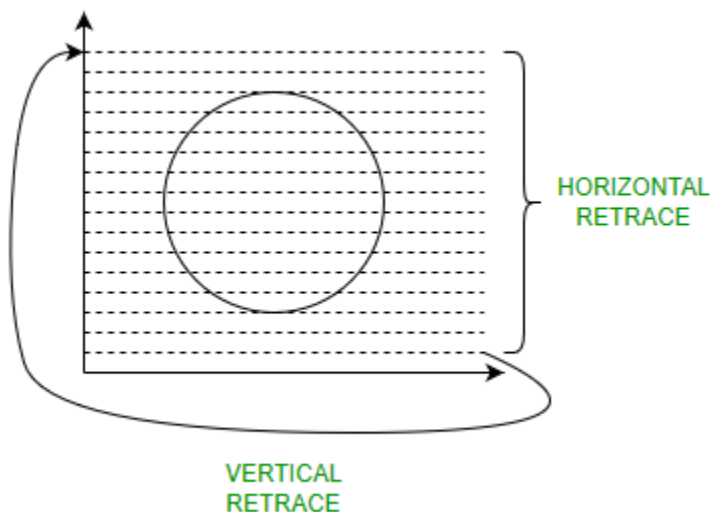# Raster-Scan Displays

Raster Scan Displays are most common type of graphics monitor which employs CRT. It is based on television technology. In raster scan system electron beam sweeps across the screen, from top to bottom covering one row at a time.A pattern of illuminated pattern of spots is created by turning beam intensity on and off as it moves across each row. A memory area called refresh buffer or frame buffer stores picture definition. This memory area holds intensity values for all screen points. Stored intensity values are restored from frame buffer and painted on screen taking one row at a time.Each screen point is referred to as pixels.
In raster scan systems refreshing is done at a rate of 60-80 frames per second. Refresh rates are also sometimes described in units of cycles per second / Hertz (Hz). At the end of each scan line, electron beam begins to display next scan line after returning to left side of screen. The return to the left of screen after refresh of each scan line is known as *horizontal retrace* of electron beam. At the end of each frame electron beam returns to top left corner and begins the next frame.

Raster-Scan Display Processor:

An important function of display process is to digitize a picture definition given in an application program into a set of pixel-intensity values for storage in refresh buffer. This process is referred to as **scan conversion**. The purpose of display processors is to relieve the CPU from graphics jobs.
Display processors can perform various other tasks like: creating different line styles, displaying color areas, etc. Typically display processors are utilized to interface input devices, such as mouse, joysticks.
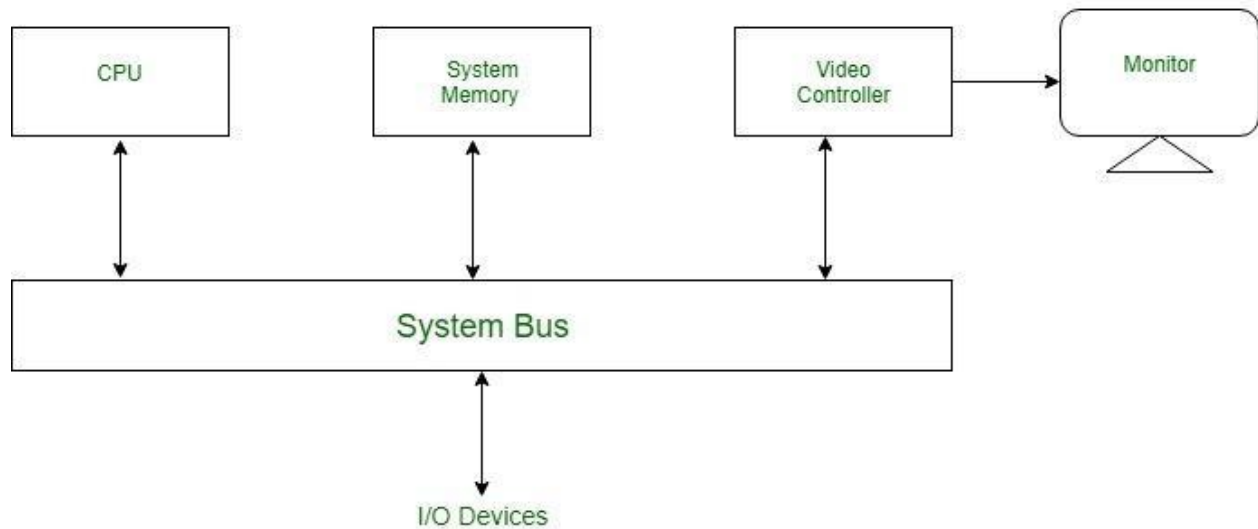
ADVANTAGES:

- Real life images with different shades can be displayed.
- Color range available is bigger than random scan display.

