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A REVIEW ON TOUCH SENSOR SCREEN SYSTEM

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A touch screen is computer display screen that is sensitive to human touch, allowing user to interact with the computer by touching pictures or words on the screen. Touch screen are used with information kiosks (an interactive computer terminal available for computer user, as one with internet access or site specific information), computer based training devices, and system designed to help individuals who have difficulty in manipulating a mouse or keyboard. Touch screen technology can be used as an alternative user interface with application that normally requires a mouse, such as a web browser. Some applications are designed specifically for touch screen technology, often having larger icon and link than typical PC application. Monitors are available with built in touch screen kit. A touchscreen kit includes a touch screen panel, a controller, and a software driver. The touch screen panels are a clear panel attached externally to the monitors that plug into a serial or a universal serial bus (USB) port a bus card installed inside the computer. The touch screen panel registers touch event and passes these signal to the controller. The controller then process the signals and sends the data to the processor. The software driver translates the touch events into mouse events. Driver can be provided for both windows and macintosh operating system. Internal touch screen kits are available. But requires professional installation because they must be installed inside themonitors

Keywords: Touch screen, Human touch, Information kiosks

INTRODUCTION

A touch screen is a two dimensional sensing device display that can detect the presence and location of a touch within the display area. The term generally refers to touching the display of the device with a finger or hand. Touch screens can also sense other passive objects, such as a stylus. Touch screens are in common in device such as game consoles, all-in-one computers, table computers and smart phones. The touchscreen has two main attributes. First, it enables one to interact directly with what is displayed, rather than indirectly with a pointer controlled by a mouse or touchpad. Secondly, it lets one do so without requiring any intermediate device that would need to be held in the hand.
other than a stylus, which is optional for most modern touchscreens). Such displays can be attached to computers, or to networks as terminals. They also play a prominent role in the design of digital appliances such as the satellite navigation devices, palmtop computer, mobile phones, and video games etc.

COMPONENTS OF TOUCHSCREEN KIT

A basic touch screen has three main components,

- A Touchscreen panel
- A Controller
- A software driver

The touch screen is an input device, so it needs to be combined with a display and a PC (personal computer) or other device to make a complete touch input system. The touch screen panels are a clear panel attached externally to the monitors that plug into a serial or a universal serial bus (USB) port a bus card installed inside the computer. The touch screen panel registers touch event and passes these signal to the controller. The controller, then process the signals and sends the data to the processor. The software driver translates the touch events into mouse events. Driver can be provided for both windows and macintosh operating system. Internal touch screen kits are available, but it requires professional installation, because they must be installed inside the monitors.

Touch Screen Panel

A touch screen sensor is a clear glass panel with a touch responsive surface. The touch sensor/panel placed over a display screen so that the responsive area of the panel covers the viewable area of the video screen. There are several different touch sensor technologies on the market today, each using a different method to detect touch input. The sensor generally has an electrical current or signal going through it and touching the screen causes a voltage or signal change. This voltage change is used to determine the location of the touch to the screen.

Controller

The controller is a small PC card that connects between the touch sensor and the PC. It takes information from the touch sensor and translates it into information that PC can understand. The controller is usually installed inside the monitor for integrated monitors or it is housed in a plastic case for external touch add-ons /overlays. The
controller determines what type of interface/connection you will need on the pc. Integrated touch monitors will have an extra cable connection on the back for the touch screen. Controllers are available that can connect to a serial/COM port(PC) or to a USB port(PC or macintosh). Specialized controllers are also available that work with DVD players and other devices.

Software Driver

The driver is a software update for the PC system that allows the touch screen and computer to work together. It tells the computer’s operating system how to interpret the touch event information that is sent from the controller. Most touch screen drivers today are a mouse-emulation type driver. This makes touching the screen the same as clicking your mouse at the same location on the screen. This allows the touch screen to work with existing software and allows new applications to be developed without the need for touch screen specific programming. Some equipment such as thin client terminals, DVD players, and specialized computer systems either do not use software drivers or they have either own built-in touch screen driver.

