Unit-2

Input, Hard/Soft Copy Devices, Storage Devices

Input Devices

These are those devices, which facilitate a user to give input. Information is entered in to a computer through input devices. An input device converts input information in to suitable binary format, which can be accepted by the computer system. Some examples of input devices are keyboard, mouse, Light pen etc. Some of theses devices permit the user to select some thing on the CRT screen by pointing to it. Therefore, these devices are also known as pointing devices.

The computer system has to process details of each command, therefore the command will have to be converted in to machine readable format and this work can be done through input unit. This unit will transmit the data as a series of electric pulses in to the computer memory unit, where it will be available for processing. These devices translate the data into a code that can be read by the computer's system electronic circuitry.

Keyboard

Keyboard is one of the most widely used peripheral devices. Data is entered in to the computer system through keyboard. Keyboards are designed for the input of text and characters and also to control the operation of a computer. A keyboard is similar to the keyboard of a type-writer.

Physically, computer keyboards are an arrangement of rectangular or near-rectangular buttons, or "keys". Keyboards typically have characters engraved or printed on the keys; in most cases, each press of a key corresponds to a single written symbol. Keyboard come in a variety of sizes and shapes, But most of the keyboard have a common number of features like:

1. Standard type writer keys
2. Function keys
3. Special purpose keys
4. Cursor Movement Keys
5. Numeric keys

Working Of A Keyboard

1. When a key is pressed, it pushes down on a rubber dome sitting beneath the key. A conductive contact on the underside of the dome touches a pair of conductive lines on the circuit below.
2. This bridges the gap between them and allows current to flow.
3. A scanning signal is emitted by the chip along the pairs of lines to all the keys. When the signal in one pair becomes different, the chip generates a "make code" corresponding to the key connected to that pair of lines.
4. The code generated is sent to the computer through a keyboard cable.
5. A chip inside the computer receives the signal bits and decodes them into the appropriate keypress. The computer then decides what to do on the basis of the key pressed. Eg: Either display a character on the screen, or perform some action.

2.1.2 Mouse

This input deice is used especially for Graphica User Interface. Mouse is a device which is used to move the cursor on the screen and to select options. When the mouse is moved on the surface the cursor is also moved in the same direction on the monitor. By moving the mouse the user can point to menu on the screen i..e. Mouse is also known as pointing device. Pressing the button of a mouse is known as clicking. Technicians often describe mouse speed in DPI(dots per inch). One DPI is intended to be the number of pixels the mouse cursor will move when the mouse is moved one inch.

Some common types of mouse are

Mechanical Mouse

This type of mouse are used on personal computer.It has a rubber ball inside it , which can roll in any direction. There is a mechanical sensor which is present inside the mouse and which is able to detect the direction of rolling the ball and moves the pointer according to that.

1 Moving the mouse turns the ball.
2 X and Y rollers grip the ball and transfer movement.
3 Optical encoding disks include light holes.

4 Infrared LED shine through the disks.
5 Sensors gather light pulses to convert to X and Y velocities.

Optical Mouse

This mouse works on the basis of light source and the base where optical mouse kept should be clean. The statement does not mean that any special base is needed: we should required the base where 50% of the light should be reflected. An optical mouse uses a light-emitting diode and photodiodes to detect movement relative to the underlying surface, rather than moving some of its parts — as in a mechanical mouse.

2.1.3   Light Pen

A light pen is a pointing device.It is an input device in the form of a light-sensitive wand used in conjunction with the computer's CRT monitor. It allows the user to to select a displayed menu option on the CRT. A light pen can work with any CRT-based monitor, but not with LCD screens, projectors or other display devices. It is capable of sensing a position on the screen when its tip touches it ,its photocell sensing element detects the light coming on the screen and sends the corresponding signal to the processor.

2.1.4   Touch Screens

It is a type of display screen in which one can use finger to point the command displayed on the screen. In this user touches the icon that represent their choices and the computer display information about their choices.
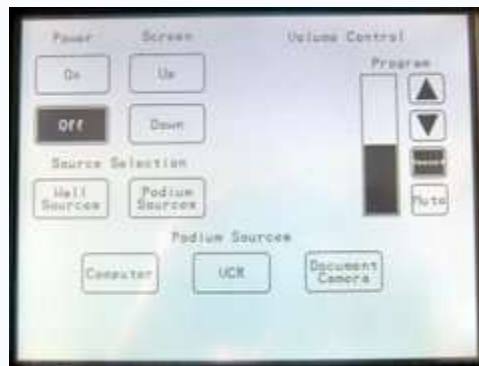
There are some types of touch screen technology:

1. A resistive touch screen panel is coated with a thin metallic electrically conductive and resistive layer that causes a change in the electrical current which is registered as a touch event and sent to the controller for processing.
2. Surface wave technology uses ultrasonic waves that pass over the touch screen panel. When the panel is touched, a portion of the wave is absorbed. This change in the ultrasonic waves registers the position of the touch event and sends this information to the controller for processing.

2.1.5 Joystick

A joystick is a personal computer peripheral devices. It is also used to move the cursor position on the CRT screen. Most joysticks are two-dimensional, having two axes of movement, but three-dimensional joysticks do exist. A joystick is generally configured so that moving the stick left or right signals movement along the X axis, and moving it forward (up) or back (down) signals movement along the Y axis. Joysticks are often usedto control games.

2.1.6 MICR

Magnetic Ink Character Recognition, or MICR, is a special kind of character recognition technology that was adopted mainly by the banking industry to facilitate the processing of cheques. A special ink called magnetic ink is used to write the character of the cheques and deposit forms which are to be processed by an MICR. The magnetic ink is magnetized during the input process. The MICR reads these pattern and compared with the special pattern stored in the memory. This method is fast, accurate and automatic. Moreover, the the chances of errors are negligible.

2.1.7 OCR

It is an abbreviated form of Optical Character Reader. It detects the alphanumeric character printed on paper. It is a computer software designed to translate images of handwritten or typewritten text into machine-editable text, or to translate pictures of characters into a standard encoding scheme representing them (e.g. ASCII or Unicode). It works on the basis of light scanning techniques in which each character is illuminated by the light source and the reflected images of the character is received by the photocells which provides binary data corresponding to the lighted and dark areas.OCR is quite costly because the memory requirement is very high.

2.1.8 Bar Code Reader

Bar code is a machine readable numerical code, printed as a set of varying width vertical bars.Bar codes are used in many applications where strict control of inventory is needed. A barcode reader is a computer peripheral for reading barcodes printed on various surfaces.As you know bar codes are present on most of the grocery item, it consist of a

number of thick lines with a varying distance between them.A barcode reader scans the bar code, and converts it into a number that the computer that the computer can then process and display on the screen. Bar code reader, generally consists of a light source, a lens and a photo conductor translating optical impulses into electrical ones. Therefore, it read such bars and convert thm in to electrical pulses which is processed by the computer.

Benefits of using barcodes

- Barcodes can provide very detailed up-to-date information , enabling decisions to be made much quicker and with more confidence.
- Bar code scanners are also relatively low costing and extremely accurate – only about 1/100000 entries will be wrong.

