

## **UNIT NO 1**

### **BASICS OF COMPUTER GRAPHICS (Weightage-8marks)**

- What is Pixel and Resolution?
  - What is Text mode and Graphic Mode?
  - Explain Basic Graphic Pipeline.
  - State the Applications of Computer graphics.
  - Explain Types of Display Devices.
  - What is Virtual Reality.?
  - State and explain Augmented Reality?
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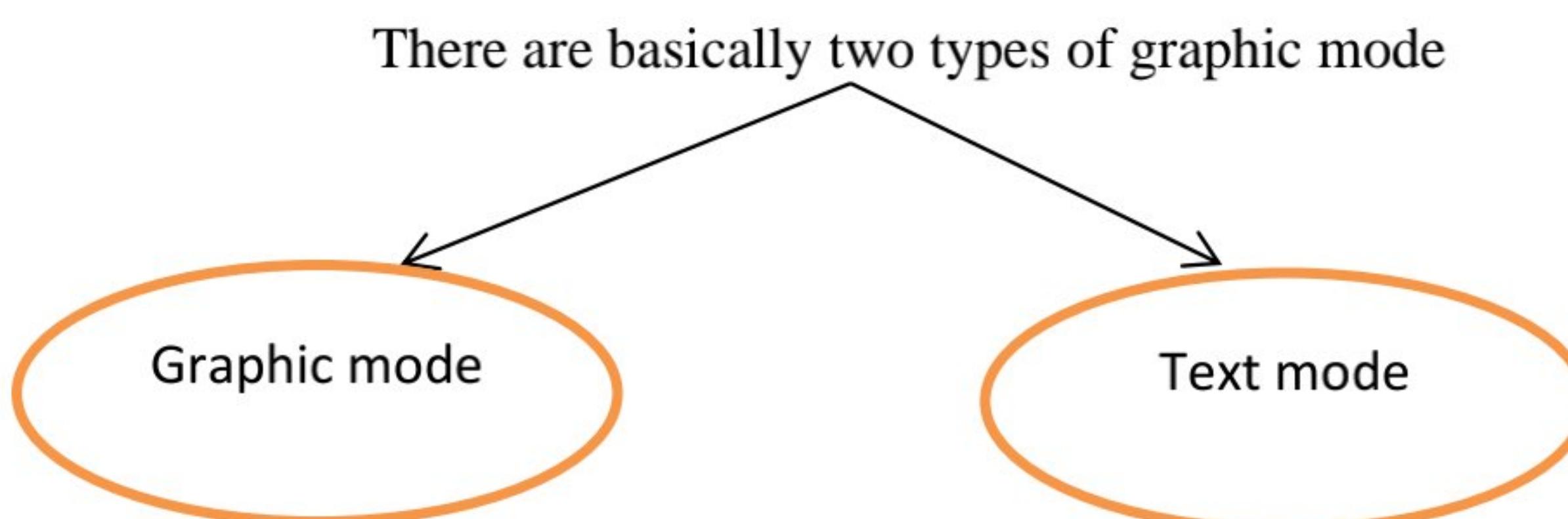
#### **Object and Image.**

- ❖ An image is basically representation of a real world object on a computer or any display device.
  - ❖ It can be actual picture or stored page in a video memory or a source code generated by a program.
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#### **Pixel & Resolution**

- ❖ Pixels Stands for Picture Element.
  - ❖ A pixel is the smallest piece of information in an image.
  - ❖ In Computer Graphics , objects are represented as collection of pixels , where pixel is smallest addressable point which can be displayed on Screen.
  - ❖ Pixels Can be displayed by setting their intensity and colour on the screen
    - In computer , Resolution is the number of pixels contained on a display.
    - It is expressed in the terms of the numbers of pixels on horizontal axis as well as vertical axis.
    - The sharpness of the image on the display device depends upon the size of display
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#### **Text Mode and Graphic Mode**



## **Text Mode :**

- ❖ Text mode is also called character mode.
- ❖ In the text mode , Display is divided into rows and columns of boxes.
- ❖ Each box contains one character .
- ❖ All video standards support a text mode that divides the screen into 25 rows and 80 columns.(Alphanumeric)
- ❖ Character based programs run in text mode

## **Functions of Text Mode:**

### I. Window()

This Function specifies a window on screen.

Syntax : window(left,right,top,bottom);

The four integer co-co-ordinates of the window are passed as parameters to the function.

### II. Puts()

It displays string at cursor position

Syntax: puts(s);

### III. Putch()

It display single character cursor poistier.

Syntax:putch(char);

### IV. Clrscr()

It clears the entire screen and locates the cursor in the top left corner of screen. i.e (1,1)

Syntax:clrscr();

## **Graphics Mode :**

- ❖ It is a computer display mode that displays image using pixels .
- ❖ In the graphics mode, the display screen is treated as array of pixels.
- ❖ Programs that runs in graphic mode can display in variety of shapes and fonts.
- ❖ In this mode , we can display different effective text as well as draw different graphical figures.

