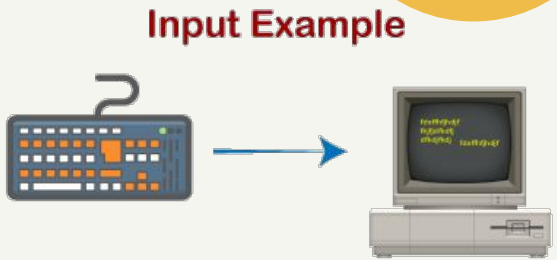
Input devices



Keyboard

When the key of the keyboard is pressed by the user, this completes the circuit so that the location of the keypress could be calculated. This is done by the keys which send binary information into the computer which is thus interpreted using the ASCII character data sets (each key has a unique ASCII value).

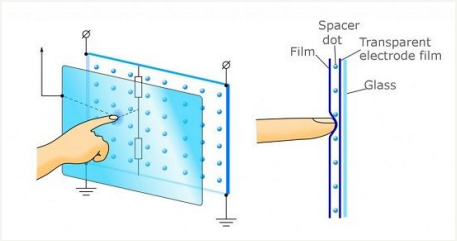
Barcode scanner

The scanner shines light onto the barcode. The light is reflected back (the white lines reflect more light than the black lines). This light is then detected by sensors in the scanner which interpret the light reflections (interpretation is done by the microprocessors in the sensors). Different reflections give different binary values

Touch Screens

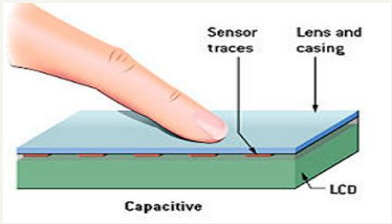
Resistive

A resistive touch screen has two or more layers. When the user presses the top layer, it connects to the bottom layer which thus creates a circuit. Then, calculations are carried out on where the layers are connected.



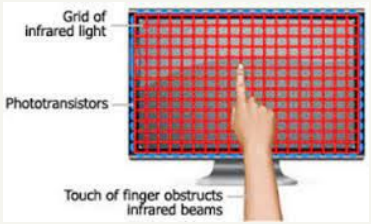
Capacitive

Electric charge is spread across the touch screen and sensors are located around the screen to monitor the electrostatic field. When its touched, charge is transferred to the user's finger. The location of the touch can then be calculated.



Infrared

Infrared rays are sent across the screen. The sensors then capture those beams. Infrared rays form a grid across the screen. When touched, the infrared ray is broken, so calculation is made to locate the 'touch'.



Scanners

2D Scanners: used to make digital copies of documents/pictures

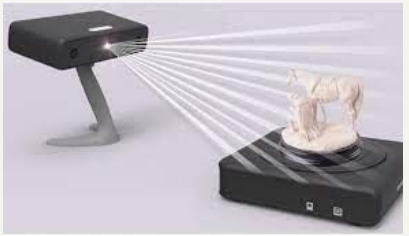
This scanner shines light onto the surface of the document. The reflected light is captured and sensors are used to detect the light. The captured image is converted into a digital file. This produces a 2D digital image.

- A lamp is used to brighten up the document
- The scan head is moved across the panel to scan the document.
- The angled mirror reflects the image to another mirror. The mirror then reflects the image onto the lens to create more focus on the image.

3D Scanners: used to create a digital 3D representation of a physical object

This scanner shines a laser over the surface of a 3D object. It records the measurements such as the width, height & depth of the object and converts it to a digital file. It produces a 3D digital model.

- Tiny triangles and polygons which are combined to create the model
- Sensors to detect the surface of a physical object and assign data points to the location of that surface.

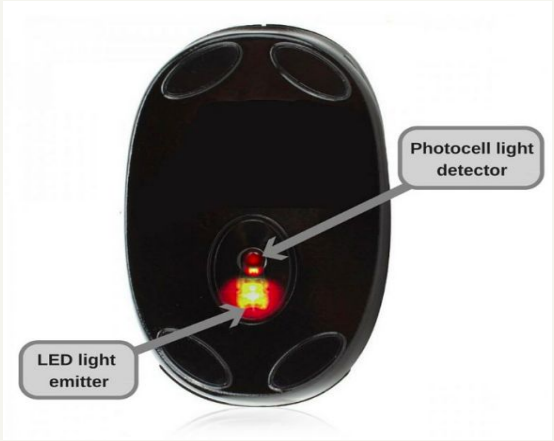


QR code scanner

A phone can be used to scan a QR code. The QR code is read and interpreted using an app. The three large squares in the corner define the alignment. The black squares reflect less light than the white squares. Each small square is converted to a binary value so that the data could be decoded by the app.

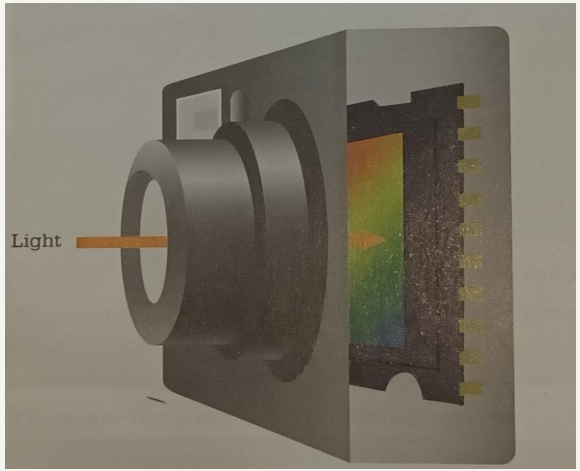
Optical mouse

The optical mouse contains light sensors which detect the movement of your hand. It shines bright LED light onto your desk which reflects from the surface and enters a photocell (the light detector). As the mouse is moved, the pattern of the reflected beam changes which helps the sensor detect the direction you're moving your mouse in.



