



1. Introduction and Overview of Graphics System



What is Computer Graphics

The computer graphics is one of the most effective and commonly used way to communicate the processed information to the user.

It displays the information in the form of graphics objects such as pictures, charts, graphs and diagrams instead of simple text.

The Computer Graphics is rendering (Service) tool for generation of images and manipulation of images.



Image: an Image is a Combination of pixels, a Visual Representation of Something.



Models: 3d Representation of Something is Called Model.



Rendering: Rendering is the process of generating an image from a 2D or 3D model or models in what collectively could be called a scene file by means of computer programs. Also, the results of such a model can be called a rendering.



Animation: Techniques of creating illusive movements using Successive Images is called Animation.

Computer
Graphics
made up of 4
Components

Applications of Computer Graphics

- [User Interface](#)
- [Plotting of graphics and charts](#)
- [Office automation and Desktop Publishing](#)
- [Computer-aided Drafting and Design](#)
- [Simulation and Animation](#)
- Art and Commerce
- Process Control
- [Cartography](#)

User interfaces: GUI

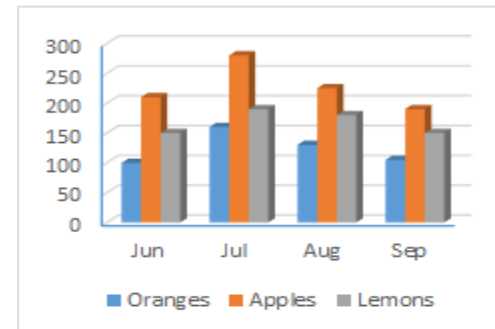


- A graphical user interface (GUI) is a type of user interface through which users interact with electronic devices via visual indicator representations.

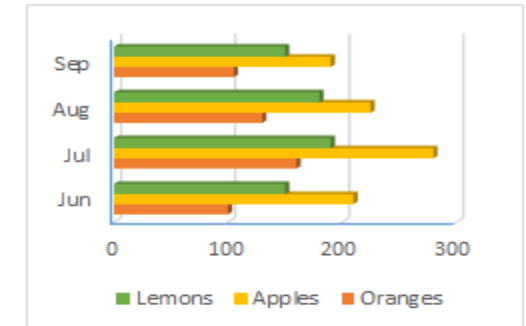
Plotting of graphics and chart.

- Visual representations help us to understand data quickly. When you show an effective graph or chart, your report or presentation gains clarity and authority

