

TOUCH SENSITIVE DISPLAY WITH ULTRASONIC VIBRATIONS FOR TACTILE FEEDBACK

BACKGROUND OF THE INVENTION

[0001] Implementations described herein relate generally to input devices, and more particularly, to handheld input devices that may provide tactile feedback in response to key entries.

[0002] Devices, such as handheld mobile communication devices, conventionally include input devices that provide some form of tactile feedback to a user indicating that a keystroke has been detected by the communication device. These conventional keypads are formed of physically distinct keys. Currently, there are no adequate solutions of providing tactile feedback to keypads formed of a single physical device or surface, such as a touch sensitive surface.

SUMMARY OF THE INVENTION

[0003] According to one aspect, a mobile communication device is provided. The mobile communication device may comprise a keypad assembly comprising a touch sensitive cover, an ultrasonic element and a display for displaying characters, and logic configured to sense an input on the touch sensitive cover, and actuate the ultrasonic element based on the sensed input to provide tactile feedback to a user.

[0004] Additionally, the keypad assembly further comprises an enclosure that contains a liquid and the ultrasonic element.

[0005] Additionally, the ultrasonic element produces an ultrasonic wave through the liquid to provide the tactile feedback to a user.

[0006] Additionally, the logic may be further configured to determine a position of input on the touch sensitive cover.

[0007] Additionally, the logic may be further configured to display a character based on the determined position of input on the touch sensitive cover.

[0008] According to another aspect, a method may be provided. The method may comprise receiving input on a touch sensitive surface of a device and activating an ultrasonic element to vibrate in response to the received input, where the vibration provides tactile feedback to a user indicating that the device has received the input.

[0009] Additionally, the method may further comprise sensing the input on a touch sensitive surface by a capacitive film.

[0010] Additionally, the receiving input on a touch sensitive surface comprises detecting a finger of the user on the touch sensitive surface.

[0011] Additionally, the method may further comprise determining a position of the received input on the touch sensitive surface.

[0012] Additionally, the method may further comprise displaying a character based on the determined position of the received input on the touch sensitive surface.

[0013] According to yet another aspect, a mobile communications device may comprise means for providing a plurality of keys; means for sensing a position of input relative to the plurality of keys; means for providing ultrasonic vibrations within the mobile communication device in response to sensing a position of input; and means for displaying a character based on the sensed position of input relative to the plurality of keys.

[0014] Additionally, the means for providing a plurality of keys includes a liquid crystal display (LCD).

[0015] Additionally, the means for sensing a position of input relative to the plurality of keys includes a capacitive film.

[0016] Additionally, the means for providing ultrasonic vibrations within the mobile communication device includes a piezo-electric element.

[0017] Additionally, the means for providing ultrasonic vibrations within the mobile communication device further comprises an enclosure that contains a liquid and the piezo-electric element.

[0018] According to yet another aspect, a device may comprise a keypad assembly comprising: a touch sensitive surface; an enclosure that contains a liquid; and an ultrasonic element, where the ultrasonic element is located within the enclosure; and logic configured to: determine an input position on the touch sensitive surface, and activate the ultrasonic element to produce a vibration through the liquid to provide tactile feedback to a user in response to the determined input position on the touch sensitive surface.

[0019] Additionally, the touch sensitive surface is glass.

[0020] Additionally, the enclosure is in contact with the bottom of the touch sensitive surface.

[0021] Additionally, a plurality of keys are displayed on a liquid crystal display (LCD) of the keypad assembly, where the LCD is located beneath the enclosure.

[0022] Additionally, the device may further comprise a display, where a character is displayed on the display based on the determined position of input on the touch sensitive surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate an embodiment of the invention and, together with the description, explain the invention. In the drawings,

[0024] FIG. 1 is a diagram of an exemplary implementation of a mobile terminal;

[0025] FIG. 2 illustrates an exemplary functional diagram of a mobile terminal;

[0026] FIG. 3 illustrates an exemplary functional diagram of the keypad logic of FIG. 2;

[0027] FIGS. 4A-4B illustrate an exemplary keypad assembly; and

[0028] FIG. 5 is a flowchart of exemplary processing.

DETAILED DESCRIPTION OF THE INVENTION

[0029] The following detailed description of the invention refers to the accompanying drawings. The same reference numbers in different drawings may identify the same or similar elements. Also, the following detailed description does not limit the embodiments.

[0030] Exemplary implementations of the embodiments will be described in the context of a mobile communication terminal. It should be understood that a mobile communication terminal is an example of a device that can employ a keypad consistent with the principles of the embodiments and should not be construed as limiting the types or sizes of devices or applications that can use implementations of keypads described herein. For example, keypads consistent with the principles of the embodiments may be used on desktop communication devices, household appliances, such as microwave ovens and/or appliance remote controls, automobile radio faceplates, televisions, computer screens, industrial devices, such as testing equipment, etc.