Abstract: Provided is an optical touch screen. The optical touch screen comprises: a display substrate having a plate-like observing part formed at the center of the substrate, step parts formed at edges of the substrate and protruding upward above the observing part, and space parts formed inside the step parts; a pair of a light-emitting part and light-receiving part inserted into the space parts of the display substrate and adapted to perform light emission and light receiving through an upper surface of the observing part by way of the step parts; and light-shielding parts embedded at the boundary between the observing part and the step part of the display substrate and shielding light transmission of the light-emitting part and the light-receiving part.

Title: OPTICAL TYPE TOUCH-SCREEN

Fig. 3
Description

OPTICAL TYPE TOUCH-SCREEN

Technical Field

The present invention relates to an optical touch screen. More specifically, the present invention relates to an optical touch screen which is applicable to small-scale devices, due to size reduction through the coplanar arrangement of a light-emitting part and a light-receiving part in combination with a display substrate, each of the light-emitting and light-receiving parts being installed at edges of x-axis and y-axis of the display substrate.

Background Art

With recent development and common propagation of graphic user interface (GUI) systems, touch screen devices with simple and easy input function are gaining popularity among users.

Touch technologies differ in the way each detects a touch. The touch screen may be broadly categorized into a resistive touch screen, a capacitive touch screen, an optical touch screen, a surface acoustic wave touch screen, an electromagnetic touch screen, a vector force-based touch screen, etc., each of which exhibits strengths and weaknesses.

Hereinafter, a brief description will be given of individual types of touch screens.

The resistive type is a touch screen which is comprised of two substrates covered with transparent conductive layers and is operated in a manner that the two conductive layers come in contact when the screen is touched by a pointing means, such as a finger or a pen-like stylus, and then two-dimensional coordinate information is generated by the voltages produced at the touch location. The resistive touch screen has relatively easy realizability and superior performance as compared to other currently available touch screen types, but suffers from disadvantages connected with poor mechanical and environmental reliability.

The surface acoustic wave type, also similar to the optical sensor type, is a touch screen which is based on position coordinate determination of the touch point when the acoustic wave path between an acoustic wave generation device and an acoustic wave recognition device is intercepted. Unfortunately, this type of touch screen is disadvantageously vulnerable to acoustic noise such as factory noise.

The electromagnetic type is a touch screen taking advantage of a magnet and a phenomenon of the electromotive force generation on the basis of Faraday's law, which involves calculation of touch position coordinates by measuring an amount of the current flowing through the coil at each corresponding position. This touch screen type requires use of a dedicated input pen due to the need for application of AC signals to
the coil.

The capacitive touch type is based on determination of the touch position coordinates by sensing the flow of micro-current in response to capacitance changes occurring between a sensor electrode and a user’s finger. This type suffers from a disadvantage of susceptibility to noise signals, but has advantages such as high environmental reliability and easy changeability of mechanical reliability by the modification of an upper protective film.

The optical type requires no use of a film for touch recognition, which in turn results in transmissivity of 100%. As a result, this type of touch screen does not involve problems such as reflection, lowering of brightness and display bleeding, which may occur upon attachment of a different type of a touch screen. Constant maintenance of transmissivity and brightness in the display is an important factor determining the quality of a device. Therefore, the optical type is suitable for configuration of a high-quality display.

Further, the optical touch panel is based on light interception in the detection of touch location coordinates. That is, the coordinate detection involves no physical and/or electrical contact, which therefore results in no load on a sensor. With consequent high reliability, the optical touch panel is widely used for a variety of applications such as plant supervision systems, automated machines and banking terminals. Further, no use of a film or ITO protective layer results in advantages associated with low risk of malfunction error, due to high durability against damage or external impact.

FIG. 1 is a cross-sectional view showing a structure of a conventional optical touch screen.

As shown in FIG. 1, the conventional optical touch screen (A’) includes a display substrate 2’ made of glass or plastic material, an LED sensor module 4’ composed of a PCB 60’ having an LED 42’ for projecting infrared beams and installed on the x-axis edge of the display substrate 2’, and a phototransistor sensor module 6’ composed of a PCB 60’ having phototransistor sensors 62’ for receiving and processing the infrared beams into electrical signals and installed over an opposite edge of the display substrate 2’, wherein light-shielding frames 9’ surround each of the sensor modules 4’ and 6’ to thereby prevent the entrance of external light.

Infrared light generated from an infrared LED is transmitted through a light-transmitting filter to opposite phototransistor sensors, and each of the sensor modules serves as a means to avoid the invasion of light noise from the outside and is deeply mounted into a light-transmitting film.

The display substrate may serve as a supporting structure as well as a protective film against external impact, and is of a very thick structure that is highly impact-resistant.

FIG. 2 is a view showing a schematic principle of touch position detection using a
conventional optical touch screen.

[16] As shown in FIG. 2, infrared beams emitted from the LED sensor module 4’ are input to a plurality of phototransistor sensor modules 6’, and each of sensor pairs is then sequentially turned-on to thereby detect the motion.