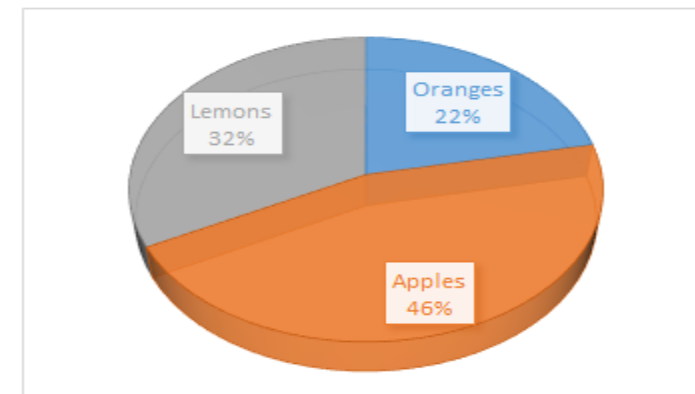
3-D Column chart



3-D Bar chart



3-D Pie chart



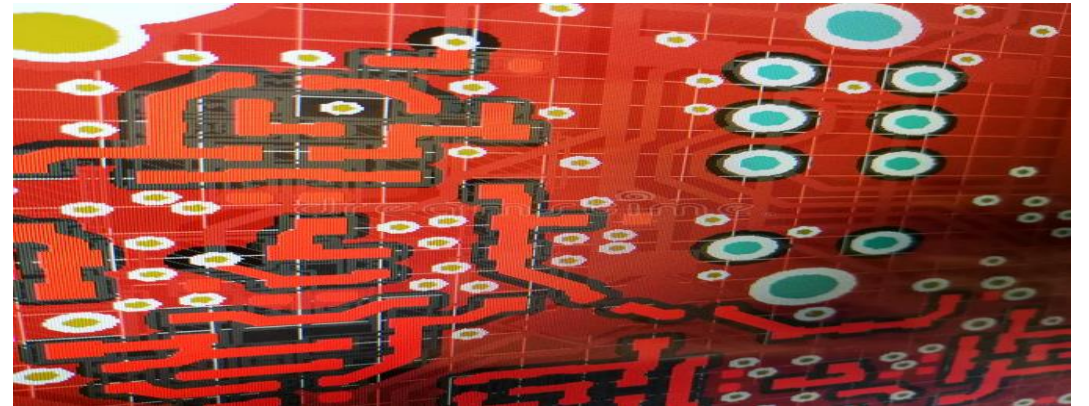
Office automation and Desktop Publishing.



- Desktop publishing (DTP) software is designed for creating visual communications such as brochures, business cards, greeting cards, web pages, posters, and more for professional or personal printing online or on-screen.

Computer-aided Drafting and Design(CADD).

- It is the act and discipline of composing drawings that visually communicate how something functions or is constructed.
- It assist in the creation, modification, analysis, or optimization of design.
- It describe the process of creating technical drawing with the use of computer software.

