ONE BUTTON REMOTE CONTROL WITH HAPTIC FEEDBACK

FIELD OF THE INVENTION

[0001] The present invention relates generally to one-button computer input devices, and more particularly to one-button remote controls with haptic feedback for TVs and the like.

BACKGROUND OF THE INVENTION

[0002] Data input devices such as TV remote controls typically include depressible buttons that users can manipulate to input commands, such as channel up/down, etc. Touch pad-like input devices have been provided in which the buttons do not physically move, but are simply touched by hand to input commands. While these devices provide advantages over mechanical buttons, users may prefer the tactile feedback that mechanical buttons provide. Furthermore, current touch-pad like input devices typically model conventional remote controls with mechanical buttons by providing the same multiplicity of touch keys as are provided on conventional remote controls, which defeats one potential advantage of touch-pad like devices, namely, the ability through software to reduce the number of components that must be incorporated into the device.

SUMMARY OF THE INVENTION

[0003] A TV remote control system includes a portable hand-held housing and a wireless transmitter supported by the housing. A processor is supported by the housing and provides signals for wireless transmission by the transmitter. A touch surface on the housing is exposed to a user's touch, with a pressure sensor array supported on the housing below the touch surface providing input signals to the processor in response to pressure from a person's finger on the touch surface. Also, a haptic membrane assembly is disposed between the touch surface and pressure sensor array and is selectively moved by the processor in response to finger pressure on the pad. A display presents an image of a remote control key array based on signals from the processor responsive to finger pressure on the pad. If desired, the image may present more keys than are on the housing. Indeed, in one non-limiting implementation the touch surface is the only input device on the housing.

[0004] The display can be associated with a TV receiving signals from the transmitter. Or, the display can be supported on the housing of the remote control.

[0005] One non-limiting membrane assembly includes an array of individually inflatable fluid sacs. Each sac is associated with a respective valve controlled by the processor to inflate and deflate to provide haptic feedback of a finger moving over emulated button boundaries, with the sac actuation thus being in response to finger pressure on the touch surface.

[0006] Another non-limiting membrane assembly includes an array of individually movable diaphragms that are moved by electrostatic force or an array of electromagnetic coils.

[0007] With more specificity, in response to a non-sliding, rolling motion of a finger on the pad, the processor selectively moves the haptic membrane assembly to propagate a wave across the pad as a haptic model of a finger moving across a boundary of a mechanical data input key. Moreover, the non-limiting display presents indication (such as cursor position) of which key in the image of a remote control key array is modeled as the key currently associated with the touch surface. In this way, the touch surface is associated with a sequence of two or more keys in the image of a remote control key array as a finger moves as by slightly rolling on the touch surface.

[0008] In another aspect, a method of data entry includes providing a touch surface on an input device, and sensing changing pressure as a user moves a finger on the touch surface. The method further includes providing haptic feedback through the touch surface of emulated finger motion on a notional keypad in response to the changing pressure. Visual feedback is provided on a display of emulated finger motion on a notional keypad in response to the changing pressure, with the visual feedback being keyed to the haptic feedback.

[0009] In yet another aspect, an input system has a touch surface and a deformable haptic assembly below the touch surface and in contact with the touch surface. A user placing a finger on the touch surface can feel deformation of the assembly. A pressure sensing assembly is below the haptic assembly to sense motion of a finger on the touch surface. A processor receives input from the pressure sensing assembly and provides output to the haptic assembly in response, while a display receives input sent by the processor in response to input from the pressure sensing assembly to cause the display to present a changing image of a keypad as a user moves a finger on the touch surface.

[0010] The details of the present invention, both as to its structure and operation, can best be understood in reference to the accompanying drawings, in which like reference numerals refer to like parts, and in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a schematic view of a first environment in which present principles may be used, showing a TV remote control with input pad for sending commands to a TV system;

[0012] FIG. **2** is a schematic view of a second environment in which present principles may be used, showing an input pad for a computer;

[0013] FIG. **3** is a schematic view of a third environment in which present principles may be used, showing an input pad for a wireless telephone;

[0014] FIG. **4** is a perspective view of a non-limiting pressure sensor array supported on a substrate such as a circuit board in the housing of the remote control shown in FIG. **1**;

[0015] FIG. **5** is a perspective view similar to FIG. **4**, schematically showing the area of pressure on the sensor array from a person's finger;

[0016] FIG. **6** is a perspective view similar to FIGS. **4** and **5**, schematically showing the area of pressure on the sensor array from a person's finger when the person rolls the finger slightly to induce a motion vector;

[0017] FIG. **7** is a schematic plan view of one non-limiting implementation of the haptic membrane as established by plural inflatable fluid sacs in an array that is disposed on top of the pressure array shown in FIGS. **4-6**;

[0018] FIG. **8** is a schematic plan view similar to FIG. **7** illustrating how a non-round button shape can be modeled by the haptic membrane;

[0019] FIG. **9** is a flow chart of general non-limiting logic that may be used; and

[0020] FIG. **10** is a schematic plan view of another non-limiting implementation of the haptic membrane as estab-