BSc Computer Science
CS1541 Computer Graphics

Module I

Display Technology

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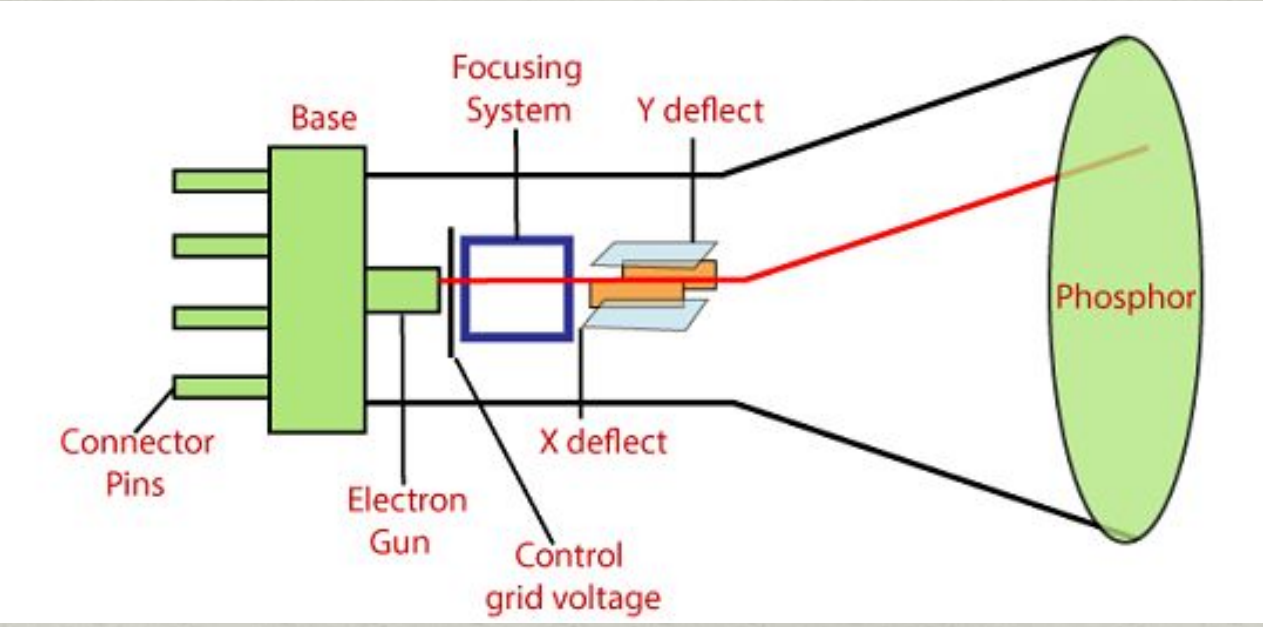
SAC

Video Display Types

- Cathode-Ray Tube(CRT)
- Color CRT Monitor
- Liquid crystal display(LCD)
- Light Emitting Diode(LED)
- Direct View Storage Tubes(DVST)
- Plasma Display
- 3D Display
- **Organic Light Emitting Diode (OLED)**

Cathode-Ray Tubes (CRT)

- Technology which is used in traditional computer monitor and television.
- Type of vacuum tube that displays images when an electron beam collides on the radiant surface.



Component of CRT

- **Electron Gun:** The electron gun is made up a heating filament (heater) and a cathode. The electron gun is a source of electrons focused on a narrow beam facing the CRT.
- **Focusing & Accelerating Anodes:** used to produce a narrow and sharply focused beam of electrons.
- **Horizontal & Vertical Deflection Plates:** used to guide the path of the electron the beam. The plates produce an electromagnetic field that bends the electron beam through the area as it travels.
- **Phosphorus-coated Screen:** used to produce bright spots when the high-velocity electron beam hits it.