## **Functions of Graphics Mode:**

### 1) initgraph()

It is used to initialise graphics mode.

Syntax:initgraph(int driver,int mode , char path);

### 2) closegraph()

It is used to close the graphic mode.

When you exit the graphic mode then you should restore the system to the previous text mode.

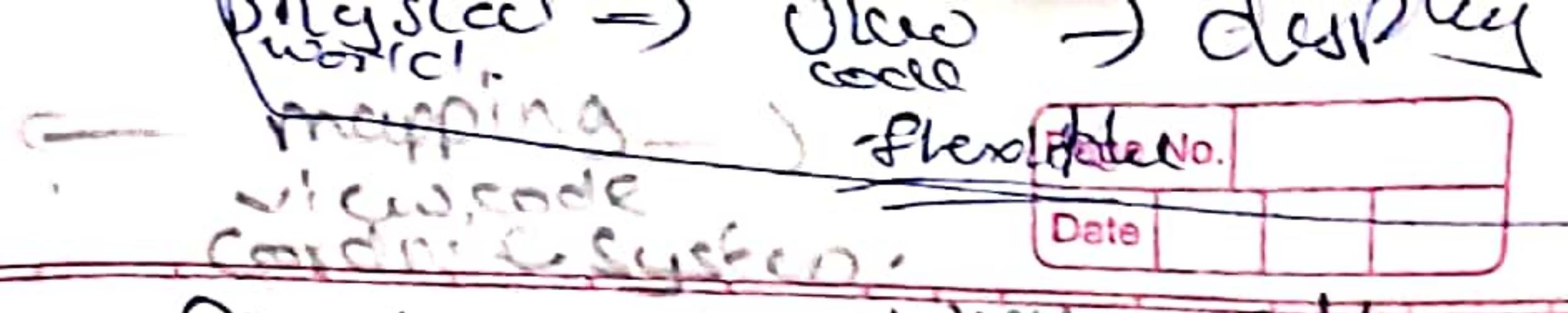
Syntax:closegraph();

## **Applications of Computer Graphics.**

- 1) **GUI** (Graphical User Interface)
  - i. GUI is a computer program that enables a person to communicate with a computer through the use of symbols, visual metaphors and pointing devices
  - ii. A Graphical User Interface (GUI) is a type of user interface which allows people to interact with a computer and computer-controlled devices which employ graphical icons, visual indicators or special graphical elements called "widgets".
- 2) **GIS** (Geographical Information System)
  - i. A Geographic Information System (GIS) is a system for capturing, storing, analyzing and managing data and associated attributes which are spatially referenced to the earth.
  - ii. It is a computer system analyzing, sharing results of all these operations capable of integrating, storing, editing, and displaying geographically-referenced information
  - iii. In a more generic sense, GIS is a tool that allows users to create interactive queries (user created searches), analyze the special information, edit data, maps, and present the
- 3) **Entertainment**
  - i. In making motion pictures, music videos and television shows, computer graphics methods are widely used.
    - o **Animation:** It is the rapid display of a sequence of images of 2-D artwork or model order to create an illusion of movement. 2D and 3D animations are used.
    - o **Video Game:** Video game is a game that involves interaction with a user interface to generate positions in visual feedback on a video device. The electronic systems used to play video games are known as platforms.
  - ii. Examples of these are Personal Computers and Video Game Consoles.
- 4) **Image processing**
  - i. Image processing provides us techniques to modify or interpret existing Images.
  - ii. One can improve picture quality through Image processing techniques and can also be used for machine perception of visual information in robotics.
  - iii. Typical operations among many other image processing operations are;
    - o Alignment of two or more images.
    - o Geometric transformations such as enlargement, reduction and rotation.
- 5) **Education and Training**
  - i. Computer graphics can make us understand the functioning of a system in a better way.
  - ii. In physical systems, biological systems, population trends, etc., models makes it easier to understand.
  - iii. In some training systems, graphical models with simulations help a trainee to train in virtual reality environment.
  - iv. For example, practice session or training of ship captains, aircraft pilots, air traffic control personnel.
- 6) **Presentation graphics**

In applications like summarizing of data of financial, statistical, mathematical, scientific and economic research reports, presentation graphics are used.

