METHOD AND APPARATUS FOR CONTROLLING A DISPLAY OF A DEVICE

RELATED CO-PENDING APPLICATIONS

[0001] This application is related to co-pending applications entitled "METHOD AND APPARATUS FOR CONTROLLING A SKIN TEXTURE SURFACE ON A DEVICE", filed on Apr. 4, 2007, having Ser. No. 11/696,466, inventor Michael E. Caine, owned by instant Assignee and is incorporated herein in its entirety by reference; "METHOD AND APPARATUS FOR CONTROLLING A SKIN TEXTURE SURFACE ON A DEVICE USING A SHAPE MEMORY ALLOY", filed on Apr. 4, 2007, having Ser. No. 11/696,481, inventor Michael E. Caine, owned by instant Assignee and is incorporated herein in its entirety by reference; "METHOD AND APPARATUS FOR CONTROLLING A SKIN TEXTURE SURFACE ON A DEVICE USING HYDRAULIC CONTROL", filed on Apr. 4, 2007, having Ser. No. 11/696,496, inventor Michael E. Caine, owned by instant Assignee and is incorporated herein in its entirety by reference; and "METHOD AND APPARATUS FOR CONTROLLING A SKIN TEXTURE SURFACE ON A DEVICE USING A GAS", filed on even date, having Ser. No. 11/696,503, inventor Michael E. Caine, owned by instant Assignee and is incorporated herein in its entirety by reference.

FIELD OF THE INVENTION

[0002] The disclosure relates generally to portable electronic devices and more particularly to portable electronic devices that employ variable skin texture surfaces.

BACKGROUND OF THE INVENTION

[0003] Portable electronic devices, such as laptops, wireless handheld devices such as cell phones, digital music players, palm computing devices, or any other suitable devices are increasingly becoming widespread. Improved usability of such devices can increase sales for sellers as consumer demand can be driven by differing device usability characteristics and device features.

[0004] Providing differing device usability such as by changing the tactile configuration and/or visual appearance of a surface of a portable electronic device by altering the emission reflection of light to change the overall color or graphics that appear and disappear are known. Surfaces of electronic devices, including portable electronic devices may include, for example, exterior surfaces of the device, activation keys such as keys in a keypad or navigation keys, tactile navigation interfaces, or any other suitable surface.

[0005] Also, as one example to enhance the tactile configuration and/or visual appearance of a device, it has been proposed to employ haptics such as in the form of electro-active polymers that change **3**D shape, also referred to as texture, based on the application of a voltage to portions of the electro-active polymer. Differing textures and shapes can thereby be produced to give the device a different visual appearance and/or tactile configuration. For example, if a portable device includes such electro-active polymers as a type of outer skin, turning power on to the device can cause the electro-active polymer to be activated so that a 3D texture is present and can be felt by a user of the device. It has also been proposed to use piezoelectric actuators as a type of haptic sensor on handheld devices. In one example, a control slider is configured as a bending piezo-actuator. Also it has been proposed to provide handheld devices with menus, such as piezo-actuated haptic icons, that have different tactile feedback for a user so that the user can, for example, turn a phone to a "silent" mode from an active mode by feeling the proper control key and receiving feedback of actuation of the key once it is activated. Further, it has been proposed to use an array of microchambers to provide a reconfigurable keypad having emulated hard keys. However, some portable electronic devices do not include a keypad. In these "non-keypad" devices a user inputs information by selecting portions of a display with a finger, stylus or other suitable user interface. It is desirable to provide, among other things, differing methods and apparatus for actuating skin texture surfaces of a device and differing user experiences.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The present invention and the corresponding advantages and features provided thereby will be best understood and appreciated upon review of the following detailed description of the invention, taken in conjunction with the following drawings, where like numerals represent like elements, in which:

[0007] FIG. **1** is a perspective view of an example of a wireless handheld device that employs a controllable skin texture surface in accordance with one embodiment of the invention;

[0008] FIG. **2** is a block diagram illustrating one example of an apparatus that includes control logic that controls a controllable skin texture surface in accordance with one embodiment of the invention;

[0009] FIG. **3** is an assembly view of a portion of an apparatus in accordance with one embodiment of the invention;

[0010] FIG. **4** is a perspective view illustrating one example of a portion of a mechanical actuation structure that may be part of a controllable skin texture surface in accordance with one embodiment of the invention;

[0011] FIG. **5** is a perspective and side view of the structure shown in FIG. **4** and a portion of a flexible skin structure in accordance with one embodiment of the invention;

[0012] FIG. **6** is a cross-sectional view illustrating another example of a controllable skin texture surface that employs a mechanical actuation structure in accordance with one embodiment of the invention;

[0013] FIG. **7** is a cross-section view as shown in FIG. **6** with texture actuation in accordance with one disclosed example;

[0014] FIG. **8** is a top view of one example of a shape memory alloy actuation structure that may be employed as part of a controllable skin texture surface according to one example of the invention;

[0015] FIGS. **9** and **10***a* are cross-sectional views illustrating the operation of the structure shown in FIG. **8**;

[0016] FIG. **10***b* is a diagram illustrating one example of a bi-stable shape memory alloy actuation scheme according to one example of the invention;

[0017] FIG. **11** is a top view illustrating a portion of a portable electronic device that employs an embodiment of a controllable skin texture surface;

[0018] FIGS. **12** and **13** are cross sectional views of portions of FIG. **11** illustrating a deactuated and actuated skin texture structure in accordance with one embodiment;