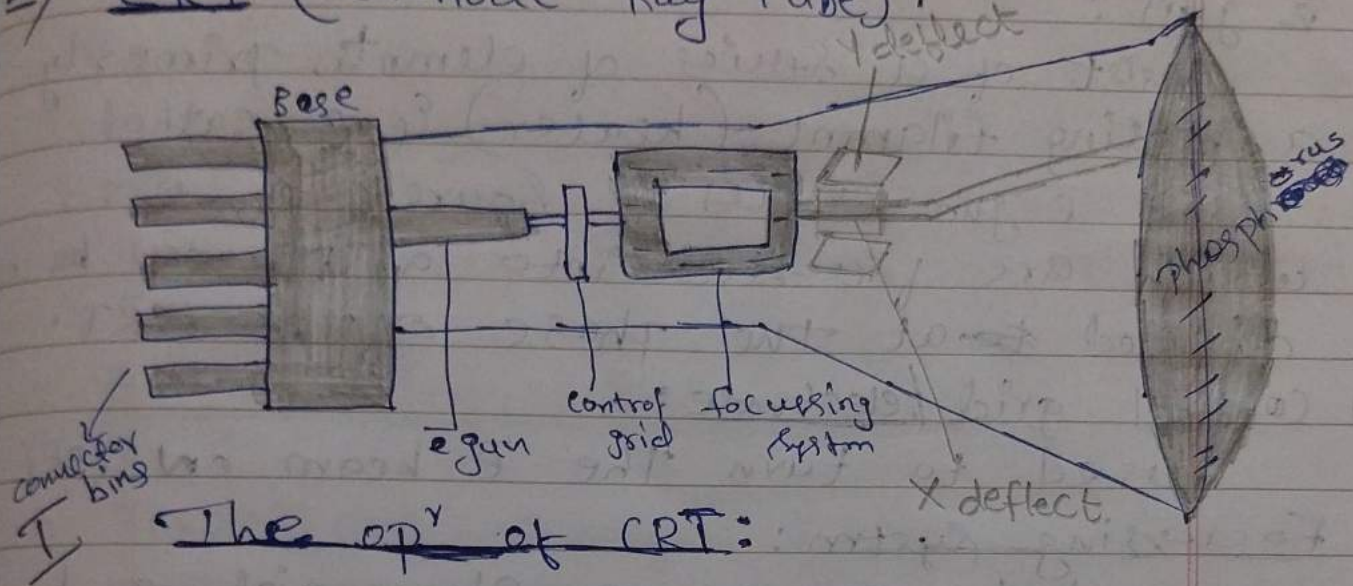


⇒ CRT (Cathode Ray Tube):



The opⁿ of CRT:

- * The e^- gun emits a beam of e^- cathod rays.
- * The e^- beam passes through focussing & deflection system that direct it towards specified position on the phosphor coated screen.
- * When the beam hits the screen, the phosphor a small spot of light at each position contacted by the e^- beam.
- * It redraws the picture by directing the e^- beam back over the same screen points quickly.

$\left[\begin{array}{l} 1 \rightarrow \text{img} \\ 0 \rightarrow \text{no img} \end{array} \right]$

IV Components of CRT:

1) e gun:

Consist of a series of elements, primarily a heating filament (heater) & a cathode.

The e gun creates a source of e^- s which are focussed into a narrow beam directed at the phase of the CRT.

2) Control grid/Electrode:

used to turn the e^- beam on & off

3) Focussing system:

used to create a clear picture by focussing the e^- into a narrow beam.

4) Deflection Yoke:

used to control the direction of the e^- beam. It creates an electric /

magnetic field which will bend the e^- beam as it passes to an area.

5) Phosphors-coated screen:

The inside front surface of every CRT is coated with phosphors (P). P glow when a high energy e^- beam hits them.

IV Persistence

Different kinds of phosphors are used in a CRT. The difference is based on the time for how long the P continues to emit light after the CRT beam has been removed.

This property is referred to as persistence.

=> Raster Scan Display:

These are 2 ways random scan & raster scan by which we can display an obj on the screen —

Base of diffn	Raster scan system	Random scan system
* Structure	Fig. below	Fig. below.
* Resolution	It's resolu ⁿ is poor, bcz raster system in contrast produces zigzag lines that are not plotted as discrete point sets.	It's resolu ⁿ is good, bcz this system produces smooth lines drawings, bcz CRT beam directed only to the parts of screen where a picture is to be drawn.
* e^- beam	e^- beam swept across the screen 1 row at a time from top to bottom	e^- beam is directed only to the parts of screen where a picture is to be drawn.

* picture definition

picture def is stored as a set of intensity values for all screen points - pixels in a refresh buffer area. The capability of this system to store intensity values for pixel makes it well suited for the realistic display of scenes containing shadow of color patterns screen points/pixels are used to draw an img.

picture def is stored as a set of line drawing instruction in a display file. This system are designed for line drawing & can't display realistic shadow scenes.

mathematically ()s are used to draw an img. Also -> vector scan system.

