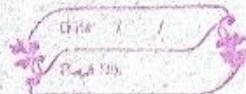


CGMT

UNIT -1



BASIC OF COMPUTER GRAPHICS -

Computer Graphics is one of the most effective & commonly used way of communication with the user.

In CG pictures or graphics objects are presented as a collection of discrete pixels.

Rasterization- The special procedure determines which pixel will provide the best approximation to the desired picture or graphics object this process is known as Rasterization.

The process of representing continuous picture or graphics object as a collection of discrete pixel is called **SCAN CONVERSION**.

APPLICATION OF CG :-

→ User Interface

→ Plotting of graphics & chart in industry, business, govt & educational organizations

→ Office automation & desktop publishing

→ Computer aided drafting & design

→ Art & Commerce

→ Cartography (Maps, Oceanographic charts etc)

→ Education & training

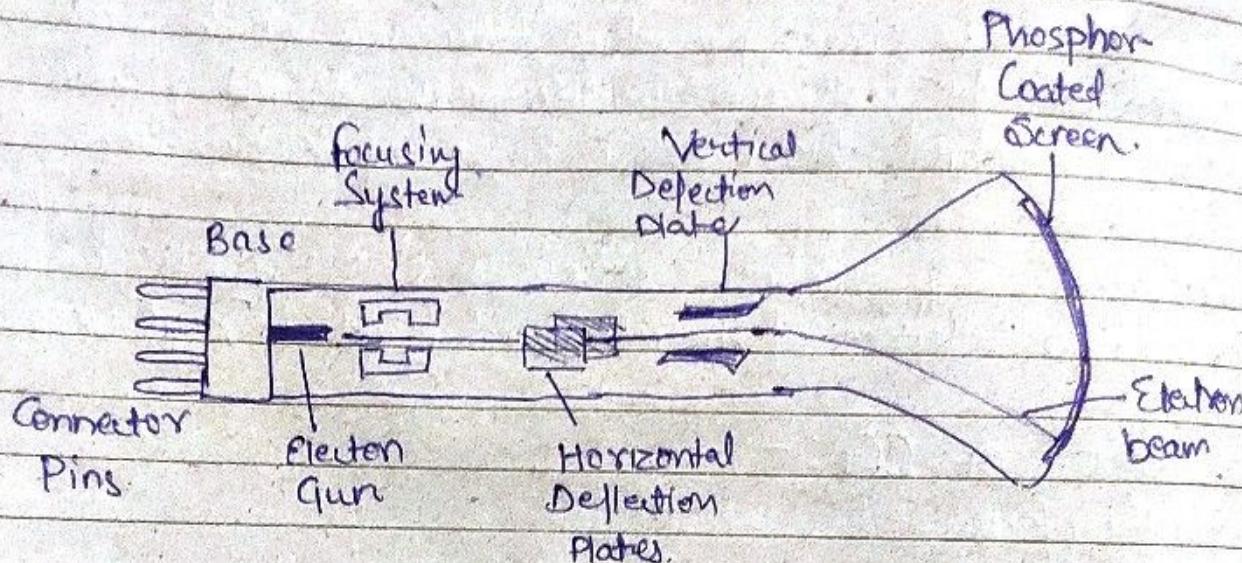
→ Image Processing

DISPLAY DEVICES

They are also known as output devices.

Most commonly used output device in a graphics system is a Video Monitor.

CATHODE-RAY TUBE :-



- It is an evacuated glass tube.
- Electron gun produces a beam of e⁻s which is directed toward the screen by high voltage typically 15000 - 20000 Volts.
- Inner side screen is coated with phosphor which gives light when it is struck by e⁻s.

Control grid controls velocity of e⁻s before they hit Phosphor.

→ Control grid controls intensity of spot where beam strikes the screen.

→ focusing system concentrates the e⁻s beam so it converges to small point when hits the phosphor coating.

