

भारतीय ज्ञान परंपरा में शिक्षा के समाजशास्त्रीय आधार

सम्पादक :
डॉ. दिनेश चन्द्र शर्मा

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रचना - भारतीय ज्ञान परम्परा में शिक्षा के समाजशास्त्रीय आधार

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मुद्रक - श्रीनिवास प्रिन्टोग्राफिक्स, अजमेर

Computer Graphics

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Introduction of Computer Graphics

Computer Graphics is used with technology to access. The Process converts and displays information in a graphical form. The use of computer graphics insensible. In today's life, computer graphics now a prevalent feature of user interfaces, T.V. commercial motion pictures.

Computer Graphics is the generation of images with the assistance of a computer. The final output of the computer graphics is an image it could be a business graph, drawing, and engineering.

Two or three-dimensional images are generated in the field of computer graphics that are employed for research. Numerous hardware devices algorithm has been evolving with the passage of time for enhancing picture generation speed. It involves the storage creation of model and image of objects. These models for different disciplines such as engineering, mathematical and so on.

Now computer graphics is quite different from the previous one. It is impossible. It is an interactive user can manipulate the structure of an object of different input devices.

Definition of Computer Graphics :-

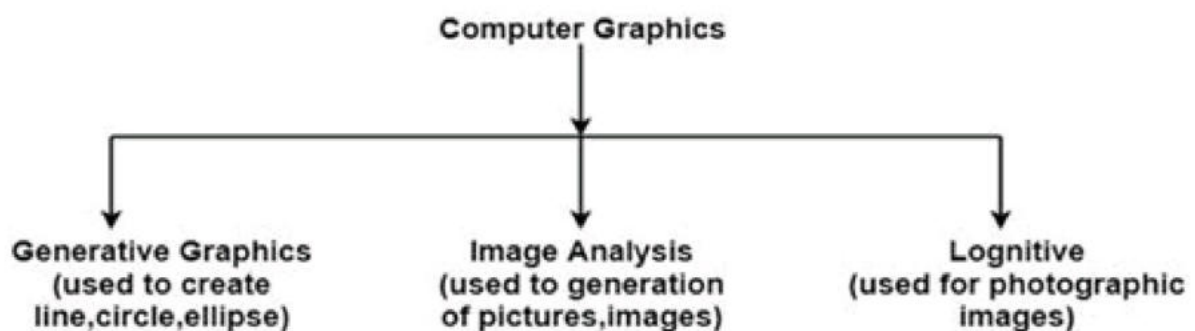
It is computer application for creation and manipulation of pictures on a display device. It includes software techniques to form, store, alter, represents pictures.

Why computer graphics used?

Assume a shoe production company would like to display five years of shoe sales. To store this huge amount of data will be difficult. So much time and space will be required. This technique will be

difficult to comprehend by a layman. In this case, graphics is a better option. Graphics tools are graphs and charts. By using graphs, information can be presented in picture form. A picture can be comprehended very simply with one glance.

Interactive computer graphics operate based on the principle of two-way communication between computer users. The computer will receive signals from the input device, and the picture will be altered accordingly. Picture will be altered rapidly when we will apply command.



Use of Computer Graphics

1. Training and Education :- Physical, financial and economic system can be modelled computer-generated as educational tools. Physical systems model, physiological system, population trends or equipment can assist trainees to visualize the functioning of the system.

Specific systems can be prepared for specific training applications. For instance Flight Simulator.

Flight Simulator : It assists in providing training to the airplance pilots. The pilots spend most of their training not on an actual aircraft but grounded at the Flight Simulator's controls.

Advantages:

1. Fuel Saving
2. Safety
3. Capacity to familiarize the training with a large number of the world's airports.

2. Application in Biology :- Molecular biologist can show a picture of molecules and understand their structure with the assistance of computer graphics.

3. Computer-Generated Maps :- Town planners and

transportation engineers can make use of computer-generated maps that present data beneficial to them in their planning activities.

4. Architect :- Architect can find another solution to design problems at an interactive graphics terminal. Thus, they can evaluate a great number of solutions that would be impossible without the computer.

5. Presentation Graphics :- Examples of presentation Graphics are bar chart, line graph, pie chart and other presentations displaying relationships between two or more parameters. Presentation Graphics is widely used to summarize

- * Financial Reports
- * Statistical Reports
- * Mathematical Reports
- * Scientific Reports
- * Economic Data for research reports
- * Managerial Reports
- * Consumer Information Bulletins
- * And other reports

6. Computer Art :- Computer Graphics are also applied in the area of commercial arts. It is applied to produce television and commercial advertisement.

7. Entertainment :- Computer Graphics are increasingly being applied in the production of motion pictures, music videos and television programs.

8. Visualization :- It is applied for visualization of scientists, engineers, medical professionals, business analysts for studying a large volume of information.

9. Educational Software :- Computer Graphics is employed for developing educational software for preparing computer-aided instruction.

10. Printing Technology :- Computer Graphics is employed for printing technology and textiles design.

Example of Computer Graphics Packages: LOGO, COREL

DRAW,AUTO CAD, 3D STUDIO, CORE, GKS (Graphics Kernel System), PHIGS, CAM (Computer Graphics Metafile),CGI (Computer Graphics Interface)

Interactive and Passive Graphics

(A) Non-Interactive or Passive Computer Graphics :- In non-interactive computer graphics, the image is generated on the screen, and the user has no control over the image, i.e., the user can not introduce any modification in the generated image. A simple example of its Titles displayed on T.V. Non-interactive Graphics has one-way interaction between the computer and the user, User can view the generated image, and he can not introduce any modification in the image.