Methods to Display Images

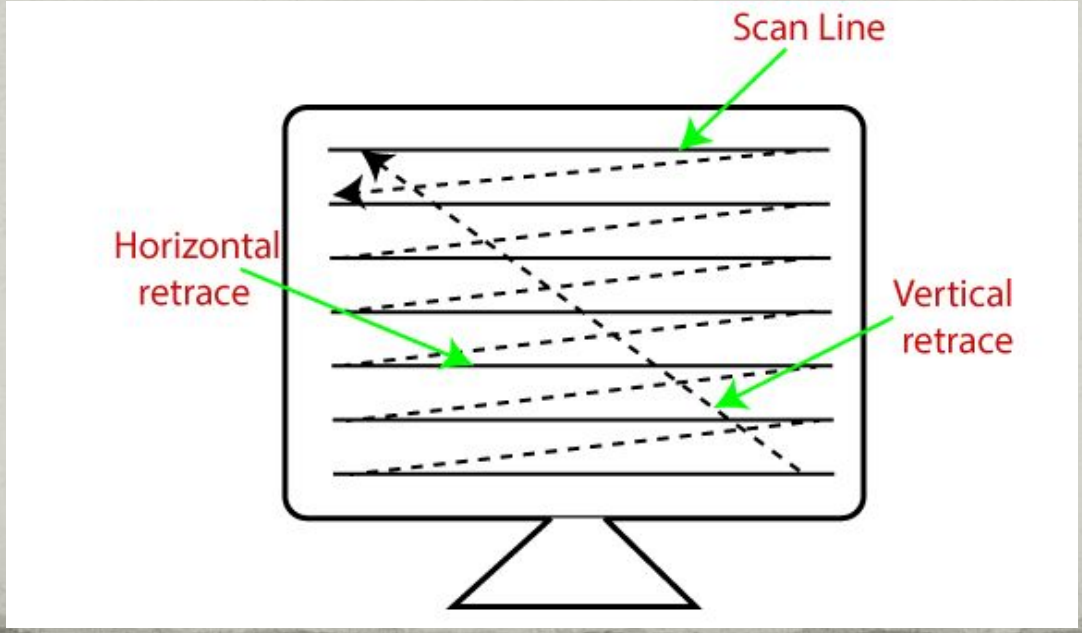
- **Raster Scan vs Random Scan (Vector scan)**
- **Raster Scan:** It is a scanning technique in which the electron beam moves along the screen. It moves from top to bottom, covering one line at a time.
- A raster scan is based on pixel intensity control display as a rectangular box on the screen called a **raster**.
- Picture description is stored in the memory area called as **Refresh buffer, or Frame Buffer, Raster or Bitmap.**

- **Advantages**
  - Real image
  - Many colors to be produced
  - Dark scenes can be pictured

- **Disadvantages:**
  - Less resolution
  - Display picture line by line
  - More costly

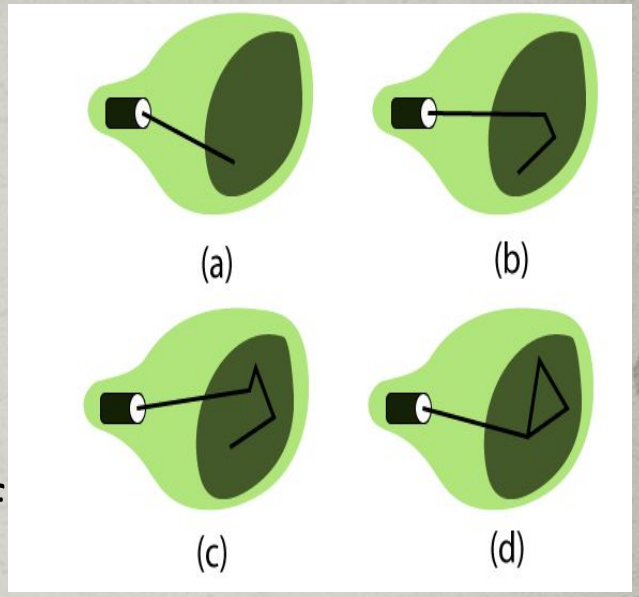
Beam Refreshing Methods

- Horizontal Retracing vs Vertical Retracing
- When the beam starts from the top left corner and reaches bottom right, and again return to the top left, it is called the **vertical retrace**.
- It will call back from top to bottom more horizontally as a horizontal reversal.



