3.2 Hardware Output Input Devices

Objective:

- Show understanding of need for input output devices.
- Identify hardware devices used for output and show understanding of basic internal operation of following specific types of device: – **speakers**, **inkjet printer**, **laser printer**, **touchscreen**, **3D printer**, **virtual headset.**

Output Devices: It is a hardware that is used to **display** or **output data** which has been processed or has been stored on computer.

Types of Output Devices

a) Printers:

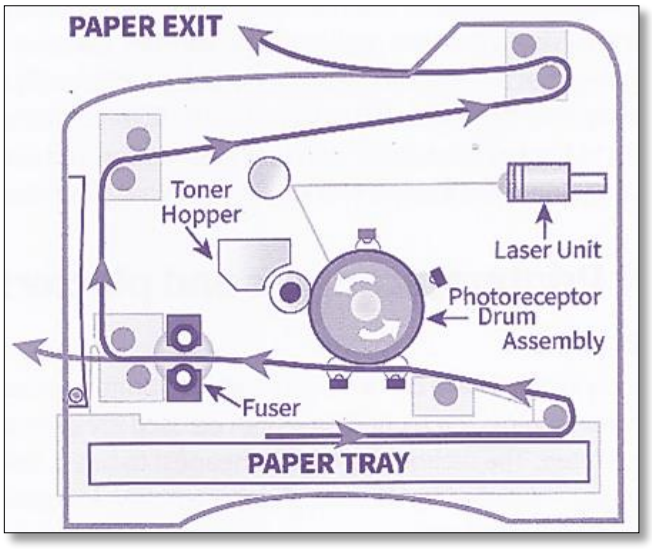
Printer is an **output** device, which is used to print information on paper.

Laser Printer:

Laser printer is example of **non-impact** page printer. Laser printers use **dry powder ink** rather than **liquid ink** and make use of properties of **static electricity** to produce text and images. Laser printers print **whole page** in one go.
Colour laser printers use **four** toner cartridges – blue, cyan, magenta and black.

Operation of Laser Printers:

- Data from Computer is sent to a **printer driver** and printer driver ensures that data is in a format that chosen printer can understand.
- Data is sent to **printer** and stored in printer **buffer**.
- Drum is given **electric charge** and drum starts to **revolve** step by step.
- At each step a laser beam is directed by **mirror** and **lens** assembly across width of drum.
- At each position, laser is either **switched off** to leave charge on drum or **switched on** to discharge position. This process repeats until a full page **electrostatic image** has been created.
- Drum is coated with charged **toner** which only sticks to positions where drum has been **discharged.**
- Drum rolls over **sheet of paper** which is initially given an **electric charge**.
- Sheet of paper is discharged and then is passed through **heated rollers** to **fuse toner** particles and seal image on paper surface.
- Drum is discharged before process starts again for next page.



In **Laser Colour printers**, separate toners are required for each colours and process has to take place for **each** colour. Colours are created from cyan, magenta, yellow and black.

Inkjet Printers

Inkjet is **non-impact line** printer. It produces **good quality** color prints. It is suitable if numbers of prints required are **less** because it prints **slowly** as compared to color **LASER printer**.
Inkjet printers are made up of;

- **Print Head:**
  - ✓ Print head contains a large number of very **small nozzles**.
  - ✓ Ink is fed to each nozzle from different ink cartridges.
  - ✓ **Print head** fires **droplets** of **ink** onto paper to form characters.
  - ✓ Print head moves **horizontally** across paper.

- **Ink Cartridge**:
  - ✓ One cartridge for each colour (blue, yellow and magenta) and a black cartridge.

- **Stepper Motor:**
  - ✓ (Print head) stepper motor is connected to the print head by a **belt**.
  - ✓ (Print Head) stepper motor moves print head across paper.
  - ✓ (Parking) stepper motor parks print head assembly when not in use.
  - ✓ (Paper feed) stepper motor moves **paper** in small increments.

- **Paper feed** which automatically feeds printer with pages as they are required.

Inkjet Printer Working:

- ✓ Printer driver translates data into a suitable format for printer.
- ✓ Printer receives data from computer and stores data in **printer's buffer**.
- ✓ A sheet of paper is **fed in**.
- ✓ Ink is supplied to the printhead from one or more **ink cartridges**.
- ✓ **Printhead** moves across sheet depositing ink on to paper. Paper is moved forward a fraction and printhead moves across paper again. This continues until sheet has been fully printed.
- ✓ Printhead consists of **nozzles** that spray droplets on to paper.

Graphic Plotter

Plotter is a computer printer for printing **vector** graphics. Plotter gives hard copy of output. It draws pictures on a paper using a **pen**.
Plotters are used to print designs of ships and machines, plans for buildings and so on.

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3.2 Hardware Output Input Devices

Graphics plotter uses pens to write on a large sheet of paper constrained by **sprockets** along one pair of sides.

Sprockets can move paper forwards or backwards and pens can either be parked or in use at any given time. **Controlling circuitry** and **software** can create drawing directly from original **vector graphic file.**

Types of plotters:

1) **Pen Plotter:** Pen plotters are used to draw or type of text. These are used in architecture or engineering to create designs.
2) **Cutting Plotters** come with a **sharp blade** instead of a pen-like instrument and are used for cutting paper, mylar or vinyl.

3D Printer

- ✓ 3D Printer is an Output device used to generate a three-dimensional (3D) physical object from a **digital file**.
- ✓ 3D printer produce **solid objects** which is built up, **layer by layer** using materials such as **powdered resin**, **powdered metal**, **paper** or **ceramic powder** using technology known as **BINDER 3D PRINTING**.

