user. In some embodiments, the user interface can change topography according to an event, such as a touch event on the user interface surface. The changing topography can define different user interface layouts. The user interface can, for example, be associated with input and/or output devices, such as touch pads, touch screens, and the like.

[0067] The topographical change can be implemented by a shape changeable surface that can include one or more alterable nodes. The nodes can be altered either individually or in combination and be associated with certain user interface elements. For example, the nodes can be altered to define or

form a physical or virtual button, a key, a navigation pad, a scroll wheel, and the like. In some embodiments, the nodes can comprise electromechanical devices that can move from one level to another to form raised and lowered regions of the user interface. In some embodiments, the nodes can comprise shape changeable material that can change shape to form raised and lowered regions of the user interface. In some embodiments, the nodes can comprise a deformable membrane that can deform to form raised and lowered regions of the user interface.

[0068] This type of configuration can create a different look as well as create a different tactile feel at the user interface surface. In so doing, the user interface can inform the user as to what input and/or output is pertinent for a particular use of an electronic device having the user interface. That is, shape changeable nodes can be moved, shaped, or deformed above or below the initial user interface surface in order to produce a surface of varying topography. When used in conjunction with a display, the shape changeable surface can provide an effective and unobtrusive way to emphasize or highlight certain display elements to the user, and the display can provide a way in which outputs can be viewed by the user. When used in conjunction with a touch sensing device, the shape changeable surface can provide an effective and unobtrusive way for a user to know where the user interface elements are, and the touch sensing device can provide a way in which inputs can be received when the user interface elements are touched. The nodes can correspond directly with a user interface element. For example, the nodes and user interface element can be combined to form an enhanced user interface element. The nodes can also be used indirectly to help define a user interface element. For example, the nodes can help define borders or boundaries of the user interface element.

[0069] Although some embodiments of this invention can be described herein in terms of touch sensitive devices with user interfaces, it should be understood that embodiments of this invention are not so limited, but are generally applicable to any devices utilizing other types of sensing technologies with user interfaces.

[0070] It should be noted that the terms “activate,” “actuate,” “stimulate,” and the like herein can generally be used synonymously to refer to the shape changeable actions of the user interface to change topography according to embodiments of the invention.

[0071] FIG. 1 illustrates an exemplary user interface that can change topography according to embodiments of the invention. In the example of FIG. 1, user interface 10 can include shape changeable surface 11 having shape changeable nodes 12 to change the topography of the user interface. A user interface can be defined as a component associated with a device through which a user interacts with the device to provide input and/or receive output. A topographical (or shape) change can be defined as a change in height, width, length, orientation, configuration, layout, texture, pattern, three-dimensional form, and the like of all or a portion of the surface associated with the user interface. The change can be implemented by physically altering individual shape changeable nodes, as in FIG. 2 described below, or by physically altering a group of shape changeable nodes, as in FIG. 3 described below. The nodes can include an actuator that can change between physical states, thus causing the nodes to change. For example, the actuator can include a moving member that can move the node from an initial state to a raised or lowered state or that can deform, rather than move, the