Methods to Display Images

- **Random Scan (Vector scan) Stroke-writing display or calligraphic display**.
- The electron beam points only to the area in which the picture is to be drawn.
- It uses an electron beam like a pencil to make a line image on the screen. The image is constructed from a sequence of straight-line segments. On the screen, each line segment is drawn by the beam to pass from one point on the screen to the other, where its x & y coordinates define each point.



- **Advantages**
  - High Resolution
  - Draw smooth line Drawing

- **Disadvantages:**

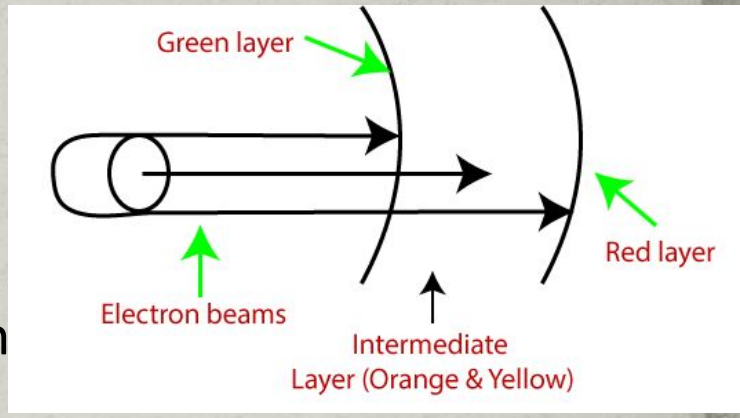
It does only the wireframe.
It creates complex scenes due to flicker.

Color CRT Monitor

- **B**asic idea behind the color CRT monitor is to combine three basic colors- Red, Green, and Blue.
- By using these three colors, produce millions of different colors.
- **The two basic color display producing techniques are:**
- **Beam Penetration Method**
- **Shadow Mask Method**

Beam Penetration Method

- Used with a **random scan** monitor for displaying pictures.
- There are two phosphorus layers- Red and Green are coated inside the screen. The color shown depends on how far the electron beam penetrates the phosphorus surface.
- A powerful electron beam penetrates the CRT, it passes through the red layer and excites the green layer within.
- A beam with slow electrons excites only th red layer.
- A beam with the medium speed of electrons, a mixture of red and green light is emitted to display two more colors- orange and yellow.



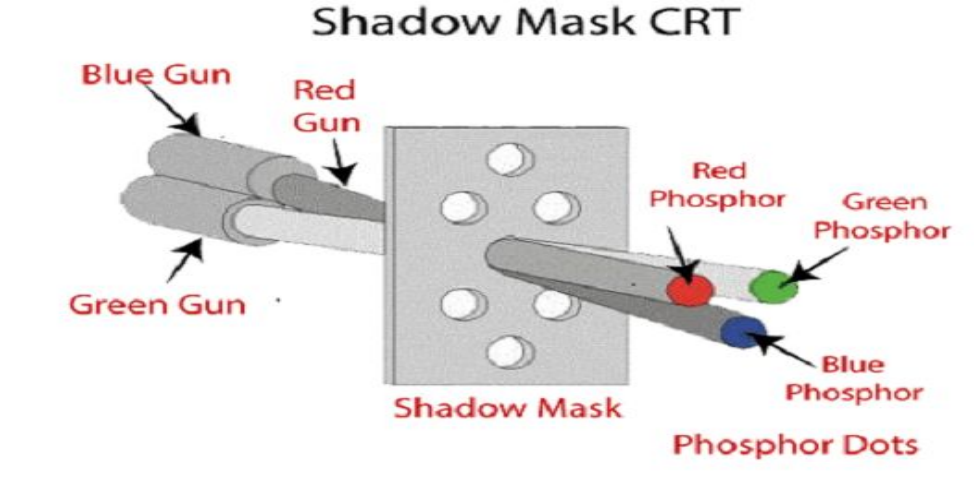
- **Advantages**
  - Better Resolution
  - Half cost
  - Inexpensive
- **Disadvantages:**
  - Only four possible colors
  - Time Consuming

