

09-12-19.

Unit - IIntroduction to Computer Graphics.

## \* Introduction.

- The computer is an information processing machine. It is storing tool for manipulating & correlating data. There are many ways to communicate the process information to the user.
- The computer graphics is one of the most effective & commonly used way to communicate the process information to the user.
- It displays the information in the form of graphics objects such as picture, chart, graphs & diagrams instead of simple text. We can say that computer graphics makes it possible to express data in pictorial form. The picture or graphics may be an engineering drawing, business graphs, architecture and a single frame from an animated movie or a machine part.
- It is a fundamental comprehensive concept of CG. It is important to understand:
  - How pictures & graphics objects are created in CG?
  - How picture or graphics objects are presented for presentation?
  - How previously picture or graphics objects are presented?
  - How interaction with picture & graphics objects

- In CG graphics object are presented as a collection of discrete picture element called pixel.
- Pixel is a smallest addressable screen element.
- It is a smallest piece of display screen which we can control.
- The control is achieved by setting the intensity & the color of the pixel which compose the screen.
- Each pixel on the graphics display does not represent mathematical point rather it represent a region which theoretically can contain an infinite no. of points.

## # Applications of CG :

- The use of computer graphic widely used. It is used in various areas such as industry, business, government organisation, entertainment & most at home.

### i] User Interface :

- User friendliness is the ~~person~~ main factor, underline the success & popularity of any system.
- It is now well establish fact that graphical interface provided an attractive & easy interaction between users & computer.

- The built in graphics provided with user interfaces use visual control items such as buttons, menus, icon, scroll bar, etc. which allows user interact with computer only by mouse clicks & touch pad.
- Typing is necessary input text to be stored manipulating.

### i] Plotting of graphics and charts :

- In industry, business, government & educational organisation, it is most commonly used to create 2D, 3D, 4D, 5D.
- Graphs of mathematical, physical & economic fun<sup>n</sup> in the form of histogram. These graphs & charts are very useful for decision making.

### ii] Arts and Commerce :

- There is a lot of development in the ~~total~~ tools provided by computer graphics.
- This allows user to create artistic picture which express message and attract attention such picture are very useful in advertisement.

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### iv] Office automation & desktop publishing :

The desktop publishing on personal computer terms allow the use of graphics for the creation & destination of information many organisation

does the in house creation & printing of documents. The desktop publishing allows user to create document such which contain text, tables & graphs & other forms of drawn or scan image or picture. This is one approach towards the office automation.

v] Computer aided graphic & design :

The computer aided graphic & design use graphics to design components & system electrical, mechanical, electromechanical & electronic devices such as automobiles body structure of building, aeroplane, ships, VLSI chip, optical system & computer networks.

vi] Simulation & animation :

Use of graphics in simulation mathematical model of mechanical system more realistic & easy to study.

The interactive graphics supported by animation software through their use in production of animated movies & cartoon.

vii] Process Control :

