UNIT 3:

2.1   INPUT DEVICES

Input devices are used to feed data and instructions to computers from users, other machines or from surrounding through sensors. Data and instructions can be typed (fed manually)with the help of keyboard, mouse, touch screen or other pointer devices. Other inputs devices are capable of inputting data automaticallyto computer. Electronic sensor,Scanner and OMR are used for automatic feeding of data.

One of the major constraints in manual feeding of inputs is the mismatch between speed of CPU and input devices. An efficient computer operator can only type 35 to 40 words per minute. Thus most of the time, CPU remains idle, waiting for the inputs from users.In last unit, we have understood role of controllerin overcoming mismatch between speeds of input device,and processing unit. Controllers act as buffer between input devices, memory and CPU units to overcome mismatch in their speeds.

KEYBOARD

This input device is used to feed alphanumeric data to computer. This is the most popular input device. Wecannot think of a computer without keyboard. Users can feed characters, numbers and other special characters to computers with the help of keyboard. Keys are mounted on the front panel of the keyboard. The layout of the keys inthe keyboard is similar to layout of keys on a typewriter machine.A standard keyboard usually has 102 to 105 keys. Some keyboards have additional keys to run commands on window operation system, to play multimedia applications and/or browsing internet and email. Keys on a keyboard are classified into following groups:

Fig. No. 2

Alphanumeric keys

The alphanumeric keys consist of a separate key for each alphabet of the English language, keys for 0 to 9 numbers and special characters like +, - * etc.The layout of alphanumeric keys is similar to that of typewriter.This layout is popularly known as the QWERTY layout. It is named after the firstsix letters in the top row of alphabet keys pad. The same key is used to type capital and small letter however, only capital letter is inscribed over the keys. Shortly, we will understand how to type capital and small alphabet from the same key, when we discuss the functions of the Shift and Cap Lock keys.Now, keyboards forIndian regional languages are also available in the market, but you will get, keyboard for English language in most of the office as most of the business correspondence in current time is done in the English language.

Function keys

There are twelve function keys,labeled as F1, F2, F3, F4 …F12, on the keyboard. Function keys are situated at the top row of the keyboard. The function keys perform special tasks. These tasks differ from one software to another. Thus same function key performs different tasks in different applications. Some software allow users to assign tasks to function keys. However, most of the software reserve F1 function key to extend online support to users.

Enter key

It is similar to the 'return' key of the typewriter. It is used to insert new paragraph/line, while typing of documents. A new paragraph is inserted at the position of cursor by pressing the enter key. This key is also used to instruct computer to execute a command or programme. Select the application to be run by clicking its icon, than press enter key to run that application or type the command in the Run-box of the Windows operating system and press enter key to execute command typed in the run-box.

Spacebar key

It is used to enter unit space at the position of cursor during typing of documents. Cursor along with texts moves to right side after inserting a space by pressing the spacebar key once. This is the largest key situated on the bottom side of keyboard.

Backspace

This key is used to delete one character, positioned left to cursor, Cursor also moves to the left by one character, when backspace key is pressed. Press backspace key repeatedly to delete desired characters, while one character is deleted by each stroke.

Delete

This key is used to delete one character right to the cursor, while rest of the text move to left and cursor remains at the same position after the deletion.

Insert

Insert key is used to toggle between insert or overwrite modes during data entry or typing a document. When you are in the insert mode, whatever you type, is inserted at the position of cursor and existing texts right to the position of cursor, move further away to the right side. When you are in overwrite mode, whatever you type it will replace the existing texts right to the position of cursor. Some software has disabled the function of this key. For example, Insert key works in the earlier versions of the MS-Office i.e. MS Office 98 and MS Office 2003, but later versions of the MS-Office i.e.MS-Office 2010 and MS-Office 2007 have disabledthe function of the insert key.

Shift

Special and number keys on the keyboard are assigned two characters/symbols, similarly same alphabet keyis used to type small and capital letter of the English alphabet. Each key in the number pad is assigned one more special symbol. Number assigned to a key is inscribedon the lower side and the corresponding special character isinscribed on the upper side,over the number, on the face of key. For example, the key inscribed 2 is also used to type @ symbol.

The shift key is used to type capital letter from alphabet keys and special character assigned to number keys. First press the shift key and then without leaving it press, the key assigned the special character. You can type capital letters in the similar fashion with the help of shift key.

Shift + Alphabet keys = Capital letters
Shift + Numeric keys = special characters inscribed on the top of number

There are two shift keys on the keyboardpositioned on the left and right corners of the alphabet panel.

Home and End keys

These keys behave differently in different software, for example, when you are typing a document in MS-Word, pressing of home key takes cursor to the start of line and pressing of the End key take cursor to end of line. However when you are preparing a worksheet in MS Excel software, pressing of the Home key move to the first field of the focused row and pressing of the End key takesworksheet in the end mode.

Caps Lock

The Caps Lock key function in toggle mode i.e. on and off the capital lock features. When it is inthe 'on'position, it locks the alphabetkeys for capital letters only. Whatever you type now, it will be typed in capital letters. There is a light indicator over the keyboard to reflect the position of the Cap Lock key. This indicator flashes light when Cap Lock is on. You can switch off the capital lock by pressing Caps Lock key again, now capital lock indicatorgoes off.Whatever you type now, it will be typed in small letters.You can type capital letter in this situation by combining Shift and alphabet keys. The Cap Lock key has no impact on number and special keys.

Tab

Tab key is used to insert predefined gap in the text at the position of the cursor while typing a document. When you press the Tab key, the cursor move to the next tab position defined in that document. You will learn the procedure to define tab position in a document in the next of this course. Tab key is also used to insert indentation into a document. When you are filling forms online, pressing of the tab key, moves cursor to next dialogue box, to be filled by you. The pressing of Tab key shifts focus to next icon on the desktop, while focus is on any of the shortcut/icon on the desktop of the Windows operating system. Thus, function of tab key varies; it depends on application under focus and operations performed by computer at the time of pressing tab key.

Ctrl

The Control key (Ctrl) is used in conjunction with other keys of the keyboard to execute specific tasks. The combination of Ctrl and other keys perform different tasksin different software. These combinations are called as shortcuts of that software.For example, Ctrl + O and Ctrl + P shortcuts are used to open and print files respectively from any of the applications of MS Office. Short-cut keys of software popular in the office environment will be deliberated later in other units of this course.

Alt key

Alt key is used in combination of other keys of the keyboard to perform specific tasks. The meaning of combinations of Alt key with other keys changes from one software to another. Same keys combinations behave differently in different software. Combinations of Alt key with other keysare frequently used by application software to activate menus or to select specific command from the menu.

Esc

This key is used to stop/abort the current process/task and probably it reverts back changes made by the task being cancelled by pressing the Esc key. Be careful, you would not be always successful in reverting back changes made by the cancelled task. For example, while formatting a drive, pressing of escape key could not protect data stored on the drive. Some commands, particularly system commands, do not expect from you to press escape key to abort operation till operation is successfully completed. Thus, make sure the possible outcomes of pressing Escape key before aborting a programme. For example, when you restore data on computer, the system warns you not to abort the restore function.

Arrow keys

There are four arrow keys with arrows heading in four directions (left, right, up and down). These keys are used to move cursor in any of the four directionswhile drafting a document and data entry.

Numeric keypad

The numeric keypad consist of keys inscribed with numbers 0 to 9 andarithmetic operations (+, -, x, %). The layout of numeric keypad is analog to that of traditional calculator. These keys are duplicated elsewhere in the keyboard. The number keys are assigned dual characters each key is assigned a special symbol apart from number. The Num lock key at the upper left corner of the numeric keypad works in toggle mode. When it is on, numeric keypad behave like a calculator and when it is off, it is used to type alternative characters assigned to keys of the numeric keypad.

Print Screen

Earlier, this key captured text from the screen of computer and sent it to print. Now, this key captures image of the screen, called screen-shot and copies it in the clipboard instead of sending to printer. Screen - shot can be pasted easily in different applications from the clipboard. Clipboard can be defined as common memory space, used by application software to store copies of data, which can be pasted in the same or other applications.

