

Computer Graphics

classmate

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Unit 1 (self notes)

* What are graphics

- graphics are defined as any sketch or drawing or a special network that pictorially represents something meaningful

- There are 2 types of graphics
2D & 3D graphics

- Computer graphics can be used in films, entertainment and other technologies

* Application of graphics

- Education and training
- Flight simulator
- Gaming
- Architecture
- Use in Biology
- Presentation graphics
- Entertainment
- Education Software

* Explain the types of computer graphics

=> - There are two types of computer graphics

① Raster

② Vector

① Raster

- uses pixels to draw images

- also called as Bit map image
as it uses bit map image

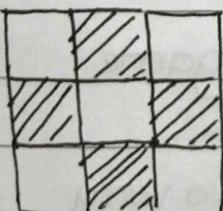
- .jpg , .gif , .tif

② Vector

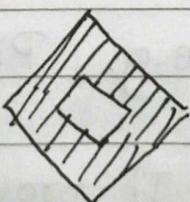
- Uses mathematical formulas to
draw different shapes & objects

- .svg , .esp
- it is smoother as compared to

Raster graphics



Raster Graphics



Vector graphics

* Explain Interactive and Passive Graphics

=>

① Passive / Non interactive Graphics :

- in this the picture is produced on a monitor / screen and the user does not have any control over the image
- i.e. the user cannot make any changes in the rendered image
- e.g. Images shown on TV
- Non-interactive graphics provides only one way communication.

② Interactive Graphics :

- In this the user have some control over the image i.e., the user can make changes in the images which are produced.

- e.g., Ping pong game

- It provides a two way communication between user and screen / computer

Important ***

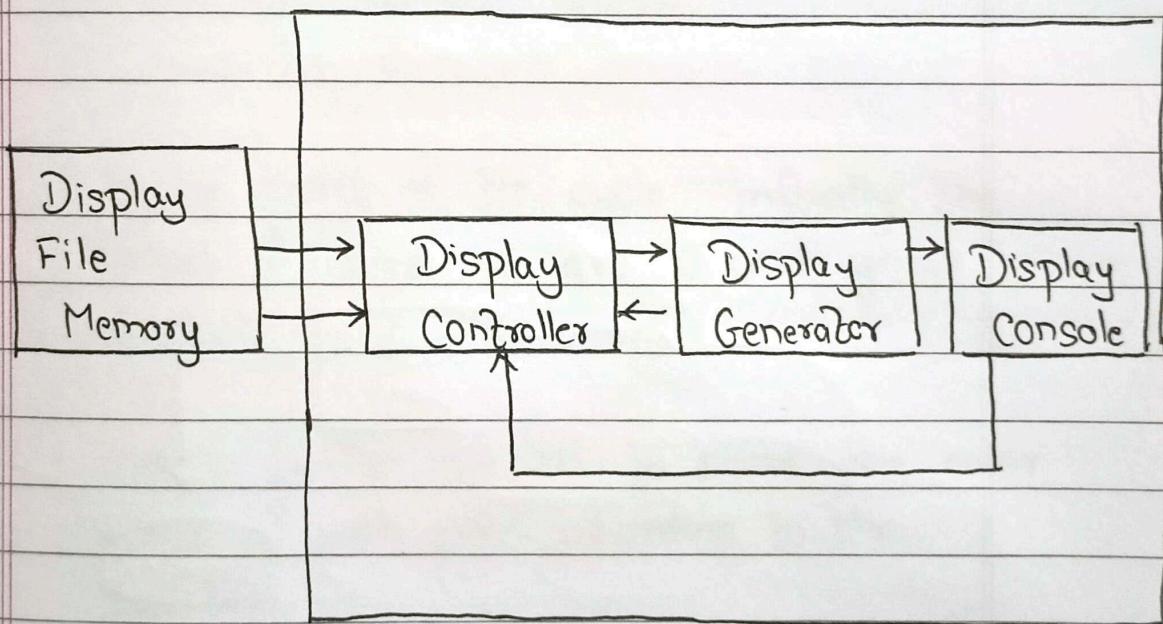
* Explain the Structure of Display Processor