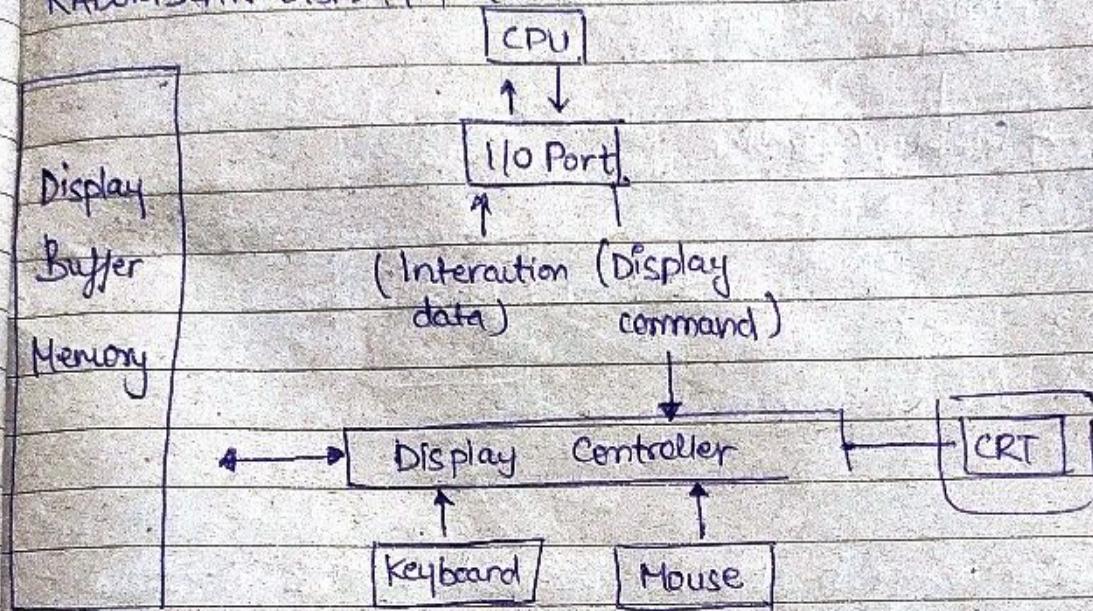
→ Deflection system directs beam which decides the point where beam striking the screen.

Deflection system consist of two pair of parallel plates which are vertical & horizontal deflection plates.