Scroll Lock

This key stops the scrolling of text temporarily or halts the operation of the current programme. Earlier, pressing of scroll key caused document to scroll without changing the position of the cursor.Now, this key is inactive in most of applications as text is automatically adjusted within window. The concept of window-based display is explained in third and fourth units of this block. Few applications allow scroll lock key to change behaviour of the arrow keys, page-up and page-down keys. Scroll lock key toggle in on and off positions. There is a light indicatoron keyboard to reflect the position of the scroll lock key. When scroll lock key is in on stage, the indicator emits light. The scroll lock key can be switched off by pressing this key again.

Pause/Break

Earlier, this key was used to pause a long running text.This function is disabled as flow of long text is automatically framed in windows. Now Break key is being used by software in different ways. It may be used to switch between multiple login sessions, to terminate a programme or to stop a modem connection. Text never runs beyond boundary of window.

Keyboard Shortcuts

Keyboard shortcuts are used to instruct computer to perform specific functions/tasks by using keyboard. This process expedites instruction-feeding process that is why these are called shortcuts. Shortcuts are documented with '+' sign between two keys. For example, CTRL + S shortcut reflects that press and hold Control key and then press S to save document in MS-Word software. Every software has special shortcuts for operations performed frequently. Shortcutsdiffer from one software to another.You can easily find keyboard shortcuts from the manual of the software. Shortcuts of software can also be found from menus and tool-bars of that software as shortcuts of commandsareusually written next to it on the menu bar.

MOUSE

Mouse is the input device used to move cursor at any place over the screen.Therefore, mouse is alsorecognized as pointer device. Mouse is an important input devise in the Graphical User Interface(GUI) based environment. It gets its name due to its physical shape, which looks like a mouse. Its outer cover can be easily gripped under palm. The mouse was first packaged with the Apple Mac computer in 1984. Mouses are available in different shapes and sizes in the market. Mouse may have two, three or four buttons on the top, with or without rolling wheel.

Input from mouse generates two actions. First, as we move mouse over a flat surface, cursor on the screen moves accordingly, second there are buttons on the top of mouse similar to keys of keyboard, when you press a button, computer takes action on the basis of which button is press, how many times it is pressed, location of pointer on the desktop, icons under the mouse pointer at that time and any movement in cursor at the time of pressing key. Left button is used to select objects and to execute command and right button is used to open popup menu for object/icon under the pointer. The scroll wheel on the top of mouse is used to move text up or down in the active window.

Mousses are classified into two categories on the basis of theirworking principle i.e.mechanical mouse with roller ball and optical mouse. Roller ball based mechanical mouse has a rubber ball at the bottom side of mouse.When you move mouse over a flat surface, this ball also rolls. Mouse sense the movement of ball in two directions (horizontal and vertical)accordingly cursor move over the screen.
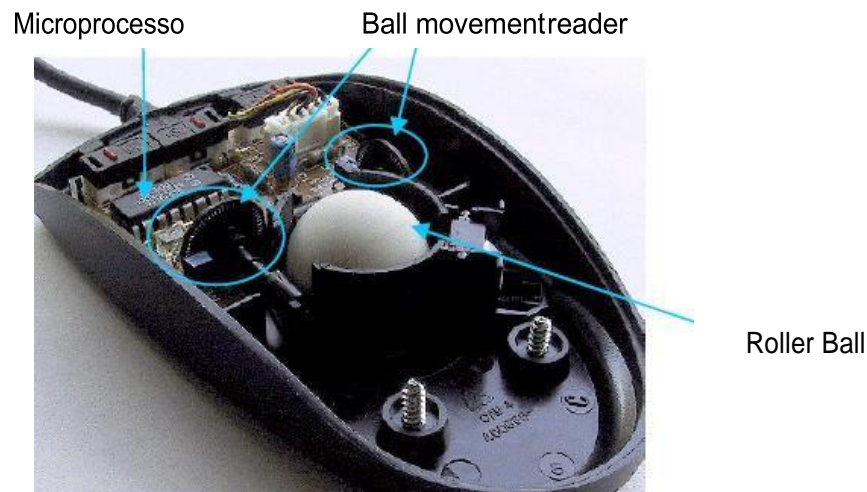
Microprocesso   Ball movementreader

Roller Ball

Fig 3

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Optical mouse emits red colour light from bottom side, there is a light sensor on the bottom side of the mouse. It sense any change in the intensity of light reflected by surface,when mouse is moved. As you move mouse over a flat surface, the intensity ofreflected light also change. The change in the intensity of reflected light is sensed by the mouse and it makes appropriate change in pointer position over the screen. Optical mouse are more reliable and have longer life than mechanical mouse as there is no moving part in the mouse. Dust, small pins, papers, hairs get inside of mechanical mouse by sticking over its roller ball. These objects can damage internal parts of mechanical mouse.

The latest update in mouse technology is tail-less mouse. This mouse is connected with computer through infrared orBluetooth connectivity. Bluetooth and infrared communication allows wireless transfer of data between two closely placed electronic devices. Users are free to take tail-less mouse at any place within five metersradius of computer. This kind of mouse can be connected to computer, which supportsinfrared or Bluetooth communication.

Mouse is replaced with touchpad in laptop. Touch pad is astationary, pointer device. Touchpad has a small rectangle pad and few buttons on the side of the pad. Computer senses the movement and pressure of finger over the pad; makes movement in the cursor and takes action accordingly. Single quick hit of the index figure over the touch pad is equivalent to single click action of mouse. Similarly, two consecutive hits of the index figure over the touch pad is equivalent to double click action of mouse.

How to handle mouse:

a) Rest palm on the body of mouse
b) Index finger rests on left button and middle finger on the right button, do not press buttons
c) Wrist should rest on table and other figures and thumb can be used to have a better grip of the mouse
d) Gently drag mouse over the mouse pad, without jerks. Keep the movement of mouse over the mouse-pad

The mouse pointers takes different shapes depends upon task being processed and location of pointer over the screen at that time. The popular icons used as mouse pointer and there meanings are as follows:

Arrow pointer (□): when mouse pointer points to an executable object/programmed, it takes the shape of arrow pointer. Double clicks over the object to run that programme.

Hourglass (⧗): When computer isprocessing task and expects you to wait until work isprocessed, the pointer change to hourglass. You are usually not allowed to feed data or instruction in that application till pointer shape is hourglass. Some applications has replaced hourglass with

other movable icons. For example, Windows Vista operating system uses 🔵 icon, in place of Hourglass to indicate busy state ofcomputer.

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Hand ([ ]): When pointer points to hyperlinked text or icon, it changes from arrow to hand shape. Clicking on hyperlink opens the relevant web page or MS Outlook to send e-mail.

Cross hair or Double arrows (↕ ↔): when you move pointer to the border of window, the pointershape change from arrow to cross hair or double arrows shape. You can resize the window by drag action, when pointer shape is double arrows. You can move the underlying window, when pointer shape is the cross hair.

I beam: the pointer changes to I beam, when you are typing in word processing application. The I beam reflects the position of typing.

There are four ways to feed instructions through mouse. Buttons of the mouse are used to perform following operations.

a) Click,
b) Double click,
c) Right click, and
d) Drag and drop action

Click: Press and release the left button of mouse quickly only once, without moving the mouse. When pointer takes the shape of arrow point, single click is used to select object under the pointer.

Double click: Press and release the left button of mouse twice in quick succession without moving mouse. Double click is used to run application software. Take mouse pointer over the shortcut or icon of the application to be run, and then double click the left button without moving the mouse to run that application.

Right Click: Press and release the right button of mouse without moving it. Right click, when pointer is over an icon/shortcut or objects. It brings the pop-up menu relevant to objects under the pointer at the time of doingthe right click. The pop-up menu is also recognized as on-demand menu. Commands in the pop-up menu depends on the objects over which pointer is positioned.

Drag and Drop Action: you can move files, folders or objects from one place to another over the desktop (screen), hard disk, pen drive, CD etc.through drag and drop action. First, take pointer over object, which is to be moved. Press and hold down left button. Move the pointer to the position where selected objects to be moved. Release the mouse button, once pointer reaches the destination. This action move the selected object to desired folder. Drag action is also used in selection of text, while preparing a document. Different actions of mouse in application software are discussed in the other units of the course.