=>

- A Display processor is a interpreter or a hardware device that converts display processor code into pictures

- Parts of Display Processor

- ① Display File Memory
- ② Display controller
- ③ Display Generator
- ④ Display Console



Display File memory :-

- Used for generation of picture
- Used for identification of graphic entities

Display Controller :-

- handle interrupts
- maintain timings
- to analyse the instructions

Display Generator :-

- used to generate characters
- used to generate curves

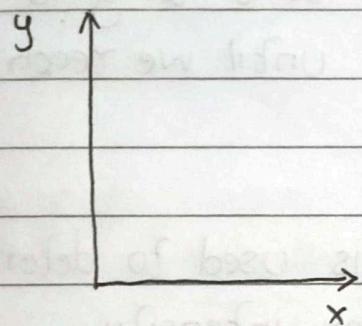
Display Console :-

- it contains CRT, Light pen, keyboard, deflection system

Important *

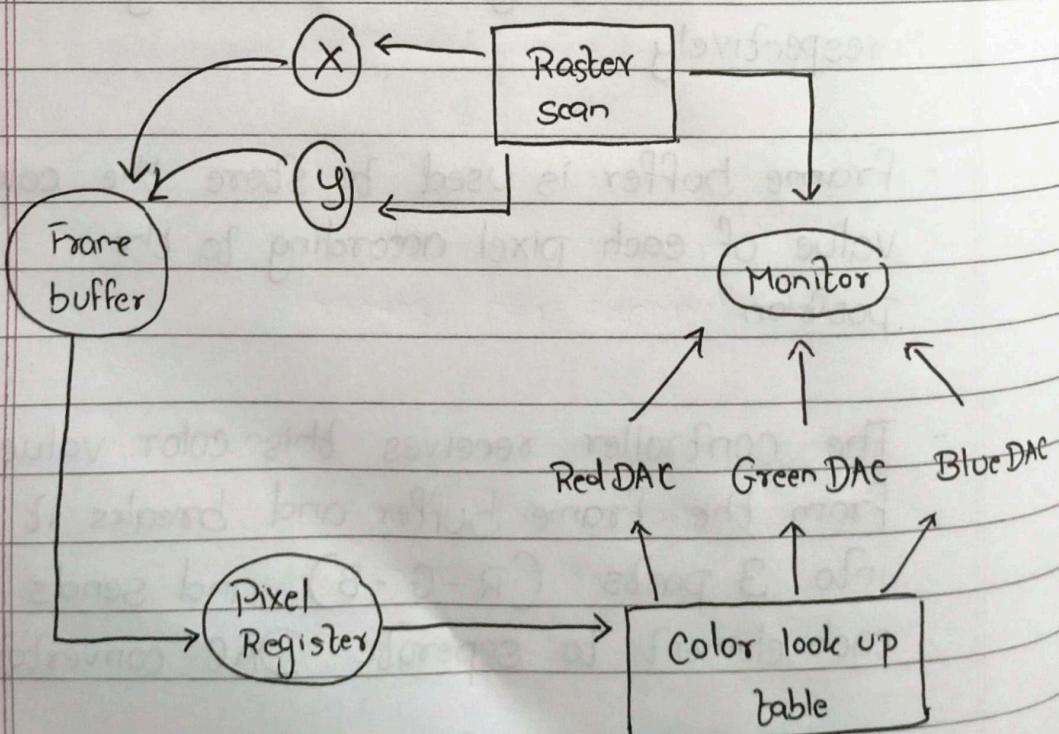
* Working Display Processor

- ⇒
 - The display controller in the output generates horizontal and vertical signals
 - 2 registers (x register & y register) are used to store the coordinates of the screen pixels



