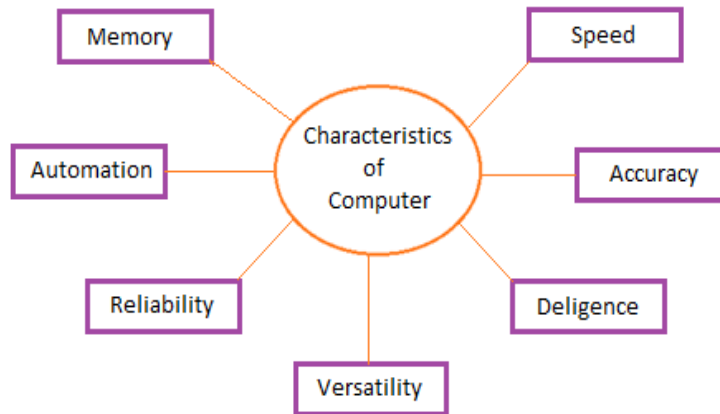


Computer Fundamentals

A **computer** is a machine that can be instructed to carry out sequences of arithmetic or logical operations automatically via computer programming. Modern computers have the ability to follow generalized sets of operations, called programs. These programs enable computers to perform an extremely wide range of tasks.

A **computer** is a machine that accepts data as input, processes that data using programs, and outputs the processed data as information. Many computers can store and retrieve information using hard drives.

The characteristics of the computer system are as follows –



Speed : A computer works with much higher speed and accuracy compared to humans while performing mathematical calculations. Computers can process millions (1,000,000) of instructions per second. The time taken by computers for their operations is microseconds and nanoseconds.

Accuracy : Computers perform calculations with 100% accuracy. Errors may occur due to data inconsistency or inaccuracy.

Diligence : A computer can perform millions of tasks or calculations with the same consistency and accuracy. It doesn't feel any fatigue or lack of concentration. Its memory also makes it superior to that of human beings.

Versatility : Versatility refers to the capability of a computer to perform different kinds of works with same accuracy and efficiency.

Reliability : A computer is reliable as it gives consistent result for similar set of data i.e., if we give same set of input any number of times, we will get the same result.

Automation: Computer performs all the tasks automatically i.e. it performs tasks without manual intervention.

Memory: A computer has built-in memory called primary memory where it stores data. Secondary storage are removable devices such as CDs, pen drives, etc., which are also used to store data

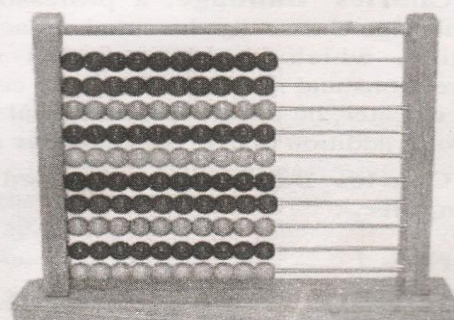
HISTORY OF COMPUTER

The evolution of Computer has passed through different stages before it reaches the present state of development.

The evolution started from the **3500 BC** when human being first started to learn to calculate with a calculating machine names abacus.

Abacus

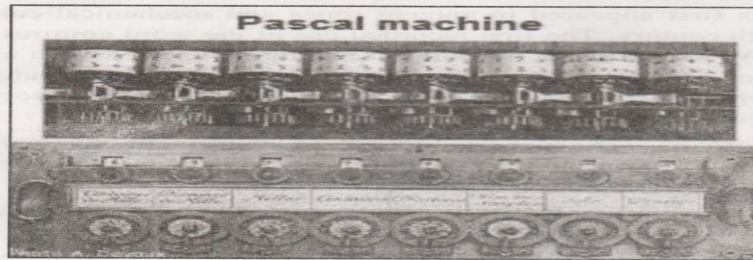
Abacus seems to be the earliest calculating machine, which was developed by the Chinese. Abacus consists of beads, which can move in wires. The wires represented the columns. The right most columns represented the unit, next for ten and so on. Abacus could perform simple addition and subtraction.



PASCAL'S Mechanical Calculator

Blaise Pascal, the French Mathematician, laid the foundation of automatic computing. Pascal used his adding machine (1662) simply for the addition and subtraction. The machine consisted of gears wheels and dials. Where these, calculation could be performed by dialing these series of wheel carrying the number around their circumference.