**TYPES OF TOUCH SCREEN TECHNOLOGY**

Some of the different existing and developing types of the touchscreen techniques are

- Resistive sensing technology
- Capacitive sensing technology.

These technologies are also having various major classifications. The above two technologies are only widely used now-a-days.

**Resistive Sensing Technology**

This type of a touch screen uses two layers that are coated with a resistive and a conductive material. These two layers that are separated from each other with the help of an air-gap or spacers. On top of the whole mechanism will be a layer to provide resistance to scratches. The monitor of the display is made operational in nature. Thus, when our finger touches the screen, a contact is made between the two layers and current flows through them. As the layers make contact at the same point, the correct location of the point is noted. The location is calculated by
the computer in course of the change in the electric field occurred by our touch. Thus when the position is known, it is passed on to a driver in the device which codes it and sends it to the OS of the device.

This technology can be used with the contact of any object like finger, pen, and stylus and so on. Thus it is also considered as a passive technology.

When an object, such as a fingertip or stylus tip, presses down on the outer surface, the two layers touch to become connected at that point. The panel then behaves as a pair of voltage dividers, one axis at a time. For a short time, the associated electronics (device controller) applies a voltage to the opposite side of one layer, while the other layer senses the proportion (think percentage) of voltage at the contact point. That provides the horizontal\[x\] position. Then, the controller applies a voltage to the top and bottom edges of the other layer (the one that just sensed the amount of voltage); the first layer now senses height\[y\]. The controller rapidly alternates between these two modes. As well, it sends position data to the CPU in the device, where it’s interpreted according to what the user is doing.

Different configuration of resistive touch screen are available, namely 4-wire, 5-wire, 6-wire, 7-wire and 8-wire systems where 8-wire is similar to 4-wire and the others are similar among themselves. The most popular are 4-wire and 5-wire.

**Capacitive Sensing Technology**

This is one of the most widely used techniques for touch screens. This technology is based on the capacitor coupling effects. It has been used in devices like MP3 players, computer monitors, mobile phone displays and so on. As this technology has advantages like detecting the correct position at a very small time, less cost in production, and also a very unique human device interface, it is widely used. It also has properties like multiple touching sensing and also gesture based touch screens. The latest and most famous gadget to be released with this technology is the Apple i-pod click wheel. This mechanism is more advantageous than the resistive sensing because it can transmit to a maximum of 90% of the light from the monitor. Thus a much better vision can be obtained from these screens.

Here also, a glass panel is arranged on top of which a layer that is able to store electrical charge is kept. When the monitor is touched by the user, the charger begins to move from the layer to our body. This decrease in the charge on the conductive layer is measured with the help of electronic circuits which are placed inside the monitor. As the electronic circuits are placed on each corner of the monitor the difference in charge attained at each corner is calculated by the computer and the exact position of touch is obtained. This information is then passed on to the touch-screen driver software.
A capacitive touch screen consists of a glass panel with a capacitive (charge storing) material coating its surface. Circuit located at corners of the screen measure the capacitance of a person touching the overlay. Frequency changes are measured to determine the X and Y co-ordinates of the touch event. A capacitive touchscreen panel consists of an insulator such as glass, coated with a transparent conductor such as indium tin oxide (ITO). As the human body is also an electrical conductor, touching the surface of the screen results in a distortion of the screen’s electrostatic field, measurable as a change in capacitance.

Derivation of capacitive touch screens include:
- Surface capacitance.
- Projected capacitance.
- Mutual capacitance.
- Self-capacitance.

Mechanism to find out the location of the display and to carry on the appropriate command.

The most commonly used technologies are the resistive and capacitive sensing technologies (both are explained below in detail). For both these methods, a touch screen should have four layers.

1. A spacing layer which is mostly an air-gap.
2. A glass layer beneath the spacing with a conducting transparent coating on its top.
3. An adhesive layer beneath the glass layer. This layer is mostly used for mounting purposes.