DISADVANTAGES:

- Resolution is lower than random scan display.
- More memory is required.
- Data about the intensities of all pixel has to be stored.

Raster Scan Display:

A Raster Scan Display is based on intensity control of pixels in the form of a rectangular box called Raster on the screen. Information of on and off pixels is stored in refresh buffer or Frame buffer. Televisions in our house are based on Raster Scan Method. The raster scan system can store information of each pixel position, so it is suitable for realistic display of objects. Raster Scan provides a refresh rate of 60 to 80 frames per second.

Frame Buffer is also known as Raster or bit map. In Frame Buffer the positions are called picture elements or pixels. Beam refreshing is of two types. First is horizontal retracing and second is vertical retracing. When the beam starts from the top left corner and reaches the bottom right scale, it will again return to the top left side called at vertical retrace.

- If the electron beam takes too much time to refresh, it looks like the **flickering** of the image.
- To eliminate flickering, the screen image must be regenerated quickly enough that the eye is oblivious to the fact that it is being refreshed or by **interlacing**.

Then it will again more horizontally from top to bottom call as horizontal retracing shown in fig:
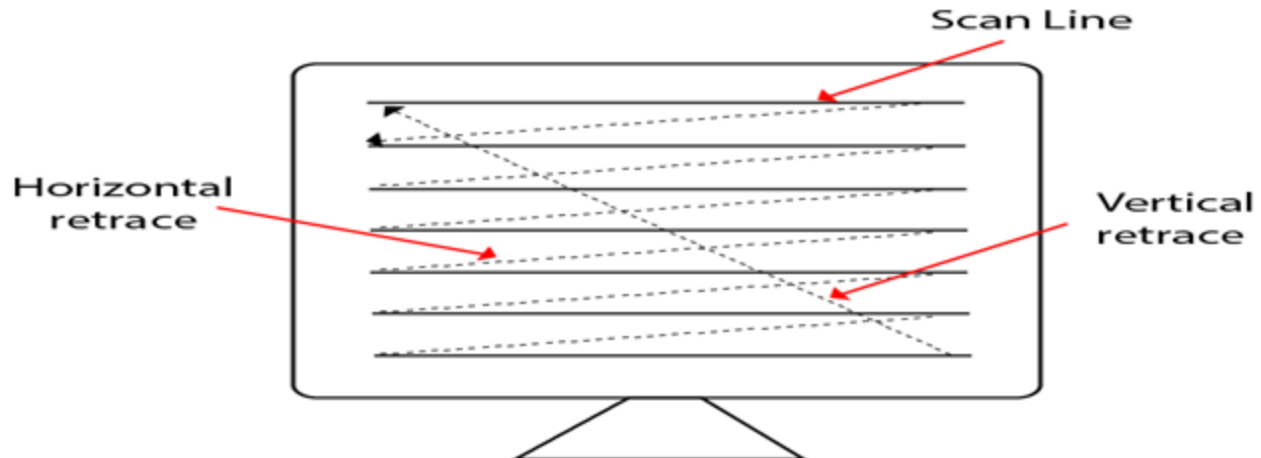
Types of Scanning or travelling of beam in Raster Scan

1. Interlaced Scanning
2. Non-Interlaced Scanning

In Interlaced scanning, each horizontal line of the screen is traced from top to bottom. Due to which fading of display of object may occur. This problem can be solved by Non-Interlaced scanning. In this first of all odd numbered lines are traced or visited by an electron beam, then in the next circle, even number of lines are located.

For non-interlaced display refresh rate of 30 frames per second used. But it gives flickers. For interlaced display refresh rate of 60 frames per second is used.