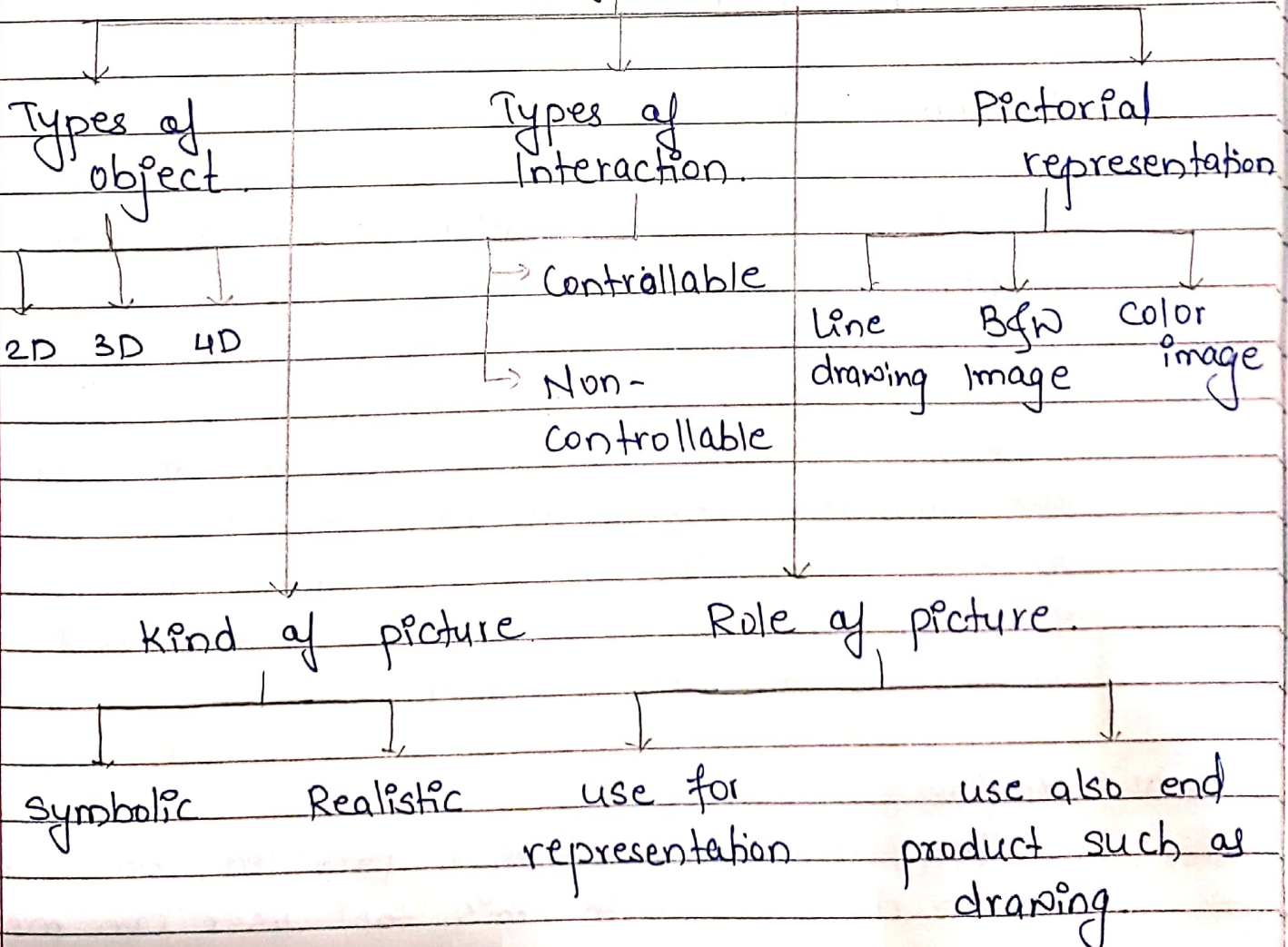
By the use of computer now it is possible to control various process in the industry from

a remote control room. In such cases, process system & process parameters are shown on the computer with graphics symbol of identification.

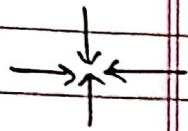
### viii] Cartography :

Computer graphics is also use to represent geographic map, wheather map, ocean graphic chart, population density map.

### Uses of computer graphics



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## Advantages of CG :

### i) High quality graphics :

A high quality graphics display a personal computer provide a one of the most natural means of communicating with a computer.

### ii) Producing picture :

It provides tools for producing picture not only concrete, real world objects but also of abstract synthetic objects such as mathematical surfaces in four dimensional & of the data that have no inherent geometry such as survey result.

### iii) Moving Picture :

It has an ability to show moving picture & it is possible to produce animation with interactive graphics.

### iv) Interactive graphics :

With interactive graphics use can also control the animation by adjusting the speed, portion of the total scene in view, geometric relationship of object in the scene to one another and to show the amount of details.

### v) Motion Dynamics :

The interactive graphics provided tools called motion dynamics. With this tool user can move

and tumble objects with respect to a stationary observer or he/she can make object stationary & the viewer moving around them.

A typical example is walk through made by builder to show flat interior of building surrounding. In many cases, it is also possible to move both objects & viewer.

vii] Update dynamic :

The interactive graphics also provide facility called update dynamics. With update dynamics it is possible to change the shape, color or other properties of object with view.