When a person presses his finger on the top of the screen, there will be a change in the electrical current in the display model. This change is measured in either way explain above and the exact location of touch and the amount of force applied is calculated. Later, the command
to be carried out is passed on to the operating system and the command is carried out.

**WORKING**

Touch screen is the basic principle, with the fingers or other objects touching the installed display the front of the touch screen when the touch location (in co-ordinate form) from the touch screen controller testing, and through the interface (such as RS-232 serial port) to the CPU, to determine input. Touch screen system typically include touch-screen controller (card) and touch detection device of two parts. Which touch screen controller (card) from the main role is to touch the touch detection device to receive information and convert it into contact co-ordinates, and then send to CPU, it also can receive commands and then send CPU to execute: touch detection device is usually installed in-front of the monitor, the main role is to detect a user’s touch position, and send it to the touch-screen controller.

**Resistive Touch Screen**

Resistive touch screen panel part of the body with a display to match the surface of multi-layer composite film by a layer of glass or plexi glass as a grass-roots level, the surface coated with a layer of transparent conductive layer, above and then covered with a layer of hardening the outer surface handing, smooth scratch-resistance plastic layer, and its inner surface is also coated with a layer of transparent conductive layer between two layers of many small (less than one thousandth inch) transparent insulating isolation points separate them. When the fingers touch the screens usually to mutually insulator conductive layer in touch with a contact point, because of which a conductive layer connected to the Y axis 5V uniform voltage field, making the detection of the voltage from zero to non-zero, which was connected to the gate controller to detect, for the A/D conversion, and will be the voltage value can be compared with the 5V and touch the Y-axis co-ordinates, the same reason, the co-ordinates of the X-axis. That is all the resistance technology the common basic principles of resistance type touch screen key
material. Resistance screen according to lead the number of how many, is divided into four or five lines, six line or multi wire resistive touch screen. Resistive touch screen the glass surface where coated with the two layers of OTI transparent conductive metal oxide layer, the outer most layer of OTI as a conductive coating, and the second layer of OTI is attached to the network through sophisticated in both directions anyway 0V+5V to the voltage field, between two layers of OTI transparent to small isolated points separated. when the fingers touch screen, two OTI conductive layer will be contact point, the computer simultaneously detect voltage and current, calculates the location of touch, response rate of 10-20ms.5-wire resistive touch screen of the outer conductive layer scalability is a good use of nickel-gold coating materials, conductive outer layer due to the frequent touch, use a good ductility nickel deposit materials in order to extend the service life, but the technology costs more expensive. Nickel deposit conductive layer although the scalability, but only for transparent conductors, is not suitable for resistive touch screen face, because it is high conductivity, and metal is very difficult to achieve uniform thickness, suitable for voltage distribution layer can only explore as a layer. Resistive touch screen is a kind of working environment completely isolated from the outside world, afraid of dust and water vapour, which can be used to touch any object can be used draw and write, more suitable for industrial control and office areas of the limited human use. Resistive touch screen is a common drawback is that the outer layer of composite thin films of plastic material, does not know too sharp or the use force likely to scratch the touch screen, touch scrapped as a result. However, the limits, scratch will only hurt the conductive outer layer, outer layer of conductive scratch for the 5-wire resistive touch screen is not related, and four-wire resistive touch screen is fatal.

**Capacitive Touch Screen**

It is the use of ****to work the current sensors. The capacitive touch screen has the four layers of composite glass screen. Glass screen of the inner surface of the sandwich and coated with a layer ITO, thin outer layer is a protective layer of silica glass laminated ITO coating as a face, four corner leads to the four electrodes, the inner layer of ITO as a shield to ensure a good working environment. When the fingers touch the metal layer, because the body electric, users and touch screen surface of a capacitive coupling, the high-frequency current to said capacitor is the conductor directly, so fingers away from the contact point of the small current. The current points from the four corners of the touch screen on the outflow of electrodes, and flows through four electrodes to the four corners of the current and the distances between the fingers proportional to the controller through the four current ratio of precision calculated touch point. Capacitive touch screen features:

For most pollutants in the environment there is resistance.
Line to become part of the body, and thus drift quite serious.
Does not work with gloves.
Need to be calibrated.
Not apply to metal cabinets.
When the outside world when the inductance and magnetic induction, will touch screen failure.

