

A Review on Touch Screen Technology

Anubhuti Singh

Research Scholar, ECE Dept., University Of Technology, Jaipur

ABSTRACT

In the present scenario, there's an outsized interaction with the electronic devices. This change is leading to a huge advancement including the growth of touch screen technology. The demand of touch screen gadgets is increasing day by day and has proven reliability. Touchscreens are type of display screen that has a touch-sensitive transparent panel which covers the screen. Instead of using a pointing device like mouse or a light pen, we can use our finger to point directly to the objects on the screen. This technology is a unique type of visual display device that allows the user to physically interface with the computer or other electronic device like smart phones, video games, navigation system, etc. by touching the screen.

Keywords: Touch Screen, Sensors, Layers, Capacitive, Fingers, Infra-red Technology, Touch- Screen Technology, Resistive and Stylus.

I. INTRODUCTION

Touch screen is an electronic visual display by which the user can control the screen. The term usually refers to touching the display of the device with finger and other passive things like stylus. Touch screen are common in devices such as all-in-one computers, tablets and smart-phones. Touchscreens are also important in educational settings such as classrooms or college campuses. The popularity of smartphones, tablets, and many types of information appliances is motivating the demand and acceptance of common touch screens for portable and functional electronics. They also play a major role in the design of digital appliances such as Personal Digital Assistant (PDA), satellite navigation devices and video games.

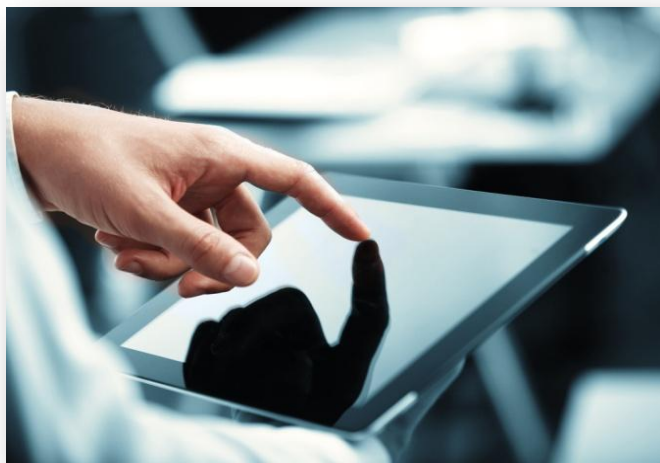


Fig. 1: Touch Screen

A. History

The first finger-controlled touch screen i.e. Capacitive Touch Screen, was created by E.A. Johnson in 1965 at the Royal Radar Establishment in Malvern, UK. Johnson's original technology was only able to process one touch at a time. Capacitive touch screens were soon replaced by Resistive Touch Screens. In 1970 Dr G Samuel Hurst invented Resistive Touch Screens, calling this technology as 'ELOGRAPHICS', at the University of Kentucky. In 1971, PLATO IV terminal

was designed by The University of Illinois. It employed infrared technology rather than capacitive or resistive, and was the first touch screen computer to be used in a classroom. In 1993, IBM and BellSouth launched the Simon Personal Communicator, one of the first mobile phones to feature touch screen technology. In 2002 Microsoft's Windows XP tablets were launched. In 2007 Apple's multi touch iPhone was launched. In 2007, 93% of touch screens shipped were resistive and only 4% were projected capacitance. In 2013, 3% of touch screens shipped was resistive and 90% were projected capacitance. In 2010, Apple, Samsung like companies launches its iPad and Tablets.