Working of 3D Printer:

- ✓ 3D design created using computer aided design (CAD) package is split into layers.
- ✓ Data for first layer is transmitted to 3D printer.
- ✓ 3D printer uses a **nozzle** to spray material on to printer bed to create a physical layer to match design. This process is repeated for successive layers.
- ✓ When whole object has been formed it has to be cured in some way to ensure that layers are welded together.

3D Printer use following Technique:

- **Additive Manufacturing:**

  3D Printers use **ADDITIVE Manufacturing** in which object is built up layer by layer.
- **Subtractive Manufacturing** is removal of material to make the object. It involve carving the statue out of solid stone by removing the stone not required until final item was produced.

Difference between Printers and Plotters:

- Printers spray ink onto surface of paper while plotter actually places pen-like instrument on paper and draws on it.
- Printers are faster, while plotters take a while.

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Output Input Devices

Speaker:

Speaker is output device used to output digital sound.

How Speaker Work ?

- Digitised sound stored in a computer can be converted into sound.
- Digital data is first passed through a digital to analogue converter (DAC) where it is converted into an **electric current.**
- **Current flows** through **coil** suspended within **magnetic field** provided by a **permanent magnet** in the speaker.
- Direction of current keeps reversing, **coil** moves backwards and forwards. This movement controls movement of a diaphragm which causes **sound** to be created.
- Amount of movement will determine **frequency** and **amplitude** of sound wave produced

Screen

Screens are used to show output from computer. Modern screens use an LCD, backlit with LEDs or newer organic light emitting diode (OLED) technology.

OLED use **organic materials** to create flexible semiconductors. Organic films are sandwiched between two charged **electrodes**. When electric field is applied to electrodes, they give off light. This means that no form of back lighting is required. This allows for very **thin** screens. It also means that there is no longer a need to use LCD technology, since OLED is a self-contained system.

Screen displays are based on **pixel** where each screen pixel is made up of three **sub-pixels**, which are red, green and blue. By varying **intensity** of three **sub-pixels**, it is possible to generate millions of colours.
Greater number of pixels on a screen, greater is **screen resolution**.

Touch Screen

Touch screen works as both an input and an output device. You view options available to you on screen (**output)** and you then use your finger to touch option that you have chosen (input).

Types of Touchscreen technologies:

1) **Capacitive:**

It is made up of many layer of **glass** that act like **capacitors**, creating **electric field** between **glass plates** in layers. When **top layer** of glass is touched, **electric current** changes and **coordinate** where screen is touched is determined by **microprocessors.**

Merits	Demerits
Screen visibility is good even in strong light.	Allow only the use of bare fingers as form of inputs
This is medium Cost technology	
The Screen is very durable (long Lasting)	

2) Infra-Red: There are two types of infra-red touch screen.

a) Heat Sensitive Touch Screen:

It uses **glass** as screen material and needs a **warm object** (e.g fingers) to carry out an input operation.

b) Optical Touch Screen:

It uses **glass** as screen material. An array of **sensors** (grid form) is used to find **point of contact** based on which grid coordinate is touched.

Advantage	Disadvantage
It allow multi touch capabilities	It is relatively expensive technology
The Screen is very durable (long Lasting)	It allow only bare fingers to be used for input. (Gloved fingers don't work)

3) Resistive Touch screen: It make use of an upper layer of polyester (form of plastic) and a bottom layer of glass. When top layer is touched, top layer and bottom layer complete circuit. Signal are then sent out which are interpreted by **microprocessor** which determine coordinate of where screen was touched.

Advantage	Disadvantage
It is relatively inexpensive technology	Screen visibility is poor in strong sunlight
It is possible to use gloved or bare fingers to carry out an input operations	It doesn't allow multi-touch capability
	Screen is not durable.

Virtual Reality Headset

- Virtual (reality) headset is **head-mounted device** that provides **virtual reality** for wearer.
- Images can be created using a **3D** graphics package.
- These are **fed paired images** from controlling system which, when looked at together, give eyes sensation of being in a 3D environment.
- Wearer of headset can control which part of 3D environment is in view. They do this by moving their head or by using a controlling device.
- These are widely used with **video games** but they are also used in other applications, including simulators and trainers.
- Virtual reality (VR) computer-generated simulation in which a person can interact within an artificial 3-D environment.

Microphones

Microphone is **input device** that allows sound to be entered into a computer system. Microphones are either built into computer or are external devices connected through USB port or through wireless connectivity.

How Microphone Works?

- When sound is created, it causes air to vibrate. When a **diaphragm** in microphone picks up air vibrations, diaphragm also begins to vibrate.

- Copper coil is wrapped around a **permanent magnet** and coil is connected to diaphragm using a cone.
- Movement of diaphragm causes a **coil** to move.
- Coil moves backwards and forwards past the magnet.
- Movement of coil creates a current (electromagnetic effect).
- Electric current is **digitized** by sound card using **ADC** and sends to computer.

Input of Graphic

There are multiple ways to store image data in computer.

- **Webcam** is device used to **stream video** images into a computer system.
- **Digital Camera** can be connected to a computer and stored images or videos can then be downloaded into computer.
- **Scanner**:

  Scanner takes an image and creates a digital representation from it. A sheet of paper containing image (which may be text) is held in fixed position and light source moves from one end of sheet to other.

  It covers width of paper. Reflected light is directed by a system of mirrors and lenses on to a Charge-Coupled Device (CCD).

ESQ#1 Name most suitable input or output device for each of following uses. Give a different device in each case.

Ans:

Description of use	Input or output device
input of credit card number into an online form	**Keyboard/keypad/numberpad**
selection of an option at an airport information kiosk	**touch screen**
output of a singe high quality photograph	**ink jet printer**
output of several hundred high quality leaflets	**laser printer**
input of a hard copy image into a computer	**scanner**

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