APPLICATIONS

The touch screen enables the user to interact directly with what is displayed, rather than using a mouse, touch pad, or any other intermediate device (other than a stylus, which is optional for most modern touch screens).

Touch screens are common in devices such as game consoles, personal computers, tablet computers, and smart phones. They can also be attached to computers or as terminals to networks. They can also be attached to computers or, as terminals, to networks. They also play a prominent role in the design of digital appliances such as personal digital assistants (PDAs), satellite navigation devices, mobile phones, and video games and some books (Electronic books).

The popularity of smartphones, tablets, and many types of information appliances is driving the demand and acceptance of common touch screens for portable and functional electronics. Touch screens are found in the medical field and in heavy industry, as well as for automated teller machines (ATMs), and such as museums displays or room automations, where keyboard and mouse systems do not allow a suitably intuitive, rapid, or accurate interaction by the user with the display’s content.

Public Information Displays
Tourism displays, trade show displays, information kiosks and other electronic displays are used by large number of people that have little or no computing experience. The touch
screen interface is easier to use than other input devices especially for novice users. A touch screen is useful to make your information more easily accessible by allowing users to navigate your presentation by simply touching the display screen.

**Retail and Restaurant Systems**

Time is money, especially in a fast-paced retail or restaurant environment. In retail or restaurant environments, touch screen systems are easy to use so employees can get work done faster and also training time can be reduced for new employees. As input is present right on the screen, valuable counter space can be saved. Touch screens can be used in order entry stations, cash registers, seating, reservation systems, and more.

**Control and Automation Systems**

The touch screen device is useful in systems ranging from industrial process control to home automation. Variable workspace can be saved by integrating the input device with the display. In real-time by simply touching the screen and with a graphical interface, operators can monitor and control complex operations.

**Computer Based Training**

The touch screen interface is more user-friendly than other input devices so overall training time for computer novices and therefore training expenses can be reduced. It can also be more useful to make learning more fun and interactive, which can lead to more beneficial training experiences for both students and educators.

**Assistive Technology**

The touch screen interface is very useful for those having difficulty using other devices such as a mouse or keyboard. When touch screen used with software such as on-screen keyboards or other assistive technology, they can help make computing resources more available to people that have difficulty using computers.

The touch screen interface is being used in a wide variety of applications to improve human-computer interaction. Touchscreens are the most common means of input in personal Digital Assistants (PDAs). Other applications include digital jukeboxes, computerized gaming, student registration systems, multimedia software, financial and scientific applications, and more.

**FORECASTS ON TOUCH SCREEN TECHNOLOGY**

Touch screen Interfaces are becoming increasingly common in mobile consumer devices, such as mobile phones, tablets, and e-books. IDT techEx forecasts revenue of the touch screen market to be US$14bn in 2012 and to triple in the next decade. The report provides a 10-year forecasts for the touch screen market by the applications and by technology, explaining the primary use markets for each technology.

**COMPARISON OF TOUCH SCREEN TECHNOLOGY**

**Technology**

Capacitive touch screen uses electrostatic fields.
Resistive touch screen uses resistive technology.

**Activation**
Both technology requires only low activation pressure.

**Transmisstivity/Optics**
Capacitive technology has very good transmisstivity greater than 92%.

Resistive technology has some distortion to graphics due to coatings and has transmisstivity lesser than 82%.

**Drag and Drop**
Both technology requires constant pressure to draw smooth lines.

**Calibration**
Capacitive technology requires periodic recalibration where Resistive technology requires periodic calibration due to wearing of coatings.