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## Basic Graphic Pipeline

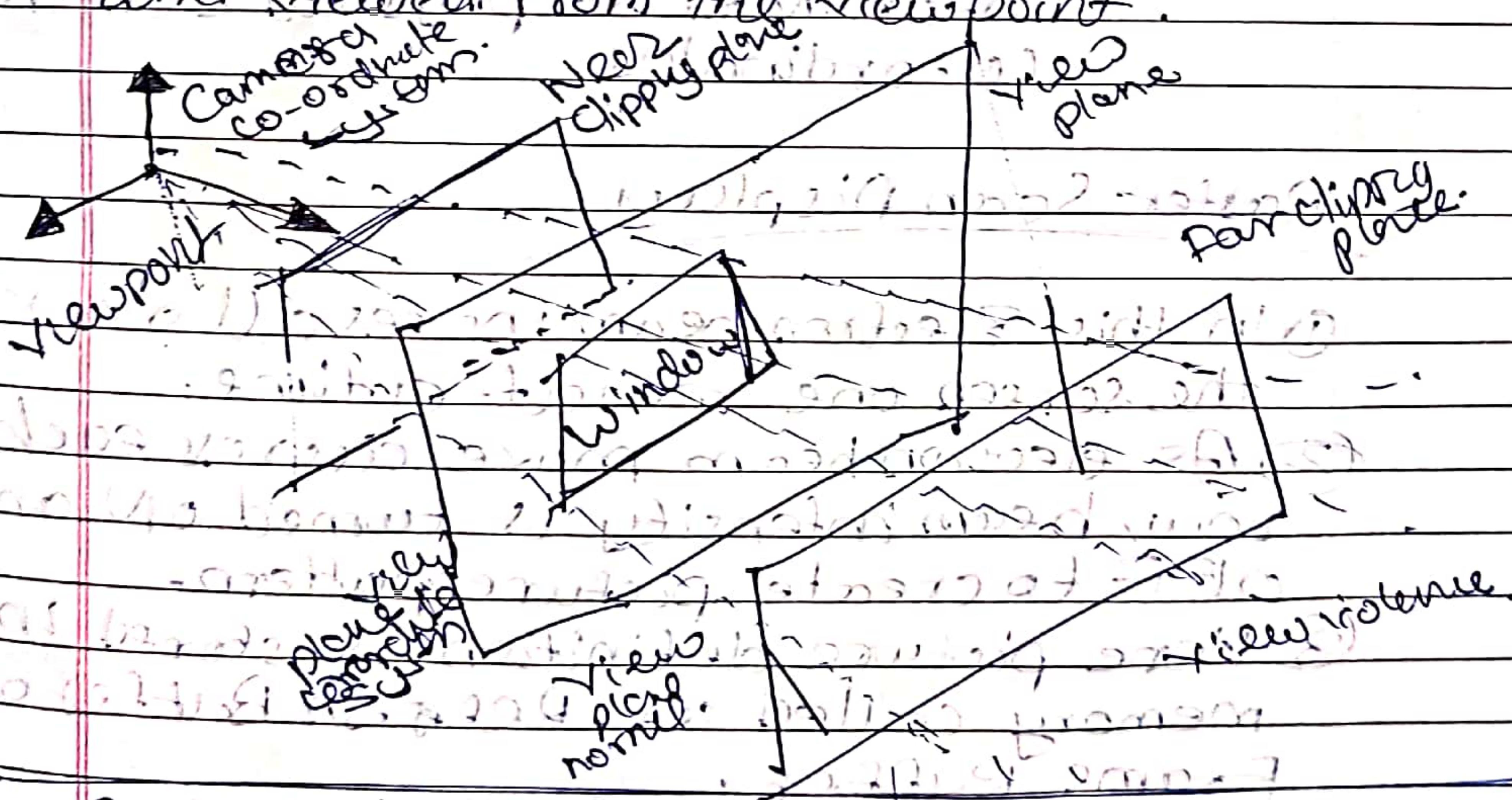
① In CGR, Graphic Pipeline refers to a series of interconnected stages through which data and commands related to a scene go through rendering process.

② Graphic Pipeline process converts mathematical data of an object to its actual representation on the device.

③ First the real world objects are represented by world co-ordinate system, then it is projected into a view plane.

④ The projection is done from the view-point of position of a camera or eye.

⑤ There is a camera co-ordinate system whose z-axis specifies the view direction when viewed from the viewpoint.



## Representation of 3D Object

Transform into camera coordinates

Clip against view volume

Project to view plane

Transform to view port  $\rightarrow$  transform to device

- ⑥ Ray emerging from the view point and passing from the window is called view pyramid.
- ⑦ Clipping planes are used to limit the output of objects.
- ⑧ The mapping of an object to a display device requires the transformation of view plane co-ordinates to physical device co-ordinates.

Two step involved in this process:

Step 1: Window to view port transformation:

The view port is basically a rectangle of a fixed rectangle known as logical screen.

Step 2: Transformation of logical screen

co-ordinates to physical screen co-ordinates.