There are two techniques used for producing images on the CRT:-

- 1) Vector Scan / Random Scan display
- 2) Raster Scan display

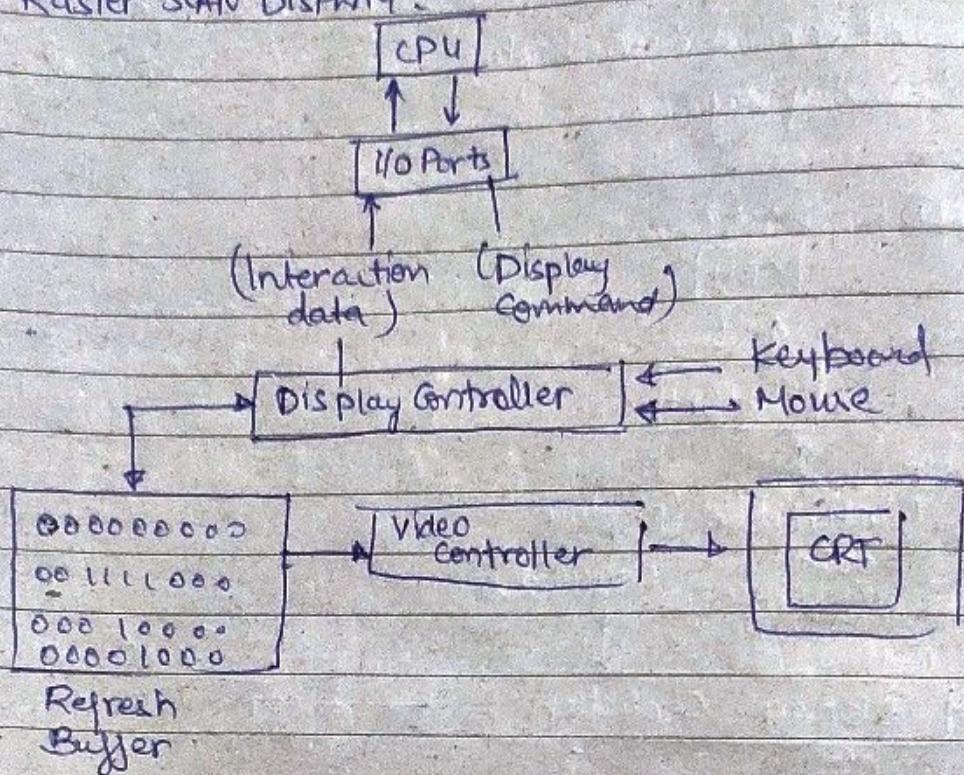
RANDOM SCAN DISPLAY (VECTOR) :-



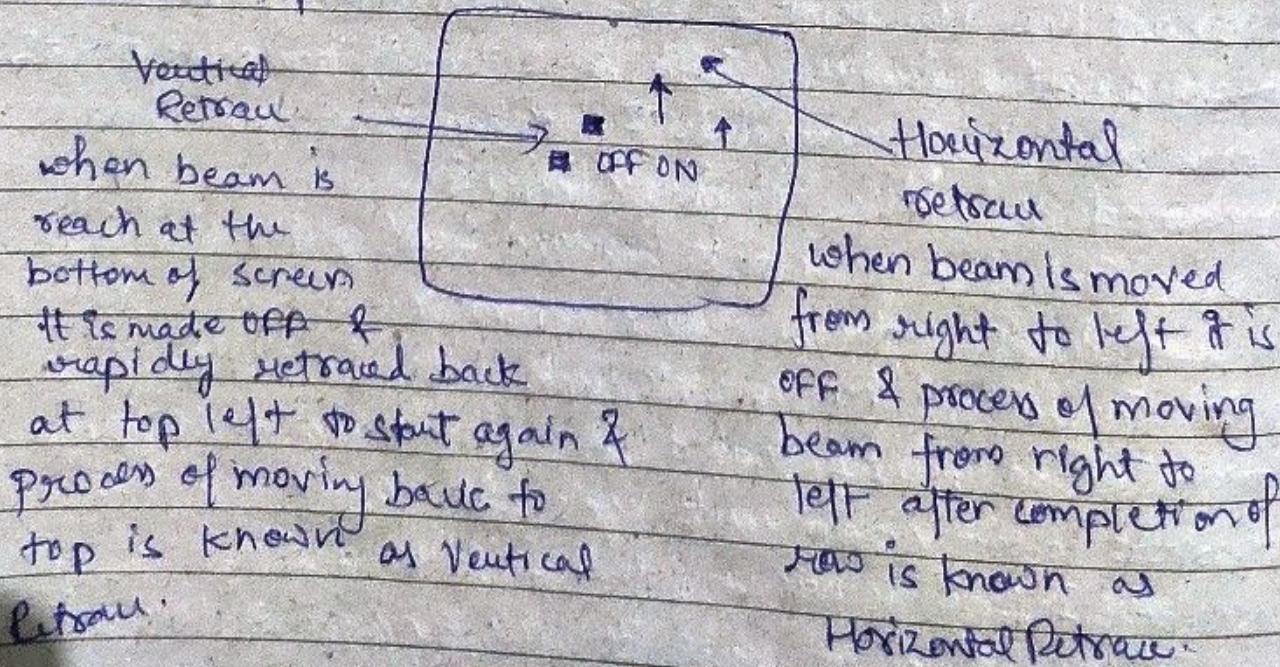
ARCHITECTURE OF VECTOR DISPLAY

- Vector directly traces out only the desired lines on CRT.
- If we want line b/w point p₁ & p₂ then we directly drive the beam deflection circuitry focus beam directly from point p₁ to p₂.
- To move beam, both magnitude & direction is required, that is generated by vector graphics Generator.
- Display Controller interprets command & sends digital & point co-ordinate ~~to~~ to Vector generator.
- Vector Generator then converts signal to analog voltages for beam deflection circuits that displace an e⁻ beam on CRT screen.
- Phosphors coated screen emits lights but decay after few milliseconds & ∴ it is necessary to repeat the display list to refresh the screen at least 30 times per second to avoid flicker.
- Display buffer is used to store display list. for refreshing, it is also called refresh buffer.

Raster SCAN DISPLAY :-



- The display image is stored in form of 1's & 0's in refresh buffer.
- Video controller reads refresh buffer & produces actual image on screen.
- It will scan one line at a time from top to bottom & then back to top.



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The screen image is maintained by repeatedly scanning the same image. This process is known as Refreshing of Screen. In raster scan displays a special area of memory is dedicated to graphics only. This memory is called frame buffer. Frame buffer holds set of intensity value for all the screen points. Each screen point referred as pixel or Pel (Picture element).

Each pixel can be simply black or white or color system.