Advantages:

1. Realistic image
2. Million Different colors to be generated
3. Shadow Scenes are possible.

Disadvantages:

1. Low Resolution
2. Expensive

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Random Scan Display:

Random Scan System uses an electron beam which operates like a pencil to create a line image on the CRT screen. The picture is constructed out of a sequence of straight-line segments. Each line segment is drawn on the screen by directing the beam to move from one point on the screen to the next, where its x & y coordinates define each point. After drawing the picture. The system cycles back to the first line and design all the lines of the image 30 to 60 time each second. The process is shown in fig:
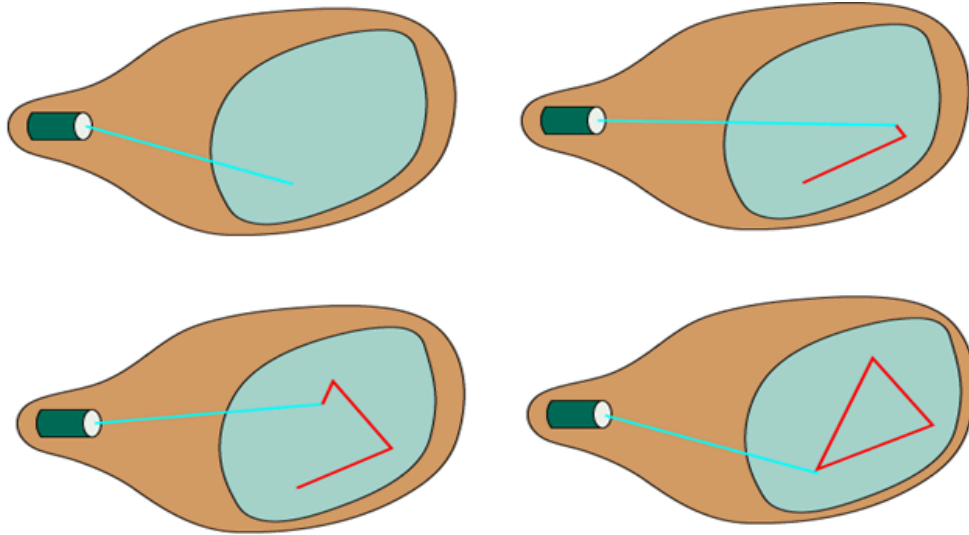
Random-scan monitors are also known as vector displays or stroke-writing displays or calligraphic displays.

Advantages:

1. A CRT has the electron beam directed only to the parts of the screen where an image is to be drawn.
2. Produce smooth line drawings.
3. High Resolution

Disadvantages:

1. Random-Scan monitors cannot display realistic shades scenes.

Cathode Ray Tube (CRT):

CRT stands for Cathode Ray Tube. CRT is a technology used in traditional computer monitors and televisions. The image on CRT display is created by firing electrons from the back of the tube of phosphorus located towards the front of the screen.

Once the electron heats the phosphorus, they light up, and they are projected on a screen. The color you view on the screen is produced by a blend of red, blue and green light.

Cathode Ray Tube
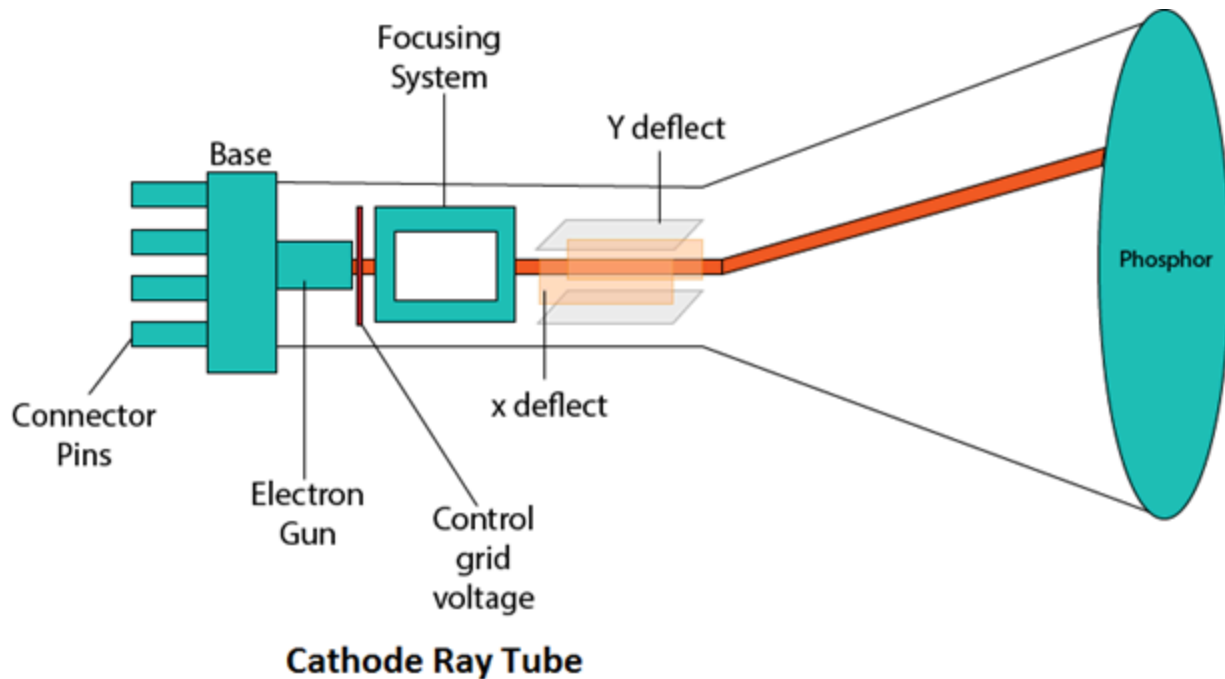
Components of CRT:

Main Components of CRT are:

1. Electron Gun: Electron gun consisting of a series of elements, primarily a heating filament (heater) and a cathode. The electron gun creates a source of electrons which are focused into a narrow beam directed at the face of the CRT.

2. Control Electrode: It is used to turn the electron beam on and off.

3. Focusing system: It is used to create a clear picture by focusing the electrons into a narrow beam.

4. Deflection Yoke: It is used to control the direction of the electron beam. It creates an electric or magnetic field which will bend the electron beam as it passes through the area. In a conventional CRT, the yoke is linked to a sweep or scan generator. The deflection yoke which is connected to the sweep generator creates a fluctuating electric or magnetic potential.

5. Phosphorus-coated screen: The inside front surface of every CRT is coated with phosphors. Phosphors glow when a high-energy electron beam hits them. Phosphorescence is the term used to characterize the light given off by a phosphor after it has been exposed to an electron beam.

Direct View Storage Tubes:

DVST terminals also use the random scan approach to generate the image on the CRT screen. The term "storage tube" refers to the ability of the screen to retain the image which has been projected against it, thus avoiding the need to rewrite the image constantly.

Function of guns: Two guns are used in DVST

1. **Primary guns:** It is used to store the picture pattern.
2. **Flood gun or Secondary gun:** It is used to maintain picture display.

Direct View Storage Tube
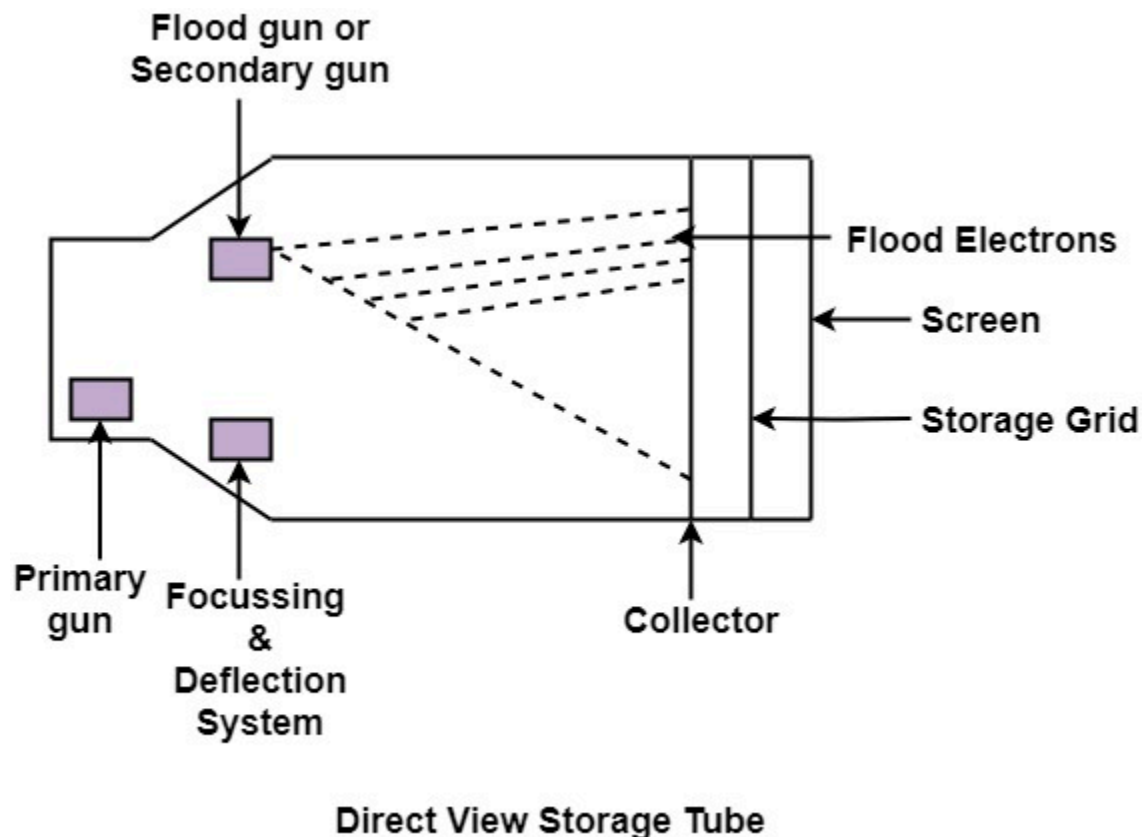
Advantage:
1. No refreshing is needed.
2. High Resolution
3. Cost is very less

