



GALGOTIAS
UNIVERSITY

**School of Computing
Science and Engineering**

Program: B.C.A.

Course Code: BCAS3003

Course Name: Computer Graphics

Course Prerequisites

- Knowledge of Mathematics**
- Fundamental knowledge of Computer**

Unit 1 - Overview of Graphics Systems

- Video Display Devices**
- Raster-Scan System**
- Random-Scan Systems**
- Graphics Monitors and Work Stations**
- Input Devices: Hard Copy Devices, Graphics Software**

Video Display Devices

- ❑ A Video display device is an output device for presentation of information in visual way.
- ❑ When the input information is supplied as an electrical signal, the display is called an electronic display.
- ❑ Common applications for electronic visual displays are televisions or computer monitors.
- ❑ Different types of Video display devices are Cathode Ray Tube, Raster Scan displays, Random Scan displays, Color CRT-monitors, Direct View Storage Tube, Flat-Panel Displays, Light-emitting Diode(LED), Liquid-crystal Displays(LCDs)

Video Display Devices

Cathode Ray Tube (CRT)

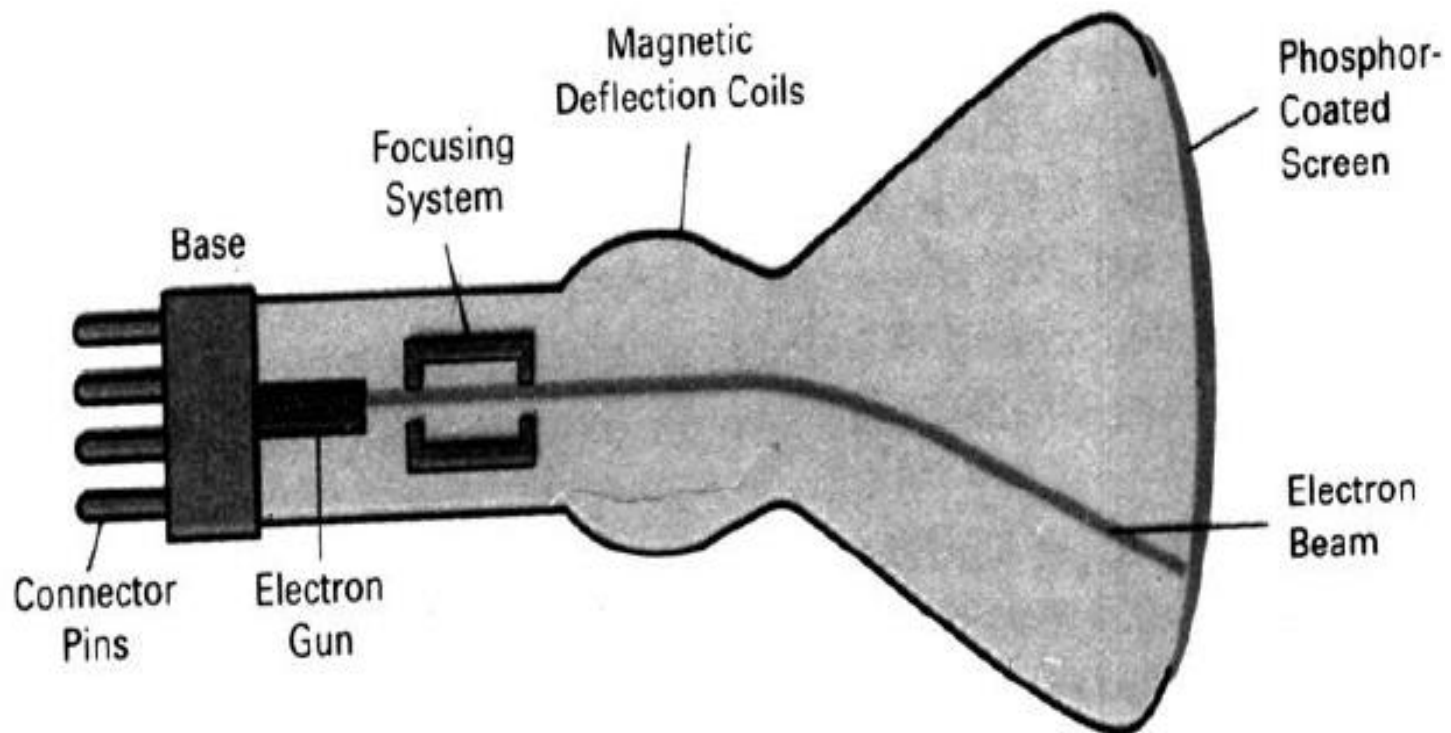


Figure 1: Cathode Ray Tube (CRT)

Video Display Devices

Cathode Ray Tube (CRT)

- Invented by Karl Ferdinand Braun(1897).
- Convert electrical signals to visual signals.
- Beam of electrons directed from cathode(-) to phosphor-coated (fluorescent) screen (anode(+)).
- Directed by magnetic focusing and deflection coils(anodes) in vacuum filled tube.
- Phosphor emits photon of light, when hit by an electron, of varied persistence (long 15-20 ms for texts/short <1 ms for animation)
- Phosphors are organic compounds characterized by their persistence and their color (blue, red, green).

