

TOUCH PANEL AND ELECTRONIC DEVICE INCLUDING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from Korean Patent Application No. 10-2009-55034, filed on Jun. 19, 2009, the disclosure of which is incorporated by reference in its entirety.

BACKGROUND

[0002] 1. Field

[0003] Apparatuses and devices consistent with the following description relates to a user input device, and more particularly, to a touch panel used in a user input device and an electronic device including the same.

[0004] 2. Description of the Related Art

[0005] A touch panel is one example of a kind of user input device used to determine whether a user generates an input and the position of the user's input by sensing the user's contact thereon. A user may input data or signals to a touch panel by contacting or pressing a surface of the touch panel with his or her finger, a stylus pen or the like. The touch panel may be used in association with a display. A touch panel which is mounted on the screen of a display device, such as a liquid crystal display (LCD), a plasma display panel (PDP), cathode ray tube (CRT) and the like, is generally called a "touch screen". A touch panel may be integrated with a display device to configure the screen of the display device or may be attached additionally on the screen of the display device.

[0006] In certain situations, a touch panel may be substituted for a user input device such as a keyboard, trackball or mouse, and also may allow for simple manipulations. Moreover, the touch panel can provide users with various types of buttons according to the types of applications to be executed or stages of the executed application. Accordingly, a touch panel, and more specifically, a touch screen, has been used as an input device for electronic equipment, such as a mobile phone, a personal digital assistant (PDA), a portable multimedia player (PMP), a digital camera, a portable games, a Moving Picture Experts Group Layer-3 (MP3) player, etc., as well as an automated teller machine (ATM), an information trader, a ticket vending machine, etc.

[0007] A touch panel can be classified into a resistive type, a capacitive type, a saw type, an infrared type, etc., according to methods of sensing user's inputs. A capacitive type touch panel determines whether a user generates an input and the position of the user's input by measuring variations in capacitance due to contact or pressure. However, the various types of touch panels fail to provide users a sense of input, that is, a feeling of recognition that a user gets upon inputting. In order to overcome this disadvantage, a method of installing a vibration motor below a touch panel has been proposed. The method offers users a sense of input by vibrating the whole touch panel using the vibration motor when a user's contact is sensed.

SUMMARY

[0008] One or more embodiments relate to a touch panel on which provides the ability to identify a button through tactile sense, and an electronic device including the touch panel.

[0009] One or more embodiments also relate to a touch panel which provides a clicking sensation similar to that experienced when pressing a general keypad or button, and an electronic device including the touch panel.

[0010] According to an aspect of an embodiment, there is provided a touch panel including a first substrate and a second substrate. The second substrate is spaced apart from the first substrate by a gap and includes a user contact surface. A plurality of driving electrodes are formed on each of the first substrate and the second substrate, and the gap between the first substrate and the second substrate is filled with electro-rheological fluid. If a driving voltage is applied to one or more of the plurality of driving electrodes, a button area for inputting a signal having a pattern is defined due to a variation in viscosity of the electro-rheological fluid, and if the button area is pressed so that a thickness of the gap becomes equal to or less than a threshold value, the driving voltage is cut off.

[0011] According to an aspect of another embodiment, there is provided a touch panel including a first substrate, a second substrate, a plurality of driving electrodes and electro-rheological fluid. The second substrate is spaced apart from the first substrate by a gap and the second substrate comprises a user contact surface thereon. The plurality of driving electrodes includes a first electrode formed on the first substrate and a second electrode formed on the second substrate, and the electro-rheological fluid is filled in the predetermined gap between the first substrate and the second substrate. The user contact surface is divided into a first area in which a viscosity of electro-rheological fluid increases and a second area in which a viscosity of electro-rheological fluid does not vary, due to an electric field formed by all or some of the plurality of driving electrodes, and the first area is defined as a button area for inputting a signal on the user contact surface.

[0012] According to an aspect of another embodiment, there is provided a touch panel including a hard, transparent lower substrate and a deformable, transparent upper substrate spaced apart from the lower substrate by a gap. The touch panel includes a plurality of driving electrodes including a first electrode formed on the first substrate and a second electrode formed on the second substrate, a plurality of elastic spacers placed in a dispersed manner in the gap between the upper substrate and the lower substrate, and electro-rheological fluid filled in the predetermined gap. An area in which a viscosity of the electro-rheological fluid increases locally due to an electric field formed by a driving voltage is defined as a button area.

[0013] According to an aspect of another embodiment, there is provided an electronic device including a pair of substrates, a plurality of driving electrodes, electro-rheological fluid and a controller. The pair of substrates include of a first substrate and a deformable second substrate spaced from the first substrate. The plurality of driving electrodes include a first electrode formed on the first substrate and a second electrode formed on the second substrate. The electro-rheological fluid is filled in a gap between the pair of substrates, and the controller controls a driving voltage to be applied to all or some of the plurality of driving electrodes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The above and/or other aspects will be more apparent from the following detailed description taken with reference to the accompanying drawings, in which:

[0015] FIGS. 1A and 1B are cross-sectional views showing an exemplary touch panel, in which FIG. 1A corresponds to a