- for Black & white ON or OFF, so only one bit per pixel is needed.
- For color & intensity variations up to 24-bits per pixel are included in high quality display system.
- On Black & white system one bit per pixel the frame buffer is commonly called a BITMAP.

And for multiple bits per pixel, the frame buffer is often referred as PIXMAP.

RASTER

- Electron beam is swept across the screen.
- Resolution is poor because raster system produces zigzag lines that are plotted as discrete point set.
- Picture definition is stored as a set of intensity values for all screen point called pixels.
- Suited for realistic display of scenes contain shadow & color pattern.
- Screen points/pixels are used to draw an image.

RANDOM

- directed only to the parts of screen.
- Good resolution as it produces smooth line drawing as e⁻ beam follows the line path.
- Stored as a set of line drawing instructions in a display file.
- designed for line-drawing & can't display realistic shaded scenes.
- Mathematical fns are used to draw an image.

COLOR CRT Monitors :-

It display color pictures by using a combination of phosphors that emit different colored lights.

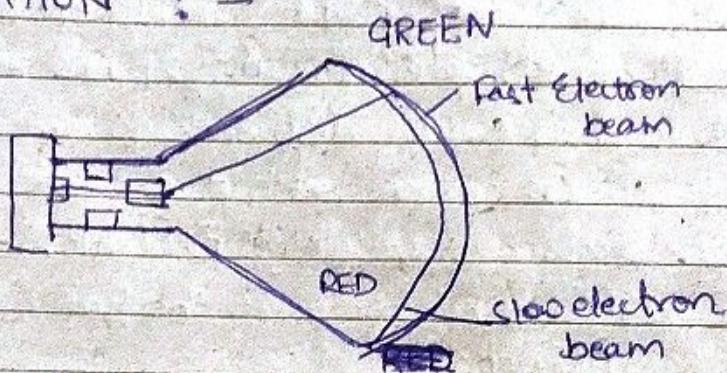
It produces range of colors by combining the light emitted by different phosphors.

Two basic techniques for color display :-

1. BEAM PENETRATION TECHNIQUE

2. Shadow - mask technique

BEAM PENETRATION :-



→ It is used with Random scan monitors.

→ Inside of CRT coated with two phosphor layers usually red & Green. The outer layer of red & inner layer of green phosphor.

→ Color depends on how far e⁻s penetrates.

→ fast beam penetrates more & excites green layer & slow one red.

→ Intermediate beam speed we can produce combination of red & Green lights which emits additional two colors orange & Yellow.

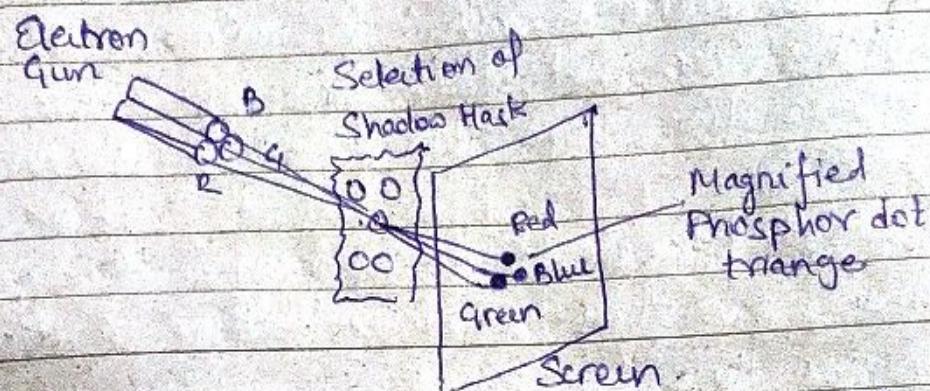
→ The beam acceleration voltage controls the speed of e⁻s & hence color of Pixel.

→ It is less cost technique to produce color in random scan monitors.

If can display only 4 colors.

