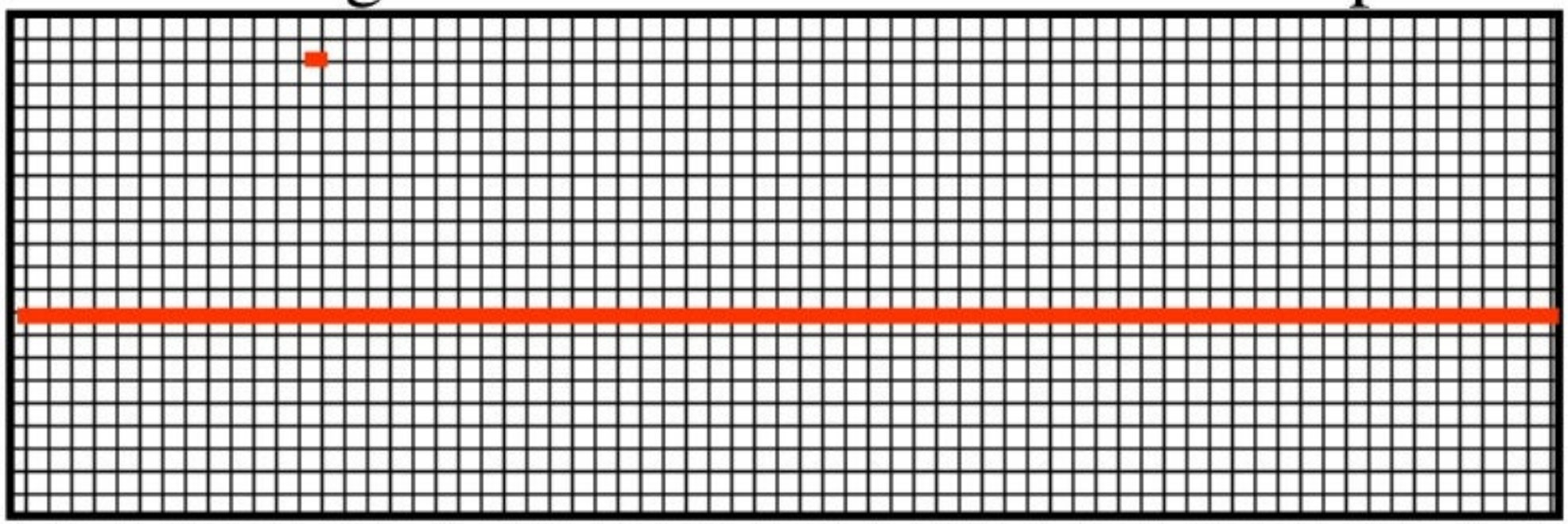
RANDOM SCAN DISPLAYS AND RASTER SCAN DISPLAYS

RASTER SCAN DISPLAY

- **Raster:** A rectangular array of points or dot.
- An image is subdivided into a sequence of (usually horizontal) strips known as "scan lines" which can be further divided into discrete pixels for processing in a computer system.