Types of barcodes:

- Linear barcodes

- Stacked barcodes

- 2D barcodes: A matrix code, also known as a 2D barcode, is a two-dimensional way of representing information. It is similar to a linear (1-dimensional) barcode, but has more data representation capability.

2.1.9   Digital Camera

A digital camera is an electronic device used to capture and store photographs electronically instead of using photographic film like conventional cameras. Digital cameras are those cameras whose primary purpose is to capture photography in a digital format. In this once the picture is taken then it can be transferred or downloaded it in to the computer.

Many modern digital photography cameras have a video function, and a growing number of camcorders have a still photography function. The resolution of a digital camera is

determined by the camera sensor which is usually a Charged Coupled Device or CCD chip that turns light into digital information, replacing the job of film in traditional photography. It represents this light value in pixels, which are little squares that make up the image. Each pixel can store one digital value, which can then be recalled and put with other pixel values to generate a digital photograph. The more pixels the camera can recall, the better the resolution it can offer. Many digital cameras can connect directly to a computer to transfer data. Early cameras used the PC serial port. Digital cameras need memory to store data. Common formats for digital camera images are the Joint Photography Experts Group standard (JPEG).

2.1.10   Web Camera

A web camera (or webcam) is a real-time camera whose images can be accessed using the World Wide Web. Web-accessible cameras typically involve a digital camera which uploads images to a web server, either continuously or at regular intervals. Web camera focuses on an object at one end and reflect it on the screen at the other end. You can be able to see the person while chatting by the help of this web camera. Videoconferencing cameras typically take the form of a small camera connected directly to a PC. Webcams typically include a lens, an image sensor, and some support electronics.

2.1.11   Graphic Tablet

A graphics tablet is a computer input device that allows one to hand-draw images and graphics, similar to the way one draws images with a pencil and paper.Graphics tablets consist of a flat surface upon which the user may "draw" an image using an attached stylus,it is just a pen-like drawing apparatus. The image generally does not appear on the tablet itself but, it is displayed on the computer monitor. The stylus is a technology, that was originally designed as a part of the electronics, but later it simply took on the role of providing a smooth, but accurate "point" that would not damage the tablet surface while "drawing".

Graphics tablets, because of their stylus-based interface has the ability to detect pressure, tilt, and other attributes of the stylus and its interaction with the tablet, are widely considered to offer a very natural way to create computer graphics, especially two-dimensional computer graphics. The first home computer graphics tablet was the KoalaPad. ACE CAD Enterprise Co. Ltd, Aiptek, Wacom are some of the manufacturer f the graphic tablet. Some examples are:

- the Crosfield imaging system

- the Quantel Paintbox

2.1.12   Microphone (Mic)

A microphone, sometimes referred to as a mike or mic.It is an electric transducer that converts sound into an electrical signal. The first commercially practical microphone was the carbon microphone conceived in October, 1876 by Thomas Edison. A microphone is a device which is able to capture waves in air, water or hard material and translate it to an electrical signal.

Microphones are used in many applications such as telephones, tape recorders, hearing aids, in radio and television broadcasting and in computers for recording voice, and numerous other computer applications.

2.1.13 Scanner

Scanner is that kind of input device which are capable of entering the information directly in to the computer system. A scanner is a device that analyzes an image such as a photograph, printed text, or handwriting and converts it to a digital image.

Scanners typically read red-green-blue color (RGB) data from the array. This data is then processed with some proprietary algorithm to correct for different exposure conditions and sent to the computer. The other qualifying parameter for a scanner is its resolution, measured in pixels per inch (ppi). The third important parameter for a scanner is its density range. A high density range means that the scanner is able to reproduce shadow details and brightness details in one scan.

Scanner works on the basis of light source. In this light source emit the light to the object. Some amount of light is absorbed by the object, wherease some amount of light is reflected by it to the sensor. The work of the sensor is to convert that amount of light into the digital data and the that digital data is transmitted to the computer.

object

Light source

Sensor
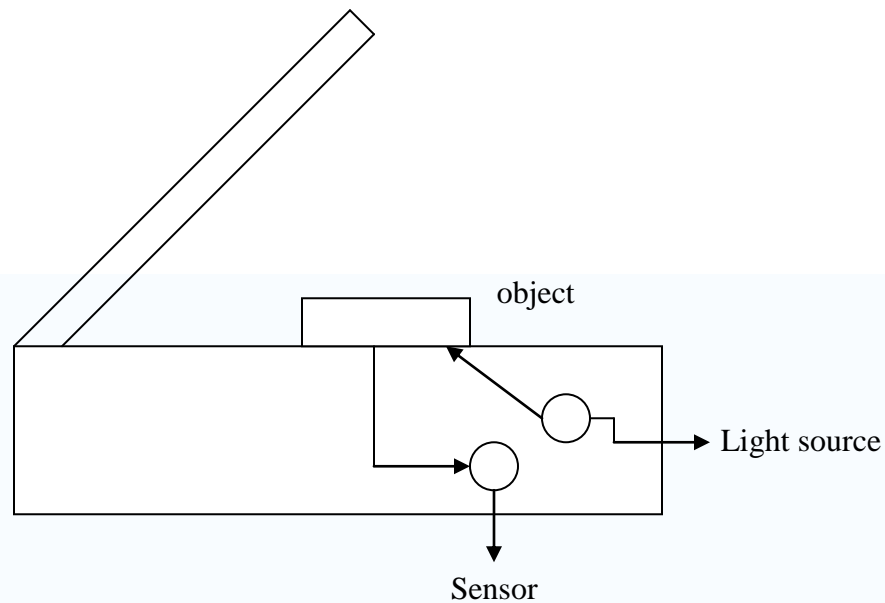
Side View Of The Scanner

Types Of Scanner

Drum scanners: Drum scanners capture image information with photomultiplier tubes (PMT). It is of medium size. In this drum roles over the image for scanning. The scanner drum, which rotates at high speed while it passes in front of the precision optics that deliver image information to the PMTs. The Most modern color drum scanners use 3 matched PMTs, which read red, blue and green light respectively. Drum scanners are rarely used to scan prints of high quality because inexpensive flatbed scanners are readily available.

Flatbed scanner: A flatbed scanner is usually composed of a glass pane, under which there is a bright light which is often of cold cathode fluorescent which illuminates the pane. Images to be scanned are placed face down on the glass and the sensor array and light source move across the pane reading the entire area.

Hand scanner: Hand scanners are manual devices which are dragged across the surface of the image to be scanned. They typically have a "start" button which is held by the user for the duration of the scan, some switches to set the optical resolution, and a roller which generates a clock pulse for synchronisation with the computer. Most hand scanners were monochrome, and produced light from an array of green LEDs to illuminate the image.

Scanner quality

Scanners typically read red-green-blue color (RGB) data from the array. This data is then processed with some proprietary algorithm to correct for different exposure conditions and sent to the computer, via the device's input/output interface (usually SCSI or USB, or LPT in machines pre-dating the USB standard). Color depth varies depending on the scanning array characteristics, but is usually at least 24 bits. High quality models have 48 bits or more color depth. The other qualifying parameter for a scanner is its _resolution_, measured in pixels per inch (ppi), sometimes more accurately referred to as samples per inch (spi). Instead of using the scanner's true optical resolution, the only meaningful parameter, manufacturers like to refer to the _interpolated resolution_, which is much higher thanks to software interpolation., a good flatbed scanner has an optical resolution of 1600–3200 ppi, high-end flatbed scanners can scan up to 5400 ppi, and a good drum scanner has an optical resolution of 8000–14,000 ppi.

