Touch Screen Technology

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Abstract: In the present scenario, there is a large interaction with the electronic devices. This is changing the focus on the technological research. This change is leading to a huge advancement including the development of touch screen technology. The demand of touch screen electronic devices is improving day-by-day. This has proven reliability. Touch screen has become subsequently familiar in daily life. This technology is a unique type of visual display which allows the user to interact physically with any electronic device by touching the screen. This paper will discuss all about the touch technology and the way it is evolved.

Keywords - Fingers, touch screen, resistive, capacitive, sensors, layers, technology, surface-acoustic and infrared technology.

I. INTRODUCTION

Touch screen is an electronic visual display by which the user can control through multi-ways by touching the screen. Now-a-days touch screens play a vital role in many of the electronic devices such as computers, laptops, smart phones, satellite navigation devices etc. In the increase in the technological changes, touch screens are also provided for the electronic books in-order to make it easy for the reader.

In the early 1970s, the resistive touchscreens are invented. Although capacitive touchscreens were designed first, they were surpassed in the early years of touch by resistive touch screens. An American inventor named Dr. G Samuel Hurst developed the resistive touchscreens.

Touchscreen based system allows an easy navigation around a GUI (Graphical User Interface) based environment. There has been a huge demand for the touchscreen sensors. Display manufacturers and chip manufacturers worldwide have acknowledged the trend towards the acceptance of touch screens as a highly desired user interface component. They have also began to integrate the touch screens into the fundamental design of their products.

In the year 1983, HP-150 home computer used infrared technology. In 1993, Apple's Newton and IBM's Simon came. In 2002, Microsoft's Windows XP was launched. In 2007, Apple's IPHONE (multi-touch) was launched.
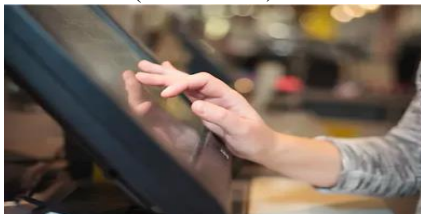

Fig 1: Image of a touch screen

II. WORKING

The development of the multi-point touch screens facilitated the tracking of more than one finger on the screen, thus operations that require more than one finger are possible.

There are two attributes of the touch screen technology. One attribute is that-It enables one to interact with what is displayed directly on the screen where it is displayed, rather than indirect usage with the help of a mouse or a touch pad. The second one is that- It lets one to do so without requiring any intermediate device that it would be in the hand. Till date, most consumer touch screens could only sense one point of contact at-a-time and few have had the capability to sense how hard one is touching.

Basically a touch screen works on the basis of three main components. They are TOUCH SENSOR, CONTROLLER, SOFTWARE DRIVER.

A. TOUCH SENSOR

A touch sensor is a clear plain glass panel with a touch responsive surface. It is placed over the display screen. It is placed in such a way so that the responsive area of the panel covers the viewable area of the video screen. Basically the sensor has an electrical current or a signal going through it. By touching the screen there is a cause of voltage or signal changes. This change in voltage is therefore used in the determination of the location of the touch to the screen. There are different touch sensors in the market. Also there are different methods to detect touch input.
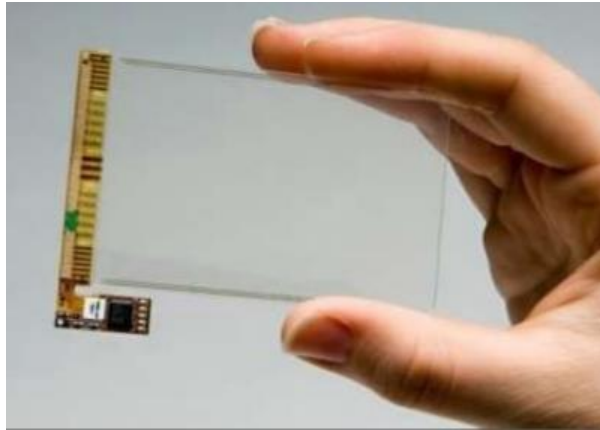
Fig 2: Touch sensor

B. CONTROLLER

A small PC card that connects between the touch sensor and the PC is known as a Controller. This takes the information from the touch sensor and translates into the information that the PC can understand. Controller is usually built inside the monitor for the integrated monitors. What type of interface will be needed on the PC is determined by the controller. There are specialized controllers that works with DVD players and other devices.
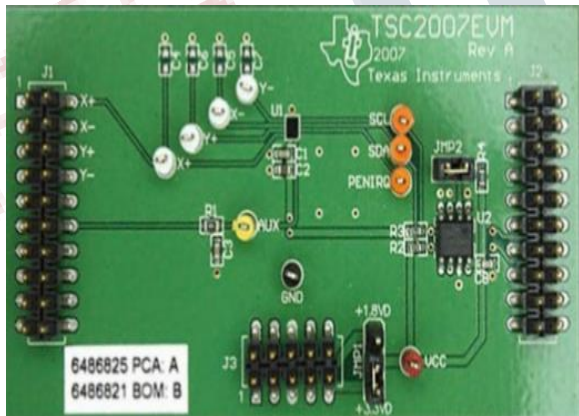