A raster image is a collection of dots called pixels

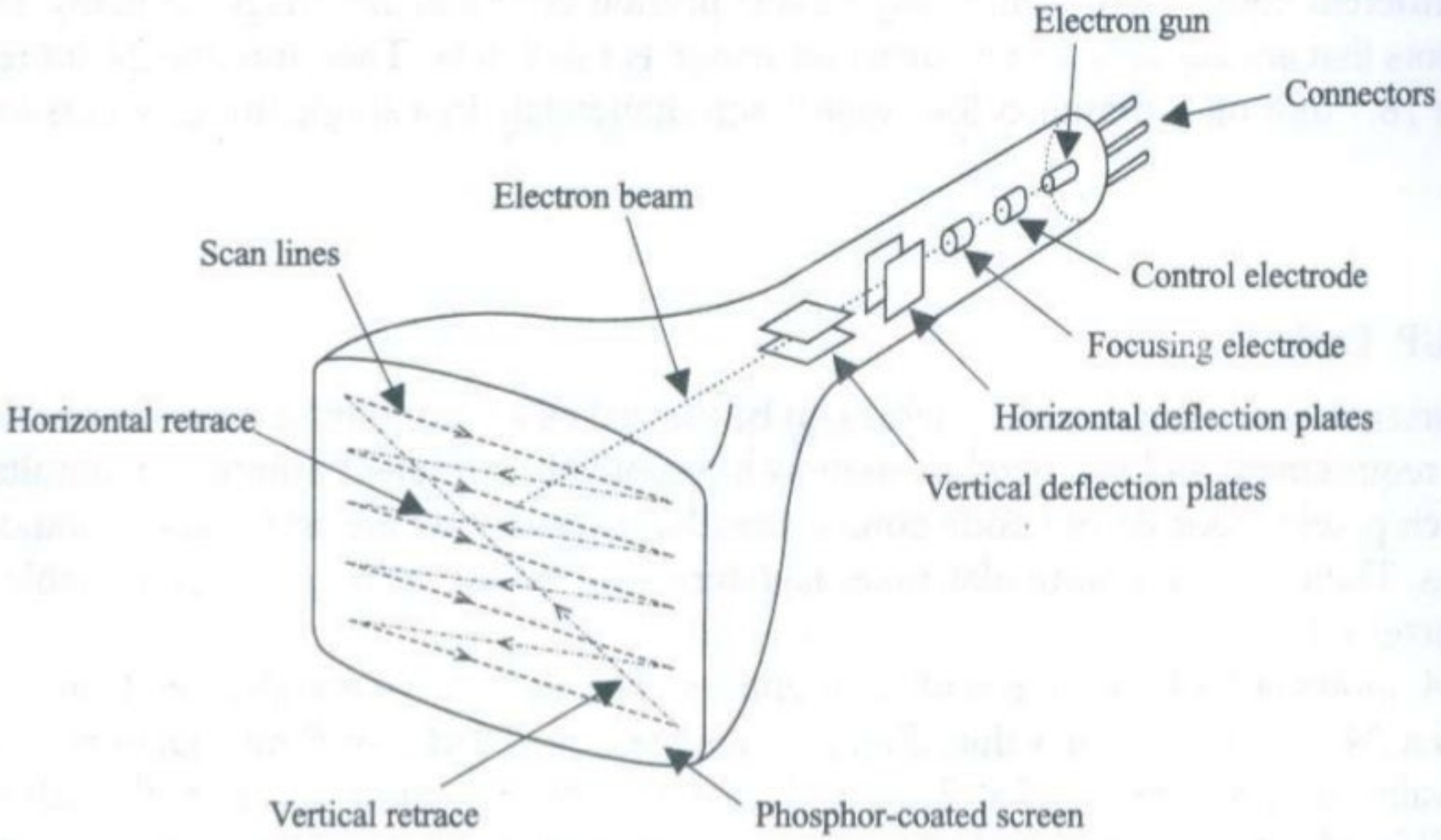


RASTER IMAGE

WORKING

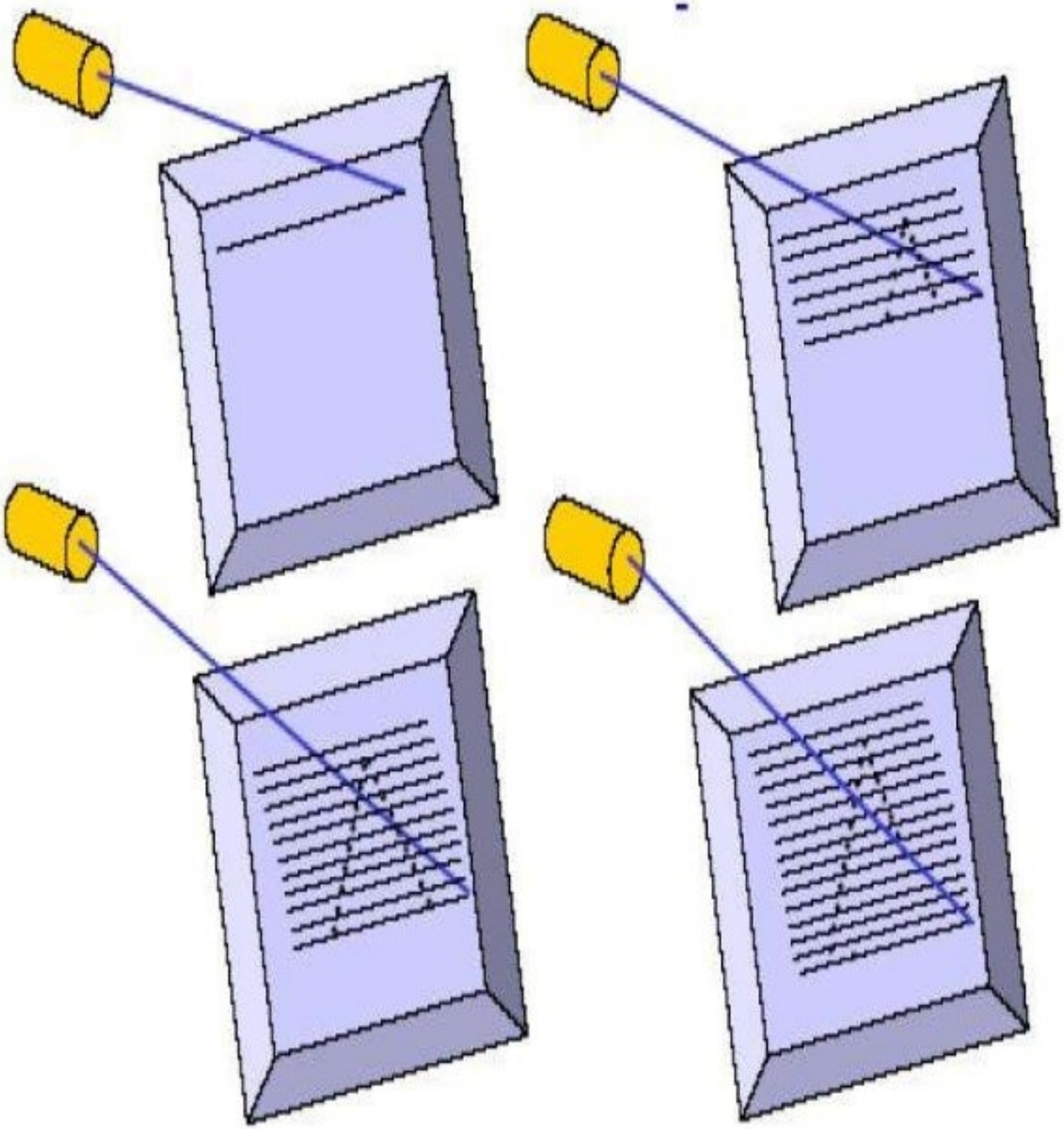
- In a raster scan system, the electron beam is swept across the screen, one row at a time from top to bottom.
- As the electron beam moves across each row, the beam intensity is turned on and off to create a pattern of illuminated spots.
- The return to the left of the screen, after refreshing each scan line is called **Horizontal retrace**.
- At the end of each frame the electron beam returns to the top left corner of the screen to begin the next frame is called **Vertical retrace**:

Raster Scan Display



WORKING

- Picture definition is stored in a memory area called the **refresh buffer** or **frame buffer**.
- **Refresh buffer** or **frame buffer** is memory area that holds the set of intensity values for all the screen points.
- Stored intensity values then retrieved from refresh buffer and "**painted**" on the screen one row (**scan line**) at a time.



Object as set of discrete points across each scan line

- The quality of a raster image is determined by the total number pixels (**resolution**), and the amount of information in each pixel (**color depth**)
- A black-and-white system: each screen point is either on or off, so only **one bit** per pixel is needed to control the intensity of screen positions. Such type of frame buffer is called Bit map
- High quality raster graphics system have **24** bits per pixel in the frame buffer (a **full color** system or a **true color** system)
- Refreshing on raster scan displays is carried out at the rate 60 to 80 frame per second.