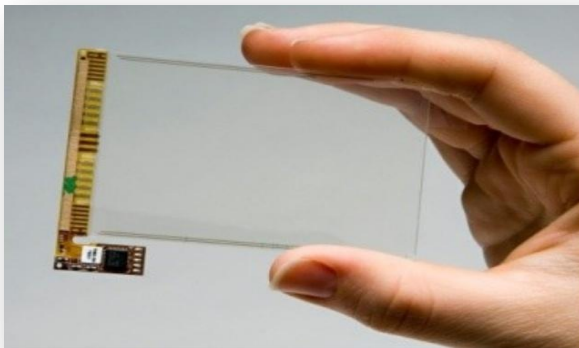
II. WORKING

There are three main components of touch - screen, they are:

- i. Touch Sensor
- ii. Controller
- iii. Software Driver

i. TOUCH SENSOR

A touch screen sensor is a clear glass panel with a touch responsive surface. It is placed over a display screen in such a way that the responsive area of the panel covers the viewable area of the video screen. There are several types of touch sensor technologies available in market nowadays that each using different method to detect touch input. The sensor generally has an electrical current or signal going through it and by touching the screen it causes a voltage or signal changes. This voltage change is used to determine the location of the touch to the screen. Also, there are different methods to detect the touch input.



ii. CONTROLLER

Fig. 2: Touch Sensor

A Controller is known as a small PC card that connects between the touch sensor and PC. It takes the information from the touch sensor and translates it into information that PC can easily understand. The controller is generally install inside the monitor for integrated monitors. What type of connection your PC need is determined by the controller. There are some specialized controllers available that will work with DVD players and some other devices.

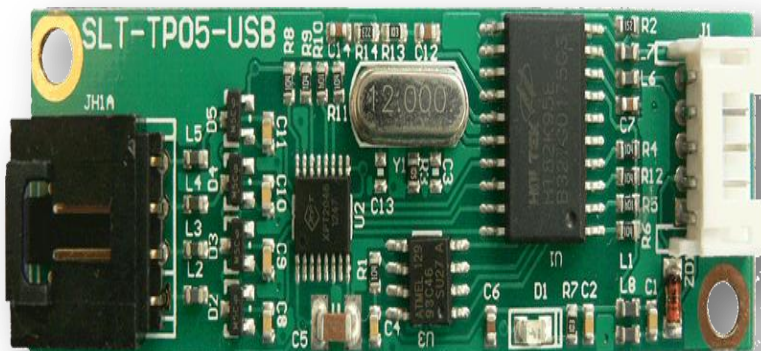


Fig. 3: Controller

iii. SOFTWARE DRIVER

The Software Driver allows the touch screen and computers to work together. It tells the operating system how to recognize the touch information that was sent by the controller. Nowadays most of the touch screen drivers are mouse-elimination type drives. This makes touching the computer screen the same way as you click your mouse at the same location on the screen. This allows the touch screen to work with the existing software.



Fig. 4: Software Driver

III. TYPES

There are four types of Touch Screen Technologies, they are:

- i. Resistive Touch Screen Technology
- ii. Capacitive Touch Screen Technology
- iii. Surface Acoustic Wave(SAW) Touch Screen Technology
- iv. Infrared Touch Screen Technology

i. Resistive Touch Screen Technology

Resistive touch screens are operated by sensing the direct pressure which was applied by the user. It can be activated by pressing it not only with a finger but also with a stylus. A resistive touch screen consists of a touch layer placed on top of a standard display. The touch layer usually includes two transparent electrical layers which were separated by a small gap. By pressing the display's surface it causes the two separate layers to come into contact with each other, this creates an electrical connection that can be sensed and located.

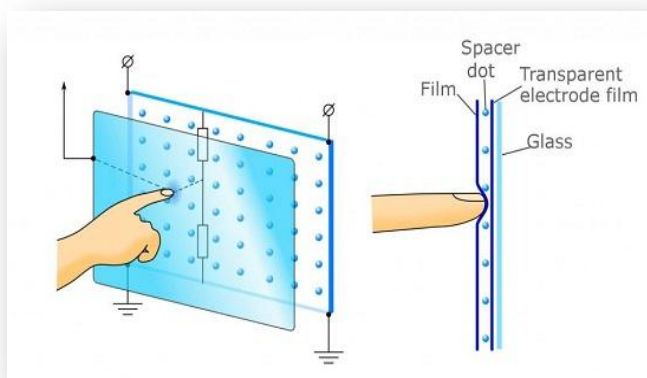


Fig. 5: Resistive Touch Screen Technology

ii. Capacitive Touch Screen Technology

The Capacitive Touch Screen Technology is used in almost all over the world because it is most popular and durable technology. It consists of glass panel, coated with a transparent conductor such as Indium Tin Oxide (ITO). It has higher transmittance than resistive touch screen technology. It is a control display that uses the conductive touch of a human finger or a specialized device for input. Many current smart phones, tablets and other mobile devices rely on Capacitive Touch Screen Technology, including android phones, iPhone, iPad and iPod.