Inside a Mouse

The main goal of any mouse is to translate the motion of your hand into signals that the computer can use. Almost all mice today do the translation using five components:
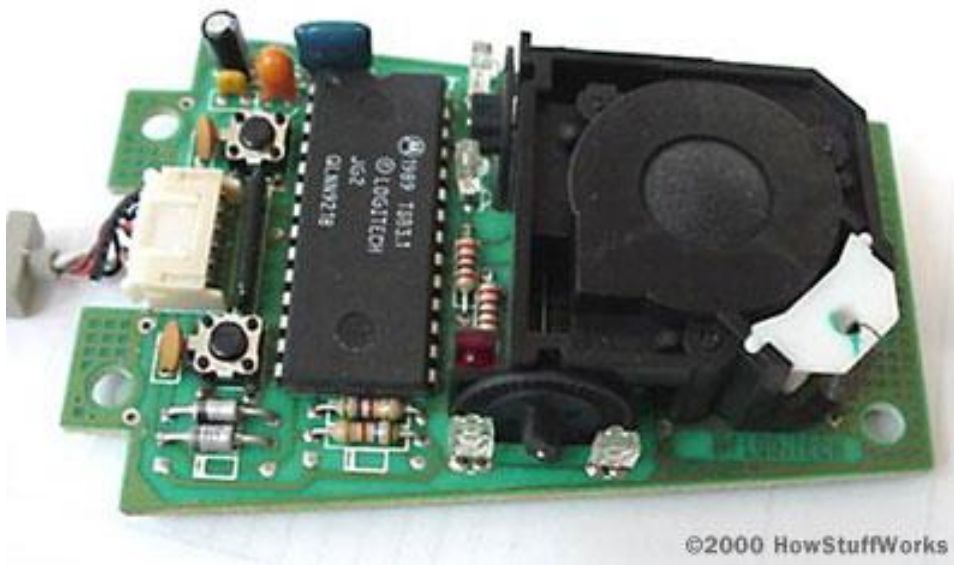

1. A **ball** inside the mouse touches the desktop and rolls when the mouse moves.
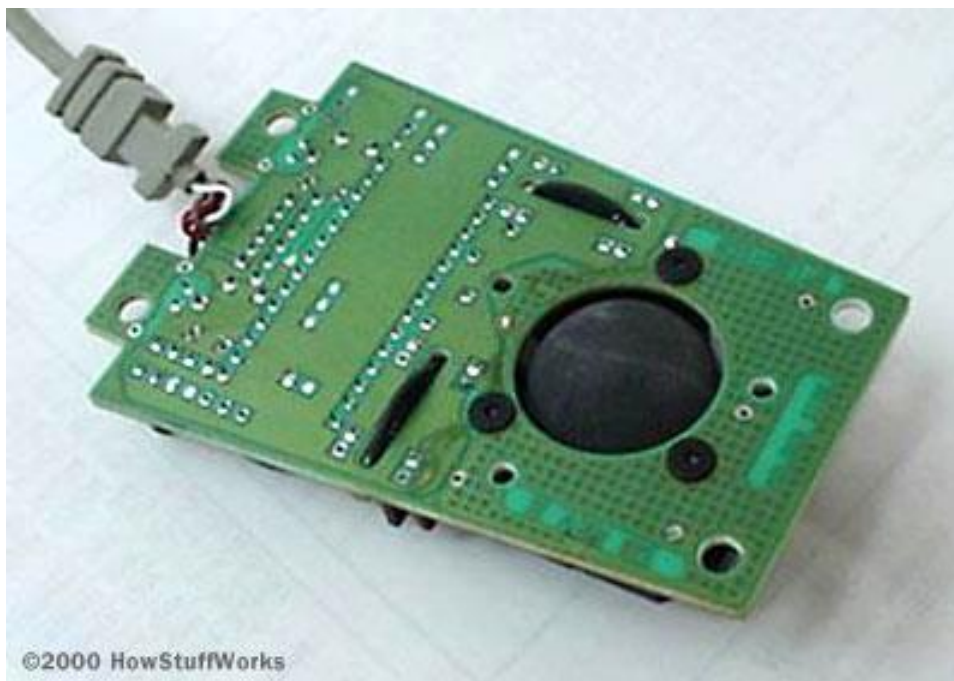
2. **Two rollers** inside the mouse touch the ball. One of the rollers is oriented so that it detects motion in the X direction, and the other is oriented 90 degrees to the first roller so it detects motion in the Y direction. When the ball rotates, one or both of these rollers rotate as well. The following image shows the two white rollers on this mouse:
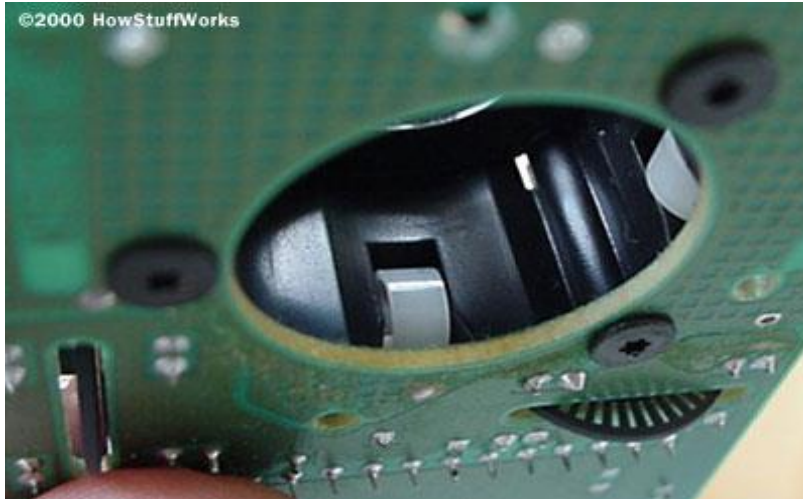

3. The rollers each connect to a **shaft**, and the shaft spins a **disk** with holes in it. When a roller rolls, its shaft and disk spin. The following image shows the disk:
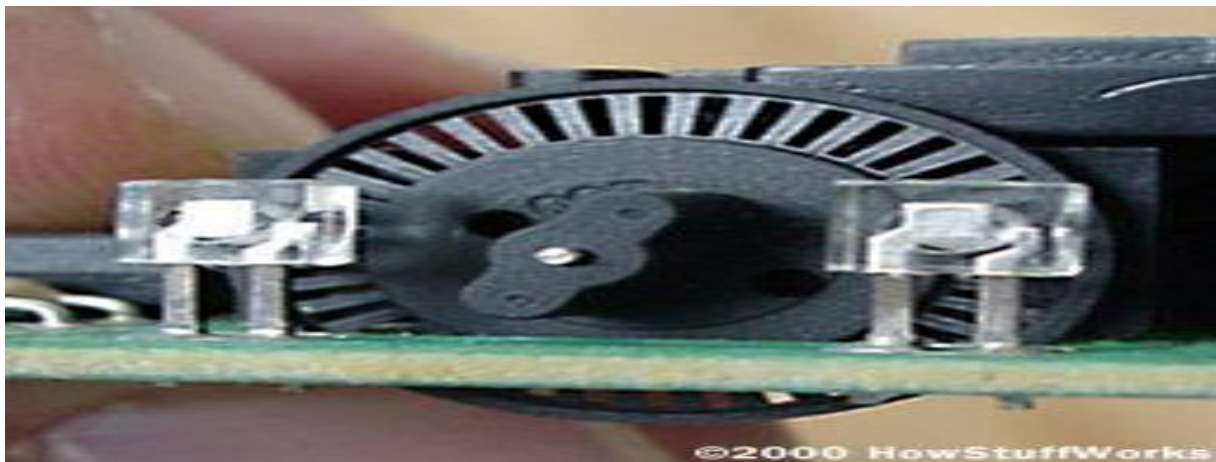
4. On either side of the disk there is an **infrared LED** and an **infrared sensor**. The holes in the disk break the beam of light coming from the LED so that the infrared sensor sees pulses of light. The rate of the pulsing is directly related to the speed of the mouse and the distance it travels.