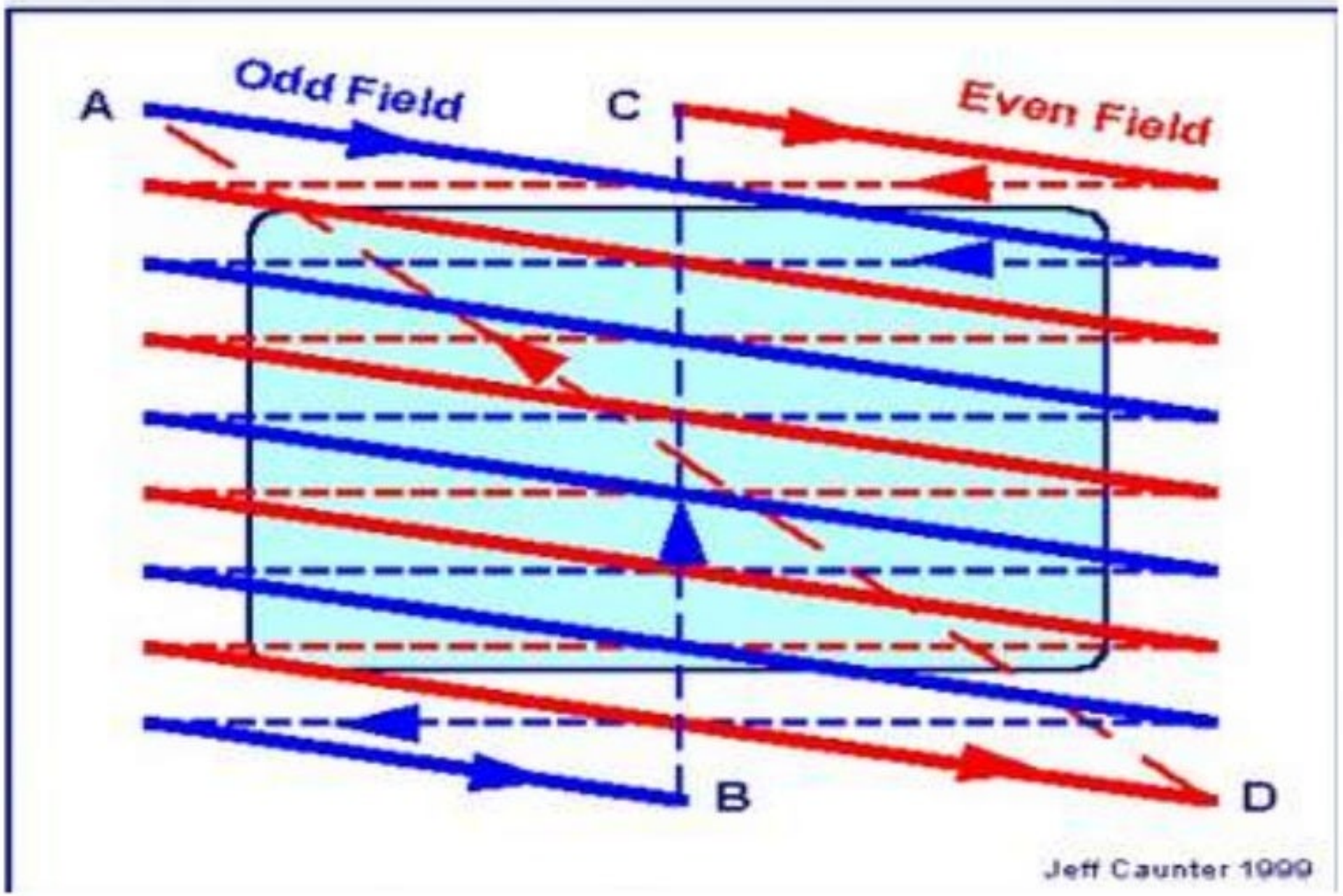
INTERLACING

- On some raster systems (TV), each frame is displays in two passes using an interlaced refresh procedure.

- Interlacing is primarily used for slower refresh rates.

- An effective technique to avoid **Flicker**.(Flicker occurs on CRTs when they are driven at a low refresh rate, allowing the brightness to drop for time intervals sufficiently long to be noticed by a human eye)