- The origin is at the lowest left corner of the screen
- At the start of the cycle, initially the values of x & y are 0 and y_{max} respectively
- Frame buffer is used to store the color value of each pixel according to the position
- The controller receives this color value from the frame buffer and breaks it into 3 parts (R - G - B) and sends each element to separate DAC converter

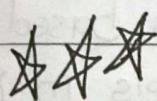
- This process is repeated for each pixel along top scan line each time incrementing X register by y
- As pixels on first line are generated the X register is incremented through X_{max}
- Then the x is reset to 0 & y is decremented by 1 until we reach X_{max} & $y = 0$
- A color lookup table is used to determine exact value of the color intensity



* What are the different types of display devices?

=>

- Refresh CRT
- Random & Raster Scan
- Color CRT monitor
- DVST
- Flat Panel
- Look up table



Explain Random & Raster Scan

① Random Scan :-

- Uses electric beam which works like pencil to create images / shapes

- picture is constructed out of straight lines

- each line is drawn by moving the beam from one point to another

- Random Scan monitors are called as Vector Displays

Advantages of Raster Scan

- smooth lines
- High Resolution

Disadvantages of Raster

- No realistic images
- No 3D Diagrams

② Raster Scan Display :-

- Raster scan display is based on intensity control of pixels in the form of rectangular box

- Information of the pixel is stored in Frame buffer

- e.g. T.V.

- provides refresh rate of 60 to 80 frames per second

Advantages

- Realistic images
- more colors
- shadows

Disadvantages

- low resolution
- expensive

* There are 2 types of Raster Scan

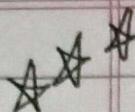
Interlaced

Non-Interlaced

- each horizontal line is traced from top to bottom
- fading of display of object occurs
- 60 Fps
- odd lines are traced
- in next cycle all even lines are traced
- 30 Fps

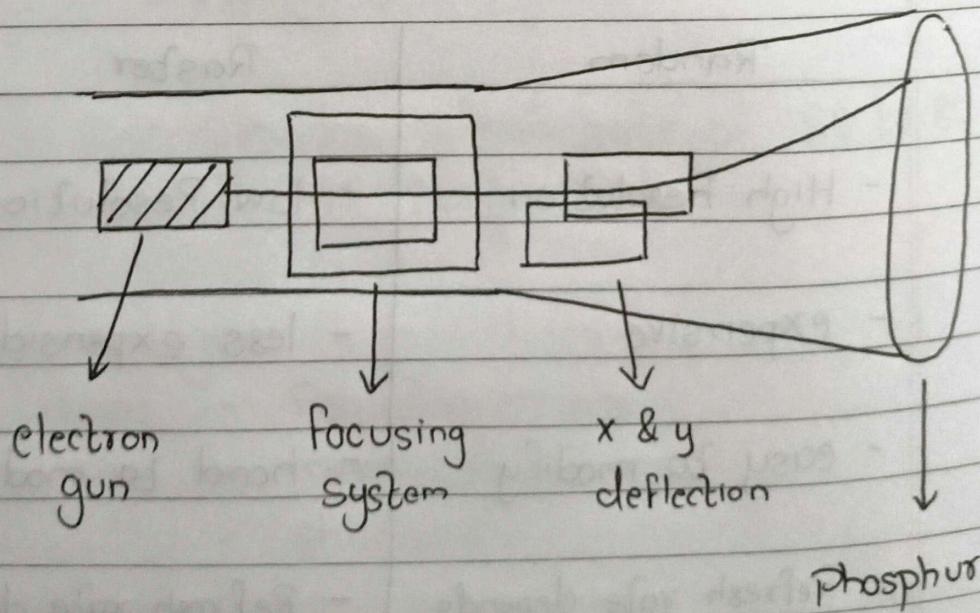
* Difference between *
Random and Raster

Random	Raster
- High Resolution	- low Resolution
- expensive	- less expensive
- easy to modify	- hard to modify
- Refresh rate depends on Resolution	- Refresh rate does not depends on Resolution



