

Advantages of Trackball: -

1. Trackball is stationary.
2. Require Less Space.
3. Compact size.
4. Most suitable for portable computers.
5. It can be placed on any type of surface.



5. Touch Screen

Touch Screen is the most simple and easiest to learn of all input devices. It is also a pointing device by which users touch areas of the screen with their fingers to issue commands. Touch screen enables the users to choose from available options by simply touching with their fingers the desired icon or menu displayed on the screen.

E.g. A common application of touch screen is ATM's installed in banks.



6. Light Pen

Light is pointing device which is used to select a displayed menu item or draw pictures on the monitor screen. It is connected by a cable to the display device. The light pen consists of a light sensing element (photo diode) at the tip of pen and a cable through which the signal is transmitted. When the screen touched with the tip of pen, pen gets activated light spots are sensed and a signal sent to the system indicating the position.

E.g. Used for corrections in architectural designs.



7. Speech recognition system

These devices are used to recognize the voice and translate it into the text using speech recognition system. Speech recognition software is loaded into the machine which gathers sound waves remove unwanted noise and compare the incoming signal against a pattern stored in memory. If sound is similar or almost similar then the voice is translated into text otherwise it is ignored.



Speech recognition system equipped with the following components:

- a) Computer system with sound card
- b) Speech Recognition software
- c) Microphone

8) Scanner

“A scanner is an input device which translates paper documents into an electronic format, which can be stored in a computer.”

Scanner is an input device that is capable of capturing image, text and handwritten document and stores it in computer system. Scanner captures data and converts it into bit pattern for processing.

Characteristics of Scanner

1. Human efforts required for manually entry of data is eliminated by scanner.
2. The reduction in human intervention improves the data accuracy.
3. Scanner requires high quality of input document.
4. Most of these device are not economical feasible.

Types of scanner

Scanner comes in various shapes and sizes following are its category :-

1. Flatbed scanner
2. Sheet-fed Scanners
3. Hand-held scanner
4. Drum Scanners

Example of Scanners based on technology

Example of scanner is **optical scanner** and **Magnetic ink character readers**.

1. Optical scanner

Optical scanner uses light source and light sensors to read information recorded on paper. Commonly used optical scanner include

- a) Optical character reader (OCR)
- b) Optical mark reader (OMR)
- c) Optical barcode reader (OBR)

a) **Optical mark reader (OMR)**

Optical Mark Recognition is the process of gathering data with an optical scanner (Optical mark reader) by measuring the reflectively of light at predetermined positions on a surface. Optical mark reader is commonly used to check special examination sheets.

How it works?

Sheet may contain square or bubble that is marked by pen/pencil. The actual technique used for OMR device for recognition of marks involves focusing a light source on page. The reflected light is detected by OMR and corresponding signals are sent to processor. The change in light detects the presence of mark.

Advantages

Roll Number	Set	Subject
01	01	01
02	02	02
03	03	03
04	04	04
05	05	05
06	06	06
07	07	07
08	08	08
09	09	09
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
17	17	17
18	18	18
19	19	19
20	20	20
21	21	21
22	22	22
23	23	23
24	24	24
25	25	25

- 1) Large volumes of data can be collected quickly and easily without the need for specially trained staff.
- 2) The cost of inputting data and the chance of data input errors can be reduced.
- 3) Only one computer needed to collect and process data.

Disadvantages

- 1) OMR readers are relatively slow as compare to other optical scanners.
- 2) Only suitable for multiple choice question not suitable for text input.
- 3) Marks are required to be fill clearly otherwise OMR will not read correctly.
- 4) Documents for optical mark recognition are complicated to design.
- 5) Any folding or dirt on a form may prevent the form from being read correctly.
- 6) It is very expensive.

2) OCR

It is used to recognize alphanumeric characters printed or typewritten on paper. The scanner detects the light reflected from the paper. The change in the reflected light is converted to binary data which is sent to processor.

OCR can recognize text written in two font format specified by ANSI (American National Standard Institute) that are OCR-A (American standard) and OCR-B (European standard).

Application of OCR

These devices are used in bank, insurance companies, air lines and some retail outlets.

Advantages

- 1) It reduces manual key stroke operation.
- 2) It can also read the hand written characters.
- 3) It saves time and money in transforming the data.
- 4) It can easily & quickly convert printed text into an electronic & editable form.