INTERLACING



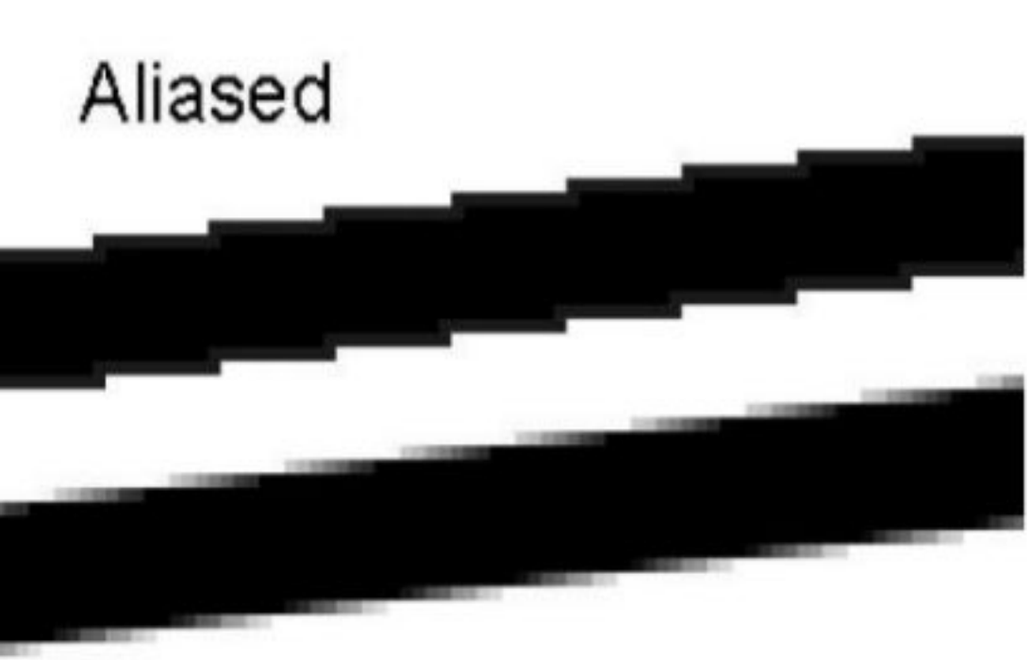
APPLICATIONS

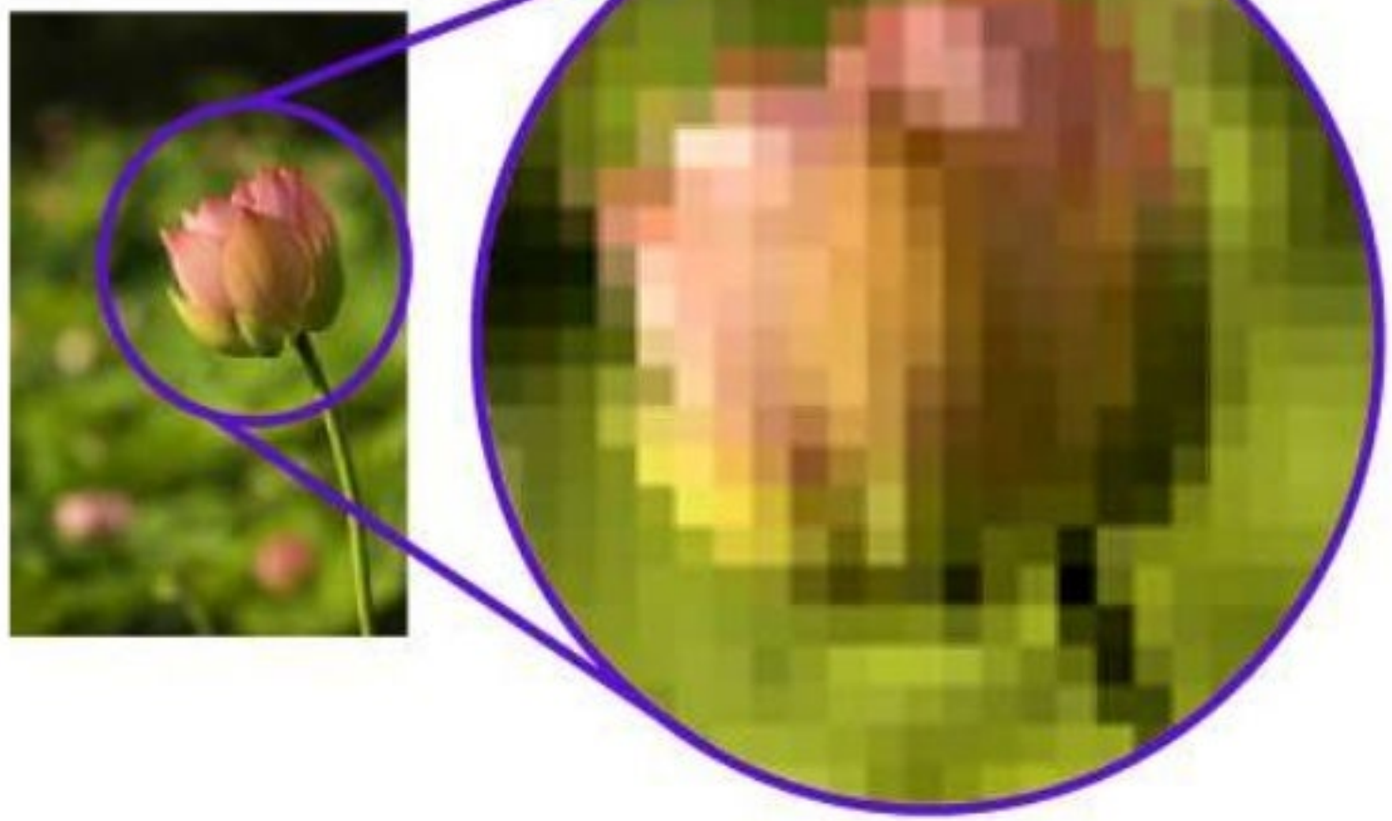
- Suited for realistic display of screens
- Home television computer printers create their images basically by raster scanning. Laser printers use a spinning polygonal mirror (or an optical equivalent) to scan across the photosensitive drum, and paper movement provides the other scan axis

- Common raster image formats include BMP (Windows Bitmap), JPEG (Joint Photographics Expert Group), GIF (Graphics Interchange Format) , PNG (Portable Network Graphic), PSD (Adobe PhotoShop)

DISADVANTAGE

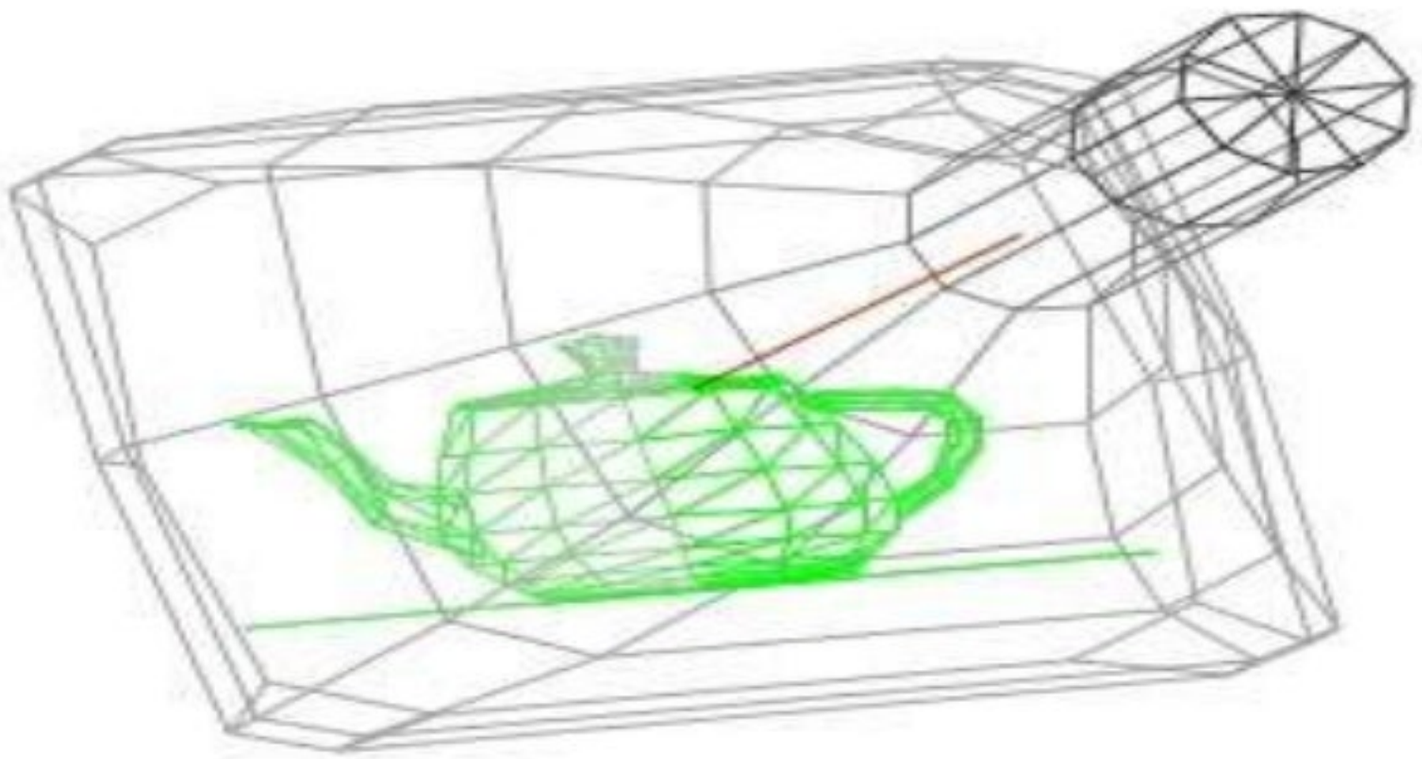
- To increase size of a raster image the pixels defining the image are be increased in either number or size Spreading the pixels over a larger area causes the image to lose detail and clarity.
- Produces jagged lines that are plotted as discrete points



