

# CHAPTER 1

## HARDWARE CONCEPTS

### BASIC COMPUTER OPERATIONS

A computer as shown below performs basically five major operations or functions irrespective of their size and make. These are 1) it accepts data or instructions by way of input, 2) it stores data, 3) it can process data as required by the user, 4) it gives results in the form of output, and 5) it controls all operations inside a computer. We discuss below each of these operations.

**1. Input:** This is the process of entering data and programs in to the computer system. You should know that computer is an electronic machine like any other machine which takes as inputs raw data and performs some processing giving out processed data. Therefore, the input unit takes data from us to the computer in an organized manner for processing.

**2. Storage:** The process of saving data and instructions permanently is known as storage. Data has to be fed into the system before the actual processing starts. It is because the processing speed of Central Processing Unit (CPU) is so fast that the data has to be provided to CPU with the same speed. Therefore the data is first stored in the storage unit for faster access and processing. This storage unit or the primary storage of the computer system is designed to do the above functionality. It provides space for storing data and instructions.

The storage unit performs the following major functions: All data and instructions are stored here before and after processing. Intermediate results of processing are also stored here.

**3. Processing:** The task of performing operations like arithmetic and logical operations is called processing. The Central Processing Unit (CPU) takes data and instructions from the storage unit and makes all sorts of calculations based on the instructions given and the type of data provided. It is then sent back to the storage unit.

**4. Output:** This is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.

**5. Control:** The manner how instructions are executed and the above operations are performed. Controlling of all operations like input, processing and output are performed by control unit. It takes care of step by step processing of all operations in side the computer.

### **Arithmetic Logical Unit (ALU)**

After you enter data through the input device it is stored in the primary storage unit. The actual processing of the data and instruction are performed by Arithmetic Logical Unit. The major operations performed by the **ALU** are addition, subtraction, multiplication, division, logic and comparison. Data is transferred to **ALU** from storage unit when required. After processing the output is returned back to storage unit for further processing or getting stored.

### **Control Unit (CU)**

The next component of computer is the Control Unit, which acts like the supervisor seeing that things are done in proper fashion. The control unit determines the sequence in which computer programs and instructions are executed. Things like processing of programs stored in the main memory, interpretation of the instructions and issuing of signals for other units of the computer to execute them. It also acts as a switch board operator when several users access the computer simultaneously. Thereby it coordinates the activities of computer's peripheral equipment as they perform the input and output. Therefore it is the manager of all operations mentioned in the previous section.

### **Central Processing Unit (CPU)**

The **ALU** and the CU of a computer system are jointly known as the central processing unit. You may call CPU as the brain of any computer system. It is just like brain that takes all major decisions, makes all sorts of calculations and directs different parts of the computer functions by activating and controlling the operations.

### **Personal Computer Configuration**

Now let us identify the physical components that make the computer work. These are

1. Central Processing Unit (CPU)
2. Computer Memory (RAM and ROM)
3. Data bus
4. Ports
5. Motherboard
6. Hard disk
7. Output Devices
8. Input Devices

All these components are inter-connected for the personal computer to work.

### **Memory**

There are two kinds of computer memory: **primary and secondary**. Primary memory is accessible directly by the processing unit. RAM is an example of primary memory. As soon as the computer is switched off the contents of the primary memory is lost. You can store and retrieve data much faster with primary memory compared to secondary memory. Secondary memory such as floppy disks, magnetic disk, etc., is located outside the computer. Primary memory is more expensive than secondary memory. Because of this the size of primary memory is less than that of secondary memory.

**Random Access Memory (RAM):** The primary storage is referred to as random access memory (RAM) because it is possible to randomly select and use any

location of the memory directly store and retrieve data. It takes same time to any address of the memory as the first address. It is also called read/write memory. The storage of data and instructions inside the primary storage is temporary. It disappears from RAM as soon as the power to the computer is switched off. The memories, which loose their content on failure of power supply, are known as volatile memories .So now we can say that RAM is volatile memory.

