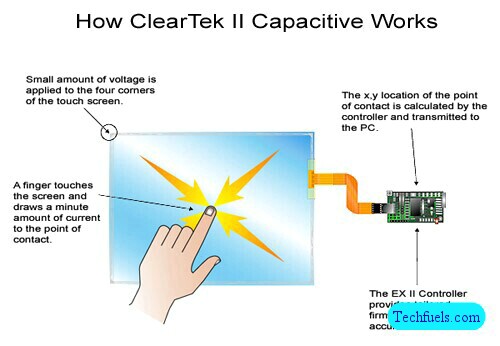
**TOUCH SCREEN TECHNOLOGY**

**Abstract:**  
A touchscreen is a display that can detect the presence and location of a touch within the display area, generally refers to touch or contact to the display of the device by a finger or hand. touchscreen is also an input device. The screens are sensitive to pressure; a user interacts with the computer by touching pictures or words on the screen,Touchscreens can also sense other passive objects, such as a stylus, The touchscreen has two main attributes. First, it enables one to interact with what is displayed directly on the screen, where it is displayed, rather than indirectly with amouse or touchpad. Secondly, it lets one do so without requiring any intermediate device, again, such as a stylus that needs to be held in the hand. Such displays can be attached to computers or, as terminals, to networks. They also play a prominent role in the design of digital appliances such as the personal digital assistant (PDA),satellite navigation devices, mobile phones, and video games  
  
  
**Technologies**  
There are a number of types of touchscreen technology available now   
  
**1.Resistive**  
A resistive touchscreen panel is composed of several layers, the most important of which are two thin, metallic, electrically conductive layers separated by a narrow gap. When an object, such as a finger, presses down on a point on the panel's outer surface the two metallic layers become connected at that point: the panel then behaves as a pair of voltage dividers with connected outputs. This causes a change in the electrical current which is registered as a touch event and sent to the controller for processing. In another way The resistive system consists of a normal glass panel that is covered with a conductive and a resistive metallic layer. These two layers are held apart by spacers, and a scratch-resistant layer is placed on top of the whole setup. An electrical current runs through the two layers while the monitor is operational. When a user touches the screen, the two layers make contact in that exact spot. The change in the electrical field is noted and the coordinates of the point of contact are calculated by the computer. Once the coordinates are known, a special driver translates the touch intosomething that the operating system can understand, much as a computer mouse driver translates a mouse's movements into a click or a drag.  
  
**2.Surface acoustic wave**  
Surface acoustic wave (SAW) sumit technology uses ultrasonic waves that pass over the touchscreen 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 touchscreen,an din surface acoustic wave system, two transducers (one receiving and one sending) are placed along the x and y axes of the monitor's glass plate. Also placed on the glass are reflectors -- they reflect an electrical signal sent from one transducer to the other. The receiving transducer is able to tell if the wave has been disturbed by a touch event at any instant, and can locate it accordingly. The wave setup has no metallic layers on the screen, allowing for 100-percent light throughput and perfect image clarity. This makes the surface acoustic wave system best for displaying detailed graphics (both other systems have significant degradation in clarity).  
  
**3.Capacitive**  
capacitive touchscreen panel consists of an insulator such as glass, coated with a transparent conductor such as indium tin oxide (ITO).[2][3]As the human body is also a conductor, touching the surface of the screen results in a distortion of the local electrostatic field, measurable as a change in capacitance. Different technologies may be used to determine the location of the touch. The location can be passed to a computer running a software application which will calculate how the user's touch relates to the computer software. And in capacitive system, a layer that stores electrical charge is placed on the glass panel of the monitor. When a user touches the monitor with his or her finger, some of the charge is transferred to the user, so the charge on the capacitive layer decreases. This decrease is measured in circuits located at each corner of the monitor. The computer calculates, from the relative differences in charge at each corner, exactly where the touch event took place and then relays that information to the touch-screen driver software. One advantage that the capacitive system has over the resistive system is that it transmits almost 90 percent of the light from the monitor, whereas the resistive system only transmits about 75 percent. This gives the capacitive system a much clearer picture than the resistive system   
  
**4.Surface capacitance**  
In this basic technology, only one side of the insulator is coated with a conductive layer. A small voltage is applied to the layer, resulting in a uniform electrostatic field. When a conductor, such as a human finger, touches the uncoated surface, a capacitor is dynamically formed. The sensor's controller can determine the location of the touch indirectly from the change in the capacitance as measured from the four corners of the panel. As it has no moving parts, it is moderately durable but has limited resolution, is prone to false signals from parasitic capacitive coupling, and needs calibration during manufacture. It is therefore most often used in simple applications such as industrial controls and kiosks.  
  