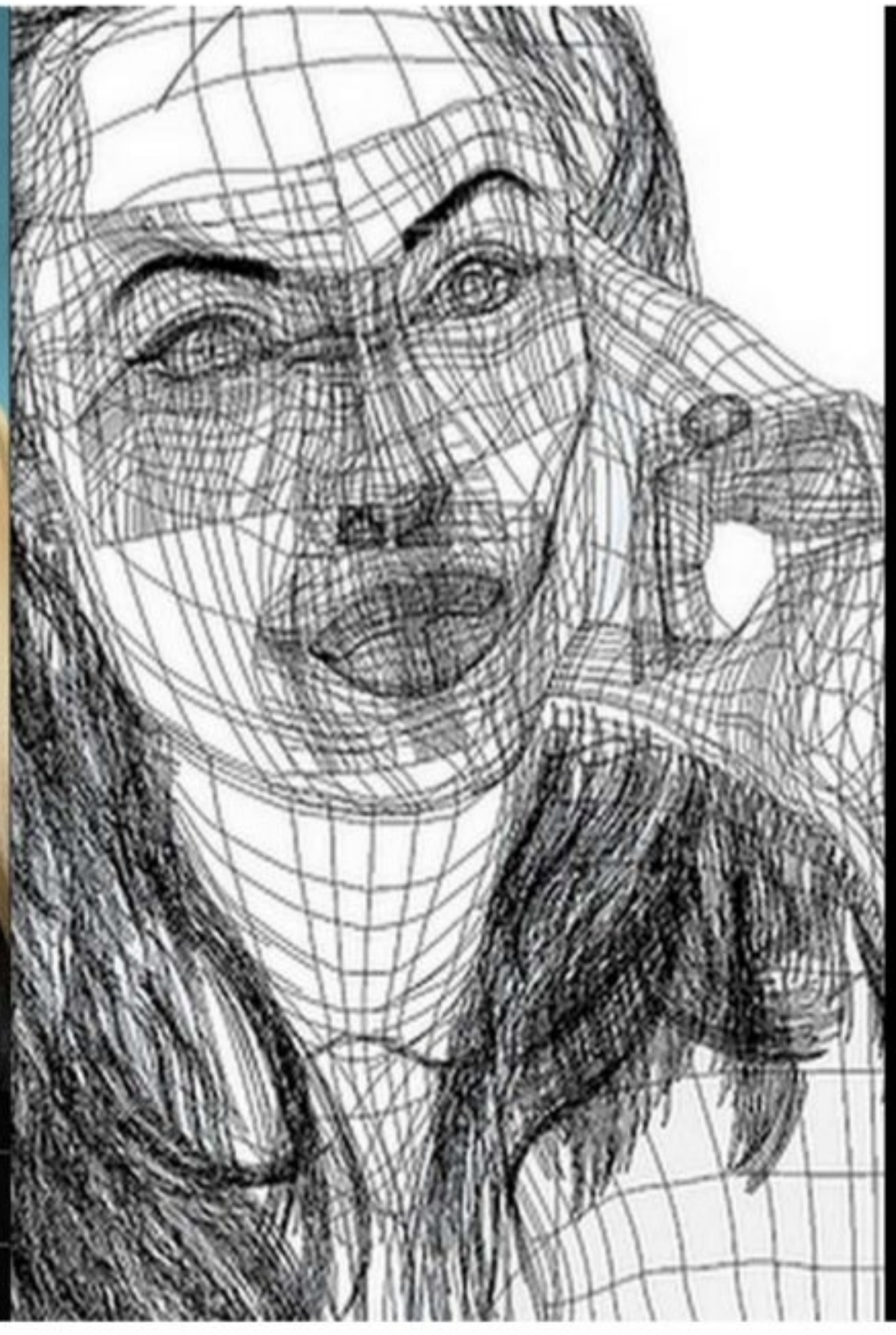


RANDOM SCAN DISPLAY

- Random scan display is the use of geometrical primitives such as points, lines, curves, and polygons, which are all based upon **mathematical**