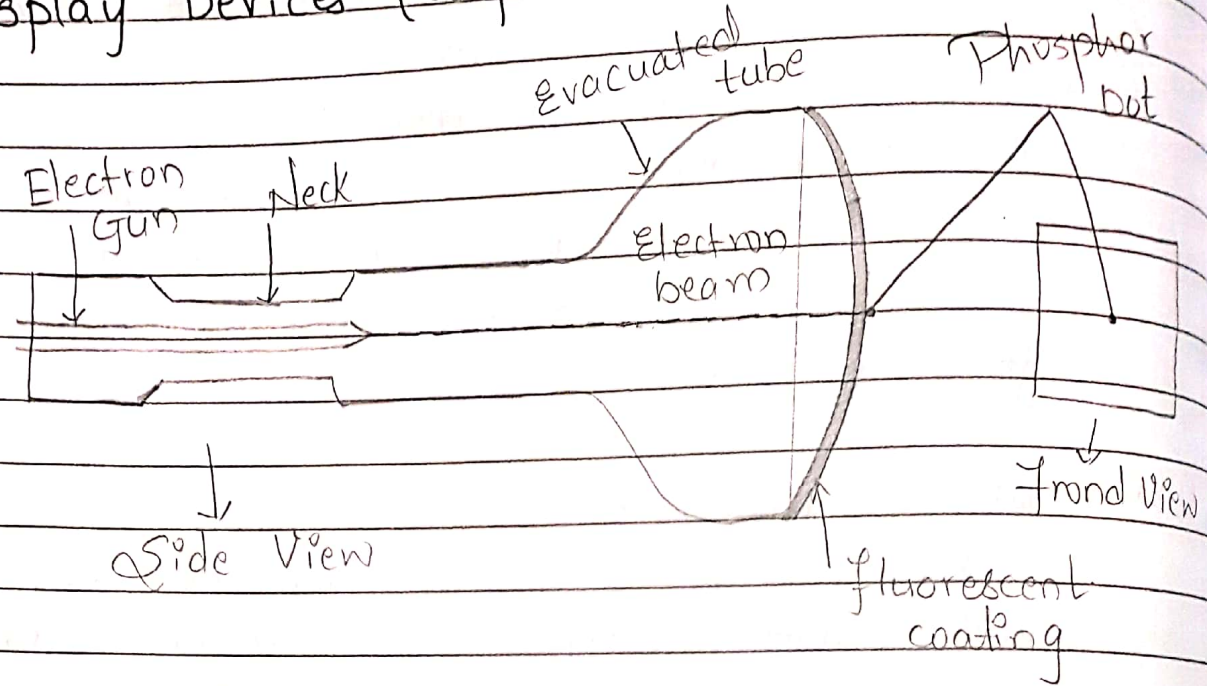
viii] DSP (Digital signal Processing) :

With the recent development of an audio synthesis chip. The interactive graphics can now provide audio feedback along with the graphical feedback. To make the stimulated environment.

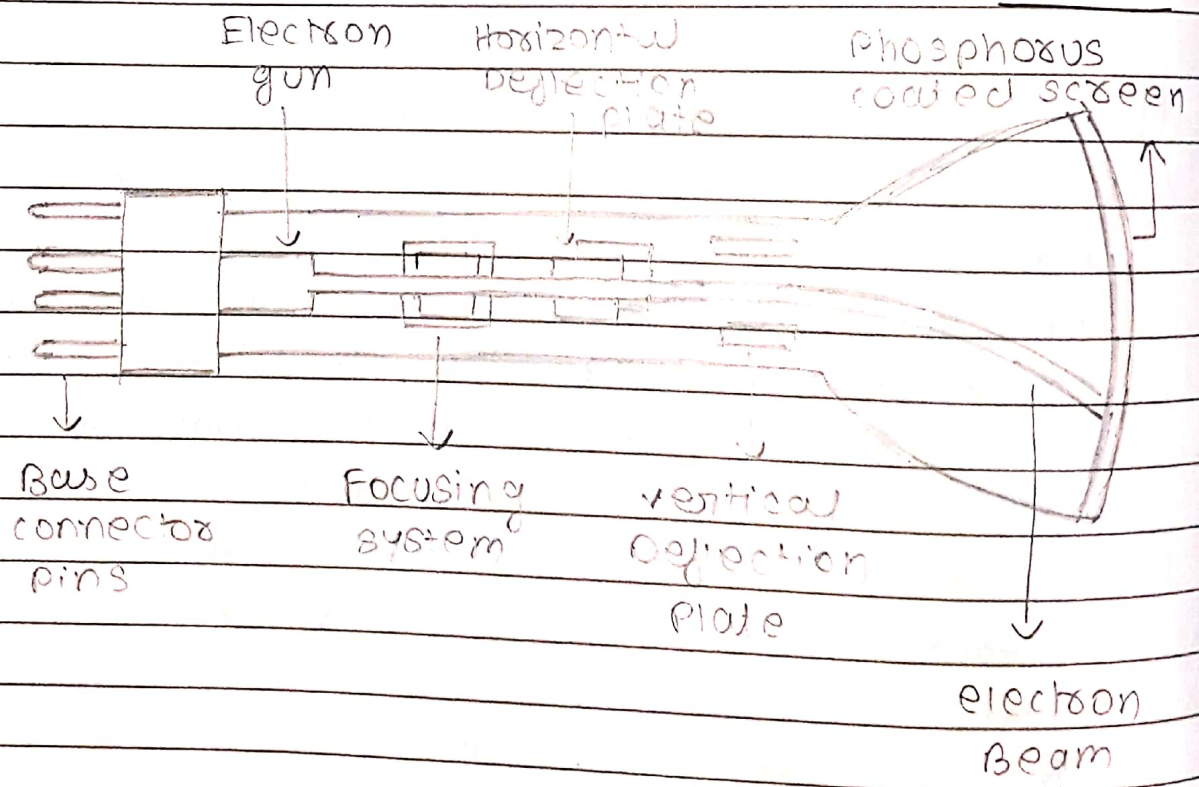
In short, these interactive graphic permit extensive high bandwidth user computer interaction. It significantly enhance the ability to understand information to perceive trends and to visualize real & imaginary object either moving or stationary in a realistic environment.