(B) Interactive Computer Graphics :- In interactive Computer Graphics user has some control on the picture, i.e., user can do any modification in the generated image. One of its examples is the ping-pong game.

Interactive Computer Graphics demand two-way communication between the user and the computer. A User can view the image and do any modification by sending his command using an input device.

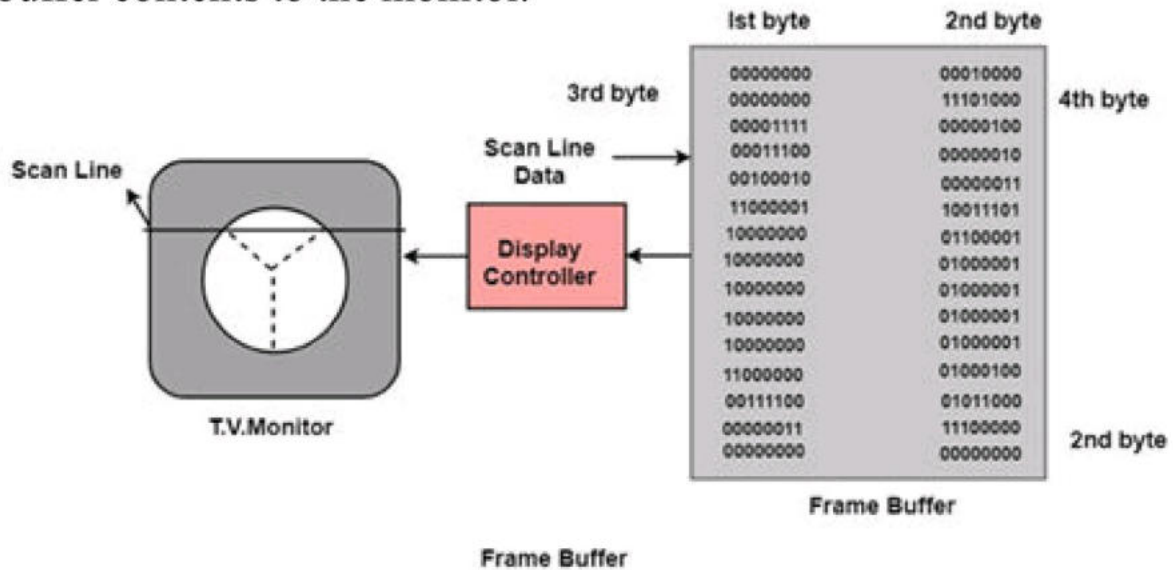
Advantages:

1. More Quality
2. More accurate results or products
3. More Productivity
4. Reduces analysis and design expense
5. Much more increases our capability to comprehend data and to see trends.

Operation of Interactive Computer Graphics :- The contemporary graphics display is extremely uncomplicated in structure. It is made up of three elements:

1. Frame Buffer or Digital Memory
2. A Monitor such as a home T.V. set except for the receiving and tuning electronics.

3. Display Controller or Video Controller: It sends the frame buffer contents to the monitor.



Frame Buffer :- A large, contiguous block of computer memory that is used to contain or map the image on the screen.

- * There is at least 1 memory bit per pixel in the raster. It is referred to as a bit plane.

- * 1024 x 1024 element consumes 220 (210=1024;220=1024 x 1024)sq.raster or 1,048,576 memory bits in one bit plane.

- * The image is constructed in the frame buffer bit by bit.

- * A memory bit can exist in only two states (binary 0 or 1), a single bit plane produces a black and white (monochrome display).

- * Since frame buffer is a digital device write raster CRT is an analog device.

Properties of Video Monitor:

1. Persistence :- Persistence refers to how long the phosphorescence lasts. Various types of phosphors can be used in a CRT. Apart from color, one primary distinction among phosphor is how they persist after the removal of the electron beam.

2. Resolution :- Utilized to refer to the amount of pixels utilized on display picture.

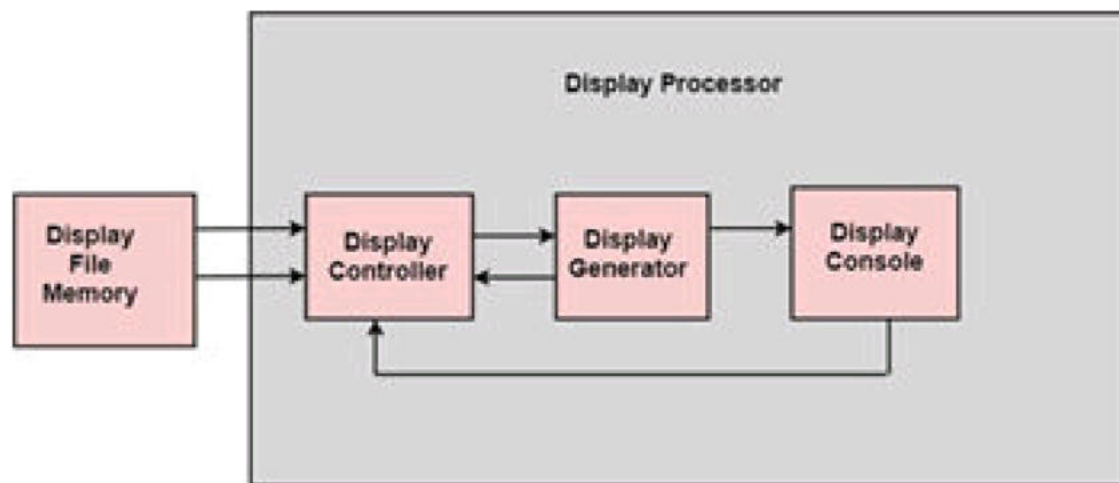
3. Aspect Ratio :- It is the ratio of width to its height. Its measurement is unit in length or number of pixels.

$$\text{Aspect Ratio} = \frac{\text{width unit}}{\text{height unit}}$$

Display Processor :- It is interpreter or hardware piece that translates display processor code into pictures. It is one of the four core sections of the display processor

Parts of Display Processor

1. Display File Memory
2. Display Processor
3. Display Generator
4. Display Console



Block diagram of Display System

Display File Memory :- It is utilized for the generation of the image. It is utilized for the identification of graphic entities.

