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What is computer graphics?

Computer graphics are pictures that are generated by a computer. for eg in magazines and on television.
Computer graphics also refers to the tools used to make such pictures. There are both H/w & S/w tools used to make such pictures.
H/w tools includes video monitors, graphics cards & printers that displays graphics as well as input devices such as mouse, trackball.

S/w tools are paints, MS office, Adobe photoshop. All these have function to draw line, circle etc and also to draw 2-D & 3-D objects.

where it is used?

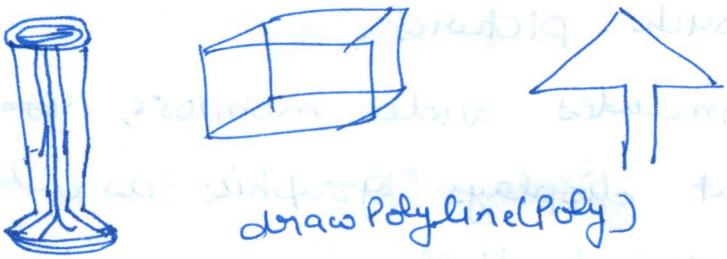
1. Magzines
2. Books
3. Games
4. Videos
5. Presentation
6. Art and Entertainment
7. CAD
8. education & training
9. Image Procesing

Elements of pictures created in computer graphics

1. Points
2. Lines
3. Poly lines
4. Text
5. Filled regions

Poly lines → It is connected sequence of straight lines.

For eg →



Polygon → When first point and last point are connected by edge.

Text → text with addⁿ attributes such as color, size, spacing and orientation.

font type → Arial Narrow, Times New Roman

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drawString(x, y, string);
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Filled Regions → The filled region is a shape filled with some color or pattern.

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fillPolygon(poly, pattern);
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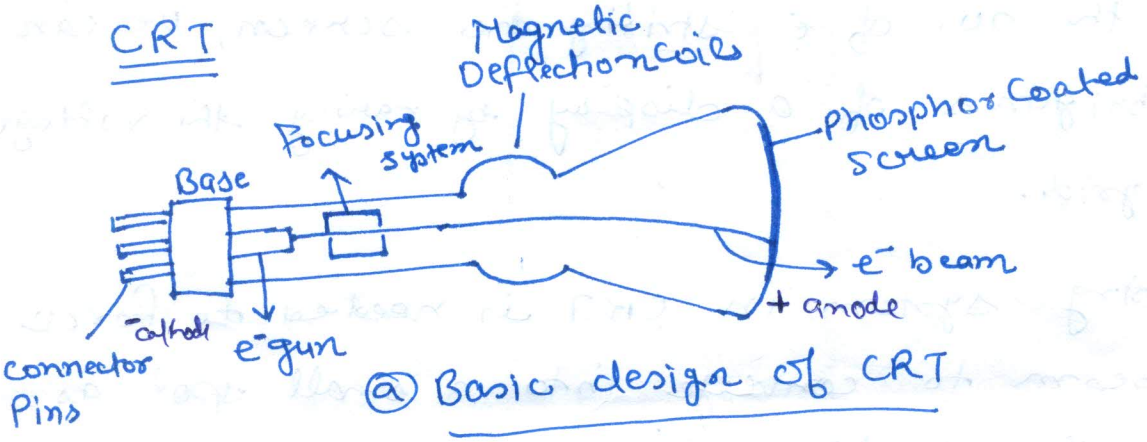
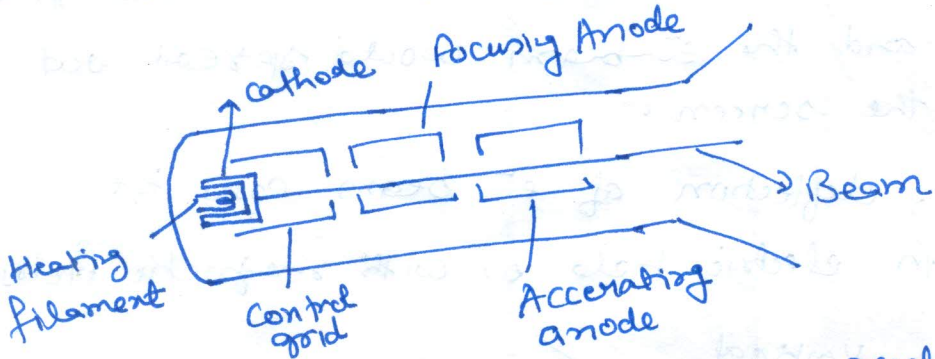
Graphics System → due to large use of graphics in real life application, computer graphics sys is used to generate graphics. which is consist of two component i.e H/w and S/w.