5. An **on-board processor chip** reads the pulses from the infrared sensors and turns them into binary data that the computer can understand. The chip sends the binary data to the computer through the mouse's cord.
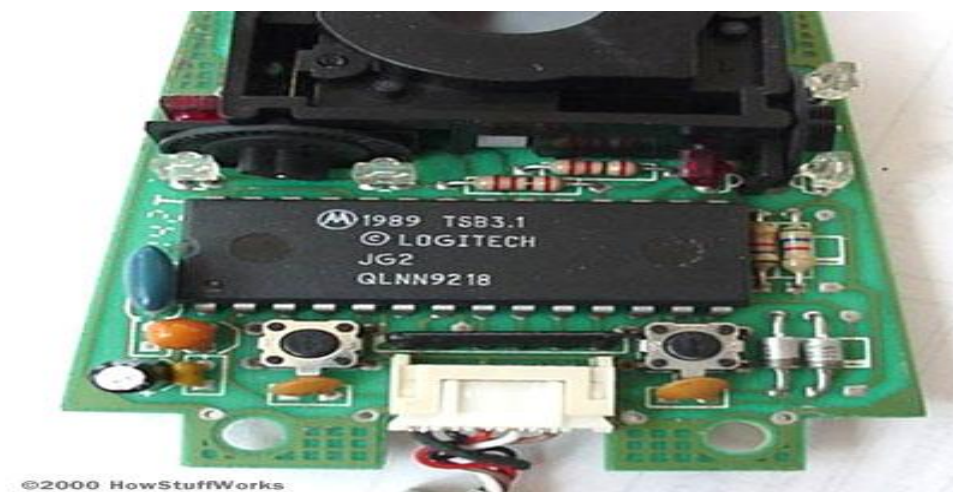
In this **optomechanical** arrangement, the disk moves mechanically, and an optical system counts pulses of light. On this mouse, the ball is 21 mm in diameter. The roller is 7 mm in diameter. The encoding disk has 36 holes. So if the mouse moves 25.4 mm (1 inch), the encoder chip detects 41 pulses of light.

You might have noticed that each encoder disk has two infrared LEDs and two infrared sensors, one on each side of the disk (so there are four LED/sensor pairs inside a mouse). This arrangement allows the processor to detect the disk's **direction of rotation**. There is a piece of plastic with a small, precisely located hole that sits between the encoder disk and each infrared sensor. It is visible in this photo:

The Optical Mouse

With advances it mouse technology, it appears that the venerable wheeled mouse is in danger of extinction. The now-preferred device for pointing and clicking is the optical mouse.

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Developed by Agilent Technologies and introduced to the world in late 1999, the optical mouse actually uses a tiny camera to take 1,500 pictures every second.

Able to work on almost any surface, the mouse has a small, red light-emitting diode (LED) that bounces light off that surface onto a complimentary metal-oxide semiconductor (CMOS) sensor. The CMOS sensor sends each image to a digital signal processor (DSP) for analysis. The DSP, operating at 18 MIPS (million instructions per second), is able to detect patterns in the images and see how those patterns have moved since the previous image. Based on the change in patterns over a sequence of images, the DSP determines how far the mouse has moved and sends the corresponding coordinates to the computer. The computer moves the cursor on the screen based on the coordinates received from the mouse. This happens hundreds of times each second, making the cursor appear to move very smoothly.

Optical mice have several benefits over wheeled mice:
- No moving parts means less wear and a lower chance of failure.
- There's no way for dirt to get inside the mouse and interfere with the tracking sensors.
- Increased tracking resolution means smoother response.
- They don't require a special surface, such as a mouse pad.
-

- Although LED-based optical mice are fairly recent, another type of optical mouse has been around for over a decade. The original optical-mouse technology bounced a focused beam of light off a highly-reflective mouse pad onto a sensor. The mouse pad had a grid of dark lines. Each time the mouse was moved, the beam of light was interrupted by the grid. Whenever the light was interrupted, the sensor sent a signal to the computer and the cursor moved a corresponding amount.
- This kind of optical mouse was difficult to use, requiring that you hold it at precisely the right angle to ensure that the light beam and sensor aligned. Also, damage to or loss of the mouse pad rendered the mouse useless until a replacement pad was purchased. Today's LED-based optical mice are far more user-friendly and reliable.

Data Interface

Most mice in use today use the standard PS/2 type connector, as shown here:

These pins have the following functions (refer to the above photo for pin numbering):
1. Unused
2. +5 volts (to power the chip and LEDs)
3. Unused
4. Clock
5. Ground

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6. Data

What Data is Sent

Whenever the mouse moves or the user clicks a button, the mouse sends 3 bytes of data to the computer. The first byte's 8 bits contain:

1. Left button state (0 = off, 1 = on)
2. Right button state (0 = off, 1 = on)
3. 0
4. 1
5. X direction (positive or negative)
6. Y direction
7. X overflow (the mouse moved more than 255 pulses in 1/40th of a second)
8. Y overflow

The next 2 bytes contain the X and Y movement values, respectively. These 2 bytes contain the number of pulses that have been detected in the X and Y direction since the last packet was sent.

SPEECH RECOGNITION SOFTWARE

Speech Recognition Software converts speech into text. Now, textand instructionscan be dictated to computer through Speech Recognition Software.This kind of input devices encourage uses of natural language to programme and instruct computer. However, the most successful speech recognition software is able to recognize about 80% of words accurately.The way of delivery of speech changes from one person to another.Tone and ascent of the speaker can change the meaning of sentence though speech recognition software could not differentiate these differences. Thus, every person needs to createits own database of spoken wordsand corresponding typed words to train the speech recognition software. Carrying out full conversation with computer is the ultimate goal of speech recognition input. The Optical Character Recognizing (OCR) and speech recognition software are viable alternative of keyboard and mouse, these devicespermit auto-feeding of data. These devices improve the accuracy and speed of inputting data. The physically challenged people, who could not use keyboard and mouse,can effectively instruct computer through speech recognition software.

SCANNER

Scanner is an input device used to feed data and instructions directly from papers to computer. Scanner captures image of the whole paper and converts it into digital format. Computer extracts text from the captured digital image of paper with the help of Optical Character Recognition (OCR) software. Users can edit and make last minute changes in scanned texts and images. Thus, users can prepare documents without retyping.Thus, scanner minimizes errors incurred due to typing.An intelligent OCR can easily segregate images and text from the scanned documents. An intelligent scanner can auto set the orientation of text collected from various scanned documents. All scanned

papersare aligned in the same direction regardless of orientations of papers during scanning. IGNOU, UGC, other government agencies have uploaded large volume of scanned documents, over their web for the public. The scanned documents are digitized before uploading over web sites so that web surfers can perform search on the scanned documents and easily get contents of their interest. Scanners are classified as flatbed and hand-held scanners on the basis of the manner documents are scanned. The flatbed scanner scans a paper in the similar fashion as a photocopier machine scans documents. Paper is placed over a glass pan in the flatbed scanner. Scanner head automatically moves from one corner to another corner of the paper to scan it. Users need to move scanner-head physically over paper in the case of hand held scanner. Hand held scanners are portable. You must have seen held scanner in big shops and shopping malls to scan and note down details of items purchased by customers. Hand held scanner is scanned over the price and product specification tags to note down details. Scanners are also characterized by scanning speed i.e. number of papers scanned in a minute, resolution of scanner i.e. number of dots scanned in per inch^2 area,its capability to extract texts and images from the scanned documents and its compatibility and connectivity with popular software in office environmentso that scanned documents can be edited easily with popular documentation software.

The basic principle of a scanner is to analyze an image and process it in some way. Image and text capture (optical character recognition or OCR) allow you to save information to a file on your computer.

Scanners have become an important part of the home office over the last few years. Scanner technology is everywhere and used in many ways.

On your computer, you need software, called a driver, that knows how to communicate with the scanner. Most scanners speak a common language, TWAIN.

