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Wafer thin

Beneath the iPhone screen & how the
touch system works

Wafer thin

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The visual display of an iPhone is seemingly thin. But the layers that makeup the multi-touchscreen is considerably wafer thin. A touchscreen is an electronic touch-sensitive display that is responsive in the way of detecting the presence and positioning of a touch in multiple locations. Having the user interface built into the screen allows direct interaction, rather than indirectly with a touchpad or a by a mouse controlling the cursor. You are all users of touchscreens but what lies beneath it?

When using a touch screen, the device is able to transmit contact that is made with the screen to the processor allowing actions to be performed on the digital screen. This idea is based in history from a 1970's lamp that could turn on by touching a growing plant. This old technology operated through using a timer that monitors the clicks that would react to an external contact. A growing plant is the route to a touch point when it comes into contact with the electricity of a human. Devices have taken on this old technology to develop the understanding of the detection of a touch,

whether it being a tap, swipe, and strength of the touch.

The iPhone touch screen is made up of multiple layers considerably 'wafer thin'. The touchscreen is activated only by a touch of your finger or stylus as it senses tiny electrical charges on your skin. When your finger interacts with the screen, the charge will change to the specific point of contact. This type of touch screen is called **mutual capacitance**. Mutual capacitive touch screen panel consists of two distinct layers beneath the screen. It is a grid like panel coated with material that stores electric charges. The two layers are the **transmitting layer**, which carries the electricity across the screen, and the **sensing layer**, which is where the electricity is received and jumps across to the sensing layer from the transmitting layer. This process is called capacitance. The capacitors electric circuit can sense charges at any point on the grid. In a simpler form, when the screen is touched the grid generates its own signal then transmits that signal to the iPhone's

Mutual Capacitance Layers
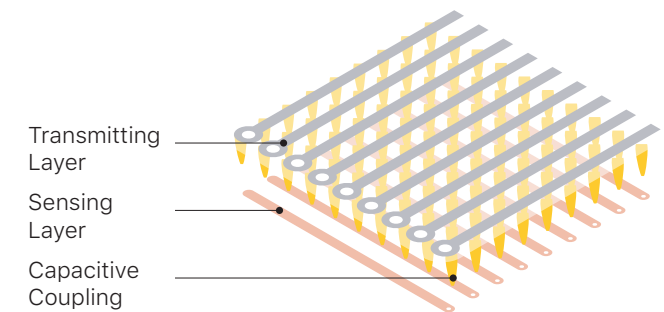
Transmitting Layer

Sensing Layer

Capacitive Coupling

The electricity is received and jumps across to the sensing layer from the transmitting layer. This process is called capacitance.
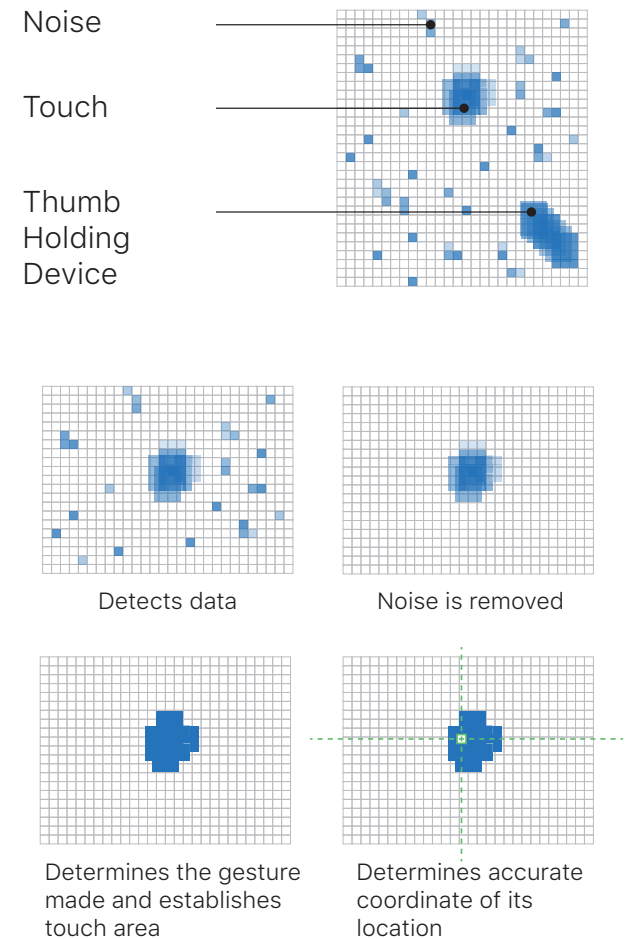
processor. This allows multi-touch to be capable through it determining multiple touch points and movement simultaneously. The multi-touch command responds to multiple touches as a user interface.

Detecting a touch is determined through refining the **noise** of electrical interference. This is used to determine the **location**, strength, and shape of an action made to the screen. Mutual capacitance reads the placement of the touch and it allows multiple touches at once. To measure a touch the capacitive grid sends data to the processor to **interpret the gestures** made. The process of detecting a touch starts with your finger making contact with the screen. Signals will transmit though electrical impulses to the processor. The noise will be filtered to determine the function of each touch detected including location, strength and shape. The background noise is refined to generate a more accurate coordinate of its location. The refining of noise will also determine the gesture made in the process of matching an accurate **coordinate**. The pressure points are measured to conclude if

the touch was soft or hard. At this point the device reads the shape of the action made. This is so the device can recognise whether the object is a finger, stylus and etc. Once action is refined, the processor will convey the information determined to the program in use. This all seems like a very long process but these devices transmit this information in a matter of nanoseconds.

Who would have thought that this seemingly thin device could underlie numerous layers that are considerably 'wafer thin'? Being a user of a device doesn't mean you know the functionality of it. But at this point you all now know that the process of making contact to an iPhone screen is more complex beneath the screen than you think. If this is what has derived from a 1970's capacitive lamp, what will be next?

Detecting a Touch

Noise

Touch

Thumb Holding Device

Detects data

Noise is removed

Determines the gesture made and establishes touch area

Determines accurate coordinate of its location

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Beneath the Screen

Protective
Glass
Layer

Transmitting
Layer
Carries the electricity
across the screen

**Mutual
Capacitance
Layers**

Sensing
Layer
The electricity is received and jumps
across to the sensing layer from the
transmitting layer. This process is
called capacitance.

Glass
Substrate
The supporting material on which the circuit
is fabricated on which is aimed to reduce
interference from the display. It also prevents
any miscalculations of capacitance.

LCD
Display
Screen