Disadvantage:
1. It is not possible to erase the selected part of a picture.
2. It is not suitable for dynamic graphics applications.
3. If a part of picture is to modify, then time is consumed.

Color CRT Monitors:

The CRT Monitor display by using a combination of phosphors. The phosphors are different colors. There are two popular approaches for producing color displays with a CRT are:

1. Beam Penetration Method
2. Shadow-Mask Method

1. Beam Penetration Method:

The Beam-Penetration method has been used with random-scan monitors. In this method, the CRT screen is coated with two layers of phosphor, red and green and the displayed color depends on how far the electron beam penetrates the phosphor layers. This method produces four colors only, red, green, orange and yellow. A beam of slow electrons excites the outer red layer only; hence screen shows red color only. A beam of high-speed electrons excites the inner green layer. Thus screen shows a green color.
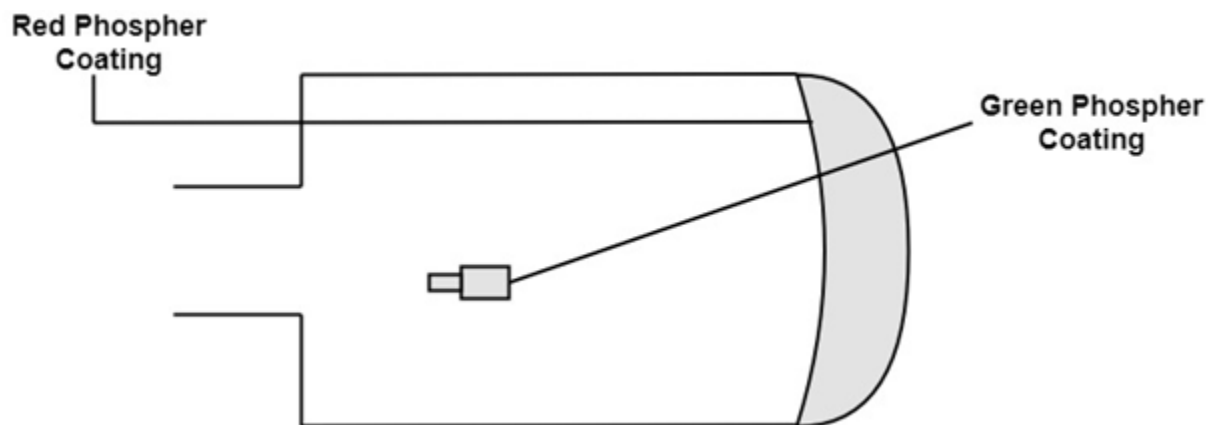
Advantages:

1. Inexpensive

Disadvantages:

1. Only four colors are possible
2. Quality of pictures is not as good as with another method.

2. Shadow-Mask Method:

o Shadow Mask Method is commonly used in Raster-Scan System because they produce a much wider range of colors than the beam-penetration method.
o It is used in the majority of color TV sets and monitors.

**Construction:** A shadow mask CRT has 3 phosphor color dots at each pixel position.

o One phosphor dot emits: red light
o Another emits: green light
o Third emits: blue light

This type of CRT has 3 electron guns, one for each color dot and a shadow mask grid just behind the phosphor coated screen.

Shadow mask grid is pierced with small round holes in a triangular pattern.