The third important parameter for a scanner is its density range. A high density range means that the scanner is able to reproduce shadow details and brightness details in one scan.

2.1.14 Smart Card Reader

Smart cards were invented and patented in the 1970s. The first mass use of the cards was used for payment in French pay phones, starting in 1983. A smart card, is also known as chip card, or integrated circuit(s) card (ICC), is defined as any pocket-sized card with embedded integrated circuits. Although there is a diverse range of applications, there are two broad categories of ICCs. Memory cards contain only non-volatile memory storage components, and perhaps some specific security logic. Microprocessor cards contain memory and microprocessor components.

Smart cards stores data in the magnetic stripes which is present at the back side of the card. These data cannot be read visually, and therefore, to read this data, special card reader machine is required, which can decode data present on these magnetic strips.The smart card can hold many information and it is impossible to duplicate it because data is stored in magnetic strips. They can serve as multipurpose card such as credit card, electronic cash card etc.

There is a , Contact Smart Cards which has a small gold chip about ½ inch in diameter on the front. When inserted into a reader, the chip makes contact with electrical connectors that can read information from the chip and write information back. The cards do not contain any batteries, energy is supplied by the card reader. Contact smart card readers are used as a communications medium between the smart card and a host, e.g. a computer.

2.1.15   Biometric Sensor

Biometric sensor is a type of input device which is used for identifyind a person. This technology includes signature verification, voice recognition, finger prints identification. Automated Fingerprint Identification System (AFIS) or Automated Fingerprint Verification System refers to a computer system capable of establishing the identity of an individual through fingerprints. Automated Fingerprint Verification is used to refer to more civilan applications such as attendance and access control systems. On a technical level, verification systems verify a claimed identity (a user might claim to be John by presenting his PIN or ID card and verify his identity using his fingerprint) where as an identification system determines the identity based solely on fingerprints. The US government maintains an extensive database system containing fingerprint and criminal history system that is maintained by the Federal Bureau of Investigation (FBI).

Pointing Devices

The pointer is a graphical representation of the movements made by a pointing device. A pointing device is "An input device that is used to move the pointer on the computer screen."The most common pointing device is the mouse, other kinds include a tracker ball, touchpad, pointing stick, lightpen, and various other kinds of digitising tablets.

A mouse moves the graphical pointer by being slid across a smooth surface. The conventional roller-ball mouse uses a ball to create this action. The ball is in contact with two small shafts that are set at right angles to each other. As the ball moves these shafts

rotate, and the rotation is then measured by sensors within the mouse. The distance and direction information from the sensors is then transmitted to the computer. The computer then moves the graphical pointer on your screen by following the movements of the mouse. Another common mouse is the optical mouse. This device is very similar to the conventional mouse but it does not use a roller-ball. An optical mouse uses visible or infrared light to detect the changes in position.

A **trackball** is a pointing device consisting of a ball housed in a socket containing sensors to detect rotation of the ball about two axes. It is similar to an upside-down mouse. As the user rolls the ball with their thumb, fingers, or palm the mouse cursor on the screen will also move. Tracker balls are commonly used on CAD workstations for ease of use, where there may be no desk space on which to use a mouse. Some are able to clip onto the side of the keyboard and have buttons with the same functionality as mouse buttons.

A **touchpad** is a stationary pointing device. It is commonly used on laptop computers. It is flat surface that you slide your finger over to make the graphical pointer move. You use the same movements as you would with a mouse. It uses a two-layer grid of electrodes to measure finger movement. The upper layer has vertical electrode strips that handle vertical movement, and the lower layer has horizontal electrode strips to handle horizontal movements.

A **pointing stick** is a pointing device that is comparible to a touchpad. It is found on laptops embedded between the 'G', 'H', and 'B' keys. The mouse buttons are commonly placed just below the Spacebar. It operates by sensing the force applied by the user. It has also been observed on computer mice and on some desktop keyboards.

Digitizing tablet is "An input device that enables you to enter drawings and sketches into a computer. A digitizing tablet consists of an electronic tablet and a cursor or pen. A cursor (also called a puck) is similar to a mouse, except that it has a window with cross hairs for pinpoint placement, and it can have as many as 16 buttons. A pen (also called a stylus) looks like a simple ballpoint pen but uses an electronic head instead of ink. The tablet contains electronics that enable it to detect movement of the cursor or pen and translate the movements into digital signals that it sends to the computer." [5] This is different from a mouse because each point on the tablet represents a point on the screen.

OMR:

Optical mark recognition is the process of capturing data by contrasting reflectivity at predetermined positions on a page. By shining a beam of light onto the document the scanner is able to detect a marked area because it is more reflective than an unmarked surface. Some OMR devices use forms which are preprinted onto 'Transoptic' paper and measure the amount of light which passes through the paper, thus a mark on either side of the paper will reduce the amount of light passing through the paper.

It is generally distinguished from <u>optical character recognition</u> by the fact that a recognition engine is not required. That is, the marks are constructed in such a way that there is little chance of not reading the marks correctly. This requires the image to have high contrast and an easily-recognizable or irrelevant shape.

One of the most familiar applications of optical mark recognition is the use of #2 (HB in Europe) pencil bubble <u>optical answer sheets</u> in <u>multiple choice question</u> <u>examinations</u>. Students mark their answers, or other information, by darkening circles marked on a pre-printed sheet. Afterwards the sheet is automatically graded by a scanning machine.

Other examples of OMR are the <u>MICR</u> recognition of the numbers on the bottom of checks, scannable <u>bar codes</u>.

Disadvantages

There are also some disadvantages, limitations to OMR. If the user wants to gather large amounts of text then OMR complicates the data collection , there is also the possibility of missing data in the scanning process, incorrectly or unnumbered pages can lead to them being scanned in the wrong order. Also, unless safeguards are in place, a page could be rescanned providing duplicate data and skewing the data.For the most part OMR provides a fast, accurate way to collect and input data.

Digitizing:

Digitization, is the process of turning an <u>analog signal</u> into a <u>digital</u> <u>representation</u> of that signal. The term is often used for the scanning of analog sources, such as printed <u>photos</u> and taped <u>video</u> into computers for editing, but it also can refer to <u>audio</u> (where sampling rate is often measured in <u>kilohertz</u>) and textures map transformation.

In this last case, like in normal photos, sampling rate refers to the <u>resolution</u> of the image (often measured in <u>dots per inch</u>). Digitizing is the primary way of storing images in a form suitable for <u>transmission</u> and <u>computer</u> processing.

Voice Input Devices

In an effort to increase worker productivity, a substantial amount of research is being done in voice recognition-programming the computer has to recognizspoken commands. Voice Input devices or voice recognition system converts the spoken words into electrical signal by comparing the electrical patterns produced by the speakers voice with a set of pre recorded patterns. If matching pattern is found, the computer accept this pattern as a part of its standard vocabulary. This technology is also used by the people who are not able to use traditional devices.