Display Controller :-

1. It services interrupt
2. It keeps timings
3. It is utilized for the instruction interpretation.

Display Generator:

1. It is utilized for the creation of character.
2. It is utilized for the creation of curves.

Display Console :- It has CRT, Light Pen, and Keyboard and deflection system.

The raster scan system is a combination of certain processing units. It comprises the control processing unit (CPU) and a special processor known as a display controller. Display Controller governs

the functioning of the display device. It is also referred to as a video controller.

Working :- The output circuitry's video controller produces the vertical and horizontal drive signals so that the monitor can sweep its beam across the screen during raster scans.

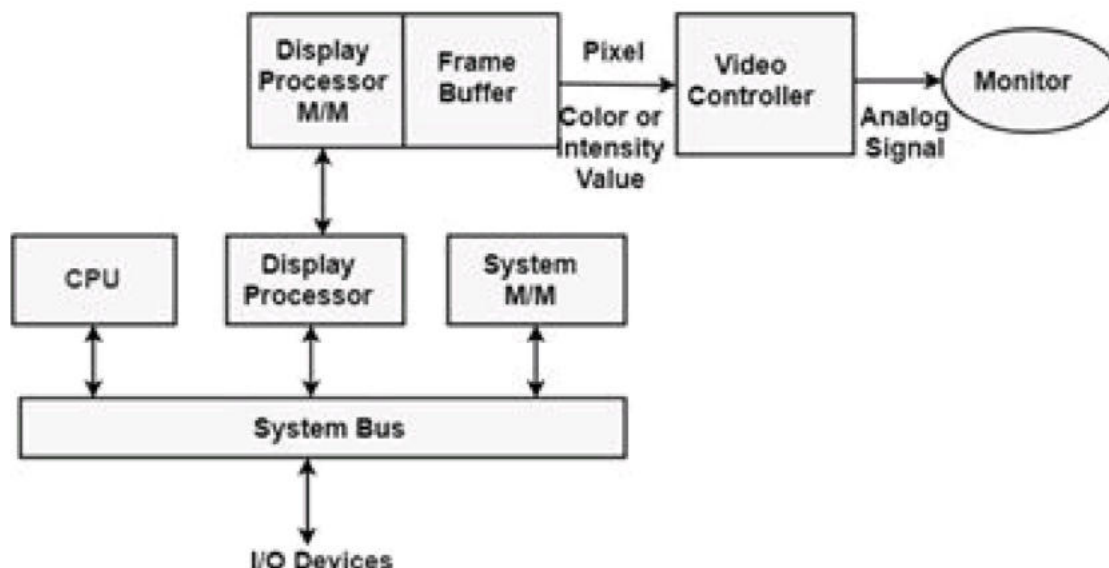


Fig: Architecture of a Raster Display System with a Display Processor

As fig indicates 2 registers (X register and Y register) are employed to save the coordinate of the screen pixels. Suppose the y values of the scan lines next to each other rose by 1 in the positive direction from 0 at the screen's bottom to ymax at the top and for each scan line the screen pixel locations or x values are incremented by 1 from 0 at the leftmost location to xmax at the rightmost location.

The origin is at the left bottom of the screen as in a normal Cartesian coordinate system.

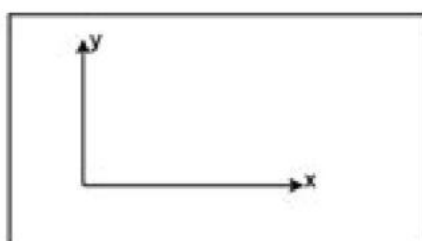


Fig: The origin of the coordinate system for identifying screen positions is usually specified in the lower-left corner.

At the beginning of a Refresh Cycle:

X register is reset to 0 and y register is reset to ymax. This (x, y') address is converted to a memory address of frame buffer where the color value for this pixel location is located.

This value of color (a binary no) is received by the controller from the frame buffer, divided into three components and transmitted to individual Digital-to-Analog Converters (DACs).

These voltages, in turn, control the intensities of 3 e-beams focused at the (x, y) screen location by horizontal and vertical drive signals.

This is done for every pixel in the top scan line, incrementing the X register by Y every time.

As pixels of the first scan line are produced, X register is incremented from xmax.