## Classification of display devices

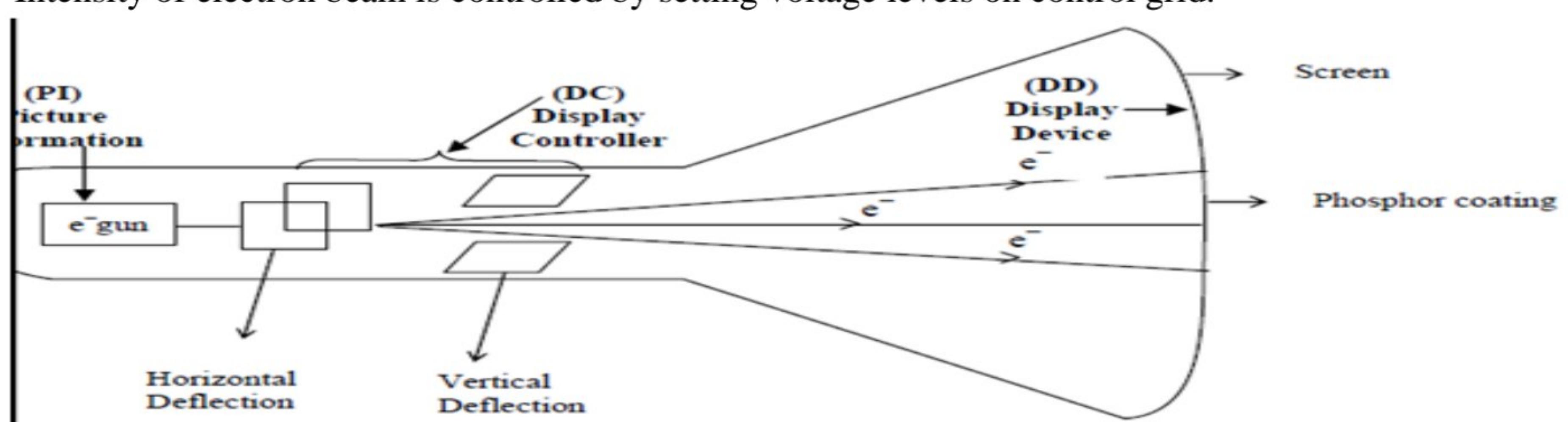
- CRT(Cathode Ray Tube)
- Raster Scan Display
- Random Scan Display
- Touch screen
- Flat Scan display / Flat display devices
  - Plasma panels
  - LCD(Liquid Crystal Display)
  - LED(Light Emitting Diodes)

## Display Devices

Display devices are used for the visual presentation of information. A display device is a device for visual or tactile presentation of images (including text)/video acquired, stored, or transmitted in various forms. Ex : Computer monitor, TV screen.

## CRT (Cathode Ray Tube)

- Cathode Ray Tube (CRT) is very common type of display device in the category of analog electronic Display device.
- CRT is evacuated glass which contain Electron gun, Focusing system., Accelerating system, Deflection system and Screen with Phosphor coated inside.
- Electron gun generates a beam of electrons (cathode ray) which passes through focusing and deflection system and strikes on phosphor coated screen.
- When electron beam strikes phosphor that phosphor spot emits light and thus the point on screen is visible.
- Basically, electron gun consists of heating filament, cathode and control grid.
- When cathode is heated with heating filament inside it by passing current through filament, cathode generates electrons.
- Cathode is surrounded by metal control grid with a hole at one end which allows electrons to escape.
- Intensity of electron beam is controlled by setting voltage levels on control grid.