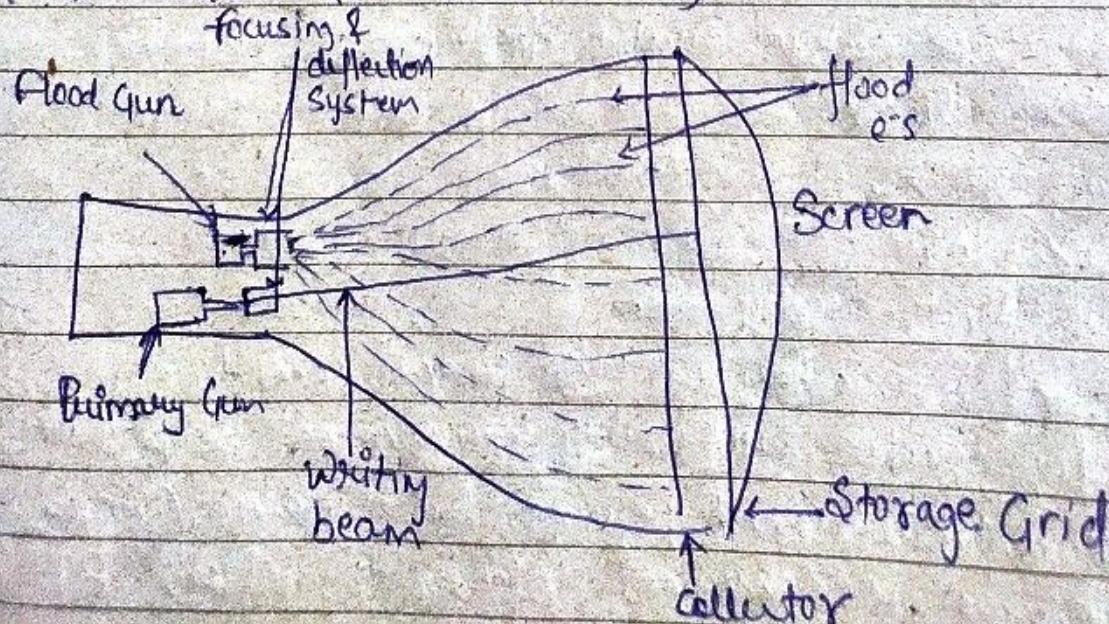
Quality is not good compared to other techniques.

SHADOW MASK TECHNIQUE :-



- It produces wide range of colours as compared to BPT.
- Dot triangle - CRT has 3 phosphor color dots at each pixel posⁿ
One dot for Red, Blue & Green each.
- Shadow Mask Grid consists of series of hole aligned with the phosphor dot pattern.
- When electron beam are passed through Mask Grid they excite a dot triangle.
- A dot triangle appears as small dot on screen which has color of combination of three small dots in dot triangle.
By changing the intensity of 3 e beam we can obtain different colors in the Shadow Mask CRT.

DIRECT VIEW STORAGE TUBES (DVST) :-





- In Master we do Refreshing of screen to maintain image.
- DST gives alternative method for maintaining the screen image.
- It uses storage grid which stores the picture information as a charge distribution just behind the phosphor coated screen.
- It consists of two e⁻ Gun a primary & flood gun.
- Primary gun stores the picture pattern & flood gun maintains the picture display.
- Primary gun emits high speed e⁻s which strike on storage grid to draw picture pattern; it knocks out e⁻s, knocked out e⁻s are attracted towards the collector.
- The continuous low speed e⁻s from flood gun pass through the control grid & attracted to the positively charged area of storage grid.
- Low speed e⁻s penetrates the storage grid & strike the phosphor coating without affecting the charge pattern on the storage grid.
- During this process the collector just behind the storage grid smooth out of flow of flood e⁻s.

ADVANTAGE :-

- Refreshing of CRT is not required.
- Very complex pictures can be displayed at very high resolution without flicker.

→ flat Screen.

DISADVANTAGE :-

- They do not display color.
- Erasing & redrawing take several seconds.
- Erasing selective part of the screen cannot be possible.
- Poor contrast, cannot be used for dynamic Graphic App.
- Performance is somewhat inferior to refresh CRT.

FLAT PANEL DISPLAY

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refers to a class of video device that have reduced volume, weight & power requirement compared to a CRT.
As these are thinner than CRT, we can hang them on walls or wear on our wrists.

