

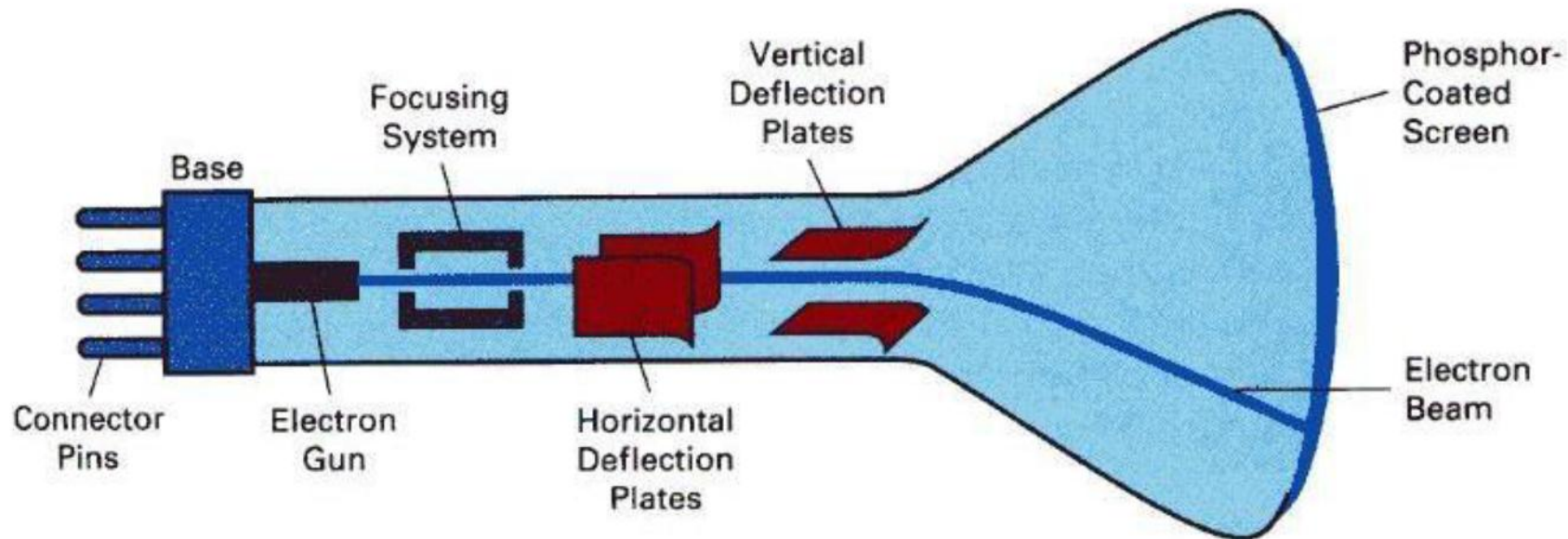
# 02 Computer Graphics

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# Video Display devices

**Cathode - Ray Tubes (CRT)** still the most common video display device presently



An electron gun emits a beam of electrons, which passes through focusing and deflection systems and hits on the phosphor - coated screen. The number of points displayed on a CRT is referred to as **resolutions** (eg. 1024x768). Different phosphors emit small light spots of different colors, which can combine to form a range of colors.

A common methodology for color CRT display is the **Shadow – mask** method

The light emitted by phosphor fades very rapidly, so it needs to redraw the picture repeatedly.

There are 2 kinds of redrawing mechanisms:

1. Raster Scan and
2. Random Scan

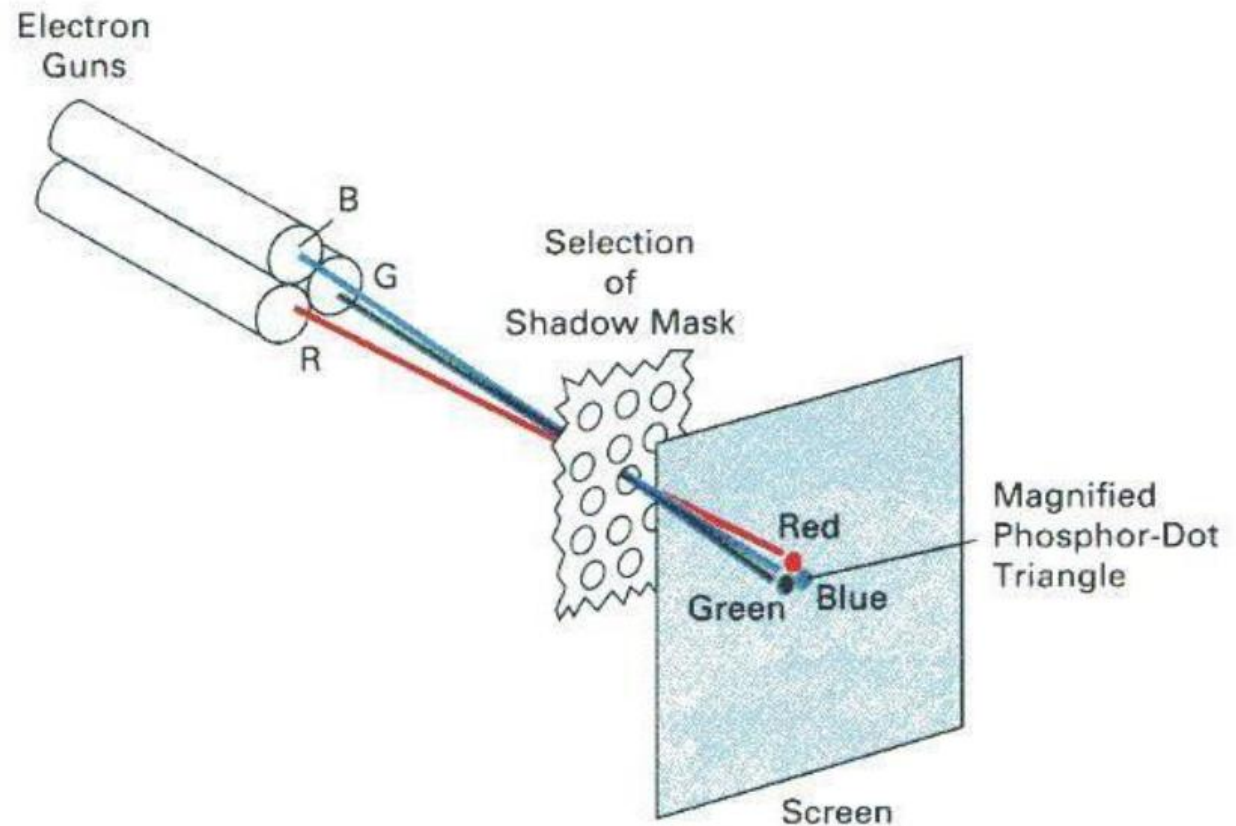


Illustration of a shadow-mask CRT

# Raster scan display

The electron beam is swept across the screen one row at a time from top to bottom. As it moves across each row, the beam intensity is turned on and off to create a pattern of illuminated spots. This scanning process is called **refreshing**.

Each complete scanning of a screen is normally called a **frame**.

The refreshing rate, called the **frame rate**, is normally 60 to 80 frames per second, or described as 60 Hz to 80 Hz.

Picture definition is stored in a memory area called the **frame buffer**. This frame buffer stores the intensity values for all the screen points. Each screen point is called a **pixel** (picture element).

On black and white systems, the frame buffer storing the values of the pixels is called a **bitmap**. Each entry in the bitmap is a 1-bit data which determine the on (1) and off (0) of the intensity of the pixel.