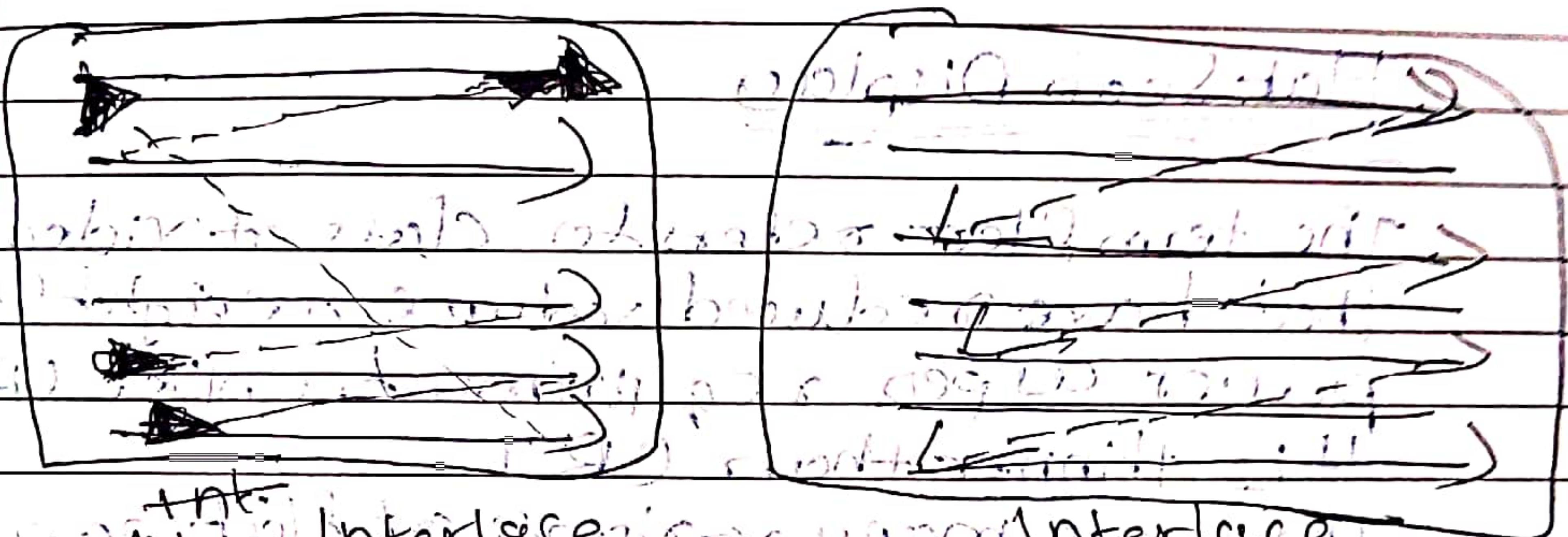


<b>Base of Difference</b>	<b>Raster Scan System</b>	<b>Random Scan System</b>
<b>Electron Beam</b>	The electron beam is swept across The screen, one row at a time, from Top to bottom.	The electron beam is directed only to the parts of screen where a Picture is to be drawn.
<b>Resolution</b>	Its resolution is poor because raster system in contrast produces zig-zag lines that are plotted as discrete Point sets.	Its resolution is good because this system produces smooth lines drawings because CRT beam directly follows the line path.
<b>Picture Definition</b>	Picture definition is stored as a set of intensity values for all screen points, called pixels in a refresh buffer area.	Picture definition is stored as a set of line drawing instructions in a display file.
<b>Realistic Display</b>	The capability of this system to store intensity values for pixel makes it well suited for the realistic display of scenes contain shadow and color pattern.	These systems are designed for line-drawing and can't display realistic shaded scenes.
<b>Draw an Image</b>	Screen points/pixels are used to draw an image.	Mathematical functions are used to draw an image.

## Raster Scan Displays

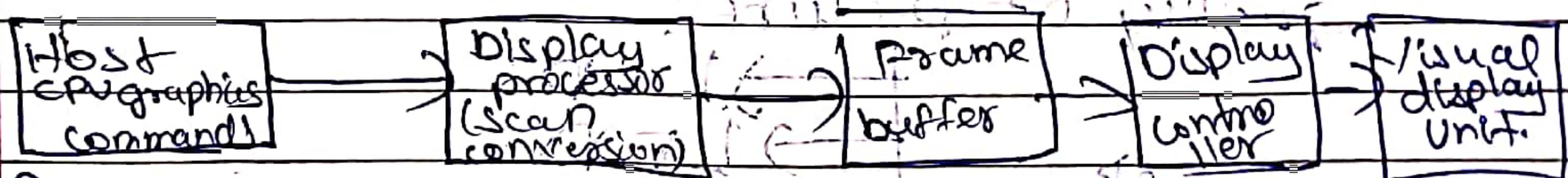
- ① In this Electron beam moves all over the screen one row at a time.
- ② As electron beam move across each row, beam intensity is turned ON and OFF to create picture pattern.
- ③ Picture definition is stored in memory called as Refresh Buffer or Frame Buffer.
- ④ When Beam is moved from left to right it is ON and when moved from right to left it is OFF. It is called horizontal retrace. Starting

- (5) When beam reaches bottom of screen it made OPE and returns to top left corner of screen which is referred as vertical retrace.
- (6) Raster Scan display maintains the steady image on the screen by repeating scanning of same image and this process is known as refreshing of screen.



Non Interlacing and Interlace

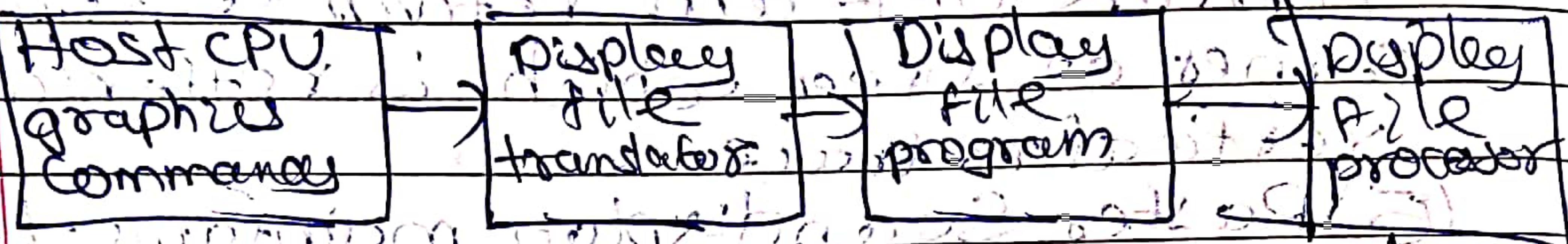
Block diagram (Host computer -> Workstation -> CRT)