The biggest problems with this technology involve limitation on the size of the computers vocabulary. Pronunciation differences among the individuals and the computers inability to accept continous speech.

Output Devices

The output devices receive information from the computer and provide them to user in a readable format. The computer sends information to the output devices in binary coded forms. Then, output devices convert them in to a form, which can be used by user. Some output devices are

- Printer
- Monitor
- Plotter
- Speaker

2.2.1 Printer

A computer printer, or more commonly just a printer, is a device that produces a hard copy which is permanent human-readable text of documents stored in electronic form, usually on physical print media such as paper or transparencies. Many printers are primarily used as computer peripherals, and are permanently attached to a computer which serves as a document source. Other printers, commonly known as network printer, have built-in network interfaces, and can serve as a hardcopy device for any user on the network. Some printers are combined with a scanners. A printer which is combined with a scanner can essentially function as a photocopier. Printers are designed for low-volume, short-turnaround print jobs; requiring virtually no setup time to achieve a hard copy of a given document. However, printers are generally slow devices, and the cost-per-page is relatively high. The choice of print engine has a substantial effect on what jobs a printer is suitable for, as different technologies are capable of different levels of image/text quality, print speed, low cost, noise; in addition, some technologies are inappropriate for certain types of physical media such as carbon paper or transparencies. Printers vary considerably in price, speed, resolution, noise level, paper-handling abilities, printing mechanism and quality and all of these points should be considered when making a selection. The data received by a printer may be:

1. a string of characters
2. a bitmapped image
3. a vector image

Some printers can process all three types of data, others not.

- Daisy wheel printers can handle only plain text data or rather simple point plots.
- Plotters typically process vector images.
- Modern printing technology, such as laser printers and inkjet printers, can adequately reproduce all three.

Printers which are used with computer can be classified in two ways. One way of classification of printer is how they print:

Character Printer: Character printer print one character at a time. Their speed lies in the range of 30-600 characters per second. It depends upon the type of printer.

Line Printer: Line printers, as the name implies, print an entire line of text at a time. It make use of a thermal technology. Three principle designs existed.

<div align="center">
Drum Printer
Chain Printer
Comb Printer
</div>

In **drum printers**, a drum carries the entire character set of the printer repeated in each column that is to be printed. The printer recieves all characters to be printed in one line of the text from the processor. The hammer hit the paper and ribbioon against the desired character on the drum when it comes in the printing position.

Ribbon   Synchronied Hammer

□ □ □ □ □ □ □ □ □ □

Paper

A B C D E F G H I J--
B C D E F G H I J K-
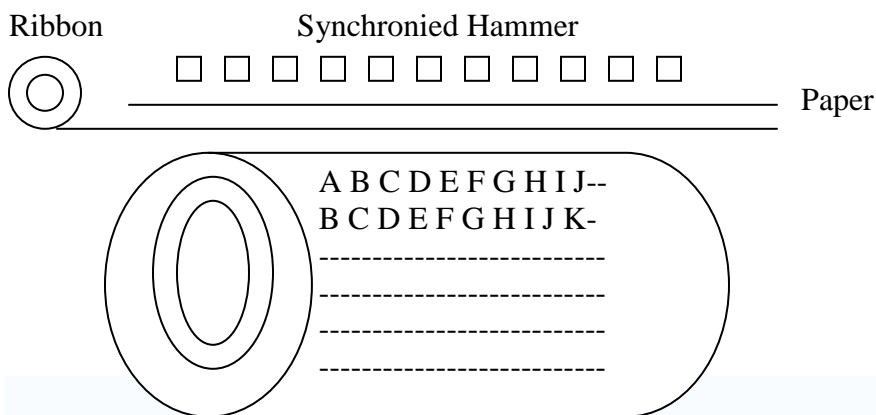
In **chain printers** which is also known as train printers, the character set is arranged multiple times around a chain that travels horizontally past the print line. In either case, to print a line, precisely timed hammers strike against the back of the paper at the exact moment that the correct character to be printed is passing in front of the paper. The paper presses forward against a ribbon which then presses against the character form and the impression of the character form is printed onto the paper.

Comb printers represent the third major design. These printers were a hybrid of dot matrix printing and line printing. In these printers, a comb of hammers printed a portion of a row of pixels at one time. By shifting the comb back and forth slightly, the entire pixel row could be printed.

Another way of classifying the printer is on the basis of manufacture:

Impact Printer: Impact printer use electromechanical mechanism that causes hammer or pin to strike against a ribbon and a paper to print the text. A printer that forms an image on paper by forcing a character image against an inked ribbon. Dot-matrix, Daisy-wheel etc are impact printer.

Non Impact Printer: A printer that creates an image without striking a ribbon against the paper.It does not use electromechanical printing head to strike against ribbon and paper.These type of printer use thermal, chemical, electrostatic, laser beam or inkjet technology for printing the text. A nonimpact printer is faster than impact printer. Non impact printer include thermal printer, inkjet printer and laser printer. These printer are all much quieter in operation than impact printer.

2.2.1.1 Dot Matrix Printer

It is a type of impact printer. The term dot matrix printer is specifically used for impact printers that use a matrix of small pins to create precise dots. The advantage of dot-matrix over other impact printers is that they can produce graphical images in addition to text; however the text is generally of poorer quality than impact printers that use letter forms.

In this character is printed by printing the selected no of dots from a matrix of dot. The formation of a character has been shown 5 dot rows and 7 dot columns. This pattern is called 5*7 dot matrix. Such printers would have either 9 or 24 pins on the print head. Print head is that part of the printer that creates the printed image. 24 pin print heads were able to print at a higher quality. Dot matrix printers were one of the more common types of printers used for general use - such as for home and small office use. These print hammer strikes the ribbion individually as the print mechanism that move across the entire printline in both the directions i.e. from left to right and viceversa. The speed of a dot matrix printer is about 240 to 4800 words per minutes.

Some dot matrix printers, such as the NEC P6300, can be upgraded to print in color. This is achieved through the use of a four-color ribbon mounted on a mechanism that raises and lowers the ribbons as needed. Color graphics are generally printed in four passes at standard resolution, thus slowing down printing considerably. As a result, color graphics can take up to four times longer to print than standard monochrome graphics, or up to 8-16 times as long at high resolution mode.

Dot matrix printers are still commonly used in low-cost, low-quality applications like cash registers, or in demanding, very high volume applications like invoice printing.

2.2.1.2 Inkjet Printer

It is a type of non impact printer. It is a printer that creates an image by spraying tiny droplets of ink from the printhead. While many dot matrix printers have 9 to 24 pins, most ink-jets have printheads with some where between 30 and 60 nozzles, and this allows them to create high resolution images in a single pass over the paper. Both color and black-and-white ink jet printers are avaiable.

In ink-jet printer, whenever we want to print the image the nozzel spread the ink, so there is a permanent remark on the paper. Suppose there is a 5 pin then it spread the ink up to 5 pixels. But it can approximately print up to 16 to 32 pixel at a time.

As you know inkjet printers consist of nozzles that produce very small ink bubbles that turn into tiny droplets of ink. The dots formed are the size of tiny pixels. Ink-jet printers can print high quality text and graphics. They are also almost silent in operation. Inkjet printers have a much lower initial cost than do laser printers, but have a much higher cost-per-copy, as the ink needs to be frequently replaced.