The wheel had 10 segments and when wheel completed one rotation, the next wheel would move by one segment.



This machine was later improved by Gottfried (Germany) to perform multiplication and division.

Charles Babbage's Differential Engine

Charles Babbage, a professor of Mathematics at Cambridge University, invented a machine called differential Engine, which could evaluate accurately algebraic expressions and mathematical table correct up to 20 decimal place. Later, he developed analytical machine, which could perform addition at the rate of 60 per minute.

Charles Babbage was called the father of the Computer.



Mark - 1

In 1946, Harvard professor **H. Eiken** developed an automatic calculating machine, which was called **Mark - 1 digital Computer**.

The basic limitation of this type of Computers were

- (a) The speed was limited due to friction or inertia generated by the movement of components.
- (b) The data movement was quite difficult and unreliable.

Electronic Numeric Integrator and Calculation (ENIAC)

The first electronic general purpose Computer was built in 1946 by a team of professors at Moore School of University of Pennsylvania and was called ENIAC. The ENIAC ushered in the era of what is known as first generation Computer. It was bulky in size consisting of 18,000 vacuum tubes, 70,000 resistor, 10,000 capacitors, 60,000 switches and a large size occupying 1500 sq. feet of space. It was a very fast machine as compared to its ancestors and could perform 5000 additions or 350 simple multiplications in just one second. ENIAC was a general purpose-computing machine where vacuum tube technique was used.

Universal Automatic Computer (UNIVAC)

In the year 1946, **Eckert** and **Mauchly** founded their own company and began to work on the Universal Automatic Computer or UNIVAC. In 1949, Remington Rand acquired the Eckert-Mauchly Computer Corporation and in early 1951 the first UNIVAC-1 becomes operational at the Census Bureau.

Advantages and disadvantages of computer

The advantages of the Computer are

1. Very high speed.
2. Large storage capacity.
3. Versatility.
4. Automatic working capability.
5. Diligence.

The disadvantages/limitation of the Computer is

1. Can't think.
2. Can't learn by experience.
3. Can't take independent decisions.

GENERATION OF COMPUTER

The term **generation** indicates the type of technology used in the computer construction. As new technology was emerging, it was being used in the making of computer. The new technology improved the speed, accuracy and storage capacity of the computers. Different technologies have been used for computers in different times.

Therefore, computers can be divided into five generations depending upon the technologies used. These are:

1. First Generation (1942 - 1955)

2. Second Generation (1955 – 1964)
3. Third Generation (1964 – 1975)
4. Fourth Generation (1975-1980)
5. Fifth Generation (Since 1980)

First Generation Computers (1942 – 1955)

The vacuum tube technology was used in first-generation computers. Mark-1, ENIAC, EDSAC, EDVAC, UNIVAC-1 etc. machines belong to the first generation of computers. The machine language only was used in first-generation computers.

Advantages

The main advantages of first-generation computers were:

1. These computers were the fastest of their time.
2. They were programmed using machine language.
3. The electronic digital computers were introduced due to the vacuum tube technology.

Disadvantages

The main disadvantages of first-generation computers were:

1. Very big in size.
2. Not reliable.
3. Consumed large amount of energy.
4. More heat generated and air-conditioning was required.
5. Very slow in speed.
6. It was difficult to programmed, because they used only machine language.
7. Non-portable.

Second Generation Computers (1955 – 1964)

The transistor technology was used in second-generation computers. The electronic component transistor was invented in 1948 at Bell Laboratories. The transistor is smaller in size and more reliable than vacuum tube. Therefore, the transistor technology was used in computer in place of vacuum tube technology. The programming assembly language was also introduced in second-generation of computers.

Advantages

The main advantages of second-generation computers as compared to first-generation computers are:

1. Low in cost.
2. Smaller in size.
3. Fast in speed.
4. Less heat generated, more reliable and accurate in calculations.

5. Consume low power.
6. Used for commercial purposes.
7. Assembly language was introduced.

Disadvantages

The main advantages of second-generation computers are:

1. Air-conditioning required.
2. Commercial production was difficult and these were very costly.
3. Constant (or frequent) maintenance required.
4. Only used for special purposes.