### Random-Scan Display

- (1) It is also known as vector scan display.
- (2) In Random Scan display electron beam is directed only to the parts of the screen where a picture is to be drawn.
- (3) In this technique CRT draw picture line by line.
- (4) One line at a time and hence called as vector display.
- (5) Here picture definition is stored as a set of line drawing commands in refresh buffer display file.

## Block diagram of video card working

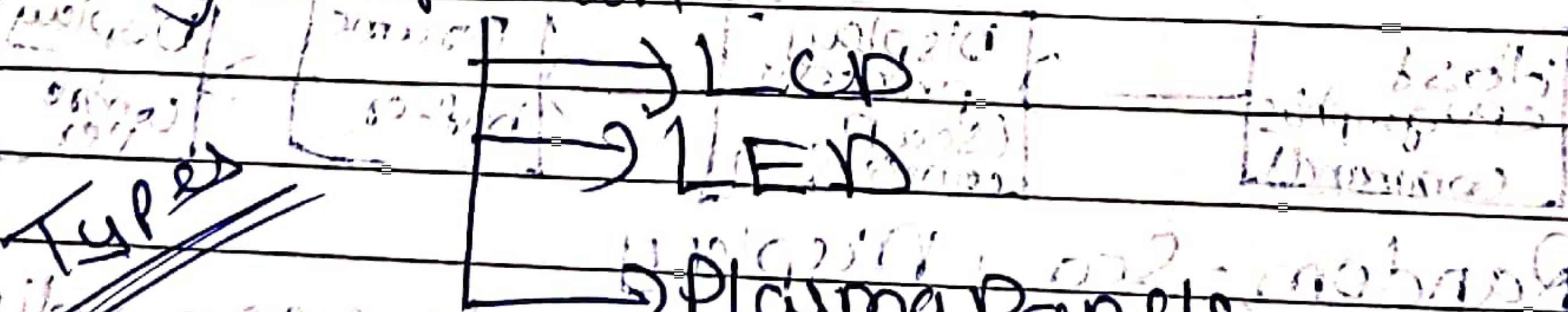


## Flat Scan Display

The term flat refers to class of video device that have reduced volume, weight and power consumption requirement, unlike CRT.

It is thinner than CRT.

There are many varieties of flat panels. Display determines the resolution and quality of picture.



## Light Emitting Diodes (L.E.D.s))

- ① L.E.D is semiconductor that illuminates when an electrical charge passes through it.
  - ② In L.E.D there are multicolor light emitting diode arranged to form the pixel position in display.
  - ③ The picture definition is stored in refresh buffer.
  - ④ The information is read from the refresh buffer and converted to voltage levels that are applied to the diodes to produce the light pattern on the display.
  - ⑤ L.E.D display is flat scan display that uses light emitting diodes as video display.
  - ⑥ L.E.D displays are used in billboards and store signs.
  - ⑦ An L.E.D panel consists of several L.E.D's whereas an LED display consists of several L.E.D panels.
- Advantages:
- ① Low power consumption.
  - ② Better and sharper screen resolution.

### Disadvantages:

High price.

Thin film  
size limited  
shorter life

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## 1. LCD (Liquid Crystal Display)

- ① LCD is a flat panel display that uses the light modulating properties of liquid crystal.
- ② LCD uses a three-dimensional arrangement of molecules have crystalline arrangement of molecules yet they flow like liquid and hence termed as liquid crystal display.
- ③ Liquid crystal material is filled in between two glass plate have horizontal transparent conductors are built into same glass plate.
- ④ Other glass plate made of clear glass right polarizer and reflector are built into it.
- ⑤ The intersection of two conductors define pixel position.
- ⑥ Picture definition are stored in refresh buffer and the screen is refreshed at rate of 60 frames per second.

### Advantages

Lightweight  
Small size  
Low cost

### Disadvantages

Low resolution  
Speed is slow

## Touchscreen

utilization

- ① It is an input technology.
- ② Touchscreen is a computer display screen that is sensitive to human touch.
- ③ Touch screen is a display device that allows the user to interact with computer by using their finger.
- ④ They can be quite useful as an alternative to a mouse or a keyboard for navigating a GUI.
- ⑤ Touchscreens are used on a variety of devices such as computers, tablets, laptops etc.
- ⑥ A touchscreen in computer display screen that serves as an input device.
- ⑦ When a touch screen is touched by fingers the event is sent to the controller for processing.
- ⑧ A touchscreen may contain pictures or words that the user can touch to interact with the device.