We can separate flat Panel in two Categories :-

Emissive display

or Emitter and device that convert electrical energy into light

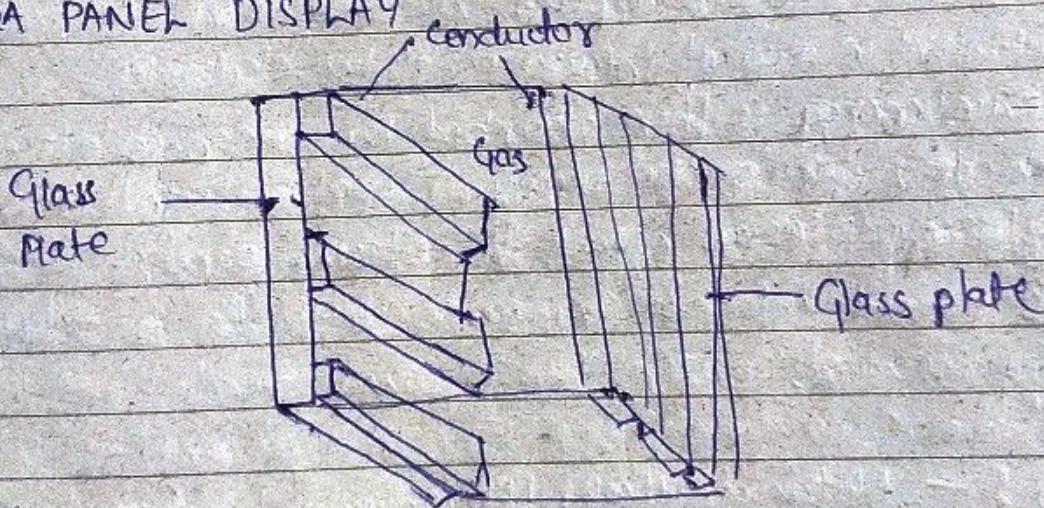
Ex Plasma panel, thin film electroluminescent displays & LED

Non emissive display

or non emitters use optical effects to convert sunlight or light from some source into graphic pattern

Ex LCD(Liquid Crystal Display)

PLASMA PANEL DISPLAY

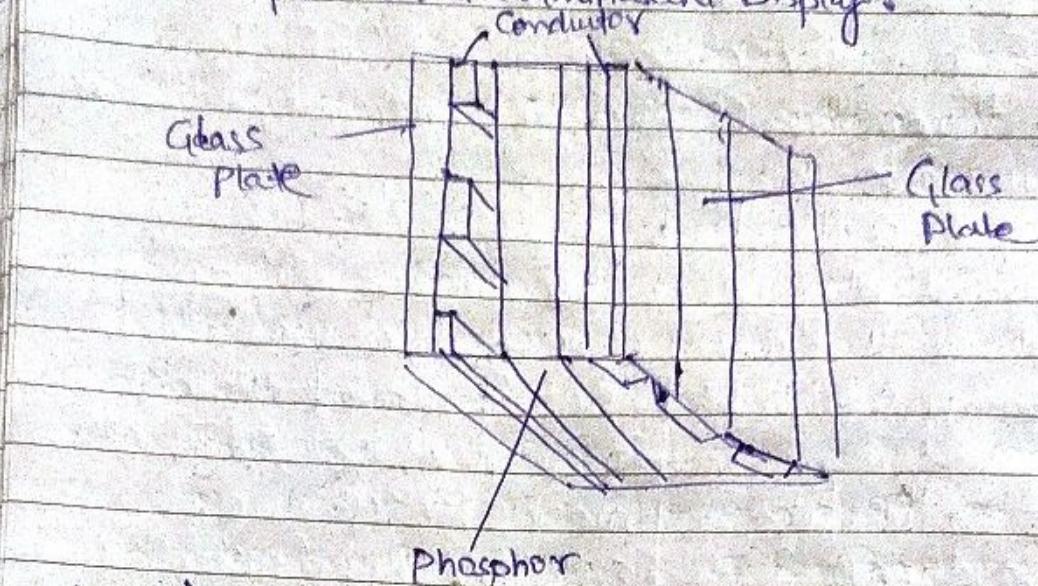


Also called gas discharge display.

firing high voltage to pair of horizontal & vertical conductors cause gas between two conductors to breakdown into glowing plasma of e⁻s & ions.