① Video Display devices → It is one of most important tool for computer graphic system i.e Cathode Ray Tube(CRT). which is most widely used. There are several other Technolo exist such LED, LCD,

CRT



ⓐ Basic design of CRT



ⓑ e⁻ gun with an accelerating node

A beam of e⁻ (cathode ray) emitted by an electron gun passes through focusing and deflection system that direct the beam toward specified positions on the phosphor-coated screen. The phosphor then emits a small spot of light at each position contacted by the e⁻ beam.

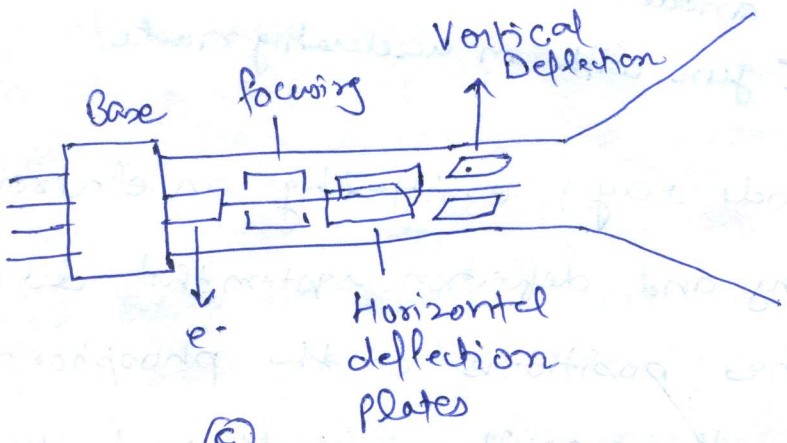
The primary components of an e⁻ gun in a CRT are heated metal cathode and a control grid.
Heat filament produce free negtively charged electrons then accelerated toward the phosphor coating by a high positive voltage.

Intensity of e⁻ beam is controlled by setting voltage levels on the control grid,

Since the amount of light emitted by the phosphor coating depends on the no. of e⁻ striking the screen, we can control the brightness of a display by varing the voltage on control grid.

The focusing system in CRT is needed to force the e⁻ beam to converge into a small spot as it strikes the phosphor. otherwise the e⁻ would repel each other, and the e⁻ beam would spread out as it approaches the screen.

As with focusing, deflection of e⁻ beam can be controlled either with electric field or with magnetic fields.