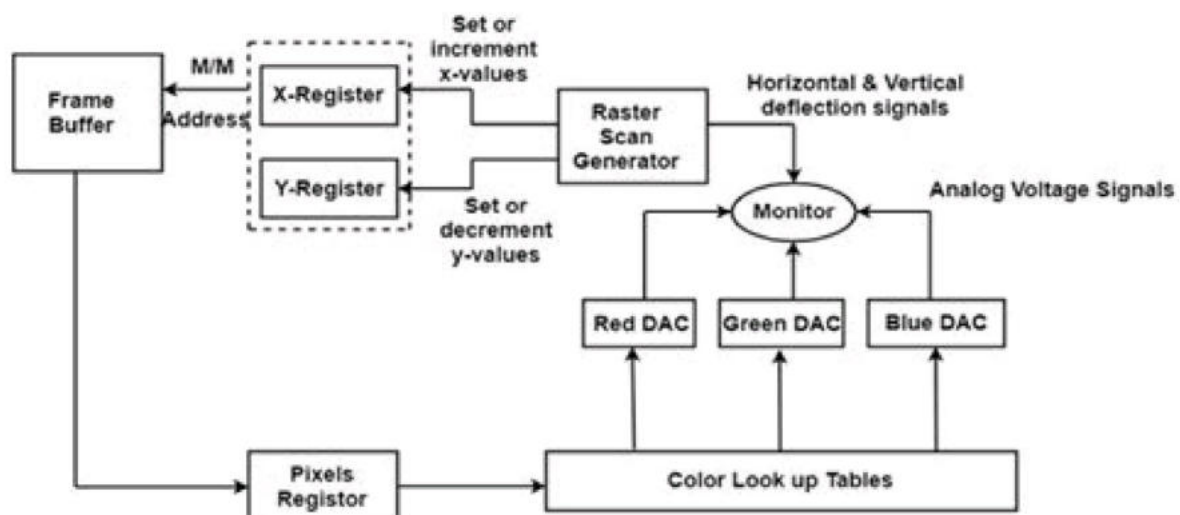
x register is then cleared to 0, and y register is decreased by 1 to move to the subsequent scan line.

Pixel at every scan line is then processed, and the process is repeated for every subsequent scan line units pixels on the final scan line ($y=0$) are created.

For a color look-up table frame buffered display system, frame buffer value is not used directly in controlling the intensity of the CRT beam.

It is utilized as an index to locate the three pixel-color value from the look-up table. The lookup operation is performed for each pixel during each display cycle.

Since the time that can be utilized in displaying or refreshing a single pixel in the screen is too minimal, reading each pixel intensity value through accessing the frame buffer each time would take more time what is available:



Several nearby pixel values are read to the frame buffer in a single access and cached in the register.

One-pixel value is shifted out from the register after each permitted time interval to drive the warm intensity for that pixel.

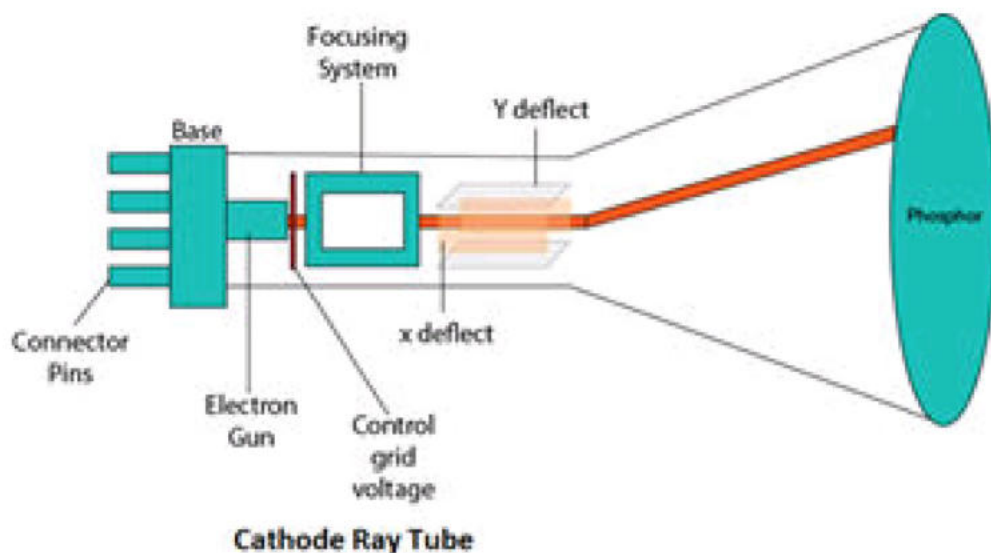
The process is continued with the following block of pixels and so on, so the entire collection of pixels will be processed.

Display Devices :- The most frequently used display device is a video monitor. The majority of video monitors work on the basis of CRT (Cathode Ray Tube). The below display devices are employed:

1. Refresh Cathode Ray Tube
2. Random Scan and Raster Scan
3. Color CRT Monitors
4. Direct View Storage Tubes
5. Flat Panel Display
6. Lookup Table

Cathode Ray Tube (CRT) :- Cathode Ray Tube is abbreviated as CRT. CRT refers to a technology applied in older computer monitors and televisions. The image on CRT screen is formed by shooting electrons from the rear of the tube of phosphorus directed near the front of the screen.

After the electron warms the phosphorus, they glow, and they are thrown onto a screen. What you see on the screen is created by a mixture of red, blue and green light.



Components of CRT:

1. Electron Gun :- Electron gun made up of a series of components, mainly a heating filament (heater) and a cathode. The electron gun produces a source of electrons which are concentrated into a thin beam aimed at the face of the CRT.

2. Control Electrode :- It controls the turning on and off of the electron beam.

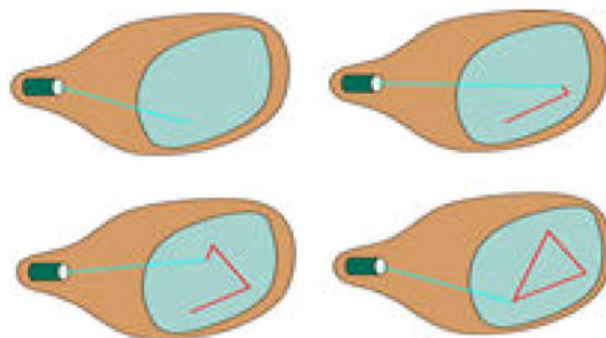
3. Focusing system :- It is employed to produce a clear image by focusing the electrons into a thin beam.

