

## TACTILE INPUT/OUTPUT DEVICE AND DRIVING METHOD THEREOF

### CLAIM OF PRIORITY

**[0001]** This application claims priority of an earlier Korean Patent Application filed in the Korean Intellectual Property Office on Dec. 12, 2007 and assigned Serial No. 10-2007-0129305, the contents of which are herein incorporated by reference.

### BACKGROUND OF THE INVENTION

**[0002]** 1. Field of the Invention

**[0003]** The present invention relates generally to a tactile input/output device used as data input/output means in various electronic equipments. More particularly, the present invention relates to a tactile input/output device that enables variety of tactile output responsive to input, and a driving method thereof.

**[0004]** 2. Description of the Related Art

**[0005]** In general, many types of electronic equipments with portable terminals include displays as data output means. The display devices evolve from early black/white Liquid Crystal Displays (LCDs) to high-definition color LCD modules with several hundreds of thousands to a few millions pixels. This is a reflection of trend for miniaturization, lightness, and slimness and simultaneously demanding a variety of functions. The displays display data such as general characters and videos such as still pictures, moving pictures, etc. to the users.

**[0006]** A recent market trend shows a data input/output device with a touch screen function. The data input/output device does not require separate data input means such as a key button, etc. and allows simultaneously enable input/output functions in one display device. Such a touch screen greatly reduces user's tactile sensation during data input compared to a general mechanical type (i.e., metal dome type) key button. Thus, in recent years, the advent of a tactile input/output device with a driver for generating a vibration has been made. The tactile input/output device is configured to provide a little vibration to a user at a time the user touches a desired screen, thus eliminating a slight feeling of aversion to a plane touch.

**[0007]** Most of conventional vibration tactile display devices are based on a scheme of vibrating the whole body using a small sized motor, such as a vibration tactile mouse, a vibration mode of a portable phone, etc. In a tactile feedback system, a tactile input unit and a tactile output unit are completely separated from each other or only a method of expressing a simple feedback for input identification exists.

**[0008]** FIG. 2 is a schematic diagram illustrating a tactile input/output device according to the conventional art. In FIG. 2, a tactile sensor input end **10** and a tactile display output end **20** are completely separated and independent from each other. However, there is a problem of causing erroneous operation and noise generation due to mutual interferences as an input cell **11** of the tactile sensor input terminal **10** and an output cell **21** of the output terminal **20** are configured to overlap with each other.

**[0009]** The above mentioned scheme of vibrating the whole device body using a small sized motor has been put on the market in recent years. However, this scheme limits an expression of tactile sensation that a user can feel with his/her fingertip and provides unsatisfactory effect. Also, a tactile

input/output device of a type in which an input sensor attached to a vibration motor has a problem that it has a limitation in reducing a thickness and has poor durability.

**[0010]** Also, in the case of the using the same array address without separation of input/output, a control complexity increases and, because the extension of a sensor array leads to an increase in operation, a circuitry complexity increases. Further, as simply controlling only the input on/off switch information by a combination of X and Y-axes, a conventional sensing technology has a difficulty in applying to a variety of input/output schemes.

### SUMMARY OF THE INVENTION

**[0011]** An aspect of the present invention is to substantially solve at least the above problems and/or disadvantages and to provide at least the advantages below. Accordingly, one aspect of the present invention is to provide a tactile input/output device to enable a tactile output of various schemes in response to an input, and a driving method thereof.

**[0012]** Another aspect of the present invention is to provide a tactile input/output device realized to prevent noise and erroneous operation from being generated due to mutual interferences between respective input/output cells by separating and applying a tactile input end and output end, and a driving method thereof.

**[0013]** A further aspect of the present invention is to provide a tactile input/output device realized to reduce an amount of operation corresponding to a Y-axis value by, out of a simple X and Y structure, matching a range of a voltage value of only an X-axis to a coordinate, obtaining an X-axis value corresponding to a center value and a Z-axis value corresponding to a pressure value, and enabling the same sensing, and a driving method thereof.

**[0014]** According to one aspect of the present invention, a tactile input/output device includes at least one input end, at least one output end, and a controller. The input end includes a plurality of input cells arranged at regular intervals. The output end includes a plurality of output cells arranged at regular intervals. The controller senses an input signal of the input end and controls the output end to generate a corresponding output signal. The input end and the output end are installed to form one array with being separated. The input cell and the output cell are arranged in a position not overlapping with each other.

**[0015]** According to another aspect of the present invention, a method for driving a tactile input/output device includes at least one input end, at least one output end, and a controller. The input end includes a plurality of input cells arranged at regular intervals. The output end includes a plurality of output cells arranged at regular intervals. The controller senses an input signal of the input end and controls the output end to generate a corresponding output signal. The input end and the output end are installed to form one array with being separated. The input cell and the output cell are arranged in a position not overlapping with each other to operate separately from each other.

**[0016]** According to a further aspect of the present invention, a method for detecting an input signal of a tactile input/output device includes at least one input end, at least one output end, and a controller. The input end includes a plurality of input cells arranged at regular intervals. The output end includes a plurality of output cells arranged at regular intervals. The controller senses an input signal of the input end and controls the output end to generate a corresponding output