Figure shows the delta-delta shadow mask method commonly used in color CRT system.
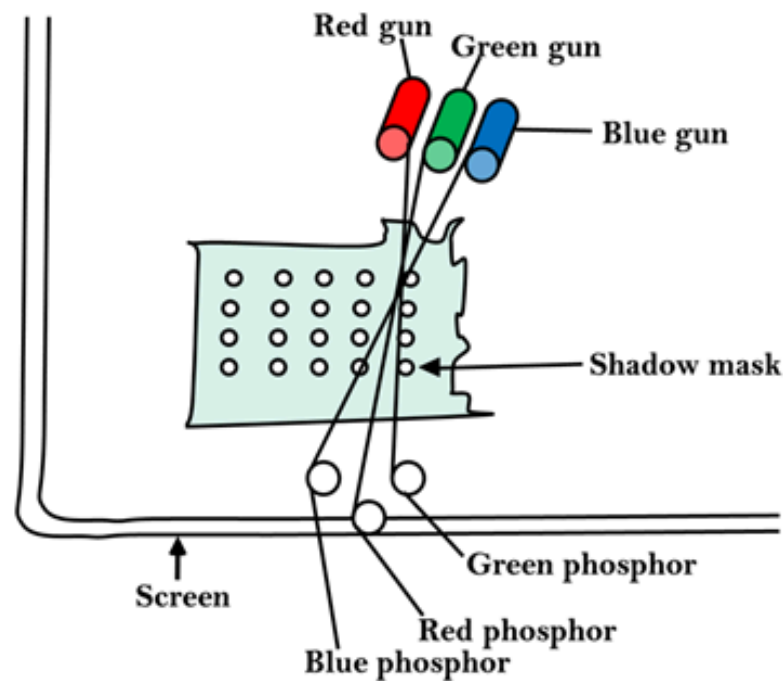
The Shadow mask CRT

Working: Triad arrangement of red, green, and blue guns.

The deflection system of the CRT operates on all 3 electron beams simultaneously; the 3 electron beams are deflected and focused as a group onto the shadow mask, which contains a sequence of holes aligned with the phosphor- dot patterns.

When the three beams pass through a hole in the shadow mask, they activate a dotted triangle, which occurs as a small color spot on the screen.

The phosphor dots in the triangles are organized so that each electron beam can activate only its corresponding color dot when it passes through the shadow mask.

Inline arrangement: Another configuration for the 3 electron guns is an Inline arrangement in which the 3

electron guns and the corresponding red-green-blue color dots on the screen, are aligned along one scan line rather of in a triangular pattern.

This inline arrangement of electron guns in easier to keep in alignment and is commonly used in high-resolution color CRT's.
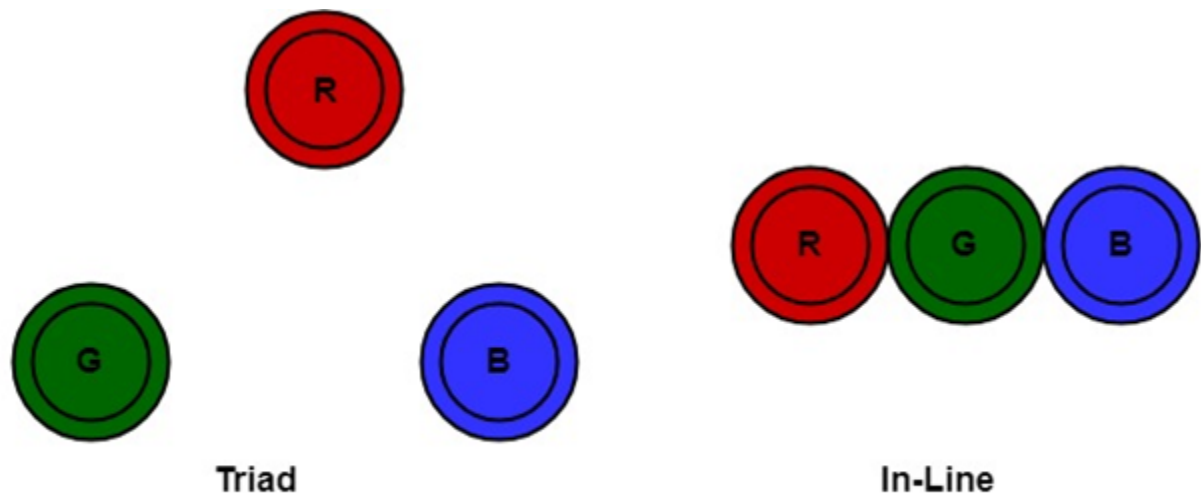
Triad   **In-Line**

Fig:Triad-and -in-line arrangements of red, green and blue electron guns of CRT for color monitors.

Advantage:

1. Realistic image
2. Million different colors to be generated
3. Shadow scenes are possible

Disadvantage:

1. Relatively expensive compared with the monochrome CRT.
2. Relatively poor resolution
3. Convergence Problem

Printer:-A printer is a hardware output device that is used to generate hard copy and print any document. A document can be of any type such as a text file, image, or the combination of both. It accepts input command by users on a computer or on other devices to print the documents.