**Type**
Both are belongs to the type of surface technique of electrical.

**Durability**
Capacitive technology is having the durability of 2 years, where the Resistive technology is having the durability of 5 years.

**Transparency**
Transparency is normal in capacitive technology, where the transparency is bad in resistive technology.

**Stability**
Capacitive technology have normal stability where resistive technology have high stability.

**Touch**
Anything can be touched by resistive technology but conductive elements only can be touched by capacitive technology.

**Response Time**
Capacitive technology have the response time less than 15ms and resistive technology have response time less than 10ms.

**Sensitivity**
Capacitive technology is very sensitive to dirt and resistive technology is very sensitive to scratch. Resistive technology requires periodic calibration due to wearing of coatings.

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**ADVANTAGES**

Touch screen have several advantages over other pointing devices;

- Touching a visual display of choices requires little thinking and is a form of direct manipulation that is easy to learn.
- Touch screens are the fastest pointing devices.
- Touch screen have easier hand eye co-ordination than mice or keyboards.
No extra workspace is required as with other pointing devices.

Touch screens are durable in public access and in high volume usage.

**Resistive Sensing Screen**

They are very accurate and can be used for high resolutions up to 4096X4096 dpi.

Very cost effective in comparison with other technologies.

It can also be used in multiple touch screen pads.

It can transmit almost 75% of the light from the monitor.

**Capacitive Sensing Screen**

Higher clarity display (up to 90% optical transparency)

Supports multi-touch

High touch resolution

High sensitivity

**DISADVANTAGES**

User’s hand may obscure the screen.

Screens need to be installed at a lower portion and tilted to reduce arm fatigue.

Some reduction in image brightness may occurs.

They cost more than alternative devices

Screens get very dirty.

These devices require massive computing power which leads to slow devices and low battery life.

Touch devices usually has no additional keys and this means when an application crashes, without crashing the OS, you can’t get to the main menu as the whole screen becomes unresponsive.

**Resistive Sensing Screen**

As the device is also used as a passive technology there will be problems regarding hand written notes taken on a stylus. As the person cannot use a whole hand down on the screen while he is writing there has to be a trade-off between the property of using a finger as a stylus and the pressing of a whole hand on the screen.

**Capacitive Sensing Screen**

Needs a human finger to register input. It is not possible to use this screen wearing gloves.

Cannot be used in all weather scenarios.

**TOUCHSCREEN RESOLUTION**

The resolution or number of touch active points on the touchscreen, affects the level of pointing precision and selection errors. For example, a capacitive screen has a resolution of 25* 40 due to limitations on the number of light beams that can be placed around the screens. Therefore, a higher resolution screen provides additional touch points allowing greater pointing precision because the software can average all the points that have been touched and there are less selection errors as touch points are mapped more easily to the targets on the display.

**CONCLUSION**

The advancement in the field of touch screen technology has created a new sense in the lifestyle of people. Touch screens are used in hospitals, ATM, in operating units of heavy industries or controlling the machines, touch screen locks. Touch screen is widely used in computer TV displays and its demand is tremendously increasing.
Touch screen technology will increase in significance as a 1/0 technique for user oriented embedded systems. Vendors have been steadily reducing or eliminating the weaknesses in touch sensors as well as adding new capabilities. This combination of steady improvement punctuated by innovation will continue to broaden the range of applications that touch screen can serve.

Moving towards the future, consumers will continue to see the growth of the touch screen industry, due to extensive engineering advancements in user interfaces. The ability to physically touch a screen is than searching for a specific key in a sea of buttons. Society, for these reasons, has found touch screens to be the future of many devices. The social norm of today includes walking the street surfing the web an i-Phone or shifting through music on an i-Pod touch. No additional buttons are necessary, just the small, portable device in one’s pocket until needed, society will continue to see the development of touch screen technology as human-device interaction is perfected.

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