4. Deflection Yoke:- It is utilized to manage the electron beam direction. It generates an electric or magnetic field that will deflect the electron beam as it moves through the region. In a typical CRT, the yoke is connected with a sweep or scan generator. The deflection yoke connected to the sweep generator produces an oscillating electric or magnetic potential.

5. Phosphorus-coated screen :- The interior front side of each CRT is covered with phosphors. Phosphors emit light when a high-energy electron beam strikes them. Phosphorescence is the term applied to describe the light emitted by a phosphor once it has been bombarded with an electron beam.

Random Scan and Raster Scan Display :-

Random Scan Display :- Random Scan System employs an electron beam that behaves as a pencil to draw a line image on the CRT screen. The image is built up out of a series of straight-line segments. A line segment is drawn on the screen by causing the beam to travel from one point on the screen to another, where its x & y coordinates specify each point. After the picture has been drawn. The system loops through the first line and plot all the lines of the picture 30 to 60 times per second. The process is illustrated in fig:



Random-scan monitors are also referred to as vector displays or stroke-writing displays or calligraphic displays.

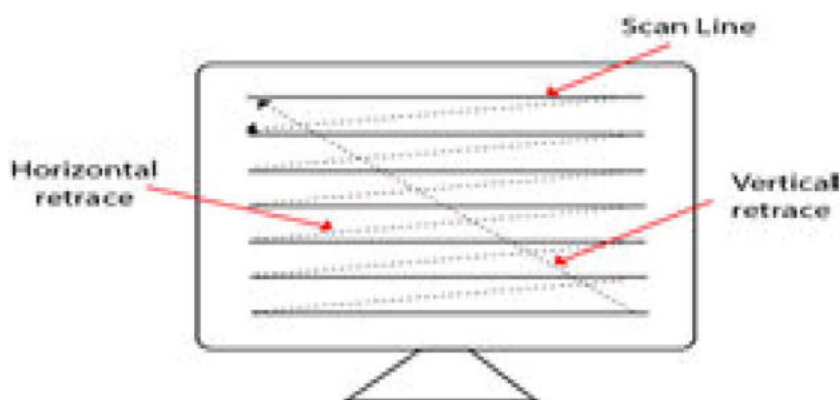
Advantages

1. A CRT has the electron beam aimed at only the areas of the screen upon which an image is to be rendered.
2. Plot smooth line drawings.
3. Good Resolution

Disadvantages :- Random-Scan monitors don't have the ability to show realistic shades scenes.

Raster Scan Display :- Raster Scan Display is founded on intensity control of pixels in the structure of a box shaped Raster on the screen. On and off pixel's information is saved in refresh buffer or Frame buffer. Televisions at our home are founded on Raster Scan Method. The raster scan mode can hold data of every pixel location, thus it is appropriate for realistic display of objects. Raster Scan gives a rate of refreshing 60 to 80 frames per second.

Frame Buffer is also referred to as Raster or bit map. In Frame Buffer the locations are referred to as picture elements or pixels. Beam refreshing is of two kinds. First is horizontal retracing and second is vertical retracing. When the beam begins from top left corner and moves towards bottom right scale, again it will come to top left side referred to as vertical retrace. Again it will move more horizontally from top to bottom referred to as horizontal retracing illustrated in fig:



Types of Scanning or travelling of beam in Raster Scan

1. Interlaced Scanning
2. Non-Interlaced Scanning

In Interlaced scanning, every horizontal line of screen is scanned from top to bottom. Because of which object display fading can take place. This is avoided by Non-Interlaced scanning. Here at first odd numbered lines are scanned or covered by an electron beam, then in subsequent circle even number of lines are found.

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

Advantages

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

Disadvantages

1. Low Resolution
2. Expensive

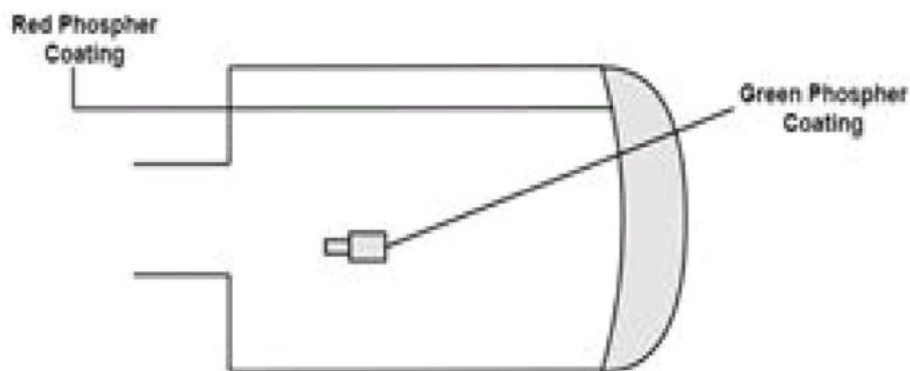
Distinguish between Random and Raster Scan Display :

S.No.	Random Scan	Raster Scan
1	It has high Resolution	Its resolution is low.
2	It is more expensive	It is less expensive
3	Any modification if needed is easy	Modification is tough
4	Solid pattern is hard to fill	Solid pattern is simple to fill
5	Refresh rate relies on resolution	Refresh rate is not based on the image.
6	Only screen displaying view on a region.	Entire screen is scanned.
7	Beam Penetration technology falls under it.	Shadow mark technology falls under this.
8	Doesn't make use of interlacing method.	It employs interlacing
9	It is limited to line drawing usage	It is appropriate for realistic display.