**Read Only Memory (ROM):** There is another memory in computer, which is called Read Only Memory (ROM). Again it is the ICs inside the PC that form the ROM. The storage of program and data in the ROM is permanent. The ROM stores some standard processing programs supplied by the manufacturers to operate the personal computer. The ROM can only be read by the CPU but it cannot be changed. The basic input/output program is stored in the ROM that examines and initializes various equipment attached to the PC when the switch is made ON. The memories, which do not loose their content on failure of power supply.

### **Input Devices**

Input devices are necessary to convert our information or data in to a form which can be understood by the computer. A good input device should provide timely, accurate and useful data to the main memory of the computer for processing followings are the most useful input devices.

**Keyboard:** - This is the standard input device attached to all computers. The layout of keyboard is just like the traditional typewriter of the type QWERTY. It also contains some extra command keys and function keys. It contains a total of 101 to 104 keys.. You have to press correct combination of keys to input data. The computer can recognise the electrical signals corresponding to the correct key combination and processing is done accordingly.

**Mouse:** - Mouse is an input device ,that is used with your personal computer. It rolls on a small ball and has two or three buttons on the top. When you roll the mouse across a flat surface the screen sensors the mouse in the direction of mouse movement. The cursor moves very fast with mouse giving you more freedom to work in any direction. It is easier and faster to move through a mouse.

**Scanner:** The keyboard can input only text through keys provided in it. If we want to input a picture the keyboard cannot do that. Scanner is an optical device that can input any graphical matter and display it back. The common optical scanner devices are Magnetic Ink Character Recognition (MICR), Optical Mark Reader (OMR) and Optical Character Reader (OCR).

**Optical Character Recognition (OCR):** - This technique unites the direct reading of any printed character. Suppose you have a set of hand written characters on a piece of paper. You put it inside the scanner of the computer. This pattern is compared with a site of patterns stored inside the computer. Whichever pattern is matched is called a character read. Patterns that cannot be identified are rejected. OCRs are expensive though better the MICR.

**Smart Card Reader:** Smart Card Readers are also known as card programmers (because they can write to a card), card terminals, card acceptance device (CAD), or an interface device (IFD). There is a slight difference between the card reader and the terminal. The term 'reader' is generally used to describe a unit that interfaces with a PC for the majority of its processing requirements. In contrast, a 'terminal' is a self-contained processing device. Smart cards are portable data cards that must communicate with another device to gain access to a display device or a network. Cards can be plugged into a reader commonly referred to as a card terminal, or they can operate with radio frequencies (RF). When the smart card and the card reader come in contact, each identifies itself to the other by sending and receiving information. If the messages exchanged do not match, no further processing takes place. So, unlike ordinary bank cards, smart cards can defend themselves against unauthorized users and uses in innovative security measures.

**Barcode Reader:** A barcode reader, also called a price scanner or point-of-sale scanner, is a hand-held or stationary input device used to capture and read information contained in a bar code. A barcode reader consists of a scanner, a decoder (either built-in or external), and a cable used to connect the reader with a computer. Because a barcode reader merely captures and translates the barcode into numbers and/or letters, the data must be sent to a computer so that a software application can make sense of the data. Barcode scanners can be connected to a computer through a serial port, keyboard port, or an interface device called a wedge. A barcode reader works by directing a beam of light across the bar code and measuring the amount of light that is reflected back. (The dark bars on a barcode reflect less light than the white spaces between them.) The scanner converts the light energy into electrical energy, which is then converted into data by the decoder and forwarded to a computer.

There are five basic kinds of barcode readers -- pen wands, slot scanners, Charge-Couple Device ( CCD ) scanners, image scanners, and laser scanners.

**Biometric Sensor:** Biometric sensors/detectors are useful in several industries as well as consumers who can put them to use in access control and identity access management and information technology applications. Sensors and detectors are semiconductors (meaning its electric conductivity is in between a conductor and an insulator) which use algorithms to process images from the user's physical characteristics.