**5.Projected capacitance**  
Projected Capacitive Touch (PCT) technology is a capacitive technology which permits more accurate and flexible operation, by etching the conductive layer. An XY array is formed either by etching a single layer to form a grid pattern of electrodes, or by etching two separate, perpendicular layers of conductive material with parallel lines or tracks to form the grid (comparable to the pixel grid found in many LCDdisplays).  
Applying voltage to the array creates a grid of capacitors. Bringing a finger or conductive stylus close to the surface of the sensor changes the local electrostatic field. The capacitance change at every individual point on the grid can be measured to accurately determine the touch location.[5] The use of a grid permits a higher resolution than resistive technology and also allows multi-touch operation. The greater resolution of PCT allows operation without direct contact, such that the conducting layers can be coated with further protective insulating layers, and operate even under screen protectors, or behind weather and vandal-proof glass.  
PCT is used in a wide range of applications including point of sale systems, smartphones, and public information kiosks. Visual Planet's ViP Interactive Foil is an example of a kiosk PCT product, where a gloved hand can register a touch on a sensor surface through a glass window.[6]Examples of consumer devices using projected capacitive touchscreens include Apple Inc.'s iPhone and iPod Touch, HTC's HD2, G1, and HTC Hero, Motorola's Droid, Palm Inc.'s Palm Pre and Palm Pixi and more recently the LG KM900 Arena, Microsoft's Zune HD, Sony Walkman X series, Sony Ericsson's Aino and now Vidalco's Edge, D1 and Jewel, and the Nokia X6 phone.  
  
**6.Infrared**  
Conventional optical-touch systems use an array of infrared (IR) light-emitting diodes (LEDs) on two adjacent bezel edges of a display, with photosensors placed on the two opposite bezel edges to analyze the system and determine a touch event. The LED and photosensor pairs create a grid of light beams across the display. An object (such as a finger or pen) that touches the screen interrupts the light beams, causing a measured decrease in light at the corresponding photosensors. The measured photosensor outputs can be used to locate a touch-point coordinate.  
Widespread adoption of infrared touchscreens has been hampered by two factors: the relatively high cost of the technology compared to competing touch technologies and the issue of performance in bright ambient light. This latter problem is a result of background light increasing the noise floor at the optical sensor, sometimes to such a degree that the touchscreenâ„¢s LED light cannot be detected at all, causing a temporary failure of the touch screen. This is most pronounced in direct sunlight conditions where the sun has a very high energy distribution in the infrared region.  
However, certain features of infrared touch remain desirable and represent attributes of the ideal touchscreen, including the option to eliminate the glass or plastic overlay that most other touch technologies require in front of the display. In many cases, this overlay is coated with an electrically conducting transparent material such as ITO, which reduces the optical quality of the display. This advantage of optical touchscreens is extremely important for many device and display vendors since devices are often sold on the perceived quality of the user display experience.  
Another feature of infrared touch which has been long desired is the digital nature of the sensor output when compared to many other touch systems that rely on analog-signal processing to determine a touch position. These competing analog systems normally require continual re-calibration, have complex signal-processing demands (which adds cost and power consumption), demonstrate reduced accuracy and precision compared to a digital system, and have longer-term system-failure modes due to the operating environment.  
  
**7.Strain gauge**  
In a strain gauge configuration, also called force panel 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 has been around since the 1960s but new advances by Vissumo and F-Origin have made the solution commercially viable. It can also measure the Z-axis and the force of a person's touch. Such screens are typically used in exposed public systems such as ticket machines due to their resistance to vandalism.   
  
**8.Optical imaging**  
A relatively-modern development in touchscreen technology, two or more image sensors are placed around the edges (mostly the corners) of the screen. Infrared backlights are placed in the camera's field of view on the other sides of the screen. A touch shows up as a shadow and each pair of cameras can then be triangulated to locate the touch or even measure the size of the touching object (see visual hull). This technology is growing in popularity, due to its scalability, versatility, and affordability, especially for larger units.  
[edit]Dispersive signal technology  
Introduced in 2002 by 3M, this system uses sensors to detect the mechanical energy in the glass that occurs due to a touch. Complex algorithms then interpret this information and provide the actual location of the touch.[10] 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 stylus. A downside is that after the initial touch the system cannot detect a motionless finger.  
  
**9.Acoustic pulse recognition**  
This system, introduced by Tyco International's Elo division in 2006, uses more than two piezoelectric transducers located at some positions of the screen to turn the mechanical energy of a touch (vibration) into an electronic signal.[11] The screen hardware then uses an algorithm to determine the location of the touch based on the transducer signals. This process is similar to triangulation used in GPS. The touchscreen itself is made of ordinary glass, giving it good durability and optical clarity. It is usually able to function with scratches and dust on the screen with good accuracy. The technology is also well suited to displays that are physically larger. As with the Dispersive Signal Technology system, after the initial touch, a motionless finger cannot be detected. However, for the same reason, the touch recognition is not disrupted by any resting objects.

**10.Coded LCD: Bidirectional Screen**  
A new system that turns LCD displays into giant cameras that provide gestural control of objects on-screen [12] was introduced by MIT Media Lab in December, 2009. Instead of an LCD, an array of pinholes is placed in front of sensors. Light passing through each pinhole strikes a small block of sensors producing a low-resolution image. Since each pinhole image is taken from a slightly different position, all combined images provide a good depth information about the sensed image.  
Pinholes are problematic because they allow very little light to reach the sensors, requiring impractically long exposure times. Instead of pinholes, an array of liquid crystals could work similarly but more effectively: The LCD's panel is composed of patterns of 19-by-19 blocks, each divided into a regular pattern of differently sized black-and-white rectangles. Each white area of the bi-colored pixels allows light to pass through. Background software uses 4D light fields to calculate depth map, changes the scene, and collects gesture information. The LCD alternates between mask pattern display and a normal scene display at a very high frequency/rate.