[17] The turned-on infrared beams are able to locate the touch position by detecting a touch event (light interception) of the finger or any pointing means in terms of x-axis and y-axis coordinate values and transmitting the calculated values to a computer.

[18] However, the above conventional art has a structure where a module substrate and a complex driving circuit are integrally installed on a very thick substrate, and therefore suffers from complex configuration and significantly increased volume of the touch panel, resulting in inapplicability thereof to small-scale equipment.

[19] Accuracy of the touch panel is dependent on array spacing between the sensor pairs. In this connection, the above conventional art performs the digital position readout of a state of light interception upon reading of the touch position of a finger or any pointing means, thus suffering from very low accuracy of the position reading.

[20] Further, the conventional touch screen system adopts the current integration architecture to enhance the detection stability of the sensor, which results in increased time consumption in the sensor switching and current integration, thus suffering from a very slow response. Therefore, it is very difficult to achieve rapid touch or double-clicking on such OS systems.

Disclosure of Invention

Technical Problem

[21] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide an optical touch screen which is capable of realizing size reduction of a touch panel due to downsizing of a vertical structure through the coplanar arrangement of a light-emitting part and a light-receiving part being installed at edges of x-axis and y-axis of a display substrate, in combination with the display substrate, consequently resulting in miniaturization of a device.

Technical Solution

[22] In accordance with an aspect of the present invention, the above and other objects can be accomplished by the provision of an optical touch screen, comprising: a display substrate having a plate-like observing part formed at the center of the substrate, step parts formed at edges of the substrate and protruding upward above the observing part, and space parts formed inside the step parts; a pair of a light-emitting part and light-receiving part inserted into the space parts of the display substrate and adapted to perform light emission and light receiving through an upper surface of the observing part by way of the step parts; and light-shielding parts embedded at the boundary
between the observing part and the step part in the display substrate and shielding light transmission of the light-emitting and light-receiving parts.

**Advantageous Effects**

[23] As apparent from the above description, the present invention overcomes the problem of a step which was suffered by a stacked structure of a substrate and a module substrate through the co-planar arrangement of a substrate and a sensor through improvement of a vertical structure of a conventional optical touch screen.

**Brief Description of the Drawings**

[24] FIG. 1 is a cross-sectional view showing a structure of a conventional optical touch screen;

[25] FIG. 2 is a view showing a schematic principle of touch position detection using a conventional optical touch screen;

[26] FIG. 3 is a cross-sectional view of an optical touch screen in accordance with the present invention; and

[27] FIG. 4 is a plan view illustrating a driving scheme of an optical touch screen in accordance with the present invention.

**Best Mode for Carrying Out the Invention**

[28] Hereinafter, the preferred embodiments of the present invention will be described in more detail with reference to the accompanying drawings.

[29] FIG. 3 is a cross-sectional view of an optical touch screen in accordance with the present invention, and FIG. 4 is a plan view illustrating a driving scheme of an optical touch screen in accordance with the present invention.

[30] As shown in FIGS. 3 and 4, an optical touch screen (A) in accordance with the present invention is comprised of: a display substrate 2 having a plate-like observing part 22 formed at the center of the substrate, step parts 23 formed at edges of the substrate and protruding upward above the observing part, and space parts 24 formed inside the step parts 23; a pair of a light-emitting part 4 and light-receiving part 6 inserted into the space parts 24 of the display substrate 2 and adapted to perform light emission and light receiving through an upper surface of the observing part 22 by way of the step parts 23; and light-shielding parts 8 embedded at the boundary between the observing part 22 and the step part 23 of the display substrate 2 and shielding light transmission of the light-emitting part 4 and the light-receiving part 6.

[31] The display substrate 2 is made of light-transmitting glass or plastic material, and has a square or rectangular plate-like structure having a rectangular observing part 22 at the center thereof and step parts 23 formed at 4 sides corresponding to edges of the observing part 22.

[32] The step parts 23 are formed to protrude upward above the observing part 22 and are
connected to the observing part 22 via inclined planes 232.

The inclined planes 232 are gradually inclined upwardly toward the step parts 23 from the observing part 22.

Upper surfaces of the step parts 23 are provided with light-shielding frames 9 to thereby prevent emission of light to the outside.

The light-emitting part 4 and the light-receiving part 6 each have a structure including a light-emitting device 42 and a light-receiving device 62 on PCB 60. The light-emitting device 42 employs an infrared LED, whereas the light-receiving device 62 employs a phototransistor.

The light-shielding parts 8 are installed on the display substrate 2 in a manner that light transmission of the light-emitting part 4 and light-receiving part 6 is shielded. Preferably, the light-shielding parts 8 should shield 2/4 to 3/4 portions of lower sides of the light-emitting part 4 and the light-receiving part 6.

Therefore, light transmission of the light-emitting part 4 and the light-receiving part 6 into the display substrate 2 is blocked by the light-shielding parts 8 and is only possible by the medium of the inclined planes 232 of the step parts 23, whereby the incidence and emission of light are made in the vicinity of an upper surface of the observing part 22.

Hereinafter, working and effects of the present invention configured as above will be described.