CRT (Cathode Ray tube) :-

- CRT stands for Cathode Ray tube
- The image on CRT display is created by firing electrons from back of the tube to phosphorus located on the screen
- these phosphorus lights up and emit lights when electrons heat them up
- the color produced on the screen is produced by blend of red, blue & green light



Electron gun : Electron gun is used to fire the electrons to the phosphorus screen. It sends the electrons to the focusing system

focusing system : It is used to focus the electrons into a narrow beam

Deflection system : It deflects the beam to a particular direction

phosphorus-coated Screen : The screen is coated with phosphor which light up when the electron beam hits it

* Color CRT monitors :-

There are two methods to display color images on CRT monitors

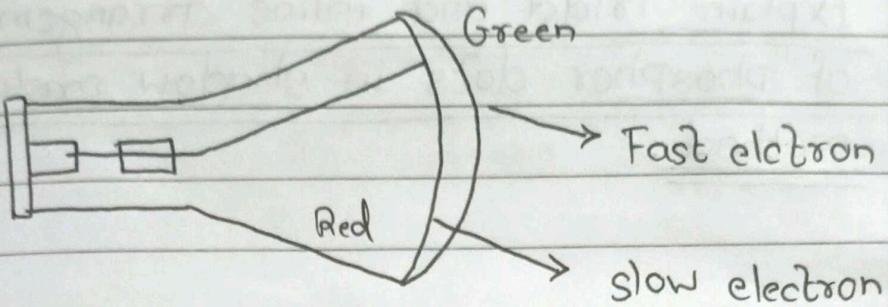
- ① Beam penetration method
- ② Shadow - Mask Method

① Beam penetration method :

- used in random scan method
- CRT screen is coated with two layers of phosphor red & green and the display color depends on how far the electron beam is penetrated
- This method only produces four colors (red, green, orange and yellow)

Advantages :- less expensive

Disadvantages :- Only four colors can be displayed
lesser resolution



② Shadow Mask Method :

- USES raster scan
- used in color TV and monitors
- The shadow mask CRT has 3 phosphor color dots at every pixel

- ① Red
- ② Blue
- ③ Green

- There are 3 electron guns for each color dot

- There are 2 types of arrangements of the phosphor color dots

- ① Triad arrangement
- ② inline arrangement

Advantages : Realistic images , Million colors
shadows

Types of Shadow

Mask Method

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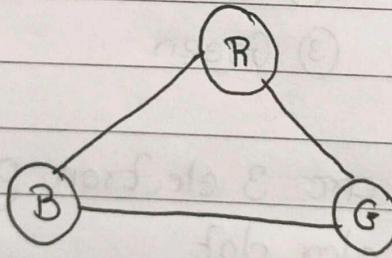
- * Explain Triad and inline arrangement of phosphor dots in shadow mask method :-

=>

① Triad arrangement

- in this the screen is coated with tiny dots of red, green & blue phosphors

- These dots are grouped together in the form of triangle called as triad

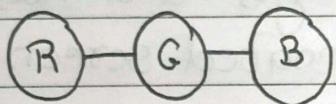


- These phosphor dots emit lights when they are hit by the electron gun

- By changing the intensity of the electron beam different colors can be produced

② Inline Arrangement

- in this the screen is coated with tiny dots of red , blue & green phosphors
- These dots are arranged in lines or strips on the screen



- Here the 3 electron guns and the corresponding red, green & blue color dots on the screen are aligned along one scan line.
- Inline arrangement is commonly used in high resolution color CRT.

* Explain Structure of DVST

- ⇒ - DVST stands for Direct View Storage tubes
- It works like CRT
- Uses electron beam & to draw pictures/images and has a phosphor coated screen
- DVST has no refresh buffer / frame buffer
- The picture stays for few minutes before fading

Here are some components of DVST :-

① Electron Guns :-

- there are two guns in DVST , flood gun & primary gun

- primary gun is used to store picture pattern
- flood gun is used to maintain picture display on the screen

② Phosphor Coated Screen :-

- in DVST the screen is coated with phosphor crystals which emit light when the beam strikes it.