## Advantages

## Disadvantages

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>* More affordable</li> <li>* Not damage by dust or water</li> <li>* Response to finger or stylus</li> </ul> | <ul style="list-style-type: none"> <li>* Only 75% clarity.</li> <li>* Can get damaged by sharp object</li> </ul> |
|--|--|

## Virtual Reality

03/02/2024

- \* Virtual reality means experiencing things through our computers that don't really exist.
- \* Virtual reality makes it possible to experience anything anywhere and anytime.
- \* It is most immersive type of reality technology and can convince the human brain that somewhere it's really not.
- \* VR is able to immerse you in a computer generated world of your own making, it may be a room or a city or even inside a human body.
- \* Virtual reality aims to achieve total immersion, total immersion means that the sensory experience feels so real that we forgot it is artificial.
- \* Artificial environment and we begin to interact with it as we would naturally in the real world.

## Components of VR

### Virtual world

- World of Reality engine
- Sensors & Interceptors
- Sensory feedback.

World of Reality

Sensors

Interceptors

Feedback

## Types of VR

### ① Non-immersive

Non-immersive is the least immersive implementation of virtual reality Technology.

In Non-immersive simulation only a small amount of users senses are simulated allowing for peripheral awareness of reality outside the virtual reality simulation.

Example, Architect might built 3D model of new building to show the clients in computer.

### ② Fully immersive simulation

It provide the most immersive impletation of virtual reality Technology.

In a fully immersive simulation hardware such as head mounted display and motion detecting device are used to stimulate all user's senses.

Fully immersive simulation are able to provide realistic user expresive.

### ③ Semi-immersive

this simulation provides a more immersive experince in which the user is partly but not fully immersed in virtual environment.

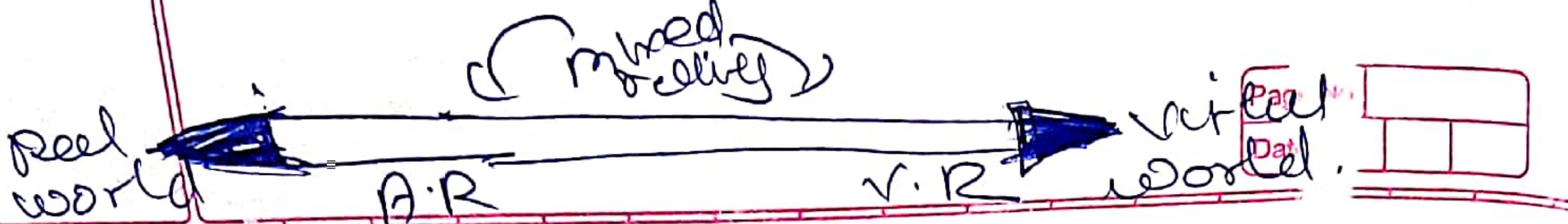
## Application

Education

Entertainment

Medical field

Industrial



## Augmented Reality.

- ① Augmented reality (AR) is made up of the word "augmented," which means to merge something great by adding something to it.
- ② Augmented Reality is a type of virtual reality that aims to duplicate the world's environment in a computer.
- ③ Augmented Reality is a method by which we can alter our real world by adding some digital elements to it.
- ④ This is done by superimposing a digital image on person's current view. It enhances the experience of reality.
- ⑤ Virtual Reality makes a virtual environment and puts the user in it, whereas Augmented reality adds the virtual components into the user's real world view.
- ⑥ For augmented reality you only need a modern smartphone then you can easily download AR app like google's "just a line" and try technology.
- ⑦ One of most popular way AR has infiltrated everyday life is through AR mobile games.
- ⑧ It is also known as mixed reality.
- ⑨ The goal of Augmented reality is to create a system in which the user cannot feel difference between real world and virtual augmentation on it.
- ⑩ In 2016, the AR game "Pokemon Go" became a sensation world wide with over 100M users.
- ⑪ AR is used in entertainment, AF etc.

AR + VR = mixed reality.

## Define Bitmap graphics (2m)

A Bitmap is an image or shape of any kind - a picture, a text character, a photo that composed of collection of tiny individual dots.

A wild landscape on your screen is bitmapped graphic, or simply or a bitmap. It is a pixel based image, not ~~scab~~-scalable and size of image (~~high~~).

## Compare Vector and Bitmap Graphics

(Summer-22) (Winter-18) (Summer-19) (Wininter)

### Bitmap Graphics

① A type of graphics that represents a rectangular grid of pixels, viewable via a monitor, paper or another display medium.