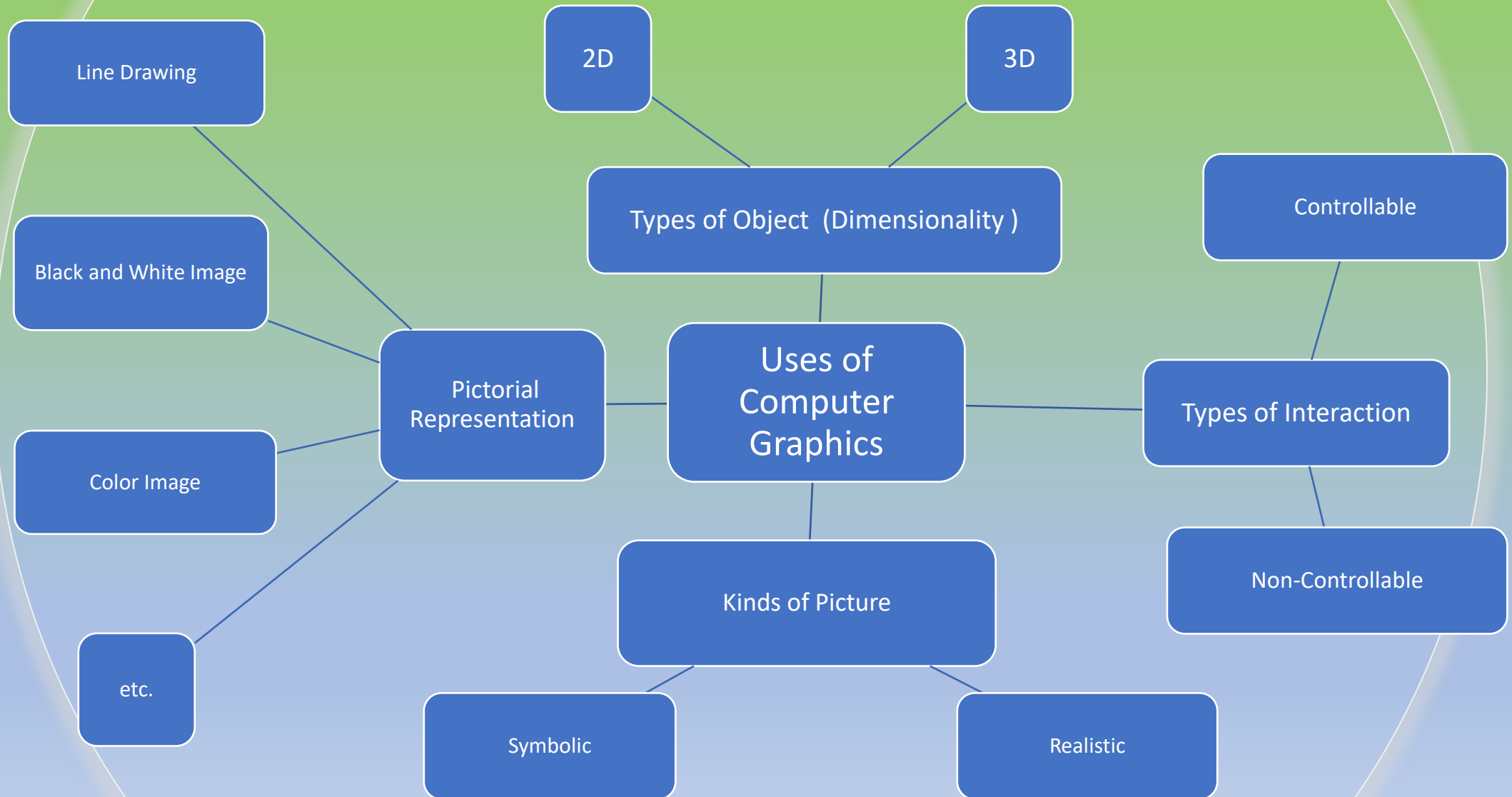


Simulation and Animation.



- Simulation is an imitation or replication from the real thing.
- Simulation is used for scientific modeling in order to acquire and get information on how they function.
- Animation is the method of creating an illusion of any movement by using rapid display images of 3-D or 2-D artwork.
- Simulations can be used as the basis for an Animation meaning the mathematically simulated motion can be used in an animation to move the objects.

Classification of Applications



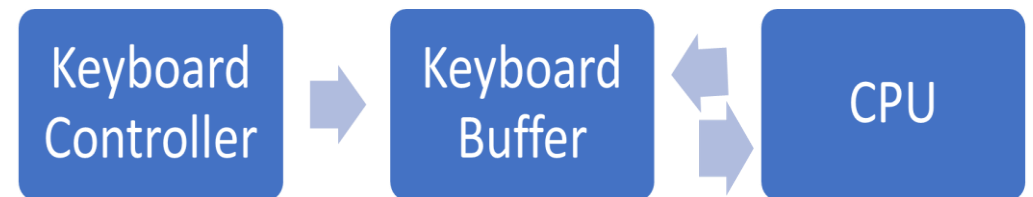
Input Devices

- [Keyboard](#)
- Mouse
- [Data Glove](#)
- Trackball
- Joysticks
- Digitizer/Graphical Tablet
- Image Scanner
- Touch Panels
- Light Pens



Keyboard

- It is a primary input device for any graphics system.
- It is used for entering text and numbers, i.e. on graphics data associated with pictures such as labels x-y coordinate etc.



Data Glove



- It is used to grasp a virtual objects.
- The input from the data glove can be used to position or manipulate objects in a virtual scene.
- Using data glove, a user can grasp, move and rotate objects and then release them.

Output Devices

- Output device is a piece of peripheral computer hardware equipment which receives data from the system and converts it into human-readable form.
- Basically computer integrates with the output device for display, projection, or physical reproduction.
- There are several output devices that present data in different forms like text, audio, visual formats, and hard copies.