Video Display Devices

Characteristics of Cathode-Ray Tube (CRT)

- ❑ **Intensity:** It is proportional to the number of electrons repelled in beam per second (brightness).
- ❑ **Resolution:** It is the maximum number of points that can be displayed without overlap. It is expressed as number of horizontal points by number of vertical points. These points are called pixels (picture elements). Example: resolution 1024 x 768 pixels. Typical resolution is 1280 x 1024 pixels.
- ❑ High-definition systems means high resolution systems.

Video Display Devices

Characteristics of Cathode-Ray Tube (CRT)

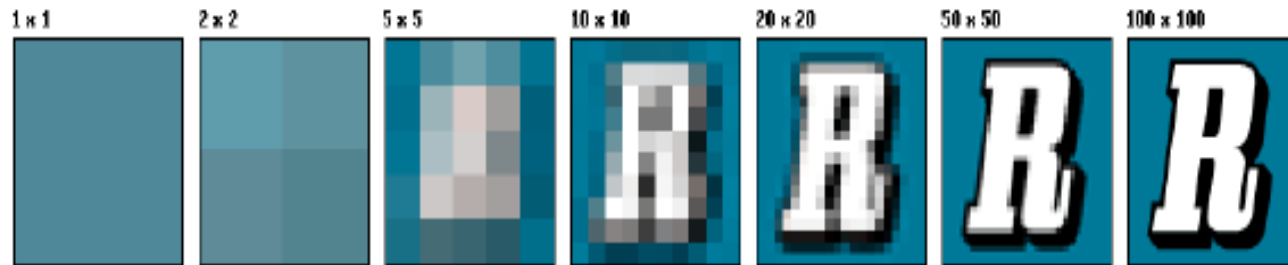


Figure 3: Resolution

Video Display Devices

Categories Cathode-Ray Tube (CRT)