② Uses pixels

③ File size is more.

④ Resolution dependent, so that they are not resizable without reducing picture quality.

⑤ Possible to edit images at some extent.

⑥ It is pixel based image.

⑦ As compared to vector, poor quality of image.

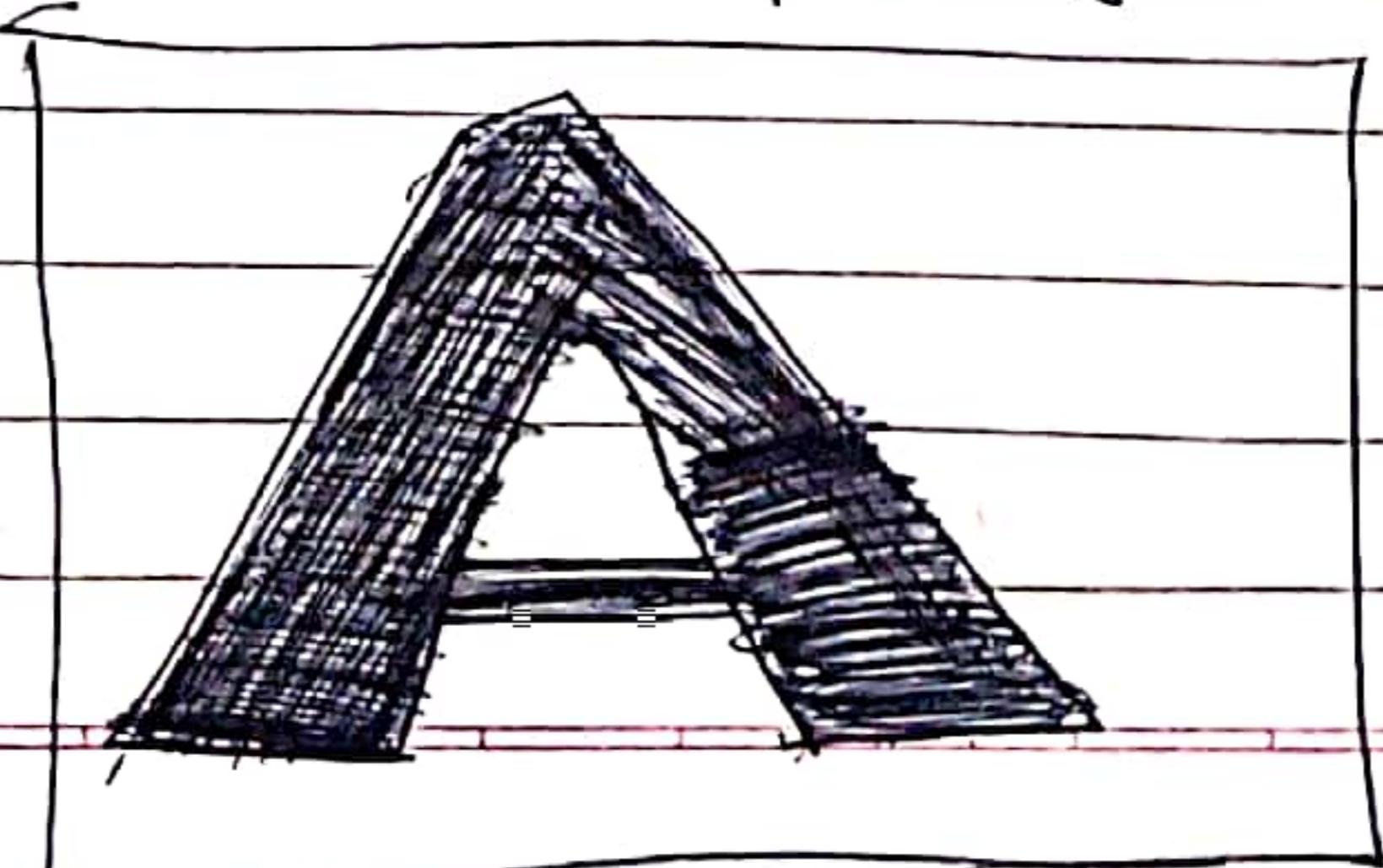
#### Types

- jpg
- png
- tiff

- gif
- psd

⑨ Bitmap graphics cost less.

⑩ Suitable for photographs.



### Vector Graphics

① A type of graphics defined in terms of 2D points that are connected by lines, curves to form polygons and other shapes.

② Uses basic geometric shape

③ File size is less.

④ Resolution independent, so they are resizable without reducing picture quality.

⑤ Possible to edit image without reducing quality.

⑥ It is mathematical base image.

⑦ Whereas, as compared it has good quality of image.

#### Types

- svg
- ps

- ai
- eps

⑨ Whereas, vector graphics cost more.

⑩ Suitable for logos, icons, clipart, images abstract etc.