Disadvantages

- 1) Poorly handwritten document cannot be easily read by OCR
- 2) It cannot read character printed in format other than some special format (OCR –A and OCR-B).
- 3) OCR is not fully accurate.

3) Bar Code Reader

It is photoelectric device that scans a set of vertical bars of different width by means of reflected light. These vertical lines are called **Bar codes** that are used to represent alpha numeric data by varying the width and combination of adjacent vertical lines. Bar code reading is done by scanner connected to a computer.



Bar code structure

These bars are detected at ten digits. The first five digits identify the supplier or manufacturer of item. The second five identify individual product.

Advantage of Barcode reader

Accuracy, Speed, Cost effective, Ease of implementation (Can be easily operated)

Disadvantage of barcode reader

If the code becomes damaged or blur it may not be read.

2) MICR

MICR stands for Magnetic Ink Character Recognition. It is a character recognition technology used to scan and read the information directly into a data-collection device. MICR characters can be read easily by humans and it is printed on documents using a magnetic ink.

E.g. MICR is primarily by the banking industry to facilitate the processing of cheques.

How it works

MICR scan document written with magnetic ink which contain iron oxide particles in it. When a MICR document needs to be read, it passes through a machine, which magnetizes the ink and then translates the magnetic information into characters.



There are two major MICR fonts in use: **E-13B** and **CMC-7**

Advantages

1. It reads the character quite speedily and accurately.
2. MICR can read data even if it's smudged crumbled or dirty.
3. It is hard to reproduce the ink, hence hard to forge cheques.

Disadvantages

1. Special type of ink is used.
2. It cannot be used for general purpose data processing
3. It can recognize few type of font type.
4. The readers and printers are relatively expensive.

Output device

An output device is an electromechanical device which accepts data from a computer and translates them into a human acceptable form.

Output generated by output device classified into two types:

1) Soft-copy output – Output which is not produced on a paper is known as soft-copy output. They are temporary in nature.

2) Hard-copy output – Output which is produced on a paper is known as hard-copy output. They are permanent in nature.

Following is list of most commonly used output device.

- 1) Monitor
- 2) Printer
- 3) Plotter
- 4) Speaker
- 5) Projector

1) Monitor

Monitor is an output device which is used for producing soft-copy output. It is also known as VDU i.e. Visual Display Unit. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the no. of the pixels.

Factors for considering display:-

1. **Dot pitch** is amount of space between the centers of adjacent pixels. Closer the dots crisper the image.
2. **Refresh rate** is the number of times per second that the pixels are recharged so that their glow remains bright. (In general it is 45-100 times per second).
3. **Resolution** is the image sharpness. Resolution is expressed in terms of formula horizontal pixels X vertical pixels. (e.g. 800 X 600 pixels)

On the basis of **volume** monitor is of two types-

a) Cathode-Ray Tube (CRT)

CRT's Screen display is made up of small picture elements called pixels. The smaller the pixels the better the image clarity or resolution. CRT is the large bulky sized monitor. It has high power requirement so it is not appropriate for portable devices.

How it works

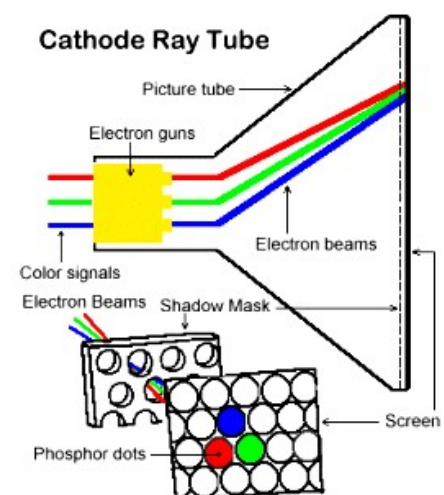
A monochrome CRT contains single electron gun which emits beam of electrons. These electrons are attached towards positive phosphorous screen. When an electron strikes the screen it glows and emits light. A small area in which an electron strikes is known as pixel. To display a screen all the pixel are strike by electrons. Accelerating anode varies the speed of the electron and deflecting system changes the path of the electron.

In short

A heated cathode emits a high-speed electron beam onto phosphor-coated glass screen. Glass screen glows when they are struck by electron beam.

