

gating through a list of items on display device **302**, items may be highlighted on the screen as the user scrolls through the list from afar.

[0061] Moreover, display device **302** may have ultrasound source/detectors **330₁-330₄** in a slightly beveled position or in the level with the frame of display device **302**. Display device **302** may also have digital image or infrared cameras **334₁-334₄** for tracking motion of objects at location points **206**, **208**, and/or **210** using algorithms such as that described in U.S. Pat. No. 7,317,872, herein incorporated by reference as if fully set forth, that can be used to perform additional sensor measurements. Other sensor measurements for additional metrics and refinement include infrared or optical detection to detect depth of objects at location points **206**, **208**, and/or **210**. These sensors can be embedded next to or within each display cell in display device **302**.

[0062] In another embodiment, display device **302** replicates, mimics, or simulates a customizable or programmable interface or control panel for a remote control, instrument panel on a vehicle, an automobile dashboard configuration, audio equalizers, multitouch equalizers, radio button list, or a consumer electronics button surface with ultrasound patterns **332₁-332₃**. For demoing consumer electronics online, ultrasound patterns **332₁-332₃** provide a user the ability to simulate buttons on a device prior to purchase or use as a tutorial. Moreover, **332₁-332₃** can be programmed for controlling volume control, replicating smart home switches or controllers, or replicating a dial or knob, as desired.

[0063] Still referring to FIG. 3, ultrasound may be used to feel, sense, or move text, images, photos, windows or icons. For instance, web searching is performed by dragging and dropping text "TEST SEARCH" **337** into search box **336**. A user may be provided substantially circular ultrasound **338** when grabbing the text "TEST SEARCH" from a distance to display device **302**. The user then moves or drags the text "TEST SEARCH" from afar via path **339** over to search box **336** and releases or drops it. The user's finger movements are tracked by ultrasound source/detector **125** in combination with elevation, indenting, or texturizing controller **121**. The text may be shown as moving on display device **302** as the user's fingers are tracked. Similarly a visual, photo, or image search may be performed by grabbing image of shirt **324** and dropping it in search box **336**.

[0064] In another example, ultrasound pattern **328** can be used to replicate or simulate a virtual stylus, pen, or pencil allowing a user to mimic writing or drawing on display device **302** similar to a notepad. The virtual stylus, pen, or pencil may be configured without the user physically holding anything. Unlike a notepad, the writing or drawing may be done at a predetermined distance from display device **302** in sensation zone **202**.

[0065] Ultrasound pattern **328** can also be used for medical applications. For instance, with laparoscopic surgery a physician located in the surgery room or remote to the surgery room may be able to feel or sense images or photos of organs of a patient provided by an internal surgical camera and displayed on display device **302**. Ultrasound pattern **328** may also be used to simulate pain of a patient to a doctor over the Internet.

[0066] In another example, ultrasound pattern **328** can be responsive to voice or visual commands or recognition detected by sensors **126**. Alternatively, ultrasound pattern **328** can be a preprogrammed texturized pattern to notify the user of an incoming call, similar to a customized ringtone. Alter-

natively, ultrasound pattern **328** may be used for providing a warning to a driver in relation to safety feature on an automobile. Alternatively, ultrasound pattern **328** may be used for enhancing icons on a system tray with each icon having a different characteristic vibration sensation. Alternatively, device **100** may be controlled remotely, either wired or wirelessly, via a server or cloud computing platform (not shown) via one or more network adapters **128**.

[0067] Moreover, ultrasound pattern **328** can be used to replicate, simulate, enhance features for biometrics, musical instruments, video clips, editing audio tracks, editing video, computer aided designs (CAD), semiconductor layouts, e-books, a children's educational product, children's productivity or educational game, a general education product, a 3-D drawing tool, distance learning, or a pop-up children's books, as desired.

[0068] FIG. 5 is a process **500** for providing elevated, indented, or texturized sensations to an object near a display device using ultrasound. In the example given here, the object may be one or more fingers or hands at location points **206**, **208**, and/or **210**. Ultrasound source/detector **125** determines the initial object location and calculates a distance and angle relative to display device **302** (step **502**) to calculate focal or control point vectors. For initialization, a user's fingers, hand, or a predetermined object may be placed over a predetermined zone over display device **302**. Alternatively, a user's fingers, hand, or a predetermined object may be detected by digital or infrared cameras **334₁-334₄** using image or photo recognition technology. Once the location of the object is determined, device **100** may display a preprogrammed image, such as a virtual keyboard or icon, on display device **302** at the detected location.

[0069] Ultrasound source/detector **125** in combination with elevation, indenting, or texturizing controller **121** projects or emits one or more ultrasound patterns, such as the ones shown in FIG. 2e, having one or more focal or control points (step **504**). In order to project a predetermined sensation, the intensity of ultrasound at one or more focal or control points may be varied. Also, in the case of multiple objects ultrasound source/detector **125** may be time multiplexed to project different ultrasound patterns to each object. Elevation, indenting or texturizing controller **121** focuses or adjusts focal or control point vectors (step **506**). Ultrasound source/detector **125** in combination with elevation, indenting or texturizing controller **121** detects, tracks, or senses movement of focal or control points to determine momentum and/or velocity of an object (step **508**). While the object moves and is tracked, the ultrasound patterns provided to the object may vary based on images, text, video, or the like displayed on display device **302**.

[0070] In order to enhance accuracy or user experience, device **100** may detect and track multitouch inputs by other fingers and/or input detected by other sensors (step **510**). An animation or video of a generated surface may be displayed on display device **302** for feedback and showing the tracking of the object (step **512**). If an input, gesture, or command is recognized by ultrasound source/detector **125** in combination with elevation, indenting or texturizing controller **121** (step **514**), the input, gesture, or command is processed by one or more processors **102** (step **516**) and information is retrieved based on the input, gesture, or command (step **518**).

[0071] Although features and elements are described above in particular combinations, each feature or element can be used alone without the other features and elements or in