Output Devices

1. Video Display Devices
2. Hardcopy devices

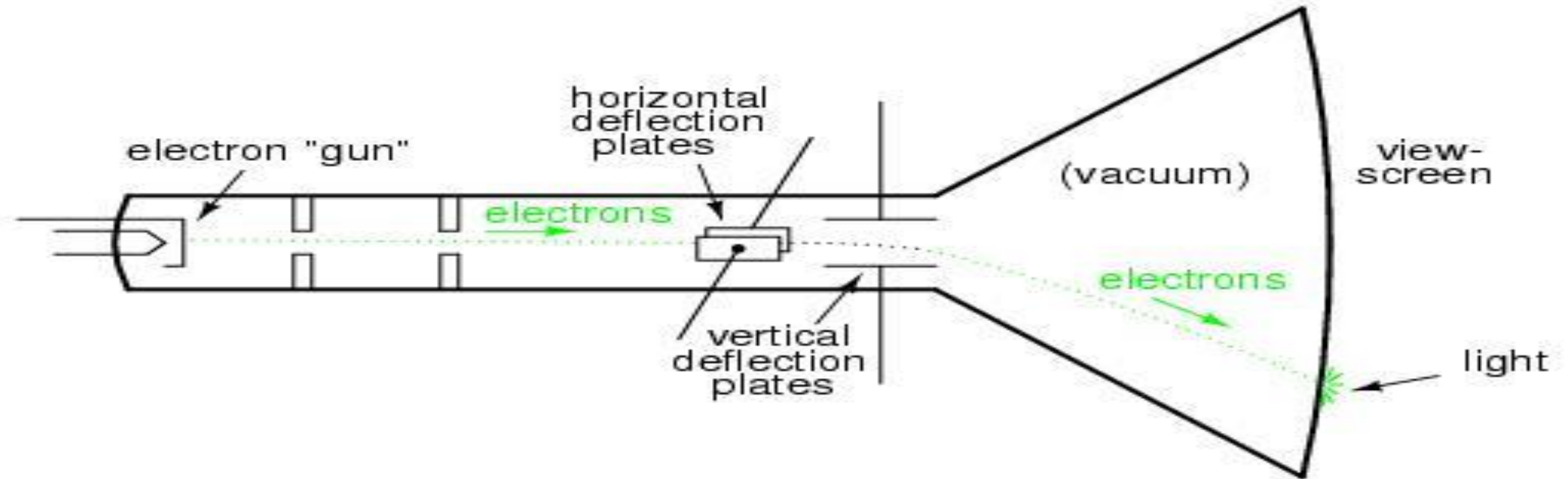
Video Display devices

- [CRT](#)
- [Vector Scan/Random Scan Display](#)
- [Raster Scan Display](#)
- Color CRT Monitors
- Direct-view Storage Tubes
- Flat Panel Displays
- Plasma Panel Display
- Liquid Crystal Monitors

Hardcopy Devices

- Printers
- Plotters
- Cameras etc.

CRT



- Cathode Ray Tube (CRT) is a computer display screen, used to display the output in a standard composite video signal.
- The working of CRT depends on the movement of an electron beam which moves back and forth across the back of the screen.

[out-put](#)