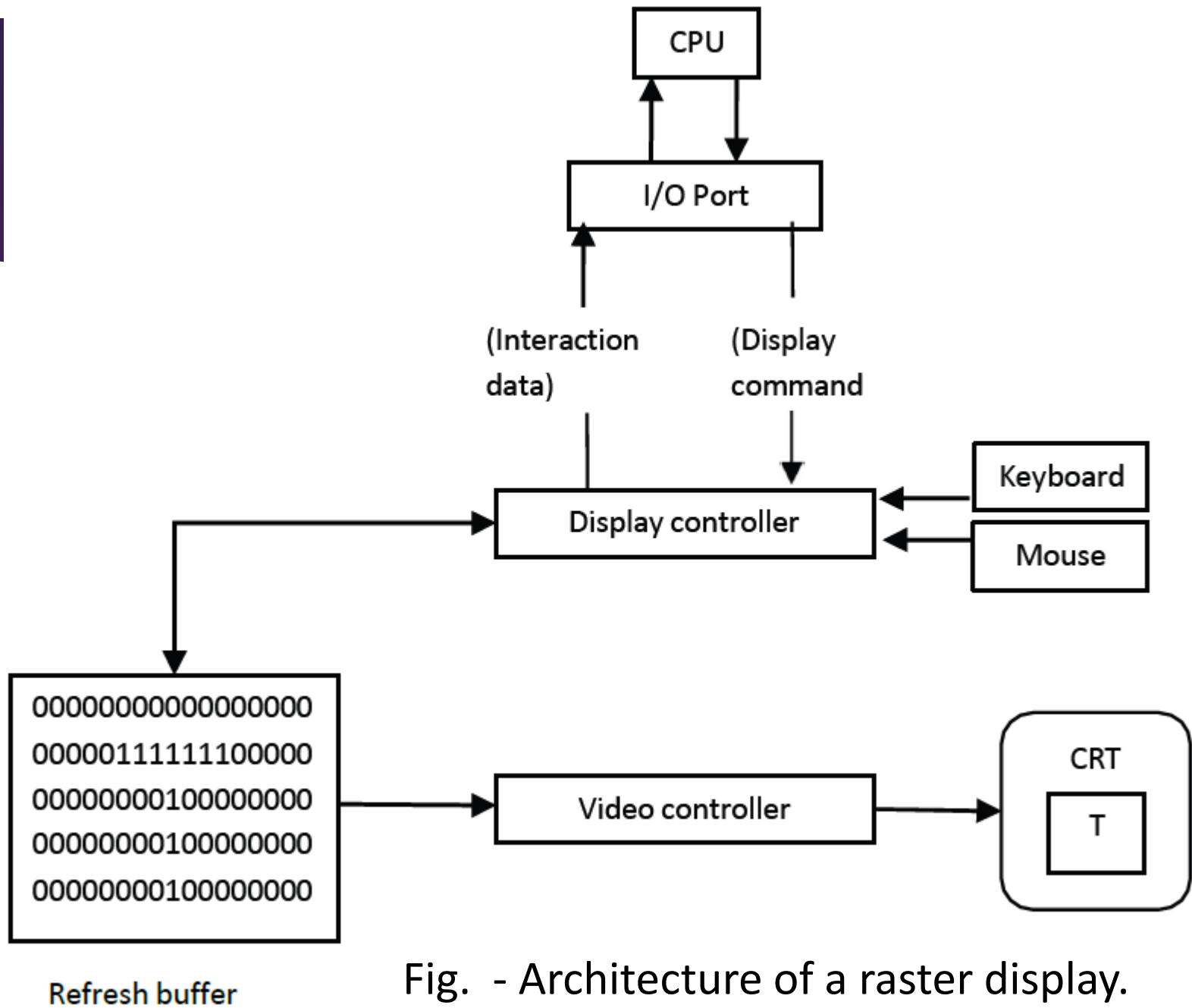