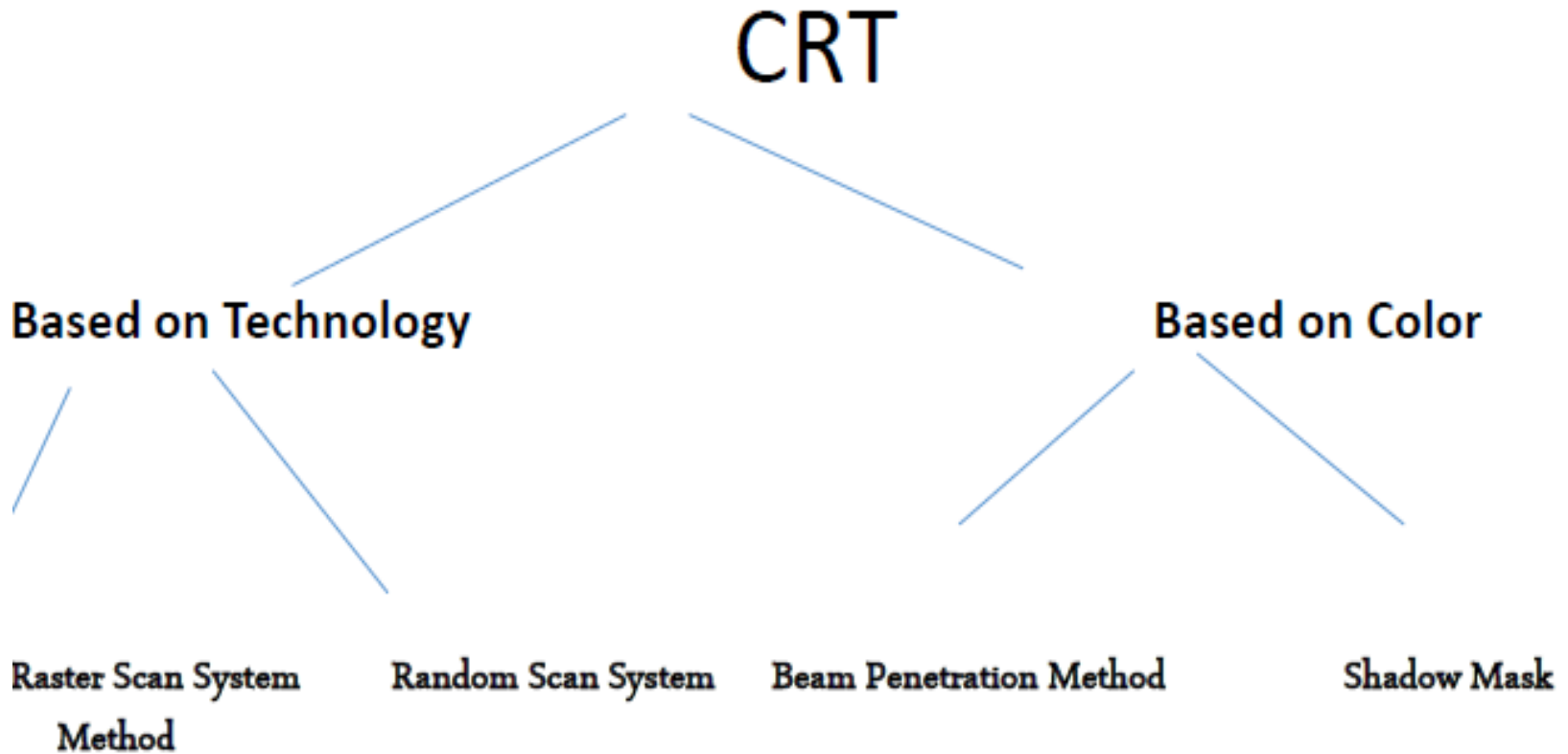


Figure 4: Types of CRT

Raster Scan System

- ❑ In raster scan approach, the viewing screen is divided into a large number of discrete phosphor picture elements, called pixels/dots.
- ❑ Pixel: One dot or picture element of the Raster.
- ❑ Scan Line: A row of pixels