It also make it possible to get high quality & more presized result of product with lower analysis & designing cost.

# \* Display Devices (output devices) :



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- The most commonly used output device in a graphic system is a monitor.
- The operation of most video monitor is based on standard CRT designs.



## # CRT :

- A CRT is an evacuated glass tube, an electron gun at the rear of the tube produce a beam of electrons which is directed to-wards the front of the tube or screen.
- The inner side of the screen is coated with phosphorus substance which gives off light when it is stroke by electron.
- It is possible to control the point at which the electron being strike the screen of therefore, the position of the dot upon the screen by deflecting the electron beam.
- The above fig. shows the electron-static deflection of the electron beam in a CRT.
- The deflection system of CRT consist of two types (or) two pairs of parallel plates referred as vertical & horizontal deflection plates.
- The voltage applied to the horizontal deflection plates control the horizontal deflection of  $e^-$  beam.
- There are 2 techniques used for producing images on the CRT screen.
  - i) Vector scan
  - ii) Raster Scan.

### Vector Scan

- In Vector scan, display the beam is move b/w end points of the graphics primitive.

### Raster Scan.

In Raster scan, the beam is move all over the screen one scan line at a time from top to bottom & back to top.

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>• Vector display flicker (shine/brightness) when the no. of primitives in the buffer become too large.</li></ul> | <p>In Raster display, the refresh process is independent of the complexity of image.</p>   |
| <ul style="list-style-type: none"><li>• In Vector Scan, conversion is not required.</li></ul>  | <p>In Raster Scan, each primitive must be scan converted, real time dynamic is far more computational &amp; required separate scan conversion hardware.</p>            |
| <ul style="list-style-type: none"><li>• In Vector Scan Display, draw a continuous &amp; smooth lines.</li></ul>  | <p>In Raster Scan Display, mathematically smooth lines, polygons &amp; boundaries of the curves primitives only by approaching them with pixel on the raster beam.</p> |
| <ul style="list-style-type: none"><li>• Vector scan cost is more.</li></ul>  | <p>Raster scan, cost is low.</p>   |
| <ul style="list-style-type: none"><li>• In Vector Scan Display, draw lines &amp; characters.</li></ul>   | <p>In Raster Scan Display, it has ability to display areas &amp; filled with solid colours &amp; patterns.</p>   |

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## \* Color CRT :

A CRT monitor display color picture by using combination of phosphorous that emit different color light.

It generates a range of colors by combining the limited life from the different phosphorous.

There are two basic techniques used for producing color display.

- i) Beam penetration techniques.
- ii) Shadow mask.

### i] Beam penetration techniques.

These techniques is used with random scan monitors. In this technique the inside of CRT screen is coated with two layer of phosphorous usually red & green. The display color depends on how far the electron beam penetrates into the phosphor layer. The outer layer is red & inner layer is green phosphor.

A beam of slow electron excites only the outer red layer.

A beam of very fast electron being penetrates to the red layer & excites the inner green layer.

At intermediate beam speed combination of red & green light are emitted & two additional colors orange & yellow displayed.

The beam acceleration voltage control the speed of the  $e^-$  & hence the screen color at any point of the screen.

## ★ Disadvantages :

- It is an inexpensive techniques to produce in random scan monitor.
- It can display only four colors (R, G, B, Y).
- The quality of picture produce by this technique not good as compare to other techniques.

## ii] Shadow mask :

It produce much wider range of colors other than BPT. This technique commonly used raster scan display including color.

In this technique has three phosphor color dot at each pixel location.

Each dot emit red, green & blue light. It has three  $e^-$  gun. One for each color dot and a shadow mask green just behind the phosphor coated screen.

A grid consist series of whole a line with the phosphor dot pattern.

A three  $e^-$  beam are reflected & focus as a group on to the shadow mask & when they pass through a whole in the shadow mask.

