

TOUCH PANEL TECHNOLOGY

Touchscreen applications are developing into a major display market niche as they ramp up their utilization of Liquid Crystal Display (LCD) flat panels into their designs. Touch technologies allow an interface to access a computer's database without relying on the traditional keyboard-mouse interface. This is advantageous in applications in which the computer has been programmed to allow the user to step through a menu system to find the answer they seek, i.e., directions from the car rental or using an ATM.

WHY TOUCH TECHNOLOGY?

Touch is one of the simplest, most instinctive, and universal human actions. There are several reasons to use touch technologies, which include limiting an end-user's access to a computer in kiosk-type applications as well as harsh environments where data entry needs to be balanced against sealing and protecting the computer. Touch technologies allow both of these applications to be retrofitted to computers utilizing one of several technologies currently available.

A touchscreen is the simplest, most direct way for a person to interact with a computer. Though it is a relatively new technology - two of the larger touchscreen manufacturers claim to have started their operations in the 70s - the basic way users interact with a touchscreen is age old: you point to what you want. It's intuitive for virtually every child and adult in the world.

Companies in a broad cross-section of industries have successfully harnessed the power of a touchscreen for a wide variety of applications. Airlines use them to simulate aircraft cockpits and train their pilots to fly. Realtors use them to put full-color images of homes for sale a fingertip away from homebuyers. Greeting card companies use them to let customers create their own one-of-a-kind cards. Restaurants use them to simplify their point-of-sale terminals. Medical schools use them to teach student nurses how to respond to crisis situations.

Regardless of the industry or application, the essential benefits touchscreen technology provides remain unchanged:

- Touchscreens enable people to use computers instantly, without any training whatsoever
- Touchscreens virtually eliminate operator errors because users select from clearly defined menus
- Touchscreens eliminate keyboards and mice, which many find intimidating and cumbersome to use

- Touchscreens are rugged enough to stand up to harsh environments where keyboards and mice often get damaged
- Touchscreens provide fast access to any and all types of digital media, with no text-bound interface getting in the way
- Touchscreens ensure that no space - on the desktop or elsewhere - is wasted, as the input device is completely integrated into the monitors
 - Simplifies the User/mPC interface
 - Durable in harsh conditions
 - Suitable for all environments
 - Greater accuracy
 - Smaller footprint

WHERE IS TOUCH USED?

- > In industrial environments
- > In hospitals
- > In retail locations
- > At tourist destinations
- > In schools

HOW DOES IT WORK?

Most of the technologies discussed here operate on the principle of dividing the screen image area into a predetermined grid (dependent upon screen size and resolution capabilities). Touching one of the quadrants of the menu selection causes a subroutine to execute in the same manner as typing the command at the prompt line or you would with a mouse.

The first touchscreen was created by adding a transparent surface to a touch-sensitive graphics digitizer and sizing it to fit a computer monitor. The purpose was to increase the speed data that could be entered into a computer.

Today, the touchscreen has been transformed into a more user-friendly and environmentally robust replacement for the computer keyboard and mouse. Because of that, touch is changing the world. With a touchscreen, people with little or no computer experience can instantly work with complex software programs, without even being aware they're doing it. And computers can go to work in places where a keyboard or mouse would be too cumbersome, fragile, or impractical.

There are five basic components associated with touch technology.

1. Touch Sensor: Capacitive, Resistive, SAW, WAV, etc.
2. Monitor: Either Cathode Ray Tube (CRT), LCD or Plasma on which the sensor can be fitted
3. Controller: Enables the sensor to work like any other peripheral
4. Software Drive: Allows the controller and the computer-operating system to communicate and helps the controller recognize input
5. A computer (usually a PC) that is interfaced to the touch panel and will run the selected option for the end-user when accessed

Of course, a software application is needed, which will enable you to develop new or customize existing touch applications to meet specific applications.

WHAT TOUCH TECHNOLOGIES ARE CURRENTLY AVAILABLE?

LIGHTPENS

Lightpens are an early and inexpensive technology that enables one to use a stylus directly on a display. Something not generally appreciated about lightpens is that they work with rear-screen projection systems as long as the data projector uses cathode beam technology. That is, they do not work with LCD projectors, for example. Hence, lightpens provide an extremely cost-effective means to convert a rear projection system into an interactive electronic whiteboard. This includes NEC's CRT-based projection systems operating in rear projection mode. On the other hand, in some situations where one needs to operate directly on the display with a stylus, the lightpen is losing ground to other technologies. These include where the stylus must be cordless, pressure sensitive, high resolution, or work with a LCD.