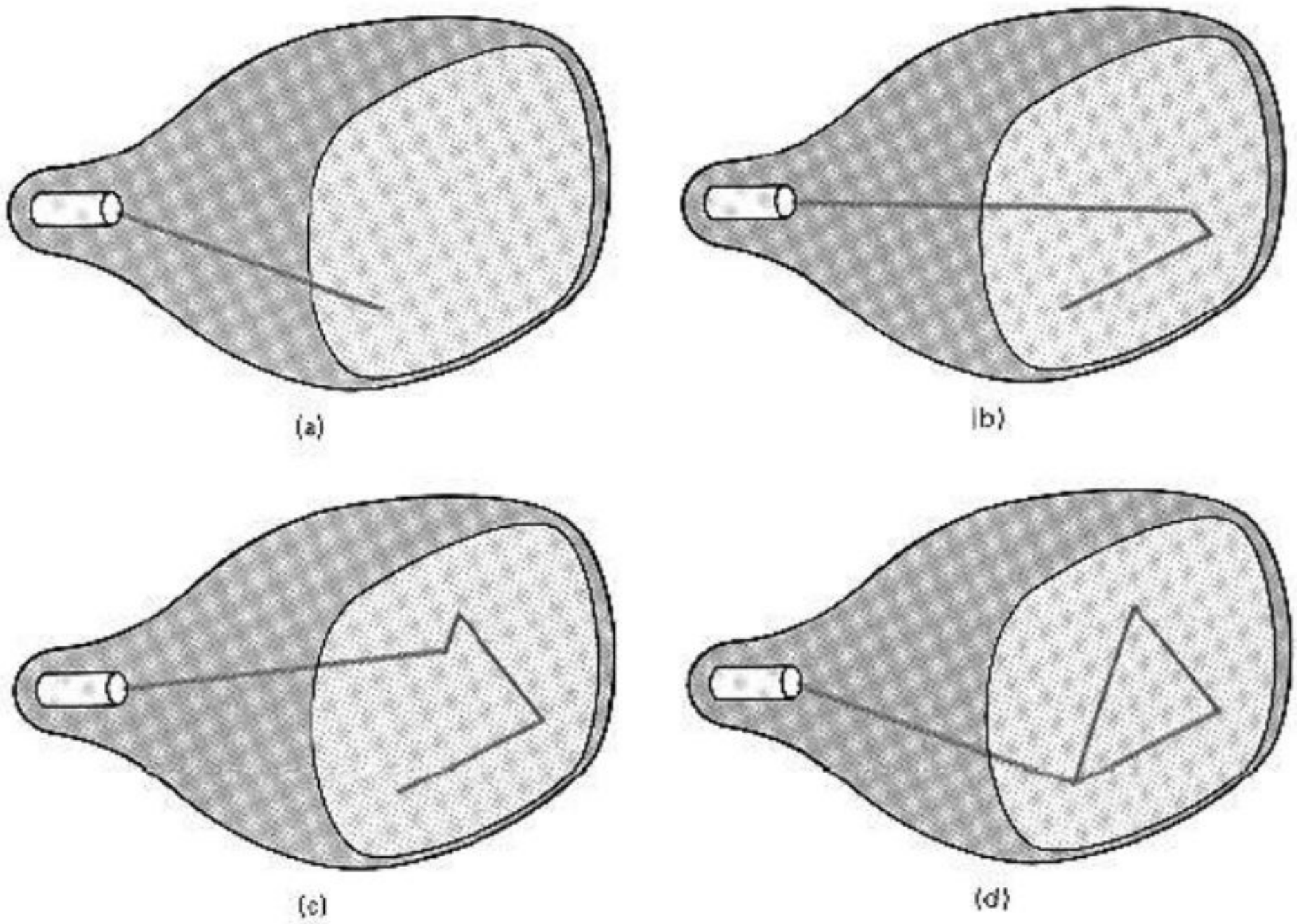
VECTOR IMAGE



WORKING

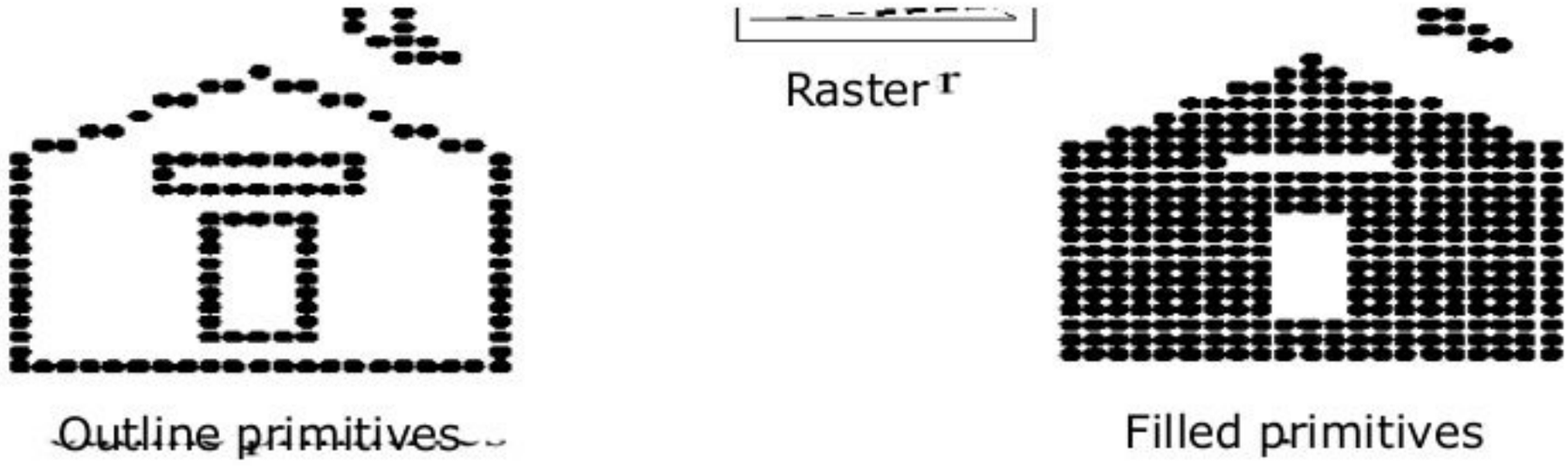
- When operated as a random-scan display unit, a CRT has the electron beam directed only to the parts of the screen where a picture is to be drawn.
- Random-scan monitors draw a picture one line at a time and for this reason are also referred to as vector displays (or stroke-writing or calligraphic displays).