In inkjet printer the ink is stored in a cartridge.A colour inkjet printer cosist of four cartridge one each for blue, green, cyan, magenta and black. This system of colour is called CYMK(K stands for black). Inkjet printers are also far slower than laser printers.

2.2.1.3 Laser Printer

A high-resolution non impact printer that uses a variation of electrophotographic process which is used in photocopying machines to print the text and graphics on to the paper. Laser printer are page printer. They make use of laser beam to produce an image of the page containing text /graphics on a photo sensitive drum. The most common type of toner-based printer is the laser printer. Laser printers are known for high quality prints, good print speed, and a low cost-per-copy; they are the most common printer for many general-purpose office applications. Laser printers are available in both color and monochrome varieties.

A laser printer uses a rotating disc to reflect laser beam onto a photosensitive drum, where the image of the page is converted in to an electrostatic charge that attracts and hod the toner. A piece of charged paper is then rolled against the drum to transfer the image , and heat is applied to fuse the tonnerand paper together to create the final image. In simple we can say that, the laser printer consist of a drum coated with photoconductive material and there is a laser beam, and the control of the laser beam is on to the computer to turn it either on or off. When the aser beam falls on the drum, then it produces a –ve potential on it. And the graphite powder has +ve potential, therefore both paper and powder attracts each other. The powder is attached only where the electric potential is present, but the powder is also spread on an unwanted area and it is removed by the heat. The graphite powder is stored in the tonner. The ink is spread through the tonner and it is spread in an unsaturated form. These type of printer are quite, fast, clean and well suitedto the home or office environment.

2.2.2 Plotter

A plotter is a vector graphics printing device that connects to a computer. It is an output device. It is used to produce precise and good quality grphics and drawings under computer control. Plotters print their output by moving a pen across the surface of a piece of paper. This means that plotters are restricted to line art, rather than raster graphics as with other printers. They can draw complex line art, including text, but do so very slowly because of the mechanical movement of the pens. It is just like dot matrix printer but the difference is that , in printer the paper has the movement wherease in plotter the pen will move arround the pape. In this the pen will move in horizontal as well as in vertical

direction. In plotter only one pin is availale.The pen moves up on the page where we want to draw the image.

Another difference between plotters and printers is that a printer is aimed primarily at printing text. This makes it fairly easy to control, simply sending the text to the printer is usually enough to generate a page of output. This is not the case of the line art on a plotter, where a number of printer control languages were created to send the more detailed information like "draw a line from here to here".

Early plotters for e.g. the Calcomp 565 of 1959 worked by placing the paper over a roller which moved the paper back and forth for X motion, while the pen moved back and forth on a single arm for Y motion. Plotter draw the graphic faster. Plotters uses inkpen to draw graphics or drawing. Either single colour or multicolour pen is used. The pen are driven by motors.The pen potter may be classified in to the following types

Drum plotter: It contain along cylinder and a pen carriage. The paper is placed over the drum. The drum rotates back and forth. The pen moves horizontally along the surfacei.e either left to right or right to left.

Flat-Bed Plotter: It uses horizontal flat surface on which paper is fixed and the pen moves along both the axes i.e. x axis and y axis.

Inkjet Plotter: These plotter uses inkjet in place of ink pens.

2.2.3 VDU

VDU stands for visual display unit. A computer display (also known as a computer monitor, computer screen, or computer video display) is a device that can display signals generated by a computer as images on a screen. A visual display terminal contain a key board for input and visua display unit for output. Quality factors used in monitor are:
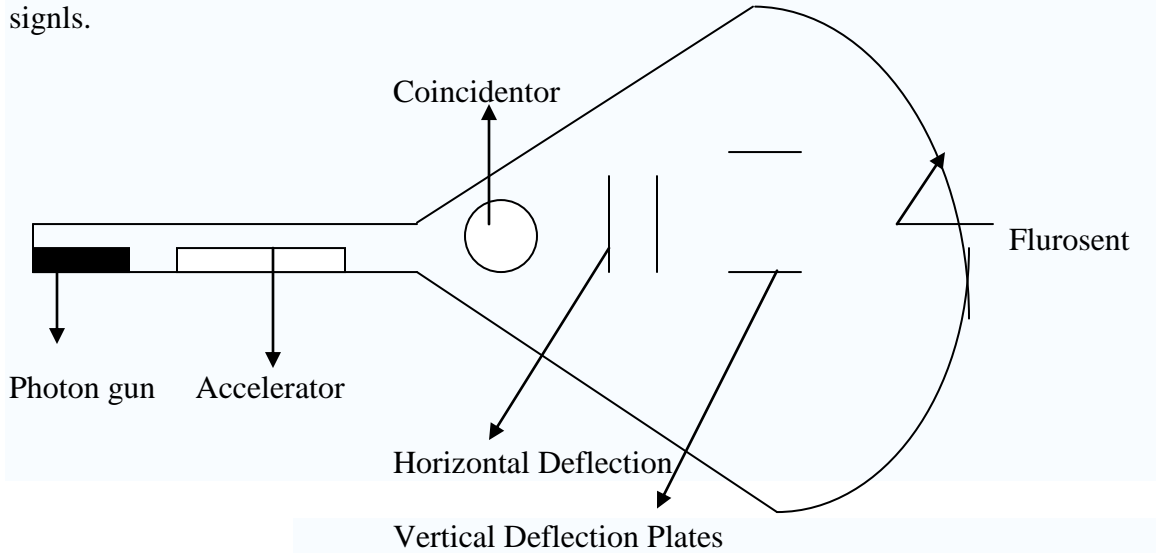
- **Pixels:** It is the smallest unit of monitor which is displayed without disturbing the other point .While designning the pixels, some distance between the pixels must be there in the horizontal as well as in vertical directin also.
- **Aspect Ratio:** It is the ratio of the pixels in the horizontal as well as in vertical direction also.
- **Resolution:** No of pixels in a per unit area.
- **Refreshing Rate:** The rate by which the pixels glow again

Refreshing Rate = 1/Refreshing Time

The visual display unit is known as monitor. Visual display unit is broadly divided into two categories:

2.2.3.1 CRT Monitors

CRT stands for the cathode ray tube.To see an image on the screen we have to glow that part. Energy of the photon goes to the fluroscent material,it produces the light and a point is introduced on the monitor.CRT makes use of the directing devices to give direction to the photon otherwise, it will goes towards the center. Some amount of magnetic field is applied to run photons in correct directions. Magnetic field is nothing but electrical signls.

Coincidentor

Flurosent

Photon gun   Accelerator

Horizontal Deflection

Vertical Deflection Plates

In thae above diag, there is a photon gun which is used to produce photonsbut the speed of the generated photon is very slow, therefore to increase its speed,there is an accelerator. It will give velocity to the photon. Before shifting the photons to different directions we have to coincident all the photonsat a point and this point is known as coincidentor. Two horizontal and vertical defection plates is usedto give direction to the photon in the upward and the downward direction. For colour monitor, 3 electron gun is used.

