

**APPARATUS AND METHOD OF PROVIDING
FINGERTIP HAPTICS OF VISUAL INFORMATION
USING ELECTRO-ACTIVE POLYMER FOR
IMAGE DISPLAY DEVICE**

BACKGROUND OF THE INVENTION

[0001] This application claims priority from Korean Patent Application No. 10-2004-0094209 filed on Nov. 17, 2004, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

[0002] 1. Field of the Invention

[0003] Apparatuses and methods consistent with the present invention relate providing fingertip haptics of visual information, and more particularly, to providing fingertip haptics of visual information using an electro-active polymer for an image display device.

[0004] 2. Description of the Related Art

[0005] Haptic is a sense of fingertip touch that people feel when touching an object. The haptic includes tactile feedback that can be felt when a person's skin contacts a surface of the object and a kinesthetic force feedback (hereinafter referred to as "force feedback") that can be felt when a movement of a joint and a muscle is disturbed.

[0006] The study of transmitting haptic information using a physical device without touching the object by a person has been widely developed. Particularly, a study on teleoperation for transmitting physical properties of a remote object to the person has been developed. A haptic interface for bi-directional information flow functions to input information on a movement or current location of an operator to a virtual environment or a remote working object and to transmit information on force or sense of touch generated from the virtual environment or the remote working object to the operator. At this point, a media object that can bi-directionally transmit, a sense of touch, a property, a shape and the like of an object to perform a haptic interface in a virtual environment or a remote working object using a haptic sense without actually touching and operating the working object using fingers is required. Such a media object is called a haptic device. Accordingly, an ideal haptic device is one that can perfectly provide a state where a person feels naturally and actually a virtual object or a remote object as if he/she were actually touching and operating the object. That is, in order to perform the ideal haptic interface, the haptic device should be designed to reproduce a movement property with responsiveness as if the person were actually touching the remote object. Most of the studies on the haptic device have been developed to realize the force feedback through a mechanical operation of a motor and a control of the motor. In order to improve the performance of the haptic interface to increase a degree of freedom for realizing the reproduction of the movement, the connecting mechanism of the mechanical links becomes complicated, increasing the weight of the device to cause an inertia problem. Accordingly, a passive haptic device using magnetorheological fluid has been developed to reduce the weight and size of the device.

[0007] According to the prior art, a haptic feedback device for providing visual information, such as a button and an icon displayed on a display part of an image display device,

to which haptic information is added, includes an interface unit that is mechanically controlled and one or more actuators for driving the interface unit. As mechanically driven actuators are added to the device, the size of the device is increased to be limited in its application or operation. Additionally, in order to accurately transmit the haptic information, the number of actuators must be increased, thereby making the structure of the device more complicated.

SUMMARY OF THE INVENTION

[0008] The present invention provides an apparatus and method of providing fingertip haptics of visual information using an electro-active polymer, which can allow a user to feel a texture of a surface of an object and a sense of touch of the object by providing force feedback and tactile feedback by moving and deforming the polymer inserted in a touch panel of an image display device.

[0009] According to an aspect of the present invention, there is provided an apparatus of providing fingertip haptics of visual information using an electro-active polymer for an image display device, the apparatus comprising a sensing unit which outputs a detecting signal by detecting a user's finger touch on a touch panel; a pattern generating unit which generates a pattern signal of haptic information from the visual information based on the detecting signal; and a control unit which moves the electro-active polymer based on the detecting signal from the sensing unit and deforms the electro-active polymer based on the pattern signal.

[0010] According to another aspect of the present invention there is provided a method of providing fingertip haptics of visual information using an electro-active polymer for an image display device, the method comprising outputting a detecting signal of a user's finger touch on a touch panel; moving the electro-active polymer to a touch point by applying a first driving voltage based on the detecting signal; generating a pattern signal of haptic information from the visual information based on the detecting signal; and deforming the electro-active polymer by applying a second driving voltage based on the pattern signal.

[0011] According to still another aspect of the present invention, a recording medium stores a program that can perform a method of providing fingertip haptics of visual information using an electro-active polymer for an image display device, the method comprising outputting a detecting signal of a user's finger touch on a touch panel; moving the electro-active polymer to a touch point by applying a first driving voltage based on the detecting signal; generating a pattern signal of haptic information from the visual information based on the detecting signal; and deforming the electro-active polymer by applying a second driving voltage based on the pattern signal.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The above and other aspects of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

[0013] **FIG. 1** is a schematic block diagram of a device for providing fingertip haptics of visual information, according to an exemplary embodiment of the present invention;