Advantages of CRT Monitors

1. It has better brightness.



2. It is cheaper in cost.
3. It is more durable.
4. It has better graphics and larger viewing angle (~180)

Disadvantages of CRT monitors

1. It bulky and large in size. It is large in size so occupies more space.
2. More power consumption.
3. It is not portable.

b) Flat- Panel Display

Flat panel monitors are thinner and lighter and commonly used with portable computer systems. Following are Flat-Panel display:

1. Light emitting diode

LED contains multiple small bulbs. The contents are displayed by turning the bulbs “on” and “off”. Initially it was used only for simple digital displays like in calculator, digital watch, etc. At present it is also used in television, desktop PC, laptop, etc.

Advantages of LED

1. It is light in weight so, it can be used in portable devices.
2. It requires less power.
3. It is small in size.
4. Its viewing angle is larger compared to LCD.

Disadvantages of LED

1. It has low brightness but is better than LCD and plasma.
2. It is expensive compared to CRT.
3. It is difficult to maintain.

2. Liquid crystal display

LCD contains liquid crystals in between two plates of the screen. The plates are made by either glass or plastic. The front plate is transparent and the back plate is reflective. Liquid crystals are charged electronically to display the content.

Advantages of LCD

1. It is small in size.
2. It is light in weight.
3. It has low power requirements so, can be used in portable devices.
4. It is cheaper than LED and plasma display.

Disadvantages of LCD

1. It has low brightness.
2. It is expensive compared to CRT.
3. It requires viewing angle of almost 90.

3. Plasma display

It contains neon gas in between the two plates of the screen in place of liquid crystals of LCD. It has larger viewing angle but is expensive than LCD. It is smaller in size, light in weight and it has low power requirement and low brightness.

Advantages of plasma display

1. It is smaller in size and light in weight.

2. It has low power requirement so can be used in portable devices.
3. It has larger viewing angle.

Disadvantages of plasma display

1. It has low brightness.
2. It is expensive than LCD.

Types of monitor on the basis of color display are:

1. Monochrome monitor

It is a single colored monitor. It can display only text and images of a single color against a contrasting background. The first monitor displayed text and images of light green color against black background.

2. Gray scale monitor

It can display 256 different variations of black and white color. It can also display video. The first television set was gray scale.

3. Color monitor

It can display 16-42 million colors. It uses 3 basic colors Red, Blue and Green. All the other colors are the combination of these colors. Color monitor is also known as RGB monitor.

2. Printers

Printers are the most popular output devices. They produce hard-copy output. Printers are broadly classified into two categories:

a) Impact printer: -

Impact printers are those printers that print the characters by striking hammers or pins against ribbon onto paper. Impact printers are noisy printers. Characteristics of Impact Printers are following

- Less expensive
- Impact printers are very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce a pattern

b) Non-impact Printers

The printers that print the characters without striking against the ribbon and onto the paper are called Non-impact Printers. Characteristics of Non-impact Printers

- Faster than impact printers.
- They are not noisy.
- High quality.
- Support many fonts and different character size.

Printers can be further classified into the different categories:-

a) Character Printer

- i. Dot Matrix Printer (Impact printer)
- ii. Daisy wheel Printer (Impact printer)
- iii. Inkjet printer (Non-impact printer)

b) Line Printer

- i. Drum printer (Impact printer)
- ii. Chain printer (Impact printer)

c) Page printer

- i. Laser printer (Non-impact printer)

1) Character printer prints only one character at a time. This types of printer is described as follows-

a) Dot matrix

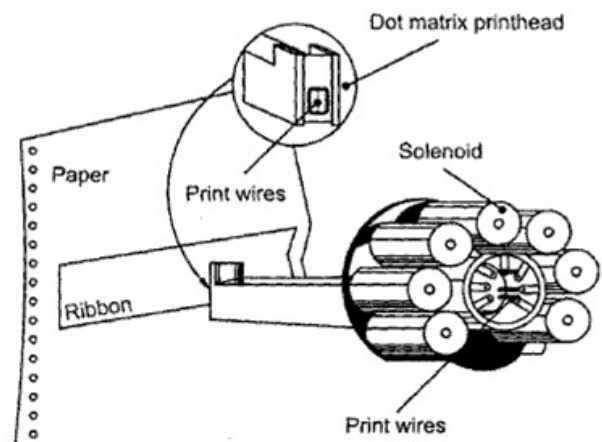
Dot matrix is an impact printer and it prints one character at a time in the form of dots. Its speed is usually ranges from 30 to 550 characters per second (cps). Dot matrix is the cheapest and the noisiest printer and has a low print quality. It was 1st introduced by Centronics in 1970.