Color CRT Monitors :- Color CRT monitors display through a mixture of phosphors. The phosphors are colored. Two well-known methods for creating color displays with a CRT are:

1. Beam Penetration Method
2. Shadow-Mask Method

1. Beam Penetration Method :- The Beam-Penetration method has been applied with random-scan monitors. In this technique, the CRT screen is painted with two phosphor layers, red and green and the color displayed is based on how deeply the electron beam penetrates the layers of the phosphorescence. The technique yields four colors only, red, green, orange and yellow. A beam of slow electrons stimulates the outer red layer only; thus screen displays red color only. A beam of high-speed electrons stimulates the inner green layer. Therefore screen exhibits a green color.



Advantages : Inexpensive

Disadvantages :-

1. Only four colors can be formed
2. Pictures' quality is less compared to another technique.

2. Shadow-Mask Method:

* Shadow Mask Method are widely utilized in Raster-Scan System as they form an enormously large number of colors compared to the beam-penetration technique.

* They are utilized in most color TV sets and monitors.

Construction :- A shadow mask CRT contains 3 phosphor color dots per pixel position.

* There is one phosphor dot that gives off:

red light

* There is another that gives off:

green light

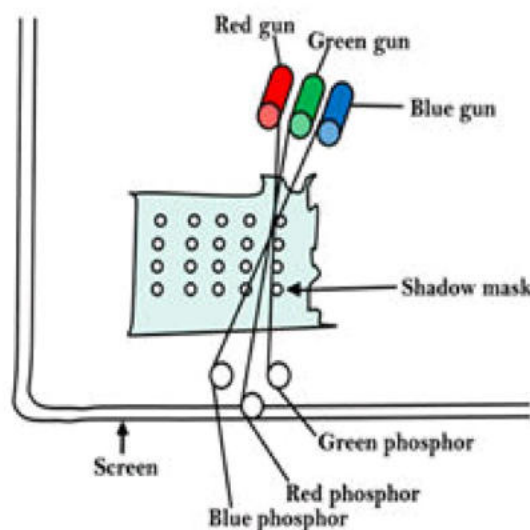
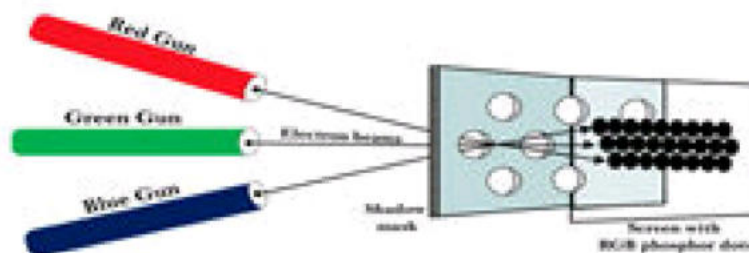
* Third emits:

blue light

3 electron guns are used in this type of CRT, one for every color dot and a shadow mask grid just behind the phosphor coated screen.

Small round holes pierce the shadow mask grid in a triangular pattern.

Figure illustrates the delta-delta shadow mask technique widely employed in color CRT system.



The Shadow mask CRT

Working :- Triad configuration of red, green, and blue guns.

The CRT deflection system works on all 3 electron beams together; the 3 electron beams are deflected and converged as a group onto the shadow mask, which has a series of holes set up in registration with the phosphor-dot patterns.

When the three beams are passed through a hole in the shadow mask, they trigger a dotted triangle, which appears as a small color spot on the screen.

The phosphor dots in the triangles are arranged such that each electron beam is able to trigger only its respective color dot as it passes through the shadow mask.

Inline arrangement :- Another configuration for the 3 electron guns is an Inline arrangement where the 3

electron guns and the red-green-blue color dots on screen corresponding to them, lie in one scan line instead of in a triangular fashion.

This inline structure of electron guns is easier to maintain in alignment and is used in high-resolution color CRT's.

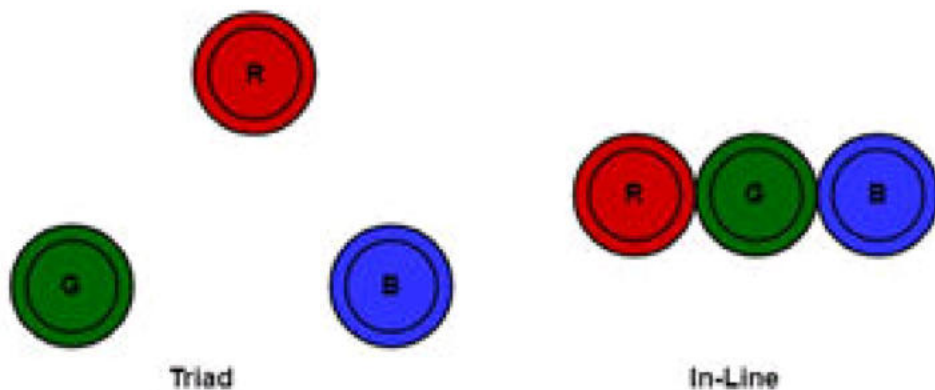


Fig: Triad-and -in-line arrangements of red, green and blue electron guns of CRT for color monitors.