Types of printer

Printers

Impact Printers

Non-Impact Printers

Daisy wheel   Dot-Matrix   Inkjet   Thermal   Laser

3
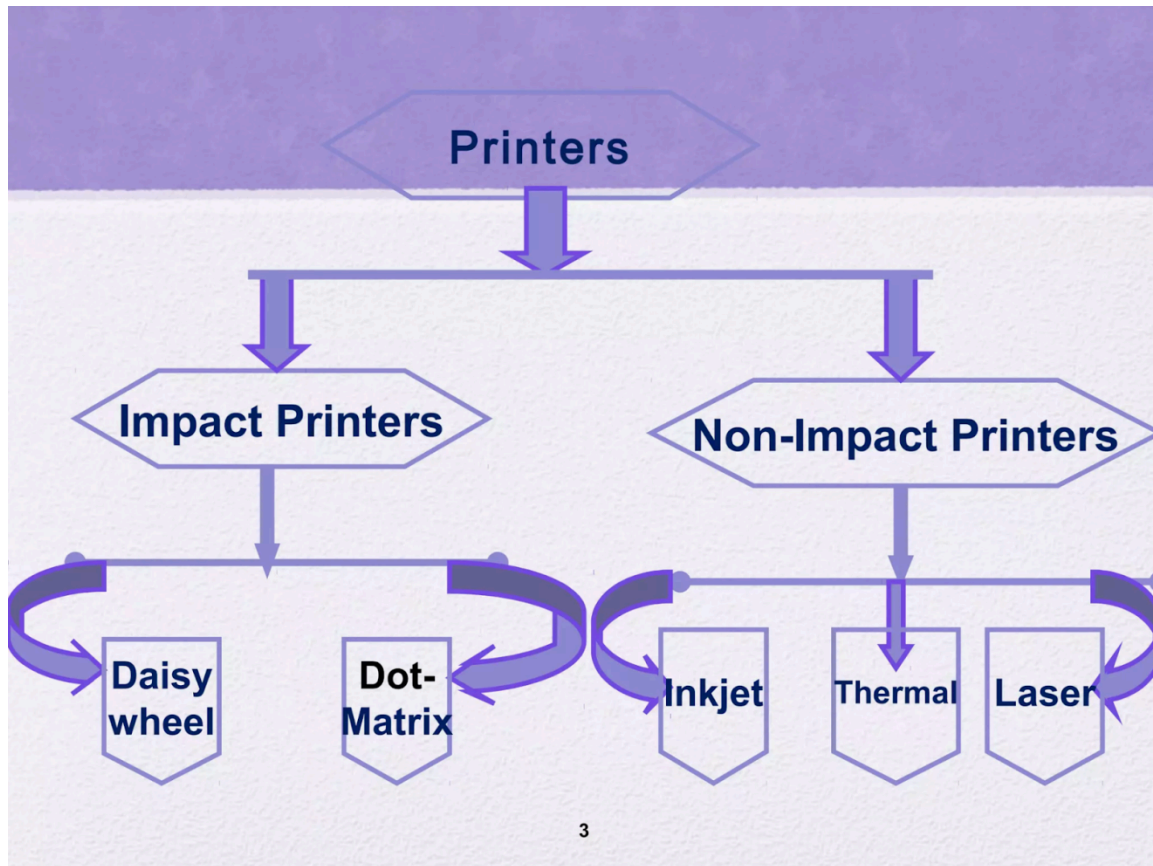
1.**Impact printers** :-Impact printers utilize an electromechanical component that impacts on the paper to print the letters on the paper sheet. It is comparable to a mechanical typewriter. The mechanism employed in these printers is referred to as an electro-mechanical mechanism. It operates at a slower speed than non-impact printers because of the use of a mechanical component.

2.**Non impact** :-Non impact printers, used almost everywhere now, are faster and quieter than impact printers because they have fewer moving parts. Non impact printers form characters and images without direct physical contact between the printing mechanism and the paper.

1(a) Daisy Wheel Printers:-

It is used to print one character at a time.

It can be used to print professional letter quality documents. It also known letter quality printer as the print quality is better as a high-quality typewriter. It gives high resolution output.

Its reliability is higher than that of dot matrix printer. It can have speed upto 90 cps.