How it works

1. In this printer an inked ribbon between paper and the print head. The print head moves across the paper and goes on printing the information.

2. Uses tiny pins to hit an ink ribbon and the paper. 9 to 24 vertical column pins are contained in a rectangular print head.

3. When print head moves across the paper, pins are activated to form a dotted character image. When pins get activated they strike on paper along with ribbon. These printers can produce carbon copies along with the originals.



Advantages :

1. Less-expensive.
2. Low per page cost.
3. Energy efficient.
4. Multipage forms can be printed on this printer.

Disadvantages :

1. Noisy
2. Low resolution
3. Limited fonts flexibility
4. Poor quality graphics output.

b. Daisy wheel printer

A daisy wheel printer is basically an impact printer consisting of a wheel and attached extensions on which molded metal characters are mounted. A daisy wheel printer produces letter quality print and it can't produce graphics output. Its speed is around 90 cps.

How it works

1. In Daisy wheel printer each petal of wheel has a character embossed on it.
2. A hammer presses the wheel against a ribbon which in turn makes an ink stain on the paper

3. A motor spins the wheel rapidly and when the desired character spins to the correct position, a print hammer strikes it to produce the output.

Advantages

1. Quality output is produced
2. The font of character can be easily changed
3. More reliable than DMP.

Disadvantages

1. Slower than DMP.
2. Produce noise while printing.
3. More expensive than DMP.

c. Inkjet printer

It is a non-impact printer producing a high quality print. Multipage forms cannot be printed by these printers. Its speed ranges from 40 to 300 characters per second with a resolution of from 300 dpi to 1200 dpi.

How it works

1. Print head having four ink cartridges moves.
2. Software instructs where to apply dots of ink, which color and what quantity to use.
3. Electrical pulses are sent to the resistors behind each nozzle.
4. Vapor bubbles of ink are formed by resistors and the ink is forced to the paper through nozzles.
5. A matrix of dots forms characters and pictures.

Advantages

1. High quality of printing.
2. More reliable.
3. Energy efficient.

Disadvantages

1. Expensive as cost per page is high.
2. Slow as compare to laser printer.

b) Line printers

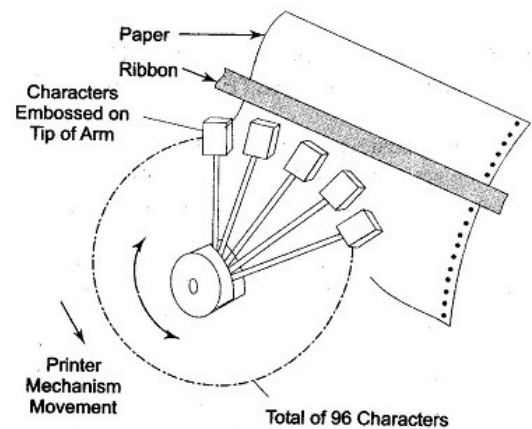
Line printers are the impact printers and are used for producing high volume paper output. These printers print the complete line at a time so that's why they are called line printers. They are faster printers having speed in the range of 300 to 2500 lines per minute.

Types of line printers

a) Drum printers

Drum printers print one line at time. It consists of a solid cylindrical drum with character embossed on its surface in the form of circular bands. Each band contains numerals, alphabets and special characters.

In addition to drum a set of hammer mounted in front of drum in manner that an inked ribbon and paper can be placed between hammers and the drum. It is very fast and also expensive. Its speed ranges from 300 to 2000 lines per minute.



