Optical Touch: How it differs from other technologies

Touch screens emerged from academic and corporate research labs in the second half of the 1960s. While many consider the touch screen a bleeding edge technology today, most of us have been using a touch screen for more than 25 years, most notably with ATM machines. Retail settings, tourist attractions, and museums have also been incorporating touch screen displays for more than 10 years.

Yet it was only with the Apple iPhone, which incorporates a touch technology called projected capacitive, that touch screens entered the mainstream and subsequently, the hearts and minds of consumers around the world. While touch may seem simple and intuitive to the end-user, the technology behind it is anything but: there are more than a dozen different touch screen technologies used today in cell phones, PCs, and displays.

Some of the more popular touch technologies include resistive, surface capacitive, projected capacitive, infrared, surface acoustic wave (SAW), and optical imaging. Other technologies include: dispersive signal technology (DST), acoustic pulse recognition, LCD in-cell optical, and force sensing.

NextWindow's optical imaging solution is one of the more modern touch technologies and has substantial benefits over earlier technologies:

- Since NextWindow's technology uses optical sensors to detect the touch point, the touch registers just before the physical touch on the screen. This means that users can apply zero or light touch to the screen to initiate a response, and any input device, such as a paintbrush, finger, pen, or stylus will work.
- Surface coating overlays are not used on the touch screen surface, which creates a crystal clear image. In addition, scratches on the touch surface will not affect the touch screen operation. This is important for high-use environments such as a lobby or kiosk.
- NextWindow's solution scales to very large displays (120 inches), making it possible to create genuinely collaborative, interactive conference and teaching settings.
- Optical imaging provides a solution without calibration drift. Once the touch screen has been calibrated it does not require any further adjustment. This means virtually zero maintenance costs.
Resistive

Resistive is the most common type of touch screen technology. It is a low-cost solution found in many touch screens, including hand-held computers, PDAs, consumer electronics, and point-of-sale-applications. The resistive screen is popular because of its relatively low price (at smaller screen sizes), and ability to use a range of input objects (fingers, gloves, hard and soft stylus).

How it works
A resistive touch screen uses a controller and a specially-coated glass overlay on the display face to produce the touch connection. The touch screen panel consists of two thin, 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 layers become connected and then cause a change in the electrical current which is registered as a touch event.

Limitations and considerations
- The primary types of resistive overlays are 4-wire, 5-wire, and 8-wire. The 5-wire and 8-wire technologies are more expensive to manufacture and calibrate, while 4-wire provides lower image clarity.
- Two options are generally available, polished or anti-glare. Polished offers clarity of image, but generally introduces glare. Anti-glare will minimize glare, but will also diffuse the light, thereby reducing clarity.
- One benefit of using a resistive display is that it can be accessed with a finger (gloved or not), pen, stylus, or a hard object.
- Resistive displays are less effective in public environments due to the degradation in image clarity and the need for periodic cleaning.
recalibration caused by the breakdown of the layers of resistive film, and its susceptibility to scratching.

- Resistive displays are susceptible to vandalism, and touches will not register if the resistive sheet is cut or scratched.

Capacitive

Capacitive touch screens are all-glass and designed for use in ATMs and similar kiosk-type applications. It has better clarity than resistive technology and is durable making it suitable for industrial applications.

How it works

A small current of electricity runs across the screen, with circuits located at the corners of the screen to measure the capacitance of a person touching the overlay. Touching the screen interrupts the current and activates the software operating the kiosk.

Limitations and considerations

- Because the glass and bezel that mounts it to the monitor can be sealed, the touch screen is both durable and resistant to water, dirt and dust. This makes it practical in harsher environments like gaming, vending retail displays, public kiosks and industrial applications.

- The capacitive touch screen is only activated by the touch of a human finger. Scratches in the coatings can cause dead spots on the screens, so a gloved finger, pen, stylus, or hard object will not work. As a result, it is inappropriate for use in
many applications, including medical and food preparation.

- Because the technology was originally created for small screens, it will not scale to larger screens easily and can require periodic recalibration.

**Surface Acoustic Wave (SAW)**

SAW technology provides good image clarity because it uses pure glass construction. Compared to resistive and capacitive technologies, SAW provides superior image clarity, resolution and higher light transmission. However, it was originally designed for smaller screens and may not scale easily to screen sizes over 30.

**How it works**

SAW technology uses ultrasonic waves that pass over the touch screen 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. When sound waves are transmitted across the surface of the display, the following sequence of events occurs:

- Each wave is spread across the screen by bouncing off reflector arrays along the edges of the overlay.
- Two receivers detect the waves.
When the user touches the glass surface, the user's finger absorbs some of the energy of the acoustic wave and the controller circuitry measures the touch location. SAW technology is used in ATMs, amusement parks, kiosks, and in banking applications.

**Limitations and considerations**

- Because the technology cannot be sealed, it can be adversely affected by surface contaminants and water, making it unsuitable for many industrial or commercial applications. The contaminants can cause dead spots on the screen, requiring periodic cleaning of the sensor and sometimes recalibration.
- Due to the way the technology works it can also be susceptible to data "noise."

**Infrared**

Infrared technology relies on the interruption of an infrared light grid in front of the display screen. The touch frame contains a row of infrared LEDs and photo transistors, each mounted on two opposite sides to create a grid of invisible infrared light. The frame assembly comprises printed wiring boards, on which the electronics are mounted and is concealed behind an infrared-transparent bezel. Infrared touch screens are often used in manufacturing and medical applications because they can be completely sealed and
How it works

- The bezel shields the electronics from the operating environment while allowing the infrared beams to pass through
- The infrared controller sequentially pulses the LEDs to create a grid of infrared light beams
- When a stylus, such as a finger, enters the grid, it obstructs the beams
- One or more phototransistors detect the absence of light and transmit a signal that identifies the x and y coordinates

Limitations and considerations

- The major issue with infrared is that the seating of the touch frame is slightly above the screen. Consequently, it is susceptible to early activation before the finger or stylus has actually touched the surface.
- Contaminants can also cause false activation on the screen inside the thick border that is required for the frame.
- Costs to manufacture infrared bezels is significant.

Because of the vast array of potential applications for touch technology, there will continue to be many options for manufacturers when developing touch screen-enabled phones, displays, and computers. Optical imaging, however, has become one of the more versatile and flexible touch technologies given its scale, high performance and resolution, durability, ease of use, and cost-effectiveness for all devices 15 inches and larger.