

[0019] FIG. 14 is a top view illustrating a portion of a portable electronic device that employs an embodiment of a controllable skin texture surface;

[0020] FIG. 15 is a perspective view of a portable electronic device with a controllable skin texture surface in accordance with one embodiment;

[0021] FIG. 16 is a perspective view illustrating one example of a flexible skin structure and corresponding portion of a hydraulic actuation structure in accordance with one example set forth in disclosure;

[0022] FIG. 17 is a block diagram illustrating the portion of a portable electronic device in accordance with one example;

[0023] FIGS. 18a and 18b illustrate a cross sectional view of an embodiment employing a flexible sliding plate in accordance with one embodiment of the invention;

[0024] FIGS. 19 and 20 illustrate cross sectional views of another example of a gas expandable actuation structure and flexible skin structure in accordance with one example;

[0025] FIGS. 21 and 22 illustrate a perspective view of a portable electronic device with a deactivated and actuated controllable skin texture surface;

[0026] FIGS. 23-25 illustrate a perspective view of a portable electronic device illustrating different portions of a controllable skin texture being actuated and deactivated in accordance with one example disclosed below;

[0027] FIG. 26 illustrates a functional block diagram of one example of controlling a controllable skin texture surface;

[0028] FIG. 27 illustrates one example of a tactile morphing display that includes the controllable skin texture surface;

[0029] FIG. 28 illustrates another example of a tactile morphing display that includes the controllable skin texture surface;

[0030] FIG. 29 illustrates one example of a top view the tactile morphing display displaying contents of a webpage;

[0031] FIG. 30 illustrates one example of a side view the tactile morphing display displaying contents of the webpage;

[0032] FIG. 31 illustrates one example of a top view the tactile morphing display displaying contents of a workspace;

[0033] FIG. 32 illustrates one example of a side view the tactile morphing display displaying contents of the workspace;

[0034] FIG. 33 is a flowchart depicting exemplary steps that can be taken to control the tactile morphing display; and

[0035] FIG. 34 is a flowchart depicting exemplary steps that can be taken to control a device having the tactile morphing display.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0036] In one example, a device includes a controllable skin texture surface, a non-keypad display, and control logic. The non-keypad display displays non-keypad information representing at least one selectable element such as a hyperlink, a menu item, an icon, a cursor, a file folder and any other suitable selectable element. The selectable element represents a location of additional display information such as, for example, the location of another webpage or the location of a file directory. The control logic controls at least a portion of the controllable skin texture surface to protrude at a location corresponding to the selectable element to provide a protruding selectable element for a user.

[0037] In one example, the device includes a sensor. The sensor senses a user activating the selectable element. The

control logic controls the non-keypad display to display the additional information in response to the sensor sensing the user activating the selectable element. In one example, the sensor senses whether a user is selecting the selectable element or activating the selectable element.

[0038] In one example, the device includes a speaker. The speaker provides audible feedback when the sensor senses the user selecting the selectable element. In one example, the audible feedback verbally describes the selectable element.

[0039] In one example, the non-keypad display adjusts a visual characteristic of the selectable element such as brightness, color, font, shape, size and/or any other suitable visual characteristic. In one example, the element includes information representing a hyperlink, a menu item, an icon, a cursor, and/or a file folder.

[0040] Among other advantages, the device includes the controllable skin texture surface to move the selectable element closer in proximity to a user's finger, stylus, and/or other suitable user input device, which aids the user in selecting and/or activating the selectable element. In addition, the device can provide audible feedback that can verbally describe the selectable elements, which can aid the user in selecting the selectable elements. Furthermore, visual characteristics of the selectable elements can be adjusted with respect to non-selectable elements to aid the user in selecting and/or activating selectable elements more efficiently. Other advantages will be recognized by those of ordinary skill in the art.

[0041] FIG. 1 illustrates one example of a portable electronic device 100, shown in this example to be a handheld wireless device, that includes a wireless telephone subsystem for communication via one or more suitable wireless networks, and other conventional circuitry along with a display 102 for displaying information to a user that is coupled to the wireless telephone subsystem as known in the art. The portable electronic device 100 also includes a controllable skin texture surface 104 that in this example, covers a portion of a housing (e.g., base housing) of the device 100 that forms part of a user interface portion, namely a user keypad. The controllable skin texture surface 104 also includes other controllable surfaces 106 and 108 that are for aesthetic purposes and are controlled to change the tactile configuration of a non-user interface portion of the portable electronic device, such as another area of the outer portion of the device. As shown in this particular example, the portable electronic device 100 is a flip phone having a foldable housing portion 110 that pivots about a pivot mechanism 112 as known in the art. The foldable housing portion 110 may also include a keypad and controllable skin texture surface as desired. The controllable skin texture surface 104 is controlled to change the tactile configuration of a portion of the skin texture surface to, in this example, raise respective portions of the skin texture to provide a tactilely detectable keypad and other tactile and/or aesthetic features. In one example, the controllable skin texture surface 104 may be flat when, for example, the phone is in a standby mode, but the controllable skin texture surface 104 is controlled to activate portions thereof to provide raised keys for a keypad when an incoming wireless call is detected and is controlled to become flat (deactivated) when a call ends. Other input information is also used to control the actuation/deactuation of the controllable skin texture as described below.

[0042] FIG. 2 illustrates in block diagram form the portable electronic device of FIG. 1 or any other suitable portable