

**LOCALLY VIBRATING HAPTIC APPARATUS,
METHOD FOR LOCALLY VIBRATING
HAPTIC APPARATUS, HAPTIC DISPLAY
APPARATUS AND VIBRATING PANEL USING
THE SAME**

CROSS-REFERENCE TO RELATED
APPLICATIONS

[0001] This application claims the benefit under 35 U.S.C. §119 of Korean Patent Application Nos. 10-2010-0136786, filed Dec. 28, 2010, 10-2010-0136787, filed Dec. 28, 2010, and 10-2010-0137089, filed Dec. 28, 2010, which are hereby incorporated by reference in their entirety.

BACKGROUND

[0002] 1. Field of the Invention

[0003] The present invention relates, in general, to a haptic apparatus and, more particularly, to a locally vibrating haptic apparatus and a method for locally vibrating the haptic apparatus, capable of vibrating a desired position of the haptic apparatus or adjusting a vibrating position by improving arrangement of vibrators and a frequency control method, and to a haptic display apparatus and a vibration panel having a plurality of excitation points, capable of isolating vibration from a housing to vibrate a desired position of a display part or adjust a vibrating position, vibrating a desired position of the display part or adjusting a vibrating position.

[0004] 2. Description of Related Art

[0005] A display apparatus having a touch window is being widely spread as an improvement in sensitive manipulation of an interface is recently demanded. The touch window is a pointer input apparatus that is similar to a mouse, and is operated in conjunction with an image display apparatus such as a light emitting diode (LED) or a liquid crystal display (LCD).

[0006] The touch window is an apparatus that directly points a position by hand, or moves a pointer and inputs a desired instruction through a specific movement while being in contact with the touch window using an exclusive input tool such as stylus.

[0007] Such a touch window is configured to be intuitively used by stimulating a user sense, mainly, sight and hearing. Recently, an apparatus employing a haptic technology using a sense of touch is a growing trend.

[0008] The haptic technology is being widely applied to an apparatus having a display, such as a mobile apparatus, a monitor or a television.

[0009] Generally, a touch screen that is an LCD for forming an image and inputting a command through touch is provided on a front of the mobile apparatus. In order to execute a command displayed on the touch screen, a pointer is moved around the screen by a user manipulation. When the pointer reaches a desired menu or position, the command is executed by tapping at the desired menu or position with a finger.

[0010] In order to improve the sensitive manipulation of the touch screen, a vibrator is provided to generate vibration. The vibrator is generally received in a main body of the mobile apparatus to transmit vibration to the main body or to the window.

[0011] If a user inputs a command by touching a specific portion using a finger or a stylus, vibration is generated by the vibrator through which rated voltage flows, thus feeling vibration.

[0012] The vibrator may use a vibration motor or a linear actuator. Such a vibrator transmits vibration to the screen or the main body.

[0013] However, such a vibrator serves to simply transmit vibration. Thus, technical development for delicate and precise vibration control is required to achieve an original function of the haptic apparatus.

[0014] Further, a different magnitude of vibration may be frequently generated for each portion of the screen according to a location of the vibrator. The vibrator arranged as such may generate a larger magnitude of vibration in the main body than in the screen.

BRIEF SUMMARY

[0015] Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a locally vibrating haptic apparatus and a method for locally vibrating the haptic apparatus, capable of locally vibrating a panel and moving a vibrating position, by setting a frequency shape of a vibratile range to a desired portion of the haptic apparatus.

[0016] Another object of the present invention is to provide a haptic apparatus and a method for locally vibrating the haptic apparatus, capable of realizing local vibration, movement of a vibrating position, and removal of vibration from an undesirable portion, by improving types and arrangement of vibrators to locally vibrate a desired position throughout a whole area of the haptic apparatus. A further object of the present invention is to provide a haptic display apparatus having a vibration isolating structure, capable of realizing local vibration of a display part and moving a vibrating position, by disposing vibrators on the haptic display apparatus to allow a desired portion of the apparatus or a vibration panel to be vibrated and suppressing transmission of vibration to portions other than a vibrating point. Yet another object of the present invention is to provide a locally vibrating haptic display apparatus and a vibration panel, capable of realizing local vibration of a display part and moving a vibrating position, by disposing vibrators on the haptic display apparatus and connecting the vibrators at specific positions to allow a desired portion of the apparatus or the vibration panel to be vibrated, and selecting vibrators for precise frequency control.

[0017] In an aspect, there is provided a locally vibrating haptic apparatus, the apparatus comprising a panel, and a vibrator transmitting vibration to the panel, wherein a vibration frequency outputted from the vibrator is adjusted in a domain less than a primary resonant frequency of the panel, thus controlling a vibrating position from a portion having the vibrator to a central portion of the panel.

[0018] In another aspect, there is provided a method for locally vibrating a haptic apparatus, comprising (a) determining a primary resonant frequency of a panel, (b) connecting a vibrator to a lower surface of an edge of the panel, and (c) vibrating the vibrator with a frequency less than the primary resonant frequency, thus vibrating a specific position between a central portion of the panel and the edge.

[0019] In a further aspect, there is provided a haptic display apparatus having a vibration isolating structure, the apparatus comprising a display part, a housing supporting the display part at an upper position and defining an appearance, a support portion protruding towards an interior of the housing, and a piezoelectric beam vibrator taking a shape of a long rectangular plate, supported at an end by the support portion,