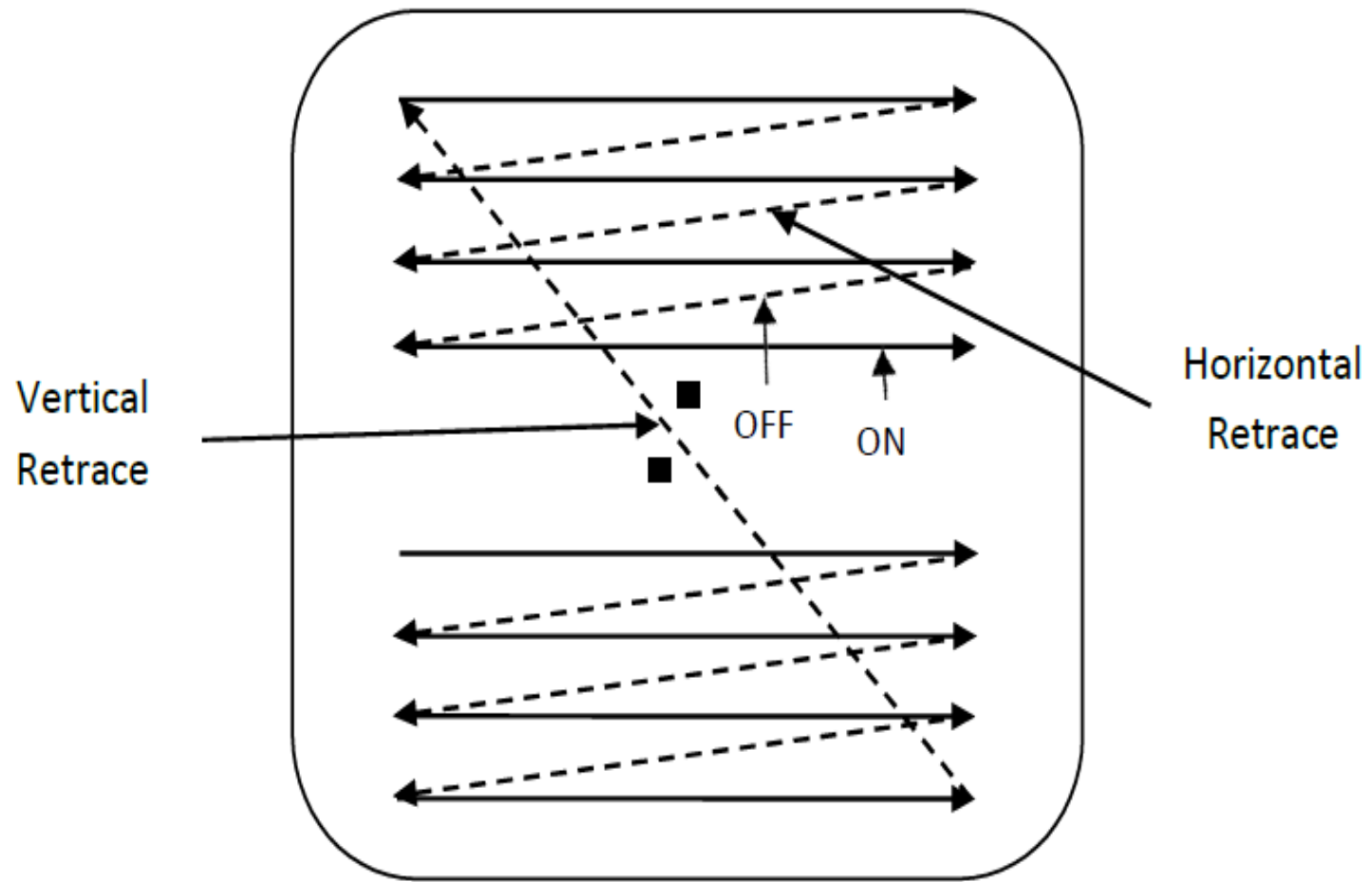