Monochrome & Colour Monitors:

Monochrome monitor is a monitor which is capable of displaying only a single colour image and an RGB monitor is a colour monitor. Both monitors differ in two ways, first, they have no of electron guns. A monochrome monitor has one electron gun whereas RGB monitor has 3 electron gun. Secod tscreen in an RGB colour monitor is coated with 3 types of phosphors: red, green, blue. In this each ixel is made up of 3 dots one of each colour. The 3 electron gun direct their beam togeter. Each gun is aimed precisely so that it can hit a specific colour dot in each pixel. A wide variety of colour is made by the combination of gun fire. For eg: if all the three guns are fired at full intensity , aspecific coour is made, if only two guns are fired with full intensiy and the third gun is fired at half intensity, an entire different colour is made,. By varying the intensity of the gun, RGB monitors are capable of displaying a large no of different colour.

2.2.3.2 Non CRT Display

1. **LCD:** LCD stands for liquid crystal display. In LCD a liquid crystaline material is sandwiched between two plate that is made of plastic the front plate is transparent and the back plate is reflective.At the back end there is one more field and the function of this field is to generate the electric field. Through back panel the light is emitted which falls on the crystal then the crystal induces the colour on the screen. When the amunt of light source falls then some amount of light source also get wasted also. The area around a particular crystal is known as segment.Each and every liquid crystal has separate segment area.

In LCD for colour monitor there is 3 layers which is made up of transparent materialand all they are made up of RGB colour. These 3 layers are overlapped with one another. Suppose, if we want to emit the light of different colour which is made by th mixture of any two colour then it is predecided that what is the proportion of each colour to be mixed so that particular colour is made.

Back panel ←——————— ——→ Front end
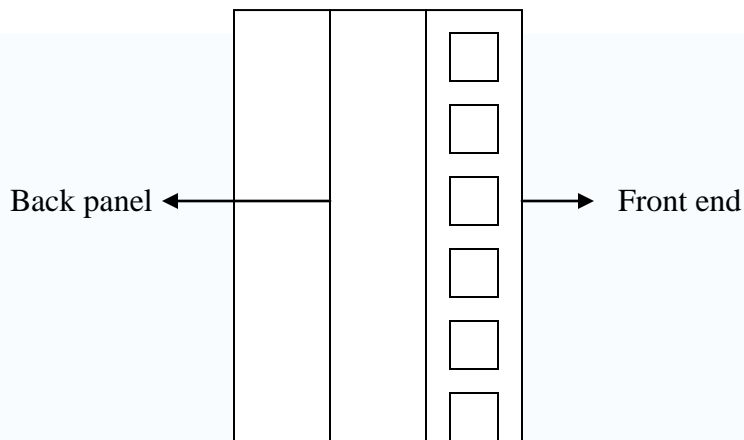
Side view Of LCD

The Principle advantage of LCD are:

- Lower power consumption.
- Low cost.
- Small size.

The biggest disadvantage of LCD are:

- LCD do not emit light; as a result, the image has very little contrast.
- The screen is very suspectible to glare, so the optimum viewing angle is very narrow.
- The resolution is not as good as that of a CRT.
2. **Plasma Display:** In this ionized gas is sandwiched between two glass plates. A no of parallel wires run horizontally as well as vertically. A small amount of current is passed through one horizontal and one vertical wire to cause the gas to glow at a spot at the intersection of wires.

The Principle advantage of gas plasma display are:

- The images are much brighter than on a standard CRT.
- The resolution is excellent.
- The screen does not flicker like some CRTs.

The biggest disadvantage of gas plasma display are:

- Only single colour is available.
- The technology is expensive.
- It uses a lot of power.
- It does not show sharp contra
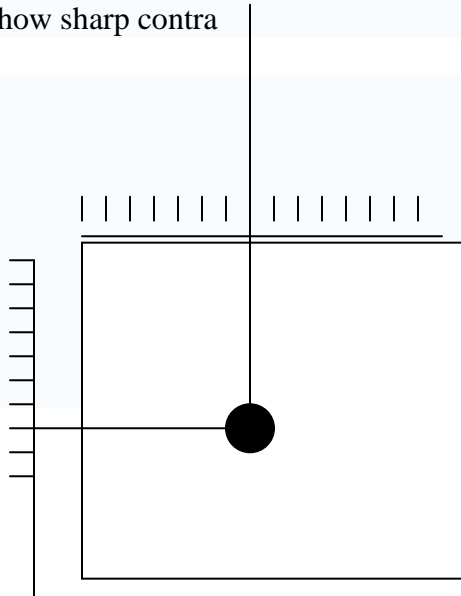
2.2.4   Speaker

Speaker is one of the output devices which is mainly used for entertainment, video conferencing etc.Computer speakers, or multimedia speakers, are external speakers and are usually equipped with a male-end stereo jack plug .The sound capability of the computer system does not work unless and unti there is a sound card. Speaker recieves the data from the sound card in the form of electric signal and then convert it in to the sound format.There are also USB speakers which gain their power from the 5 volts of a USB port. Computer speakers are usually a simplified stereo system without a radio or other media sources built in.

Computer speakers range widely in quality and in price. Typically, the simplest computer speakers come with computers. There are also advanced forms of computer speakers that have graphic equalization features such as bass, treble, etc for dynamic audio flexibility. Speaker must have the following features

- An LED, typically green, that acts as a power indicator.

- A 1/8" or even 1/4" headphone jack.
- Dials or buttons for volume, bass, and treble.
- A wired or wireless remote control for volume and power control.

Types Of Cards:

Storage Devices

Storage hardware provides the capability to store the data either temporarily or permanently. It has much larger capacity than main memory. Secondary memory is also known as auxiliary memory. The magnetic memory is used as secondary memory. Some important features of secondary storage devices are:

1. **Permanent:** The data, which is stored in these devices, is not lost even when the power is switched off.
2. **Voluminous Storage:** We can store volume of data and instructions in these devices.
3. **Cheaper:** These storage devices are cheaper than main memory.
4. **Computing Capability**: It is only a storage devices, It does not have any capability of executing a program.
5. **Portable:** All these devices act as a portable media for transferring the data from one system to another.

## 2.3.1 Some Of The Storage Devices Are:

2.3.1.1 Floppy Disk

Floppy disks, also known as floppies or diskettes. It is small, flexible, faster and cheap alternative to store data by using magnetic tape. It is made up of a very thin plastic plate coated with magnetic material like iron-oxide. It is an inexpensive storage devices and used as a backup memory. In floppy disk, data is recorded in the form of minute invisible magnetic spot. The thin platic plate i.e. floppy disk is packed in a protective paper or in a plastic envelope.

The first diskettes were single sided, but when the need to store more data became then technology has to produce the double sided disk, which is capable of storing the data twice as that of single sided disk. Double sided disk drives are equipped with read/write heads for both the top and bottom surface of a disk, so that the data can be read from or written to both the surface simultaneously.Disk capacity depends on recording density. Recording density means the no of bits written per inch. The floppy disk has to be divided in to tracks and sectors.

Tracks:- These are logical concentric circles which start from the edge of floppy disk and move inwards toward the center of the disk. The traks are numbered.

Sector:- In these tracks are subdivided in to sectors where data is physically stored and the amount of data which is to be stored depends on the type of floppy disk. Typically a disk is divided up into eight or nine sectors, or equal,wedge shaped areas that is used for storage reference area.