Third Generation Computers (1964 – 1975)

The IC (**Integrated Circuits**) technology was used in third-generation computers. In a small IC chip (**5 mm square size**) a circuit is designed having large number of electronic components like transistors, capacitors, diodes, resistors etc. Initially, an IC contained only about ten to twenty components. Thus the IC technology was named as Small Scale Integration (SSI). The third-generation was based on IC technology and the computers were designed using this technology.

Advantages

The main advantages of third-generation as compared to previous generations of computers were:

1. Smaller in size.
2. Production cost was low.
3. Low power consumption.
4. Maintenance cost was low because failure rate of hardware was very low.
5. Magnetic disk used for external storage.
6. More storage capacity.

Disadvantages

The main disadvantages of third-generation computers were:

1. Air-conditioning required.
2. Highly sophisticated technology required for the manufacturer chips.

Fourth Generation Computers (1975-1980)

The microchip technology was introduced in this generation of computers. With the advancement in IC technology, LSI (Large Scale Integration) chips were developed. It was possible to integrate over 30,000 or more components on to single LSI chip. After LSI, the VLSI (Very Large Scale Integration) was developed and the development of microprocessor

possible. It is expected that more than one million components will be integrated on a single chip of VLSI. Using VLSI technology, the entire CPU is designed on a single silicon chip. The use of microprocessor as CPU introduced another class of computers called the microcomputers. Thus fourth-generation may be called Microcomputer generation. IBM introduced its personal computer for use in 1981.

Advantages

The main disadvantages of fourth-generation computers were:

1. Smaller in size.
2. Very reliable.
3. Hardware failure is negligible.
4. Easily portable because of their small size.
5. Air conditioning is not compulsory.
6. Very high processing speed.
7. Used advanced input & output devices such as optical readers, laser printers, CD-ROM/DVD-ROM drives etc.

Disadvantages

The main disadvantages of fourth-generation computers were:

1. Highly sophisticated technology required for the manufacturer of microprocessor chips.

Fifth Generation Computers

The main drawback of first to fourth generation computers is that the computers have not their own thinking power. These are totally depending upon the instructions given by the users.

Fifth generation computers are supposed to be the ideal computers, but do not exist. The scientists are working to design such computers that will have the following features.

1. Having their own thinking power.
2. Making decisions.
3. Having capabilities of learning.
4. Having capabilities of reasoning.
5. Having large capacity of internal storage.

TYPES OF COMPUTER

Classification of Computer

Based on the performance, a Computer can be classified as follows:

- (a) Digital

(b) Analog

(c) Hybrid

On the basis of the size and the capacity a Computer can be classified as follows:

(a) Super Computer

(b) Mainframes Computer

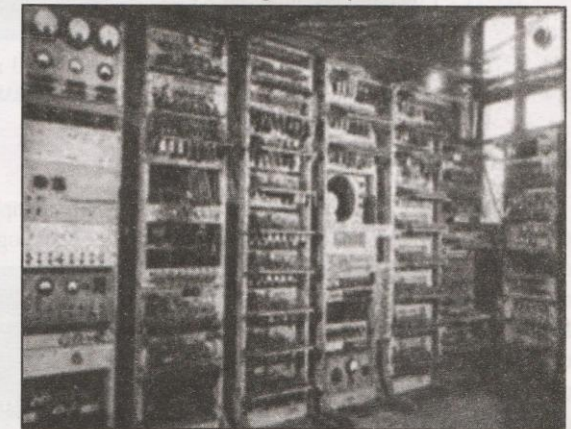
(c) Mini Computer

(d) Micro Computer

Digital Computer

Between 1937 and 1944, Aiken built the first general-purpose automatic digital computer, called the "Mark-I." It was electromechanical, using relays as one of the major calculating devices. Between 1939 and 1945, Eckert and Mauchly built the "ENIAC" (Electronic Numeric Integrator And Computer) digital computer. It consisted of 18,000 electron tubes, weighed 30 tons, and degenerate 150 kilowatts. The time required for an adding operation was only 0.21 milliseconds compared to 300 milliseconds for the Mark I. These early computers are presently displayed at the Smithsonian Institution in Washington, D.C. In 1951 Eckert and Mauchly built the first "UNIVAC" (Universal Automatic Computer) for the United States Census Bureau. The EDVAC completed in 1952, was the first computer to use internally stored instruction (program).