It is of two types:

- a) Surface Capacitive Technology
- b) Projected Capacitive Technology

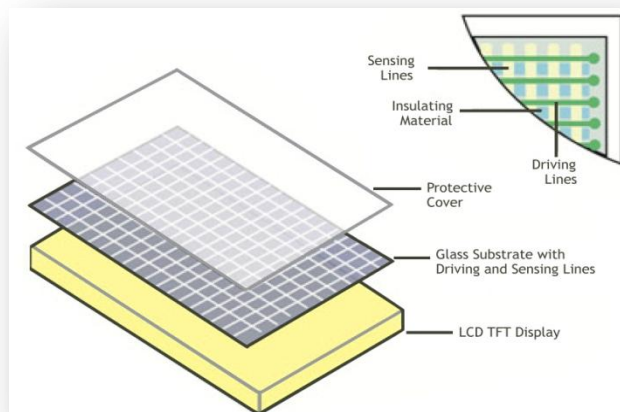


Fig. 6: Capacitive Touch Screen Technology

a) Surface Capacitive Technology

A Surface Capacitive Touchscreen is coated on one side with small voltage conductive transparent layer and uses four electrodes. Then a protective layer is applied to the conductive film. When a conductor touches the screen then the current will flow from the electrodes to the conductor. It has limited resolution and is often used for large screen panels.

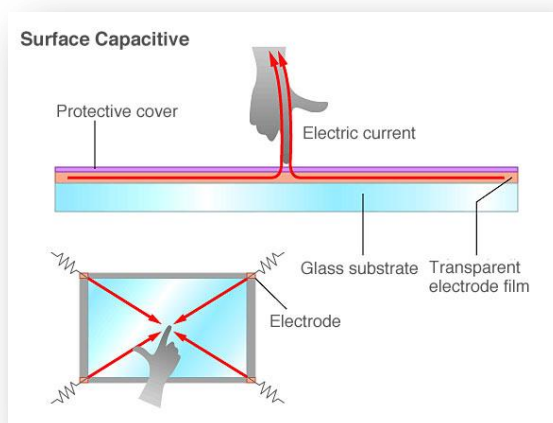


Fig. 7: Surface Capacitive Technology

b) Projected Capacitive Technology

A Projected Capacitive Touchscreen uses fixed conductive layers with electrode grid patterns. It is quick and is usually found on smaller devices like iPhones, iPads, etc. Unlike the SCT, which uses four electrodes and a conductive transparent film, the Projected Capacitive Touch screen Technology, uses a huge amount of transparent electrodes

arranged in a specific pattern and on two separate layers. When a conductor moves close to the screen, the electrical field between the electrodes changes and sensors can immediately identify the location on the screen. It has robust architecture and is generally used in point-of-sale transactions.