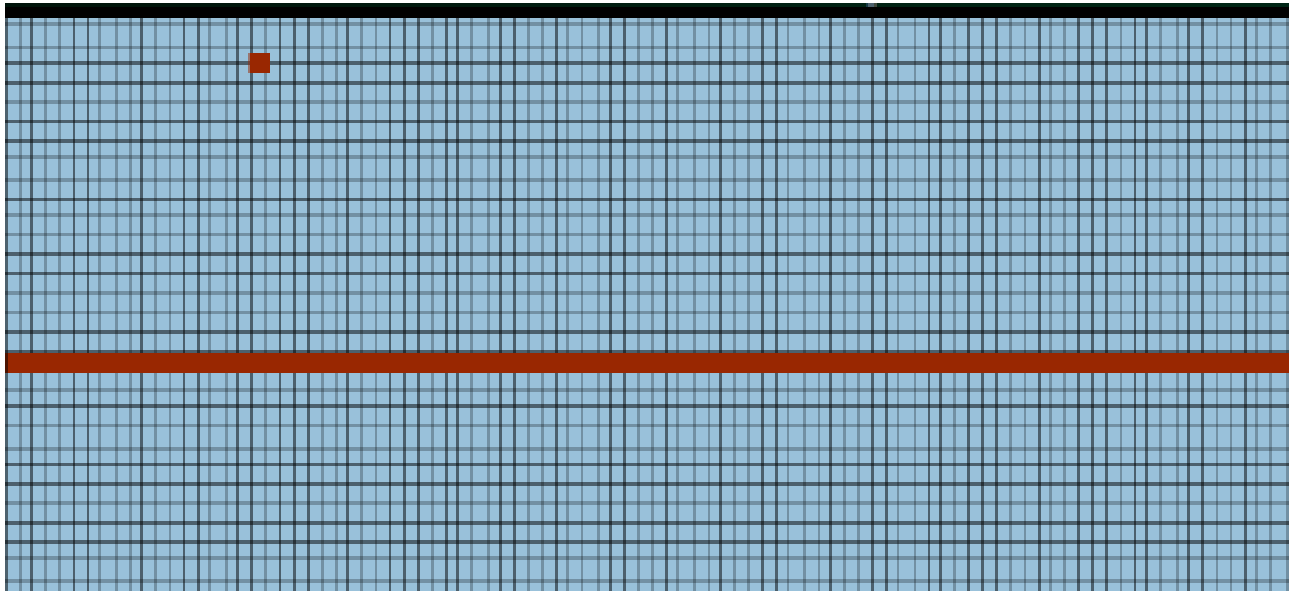


Figure 1: Example of Pixel

Raster Scan System