Parts of a typical flatbed scanner include:
- ❖ **Charge-coupled device (CCD) array**
- ❖ **Mirrors**
- ❖ **Scan head**
- ❖ **Glass plate**
- ❖ **Lamp**
- ❖ **Lens**
- ❖ **Cover**
- ❖ **Filters**
- ❖ **Stepper motor**
- ❖ **Stabilizer bar**
- ❖ **Belt**
- ❖ **Power supply**
- ❖ **Interface port(s)**
- ❖ **Control circuitry**

TYPES OF SCANNER:

- ❖ **Flatbed scanners: it is also called desktop scanners, are the most versatile and commonly used scanners.**

  Used for scanning most documents, photos, and even flat objects from a PC or laptop.

  Scans documents placed face down on the glass (scan bed)

- ❖ **Sheet-fed scanners : are similar to flatbed scanners except the document is moved and the scan head is immobile. A sheet-fed scanner looks a lot like a small portable printer.** Used to scan paper documents and photos

- ❖ **Handheld:**

  Handheld scanners use the same basic technology as a flatbed scanner, but rely on the user to move them instead of a motorized belt. This type of scanner typically does not provide good image quality. However, it can be useful for quickly capturing text.

- ❖ **Drum scanner:**

  Drum scanners are used by the publishing industry to capture incredibly detailed images. They use a technology called a photomultiplier tube (PMT). In PMT, the document to be scanned is mounted on a glass cylinder. At the center of the cylinder is a sensor that splits light bounced from the document into three beams. Each beam is sent through a color filter into a photomultiplier tube where the light is changed into an electrical signal.

Flatbed Scanner

Sheetfed Scanner

Handheld Scanner

Drum Scanner

Working of a Scanner:

Step 1 :-

The document is placed on the glass plate and the cover is closed. The inside of the cover in most scanners is flat white, although a few are black. The cover provides a uniform background that the scanner software can use as a reference point for determining the size

of the document being scanned. Most flatbed scanners allow the cover to be removed for scanning a bulky object, such as a page in a thick book.

Step 2 :-

A lamp is used to illuminate the document. The lamp in newer scanners is either a Cold cathode fluorescent lamp (CCFL) or a Xenon lamp , while older scanners may have a standard fluorescent lamp.

The entire mechanism (mirrors, lens, filter and CCD array) make up the scan head. The scan head is moved slowly across the document by a belt that is attached to a stepper motor. The scan head is attached to a stabilizer bar to ensure that there is no wobble or deviation in the pass. Pass means that the scan head has completed a single complete scan of the document.

The image of the document is reflected by an angled mirror to another mirror. In some canners,there are only two mirrors while others use a three mirror approach. Each mirror is slightly curved to focus the image it reflects onto a smaller surface

The last mirror reflects the image onto a lens. The lens focuses the image through a filter on the CCD array. The filter and lens arrangement vary based on the scanner. Some scanners use a three pass scanning method. Each pass uses a different color filter (red, green or blue) between the lens and CCD array. After the three passes are completed, the scanner software assembles the three filtered images into a single full-color image.
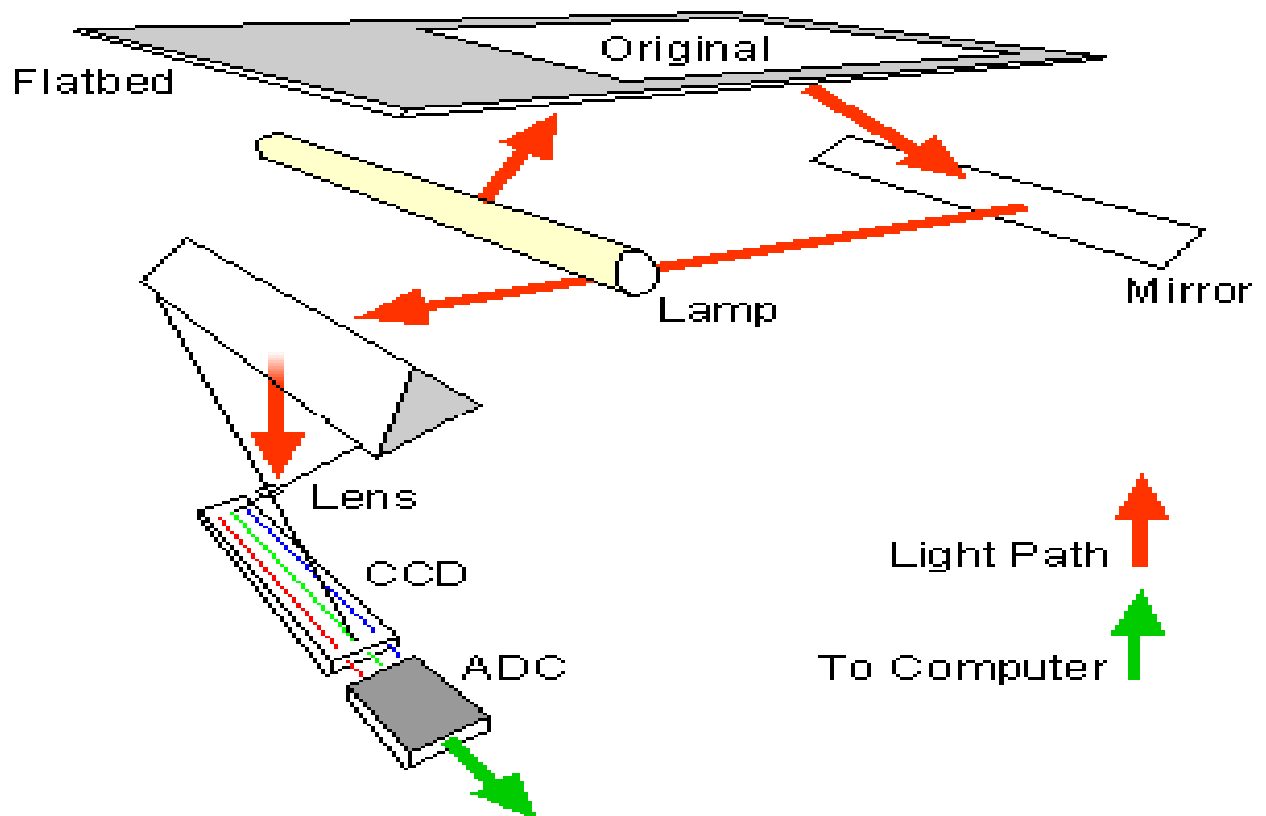
<u>Image transfer</u>

- ❖ Parallel - Connecting through the parallel port is the slowest transfer method available.
- ❖ Small Computer System Interface (SCSI) - SCSI requires a special SCSI connection. Most SCSI scanners include a dedicated SCSI card to insert into your computer and connect the scanner to, but you can use a standard SCSI controller instead.
- ❖ Universal Serial Bus (USB) - USB scanners combine good speed, ease of use and affordability in a single package.