Advantage

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

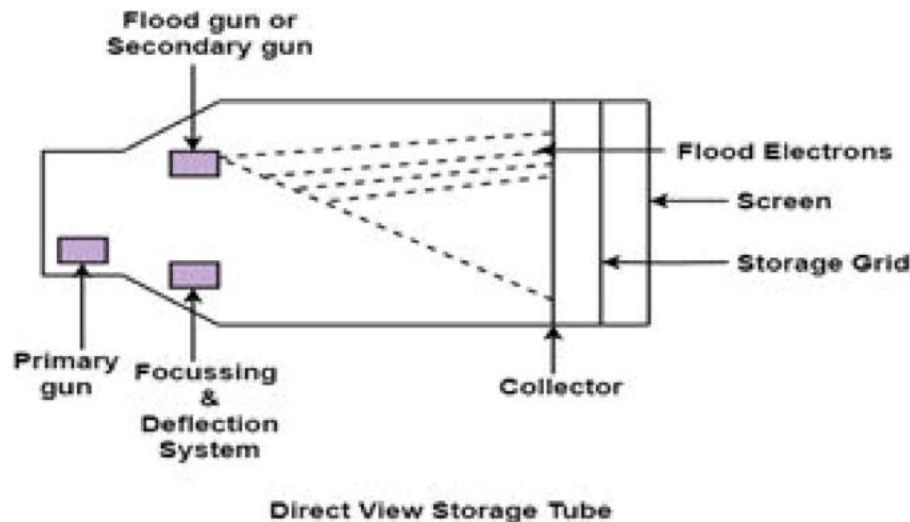
Disadvantage

1. Rather expensive compared to the monochrome CRT.
2. Rather poor resolution
3. Convergence Problem

Direct View Storage Tubes :- DVST terminals employ the random scan technique to build the image on the CRT display. The "storage tube" term applies to the screen's capability to hold the image which has been cast upon it, rather than rewriting the image continuously.

Function of guns: Two guns are employed in DVST

1. Primary guns: It is employed for storing the picture pattern.
2. Secondary gun or Flood gun: It is employed to sustain picture display.



Advantage

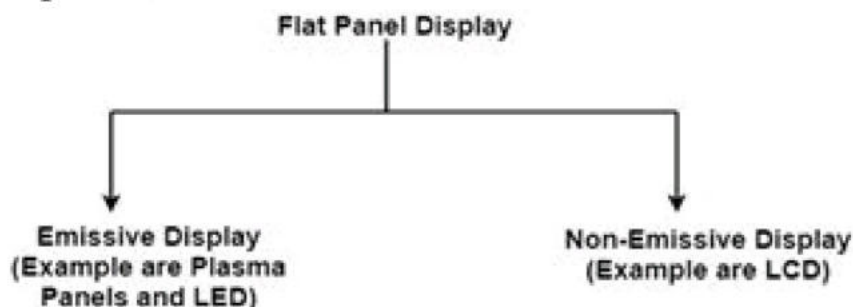
1. No refreshing is required.
2. High Resolution
3. cost is extremely low

Disadvantage

1. No erasure of selected portion of a picture is possible.
2. It is not appropriate for use in dynamic graphics applications.
3. If part of picture has to alter, then time is taken.

Flat-Panel display :- Flat-Panel display is a group of video devices that have decreased volume, weight and power consumption in comparison to CRT.

Example: Pocket video games, small T.V. monitor, calculator, laptop computers, advertisement board in elevator.



1. Emissive Display :- The emissive displays are those devices that convert electrical energy into light. Examples are Plasma Panel, thin film electroluminescent display and LED (Light Emitting Diodes).

2. Non-Emissive Display :- The Non-Emissive displays employ optical effects to transform sunlight or light from another source into graphics patterns. LCD (Liquid Crystal Device) are examples.

Plasma Panel Display :- Plasma-Panels are also referred to as Gas-Discharge Display. It is an array of small lights. Lights are fluorescent in nature. The major constituents of the plasma-panel display are:

1. Cathode :- It is made up of thin wires. It supplies negative voltage to gas cells. The voltage is discharged along with the negative axis.

2. Anode :- It is also made up of line wires. It supplies positive voltage. The voltage is given along positive axis.

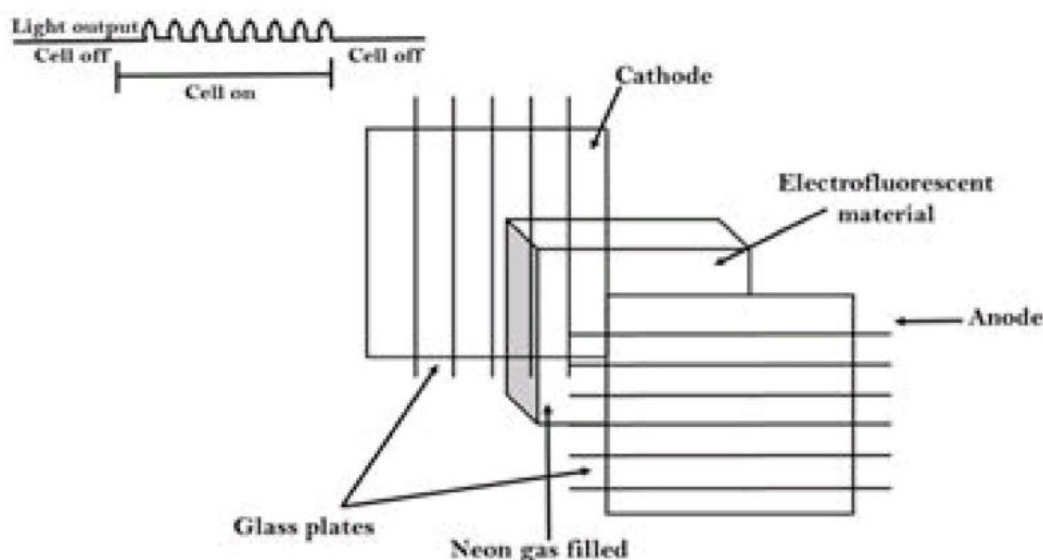
3. Fluorescent cells :- It is made up of small pockets of liquids of gas when voltage is given to this liquid (neon gas) it will glow.

