lithographically, or by such other etching process. When projector **610** projects light at barrier **613**, the digits "1", "2" and "3" are projected above screen **100**. When finger **640** is positioned over screen **100** to the left of projector **610**, as shown in FIG. **30**D, the digit "1" appears on the finger, and is captured by camera **630**. The digits "2" and "3" are not visible.

[0199] Similarly, when finger **640** is positioned in front of projector **610** (not shown), the digit "2" appears on the finger, and is captured by camera **630**; and when finger **640** is positioned to the right of projector **610** (not shown), the digit "3" appears on the finger, and is captured by camera **630**.

[0200] Reference is now made to FIG. **30**E, which is a simplified illustration of another pattern of digits projected into the space above screen **100**, in accordance with an embodiment of the present invention. The pattern of digits shown in FIG. **30**E may be generated by a barrier **613** that is implemented as a metal plate having two rows of digits etched thereon. When projector **610** projects light through barrier **613**, the digits "1", "2" and "3" are projected closer to the surface of screen **100**, and the digits "4", "5" and "6" are projected further from the surface of screen **100**. When finger **640** is positioned over screen **100** to the upper left of projector **610**, as shown in FIG. **30**E, the digit "4" appears on finger **640**, and is captured by camera **630**. The remaining digits are invisible.

[0201] Similarly, when finger **640** is positioned over screen **100** to the lower left of projector **610** (not shown), the digit "1" appears on finger **640**, and is captured by camera **630**.

[0202] FIGS. **30**B-**30**E illustrate that the location of finger **640** relative to touch screen **100** is determined by analyzing images captured by camera **630**. As the number of unique patterns, such as digits, is increased in barrier **613**, the position of finger **640** may be determined more accurately.

[0203] iii. Touch Screen as Mouse-Type Input Device for a Computer

[0204] Aspects of the present invention apply to a touch screen which serves as a mouse-type input device for a computer. Reference is now made to FIG. **31**, which is an illustration of use of touch screen **100** for processing finger motions as input to a computer, in accordance with an embodiment of the present invention. Shown in FIG. **31** is a finger motion that is detected by touch screen **100**. Controller **150** (FIGS. **6**A and **6**B) recognizes the finger motion and converts the motion to mouse pointer coordinates, for input to a computer. Thus it may be appreciated that touch screen **100** is able to emulate mouse movement.

[0205] Additionally, left and right mouse clicks may also be emulated by displaying two objects on touch screen **100**. Touching a first one of the objects corresponds to a left mouse click, and touching a second one of the objects corresponds to a right mouse click.

[0206] Further single and double clicking may be emulated by velocities of approach of touch screen **100**. As described above with respect to FIG. **27**, measurement of light intensities at different heights above touch screen **100** enables determination of finger velocity. A slow approach, made by a light tap, corresponds to a single click, and a fast approach, made by a hard press, corresponds to a double click.

[0207] Referring to FIG. **31**, it will be appreciated by those skilled in the art that the path of finger motion shown involves relative motion between a finger and touch screen **100**. The path shown may be generated by a moving finger and a stationary touch screen. It may also be generated by a moving touch screen and a stationary finger, or other stationary object.

[0208] As such, a dual embodiment of the present invention operates by moving touch screen **100** over a stationary object. The relative motion of touch screen **100** generates the path shown in FIG. **31** and, in turn, the path information is converted into mouse coordinates.

[0209] iv. Touch-Based Storefront Window

[0210] Aspects of the present invention relate not only to use of touch-based position and motion information for input to a computing device, but also to use of this information for data processing purposes. In general, the sensed position and motion information for touch screen **100** may be transmitted to a data processor for further analysis. An application of such data processing is a touch-sensitive interactive storefront window, which enables passersby to interact with a display showcase or a video display. The storefront window system responds to passersby touch inputs, and also records and analyzes their touch inputs.

[0211] In this regard, reference is now made to FIG. **32**, which is a simplified illustration of a touch sensitive display case **700** containing items of merchandise **710**, in accordance with an embodiment of the present invention. In accordance with an embodiment of the present invention, the perimeter of an opening in the display case is fitted with light sensors and light emitters, thereby providing the display case with touch screen functionality. Additionally, display case **700** includes mechanical apparatus to automatically move, rotate or otherwise manipulate a displayed item **710**, in response to a passerby **720** touching the display case at a location corresponding to the displayed item.

[0212] A passerby **720** may interactively manipulate selected items by touching and making gestures with his finger on display case **700**. For example, touching display case **700** causes a corresponding item **710** to be selected. A rotating gesture on display case **700** causes item **710** to be rotated. A swipe on display case **700** in one direction causes item **710** to be moved closer to passerby **720**, and a swipe in display case **700** in the opposite direction causes item **710** to be moved away from passerby **720**. An x-shaped gesture on display case **700** causes item **710** to be de-selected.

[0213] In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made to the specific exemplary embodiments without departing from the broader spirit and scope of the invention as set forth in the appended claims. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

What is claimed is:

1. A light-based touch screen, comprising:

a housing for a display screen;

a plurality of infra-red light emitting diodes (LEDs), fastened on said housing, for generating light beams;

at least one LED selector, fastened on said housing and connected with said plurality of LEDs, for controllably selecting and deselecting one or more of said plurality of LEDs;

a plurality of photodiode (PD) receivers, fastened on said housing, for measuring light intensity;