How it works

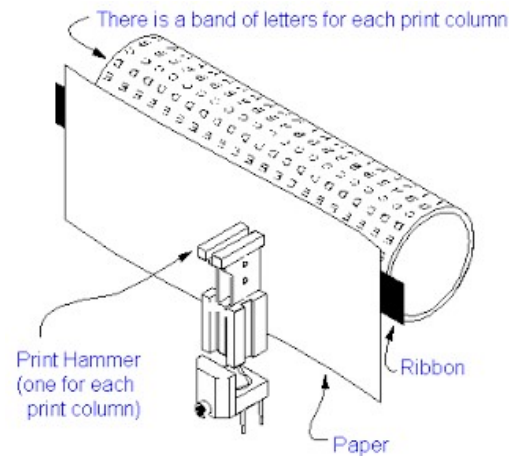
1. The drum rotates rapidly and one revolution is required to print one line.
2. Character at print position is printed by activating the appropriate hammer, when character embossed on the band at print position passes below it.

Advantages

1. They can be used to produce multiple copies by using carbon paper.
2. It is very fast.

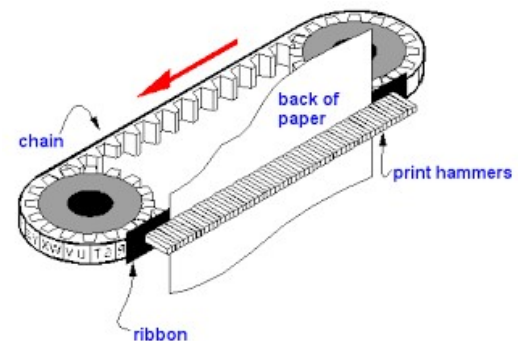
Disadvantages

1. Expensive
2. Noisy while operation.
3. Cannot produce different sizes of print and graphics.



b. Chain printer

Chain/band printers are line printers which print one line at a time. It consists of a metallic chain on which all the characters of the character set supported by printer is embossed. A character set may have 48, 64, or 96 characters. Its speed ranges from 400 to 3000 line per minute.



How it works

Chain rotates rapidly and a character at print position is printed by activating the appropriate hammer, which is embossed on the chain pass below it.

Advantages

1. Fast than drum printers
2. Chain or chain printer can be easily changed. This allows the use of different font with same printer.

Disadvantage

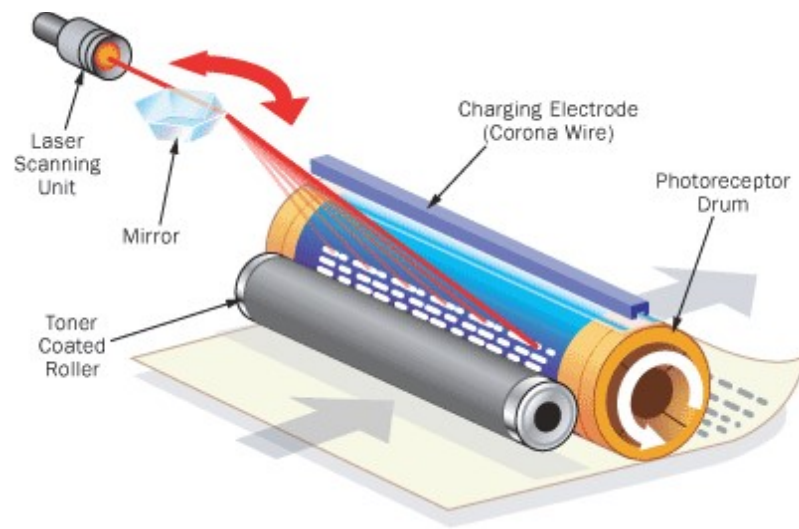
1. It does not have ability to print graphics such as charts and graphs.
2. Slower as compare to laser printer.

3) Page printer

Page printer is a very high speed non impact printer and prints the entire page at a time. The quality of these printers is the best quality but there cost is much higher.

Laser printer

Laser printers are page printers which print one page at a time. The main components of laser printers are a laser beam source, multi-sided mirror, a drum and a toner. Laser printer produces very high quality output. Its print speed ranges from 4 to 12 pages per minute in case of low speed laser printer and 500 to 1000 pages per minute in case of high speed laser printer. It has resolution 600 dpi.



How it works

1. Paper is fed and the drum rotates.
2. A laser beam conveys information from the computer to a rotating mirror and thus an image is created on the drum.
3. The charges on the drum are ionized and the toner sticks to the drum.
4. Toner is transferred from drum to paper.
5. Heat is applied to fuse the toner on the paper.

Very Short Answer Type Questions

- 1.