1(b)Dot Matrix printing

Dot Matrix printing technology is very old. It can print one character at a time. It can print any shapes of character, special characters, graphs and charts which user wishes to print.

This printer's speed can be measured by Character per second (cps). The speed can vary from about 200 to 500 cps.

The print quality is determined by the number of pins, which can be varying from 9 to 24. For the higher print resolution, more pins per inch are given.

2(A)Inkjet Printers

It is widely used by home and business computer users that prints characters by spraying the ink using magnetic plates on the paper. It contains a paper feed assembly, ink cartridge, print head, stabilizer bar, and belt.

It stores the ink in cartridges, and uses separate cartridge to print several types of color documents. These colors are a combination of cyan, magenta, yellow, and black color. These types of printers have the ability to create high-quality pictures with the help of vivid colors. Furthermore, the inkjet printers are more affordable and easier to use as compared to other printers.

2(B)Laser printers

The laser printer is one of the common personal computer printers. It was introduced in 1971,and after that it was developed at Xerox PARC by Gary Starkweather. It uses the laser or non-impact photocopier technology to print the text and images on the paper. Whenever it gets input to print any document, a laser beam draws the document on the selenium-coated drum with the help of electric charges.

Keyboard:

The most commonly used input device is a keyboard. The data is entered by pressing the set of keys. All keys are labeled. A keyboard with 101 keys is called a QWERTY keyboard.

The keyboard has alphabetic as well as numeric keys. Some special keys are also available

Numeric Keys: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Alphabetic keys: a to z (lower case), A to Z (upper case)

Special Control keys: Ctrl, Shift, Alt

Special Symbol Keys: ; , " ? @ ~ ? :

Cursor Control Keys: ↑ → ← ↓

Function Keys: F1 F2 F3....F9.

Numeric Keyboard: It is on the right-hand side of the keyboard and used for fast entry of numeric data.

Positioning Techniques:-

Pointing technique refers to look at the items already on the screen whereas the positioning technique refers to position the item on the screen to a new position, i.e., the old current position. The user indicates a position on the screen with an input device, and this position is used to insert a symbol.

There are various pointing and positioning devices which are discussed below:

Light Pen

Mouse

Tablet

Joystick

Trackball and spaceball

1.Light Pen: It is a pointing device. When light pen is pointed at an item on the screen, it generates information from which the item can be identified by the program. It does not have any associated tracking hardware instead tracking is performed by software, making use of the output function of the display. All light pen programs depend on a rapid response from the pen when it is pointed at the screen fast response light pens can be build by using a highly sensitive photocell such as a photomultiplier tube.

2. Mouse: It is a positioning device which consists of a small plastic box resting on two metal wheels whose axes are at right angles. Each wheel of the mouse is linked to a shaft encoder that delivers an electrical pulse for every incremental rotation of the wheel. As the mouse is rolled around on a flat surface, its movement in two orthogonal directions is translated into rotation of the wheels. These rotations can be measured by counting the pulses received from the shaft encoders. The connected values may be held in registers accessible to the computer on written directly into the computer memory.

3.Tablet: It is also a positioning device and is used to describe a flat surface separate from the display, on which the user draws with a stylus.

4.Joystick: A joystick consists of a small that is used to steer the screen cursor around. The distance that the stick is moved in any direction from its center position corresponds to the screen-cursor movement in that direction. Pressure sensitive joysticks have a non-moveable stick. Pressure on the stick is measured with strain gauges and converted to the movement of the cursor in the direction specified.

5. Trackball and spaceball: Trackball is a ball that can be rotated with the fingers to produces screen-cursor movement potentiometers, attached to the ball, measure the amount and direction of rotation. Trackballs are after mounted on keyboards, whereas space-ball provides six degrees of freedom.

Rubber Band Method :

This method is used to construct and position straight line segments. This method stretch line from starting position as movement of screen cursor. The user first selects position from one endpoint of line and then it moves cursor around, hen line is displayed from where user start cursor and position where cursor is placed now. Finally when user selects second endpoint on screen, then final line is displayed from starting endpoint to second endpoint on screen.

The name is Elastic or Rubber Band Technique because of effect of elastic line which is stretched between first endpoint and cursor.

Dragging

Dragging is used to move an object from one position to another position on the computer screen. To drag any other object, first, we have to select the object that we want to move on the screen by holding the mouse button down. As cursor moved on the screen, the object is also moved with the cursor position. When the cursor reached the desired position, the button is released.

The following diagram represents the dragging procedure:

Button down		Drag		Button up
Select the object		For finding new position of object		Deselect the object on desired position