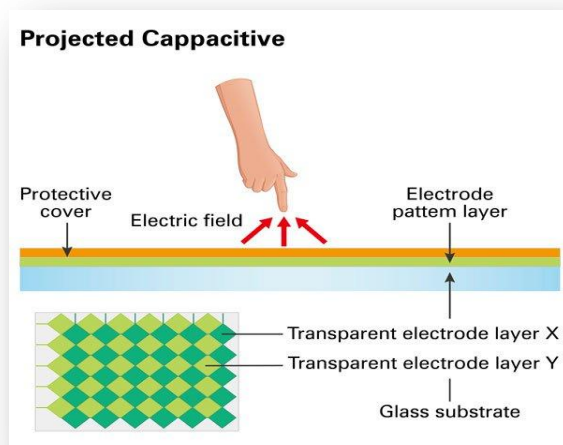


Fig. 8: Projected Capacitive Technology

iii. Surface Acoustic Wave(SAW) Touch Screen Technology

A Surface Acoustic Wave (SAW) Technology is one of the most advanced types of touch screen technology. It uses ultrasonic waves that pass over the surface of the touch screen panel. When the panel is touched, a part of the wave is absorbed. This change in the waves and sends the information to the controller for processing. The controller then sends electrical signals to the transmitting transducer, which converts the signal into ultrasonic waves. When compared to Capacitive and Resistive Touch screens, SAW technology is better. It provides better image clarity, resolution, and higher transmission of light. As compared to other touch screen technologies, SAW technology has the longest life.

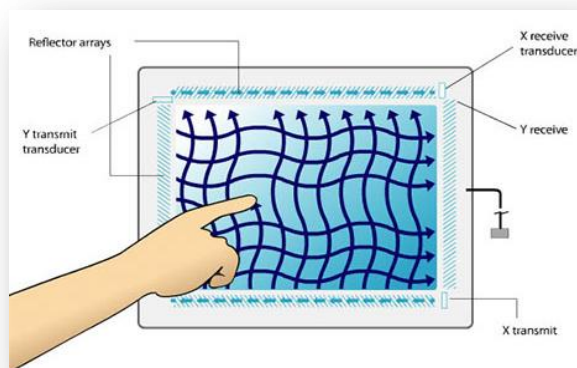


Fig. 9: SAW Touch Screen Technology

iv. Infrared Touch Screen Technology

An Infrared Touchscreen Technology's touch command is completely unique as compared to other touch screen technologies. The Capacitive touch screen devices recognize touch by measuring changes in capacitive, while Resistive touch screen devices recognize touch by pressing an upper and bottom layer together. But, Infrared Touch screen identifies touch by looking for interruptions in a uniform beam of light. It has a grid-like array of LED lights and sensors around the boundaries of the device. Despite the fact that they are invisible to the naked eye, these LEDs are constantly emitting and projecting light. When you touch the surface, it creates an interruption in this light. The device then looks to find out where this interruption occurred. Thus, allowing it to identify the exact point of contact.

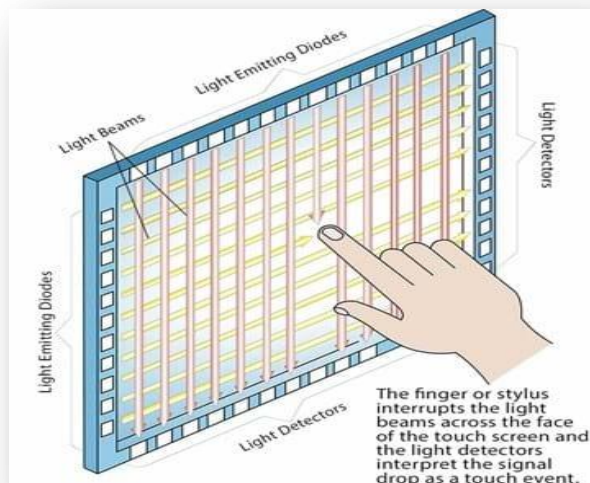


Fig. 10: Infrared Touch Screen Technology

1) Smartphone's

Almost all Smartphone's have a touch screen interface, whether it is Android or iOS. Touch screens have become identical with Smartphone's. Some of the world's earliest Smartphone's used a QWERTY keypad. In the early 2000s, manufacturers start using touch screen displays in their Smartphone's.

2) Tablets

In addition to Smartphone's, almost all tablets feature a touch screen interface. Tablets, runs the same mobile operating systems (OS) as Smartphone's. The main dissimilarity between the two is that Smartphone's are smaller and support calls as compared to tablets; they are larger and may or may not support calls. However, they both feature a touch screen interface.