Vector Scan / Random Scan Display

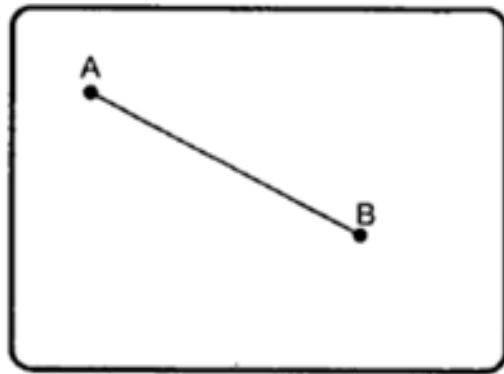
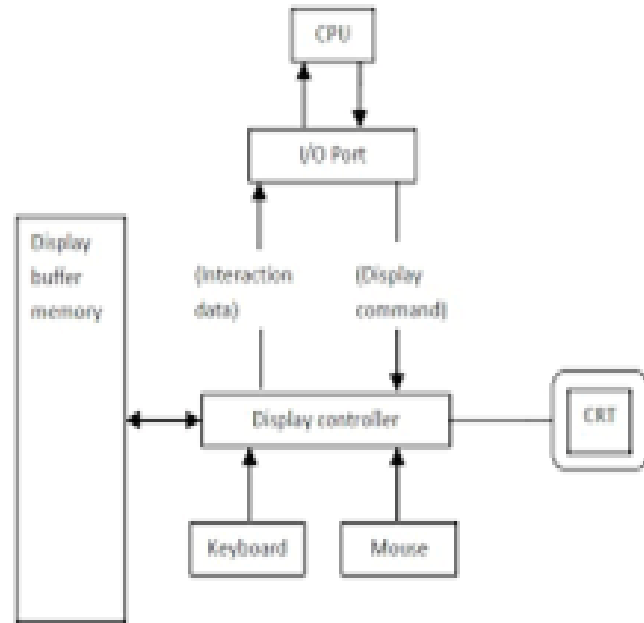
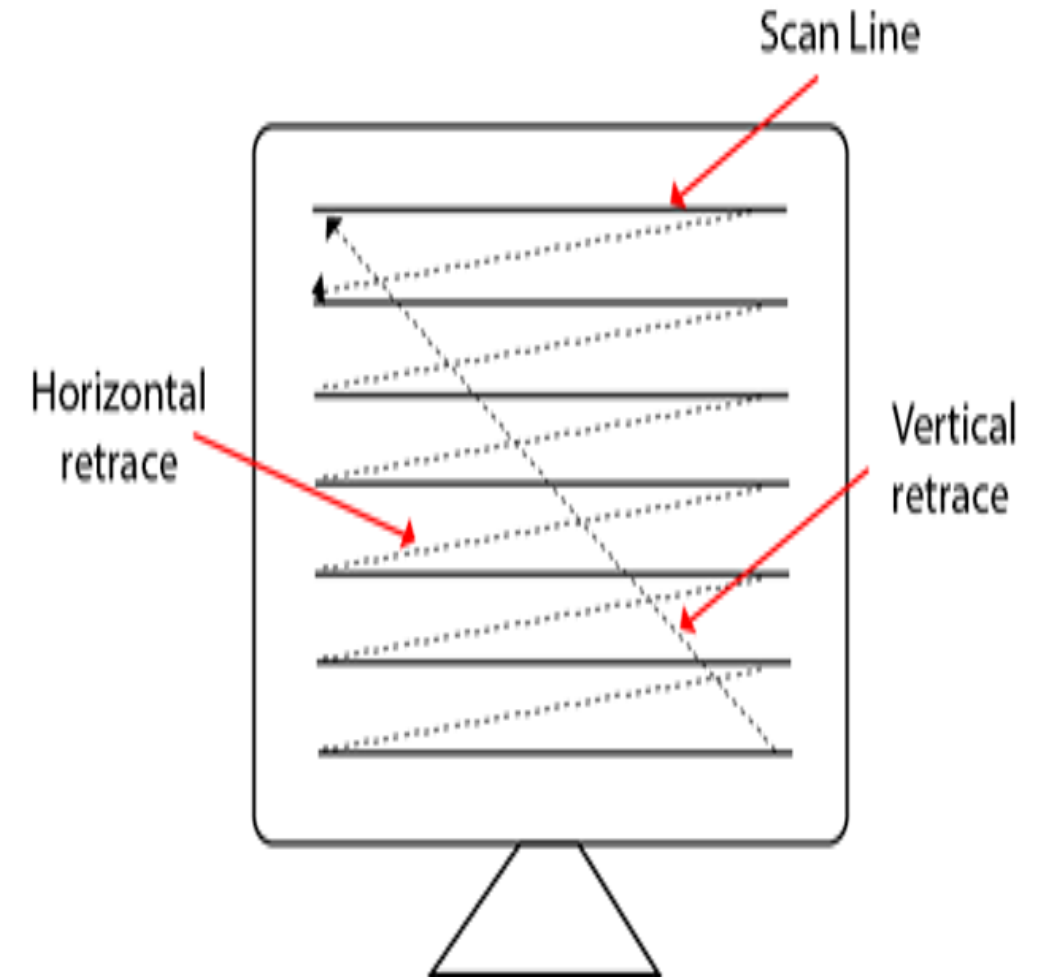
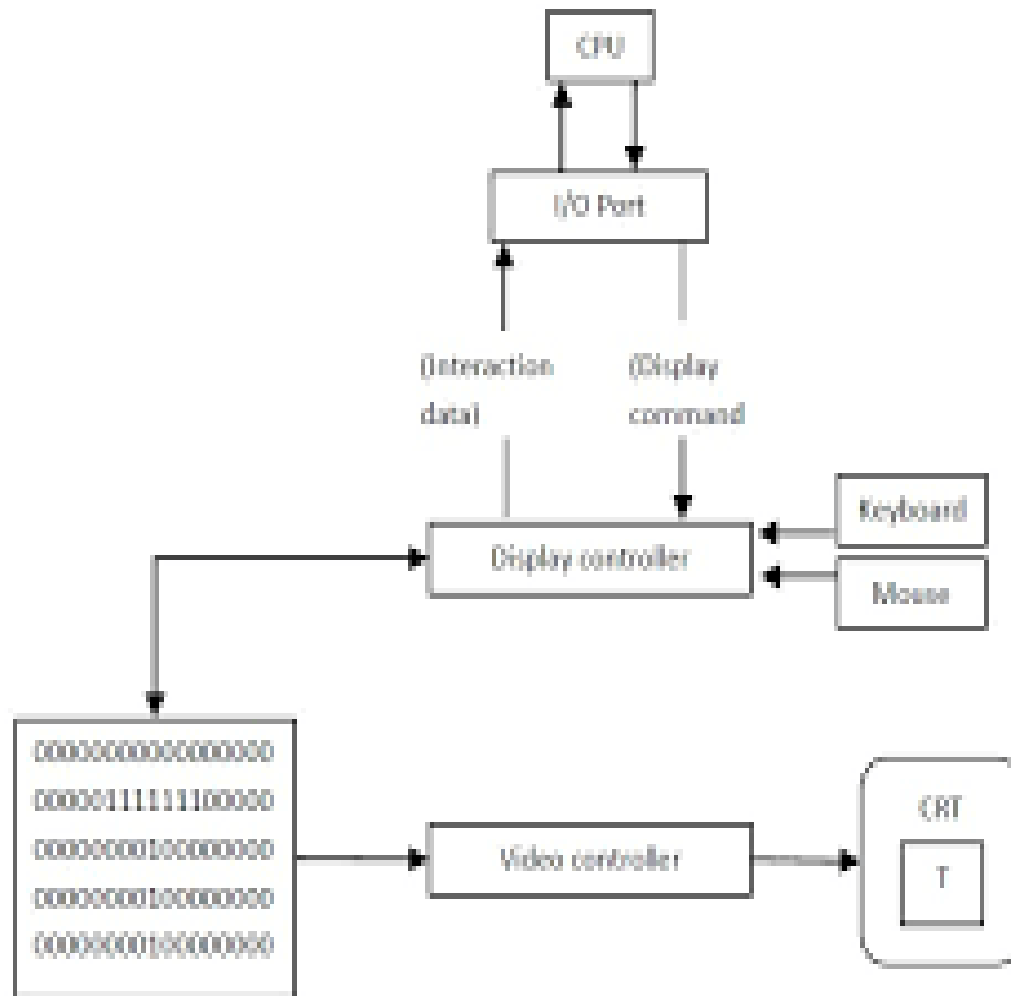