③ Storage Mesh :-

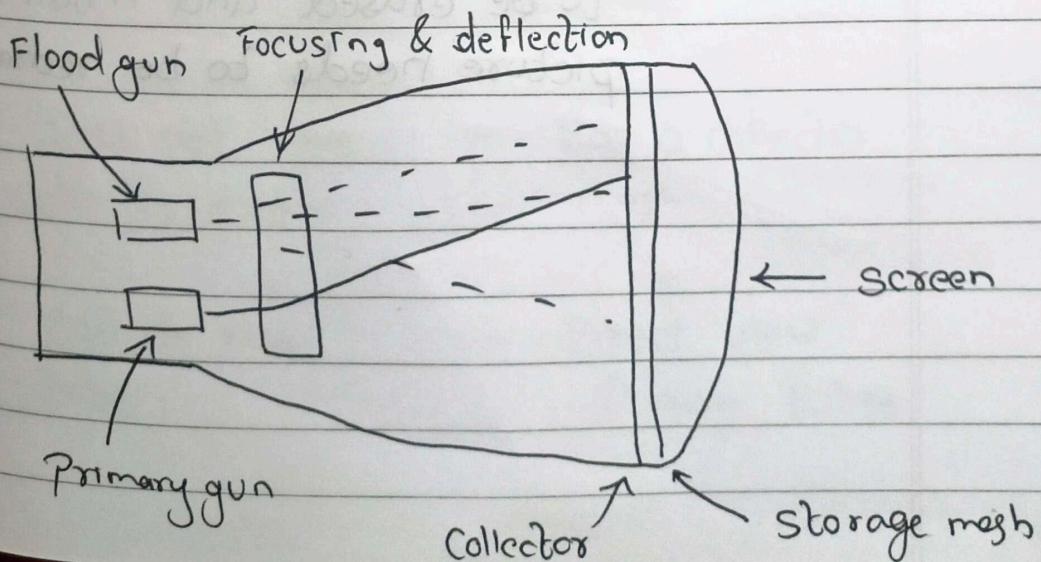
- it stores the picture to be displayed in the form of positive charges

- It is thin & high quality wire of dielectric

④ Collector :-

- It is a grid which is placed behind storage mesh

- It smooth out the flow of electron beam



* Advantages & Disadvantages of DVST

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① Advantages

- Refreshing is not required
- Display complex pictures at high resolution without flicker
- No use of frame buffer or refresh buffer

② Disadvantage

- Dynamic graphics cannot be displayed
- cannot display colors
- to erase some part of the image, entire screen needs to be erased and modified picture needs to be redrawn

Difference Between CRT & DVST

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CRT

- uses refresh or frame buffer to store picture
- Refreshing is required
- Wide range of colors
- 3 guns : red, green, blue
- can modify a particular position
- Does not have collector mesh
- Cathode ray tube
- uses storage mesh to store picture
- No refreshing is required
- Does not display colors
- 2 guns : primary & flood gun
- to modify a particular position we need to redraw the whole image
- Has a collector mesh
- Direct view storage tubes

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* Write short Note on LCD :-