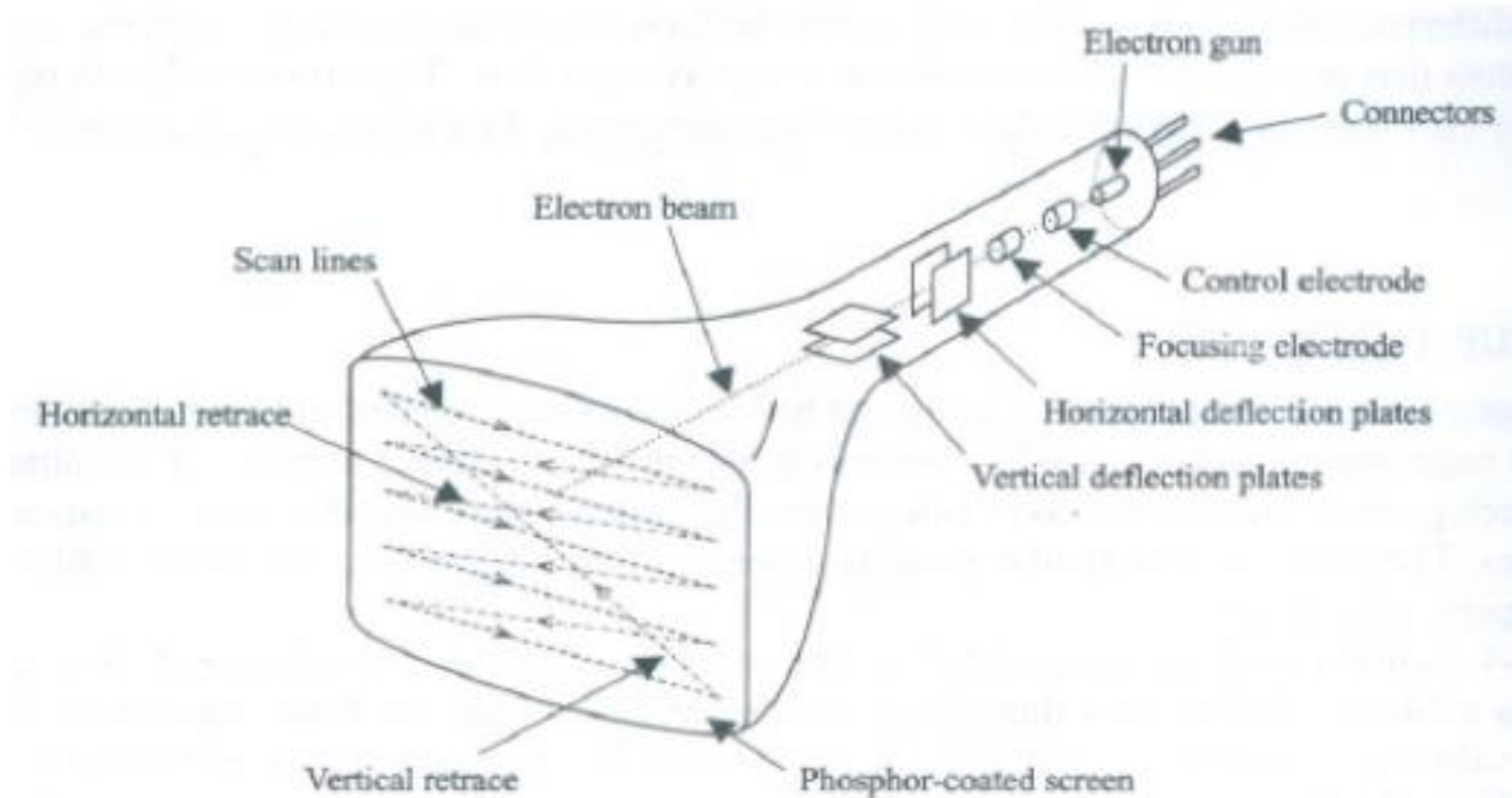
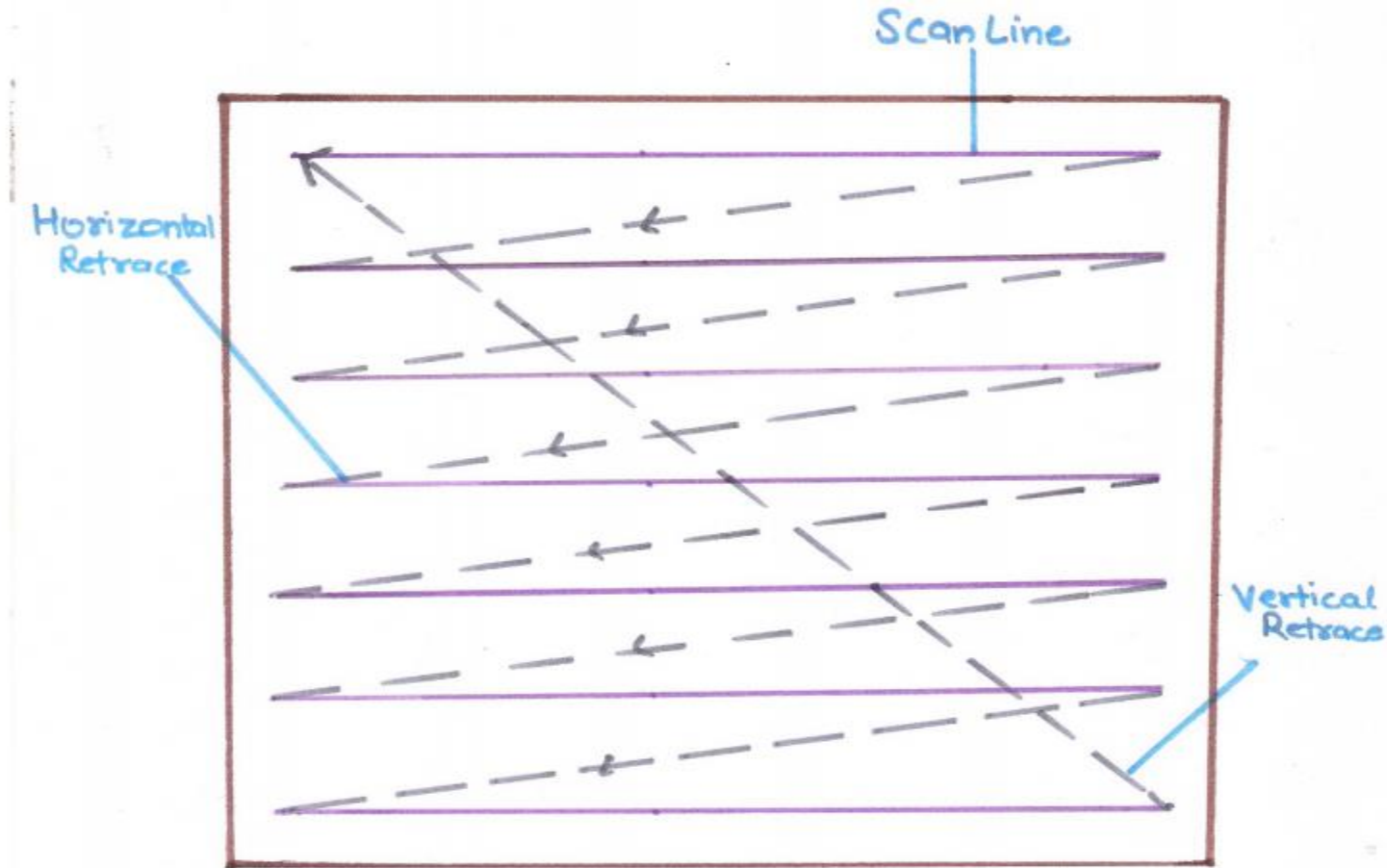


