

CG Important Notes

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- What is Computer Graphics?

- Computer graphics are graphics created using computers and representation of image data by computers specially with the help of specialized graphical hardware and software.
- It can be said as creation, manipulation and storage of geometric objects and their images.

- Application of Computer Graphics

- Computer Aided Design
- User Interface
- Presentation Graphics
- Simulation & Animation
- Image Processing
- Art & Commerce
- Process Control
- Education & Training
- Entertainment
- Web/Business publishing & Advertisement.
- Virtual Reality.

- Basic Definition

(i) Pixel :

The smallest displayable point on the screen.

(ii) Aspect Ratio :

Number of pixel in horizontal direction to number of pixel in vertical direction that requires to produce a line of same length.

Aspect Ratio -

Eg: 16:9
7:8

$$\text{Aspect Ratio} = \frac{\text{horizontal}}{\text{vertical}}$$

• Screens are rectangular since pixels on display devices are not evenly distributed in horizontal & vertical directions.

(iii) Resolution:

Maximum no. of pixels per inch that can be displayed without overlap is called resolution

E.g. 1024 X 768
640 X 200

(iv) Persistence:

The time taken by light emitted from a phosphor to decay to one tenth (1/10) of its original intensity

(v) Bit Depth:

No. of bits used to represent a single pixel.
Concept also known as bits per pixel (bpp).

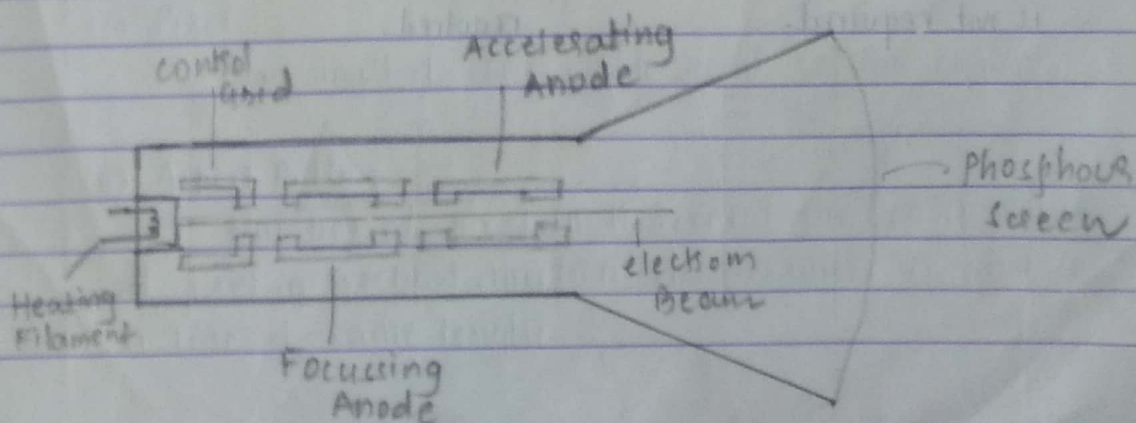
- CRT (Cathode Ray Tube)

Basic Operation

- A Beam of electrons emitted by an electron gun passes through control grid, Focussing system and accelerating element which hits the beam at specific position on phosphor coated screen.
- The phosphor that emits small spot of light at position contacted by electron beam.

Primary Components of CRT are

- Control Grid :
is used to control intensity of electrons by setting the voltage levels on the grid.
- Focussing Anode :
is used to focus the e^- beam to converge to a small spot.
It can be done either by electric or magnetic fields.
- Accelerating Anode :
is used to accelerate the e^- in order to produce light by transfer of CRT beam energy to the screen.
converts kinetic energy of e^- to light energy.



- Types of Display

(i) Raster scan display:

The e^- is swept across the screen, one row at a time from top to bottom. When e^- moves across each row the beam intensity is turned ON and OFF to create a pattern of illuminated spots. used in TV systems.

(ii) Random scan display:

The e^- beam is directed to only those parts of the screen where a picture is to be drawn. The picture is drawn one line at a time, so also called as vector or stroke writing display.

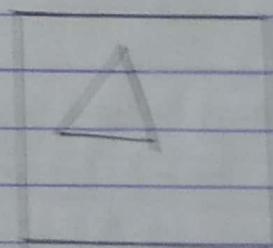
Random/Vector Scan Display

- Beam is moved betⁿ endpoints of graphic primitives.
- Flickers when complexity of image is too large.
- Scan conversion not required.
- Draws a continuous & smooth lines.
- Cost is more.
- Only draws lines & characters.
- Scan conversion hardware is not required.



Raster Scan Display

- Beam is moved all over the screen from top to bottom one scan line at a time.
- Independent of complexity of image.
- Scan conversion is required.
- Draws line by approximating them on raster grid.
- Cost is low.
- Ability to display area filled with solid colors or patterns.
- Scan conversion hardware is required.



- Color CRT monitors.

(i) Beam Penetration Technique:

- In this technique, the inside of CRT screen is coated with two layers of phosphor, usually red & green. The displayed color depends on how far the e^- beam penetrates into the phosphor layers.

• used with random scan monitors.

(ii) Shadow Mask Technique:

- In this technique, CRT has three phosphor color dots at each pixel position. One dot emits a red light, another emits a green light & third emits a blue light. By varying intensity of e^- beam we can obtain different colors.

• used with raster scan monitors.

Beam Penetration

- Produces less colors
- Color depends on speed of e^- beam
- Less costly
- Picture quality is not good.
- High Resolution
- Used for Random scan monitors.

Shadow Mask

- Produces millions of color.
- Color depends on type of ray.
- More costly
- Picture quality is good.
- Low Resolution.
- Used for Raster Scan Monitors.

- Flat Panel Display

(i) Emissive Display Device:

convert electrical energy into light to generate display. Eg. LED, plasma panels

(ii) Non-emissive Display Device:

uses optical effect to convert natural or synthetic light to graphics on screen.

Eg. LCD.

Parameters	LED	LCD	Plasma
Full Form	Light Emitting Diode	Liquid Crystal Display	Plasma
Contrast Ratio	Excellent	Poor	Moderate
Viewing Angle	Wide	Narrow	Moderate
Power Consumption	Very low	Moderate	High/More
Life Span	less compared to LCD	More	Very Less
Cost/Price	Expensive	Moderate	cheap.

= Frame Buffer

- Picture definition is stored in a memory called Frame Buffer.
- A portion of memory reserved for holding the complete bitmapped image that is sent to monitor, it stores content of image pixel by pixel.

Formulae:

- Total no. of pixel = Screen Resolution
- $\frac{\text{Size of Frame Buffer}}{\text{Total no. of bits}} = \text{Resolution} \times \text{no. of bits per pixel}$
- $\text{Time required to load buffer} = \frac{\text{Size of Frame Buffer}}{\text{Transfer Rate}}$

- | | | |
|------------------|---|-----------------------------------------------------------|
| 1 byte = 8 bits | } | Conversion of
bits, Bytes,
KiloBytes,
MegaBytes. |
| 1 KB = 1024 byte | | |
| 1 MB = 1024 KB | | |