RASTER SCAN DISPLAY

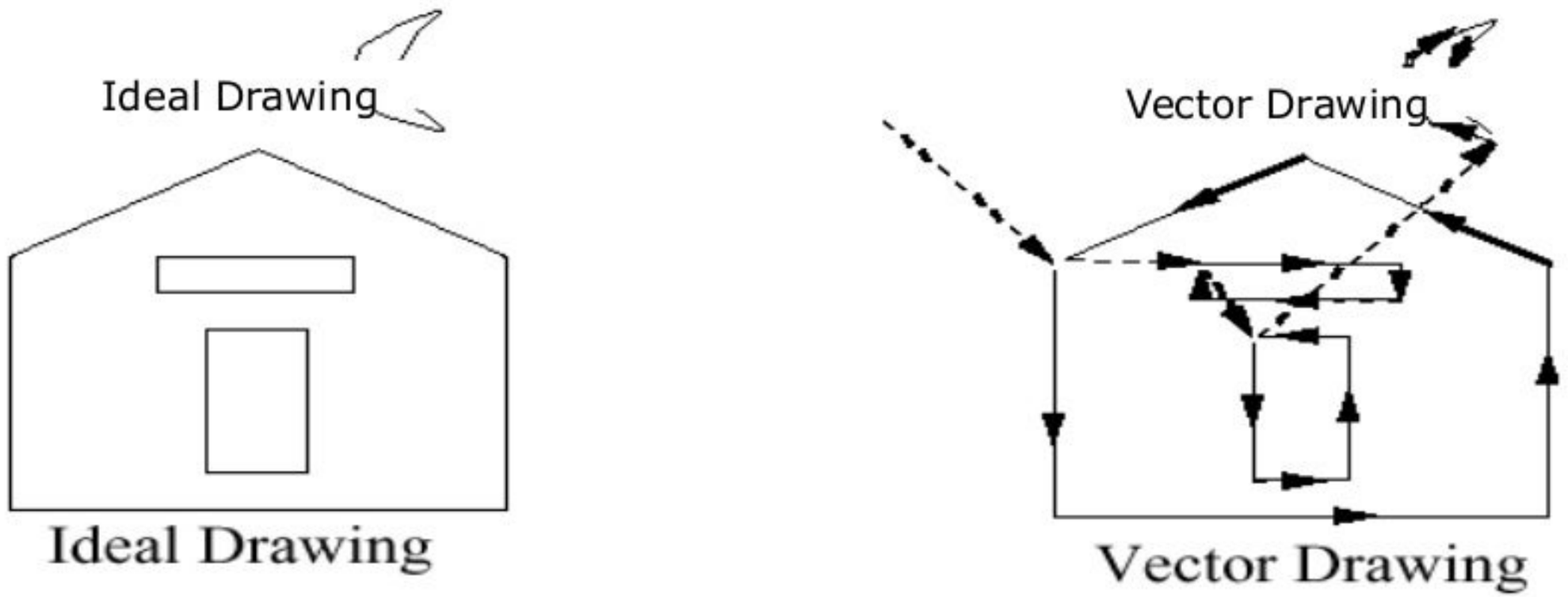


- **Refresh rate** depends on the number of lines to be displayed.
- Picture definition is now stored as a line-drawing commands an area of memory referred to as **refresh display file** (**display list**).
- To display a picture, the system cycle through the **set of commands** in the display file, drawing each component line in turn.
- Random scan displays are designed to draw all the component lines of a picture 30 to 60 times each second

➢A Raster system produces jagged lines that are plotted as discrete points sets.



➢Vector displays product smooth line drawing



- Random scan displays are designed for **line-drawing applications** and can not display realistic shaded scenes

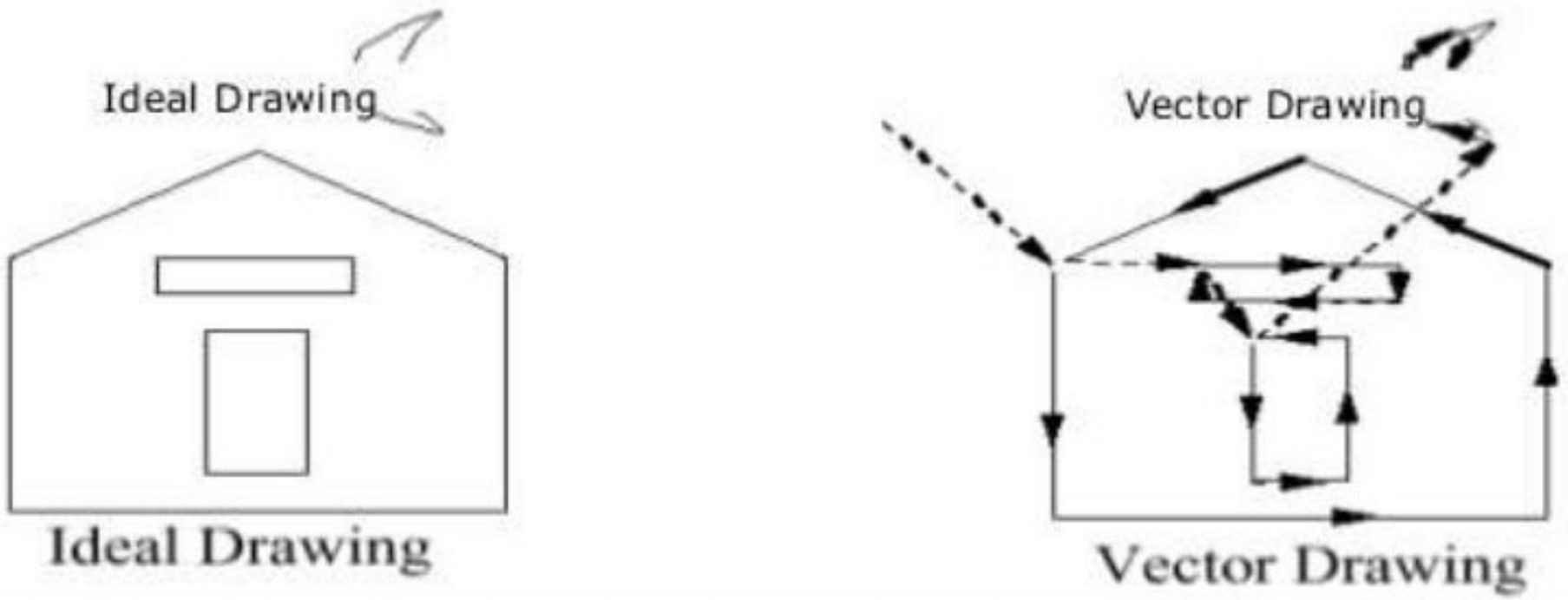
Advantages

- Random scan displays have higher resolution than raster systems.
- Vector displays product smooth line drawing.
- This minimal amount of information translates to a much smaller file size. (file size compared to large raster images)
- On zooming in, and it remains smooth
- The parameters of obje.cts are stored and can be later modified.

Difference	Raster scan displays	Random scan displays
resolution	It has poor or **less Resolution** because picture definition is stored as a intensity value.	It has **High Resolution** because it stores picture definition as a set of line commands.
Electron beam	**Electron Beam** is directed from top to bottom and one row at a time on screen, but electron beam is directed to whole screen.	**Electron Beam** is directed to only that part of screen where picture is required to be drawn, one line at a time so also called **Vector Display**.
Cost	It is **less expensive**	It is **Costlier** than Raster Scan System.
Refresh rate	Refresh rate is **60 to 80 frame per second**.	Refresh Rate depends on the number of lines to be displayed i.e **30 to 60/sec**
Picture definition	It Stores **picture definition** in **Refresh Buffer** also called **Frame Buffer**.	It Stores picture definition as a set of **line commands** called **Refresh Display File**.
Line drawing	**Zig – Zag line** is produced because plotted value are discrete.	**Smooth line** is produced because directly the line path is followed by electron beam
Realism in display	It contains shadow, advance shading and hidden surface technique so gives the **realistic display** of scenes.	It does not contain shadow and hidden surface technique so **it can not give realistic display of scenes.**
Image drawing	It uses **Pixels** along scan lines for drawing an image.	It is designed for **line drawing applications** and uses various mathematical function to draw.