Biometric sensors work by producing electrical currents when they scan a user's physical characteristic. Many physical characteristics may be scanned by a biometric sensor including eyes, fingerprints, or DNA. Sensors contain an analog to digital converter enabling it to digitize the image and store the digital information in memory so that it can verify the user next time he or she needs to authenticate their identity.

**Web Camera:-**A web camera (or webcam) is a real time camera whose images can be accessed using the World Wide Web, instant messaging, or a PC video calling application. Generally, a digital camera delivers images to a web server, either continuously or at regular intervals. A webcam is also the name of a class of video camera devices which connect directly to the PC for the purpose of video calling over the internet. The first webcam was pointed at the Trojan room coffee pot in the computer science department of Cambridge University. This webcam is now defunct, as it was finally switched off on 22 August 2001

Initially intended for personal videoconferencing, it was quickly realised that World Wide Web users enjoyed viewing images from cameras set up by others elsewhere in the world. While webcam refers to the technology generally, the "Web" part is often replaced with the "Category" of images the camera provides. Today there are thousands of webcam that provide views into homes, offices and other buildings as well as providing panoramic views of cities (Metrocams) and the countryside. Images from satellites are frequently posted on the World Wide Web. Webcams are also used to monitor traffic with TrafficCams, the weather with WeatherCams and even volcanos with VolcanoCams.

**Visual Display Unit:** The most popular input/output device is the Visual Display Unit (VDU). It is also called the monitor. A Keyboard is used to input data and Monitor is used to display the input data and to receive messages from the computer. A monitor has its own box which is separated from the main computer system and is connected to the computer by cable. In some systems it is compact with the system unit. It can be color or monochrome.

**Terminals:** It is a very popular interactive input-output unit. It can be divided into two types: hard copy terminals and soft copy terminals. A hard copy terminal provides a printout on paper whereas soft copy terminals provide visual copy on monitor. A terminal when connected to a CPU sends instructions directly to the computer. Terminals are also classified as dumb terminals or intelligent terminals depending upon the work situation.

**Printer:** It is an important output device which can be used to get a printed copy of the processed text or result on paper. There are different types of printers that are designed for different types of applications.

Depending on their speed and approach of printing, printers are classified as impact and non-impact printers.

**Impact printers:** use the familiar typewriter approach of hammering a typeface against the paper and inked ribbon. Dot-matrix printers are of this type.

**Non-impact printers:** do not hit or impact a ribbon to print. They use electro-static chemicals and ink-jet technologies. Laser printers and Ink-jet printers are of this type. This type of printers can produce color printing and elaborate graphics.

**Ink-jet (bubble-jets) printers:** Ink-jets(bubble-jets) printers spray ionized tiny drops of ink onto a page to create an image. This is achieved by using magnetized plates which direct the ink's path onto the paper in the desired pattern. Almost all ink-jets offer a color option as standard, in varying degrees of resolution.

**Laser Printers:** Laser printers operate by shining a laser beam to produce an image on a drum. The drum is then rolled through a pool, or reservoir, of toner, and the electrically charged portions of the drum pick up ink. Finally, using a combination of heat and pressure, the ink on the drum is transferred onto the page. Laser printers print very fast, and the supply cartridges work a long time. Color laser printers use the same toner-based printing process as black and white ( B/W) laser printers, except that they combine four different toner colors.

**Plotters:** Plotters are large-scale printers that are very accurate at reproducing line drawings. They are commonly used for technical drawings such as engineering drawings or architectural blueprints. The two basic types of plotters are called flatbed plotters and drum plotters. Flatbed plotters are horizontally aligned with a flat surface to which a piece of paper is attached. The paper remains stationary and the printer moves pens across the paper to draw the image. Drum plotters, also called upright plotters, are vertically positioned. They have a drum that the paper rolls on. Drum plotters usually make more noise and are more compact than flatbed plotters.