Scanner Working FlowChart
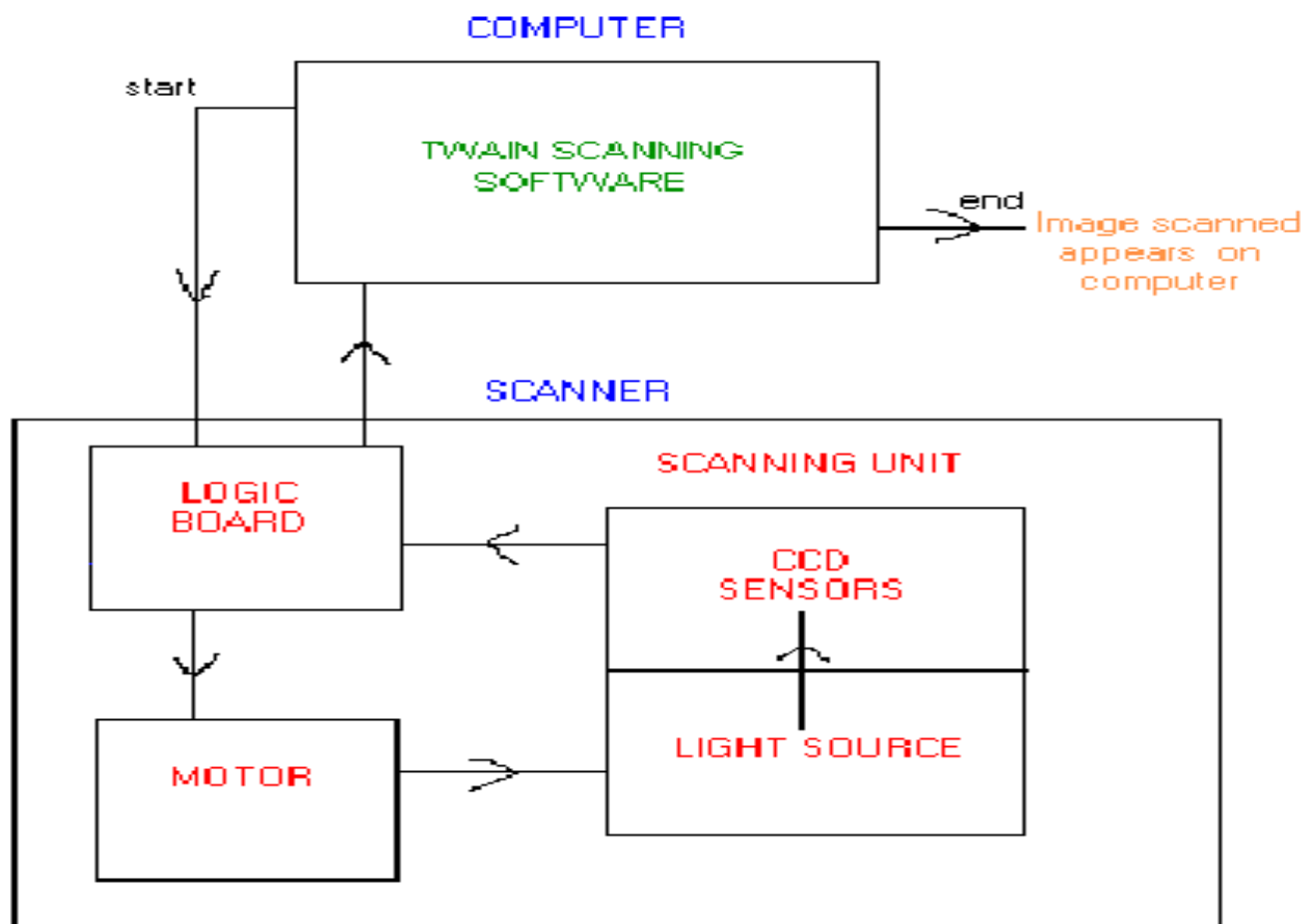
Printer types, working and usefulness

■ An external hardware device responsible for taking computer data and generating a hard copy of that data. Printers are one of the most commonly used peripherals and they print text and still images on the paper.

"Print Quality"

(1) Near typeset quality:
    A Lower quality print similar to the output of a type-writer.
(2) Letter quality:
    Print made up by fully formed (solid line) characters.
(3) Near letter quality:
    A print of high quality formed by multiple passes of print head over the same letter.
(4) Standard quality:
    A high quality print formed by a single pass of the print head.
(5) Draft quality:
    A print formed with minimum number of dots or lines and are smaller than the standard quality characters.

Factors affecting print quality

(1) DPI:
    It is a measurement of printer's resolution indicating how many ink dots can be placed by the printer in one square inch. The higher the DPI, the sharper is image.
(2) Type of printer:
    Each type of printer has its own capabilities of printing. Some types of printers produce high quality print while other produce low quality print.
(3) Print Mode:
    The printing mode may also affect the quality. For example the draft mode increases the print rate but quality is reduced.
(4) Toner:
    The quality and amount of toner also affects print quality.

Printer types

(1) Impact Printer: These printers have a mechanism that touches the paper to create an image. These printers work by banging a print head containing a number of metal pins which strike an inked ribbon placed between the print head and the paper.

> **(a) Daisy Wheel Printer**
> **(b) Dot Matrix**

(2) **Non-Impact Printers:** These printers create an image on the print medium without the use of force. They don't touch the paper while creating an image. Non-impact printers are much quieter than impact printers as they don't strike the paper.

> **(a) Inkjet Printer**
> **(b)Thermal Printer**
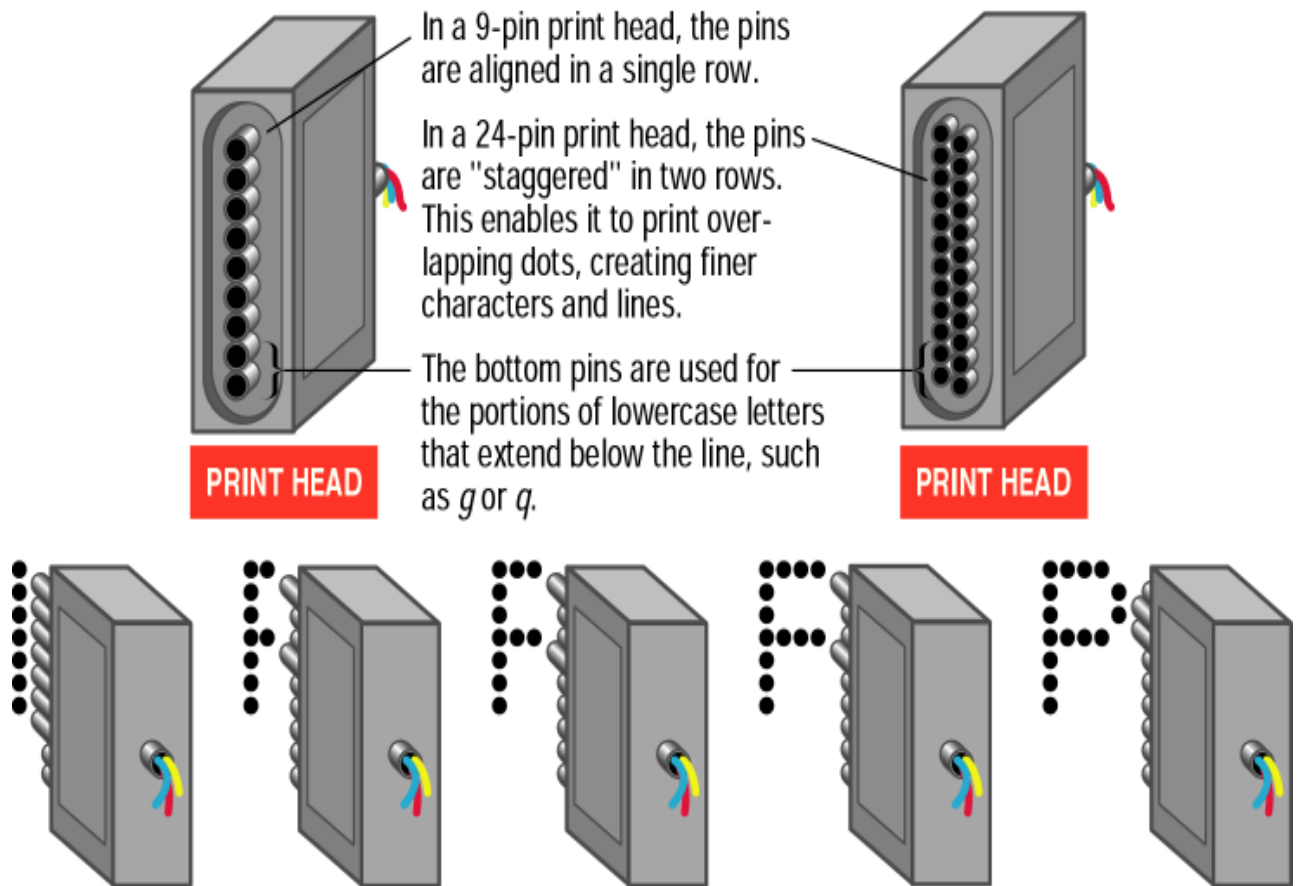> **(c) Laser Printer**

Dot Matrix Printer:

- The term dot matrix refers to the process of placing dots to form an image.
- Its speed is usually 30 to 550 characters per second (cps).
- This is the cheapest and the most noisy printer and has a low print quality. Dot Matrix were 1st introduced by Centronics in 1970.
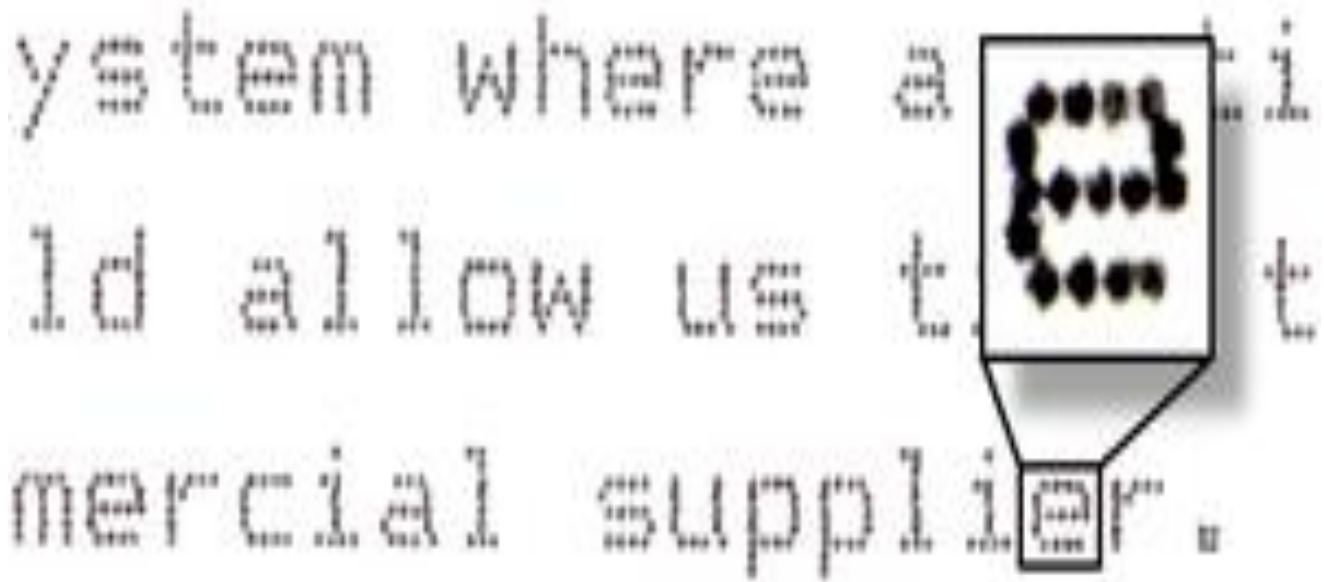
How Dot-Matrix works?
- The dot matrix forms images one character at a time as the print head moves across the paper.
- Uses tiny pins to hit an ink ribbon and the paper much as a typewriter does.
- This printer arranges dots to form characters and all kinds of images.
- 9 to 24 vertical column pins are contained in a rectangular print head.

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

In a 9-pin print head, the pins are aligned in a single row.

In a 24-pin print head, the pins are "staggered" in two rows. This enables it to print overlapping dots, creating finer characters and lines.

The bottom pins are used for the portions of lowercase letters that extend below the line, such as *g* or *q*.

PRINT HEAD

PRINT HEAD

A typical dot matrix output


Advantages/Dis-advatages of Dot-Matrix"

Advantages:
(1) In-expensive.
(2) Low per page cost.
(3) Energy efficient.

Dis-advantages:
(1) Noisy
(2) Low resolution
(3) Limited fonts flexibility
(4) Poor quality graphics output.

Daisy Wheel Printer

■ A daisy wheel printer is basically an impact printer consisting of a wheel and attached extensions on which molded metal characters are mounted. A daisy wheel printer produces letter quality print and it can't produce graphics output.
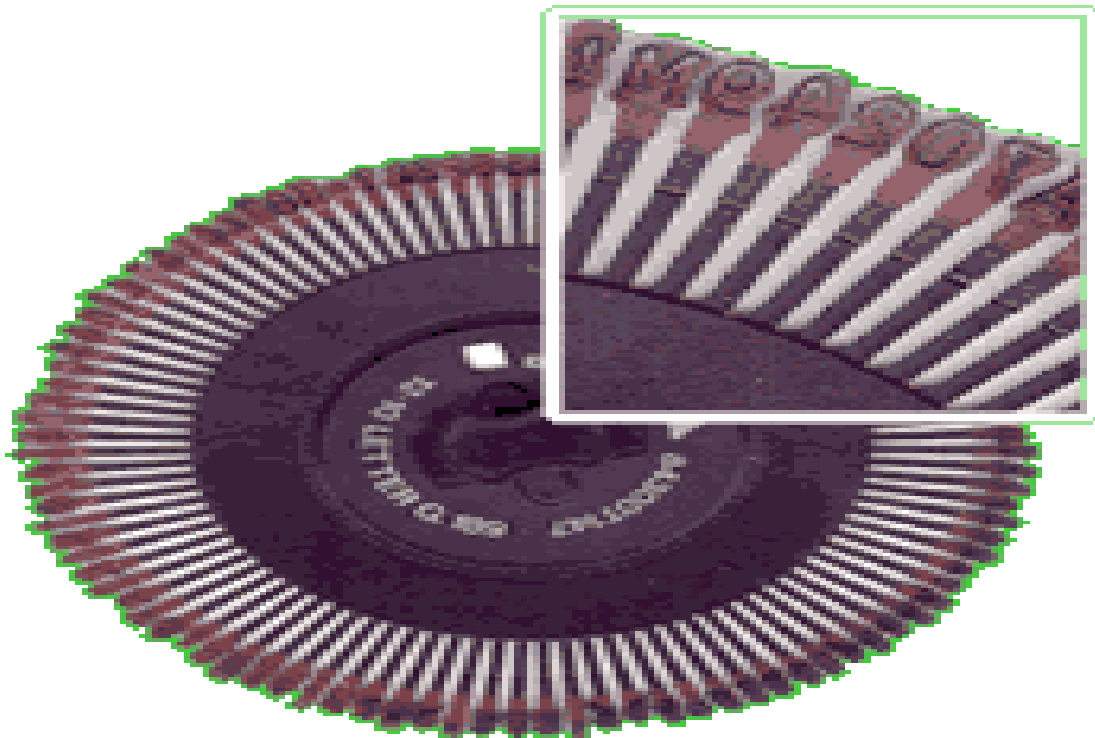
How Daisy wheel printer works?

■ In a daisy wheel printer, a hammer presses the wheel against a ribbon which in turn makes an ink stain on the paper in the form of a character mounted on the wheel extensions.

■ These printers are very noisy as there occur great movement during the printing. Its printing speed is also very slow ,i.e. less than 90cps.

Ink-Jet Printer

■ It is a non-impact printer producing a high quality print. A standard Inkjet printer has a resolution of 300dpi. Newer models have further improved dpi. Inkjet printers were introduced in the later half of 1980s and are very popular owing to their extra-ordinary performance.

How Inkjet Printer works?

(1) Print head having four ink cartridges moves .

(2) Software instructs where to apply dots of ink, which color and what quantity to use.

(3) Electrical pulses are sent to the resistors behind each nozzle.

(4) Vapor bubbles of ink are formed by resistors and the ink is forced to the paper through nozzles.

(5) A matrix of dots forms characters and pictures.