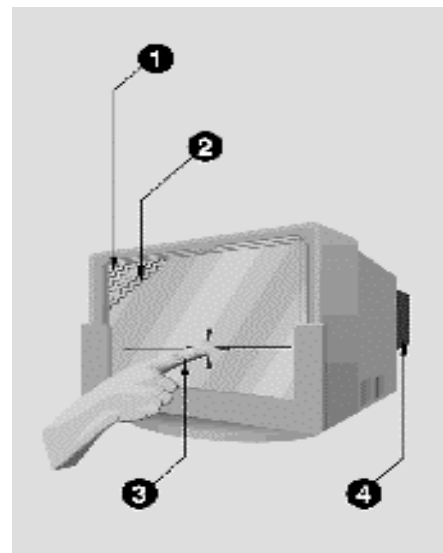
CAPACITIVE

Capacitive is noted for providing a unique combination of superior durability, optical clarity and sensitivity to touch. Resistive provides exceptional touch flexibility, responding to a wide range of touch input.

Analog capacitive touchscreens are made by adding conductive coatings to a clear glass sensor. Voltage is applied to the four corners of the screen along an X-Y axis. When the screen is not in use, electrodes spread the voltage, creating a uniform field. When a finger touches the screen, the field recognizes a disturbance. The X-Y coordinate of the touch is sent from the controller to the PC serial port. Analog capacitive touchscreens are made adding conductive coatings to a clear glass sensor.

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3. When the screen is touched by a finger, the field recognizes a disturbance.
4. The X-Y coordinate of the touch is then sent from the controller to the PC serial port.

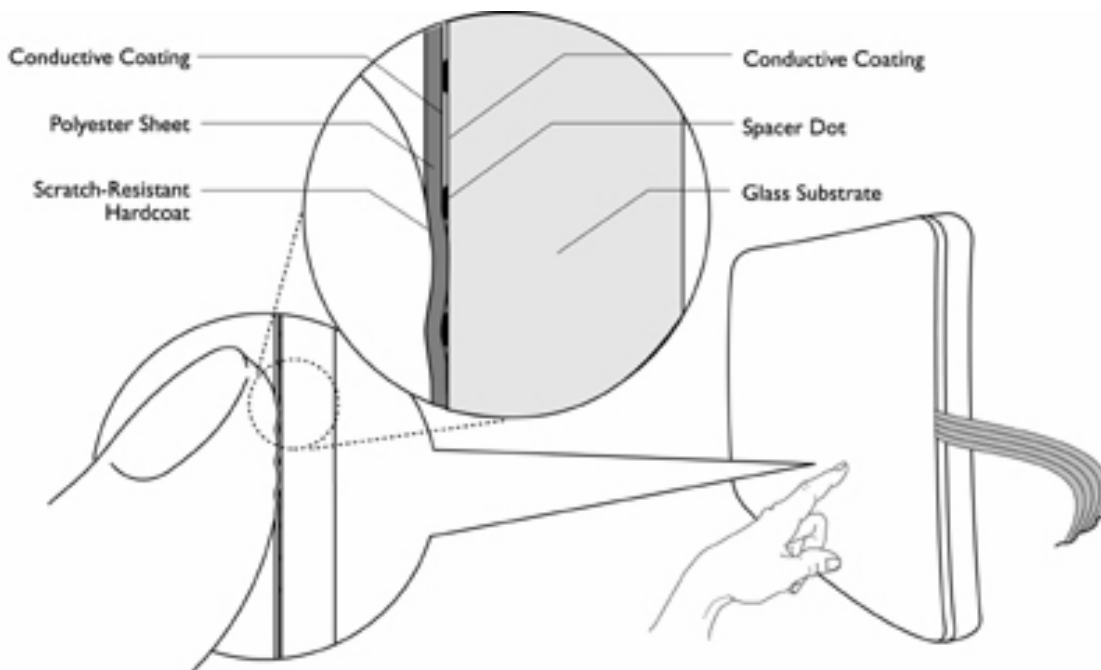
Because the glass and the bezel that mounts it to the monitor can be sealed, the touchscreen is both durable and resistant to contaminants like water, dust, dirt and grease. This makes all capacitive touchscreens ideal for harsh environments like retail displays, gaming, vending, public kiosks and industrial applications.



RESISTIVE TOUCH

Overlaying a hard-coated, conductive polyester top sheet 1/10,000-inch on a conductive clear glass sensor makes resistive touchscreens. When the surface of this flexible, polished-finished polyester sheet is touched, it's compressed into contact with the stable glass sensor. When contact is made, voltage flows to each of the four corners in proportion to the distance from the edge. As in capacitive technology, the controller uses the current flows from along the X-Y axis to calculate the position of the touch, and via the software driver, communicates this as input to the computer's serial port.