First Digital computer



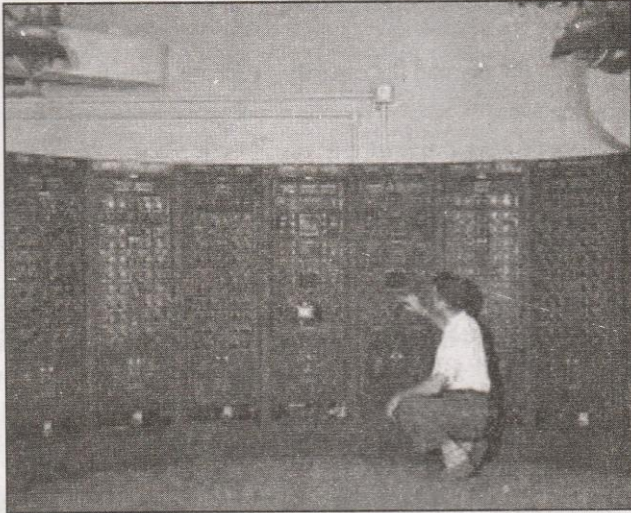
ENIAC

Analog Computer

Perhaps the first Analog computation was the graphic solution of surveying problems. The first actual Analog computer was probably the slide rule, which was developed about 1600.

Basic Features of an Analog Computer

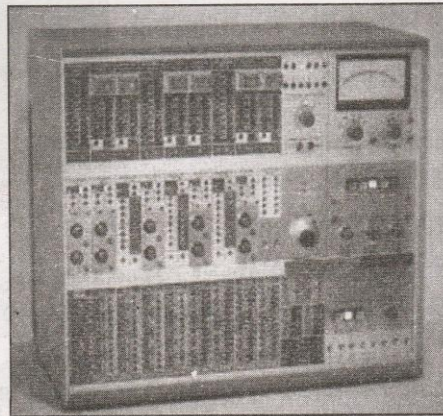
1. Addition (subtraction is merely inverse addition).
2. Multiplication (division is merely inverse multiplication).
3. Integration (solution of differential equation is essentially a combination process).
4. Function generation i.e., the ability to produce inputs such as step functions, ramps, sinusoidal functions, impulse functions.



5. Display i.e., the values of variable can be taped and measured on voltage-sensitive meters, chart recorders, or X-Y plotters.

Hybrid Computer

A Hybrid is a combination of digital and analog computers. It combines the best features of both types of computers, i.e. It has the speed of analog computer and the memory and accuracy of digital computer. Hybrid computers are used mainly in specialized applications where both kinds of data need to be processed. Therefore, they help the user, to process both continuous and discrete data. For example a petrol pump contains a processor that converts fuel flow measurements into quantity and price values. In hospital Intensive Care Unit (ICU), an analog device is used which measures patient's blood pressure and temperature etc, which are then converted and displayed in the form of digits. Hybrid computers are used for scientific calculations, in defense and radar systems.

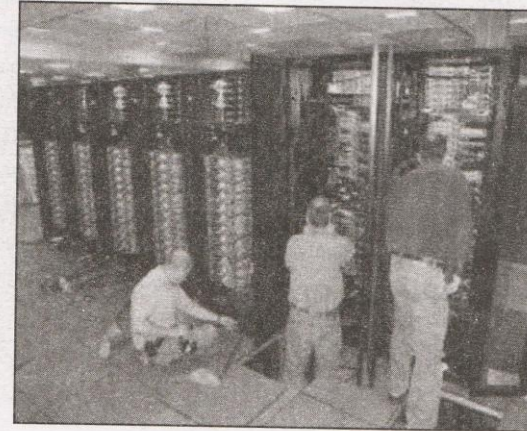


First Hybrid Computer

Super Computer

First super computer is **ILLIAC IV** made by Burroughs. Other super computers are **CRAY-I, CRAY-II, CRAY-III** (all are developed by Seymour Cray), CDC, NEC etc.

