appropriate tactile feedback is provided depending on the position, the applied pressure, the state of the GUI object (Step **914**). If the actuation event is recognized in Step **908**, the apparatus **1** provides the tactile feedback for the actuation event (Step **920**), and then activates GUI object, sends a command for appropriate events and/or performs other appropriate actions (Step **922**).

[0115] The tactile feedback may also be provided not only depending on the position but also which sub-component of GUI element the user is interacting with. FIGS. **10**(*a*)-(*d*) demonstrate an example of such a case for a slider-type GUI object **600**. It is assumed that the apparatus **1** can support three types of tactile feedback, that are referred to as tactile feedback type **1**, **2** and **3**.

[0116] On FIG. **10**(*a*), the user touches the slider-type GUI object **600** in a part **601**, which is a background part of the slider object **600**. As the user moves the finger across that part, the tactile feedback type **1** is presented to the user. On FIG. **10**(*b*), the user's finger slides over a slider handler **602** and the tactile feedback changes to the type **2**, and then when the user goes over the slider handler **602** and back to the background of the slider-type GUI object **600**, the tactile feedback changes back to the type **1**, as shown in FIG. **10**(*c*). Finally the user's finger moves to the slider end control **603**, and then the tactile feedback changes to the type **3** (FIG. **10**(*d*)). At that point the user may release the finger or press stronger to execute scrolling action. Other types of the tactile feedback to composite objects of the GUI may be employed so as that the user can be felt when the user slides over them without activating them. According to the present example, the user can recognize and operate even if the GUI objects have composite or complex structures.

[0117] After the user touches the GUI object, the user can activate it, for example, by pressing it harder.

[0118] Alternatively, the actuation of the GUI object may be recognized when the GUI object is pushed through a certain threshold of pressure or confirmation threshold. In this actuating scheme, the tactile feedback is provided twice: 1) when the actuation threshold is passed and 2) when the confirmation threshold is passed.

[0119] FIG. **11** demonstrates an example in which several thresholds are used in actuation and providing the tactile feedback. As the user touches and pushes the GUI object to pass a selection threshold, a tactile feedback is provided (Point **1** of Curve (a)) without actuating the GUI object. The user presses further to pass the actuation threshold where a different tactile feedback is provided (Point **2**). In this example, however, the GUI object is not actuated yet. To actuate the GUI object, the user should press further to the confirmation threshold that also provides still another tactile feedback (Point **3**).

[0120] The reason for providing this additional threshold or confirmation threshold is to avoid accidental activation of the GUI objects.

[0121] In the example described above, if the user pressed GUI objects very quickly, the multiple feedbacks may be presented, distracting and hamper the user interaction. In such a case, the tactile feedback may be linked to the speed with which the user pressed the GUI object. In other words, if the user presses the GUI object very quickly, then some of the tactile feedbacks corresponding intermediate thresholds will not be presented.

[0122] An example of such pressure change is presented as a curve (b) of FIG. **11**. If the user presses quickly or a time constant of the pressure change is shorter than a preset value, the tactile feedbacks for selection and actuation thresholds are not presented. In this example, the user **2** is presented with the tactile feedback only at the confirmation level (Point **4** of Curve (b)).

[0123] In the embodiments described above, visual feedback on the GUI object and/or audio feedback may also be presented. Further, such feedbacks may also be correlated with tactile feedback and/or pressure input by the user or combination thereof.

[0124] In the forgoing examples, the interaction techniques are described when the user is sliding the finger across the screen to reach the GUI object. Alternatively, there is a case where the interaction starts by directly operating or pressing the GUI object. In this case, most of the interaction techniques of the embodiments according to the present invention may be applied, and the tactile feedback may be provided to the user to separate the selection state and the actuation state of the GUI object.

[0125] The forgoing examples of the present invention may be applicable to various GUI objects, in particular the examples may relate to buttons, sliders, radio buttons, check box, toolbars, dialog box, graphical dial, borders of the windows, and other GUI objects.

[0126] In the previous descriptions, the various examples of the apparatus **1** are described with the pressure sensing unit **105** that measures a pressure value. However, many of the examples of the present invention or simplified version of the examples may also be implemented only with recognizing two modes of user's input operation: a) strong push (pressing or actuation event) and b) light push or sliding (touching or selection event). These two modes may be recognized by any pressure sensor or pressure sensitive device that can directly or indirectly differentiate the strong push and the light push applied by the user.

[0127] For example, a device configured to measure the level of noise in a signal from the 2D position sensing unit **104** may be used for differentiating the strong push and the light push. When pressure applied to the touch screen is low, the noise level significantly increases due to, for example, finger tremor and/or mechanical shattering of the device, etc. In touch screens of related art, simple low-pass filters are used to remove these artifacts. In other words, the state of high-noise may be easily identified by using any signal processing unit that measures such noise level. Accordingly, in one embodiment of the present invention, the apparatus **1** may be provided with the device including a signal processing unit to detect this state of high noise, which may be considered such that the pressure applied by the user finger is low, meaning that this is the sliding or light push. According to such configuration, the examples of interaction schemes described above may be implemented without using any dedicated pressure sensitive device.

[0128] The apparatus **1** described above may be used in mobile phones, PDAs, other small portable devices, or terminal devices that displays GUI objects on their touch screens to prompt user's inputs.

[0129] In still another embodiment of the present invention, tactile feedback is provided by embedding tactile feedback elements into a touch screen. A user input includes pressure applied to screen, and the tactile feedback provided to the user is differentiated depending on the pressure applied by the user on GUI objects and the current state of the GUI objects.