fig. Vector Scan CRT

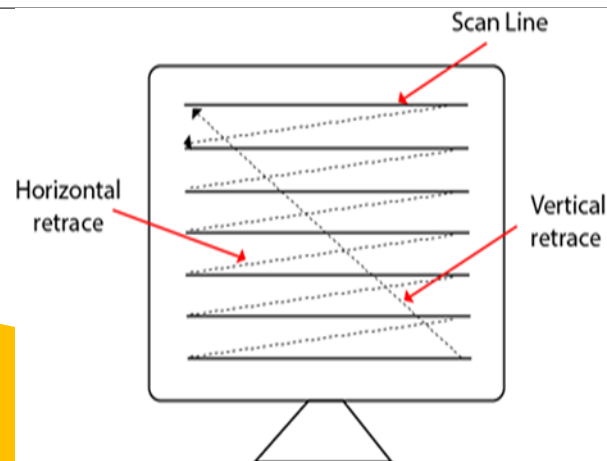
- Random Scan System uses an electron beam which operates like a pencil to create a line image on the CRT screen.
- The picture is constructed out of a sequence of straight-line segments.
- Each line segment is drawn on the screen by directing the beam to move from one point on the screen to the next, where its x & y coordinates define each point.
- After drawing the picture, the system cycles back to the first line and design all the lines of the image 30 to 60 time each second.

Raster Scan Display



Raster Scan Display

- A Raster Scan Display is based on intensity control of pixels in the form of a rectangular box called Raster on the screen.
- Information of on and off pixels is stored in refresh buffer or Frame buffer.
- Televisions in our house are based on Raster Scan Method.
- The raster scan system can store information of each pixel position, so it is suitable for realistic display of objects.
- Raster Scan provides a refresh rate of 60 to 80 frames per second.