Super computer can process 64 bits or more at a time. Their processing speed ranges 10,000 million to 1.2 Billion instructions per second (MIPS). They can support 10,000 terminals at a time.



Supercomputers are mainly used for

1. Weather forecasting.
2. Nuclear energy research.
3. Aircraft design.
4. Automotive design.
5. Online banking.

Mainframe Computer

First super computer is **ILLIAC-IV** made by Burroughs. Other super computers are **CRAY-I, CRAY-II, CRAY-III** (all are developed by Seymour Cray), CDC, NEC etc.



Super computer can process 64 bits or more at a time. **Their processing speed ranges 10,000 million to 1.2 Billion instructions per second (MIPS).** They can support 1,000 terminals at a time.

Mainframe Computers are very useful for:

- NASA (National Aeronautics and Space Administration)
- CIA, NSA, FBI, and other large government agencies.

Mini Computer

They can support 10-12 terminals at a time. Mini computers are **SPARC, NOVA, DEC, PDP-II and IBM series.** Processing speed 16 Bits to 32 Bits.

Mini Computers are very useful for:

1. Scientists.
2. Engineers.
3. Smaller businesses.
4. Colleges and universities.

Micro Computer

Micro computers are IBM-PC. **Processing speed 16 Bits to 32 Bits.**

Micro Computers are useful for:

1. Text edition
2. Spread sheet preparation
3. Graphics design
4. Accounting
5. Database management etc.

PERIPHERAL DEVICE

A peripheral device is an internal or external device that connects directly to a computer but does not contribute to the computer's primary function, such as computing. It helps end users access and uses the functionalities of a computer.

Some Peripheral devices are :

Mouse, Keyboard, Printer, Webcam, Printer, Scanner, External drives, CD- ROM etc.

INPUT DEVICES

The most popular input devices are

1. Keyboard
2. Mouse
3. Joy Stick
4. Light pen
5. Track Ball
6. Scanner
7. Microphone

8. Magnetic Ink Card Reader(MICR)
9. Optical Character Reader(OCR)
10. Bar Code Reader
11. Optical Mark Reader

Keyboard

Most common and very popular input device is keyboard. The keyboard helps in inputting the data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing some additional functions.



Keyboard is of two sizes 84 keys or 101/102 keys, but now 104 keys or 108 keys keyboard is also available for Windows and Internet. The keys are following:

Sr. No.	Keys	Description
1	Typing Keys	These keys include the letter keys (A-Z) and digits keys (0-9) which are generally give same layout as that of typewriters.
2	Numeric Keypad	It is used to enter numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machine and calculators.
3	Function Keys	The twelve functions keys are present on the keyboard. These are arranged in a row along the top of the keyboard. Each function key has unique meaning and is used for some specific purpose.
4	Control keys	These keys provides cursor and screen control. It includes four directional arrow key. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).
5	Special Purpose Keys	Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

Mouse

Mouse is most popular Pointing device. It is a very famous cursor-control device. It is a small palm size box with round ball at its base which senses the movement of mouse and sends corresponding signals to CPU on pressing the buttons.

Generally it has two buttons called left and right button and scroll ball is present at the mid. Mouse can be used to control the position of cursor on screen, but it cannot be used to enter text into the computer.



Joystick

Joystick is also a pointing device which is used to move cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The Joystick can be moved in all four directions.

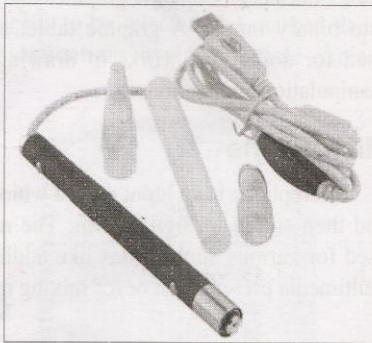
The function of joystick is similar to that of a mouse. It is mainly used in **Computer Aided Designing (CAD)** and playing computer games.



Light Pen

Light pen is a pointing device which is similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube.

When light pen's tip is moved over the monitor screen and pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.



Track Ball

Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on ball, pointer can be moved.