Fig 3: Controller

C. SOFTWARE DRIVER

A driver is the software update to the PC system that allows the touch screen and the computer to work together. It shows the computer's operating system how to interpret the touch information sent from the controller. Today most of the drivers are mouse-emulation type ones. This makes the touching the screen as same as clicking your mouse at the same location on the screen. This allows the touch screen to work with the existing software and allows new applications to be developed without the need for the touch screen specific programming.
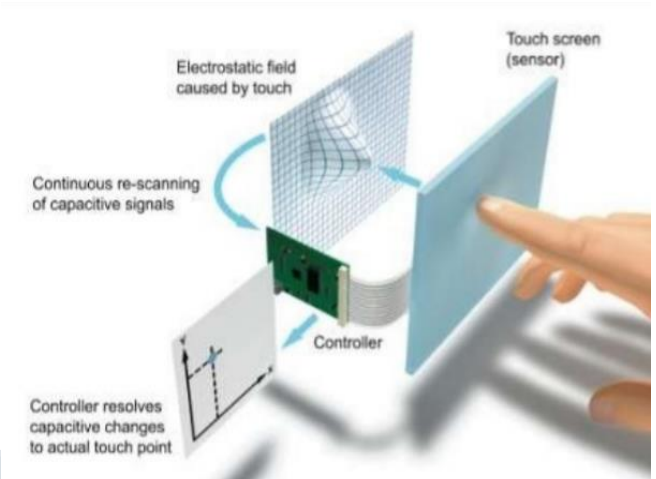

Fig 4: Picture showing how it works

III. TYPES OF TOUCH SCREEN TECHNOLOGY

A touch screen is a two dimensional sensing device made of two sheets of material separated by spacers. There are four main touch screen technologies.
A) Resistive
B) Capacitive
C) Surface Acoustic Wave(SAW)
D) Infrared

A. RESISTIVE TOUCH SCREEN TECHNOLOGY

A resistive touch screen panel consists of several layers. The most ones are the thin, metallic, electrically conductive layers separated by a narrow gap. When a finger presses down on a point on the panel's outer surface, the two metallic layers become connected at the point. This causes a change in the electrical current which is registered as a touch event and sent to the controller for the processing. The resistive system has a normal glass panel. This panel is covered with a conductive and a resistive metallic layer. These two layers are being held apart by the spacers. A scratch-resistant layer is placed on the top of the whole setup. Electrical current runs through the two layers. When the screen is being touched by the user, the two layers make contact in that exact spot. A special driver converts the touch into something that the operating system can understand.
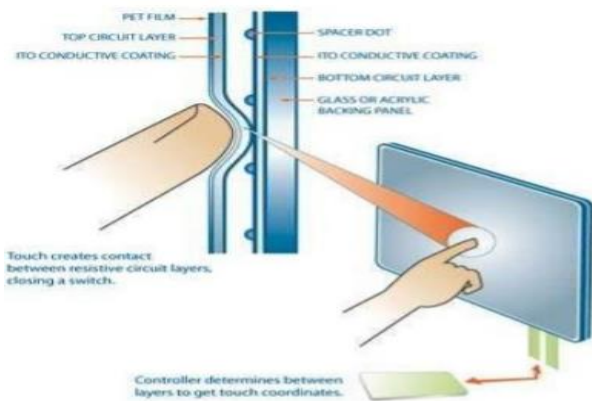
Fig 5: Resistive Touch Screen

B.   CAPACITIVE TOUCH SCREEN TECHNOLOGY

The capacitive touch screen technology is the most popular and durable touch screen technology which is almost used all over the world. It consists of a glass panel coated with a capacitive material (Indium Tin Oxide). The capacitive systems transmit almost 90% of the light from the monitor. Some of the devices using capacitive touch screen are Motorola Xoom, Samsung Galaxy Tab, Apple's iPad.
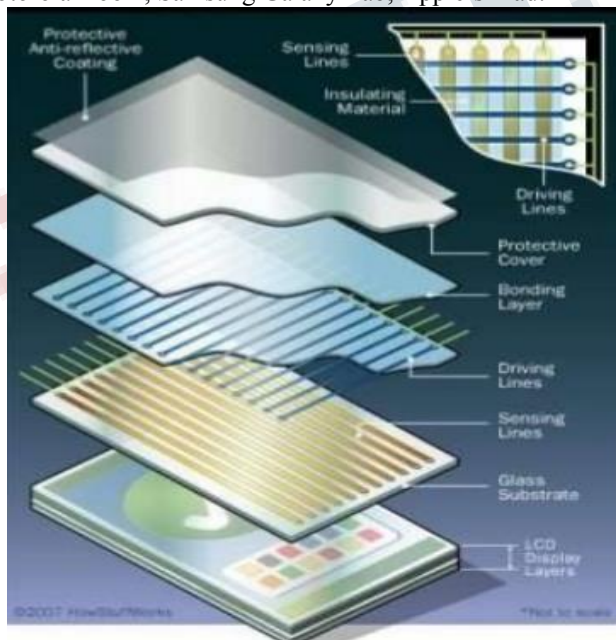