The flexible top sheet enables the touch to be registered by any input, including gloved hand, fingernail, stylus or credit card. Because the touch is actually registered on the stable glass bottom layer, the touchscreen continues to operate even if the top sheet is accidentally torn. The versatility of this resistive technology makes it ideal for many industrial, point-of-sale and medical applications.



INFRARED

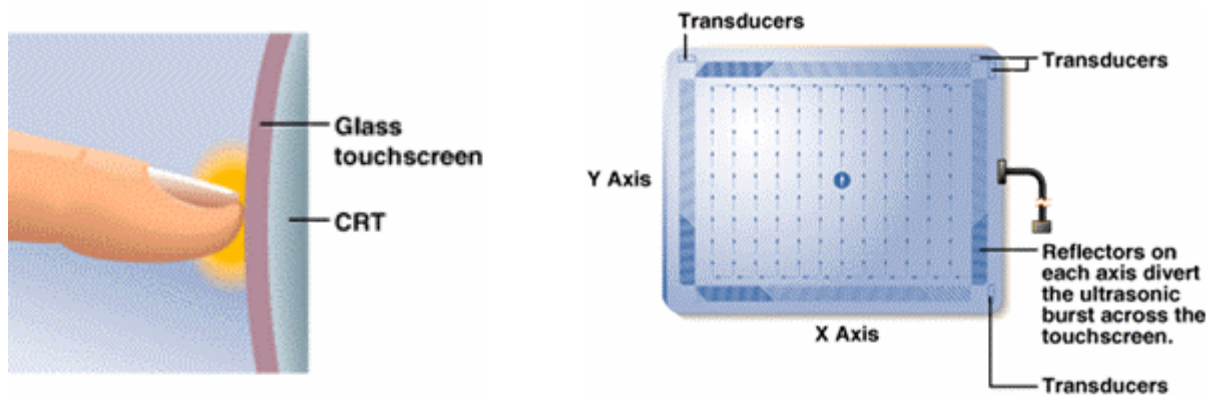
Infrared touchscreens are fabricated by adding a custom bezel (usually) to the front of a CRT utilizing Infrared Light Emitting Diodes (LED) along the horizontal and vertical X-Y axis. A touch breaks the X-Y LED beams and the sensors pass this coordinate information to the computer serial port. While infrared was once used extensively as a touch solution, shortcomings of this technology, i.e., low resolution, parallax problems and premature touchdown detection has led developers to employ other touch technologies utilizing the Windows3.1/95/98/NT™ operating systems.

SAW (SURFACE ACOUSTIC WAVE) / GAW (GROUNDED ACOUSTIC WAVE)

The IntelliTouch™ touchscreen is a glass overlay with transmitting and receiving piezoelectric transducers for the both X and Y axes. The touchscreen controller sends a five-megahertz (5 MHz) electrical signal to the transmitting transducer, which converts the signal into ultrasonic waves within the glass. These waves are directed across the front surface of the touchscreen by an array of reflectors. Reflectors on the opposite side gather and direct the waves to the receiving transducer, which reconverts them into an electrical signal - a digital map of the touchscreen surface. When you touch the screen, you absorb a portion of the wave travelling across it. The received signal is then compared to the stored digital map, the change recognized, and a coordinate calculated. This process happens independently for both the X and Y axes. By measuring the amount of the signal absorbed, a Z-axis is also determined. The digitized coordinates are transmitted to the computer for processing.

HOW SURFACE WAVE TECHNOLOGY WORKS

The IntelliTouch touchscreen consists of a clear glass overlay formed to match the shape of the display. Each axis on the overlay has a transmitting and receiving piezoelectric transducer and a set of reflector stripes. The touchscreen controls sends a 5 MHz burst to the transmitting transducers, which convert the signal into surface acoustic waves. Surface acoustic waves are mechanical waves that propagate in the surface of materials such as glass. The reflector stripes divert the burst across the face of the overlay. When a finger, gloved hand or soft stylus touches the touchscreen, a portion of the wave is absorbed. The resulting change in the received signal is analyzed by the controller and digitized into X and Y coordinates. A Z-axis level is also determined by measuring how much signal was absorbed. Unlike some other technologies, which depend upon ratios to determine touch location and thus are prone to drift, IntelliTouch is an inherently stable technology offering drift-free operation.



For more information please contact:

ELO TouchSystems: <http://www.elotouch.com>

Microtouch Systems: <http://www.pixelinkcorp.com>

This white paper was published in and based on information as of November 2001. Technical information is subject to change.