Shadow–Mask Method

- **U**sed with a **raster scan** monitor for displaying pictures.
- More range of color than the beam penetration method.
- Used in television sets and monitors.
- Three phosphorus color dots at each position of the pixel.First Dot: **Red** color Second Dot: **Green** color Third Dot: **Blue** color
- Has three different guns. Each for one color.
- Has a metal screen or plate just before the phosphorus screen, named **“Shadow-Mask.”**
- It also has a shadow grid just behind the phosphorus coated screen with tiny holes in a triangular shape.
- A Shadow Mask can display a wider range of pictures than beam penetration.

Shadow–Mask Method

- **Working:** A Shadow Mask is a metal plate with tiny holes present inside a color monitor.
- A Shadow Mask directs the beam by consuming the electrons so that the beam hits only the desired point and displays a resulting picture.
- It has three different guns. These guns direct their beams to shadow mask, which allows them to pass. It is a task of a shadow mask to direct the beam on its particular dot on the screen and produce a picture on the screen.



Advantages

- Display a wider range picture.
- Display realistic images.
- In-line arrangement of RGB color.

Disadvantages:

- Difficult to cover all three beams on the same hole.
- Poor Resolution

Liquid crystal display (LCD)

- Depends upon the light modulating properties of liquid crystals.
- Used in watches and portable computers. LCD requires an AC power supply instead of DC, so it is difficult to use it in circuits.
- It generally works on flat panel display technology. LCD consumes less power than LED. The LCD screen uses the liquid crystal to turn pixels on or off.
- Liquid Crystals are a mixture of solid and liquid. When the current flows inside it, its position changes into the desired color.
- **For Example:** TFT (Thin Film Transistor)

- **Advantages**

•Produce a bright image
•Energy efficient
•Completely flat screen

- **Disadvantages:**

Fixed aspect ratio & Resolution
Lower Contrast
More Expensive

Light Emitting Diode (LED)

- Device which emits when current passes through it. It is a semiconductor device.
- The size of the LED is small, so we can easily make any display unit by arranging a large number of LEDs.
- LED consumes more power compared to LCD. LED is used on TV, smartphones, motor vehicles, traffic light, etc.
- LEDs are powerful in structure, so they are capable of withstanding mechanical pressure. LED also works at high temperatures.

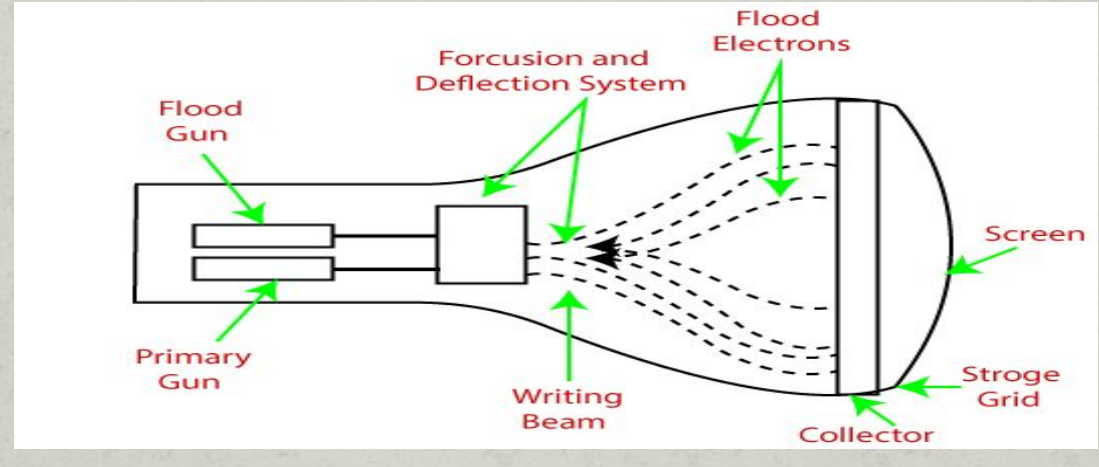
- **Advantages**

•The Intensity of light can be controlled.
•Low operational Voltage.
•Capable of handling the high temperature.