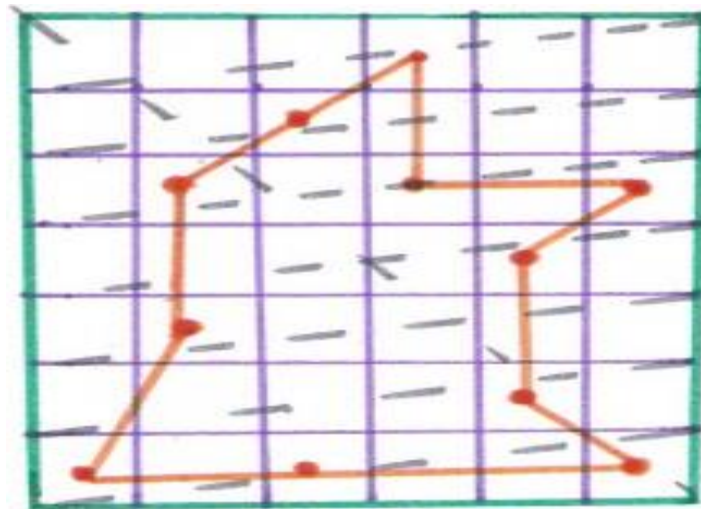
Figure 2: Image of Raster Scan System

Raster Scan System



Raster Scan System

0	0	0	1	0	0
0	0	1	0	0	0
0	1	0	1	0	1
0	0	0	0	1	0
0	1	0	0	0	0
0	0	0	0	1	0
1	0	1	0	0	0



Raster Scan System

- ❑ The electron beam is swept across the screen, one row at a time from top to bottom. As the electron beam moves across each row, the beam intensity is turned on and off to create a pattern of illuminated spots.
- ❑ Each pixel on the screen can be made to glow with a different brightness.
- ❑ Color screen provide for the pixels to have different colors as well as brightness.
- ❑ Picture Definition is stored in a memory area called the **Refresh Buffer** or **Frame Buffer**.
- ❑ This memory area holds the set of intensity values for all the screen points.
- ❑ Stored intensity values are then retrieved from there fresh buffer and "painted" on the screen one row (scan line) at a time as shown in Figure 3.