* realistic display

* draw an img

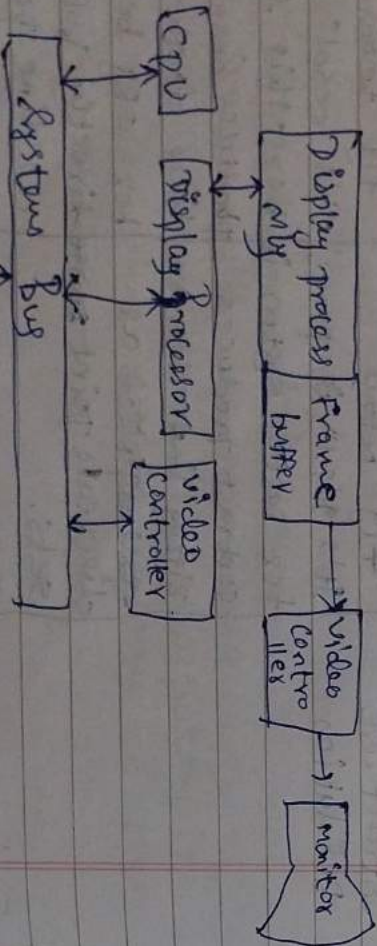


fig: Raster scan system.

I/O devices

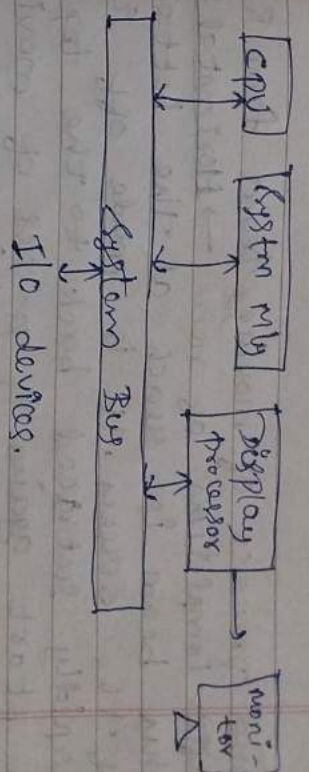
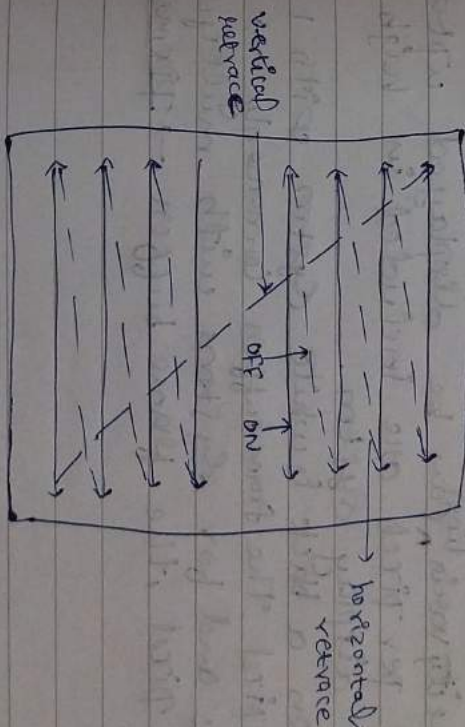


fig: Random Scan system

I/O devices.

=> Vertical & Horizontal Retrace:



vertical retrace.

horizontal retrace

* Here, beam is swept back & forth from left to right

* When beam is moved from L to R, it is on

* When beam is moved from R to L, it is off

and process of moving beam from R to L after completion of row \rightarrow Horizontal Interlace

- * when beam is reach at the bottom of the screen, it is made off \rightarrow rapidly retraced back to the top left to start again \rightarrow process of moving back to top \rightarrow vertical interlace
- * In simple black & white system each pixel is either ON/OFF, so only 1 bit per pixel is needed.

Additional bits are required when color is introduced, i.e. can be displayed upto 24 bits per pixel are included in high quality display system.

On a black & white system with 1 bit per pixel, the frame buffer commonly \rightarrow Bitmap and for systems with multiple bits per pixel, the frame buffer \rightarrow Frame

\Rightarrow Color CRT monitors :

CRT monitor display by using a combination of phosphors. The ϕ are different colors.

There are 2 popular approaches for producing color displays with a CRT are -

1) Beam Penetration Method :

- * It has been used with random scan monitors.

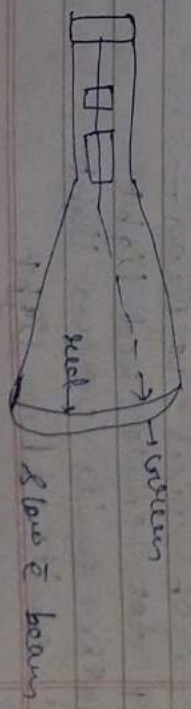
- * In this method, CRT screen is coated with 2 layers of P \rightarrow Red & Green. \rightarrow ~~the~~ display color depends on how far the e beam penetrates the P layer.