**Secondary Storage Device:** Alternatively referred to as external memory and auxiliary storage, secondary storage is a storage medium that holds information until it is deleted or overwritten regardless if the computer has power. For example, a floppy disk drive and hard disk drive are both good examples of secondary storage devices.

**Magnetic Tapes:** The Magnetic Tapes is the Type of Secondary Storage Device and this Device is used for taking back up of data and this Tape contains some magnetic fields and the Magnetic Tapes are used Accessing the data into the Sequential Form and the Tape Also Contains a Ribbon which is coated on the Single Side of the Tape and also contains a head which reads the data which is Recorded on to the Tape. And when we are reading the information from the disk then we can also read backward information means we can also back the Tape for Reading the Previous information. And For inserting the Tape into the System we also Requires Some Tape Drives Which Contains Tape and which is Responsible for Reading the contents from the Tapes. They can Store huge Amount of data into the Tape Drive , But the Main Limitation of the Tape Drive is that we cant Access the Data from the Disks directly means if we wants to 100th Record from the Tape then we must have to move all the Previous i.e. 99th Records first. And the Tapes are also easily damaged due to the Human Errors.

**Magnetic Disks :** - This is also called as the hard disk and this is made from the thin metal platter which is coated on the both sides of the magnetic Disks. And the there

are Many Plates or Platters into a single hard disk and all the Plates are Made from the Magnetic Materials and all the Disks are Rotate from the 700 to 3600 rpm means Rotation per Minute and the hard disk also Contains a head which is used for both Reading and Writing the Data from the Hard Disks.

The Plate of Disk is Divided into the Tracks and sectors and the collection of Tracks makes a Cylinder means all the Tracks of the Disk which a Consecutive Areas makes a Cylinder.

**Floppy Diskette:** Floppy disk is a kind of storage device that can be used to carried around? The Floppy Disk is also a Secondary Storage device which is used for storing the data in a Permanent Manner. The floppy is made up of Rigid Mylar Plastic and also contains a Magnetic black disk inside the Plastic Cover. The Floppy Disk also Stores all the Data into the Form of Tracks and Sectors and the floppy Disk provides both Reading and Writing the data into the Disk. The Floppy Disk is also called as Reusable Disk means the Floppy Disk Provides us the Facility to Read and Writes the Data into disk as and When Necessary and Also Many Times. We can Read and Write the data from the Disk.

**DVD:** DVD stands for Digital Versatile/Video Disc, DVDR stands for DVD Recordable and DVDRW for DVD Re-Writeable. If you're familiar with regular audio/music CDs or regular DVD-Video discs, then you will know what a recordable DVD looks like. A recordable DVD stores up to 2 hours of very good quality DVD-Video, including several audio tracks in formats like stereo, Dolby Digital or DTS and also advanced menu systems, subtitles and still pictures that can be played by many standalone DVD Players and most computer DVD-ROMs. If you choose to lower the video quality it is possible to store several hours video on a recordable DVD using low bit rates and low resolution with video quality more like VHS, SVHS, SVCD, CVD or VCD. It is also possible to have up to 4.37 GB ordinary data or mix DVD-Video and data on a recordable DVD that can be played by most computer DVD-ROMs.

**USB Drives:** USB Drives USB drives are known by a myriad of names, including thumb drives (since the most common size is that of your thumb), jump drives and flash drives. USB drives are currently available in USB 2.0 with USB 3.0 hitting the market now. These small plug-and-play drives are removable, re-writable, and great for storing personal and professional data, as many are hardware-encrypted devices for ultimate security.

**Memory Card:** A memory card (sometimes called a flash memory card or a storage card) is a small storage medium used to store data such as text, pictures, audio, and video, for use on small, portable or remote computing devices. Most of the current products use flash memory, although other technologies are being developed. There are a number of memory cards on the market, including the SD card (secure digital card), the CF card (Compact Flash card), the Smart Media card, the Memory Stick, and the Multimedia Card.