Raster Scan System

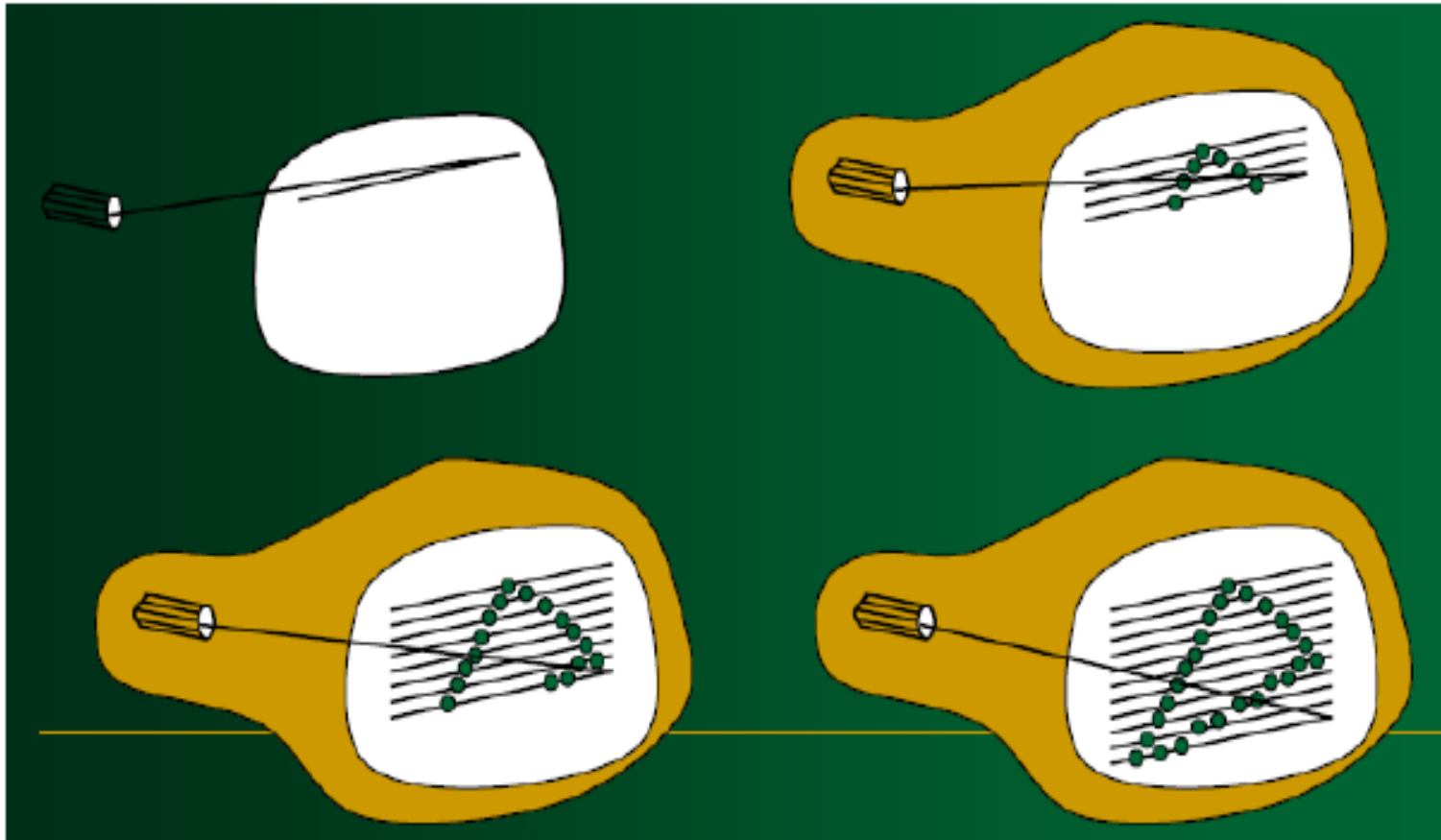


Figure 3: Image of Raster Scan System

Raster Scan System

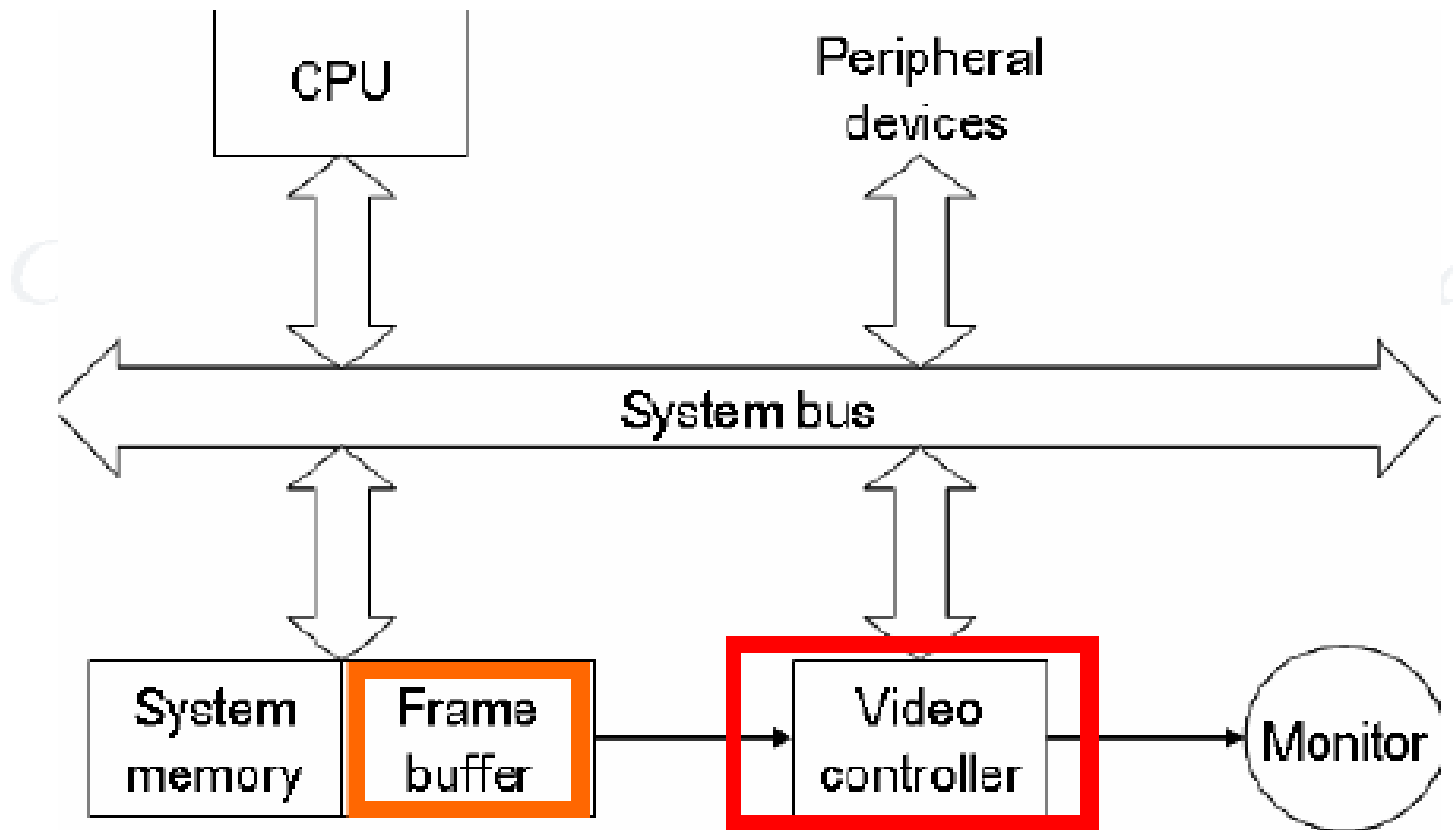


Figure 4: Raster Scan System's Architecture

Raster Scan System

Basic Refresh Operation of the Video Controller

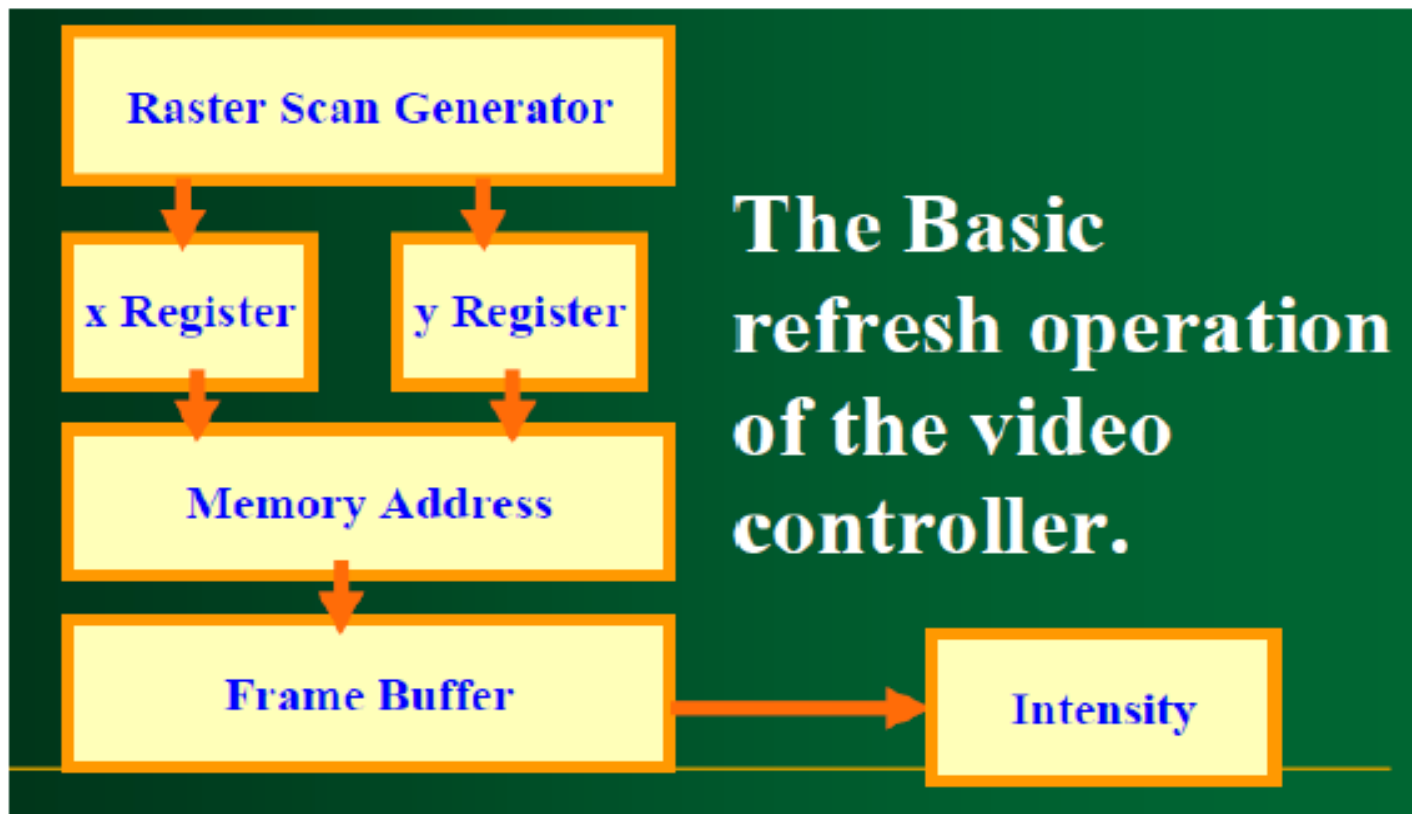


Figure 5: Video Controller's Operation

Raster Scan System

- ❑ Other Operations performed by Video Controller are:
 - It can retrieve pixel intensities from different memory areas on different cycles
 - In high quality systems, two frame buffers are often provided so that one buffer can be used for refreshing and other filled with intensity values. Provide the fast mechanism for generating real time animation.
 - Video controllers often contain a lookup table, so that pixel value in the frame buffer are used to access the lookup table instead of controlling the CRT beam intensity directly.

Recommended Books

Text books

- ❑ D. Hearn, P. Baker, "Computer Graphics - C Version", 2nd Edition, Pearson Education, 1997

Reference Book

- ❑ Heam Donald, Pauline Baker M: "Computer Graphics", PHI 2nd Edn. 1995.
- ❑ Harrington S: "Computer Graphics - A Programming Approach", 2nd Edn. Mc GrawHill.
- ❑ Shalini Govil-Pai, Principles of Computer Graphics, Springer, 2004

Additional online materials

- ❑ Coursera - <https://www.coursera.org/learn/fundamentals-of-graphic-design>
- ❑ <https://www.youtube.com/watch?v=fwzYuhduME4&list=PLE4D97E3B8DB8A590>
- ❑ NPTEL - <https://nptel.ac.in/courses/106/106/106106090/>
- ❑ <https://www.coursera.org/learn/research-methods>
- ❑ <https://www.coursera.org/browse/physical-science-and-engineering/research-methods>



Thank You