3) Human Machine Interfaces (HMI)

HMIs are industrial control systems used in manufacturing facilities and other commercial workspaces. While some of them are basic and consist of nothing more than levers and knobs, others are more complex. Some complex HMIs use a touch screen interface to provide a method of control.

4) POS Systems

Retail stores, as well as other businesses, often use touch screen based Point-of-Sale (POS) System. POS system allows businesses to accept and process payments from their customers. Traditional cash registers are hardly ever used by modern businesses. Nowadays, businesses use touches screen based POS systems.

5) Infotainment Systems

An Infotainment System is a type of an electronic system in automobiles that provides information and entertainment. Most infotainment systems feature a touch screen interface that the driver or a passenger can use it. Some of them have physical buttons, but almost all modern Infotainment Systems have a touch screen interface.

6) Smart Appliances

Smart appliances consist of washing machines, clothes dryers, ovens and other major household appliances that offer some form of wireless connectivity or automation. They are designed to optimize energy usage so that the respective appliance consumes less energy during operation. While shopping a smart appliance, you may find out that many of them feature a touch screen interface. The existence of a touch screen interface offers an easy and convenient method of control.

7) EASY ACCESS

Touch screen provide an easy to understand, intuitive interface for the human brain. Touch is a natural way for us to interact with the world around us and pointing at something with our finger is as natural as breathing air.

V. ADVANTAGES

- Touch screen enables people to use computers without any training.
- This technology is simple and user friendly.

- This is becoming more popular because of its easiness of use, proven reliability, functionality and decreasing cost.
- Touch screen virtually eliminates operator errors.
- Touch screen provides fast access to any type of digital media.
- It ensures that no space is wasted as the input device is completely integrated into monitor.
- Touch screen provided sufficient security.
- Text can be displayed on variety of languages depending upon user needs.
- The touch screen interface can be updated with simple software changes.

DISADVANTAGES

- Although user friendly, touch screen can't be used to enter large amount of data.
- This technology has not found in real world applications because system designers haven't carefully considered how the system will function.
- Another failure of the industry has been not getting fast enough processing behind the buttons.
- A touch screen system will cost about two or three times the amount of an existing keyboard display.
- Touch screen and monitors together are expensive ranging from two and half times the price of a standard computer.

CONCLUSION

This paper provides an overview of Touch Screen Technology. Touch Screen is broadly used and rising technology that is sensitive to human touch, allowing a user to interact with the computer by touching pictures or words on the screen. It provides a very good user interface with applications that generally require a mouse. It is very useful in various fields like museums, tourism displays, railway station, casino and other gaming systems, airport, telephone exchange etc. It has good future in many new technologies like in cell phones, laptops etc.

Overall, this study shows that touch screen technology has a positive influence on some key aspects of usability, especially for an efficient navigation. There is a tendency that more sensitive touch screens boost navigation. However, users still have some problems while interacting with the device; some functions are not instinctively usable, and there is still room for improvement.

REFERENCES

- [1]. en.wikipedia.org/wiki/Touchscreen.
- [2]. V Bhavya Keerthi; "Touch Screen Technology", International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE), Vol. 6, Issue1, Jan 2019.
- [3]. Anjul Jain, Diksha Bhargava, Anjani Rajput; "Touchscreen Technology"; International Journal of Advanced Research in Computer Science and Electronic Engineering (IJARCSEE), Vol. 2, Issue 1, Jan 2013.
- [4]. M. Krithika; "Touchscreen Technology - A Review"; International Journal of Trend in Research and Development, Vol. 3(1).
- [5]. www.nelson-miller.com/infrared-touchscreen-work/
- [6]. www.nelson-miller.com/touch-screens/saw-touch-screens/
- [7]. www.nelson-miller.com/6-common-applications-for-touchscreen-technology/
- [8]. www.seminaronly.com/Labels/Touch-Screens-Advantages-Disadvantages.php.
- [9]. slideplayer.com/slide/8950519/
- [10]. publish-pdf.com/4a895109edf24dc8b84e3f5281d68f77/TOUCH%20SCREEN.htm.