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One touch screen is the same as another...or is it?

Avoiding Costly Mistakes

There's advice aplenty when it comes to suggesting the different uses and applications for interactive displays but there is little to be gleaned when it comes to relating the many types of touch technologies currently available. *Tom Thornton* puts the matter in hand.

Selecting the wrong technology and product can be costly! To avoid those potentially expensive errors, Mentor Distribution says it's important you contact such a specialist to discuss requirements regardless of quantities involved. Mentor distributes the complete range of NEC display products and is an NEC Accredited Solutions Partner, enabling the company to fully integrate touch screens into the NEC range of displays.

Moreover, according to Sales Manager Tom Thornton, consideration should also be given to the daily hours that a touch screen will be operated for. A large percentage of interactive displays are used for out of office services and as such require 24/7 operation. And it's important to realise that not all products are approved for this. Even some commercial grade products from major manufacturers such as NEC are not all suitable. In fathoming the wood from the trees, Mentor is more than able to advise on suitable NEC products that best meet specific touch screen requirements.

For those not familiar with the touch options that are available for screens, the following provides a useful insight and understanding of some of the different technologies. Mentor Distribution integrates products using all of these technologies and therefore is best placed to always offer the best solution for you or your customers' specific applications.

Bending wave touch

Bending Wave or DST, Dispersive Signal Technology, is based on sensor materials using a glass substrate and piezoelectric transducers. Its principle of operation centres on the touch creating a bending wave through the glass substrate medium. Bending waves radiate to the sensor edges and are detected by piezoelectric receptors in border areas, electronics then compute a touch location based on algorithms or by signal comparison references.

Advantages of bending wave technology include an imperviousness to surface contaminants. Touch is activated by a bare or gloved finger, or a stylus. Transmission is better than 90%. The technology is able to offer a flat front surface design without the need for a bezel and is perfect for table top applications.

The disadvantages of bending wave technology need to be heeded. There are few major suppliers and the technology is not suitable where vibrations are present. It is also not ideal for drag&drop routines and is limited to one resolvable point with gesture capability.

Infrared touch

Infrared or grid touch technology is built around sensor materials of glass or an acrylic substrate, a wrap-around bezel frame and LED matrix. Operation is based on LEDs creating a grid of X and Y infrared light beams projected above the display and these are detected by photo-receptors on the opposite edge.

Touch occurs when a finger or stylus blocks the beam from reaching light detectors. The controller's constant X and Y axes scanning detects blocked light and triangulates touch locations.

Advantages of infrared technology include that systems will function with scratches and surface wear. Touch is activated by a bare or gloved hand, or a wide stylus, with transmission typically at 90~92%

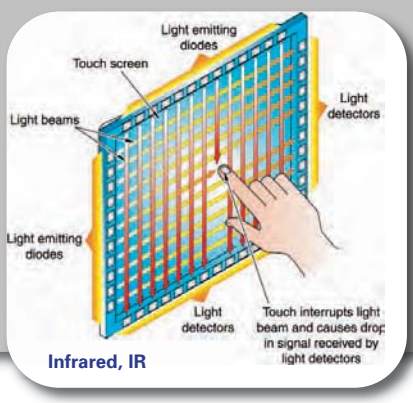
Disadvantages include that solid contaminants, moving liquids or obstructions can cause a false touch and may create dead zones until completely removed. Solutions do not scale easily, with new layouts required. Moreover, beam spacing limits accuracy and stylus width, and with touch occurring slightly above the actual surface, touch parallax or an unintended touch response may result. Infrared designs also require a bezel design to house the LEDs and detectors and are limited to two or three resolvable touches

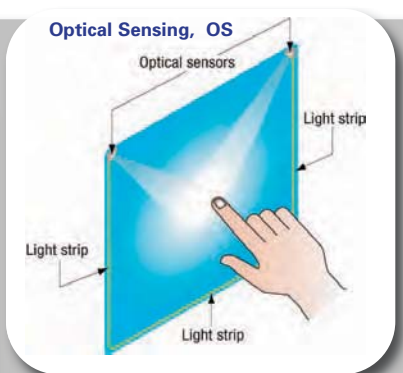
Optically sensed touch

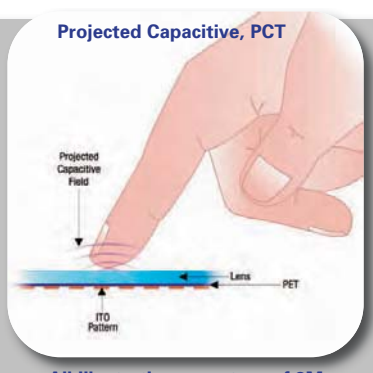
Optical sensing or camera touch technology features sensor materials based on a glass substrate, line scanning optical sensors and lighting strips.