Inside an Inkjet Printer
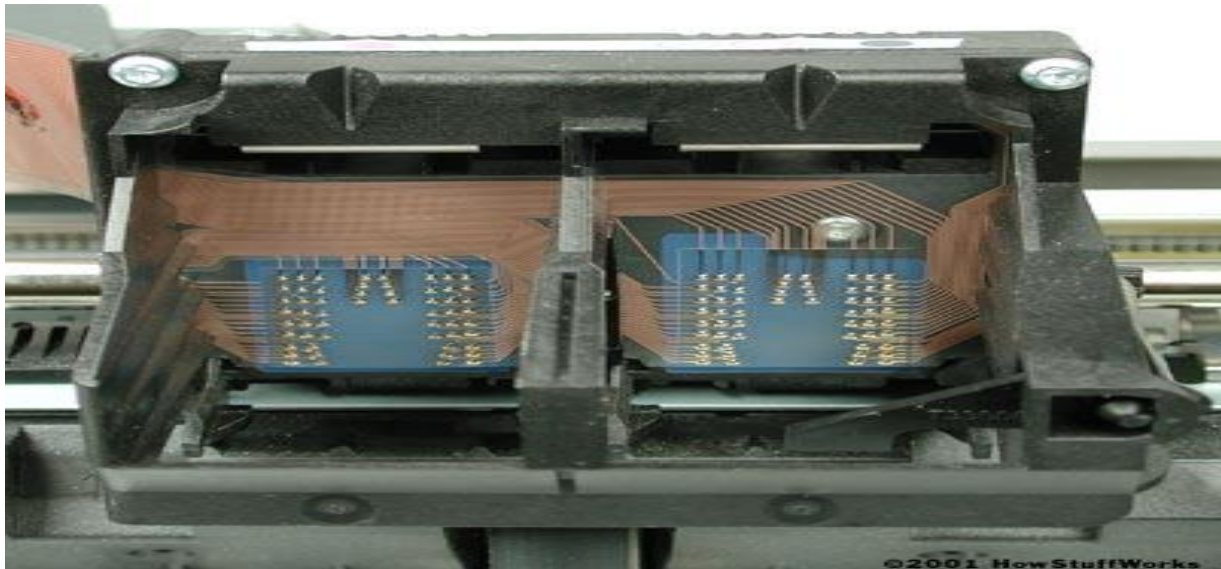
(1) <u>Print head Assembly</u>:
Contains a series of nozzles
(2) <u>Ink Cartridge</u>:
 Depending on the model & manufacturing of printers, ink cartridge come in various combinations.
(3) <u>Print head stepper motor</u>:
A stepper motor moves the print head assembly back and forth across the paper.

(4) <u>Stabilizer bar</u>:
The movement of print head is controlled and made precise by a stabilizer bar.
(5) <u>Belt</u>:
 A belt is used to attach print head assembly to the stepper motor.

(6) **Paper tray/feeder**:
It enables the user to load the paper into the printer.
(7) **Rollers**:
Control the movement of the paper.
(8) **Control circuitry**:
control all the mechanical aspects of the operation as well as decode the information sent to the printer from the computer.

Advantages/ Dis-advantages
Advantages:
(1) High resolution output.
(2) Energy efficient.
(3) Many options to select.
Dis-advantages:
(1) Expensive.
(2) Special paper required for higher resolution output.
(3) Time consuming in case of graphics printing.

Thermal Printer

Thermal printers are in-expensive printers mostly used in fax machines. The Thermal printers are further classified into two types.

(1) <u>Electro thermal printers</u>:

(2) <u>Thermal Wax printers</u>:

How thermal printer works?

Thermal printers use heated pins and ribbons with different color bands. These printers contain a stick of wax like ink. The ribbon passes in front of a print head that has a series of tiny heated pins. The pins cause the wax to melt and adhere to the paper and when temperature reaches to a certain level, it is hardened.

Laser Printer

1) LASER stands for *Light Amplification by Stimulated Emission of Radiation.*
2) Laser printers uses electrostatic printing process.
3) Laser printers are used to produce high quality images and
4) graphics.
5) It is a type of printer that utilizes a laser beam to produce an image on drum.
6) It uses a non-impact (keys don't strike the paper), photocopier technology.

❖Laser Printing Process

✓ *Cleaning:* Before a new page is printed, any remaining from the previous page are cleared away. The drum is swept free with a rubber blade,

and a fluorescent lamp removes any electrical charge remaining on the drum.

✓ *Conditioning:* The entire drum is uniformly charged by the primary corona wire. This charge conditions the drum for the next step.

Laser Printing Process
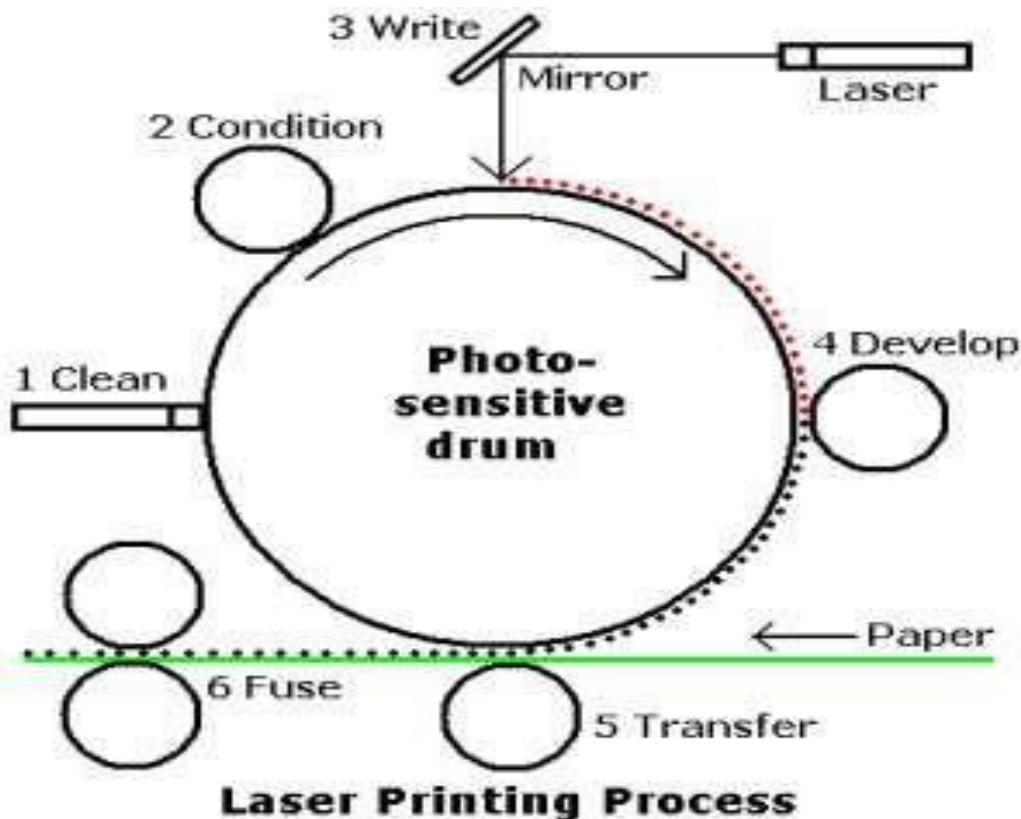
✓ *Writing:* The laser printer controller uses a laser beam and a series of mirrors to create the image of the page on the drum. The laser beam is turned on and off in

accordance with the image to be created on the drum.

✓ *Developing:* A magnet inside the developing roller attracts the iron particles in the toner. This roller rotates near the drum and the toner is attracted to the areas of the drum that have been exposed by the laser, creating the print image on the drum.

(Toner : the electrostatic image is created by changing the charges on different places. The drum continues to revolve and the toner sticks to the negatively charged places of the text.)

✓ *Transferring:* A magnet inside the developing roller attracts the iron particles in the toner. This roller rotates near the drum and the toner is attracted to the areas of the drum that have been exposed by the laser, creating the print image on the drum.

✓ *Fusing:* The fusing rollers apply heat and pressure to the toner, which melts and presses it into the paper to create a permanent bond. The rollers are covered with Teflon and treated with a light silicon oil to keep the paper from sticking to them.

❖**Advantages**
1)It is a very fast printer.
2)The printing cost of laser printer is less than inkjet printer.
3)It has the ability to print the high resolution images that is 1200 dpi consuming less time.
4)It makes no noise during printing process.
5)Their maintenance time span is longer (changing of the toner)
6)Its efficiency is very high.

❖Disadvantages

1)It is very expensive.
2)The maintenance cost is high.
3)Very Bulky and difficult to repair.
4)It has health hazards.(gases like ozone, nitrogen oxide, carbon monoxide are emitted which are harmful for health.)
5)Also emit Ultraviolet radiation that can cause eye damage.