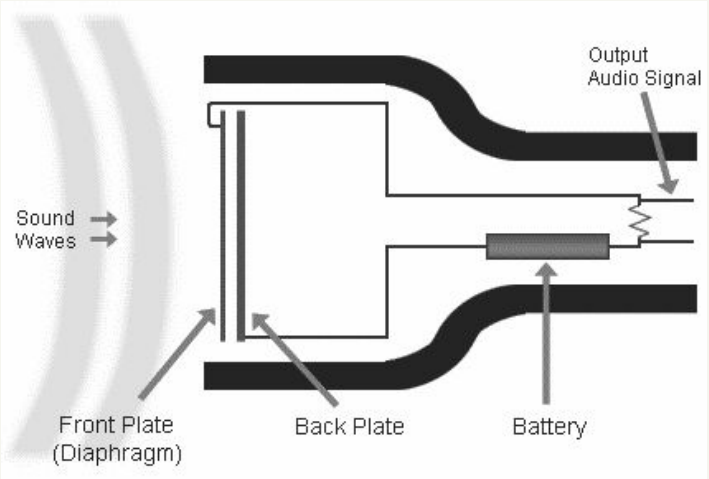
Digital Camera

It has a hole at the front which contains a lens. The lens allows the light to come into focus in a small area. The light is focused onto a sensitive electronic surface which is made up of tiny sensors. This surface reacts to the light and turn the pattern of light into electrical signals which can be sent directly into a processor.



Microphone

The air moves in a wave pattern called sound waves which is detected my the microphone. It has a diaphragm which vibrates when sound waves pass by. When it vibrates, a coil of wire around a magnet generates electricity. The electrical output is converted to a digital signal which is processed by the computer.

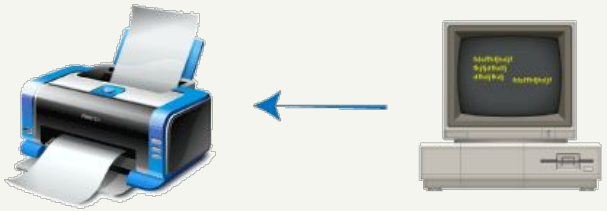


Sensors

It measures the readings of the surrounding environment. The sensor sends a signal to the microprocessor which converts the data from analog to digital using an ADC. The microprocessor compares the values with the stored value and accordingly sends a signal to the actuator if an action needs to occur.

pH sensor It detects changes in acidity levels. For example, to monitor acidity levels in the soil in a greenhouse.	**Light sensor** It detects how much light there is. For example, to turn on street lights when it's dark.	**Pressure sensor** It detects a change in pressure. For example, detecting intruders breaking into a building.
Gas sensor It detects the level of gas. For example, monitoring pollution in a river.	**Motion sensor** It detects the heat of the human/intruder. For example, used in security systems to detect intruders.	**Moisture sensor** It detects the amount of water. For example, monitoring the amount of water left in the clothes in a dryer.

Output devices



Printers

Inkjet printer

Rollers are used to move the paper through the printer. Nozzles spray ink onto the paper. Different colour inks are mixed to create the required colours. The ink is heated and evaporated into a bubble. The bubble collapses when it is pushed through the nozzle. Electric current is applied to a crystal which forces droplet of ink through the nozzle. Print head moves across the paper printing text/image. Paper is advanced so next line is printed. This is repeated until buffer is empty. Once it is done, printer send an interrupt to the processor.

Laser printer

It has printing drum which is given a positive charge. As the drum rotates, a laser beam is scanned across it removing the positive charge and leaves the negatively charged areas which match the text/image. Drum is then coated with positively charged toner, it only sticks to negatively charged parts of the drum. A negatively charged sheet is rolled over the drum. Toner on the drum now sticks to the paper to produce copy of page. The paper then goes through a set of heated rollers; heat melts the ink so it is permanent. Discharge lamp removes all electric charge from the drum, ready to print next page

DLP projector

The DLP uses a large number of tiny mirrors. Each mirror creates a pixel in the image. When the micro mirrors tilt towards the light source they are on and when they tilt away from the light source they are off. The colour is produced using a colour wheel. It can be used to display an image on a wall or a screen.

LCD projectors

A beam of light passes through the LCD and onto a wall screen. This works by shining a beam of white light to a group of mirrors which then reflect the light back at different wavelengths which correspond to the colours - red, blue, and green. When coloured light passes through the LCD screen, the coloured image is obtained and is passed through the projector lens onto the screen.

LED screen

A LED is an electronic device that makes coloured light when an electric current flows through it. It is made up of lots of little LEDs placed close together, where each of them emit three colours - red, blue, and green which light up together in order to create a range of colours.

Speaker

They have a plastic/metal cone. The bottom of the cone is fixed to a coil of wire that surrounds a magnet. Electrical signals make the magnet attract and repel the coil which moves backwards and forwards, thus pulling and pushing the speaker cone. The moving cone pumps sound out into the air. The speaker will produce sounds from the electrical signals it receives from the computer.