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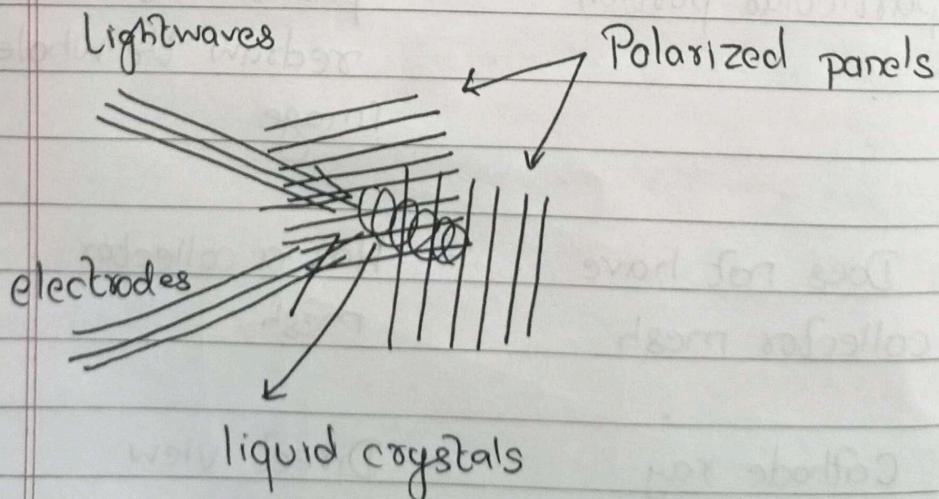
- LCD stands for liquid crystal display

- LCD is a flat panel which uses the light emitting property of the liquid crystals

- The LCD uses backlight or reflector to produce images

- the compounds has a crystalline arrangement and flows like liquid

- two light polarizers are placed facing each other at right angles sandwiching the liquid crystals



Advantages of LCD

- low power consumption
- smaller in size
- low cost

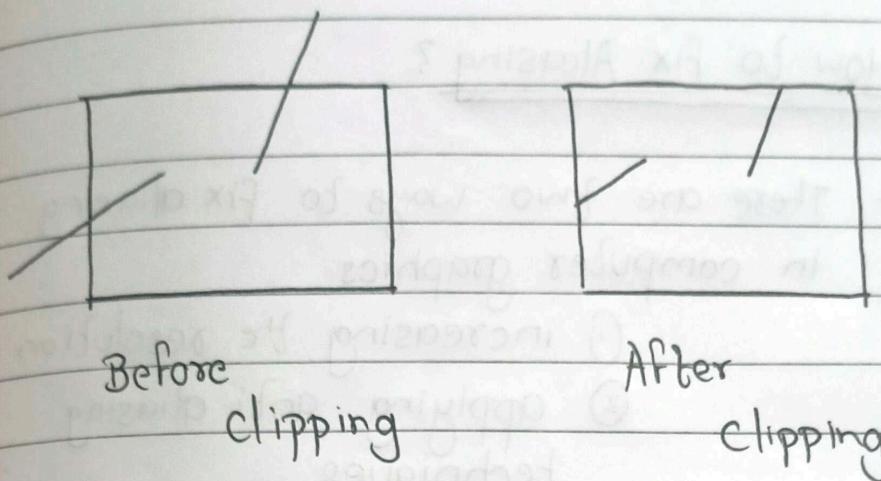
Disadvantages

- LCDs are temperature dependent
- no color capability
- less resolution as compared to CRT's

* Explain Point Clipping :-

=>

- In computer graphics the screen acts as a 2-D coordinate system
- So it is not possible that each and every point can be viewed on the screen
- We can only view the points which lies in a particular range from $(0,0)$ to (x_{max}, y_{max})
- Clipping is a process which identifies those portions which are inside this range and outside of this range.
- In clipping we only show the points which lies in the range and the points which are outside of the range are discarded



* What is Aliasing :-

=>

- Aliasing is the result of sampling a continuous signal at certain intervals
- it occurs due to low sampling which creates a distortion of image
- Here instead of smooth curves or transitions we see rough edges & strange patterns
- Aliasing is easily noticeable when the Signal has high frequencies, such as sharp edges, fine details or rapid changes.

* How to Fix Aliasing?

=> - There are two ways to fix aliasing in computer graphics

- ① increasing the resolution
- ② applying anti aliasing techniques

① increase the resolution

- adding more pixels to the image

- this can reduce or eliminate aliasing but requires more power & memory

② Applying anti aliasing techniques

- use algorithms that smooth out the edges & blend colors of the image

- this can improve the appearance of image but also introduce to blurring and softening edges