Access Time:- The access time of a disk drive is determined by measuring the time it takes to performthe following activities like positioning the read write heads over the proper track which is known as seek time,waiting for the disk to revolve until the correct sector is reached which is known as latency time,the time taken in placing the read/write heads, called setting time,and the time taking in transfer the data from disk to computer main memory.
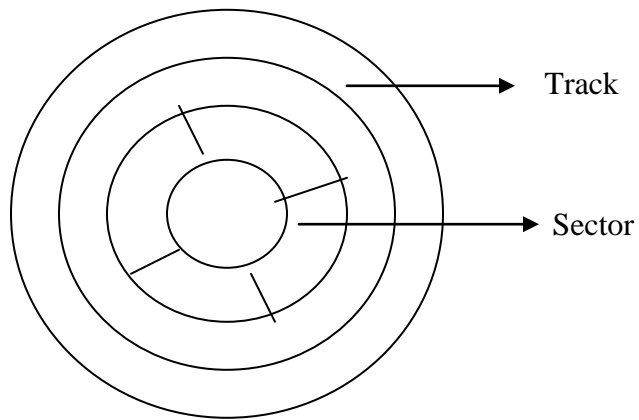
Some of the floppy disk that are commonly used:

1. 3.5 inches floppy disk
2. 5.25 inches floppy disk

3.5 inches Floppy Disk

It is introduced in the year 1987 and has the storage capacity of 1.44 MB. In this floppy disk the read/write head is covered with a sliding metal shield. When the disk is inserted into the drive, the disk drive pushes the cover aside. There is a write protect notch to store the information and it can make use of the sliding button, which can slide either of the two position. One position allows reading, writing and erasing and the other position only allow reading.
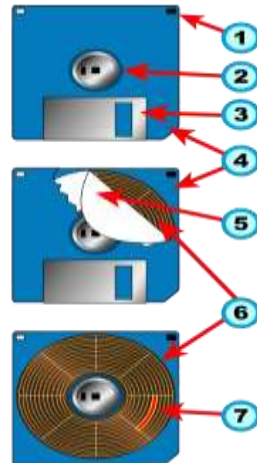
The basic internal component of 3.5 inches floppy disk are

1.Write-protect tab
2. Hub
3. Shutter
4. Plastic housing
5. Paper ring
6. Magnetic disk
7. Disk sector

5.25 inches Floppy Disk

It has a storing capacity of 1.2 MB. The protective cover of 5.25 inches is a soft plastic. Inside the cover there is a white felt liner and these liner helps in rotating the disk smoothly. In the center there is a drive spindle hole, which is fitted with a plastic hub ring so that it must be able to protect the edge of the disk. The write protect notch protects the stored information.

Head Slot   Plastic Hub Ring   Write protect notch

Drive Spindle Hole
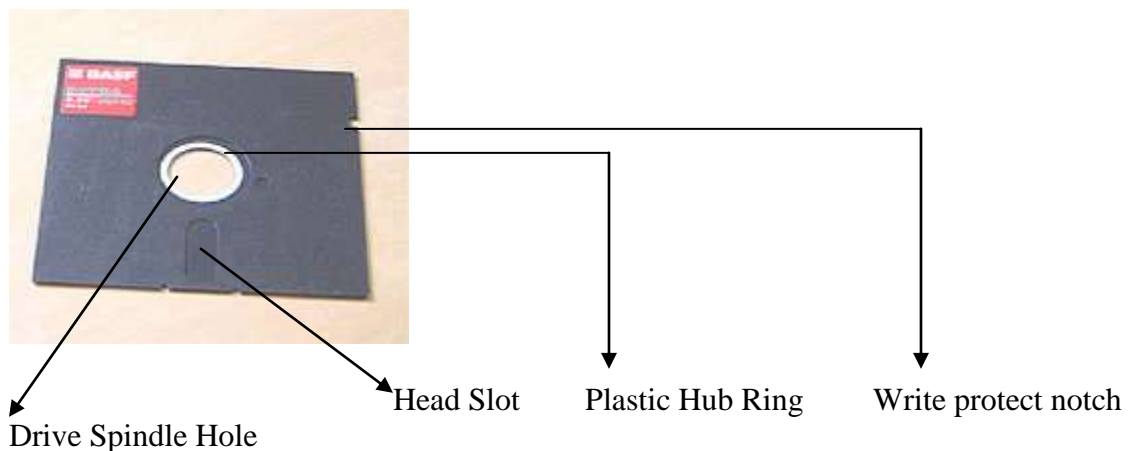
2.3.1.2 Hard Disk

A hard disk drive is also known as hard disk, hard drive, or the now-near-obsolete terms fixed disk, fixed drive, fixed disk drive, hard file.It is a non-volatile, digitally encoded data storage device that stores data on the magnetic surfaces of hard disk platters. It contain more than one disk or platters that is packed together. Unlike floppy disk, it is fixed,mostly it cannot be inserted or removed from the system.All the platter is packed in an air tight dust free container. The average access time of hard disk is about 20ms. A hard disk is also divided into tracks and sector. A low capacity hard disk drive has: 12 recording surface, 256 sectors per track, 5350 tracks per surface and 512 bytes per sector. It means it has a storing capacity of 8 GB approximately.

 The hard disk uses the rotating platters to store data. Each platter is coated with a smooth magnetic film structure on each side onto which digital data is stored. Information is written to the disk at high speed as it rotates past read-write heads that fly very close over the magnetic surface. The magnetic medium (film) on the disk surface changes its magnetization in microscopic spots due to the head's write field, which is a strong and highly localised magnetic field. The information can be read back by a magnetic sensor. The read sensor detects the magnetic flux emanating from the transitions passing underneath it through a small change of the MR(magnetoresistive) sensor's electric resistance and this is converted by electronics into a stream of 1's and 0's. There is one head for each magnetic platter surface on the spindle, mounted on a common arm. The actuator arm moves the heads on an arc (roughly radially) across the platters. The associated electronics control the movement of the actuator and the rotation of the disk, and perform reads and writes on demand from the disk controller.

The inside of a hard disk drive with the platter. To the left there is a read-write arm. In the middle the electromagnets of the platter's motor can be seen. In a hard disk , the disk is addressed by the drive no, cylinder no, surface no, and sector no. There is a separate read/write head is available for each of the platters as shown in the diagram:

2.3.1.3   Compact Disk

A Compact Disc (CD) is an optical disc used to store digital data, originally developed for storing digital audio**.** An audio compact disc consists of one or more stereo tracks stored using 16-bit PCM coding at a sampling rate of 44.1 kHz. Standard compact discs have a diameter of 120 mm or 80 mm. The 120 mm discs can hold approximately 80 minutes of audio. The 80 mm discs, sometimes used for CD singles, hold approximately 20 minutes of audio. Compact disc technology was later adapted for use as a data storage device, known as a CD-ROM, and to include record-once and re-writable media (CD-R and CD-RW). CD-ROMs and CD-Rs remain widely used technologies in the personal-computer industry as of 2006.