Picture definition is stored in refresh buffer, 60 times per second.
AC method are used to provide faster application of firing voltage & thus brighter display.

thin film Electro luminescent Display :-



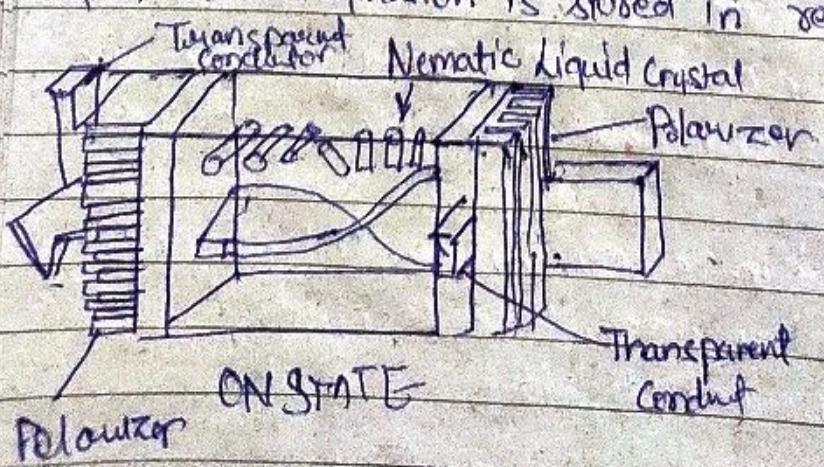
In exchange of Gas phosphor is filled such as zinc sulphide doped with magnesium.

When sufficient voltage is applied the phosphors become a conductor in area of intersection of two electrodes.

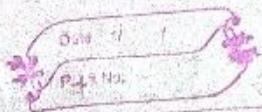
→ Electrical energy is then absorbed by magnesium atoms which then release the energy as spot of light similar to glowing plasma effect in plasma panel.

In this good color & grayscale difficult to achieve. It requires more power than plasma panel.

LED : - Matrix of Multicolor LED is arranged to form the pixel pos.
2 Picture definition is stored in refresh buffer.



GRAPHICS I/O Devices



1) Keyboard

2) Mouse

3) Track ball & Space Ball

cursor movement
Potentiometer attached

to ball, to
measure amount
& direction of rotation

6 degree of freedom.
OR

3D Positioning & Selection
Operation in Virtual Reality
System.

4) Joysticks

5) Data Glove - Group virtual object, sensor detection of
hand & finger motion

6) Digitizer - common device for draw painting or interactively
selecting coordinates position on an object.

In Graphic tablets, Stylus is flat pencil shaped
device that is pointed on tablet for positioning

7) Image Scanner

8) Touch Panel - Touch I/O can be recorded with following methods

1) Optical 2) Electrical 3) Acoustical methods

LEDs
operate
at IR
frequency

Conducting
Material
plate
horizontal
& vertical

High frequency
sound waves
are generated in
horizontal & vertical
direction

9) Light Pens - Pen

Shaped, electron beam lights on CRT screen

10) Voice System

GRAPHICS SOFTWARE & STANDARD :-

There are mainly two type of graphic Software :-

- 1) General programming package.
- 2) Special purpose application package.

General

- provides an extensive set of graphics function that can be used in high level programming lang. such as C or FORTRAN.
- It include basic drawing element shape like line, curves, polygon etc.

Ex GL (Graphic Library)

Special Purpose

are customize for particular application which implement required facility and provides interface so that user need not to worry about how it will work (programming).

Ex CAD, medical & Business System.

Coordinate Representation :- Cartesian reference frame
The World - coordinate description of the scene
is transferred to one or more O/P device reference frame for display. These display are referred as "Device Coordinates" or "Screen Coordinates".

Generally a Graphic System converts the world - Coordinate position to normalized device coordinates. In the range from 0 to 1 before final conversion to specific device coordinate.

Graphic fn:- provides variety of fn for creating & manipulating picture.

Software Standard :-

Primary goal of standardize graphic Software is portability so that it can be used in any hardware system & avoid rewriting of software program for different System.

Some standards are discuss below :-

Graphical Kernel System (GKS)

was first adopted by ISO & various national standard organizations.

It was originally designed as 2d graphic Package & later extension was developed for 3d.

PHIGS (Programmer's Hierarchical Interactive Graphic Standard)

It is extension of GKS. Increased Capacity/Capability for object modeling, colour specification, surface rendering. A picture manipulation are provided in it.