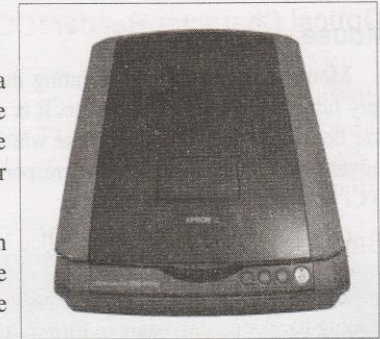
Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button and a square.



Scanner

Scanner is an input device which works like a photocopy machine. It is used when some information is available on a paper and it is to be transferred to the hard disc of the computer for further manipulation.

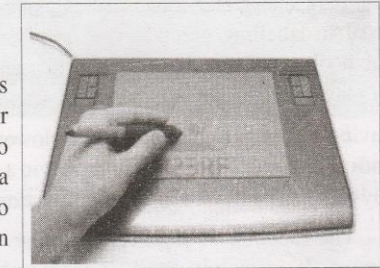
Scanner captures images from the source which are then converted into the digital form that can be stored on the disc. These images can be edited before they are printed.



Digitizer

Digitizer is an input device which converts analog information into a digital form. Digitizer can convert a signal from the television camera into a series of numbers that could be stored in a computer. They can be used by the computer to create a picture of whatever the camera had been pointed at.

Digitizer is also known as Tablet or Graphics Tablet because it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for doing fine works of drawing and images manipulation applications.



Microphone

Microphone is an input device which input sound and then stored in digital form. The microphone is used for various applications like adding sound to a multimedia presentation or for mixing music.



Magnetic Ink Card Reader (MICR)

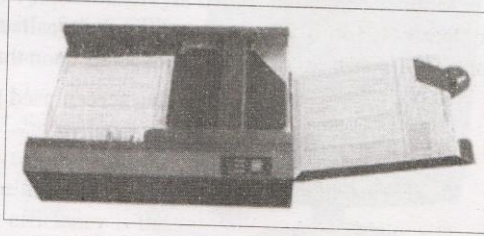
MICR input device is generally used in banks because of a large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable.

This reading process is called Magnetic Ink Character Recognition (MICR).



Optical Character Reader (OCR)

OCR is an input device used to read a printed text. OCR scans text optically character by character, converts them into a machine readable code and stores the text in the memory.



Bar Code Readers

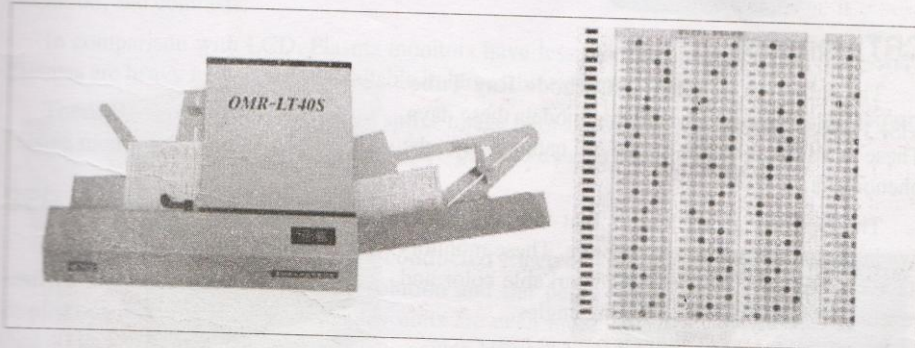
Bar Code Reader is a device used for reading bar coded data (data in form of light and dark lines). Bar coded data is generally used in labelling goods/things, numbering the books etc. It may be a hand held scanner or may be embedded in a stationary scanner.

Bar Code Reader scans a **bar code image**, converts it into an **alphanumeric value** which is then fed to the computer to which bar code reader is connected.



Optical Mark Reader (OMR)

OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked. It is specially used for checking the answer sheets of examinations having multiple choice questions.



OUTPUT DEVICES

Following are few of the important output devices which are used in Computer Systems:

1. Monitors
2. Printer
3. Plotter

MONITORS

Monitor commonly called as Visual Display Unit (VDU) is the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of the pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat- Panel Display

Types of Monitors

Now days, monitors available in markets are of many different kinds; unlike older days, when people do not have options other than CRT Monitors.