As mentioned before, the light-shielding part 8 is embedded at the boundary between the observing part 22 and the step part 23 of the display substrate 2. The light-shielding part 8 may be provided at either or both of x-axis and y-axis.

Then, the light-emitting part 4 and the light-receiving part 6 are each inserted into the space parts 24 provided in the step parts 23 of the display substrate 2, such that a plurality of light-emitting devices 42 and a plurality of light-receiving devices 62 are formed opposite to each other through the inclined planes 232, thereby resulting in the emission and incidence of light.

That is, the opposing step parts 23 of x-axis are each provided with the light-emitting parts 4 and the light-receiving parts 6 such that the x-axis coordinate is defined and the opposing step parts 23 of y-axis are each provided with the light-emitting parts 4 and the light-receiving parts 6 such that the y-axis coordinate is defined.

Next, upper surfaces of the step parts 23 are provided with the light-shielding frames 9 to thereby complete an assembly process of the present invention.

Next, when the user's finger touches a certain region in the observing part 22 of the display substrate 2, transmission of light to the corresponding touch region is intercepted to thereby enable accurate calculation of coordinates of the finger-touched position along two predetermined axes x and y. The resulting signal is transmitted to a
controller (not shown) to thereby result in operation of the device.

With the coplanar arrangement of a substrate and a sensor through improvement of a vertical structure of a conventional optical touch screen, the present invention overcomes a problem associated with a step which may occur in a stacked structure of a substrate and a module substrate. Further, a thickness of the substrate in the present invention is thinner than that of a sensor module, which advantageously coincides with a continuing trend toward reduction in size and weight of a device, upon considering that a currently available semiconductor sensor has a thickness of approx. 1 mm. With respect to a height of the step which has usually been pointed out as a structural problem of the device upon configuration of a product, the present invention enables configuration of a window touch panel having an equal height of an overall structure by lowering a height of the light-transmitting region to substantially remove a step between the touch panel surface and the transmitting region. Further, in terms of realization of a window-like panel of small-scale equipment and devices, a sufficient amount of light can be transmitted in the light transmission at a very short distance.

Industrial Applicability

As apparent from the above description, the present invention overcomes the problem of a step which was suffered by a stacked structure of a substrate and a module substrate through the coplanar arrangement of a substrate and a sensor through improvement of a vertical structure of a conventional optical touch screen. Further, a thickness of the substrate is thinner than that of a sensor module, which provides an advantage for reduction in size and weight of a device. With respect to a height of a step which is pointed out as a structural problem upon configuration of a product, the present invention enables fabrication of a window touch panel having an equal height of an overall structure by lowering a height of a light-transmitting region to substantially remove a step between the touch panel surface and the transmitting region. Such a configuration enables reduction in size and weight of a panel, so a more miniaturized touch panel can be provided for a variety of equipment.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.
Claims

[1] An optical touch screen, comprising:
a display substrate having a plate-like observing part formed at the center of the substrate, step parts formed at edges of the substrate and protruding upward above the observing part, and space parts formed inside the step parts;
a pair of a light-emitting part and light-receiving part inserted into the space parts of the display substrate and adapted to perform light emission and light receiving through an upper surface of the observing part by way of the step parts; and
light-shielding parts embedded at the boundary between the observing part and the step part of the display substrate and shielding light transmission of the light-emitting part and the light-receiving part.

[2] The touch screen according to claim 1, wherein the step parts are provided with inclined planes which are connected to the observing part and are inclined outwardly.

[3] The touch screen according to claim 1 or 2, wherein the light-emitting part and the light-receiving part are configured such that emission and incidence of light are made through inclined planes of the step parts.

[4] The touch screen according to claim 1, wherein the light-shielding parts are provided to have a height lower than devices of the light-emitting part and the light-receiving part, such that a light path is formed.

[5] The touch screen according to claim 1, wherein the light-shielding parts are formed opposite to each other on both sides of the light-emitting part and the light-receiving part.

[6] The touch screen according to claim 1, wherein the light-shielding part is provided at either of the light-emitting part and the light-receiving part.

[7] The touch screen according to claim 1, wherein upper surfaces of the step parts are provided with light-shielding frames.
[Fig. 1]

[Fig. 2]

[Fig. 3]
INTERNATIONAL SEARCH REPORT

PCT/KR2008/002287

A. CLASSIFICATION OF SUBJECT MATTER

G06F 3/041(2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 G01S G06F G09G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and applications for Utility models since 1975

Electronic database consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO Internal) "touch", "Optical"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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<tr>
<td>A</td>
<td>US 6,992,659 B2 (GETTEMY) 31 January 2006 See abstract, column 4, line 59 - column 5, line 5, claims 1, 10 and figure 3</td>
<td>1-7</td>
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* Special categories of cited documents

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"&" document member of the same patent family

Date of the actual completion of the international search

11 SEPTEMBER 2008 (11.09.2008)

Date of mailing of the international search report

11 SEPTEMBER 2008 (11.09.2008)

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Facsimile No 82-42-472-7140

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