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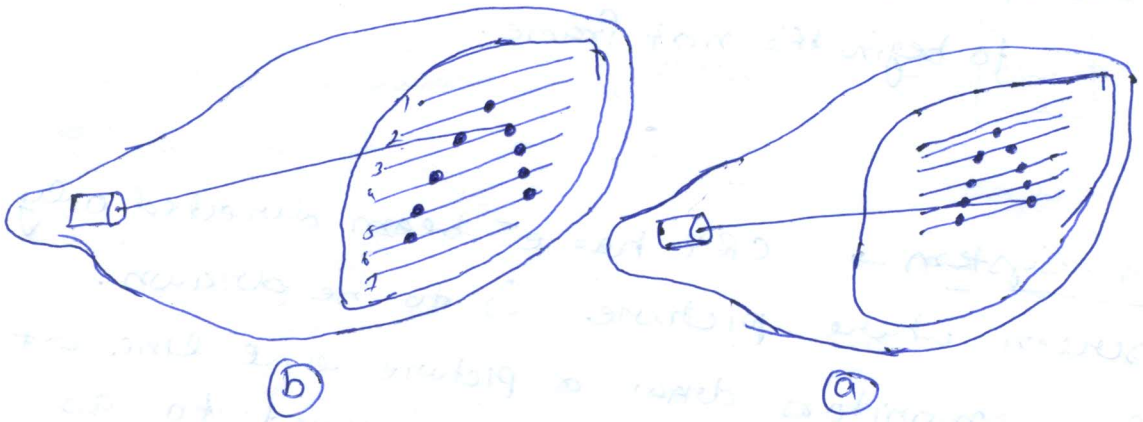
Raster Scan displays →



(b) (a)

In Raster scan display, e^- beam start scanning from left top to right of screen. i.e one row at a time from top to bottom. As e^- beam moves across each row, the beam intensity is turned on and off to create a pattern of small spot of light (illuminated spots). Picture defⁿ is stored in a memory called refresh buffer or frame buffer. This memory area holds the set of intensity values for all screen points.

Home television and printer are examples.

In simple black and white system, each screen point is either on or off, so only one bit per pixel is needed to control the intensity of screen position.

Addⁿ bits are required in case of colored CRT. upto 24 bits per pixel are required in high Quality system. which can require several megabytes of storage for frame buffer, depending upon resolution.

Refresh Rate for Raster Scan is 60 to 80 frames per sec. refresh rates are described in units of cycle per sec or Hertz (Hz), where cycle corresponds to one frame. mean 60 frames per second ⇒ 60 Hz.

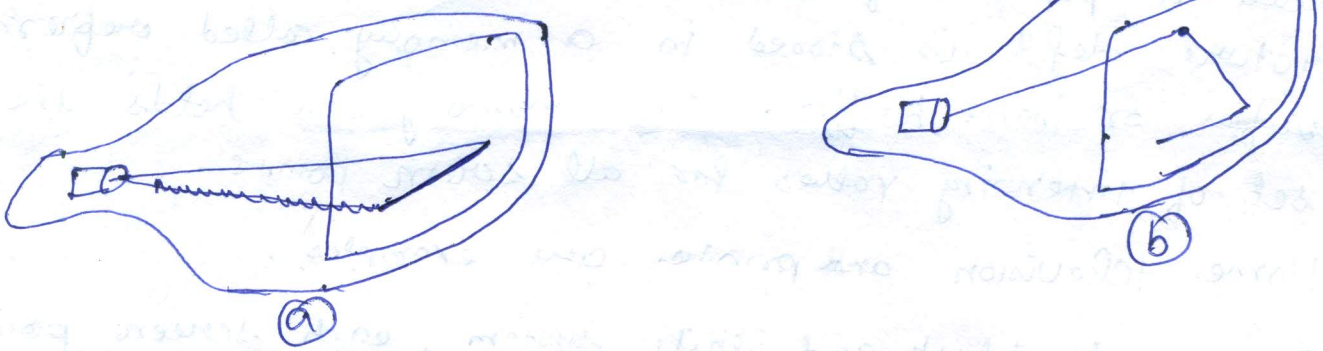
horizontal retrace → return to left of screen after refreshing each scan line

vertical retrace → return to top left corner of screen to begin the next frame.

Random Scan System → CRT has e^- beam directed only to parts of screen where picture is to be drawn.

Random Scan monitors draw a picture one line at time and for this reason are also referred to as vector display (calligraphic display)

Picture defⁿ is stored in memory as set of line drawing commands & memory is known as refresh buffer.



Random Scan system are designed for line drawing applications & can not display realistic shaded scenes.

Que Differentiate Raster and Random scan.

Color CRT Monitors →

A CRT monitor produce color pictures by using a combination of phosphors that emit different colored light.

