telephone, however, display another menu list containing the functions "EDIT", "VIEW", "CALL", and "DELETE". Light pressure on assignable input device and rocker switch again produces the fourth and fifth tactile sensations, indicating that the "Phonebook" mode or function is still active. Using the rocker switch to scroll up or down through the list again produces a click in the rocker switch as each entry is passed. The magnitude of each click and the spacing between clicks can be varied to indicate that a relatively short list is being scrolled. In addition to a click, seventh, eighth, ninth and tenth distinct tactile sensations as output to the rocker switch as the switch scrolls past "EDIT", "VIEW", "CALL", and "DELETE" respectively. Scrolling is stopped on the "CALL" entry, and the assignable input device is pushed, calling the number associated with the chosen entry from the phonebook. In addition, the ninth tactile sensation is output to the assignable input device. An attempt to active one of the functions, such as "CALL", before the device is ready causes the controller to indicate that the function is available.

[**0086**] Various other functions may be initiated by using the buttons. For example, in a mobile telephone having the functionality of instant messaging, electronic mail, voice mail, games, and missed call read-out, the user may select one of these functions. In an embodiment, a distinct tactile sensation is initiated by the controller whenever the user initiates one of these functions, and the distinct tactile sensation is different for each function.

[**0087**] Regardless of the input device being monitored by the controller, upon detection of first and second input signals, first and second pressures or first and second positions and obtaining the associated first and second functions, the controller can determine if these functions are available for execution **58**. Alternatively, the controller provides the necessary function signals to the electronic device which determines the availability of those functions. If the first and second functions are available, then the controller produces the associated tactile sensations in the appropriate input devices. If one of the first or second functions are not available then the controller obtains the tactile sensation information for the tactile sensation associated with function failure **59**, Sensation **23**, and produces that sensation in the appropriate input device. Examples of function failure include selecting the re-dial feature on a telephone when no number is stored in the re-dial memory, attempting to access a program or menu for which the user does not have authority to access, and attempting to initiate a mobile telephone call having entered an incomplete phone number.

[**0088**] FIG. **11** aids in illustrating another embodiment of the present invention. In one embodiment of the present invention, a device provides haptic feedback while navigating a menu structure, allowing a user to navigate the menu structure more efficiently, preferably without having to refer to the visual display. In such an embodiment, an actuator generates distinct sensations that represent various sections of the menu structure, specific menu options, and events that occur while navigating the menu structure.

[**0089**] For example, in one embodiment, each of the highest level or main menu options corresponds to a distinct vibrotactile sensation that varies in pitch. As the user navigates between the main menu topics, the actuator produces a distinct number of pulses. The varying pitch combined with the alternating pulses provides feedback that identifies to the user the menu currently selected or highlighted.

[**0090**] In another embodiment, the number of occurrences of a distinct vibrotactile sensation, such as a pop, corresponds to the index number of the menu option within a list of menu options. In such an embodiment, one pop signifies the first option; two pops signifies the second option. In yet another embodiment, a distinct vibrotactile effect signifies that the user is cycling from the end of a particular menu back to the beginning ("rolling over").

[**0091**] FIG. **11** is a front view of a personal digital assistant (PDA) **100** in one such embodiment of the present invention. The PDA **100** includes a display **102**, a plurality of buttons, including button **104**, for executing specific functions and applications, and a 5-way directional pad (D-pad) **105** for navigation within the various interfaces displayed on the PDA **100**. With the 5-way D-pad, a user clicks the directional keys to move up and down and left and right through the menu structure and clicks the center of the D-pad to select a particular option. In the embodiment shown, the active application is displaying a menu structure. The menu structure **108** includes main menu topics **110**. Selection of the main menu topics results in either the display of a sub-menu or the execution of an associated function or application. In the embodiment shown, selection of the File menu option on the main menu **110** results in the display of a sub-menu **112**. As with the main menu options, selection of any of the topics on the sub-menu **112** results in either the display of a secondary sub-menu or the execution of an associated function or application. For example, selection of the Send To option on sub-menu **112** results in display of secondary sub-menu **114**.

[**0092**] In the embodiment shown in FIG. **11**, a user presses button **104** to activate an application. Within the application, the user utilizes D-pad **106** to navigate to the main menu **108**. An actuator (not shown) as described herein, such as an eccentric rotating mass or voicecoil, provides a brief, distinct haptic effect as the user highlights each of the options in the main menu **108**. The effect may change in pitch or in some other manner to alert the user to the fact that the highlighted option has changed. The user may either click the center of the D-pad **106** to select an option or click the down arrow. Performing either of these actions over the File option produces sub-menu **112**.

[**0093**] The user clicks the down arrow to move through the sub-menu **112**. In the embodiment shown, when a directional arrow of the D-pad **106** is held down, the menu options in sub-menu **112** scroll at a fixed rate, and a haptic effect plays with each option that appears below the cursor. The longer the directional arrow is held down, the faster the rate of scrolling. The PDA **100** communicates the rate of scrolling by a corresponding change in the haptic effect, such as an increase in frequency. If the user clicks the right arrow when the cursor highlights the Send To option, the secondary sub-menu **114** is displayed. Navigation through the secondary sub-menu **114** occurs in a manner similar to that which occurs in sub-menu **112**. To select an option within the secondary sub-menu **114**, the user clicks the center of the D-pad **106**. Clicking the center of the D-pad **106** triggers the playing of yet another distinct haptic effect. In addition, the D-pad switch **106**, either a 5-way or a 4-way, can provide haptic effects indicating the direction that the switch was being pressed.