4. Glass Plates :- They are capacitors. The voltage is applied, the cell glows permanently.

The gas glows when there is a large voltage difference between horizontal and vertical wires. The voltage level is maintained between 90 volts to 120 volts. Plasma level doesn't need refreshing. Erasing is performed by decreasing the voltage to 90 volts.

Every cell of plasma has two states, therefore cell is referred to as stable. Visible point in plasma panel is formed by intersection of the horizontal and vertical grid. The resolution of plasma panel can be $512 * 512$ pixels.

Figure illustrates the state of cell in plasma panel display:



Strength:

1. High Resolution
2. Large size screen is also feasible.
3. Less Volume
4. Less weight
5. Flicker Free Display

Weakness:

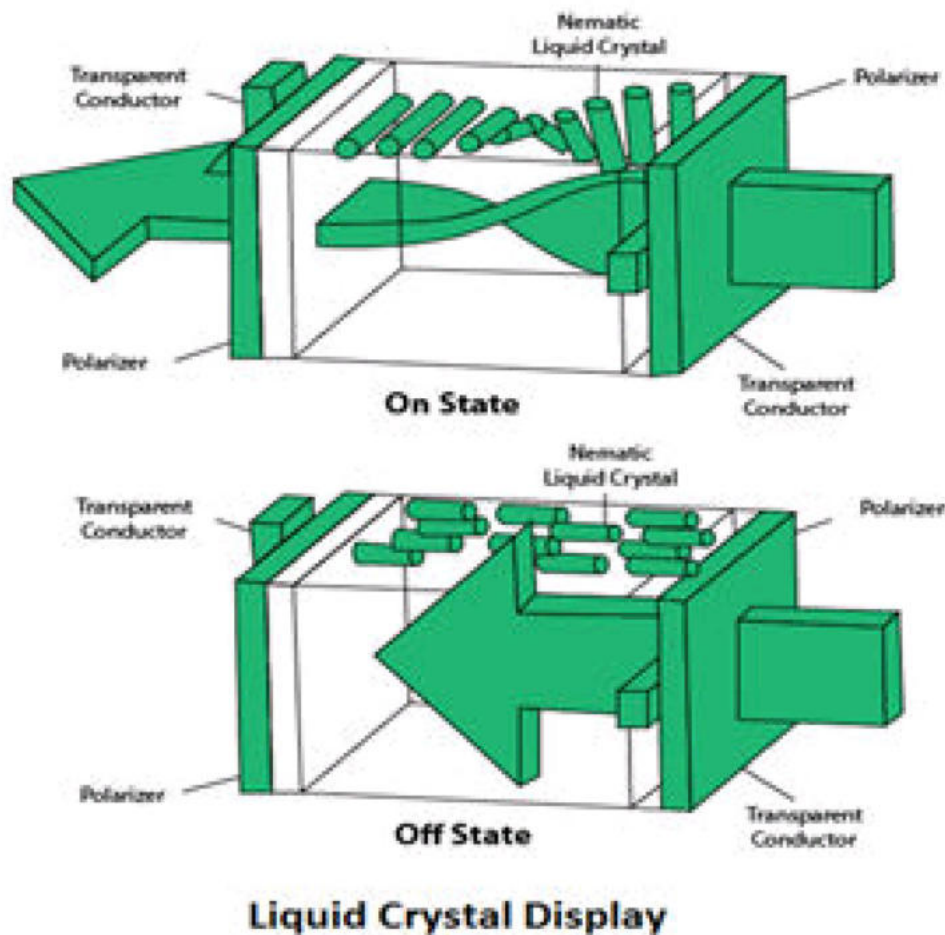
1. Poor Resolution
2. Wiring anode and the cathode requirement is tricky.
3. Its addressing is also tricky.

LED (Light Emitting Diode) :- In an LED, a diode matrix is arranged to structure the pixel locations in the display and picture definition is saved in a refresh buffer. Information is read out from the refresh buffer and transformed into voltage levels and used to drive the diodes to create the light pattern in the display.

LCD (Liquid Crystal Display) :- Liquid Crystal Displays are the technology that creates a image by directing polarized light from the environment or from an internal light source through a liquid-crystal substance that allows light to pass through.

LCD employs liquid-crystal medium between two glass plates; each glass plate is perpendicular to one another between plates liquid is filled. One of the glass plates is made of rows of conductors in vertical orientation. Another glass plate is made up of a row of conductors in horizontal orientation. The pixel location is established by the intersection of the horizontal & vertical conductor. This location is an active component of the screen.

Liquid crystal display is temperature dependent. It is zero to seventy degree Celsius. It is flat and consumes very little power to operate.



Advantage:

1. Low power consumption.
2. Small Size
3. Low Cost

Disadvantage:

1. LCDs are temperature-dependent (0-70°C)
2. LCDs do not emit light; consequently, the image has very little contrast.
3. LCDs have no color capability.
4. The resolution is not as good as that of a CRT.