Fig. - Architecture of a raster display.



Raster scan CRT.

# Vector scan/Random scan display

The CRT's electron beam is directed only to the parts of the screen where a picture is to be drawn. The picture definition is stored as a set of line - drawing commands in a refresh display file or a refresh buffer in memory.

Random - scan generally have higher resolution than raster systems and can produce smooth line drawings, however it cannot display realistic shaded scenes.

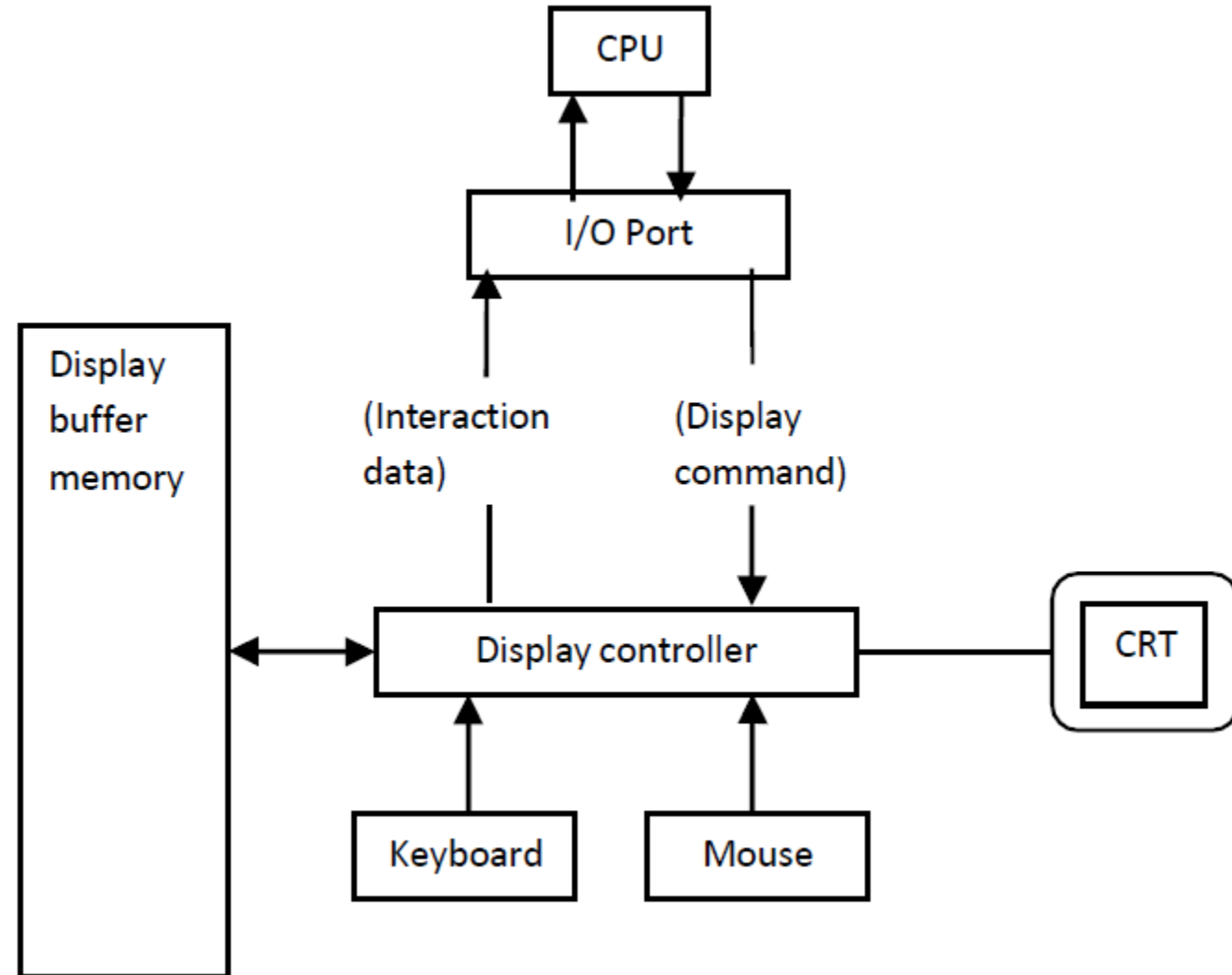


Fig. - Architecture of a vector display

# Components of a Random Scan Device

The key components of a random scan device include –

- **Display Controller** – This component interprets the instructions from the computer and directs the electron beam to draw lines or shapes on the screen.
- **Electron Beam** – The electron beam is responsible for "drawing" the shapes on the screen. It moves directly from one point to another to create the desired lines or shapes.
- **Phosphor-Coated Screen** – Similar to raster scan display systems, random scan devices use a phosphor-coated screen that emits light when hit by the electron beam. However, the way the beam interacts with the screen is different compared to raster scan systems.
- **Vector Generator** – A vector generator converts instructions into a sequence of points, allowing the electron beam to accurately follow the necessary path to create the image.



# Difference between random scan and raster scan

Base of Difference	Raster Scan System	Random Scan System
Electron Beam	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.
Resolution	Its resolution is poor because raster system in contrast produces zigzag 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.
Picture Definition	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.
Realistic Display	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.
Draw an Image	Screen points/pixels are used to draw an image.	Mathematical functions are used to draw an image.

# Graphics Monitors and Work Stations

Graphics monitors and workstations are specialized tools for handling demanding visual tasks. Graphics monitors are displays optimized for high-resolution graphics and video, while workstations are powerful computers designed for graphics-intensive applications like 3D modeling, video editing, and scientific visualization.

Graphics monitors are displays that are specifically designed to display high-resolution graphics and video. They often have wider color gamut's, higher refresh rates, and faster response times than standard computer monitors, which makes them suitable for use in applications that require fast, smooth graphics rendering.

Workstations are high-performance computers that are designed to support heavy workloads and are typically used in professional settings such as studios, design firms, and research labs. They often have powerful processors, lots of RAM, and dedicated graphics cards to support the demanding needs of graphics-intensive applications.