Compact discs are made from a 1.2 mm thick disc of very pure polycarbonate plastic. A thin layer of Super Purity Aluminium is applied to the surface to make it reflective, which is protected by a film of lacquer. The lacquer can be printed with a label. Common printing methods for compact discs are silk screening and offset printing. CD data is stored as a series of tiny indentations (*pits*), encoded in a tightly packed spiral track of pits moulded into the top of the polycarbonate layer. The areas between pits are known as 'lands'. Each pit is approximately 100 nm deep by 500 nm wide, and varies from 850 nm

to 3.5 μm of length. The spacing between the tracks, the pitch, is 1.6 μm. A CD is read by focusing a 780 nm wavelength semiconductor laser through the bottom of the polycarbonate layer. The difference in height between pits and lands leads to a phase difference between the light reflected from a pit and from its surrounding land. By measuring the intensity with a photodiode, one is able to read the data from the disc. The pits and lands themselves do not directly represent the zeroes and ones of binary data. A change from pit to land or land to pit indicates a one, while no change indicates a zero. The main parameters of the CD are

- Scanning velocity: 1.2–1.4 m/s which is equivalent to approximately 500 rpm at the inside of the disc, and approximately 200 rpm at the outside edge.
- Track pitch: 1.6 μm.
- Disc diameter 120 mm.
- Disc thickness: 1.2 mm.
- Inner radius program area: 25 mm.
- Outer radius program area: 58 mm.

Capacity

A standard 120 mm CD-ROM holds 650 or 700 MiB of data. To put this storage capacity into context, the average novel contains 60,000 words. Assume that average word length is 10 letters and that each letter occupies one byte. A novel therefore might occupy 600,000 bytes (600 kB, without layout information). One CD can therefore contain over 1,000 novels. If each novel occupies at least one centimetre of bookshelf space, then one CD can contain the equivalent of over ten metres of bookshelf. However textual data can be compressed by more than a factor of ten, using compression algorithms, so a CD-ROM can accommodate at least 100 metres of bookshelf space.

CD ROM Operation:

CD-ROM is a reflective light system, where laser light is shone against turns of track which are encoded with digital data using pits and areas of lands. Pits scatter the laser light, while areas of land produces reflected light. Reflected light is diverted to a photodetector that produces a series of electric pulses corresponding to encoded data.

A CD_ROM disc rotats at a speed to provide a constant avearge read rate of around 75 blocks/second. Because data is embedded in the track of a CD-ROM at a uniform density, the disc must spin faster when the read head converges on its center. The required constant linear velocity is achieved by coordinating the position of the read head with speed of rotation using a simple feedback system.

CD-ROM Standards:

Origins Of CD-ROM:

2.3.1.4 Magnetic Tape

Magnetic tape is a non-volatile storage medium consisting of a magnetic coating on a thin plastic strip. Nearly all recording tape is of this type, whether used for video, audio storage or general purpose digital data storage using a computer. Magnetic tape was first invented for recording sound by Fritz Pfleumer in 1928 in Germany, based on the invention of magnetic wire recording by Valdemar Poulsen in 1898. The use of magnetic tape for data storage has been one of the constants of the computer industry. The tape is nothing but a stripof plastic coated with a magnetic recording medium.Data are recordedas magnetic spots on the tape. In magnetic tape the information is recorded in blocks reffered to as a record. A tape unit is addressed by specifying the record no and the no of characters in the record. Record may be fixed or variable length.

Advantages

> ➢ Large amount of data can be stored.
> ➢ The tape is very easy and convenient to handle
> ➢ The tape is reusable, fast and saves time
> ➢ The tape is very economical.

Disadvantages

> ➢ Humans cannot read the data directly because it is stored as magnetic spots.
> ➢ Access of data from magnetic tape is sequential.Therefore, it takes much time in retrieving the data in saome cases, or searhing becomes difficult.
> ➢ Magnetic tape is sensitive to certain environmental factor like dust, temperature and moisture.

2.3.1.5 DVD

DVD is also known as "Digital Versatile Disc" or "Digital Video Disc". It is an optical disc storage media format that can be used for data storage, including movies with high video and sound quality. DVDs resemble compact discs as their physical dimensions are the same (120 mm (4.72 inches) or occasionally 80 mm (3.15 inches) in diameter) but they are encoded in a different format and at a much higher density. It is able to hold

about 15 times more information and transfer it to the computer about 20 times faster from CD-ROM.DVD comes in some format:

DVD-Video : DVD-Video discs require a DVD-drive and an MPEG-2 decoder e.g. a DVD-player, or a DVD computer drive with a software DVD player. It is mostly used for entertainment like seeing movies etc. The specifications for video files on a DVD can be any of the following:

- Up to 9.8 Mbit/s (9800 kbit/s) MPEG-2 video
- Up to 1.856 Mbit/s (1856 kbit/s) MPEG-1 video

DVD-ROM: The abbreviation stands for DVD-Read only memory format. It is mostly used in computer to store data. Through this we are able to play games as well as able to see certain movies.

DVD-R: It is a recordable DVD. The user can write data once and abe to read the da the data as many times as desired.

2.3.1.6   *Zip Drive*

The Zip drive is a medium-capacity removable disk storage system, introduced by Iomega in late 1994. Originally it had a capacity of 100 MB, but later versions increased this to first 250 MB and then 750 MB. The original Zip drive had a data transfer rate of about 1 megabyte/second and a seek time of 28 milliseconds on average, compared to a standard 1.44 MB floppy's 500 kbit/s (62.5 kB/s) transfer rate and several-hundred millisecond average seek time. Zip media is thicker, but otherwise similar in size to 3.5" (9 cm) floppy disks, which means the drive slot is large enough to accept such a floppy. To prevent drive and disk damage, the underside of Zip media cases include a retroreflective spot in one corner.

Higher capacity Zip disks must be used in a drive with at least the same capacity ability. Generally, higher capacity drives also handle all lower capacity media, although the 250 MB drive is much slower than the 100 MB one to write data on a 100 MB disk. The 750 MB drive, however, cannot write to the 100 MB media, which is the cheapest and most common.

The Zip system also introduced media access protection via a password. Like write protection, this is also implemented on the software level. When a disk is inserted, the Zip drive reads the metadata; if the data indicates the disk should be read-locked, the drive awaits a password from the computer. Until it receives such a password, the drive pretends to still be empty. Once the password has been sent and verified, the drive "activates" the disk in the drive and allows access. One side effect of this implementation is that, on some drive models, it is possible to trick the software into allowing access to a different disk than it believes to be in the drive, thereby bypassing the password protection.

Graphical Display Devices: Under this we have to discuss about CRT.

Graphical Input Devices: Under this we have to discuss the below specified input devices which we have discussed earlier.

Keyboard
Mouse
Joystick
Trackball
Digitizer

Three Dimensional Input Devices

• Accoustic devices: It consist of accoustic tablet. To measure the styulus position in 3 dimension.we can use 3 microphones aligned with the axes.
• The perpendicular distances of the stylus from these microphones can be determined from 3 arrival times and from these 3 distances the stylus coordinate can be computed.
• Mechanical Devices: Three dimensional coordinate input can also be achieved with the aid of mechanical linkage of various kinds.
• The simplest of these uses wires strectching from spring loaded reels mounted at fixed position.