Arrival of new technologies has made monitors more compact, more eyes friendly and easy to use. Take the example of **LCD, Plasma, DLP, Touch Screen** and other modified kinds of monitors and display devices. Before going on the types of monitors, let us have a little introduction what monitors are and how they work. Monitors are referred to as visual display unit for computer systems. Monitors are, in usual, assembled using an enclosure, circuitry and display device.

Monitors are available in different sizes; their sizes are measured as from the diagonal of the rectangular screen. Monitors are available from **12" to 42"**, which you can pick according to your needs and space you have.

Here, in this piece of writing, we would be discussing some types of monitors. Some of which are not more in use, while some can be found easily, on the other hand, few are used for commercial or special purposes only.

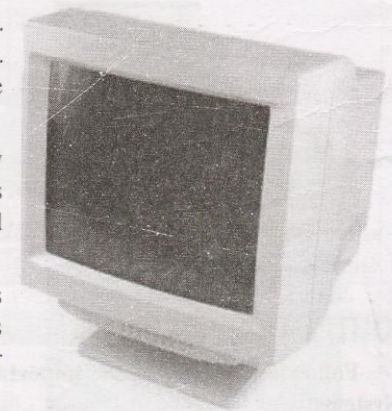
CRT Monitors

The full form of **CRT** is **Cathode Ray Tube**. CRT is oldest among all available models these days. These monitors function on the old cathode ray tube phenomena.

The best thing in CRTs is that they are easily available and are in cheaper in price. These monitors have high dynamic range and remarkable color and resolutions with excellent viewing angles.

These monitors allow the use of external devices like light pens and light guns. One of the drawbacks of these monitors is their weight and another is their size.

They consume more power, like many other old electrical and electronic appliances. That is why; experts on energy do not advice to buy CRT.



LCD Monitors

The full form of **LCD** is **Liquid Crystal Display** monitors are not the latest but the later version than CRT monitors. Unlike CRT monitors, these monitors are compact and slim.

These monitors do consume low and almost have no dependency on backlight technology. Due to its quality of consuming low power and compact in shape and size, it has been well adapted in the time when energy efficiency is the main concern.

In spite of all these technological modest characteristics, these monitors have limited viewing angles, colors, and contrasts. Issues like bleeding and distorting brightness from edges and some more related issues have been reported in some models.



Plasma Monitors

Plasma screen or plasma monitors are considered as high contrast screen with bright, vibrant colors and brightness that claims to make your visual experience worthwhile.

It works on plasma discharge on almost ideally flat panel of glass. The discharge is composed of xenon and neon without any use of mercury in it. Plasma monitors are in, mainly because of their excellent and remarkable viewing angles, color saturation, and contrasts.

In comparison with LCD, Plasma monitors have less blocky-looking picture. However, Plasmas are heavy in weight and available in larger dimensions only.

These kinds of monitors do easily suffer image burn-in. Unlike other monitors like CRT, Plasma monitors do not allow use of optical objects like lights pens and light guns.



SED Monitors

The full form of **SED** is **Surface-conducted Electron-emitted Display**. These are high resolution and flat panel display screens. Some of these display units are even more than 40 inches in diagonal measurements.

These display units are composed from an electron-emitting array and layer of phosphorus. Array and layer of phosphorus are separated by thin sheet that allows air to pass. SED consumes less energy in comparison with CRT and it gives higher resolution picture.



PRINTERS

Printer is the most important output device, which is used to print information on paper.

There are two types of printers

- Impact Printers
- Non-Impact Printers

Impact Printers

The printers that print the characters by striking against the ribbon and onto the paper are called impact printers.

Characteristics of Impact Printers are following

1. Very low consumable costs.
2. Impact printers are very noisy.
3. Useful for bulk printing due to low cost.
4. There is physical contact with the paper to produce an image.

These printers are of two types

1. Character printers
2. Line printers

Character Printers

Character Printers are printers which print one character at a time.

These are of further two types

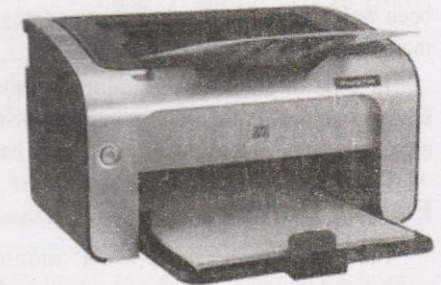
1. Dot Matrix Printer(DMP)
2. Daisy Wheel

Dot Matrix Printer

In the market one of the most popular printer is Dot Matrix Printer because of their ease of printing features and economical price. Each character printed is in form of pattern of Dot's and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which comes out to form a character that is why it is called Dot Matrix Printer.