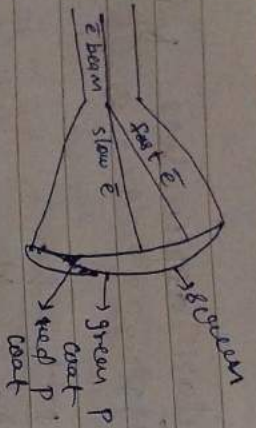
- * This method produces 4 color only, R, G, B & Y.

- * A beam of slow e excites the outer red layer only. Hence screen shows red color only.

- * A beam of high speed e excites the inner green layer. Thus screen shows a G color.

- * A beam with medium speed e, a mixture of R & G light is emitted to display 2 colors orange yellow.





Adv → inexpensive

disadv → only 4 colors are possible
 ↳ quality of pictures is not as good as with others.

2) Shadow mask method :

- * used in raster scan system bcz they produce a much wider than beam penetration method.
- * used in the ~~most~~ majority of color TV set & monitors.

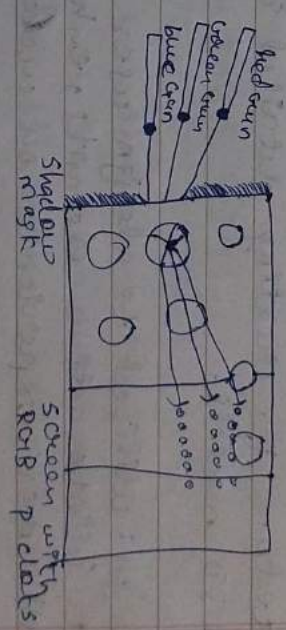
* Construction :

- A shadow mask CRT has 3 \uparrow n color dots at each pixel position —
 1 \uparrow dot emits red light
 another emits green light
 3rd emits blue light

- This type of CRT has 3 e⁻ guns —
 1 for each color dot & a shadow mask grid just behind the p coated screen.

- Shadow mask grid is pierced with small round holes in a Δ pattern.
- Figure shows the delta-delta shadow mask pattern commonly used in color CRT pattern.

Shadow mask is often used to ensure that the e⁻ beam gun the guns falls on the correct p's.



→ Appln of comp graphics :

- 1) Computational biology : used for visualizing complex molecular structures, stimulating biological p's, etc.

2) Computational Physics: Applied in simulations. Visualizations of physical phenomena, understanding of complex scientific concepts.

3) Scientific Visualization: facilitates the representation of scientific data, enabling researchers to communicate info effectively.

4) Graphic design: fundamental for creating visual elements in advertising, branding & enhancing communication.

5) CAD (Computer Aided Design): Applied in engineering architecture for creating detailed & precise 2D & 3D models.

6) User design: utilized to design user interface, layout & interactive elements, enhancing overall user experience on websites.

7) Video Games: integral to creating realistic & immersive virtual environments & enhancing gaming experience.

8) Education

9) Digital Art.

10) Info Visualization.

→ Flat panel display =

- * refers to a class of video devices that have reduced volume, weight & power req. compare to CRT.
- * eg → small TV monitor, calculator, laptop comp.

Flat panel display

Emissive display

- Are devices that convert electrical energy into light.
- eg → plasma panel (LED).

Non-emissive display

- use optical effect to convert sunlight/light from some other source into graphic pattern.
- eg → LCD

Plasma panel display:

* Also → gas-discharge display.

* consist of an array of small light. Light are fluorescent in nature.

* Essential components of P.P.D display are -
1) Cathode 2) Anode 3) Fluorescent gas

(4) Glass plates.

* Gas will flow when there is a significant voltage difference b/w horizontal & vertical wires.

* Adv \rightarrow high resolution, less volume & weight.

II LED (light emitting Diode):

* Here, a matrix of diodes is organized to form the pixel positions in the display & picture definition is stored in a refresh buffer.

* Data is read from the refresh buffer & converted to voltage levels that are applied to diode.

III LCD (liquid crystal Display):

* Are devices that produce a picture by passing polarized light from the surroundings through a liquid-crystal material that transmit light.

* LCD uses the liquid-crystal material b/w 2 glass plates.

* LCD is temperature ~~in~~ dependent. It is b/w 0 to 70°C.

* Adv \rightarrow small size & low cost.

* Dis \rightarrow LCD have no color capability.

\Rightarrow Comp graphics: (CG)

* It is an art of drawing pictures on comp screens with the help of programming. Involves computations, creation & manipulation of data.

* It is the branch of comp science that deals with generating img with the help of comp.

* It is the 1st the most efficient & commonly used way to communicate the processed info to the user.

* It displays info in the form of graphics obj like pictures, chart, graph instead of simple text.

* Comp graphic img can be \div into 3-

- a) 2D img
- b) 3D img

c) Animated graphics.

* CG make it possible to express data in pictorial form.

* pixel: smallest visual element and value display screen.

Shape of pixel is \square . The physical size of a pixel depends on how you have set the res for display screen.

pixel can be available in different cls
frame buffer / refresh buffer:

It is a digital mly where the img is stored as a matrix of intensity values of pixels.

It is stored on the video adapter's mly chips.