- **Disadvantages:**
- More Power Consuming than LCD.

Direct View Storage Tube (DVST)

- **:U**sed to store the picture information as a charge distribution behind the phosphor-coated screen.
- There are two guns used in DVST:
- **Primary Gun:** It is used to store the picture information.
- **Flood / Secondary Gun:** It is used to display a picture on the screen.



- **Advantages**

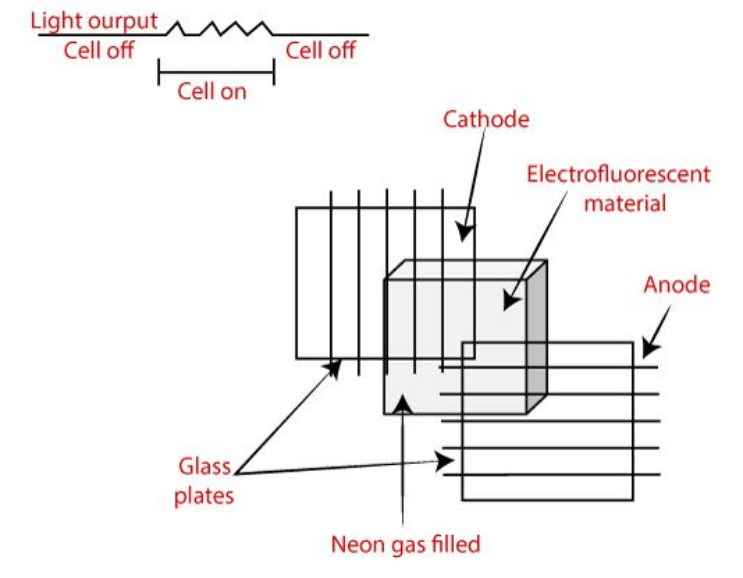
•Less Time Consuming
•No Refreshing Required
•High-Resolution
•Less Cost

- **Disadvantages:**

•The specific part of the image cannot be erased.
•They do not display color.

Plasma Display

- Type of flat panel display which uses tiny plasma cells. It is also known as **the Gas-Discharge display**.
- **Components of Plasma display**
- **Anode:** It is used to deliver a positive voltage. It also has the line wires.
- **Cathode:** It is used to provide negative voltage to gas cells. It also has fine wires.
- **Gas Plates:** These plates work as capacitors. When we pass the voltage, the cell lights regularly.
- **Fluorescent cells:** It contains small pockets of gas liquids when the voltage is passed to this neon gas. It emits light.



Advantages

Wall Mounted
Slim
Wider angle

Disadvantages:

Phosphorus loses luminosity over time.
It consumes more electricity than LCD.
Large Size

Graphics Adapters

- **A**n extension card that is used in a computer to enable the user to view graphical information that has been sent from the computer to a display device such as a monitor
- **MDA (Monochrome Display Adapter):** A monitor or graphics card that can display only one color. No longer in common use but may be found on some older systems. Usually supports only text.
- **CGA (Color Graphics Adapter):** The first color monitor and graphics cards for PC computers. Capable of producing 16 colors at 160x200 pixels.
- **EGA (Enhanced Graphics Adapter):** Following CGA, an adapter that could display 16 colors with a screen resolution of 640x350 pixels.
- **VGA (Video Graphics Adapter):** Currently the base standard for PC video cards and monitors. True VGA supports 16 colors at 640x480 pixels or 256 colors at 320x200 pixels.
- **SVGA (Super VGA):** One of the more popular labels placed on video cards and monitors. A SVGA card or monitor is capable of displaying more pixels (dots on the screen) and/or colors than basic VGA. For example, an SVGA graphics card may be able to display 16-bit color with a resolution of 800x600 pixels.
- **XGA:** A standard used on some IBM PS/2 models. XGA supports 256 colors at 1024x728 pixels, or 16-bit colors at 640x480 pixels.

Thank You