In operation, miniature cameras are positioned in the top two corners of the substrate. The illuminated border or reflective borders on the opposing three sides project a uniform field of infrared light slightly above the glass surface. Touch occurs when a finger or object blocks the light from the cameras. The controller processes the optical information and calculates the X and Y co-ordinates.

Advantages of optically sensed touch systems include functioning with scratches and surface wear. Touch is activated by bare or







All illustrations courtesy of 3M.

a gloved finger, or a stylus. the solution is scalable with transmission typically better than 90%. Optical sensing is recommended in applications where handwriting annotation is required.

Disadvantages of the technology include moving liquids or solid contaminants may cause false touches and systems may even stop functioning until the problem is completely removed.

Such systems require a bezel design to house the edge positioned camera system. System thickness is typically 3.5mm plus the thickness of the glass. Touch occurs slightly above the actual surface and is limited to two resolvable points with two cameras or, alternatively, three or more resolvable points with four cameras.

Projected capacitive touch

Projected capacitive or matrix touch sensor technology is built around sensor materials of glass, polyester sheet and a conductive coating. In operation, patterned sensor elements are attached to the back of the touch surface substrate, signal levels on each pattern are measured and touch is detected by determining the relative levels of current between adjacent patterns.

The advantages of projected capacitive touch include the use of an all glass top surface solution. It can be laminated or chemically strengthened for additional protection against breakage or user safety. The construction is generally laminated which provides shard containment if the screen gets broken.

Projected capacitive touch solutions can be used in bezel designs and flush surface designs like, for example, used in the iPhone. Durability is a function of the properties and construction of the cover material, with touch activated by a bare finger, thin gloved hand or a conductive stylus. Transmission is typically 85~90% with solutions capable of three or more resolvable points. Projected capacitive touch is ideal for general public environments.

Disadvantages are that the electronics and sensor construction are more complex compared to other technologies and the technology does not have full stylus independence support.

Resistive touch

Resistive 4, 5, 7 and 8 wire touch technology centre around sensor materials of glass or an acrylic substrate, spacer dots and polyester sheets. In operation, a touch compresses the flexible top layer into contact with the bottom glass layer. A voltage gradient is applied to the top and bottom layers (X and Y axes) sequentially, with the controller then calculating the X and Y position of the touch based on the voltage gradient applied to one side and using the opposite side as a voltage probe.

Advantages include that this touch technology is the most widely used. It is a low cost solution and can be activated by bare finger, gloved hand or a stylus.

Its disadvantages, however, are that its PET top sheet is highly susceptible to scratches, cuts and cigarette burns. The PET layer is a flexing mechanical element coated with a conductive ceramic and this wears with every flex. Transmission is typically 80~85% and limited to two resolvable points. Three or more resolvable points require a resistive matrix sensor.

Resistive touch solutions are limited by screen size and are not suitable for screens over 30in and thus are not recommended for general public use, for example in uncontrolled environments.

Surface acoustic wave touch

Surface acoustic wave or SAW touch technology features sensor materials of glass and piezoelectric transducers. The piezoelectric transmitters on the sensor generate acoustic waves on the surface of the glass substrate on alternating X and Y axes patterns.

These acoustic waves are reflected by a pattern of edge ridges directing the energy to piezoelectric receivers and touching the sensor surface attenuates a portion of the wave corresponding to the touch position. Touch location is based on the time delay from the transmitted pulse to the centre of waves attenuation area.

Surface acoustic wave technology advantages include that touch is activated by a bare finger, some gloves or a soft conductive stylus, with transmission typically better than 90%.

Disadvantages however are that moving liquids or solid contaminants may cause false touches or non-touch areas until completely removed. Dirt and water sealing can be difficult with the solution which typically has a wide border, limited to one resolvable point.

Surface capacitive touch

Surface capacitive touch solutions are built around sensor materials with a glass substrate and a transparent metal oxide coating. Voltage is applied to the corners of the touch screen and a pattern of electrodes around the periphery of the screen distributes the voltage to form a uniform electric field across the conductive surface.

A finger touching the screen draws a minute current from the surface which is measured by the controller. The current's relative magnitude is inversely proportionate to the distance from the contact point to the touch screen corners. Thus ratios of the four corner currents are calculated to determine X and Y co-ordinates.

Surface capacitive touch solutions can withstand contaminants and moving liquids on the screen. They also continue to function over the entire touch screen area. Very light finger touch is required for activation and the technology boasts the fastest touch response time, with transmission typically 88~92%

Disadvantages of the solution however are that it supports only finger or tethered pen. Moreover, a severe scratch can affect operation within the damaged area and the technology is limited to one resolvable point with gesture capability.

Whilst the above information may not necessarily make anyone an expert, it does however, provide an insight into the number of different touch technologies available. It should also have made it clear just why seeking good advice makes sense and really is the best solution to take.

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