Fig 6: Capacitive Touch Screen

C.   SURFACE ACOUSTIC WAVE TOUCH SCREEN TECHNOLOGY

The surface acoustic wave touch screen technology consists of two transducers. The two transducers involved in this technology are transmitting and receiving transducers. They are placed along X-axis and Y-axis of the monitor's glass plate along with some reflectors. The waves are propagated across the glass. These waves are reflected back to the sensors. When the screen is being touched, the waves are absorbed and a touch is detected at that point. These reflectors reflect all the electrical signals sent from one transducer to the other one. This technology provides awesome throughput and image clarity.
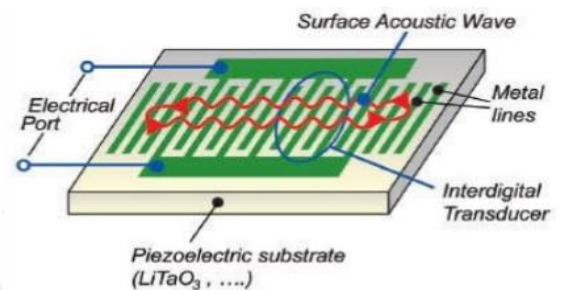

Fig 7: Surface Acoustic Wave Touch Screen

D.   INFRARED TOUCH SCREEN TECHNOLOGY

It uses an array of light emitting diodes that emits invisible light (infrared) on the adjacent sides of the display with photo sensors on the opposite edges. This creates a grid of light beams across the screen. Object interrupt these light beams lowers the intensity at the receiver and hence touch is detected. It makes the use of coordinate programming is difficult.
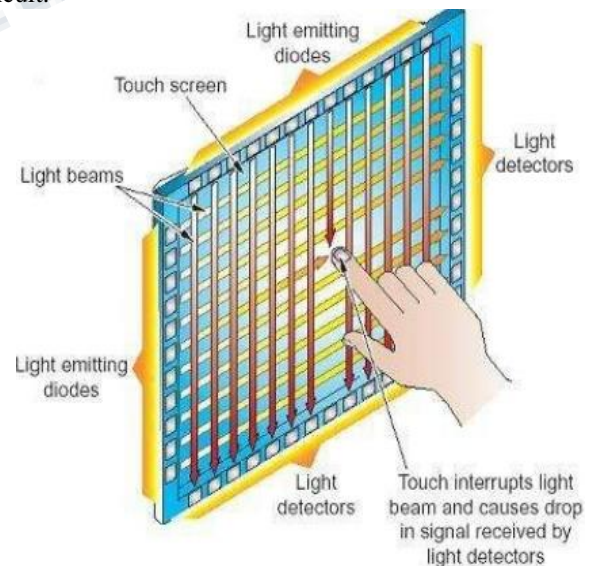

Fig 8: Infrared Touch Screen

IV. ADVANTAGES

The touch screen technology has a great reliability. It occupies less space and has simple interface. It is user friendly and has a fast response. There is no need of using a keyboard or a mouse. This makes computing quite easy. It has error-free input. No switches or buttons are required. With multi-touch function various operations are possible.

V. APPLICATIONS

There are various applications for the touch screen technology. This technology has been used in a wide range of applications. The informational kiosks are made of touch screens to make it user friendly. Now-a-days, to make it easy satellite navigation devices are also given the touch screens. In some of the tourism places such as museums have the touch screen displays to make tourists feel comfortable. The trade show displays are completely made of the touch screen technology. All the restaurant systems are also made of the touch screen technology in many of the places. Control panels and Industrial process controls have this great technology being used. The most used electronic machines these days are ATMs. The ATM machines have being manufactured with the touch screen technology which is easier to the user. Children playing gaming devices are also being made of the touch screens. The public transport is being used by most of the people, the ticket issuing machines in the public transport counters have been having the touch screen systems. Other than all these applications, the widely growing applications in different aspects of the touch screen technology are smart phones, computer systems, etc.

VI. DISADVANTAGES

Every coin has two sides. In the same way, even though there are many advantages and applications for the touch screen technology, there are some of the disadvantages in some aspects. Sometimes the touch screens may suffer from the problems of the fingerprints on the display. This can cause the damage to the screen. Screen has to be big enough not to miss the content when pressing them with the fingers. The massive computing power slows down the system.

VII. CONCLUSION

Touch systems are the rapidly growing subset of the display market. The popularity of smart phones, PDAs (Personal Digital Assistant), tablet computers and many other devices is driving away the demand and the acceptance for touch screens. For portable and functional electronics, a display of simple smooth surface and direct interaction without keyboard or mouse between the user and content is required. This could be possible only with the help of the "Touch Screen Technology". Touch screens are popular in Hospitality and Heavy Industry. Historically touch screen sensor and its accompanying controller based firmware have been made available by a wide array of after-market system integrator, and not by display, chip or motherboard manufacturers. Overall, this study shows that the touch screen technology has a positive influence on some key aspects of usability, especially for an efficient navigation.

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