They excite a dot triangle. A dot triangle consist 3 small phosphor dot (RGB). These dot are arrange so that each electron beam can active only corresponding color dot when it pass through a shadow mask.

A dot triangle when activated appears as a small dot on the screen which has color of combination of three small dots in triangle. By varying the intensity of 3  $e^0$  beam we can obtain different colors in the shadow mask CRT.

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### \* Direct View Storage Tube :

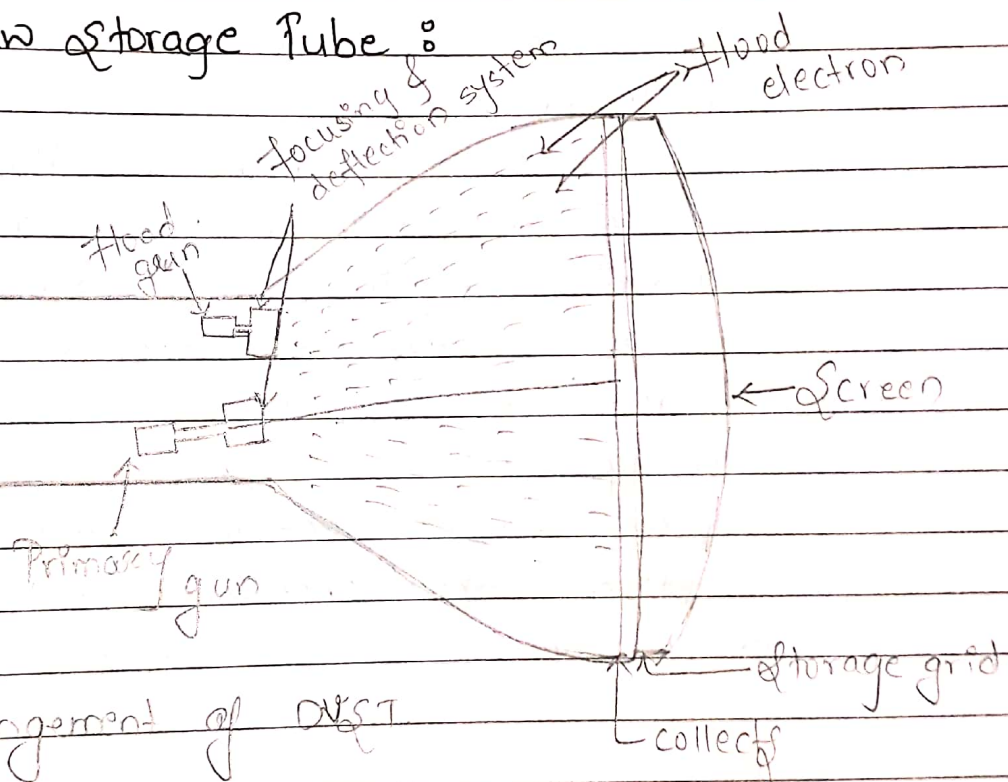


Fig: Arrangement of DVST

We know that, in raster scan display we do refreshing of the screen because to maintain a screen image.

It gives the alternative method of maintaining the screen image.

It uses the storage grid to store the picture information as the charge distribution just behind the phosphor coated screen.

It above fig. shows the arrangement of DVST.

It consist two electron guns: 1) primary 2) flood

- primary gun store the picture pattern & flood gun maintain the picture display.
- Primary gun produce high screen electrons which strike on a storage grid with high speed, it knocks out electron from the storage grid keeping the net positive charge.

The knock out electrons are attracted towards the collector.

The net positive charge on the storage grid is nothing but the picture pattern.

The continuous low speed electrons from flood gun pass through the control grid & are attracted to the positive charge areas of the storage grid.

The low speed electrons penetrate the storage grid & strike the phosphor coating without affecting the positive charge pattern on the storage grid.

During this process collector just behind the storage grid smooth out the flow of flood electrons.

### \* Advantages of DVST :

- Refreshing of CRT are not required.
- Because no refreshing is required very complex picture can be displayed at very high resolution.

without flicker.

- It has flat screen.

### ★ Disadvantages of DVST :

- They do not display colors & are available with single level of line intensity.
- Erasing requires removal of charge on the storage grid.
- Erasing and redrawing process take several sec.
- Selective or part erasing of the screen is not possible.
- Erasing of the screen produces unpleasant flash over the entire screen surface which prevents its use of dynamic graphics application.
- It has a poor contrast as a result of the comparatively low accelerating potential applied to the flood electrons.
- The performance of DVST is somewhat inferior to the refresh CRT.