FLEXIBLE MULTI-TOUCH SCREEN

FIELD OF THE INVENTION

[0001] This invention relates generally to a touch screen and, particularly but not exclusively, to an flexible multi-touch screen.

BACKGROUND OF THE INVENTION

[0002] Today, electronic devices provide an increasing amount of functionality with a decreasing size and weight. By continually integrating more and more functions within electronic devices, cost is reduced and reliability is therefore increased. Touch screens are frequently used in combination with conventional displays such as cathode ray tubes (CRTs), liquid crystal display (LCD), plasma displays and electroluminescent displays to provide a easier control. The touch screens are manufactured as devices that can only detect one touching position.

[0003] Today, there many styles of input devices for performing operations in a computer system. The operations generally correspond to the moving of a cursor and/or the selection-making on a display screen. For example, the input devices may include buttons or keys, mouse, trackballs, touch pads, joy sticks, touch screens, etc. Touch screens, in particular, are more and more popular because of their ease and versatility of operation as well as of their declining price. Touch screens allow a user to make selections and move a cursor by simply touching the display screen via a finger or stylus. In general, the touch screen recognizes one touch and position of the touch on the display screen, then the computer system interprets the touch and thereafter performs an action based on the touch event.

[0004] There are several types of touch screen technologies including resistive, capacitive, infrared, surface acoustic wave, electromagnetic, near field imaging, etc. Each of these devices has advantages and disadvantages that are taken into account when designing or configuring a touch screen. In resistive technologies, the resistive touch screen panel is coated with a thin metallic electrically conductive and resistive layer that causes a change in the electrical current which is registered as a touch event and is sent to the controller for processing. In capacitive technologies, the capacitive touch screen panel is coated with a material, typically indium tin oxide, that conducts a continuous electrical current across the sensor. The sensor therefore exhibits a precisely controlled field of stored electrons in both the horizontal and vertical axes—it achieves capacitance. The human body is also an electrical device which has stored electrons and therefore also exhibits capacitance. When the sensor's 'normal' capacitance field (its reference state) is altered by another capacitance field, for example, someone's finger, electronic circuits located at each corner of the panel measure the resultant 'distortion' in the sine wave characteristics of the reference field and send the information about the event to the controller for mathematical processing. Capacitive sensors can either be touched with a bare finger or with a conductive device being held by a bare hand. Capacitive touch screens are not affected by outside elements and have high clarity.

[0005] In surface acoustic wave technologies, ultrasonic waves that pass over the touch screen panel. When the panel is touched, a portion of the wave is absorbed. This change in the ultrasonic waves registers the position of the touch event and sends this information to the controller for processing. Surface wave touch screen panels can be damaged by outside elements. Contaminants on the surface can also interfere with the functionality of the touch screen. In infrared technologies, the infrared touch screen panel employs one of two very different methodologies. One method uses thermal that induces changes of the surface resistance. This method was sometimes slow and required warm hands. Another method is an array of vertical and horizontal IR sensors that detects the interruption of a modulated light beam near the surface of the screen. IR touch screens have the most durable surfaces and are used in many military applications that require a touch panel display.

[0006] In strain gauge technology, the screen is spring mounted on the four corners and strain gauges are used to determine deflection when the screen is touched. This technology can also measure the Z-axis. Typical application includes protecting new touch-screen railway ticket machines from vandalism.

[0007] In dispersive signal technology, which introduced in 2002, the touch panel uses sensors to detect the mechanical energy in the glass that occur due to a touch. Complex algorithms then interpret this information and provide the actual location of the touch. The technology claims to be unaffected by dust and other outside elements, including scratches. Since there is no need for additional elements on screen, it also claims to provide excellent optical clarity. Also, since mechanical vibrations are used to detect a touch event, any object can be used to generate these events, including fingers and styli.

[0008] In acoustic pulse recognition, the panel uses four piezoelectric transducers located at each side of the screen to turn the mechanical energy of a touch into an electronic signal. This signal is then converted into an audio file, and is then compared to preexisting audio profile for every position on the screen. This system works without a grid of wires running through the screen; the touch screen itself is actually pure glass, giving it the optics and durability of the glass out of which it is made. It works with scratches and dust on the screen, and accuracy is very good. It does not need a conductive object to activate it.

[0009] Some of these technologies, such as capacitive, are capable of reporting multiple points when multiple objects are touched on the sensing surface. The multi-touch screen is the trend of touch screen. But the solid, rigid substrates or material used on these devices diminish their suitability for mobile computerized systems, such as laptop computers, handheld computers, cellular telephones, etc. The weight of such sensors and their capacity for breaking are also important factors militating against their use in such systems. Mobile devices also experience far more mechanical flexing than stationary devices. A rigid, brittle and heavy component incorporated into such a device is incompatible with light and flexible components, and it may cause such flexible components to fail. Similar considerations apply to displays mounted in vehicles and large displays mounted on walls. Brittle, rigid substrates or material also increase the thickness of a display in products for which a low profile provides a commercial advantage.

[0010] Touch sensors based on glass substrates also require a specially fitted frame for mounting the sensor over a monitor or display. Such frames further add to the weight, cost and complexity of the device. A flat and solid substrate also does not conform well to displays or monitors with uneven or curved surfaces either Furthermore, bending rigid substrates