Advantages

- Inexpensive.
- Widely Used.
- Other language characters can be printed.

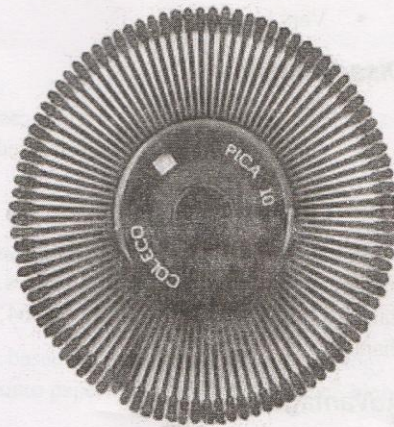


Disadvantages

- Slow Speed.
- Poor Quality.

Daisy Wheel

Head is lying on a wheel and Pins corresponding to characters are like **petals of Daisy (A type off lower)** that is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices which require a few letters to be sent here and there with very nice quality representation.



Advantages

- More reliable than Dot Matrix Printers.
- Better quality.
- The fonts of character can be easily changed.

Disadvantages

- Slower than Dot Matrix Printers.
- Noisy.
- More expensive than Dot Matrix Printers.

Line Printers

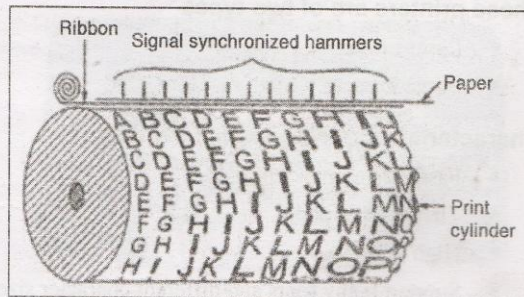
Line printers are printers which print one line at a time.

These are of further two types

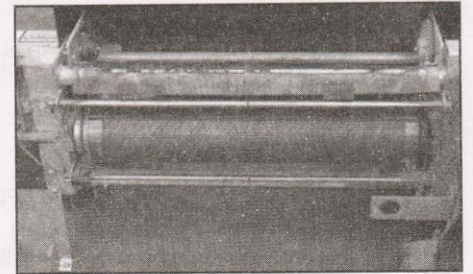
- Drum Printer
- Chain Printer

Drum Printer

This printer is like a drum in shape so it called drum printer. The surface of drum is divided into number of tracks. Total tracks are equal to size of paper i.e for a paper width of 132 characters, Drum will have 132 tracks. A character set is embossed on track. The different characters sets are available in market 48 character set, 64 and 96



characters set. One rotation of drum prints one line. Drum Printers are fast in speed and speed in between 300 to 2000 lines per minute.



Advantages

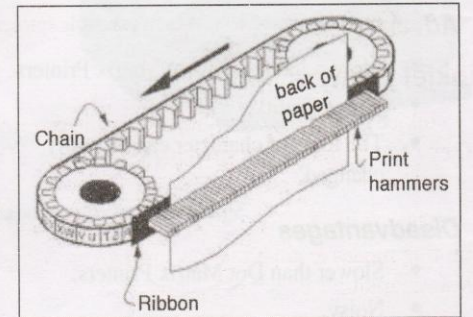
- Very high speed.

Disadvantages

- Very expensive.
- Characters fonts can't be changed.

Chain Printer

In this printer chain of character sets are used so it called Chain Printers. A standard character set may have 48, 64, 96 characters.



Advantages

- Character fonts can easily be changed.
- Different languages can be used with the same printer.

Disadvantages

- Noisy.
- Do not have the ability to print any shape of characters.

Non-impact Printers

The printers that print the characters without striking against the ribbon and onto the paper are called Non-impact Printers. These printers print a complete page at a time and also called as Page Printers.

These printers are of two types

- Laser Printers
- Inkjet Printers

Characteristics of Non-impact Printers

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