FIGS. **12**A-**12**H illustrate a zooming sequence using the method described above. FIG. **12**A illustrates a display presenting a GUI object **1202** in the form of a map of North America with embedded levels which can be zoomed. In some cases, as shown, the GUI object is positioned inside a window **1204** that forms a boundary of the GUI object **1202**. Also shown are the haptic profiles for each of the fingers relating the distance d between the two fingers to the corresponding haptic response H(d) experienced at each finger. It should be noted that in this example, the magnitude of the haptic response H(d) at each finger is denoted by the size of the circle for each response. In this case, as the distance between the two fingers increases, the haptic effect H for each finger increases linearly with distance d. For example, when the two fingers are close together as in FIG. **12**B, the haptic effect H is quite small as evidenced by the small size of the circle whereas as the two fingers move apart, the haptic effect H becomes progressively stronger at each finger. It should be noted that for the sake of simplicity only, the haptic profile H(d) is presumed linear for zooming in/out and non-linear for the rotation gesture shown in FIG. **12**F. In the described embodiment, as the zoom factor increases, the haptic profile H(d) can change by, for example, the slope becoming more steep as the resolution of the underlying map increases as shown in FIG. **12**G. FIG. **12**B illustrates a user positioning their fingers **1206** over a region of North America **1202**, particularly the United States **1208** and more particularly California **1210**. In order to zoom in on California **1210**, the user starts to spread their fingers **1206** apart as shown in FIG. **12**C. As the fingers **1206** spread apart further (distance increases) the haptic effect felt by the two fingers changes as the map zooms in further on Northern California **1212**, then to a particular region of Northern California **1214**, then to the Bay area **1216**, then to the peninsula **1218** (e.g., the area between San Francisco and San Jose Area), and then to the city of San Carlos **1220** located between San Francisco and San Jose as illustrated in FIGS. **12**D-**12**H. In order to zoom out of San Carlos **380** and back to North America **368**, the fingers **366** are closed back together following the sequence described above, but in reverse (along with the corresponding haptic effect).

FIG. **13** is a diagram of a GUI operational method **1300**, in accordance with one embodiment of the present invention. The method generally begins at block **1302** where a virtual scroll wheel is presented on the display. In some cases, the virtual scroll wheel can include a virtual button at its center. The virtual scroll wheel is configured to implement scrolling as for example through a list and the button is configured to implement selections as for example items stored in the list. Following block **1302**, the method proceeds to block **1304** where the presence of at least a first finger and more particularly, first and second fingers (to distinguish between tracking and gesturing) over the virtual scroll wheel is detected on a touch screen. The touch screen is positioned over or in front of the display. By way of example, the display can be an LCD and the touch screen can be a multi-touch touch screen. Following block **1304**, the method proceeds to block **1306** where the initial position of the fingers on the virtual scroll wheel is set. By way of example, the angle of the fingers relative to a reference point can be determined (e.g., 12 o clock, 6 o clock, etc.).

Following block **1306**, the method **1300** proceeds to block **1308** where a rotate signal is generated when the angle of the fingers change relative to the reference point. In most cases, the set down of the fingers associate, link or lock the fingers (or finger) to the virtual scroll wheel when the fingers are positioned over the virtual scroll wheel. As a result, when the fingers are rotated, the rotate signal can be used to rotate the virtual scroll wheel in the direction of finger rotation (e.g., clockwise, counterclockwise) at **1310** as well as provide an audible as well as palpable "click" at **1312** using at least two haptic actuators at **1310** to provide a physical sensation at the two fingers concurrently with the audible click simulating the "feel" of the click. In most cases, the amount of wheel rotation varies according to the amount of finger rotation, i.e., if the fingers move 5 degrees then so will the wheel. Furthermore, the rotation typically occurs substantially simultaneously with the motion of the fingers. For instance, as the fingers rotate, the scroll wheel rotates with the fingers at the same time.

The various aspects, embodiments, implementations or features of the invention can be used separately or in any combination. The invention is preferably implemented by hardware, software or a combination of hardware and software. The software can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that can store data which can thereafter be read by a computer system. Examples of the computer readable medium include read-only memory, random-access memory, CD-ROMs, DVDs, magnetic tape, optical data storage devices, and carrier waves. The computer readable medium can also be distributed over network-coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

While this invention has been described in terms of several preferred embodiments, there are alterations, permutations, and equivalents, which fall within the scope of this invention. For example, although the invention has been primarily directed at touchscreens, it should be noted that in some cases touch pads can also be used in place of touchscreens. Other types of touch sensing devices can also be utilized. It should also be noted that there are many alternative ways of implementing the methods and apparatuses of the present invention. It is therefore intended that the following appended claims be interpreted as including all such alterations, permutations, and equivalents as fall within the true spirit and scope of the present invention.

What is claimed is:

1. An apparatus providing multi-touch haptic feedback, comprising

a touch pad having a touch sensitive surface arranged to receive a user provided multi-touch event associated with at least two different locations on the touch sensitive surface;

a multi-touch detection mechanism operatively coupled to the touch sensitive surface that detects the multi-touch event and generates a corresponding a multi-touch signal; and

a plurality of haptic feedback devices operatively coupled to the multi-touch detection mechanism and the touch sensitive surface; wherein

the plurality of haptic devices are disposed beneath the touch sensitive surface and are cooperatively arranged to concurrently provide tactile feedback in the form of vibro-tactile sensations at each of the at least two different locations on the touch sensitive surface in response to the multi-touch signal; and

at least two nearby haptic devices of the plurality of haptic feedback devices concurrently respond to the user provided multi-touch event to form a single compound haptic response to the user provided multi-touch event;