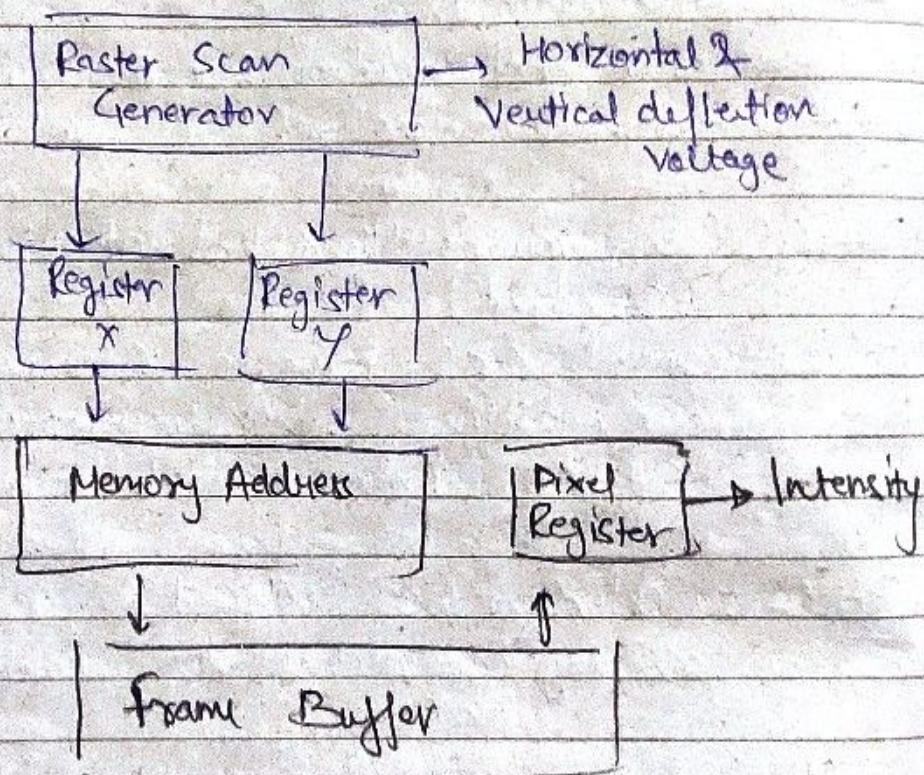
PHIGS + extension was developed to provide 3-d surface shading capabilities not available in PHIGS.

RASTER GRAPHICS SYSTEM

SIMPLE RASTER GRAPHICS SYSTEM

- It have additional processing unit like video controller or display controller
- Frame buffer can be anywhere in the system memory & video controller access this for refresh the screen.
- In addition more processor are used as co-processors to accelerate the system in sophisticated raster system.

Basic refresh operation of Video Controller

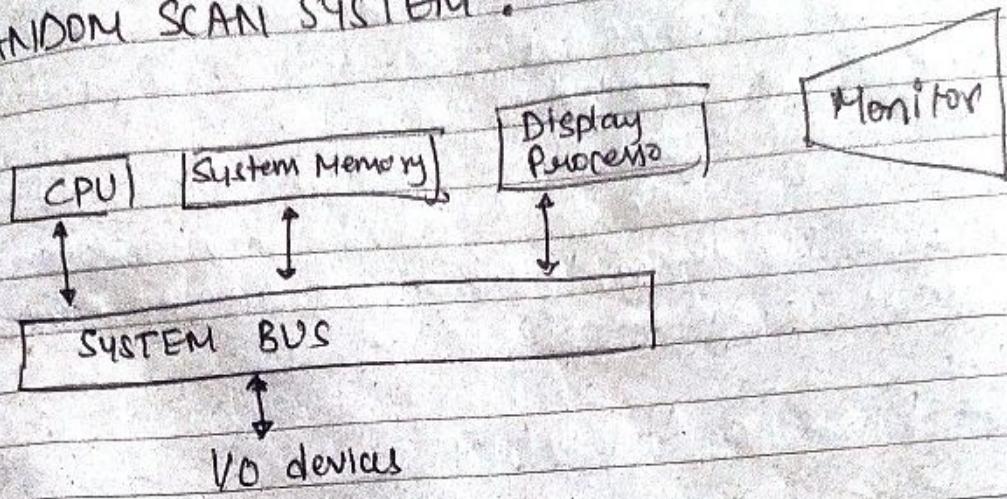


Raster graphics System with a display processor :-

Purpose of display processor is to free CPU from graphic work, & display processor have their own separate memory for fast Operation.

Main work is digitalizing a picture definition into a set of pixel intensity values for store in frame buffer.

RANDOM SCAN SYSTEM :-



Application programs are stored in system memory.
Graphic commands in the program are translated by
Graphics package into display file stored in system memory.
Display Processor in a Random Scan System is
referred to as a display processing unit or Graphic
controller.

Raster Scan display Processor