The Two basic techniques for producing color displays

① Beam penetration.

② Shadow Mask

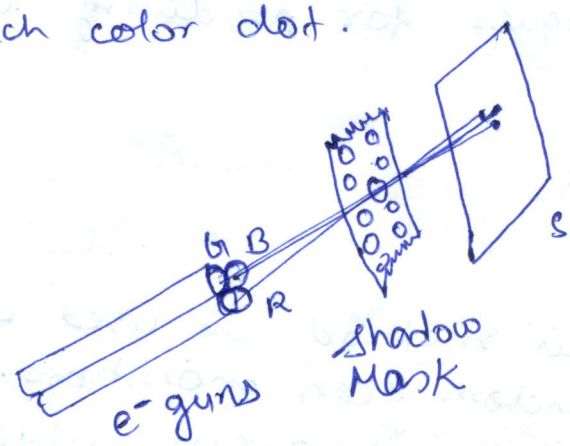
① Beam penetration → This method is used ~~with~~ in Random scan monitors. There are two layers of phosphor, red and green which are coated onto the inside of the CRT screen. The displayed color depends on how far the e⁻ beam penetrates into phosphor layer.

Speed of e⁻ plays an important role to produced Colored image. A beam of slow e⁻ excite only the outer red layer.

A beam of fast e⁻ penetrates through ~~red~~ layer and excites the inner green layer. At intermediate beam speeds, comb^n of red and green light are emitted to show two additional color, orange and yellow. The speed of e⁻ and screen color at any pt is controlled by beam acceleration voltage.

There are only four colors ~~or~~ comb^n. → quality is not as good as with other.

(2) Shadow Mask → This method is used in raster scan system. It produce more no. of color than beam penetration method.
It has three phosphor color dots at each pixel position which produces different three color ie red, blue and green. It has three e⁻ gun, each one for each color dot.



By using this Method. we obtain different type of color by varying the intensity levels of three e⁻ beams. for eg (i) By turning off red & green → blue
(ii) By turning on all → white color
(iii) By turning on red & green → Yellow.

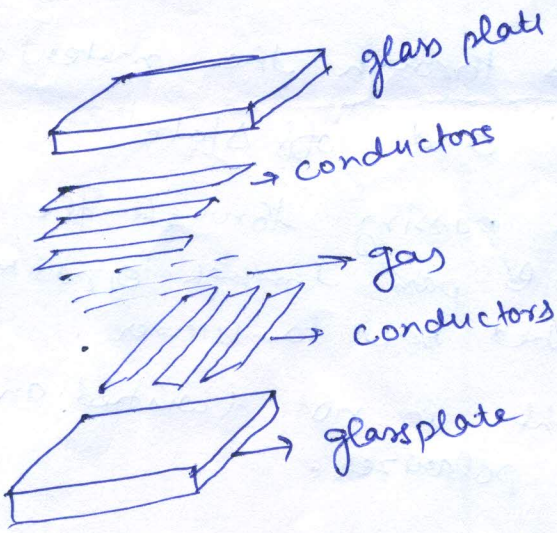
It is also known as RGB monitors. These system have 24 bit per pixel in frame buffer.

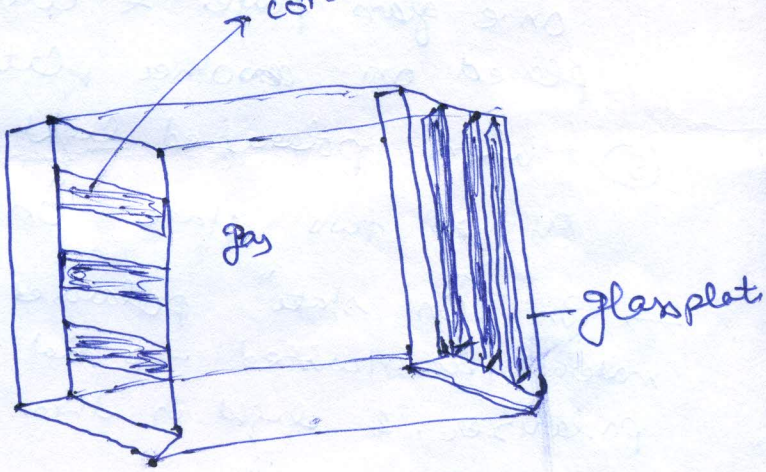
Flat-Panel Displays → The term refer to that video device which have reduced volum, weight and power consumption as compared to a CRT. It is of two types:

1. Emissive display → which convert electrical energy into light.
for eg → Plasma Panels, thin film electroluminescent LED displ
2. Non-emissive display → The video displays use optical effects to convert sunlight or light from some other source.
for LCD.

Plasma Panel → It is also referred as gas discharge display. It is constructed by filling the region b/w two glass plates with mixture of gases that contains neon. A series of vertical conducting ribbon is placed on one glass panel and set of Horizontal ribbons is placed on other glass panel. By appling voltage on both end that causes the gas at the intersection of two conductor to breat down into a glowing plasma. electric field of the conductor provide separation b/w pixel.

disadvantage → they were monochromatic devices. but now it is available for colour also.





Thin Film electroluminescent display → It is similar to plasma panel. The difference is that region b/w the glass plates is filled with a phosphor, such as zinc sulphide doped with manganese instead of gas. This display require more power than plasma panel.

LED → A matrix of diodes is arranged to form the pixel positions in display. Picture defn is stored in refresh buffer.

Non-emmisive display →

LCD → ① It produce a picture by passing polarised light from surrounding or from internal light source through a liquid crystal material that can be aligned to either block or transmit the light.

② Liquid crystal compound have crystalline arrangment of molecules which flow like a liquid.

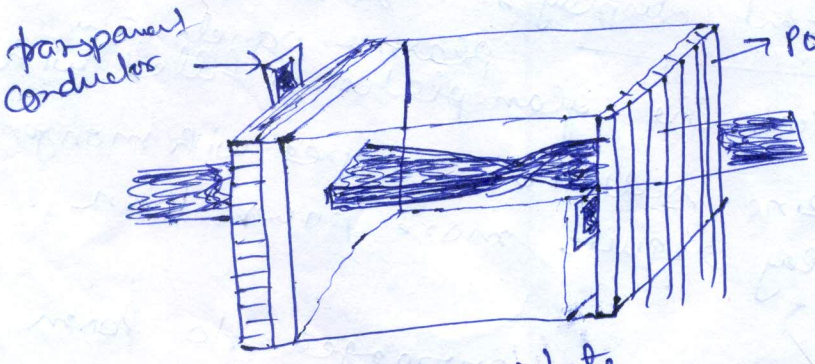
③ Two glass panel/plates, each containing a light polarizer at right angles to the other plate, in b/w the LC Material is placed.

④ Rows of horizontal transparent conductors are built into one glass plate & column of vertical conductor are placed on another plate.

⑤ When polarized light pass through the material, it has two state "on state" and "off state"

→ In "on state" polarised light passing through the material is twisted so that it will pass through opposite polarizer & light is then reflected back to viewer.

→ In "off state", Polarised light is not twisted and does not pass through opposite polarizer.