Difference between Vector Scan / Random Scan and Raster Scan Display

Vector Scan/Random Scan Display	Raster Scan Display
1. In vector scan display the beam is moved between the end points of the graphics primitives.	1. In raster scan display the beam is moved all over the screen one scan line at a time, from top to bottom and then back to top.
2. Creation of diagrams using random scan becomes easier, so can be used in engineering and scientific drawings.	2. Raster graphics can be used in animation.
3. Pen plotters and direct storage view tubes (DVST) devices are used.	3. Cathode ray tubes (CRT) are used.
4. Scan conversion hardware is not required.	4. Because each primitive must be scan converted, real time dynamics is far more computational and requires separate scan conversion hardware.
5. Requires less memory.	5. Requires more memory.
6. Cost is more.	6. Cost is low.

Overview of coordinate system

- In a 2-D coordinate system the X axis generally points from left to right, and the Y axis generally points from bottom to top. (some windowing systems will have their Y coordinates going from top to bottom.)
- When we add the third coordinate, Z, we have a choice as to whether the Z-axis points into the screen or out of the screen:



Overview of coordinate system

- Right Hand Coordinate System (RHS)
Z is coming out of the page

Counterclockwise rotations are positive

if we rotate about the X axis : the rotation $Y \rightarrow Z$ is positive

if we rotate about the Y axis : the rotation $Z \rightarrow X$ is positive

if we rotate about the Z axis : the rotation $X \rightarrow Y$ is positive

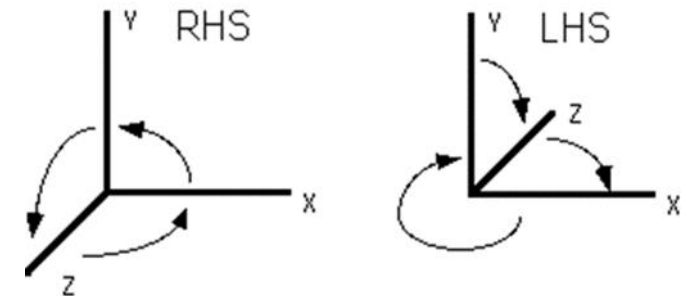
- Left Hand Coordinate System (LHS)
Z is going into the page

Clockwise rotations are positive

if we rotate about the X axis : the rotation $Y \rightarrow Z$ is positive

if we rotate about the Y axis : the rotation $Z \rightarrow X$ is positive

if we rotate about the Z axis : the rotation $X \rightarrow Y$ is positive



Multiple Coordinate Systems in a Graphics Program

- World Coordinate System - Also known as the "universe" or sometimes "model" coordinate system. This is the base reference system for the overall model, (generally in 3D), to which all other model coordinates relate.
- Viewpoint Coordinate System - Also known as the "camera" coordinate system. This coordinate system is based upon the viewpoint of the observer, and changes as they change their view. Moving an object "forward" in this coordinate system moves it along the direction that the viewer happens to be looking at the time.
- Screen Coordinate System - This 2D coordinate system refers to the physical coordinates of the pixels on the computer screen, based on current screen resolution. (E.g. 1024x768)
- Viewport Coordinate System - This coordinate system refers to a subset of the screen space where the model window is to be displayed. Typically the viewport will occupy the entire screen window, or even the entire screen, but it is also possible to set up multiple smaller viewports within a single screen window.

Basics of Computer Graphics

- Video/Display Adapters.

Display adapters are characterized by

- Resolution
 - Color Depth
 - Refresh rate
- Modes of Resolution
 - Text mode / Character mode
 - Graphics mode

*/*Simple example to draw line*/*

```
#include<stdio.h>
```

```
#include<graphics.h>
```

```
void main()
```

```
{
```

```
int gd=DETECT, gm=0;
```

```
initgraph(&gd, &gm, “ ”;
```

```
line(200,200,100,100);
```

```
closegraph();
```

```
}
```



Graphics packages

- A set of libraries that provide programmatically access to some kind of graphics 2D functions.
- Types
 - GKS-Graphics Kernel System – first graphics package – accepted by ISO & ANSI
 - PHIGS (Programmer's Hierarchical Interactive Graphics Standard)-accepted by ISO & ANSI
 - PHIGS + (Expanded package)
 - Silicon Graphics GL (Graphics Library)
 - Open GL
 - Pixar Render Man interface
 - Postscript interpreters
 - Painting, drawing, design packages