module **225**, an actuator interface **230**, an actuator **235**, a sensor interface **240**, and a sensor **245**.

[0087] The micro processor **215** may include a universal central processing unit (CPU) or a micro computer for a specified function and controls the operations of other elements included in the haptic device **200**.

[0088] To execute the application corresponding to the flag transmitted by the application selector **205**, the microprocessor **215** loads the application module **220** to a predetermined region in the memory **210** and executes the loaded application module **220**.

[0089] In addition, the microprocessor **215** determines an input mode mapped to the application to be executed. For example, the input mode may be a telephone number key mode, a touch pad mode, a four-direction key mode, or a multimedia key mode.

[0090] A mapping relationship between the application and the input mode may be stored in the memory **210** in the form of a predetermined mapping table. The mapping relation may not be a one-to-one correspondence and may be a many-to-one correspondence. In other words, the same input mode may be used in different applications.

[0091] The memory **210** is loaded with the application module **220** at the predetermined region in processor or thread units. In addition, the memory **210** may store the mapping table. In general, the memory **210** may be implemented by a nonvolatile memory such as ROM (read only memory), PROM (programmable ROM), EPROM (electrically programmable ROM), EEPROM (electrically erasable programmable ROM) or a flash memory, a volatile memory such as RAM, a storage medium such as a hard disk, or other different types of memories known in the art.

[0092] The application module **220** is loaded to the memory **210** by the microprocessor **215** and then executed. The application module **220** provides an execution procedure or an execution result to the display module **225**.

[0093] The display module **225** outputs the execution procedure or the execution result of the application module **220** so that a user can visually and/or auditorily perceive it. The display module **225** fundamentally includes a liquid crystal display (LCD), a cathode-ray tube (CRT), a plasma display panel (PDP), a light emitting diode (LED), an organic LED (OLED), a three-dimensional goggle, or other image output device and may further include an amplifier and a speaker for audio output.

[0094] The haptic button **100**, **105**, **107**, **110**, **120**, **125**, or **130** according to an exemplary embodiment of the present invention includes at least the actuator **235** and the sensor **245** and may further include the actuator interface **230** and the sensor interface **240**.

[0095] The actuator **235** generates and outputs a force or displacement in response to a signal that is generated by the micro processor **215** and then converted by the actuator interface **230**. In the current exemplary embodiment of the present invention, the actuator **235** includes the electro-active polymer **31** or **42**; the electrodes **32***a* and **32***b* for activating the electro-active polymer **31** or **42**; and a power supply (not shown). The actuator may also include electro-active polymers **31***a*, **31***b*, and the like.

[0096] The micro processor **215** provides an input voltage having an appropriate waveform stored in the memory **210** to the actuator **235** according to a current application. The input voltage includes a direct current voltage, an alternating current voltage having a sine wave, a triangle wave, or a square wave, and voltages having various waveforms as illustrated in FIG. **8**E.

[0097] The actuator **235** activates the electrodes **32***a* and **32***b* with the input voltage transmitted from the micro processor **215** via the actuator interface **230**. In addition, the actuator **235** may further include the metal dome **55** when it is needed to add an additional clicking feeling (or a bias stiffness), as illustrated in FIGS. **8**A and **8**F.

[0098] The actuator interface **230** is connected between the actuator **235** and the micro processor **215** and converts a signal generated from the micro processor **215** into a signal appropriate for driving of the actuator **235**. As is well known to those skilled in the art, the actuator interface **230** may include a power amplifier, a switch, a digital-to-analog converter (DAC), an analog-to-digital converter (ADC), and other elements.

[0099] When a button input from a user is sensed, the sensor **245** generates a signal corresponding to the button input and transmits the signal to the micro processor **215** via the sensor interface **240**. The sensor **245** may be implemented by a contact switch or a touch pad, which is usually used in a button input device, or may be implemented by the electro-active polymer **31** or **42**. The electro-active polymer **31** or **42** is interactive like it is changed by a voltage and reversely generates a voltage when it is transformed by an external force. Accordingly, the electro-active polymer **31** or **42** may be used as the actuator **235** and the sensor **245**.

[0100] The sensor interface **240** is connected between the micro processor **215** and the sensor **245** and converts a signal output from the sensor **245** into a signal that can be analyzed by the micro processor **215**.

[0101] The haptic device **200** illustrated in FIG. **11** can be used for portable devices such as a mobile phone, a personal digital assistant (PDA), a portable multimedia player (PMP), a digital camera, a portable game device, and a MP3 player and other various devices such as a desktop computer, a laptop computer, a digital television, and home appliance.

[0102] The respective components shown in FIG. **11** may be implemented by software components or modules executed in a predetermined area on a memory, such as task, class, subroutine, process, object, execution thread, or program components, or hardware components, such as FPGA (field-programmable gate array) or ASIC (application-specific integrated circuit). The functionality provided for in the components and modules may be combined into fewer components and modules or further separated into additional components and modules. In addition, the components and modules may be implemented such that they execute one or more computers. A software module may include, by way of example, components, such as software components, object-oriented software components, class components and task components, processes, functions, attributes, procedures, subroutines, segments of program code, drivers, firmware, microcode, circuitry, data, databases, data structures, tables, arrays, and variables. The functionality provided for in the components and modules may be combined into fewer components and modules or further separated into additional components and modules. In addition, the components and the modules can operate at least one processor (e.g. central processing unit (CPU) such as a microprocessor). For example, a software module may advantageously be configured to reside on an addressable storage medium and configured to execute on one or more processors.