on state

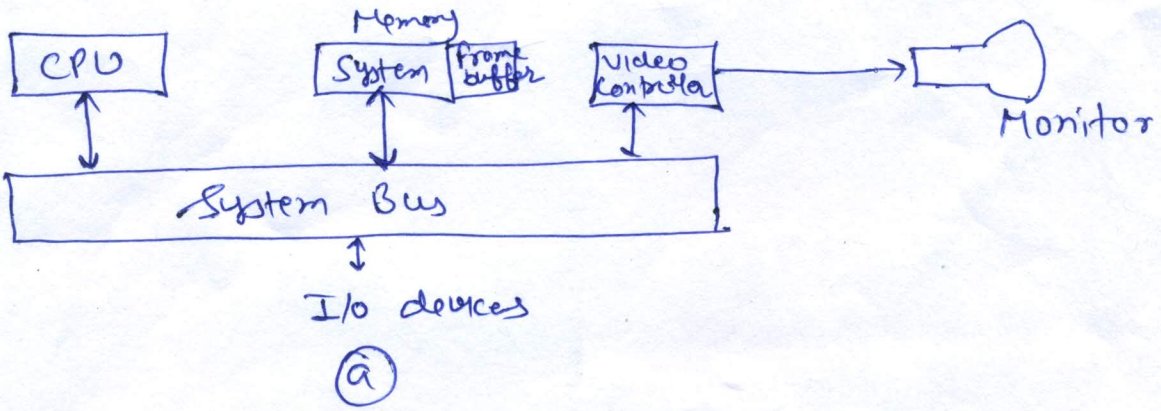
Input devices →

① Digitizers → A common device for drawing, painting or selecting co-ordinate positions on an object is called digitizers. This device is used to input coordinate values in either a two dimensional or three dimensional space. for eg → graphics tabel.

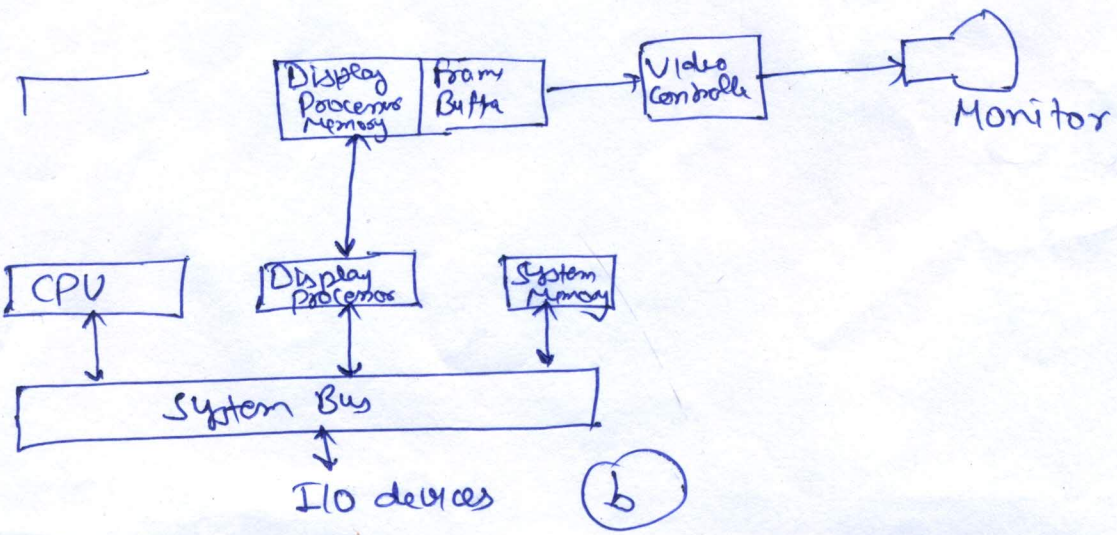
② Image I/P device → ① keyboard

② Mouse
③ Joystick
④ Trackballs
⑤ Light pen
⑥ Data glove
⑦ OMR
⑧ touch Screen

Video Controller →



(a)



(b)

Refresh Rate → how many times per second a monitor screen image is renewed. for eg 60Hz means the screen is going to redraw 60 times per second

Resolution → It is expressed no. of pixels in horizontal line and the number on vertical axis.

1280 x 1023 pixel
↓ Horizontal width
↓ vertical height

Aspect Ratio → the ratio of width to height of an image/screen

for eg 16:9, 4:3

Computer graphics std →

GKS → graphics kernel System
CGI → Computer graphics Interface
CGM → Computer graphics Metafile