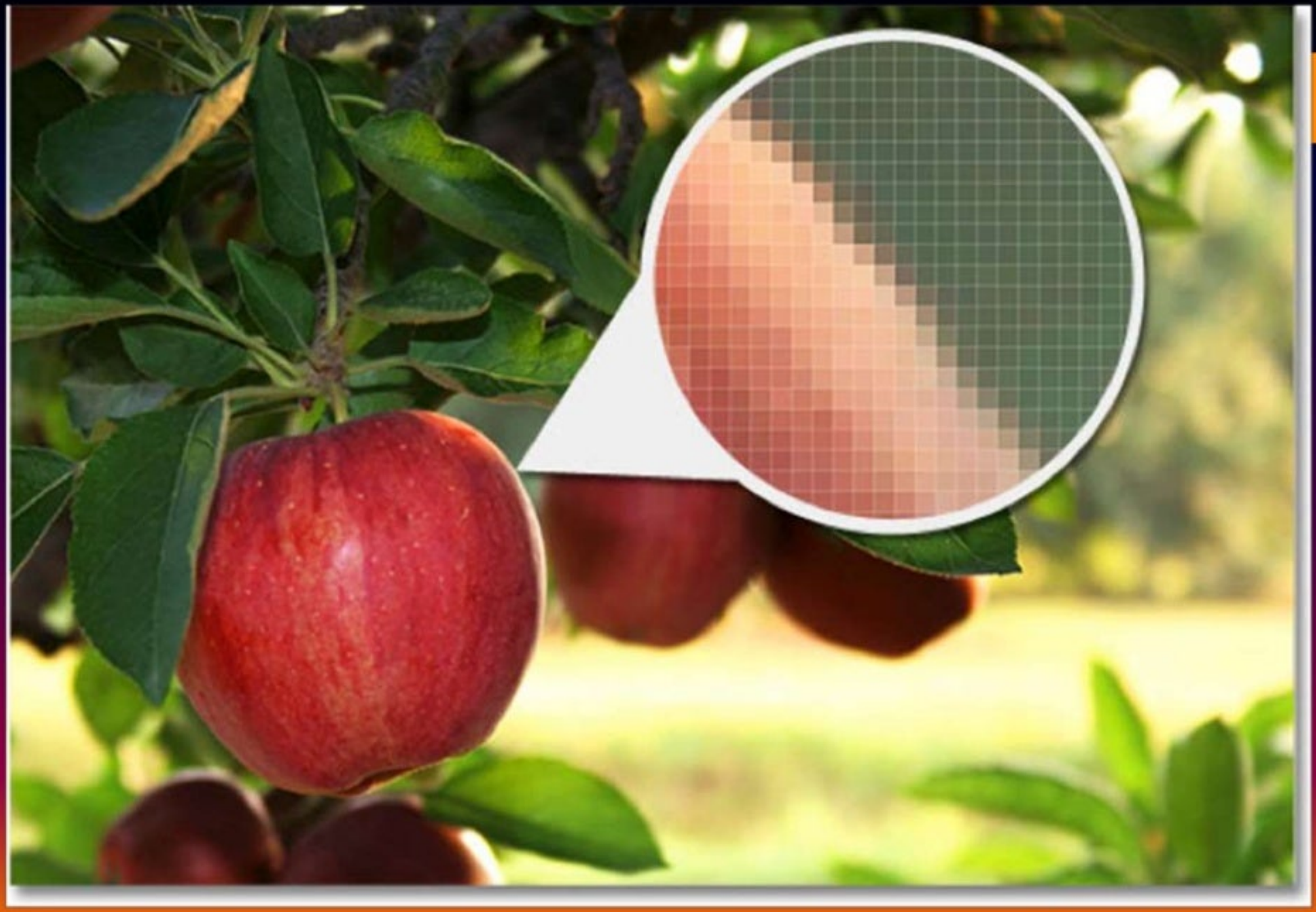
➢A Raster system produces jagged lines that are plotted as discrete points sets.

➢Vector displays product smooth line drawing

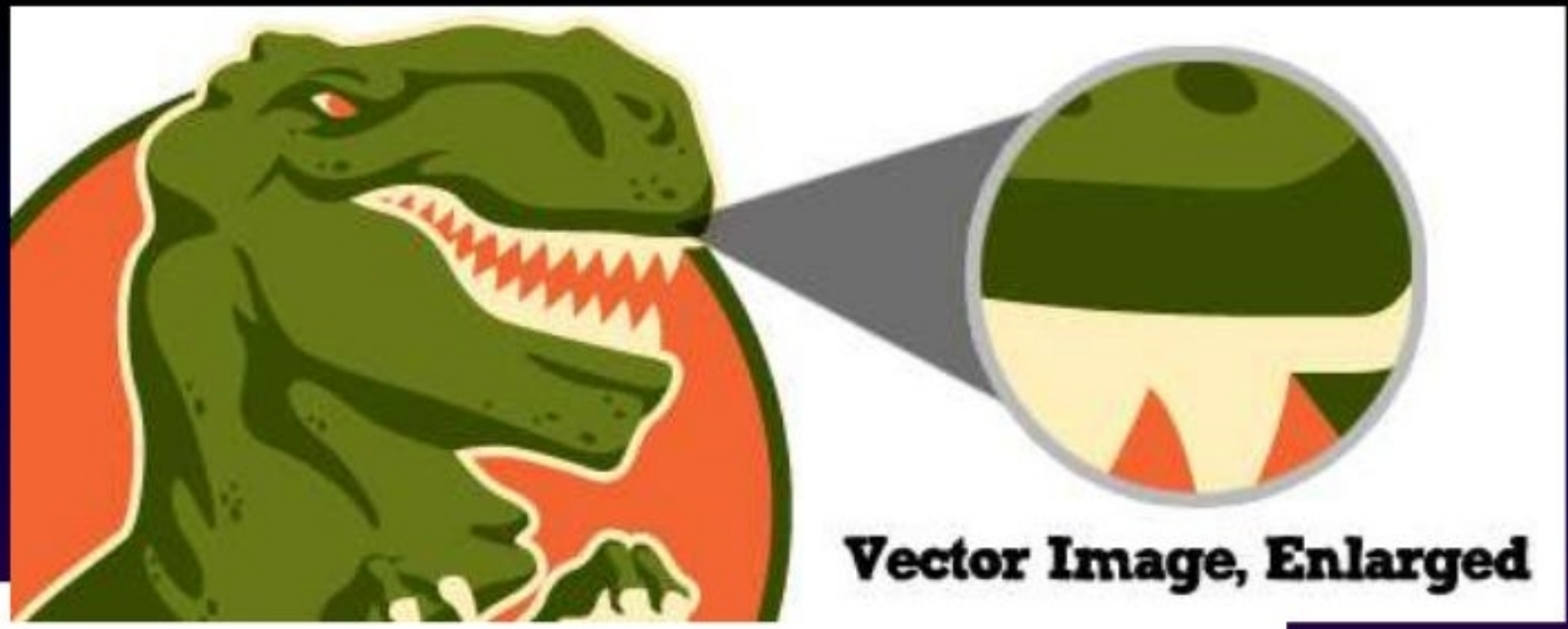


raster-scan image

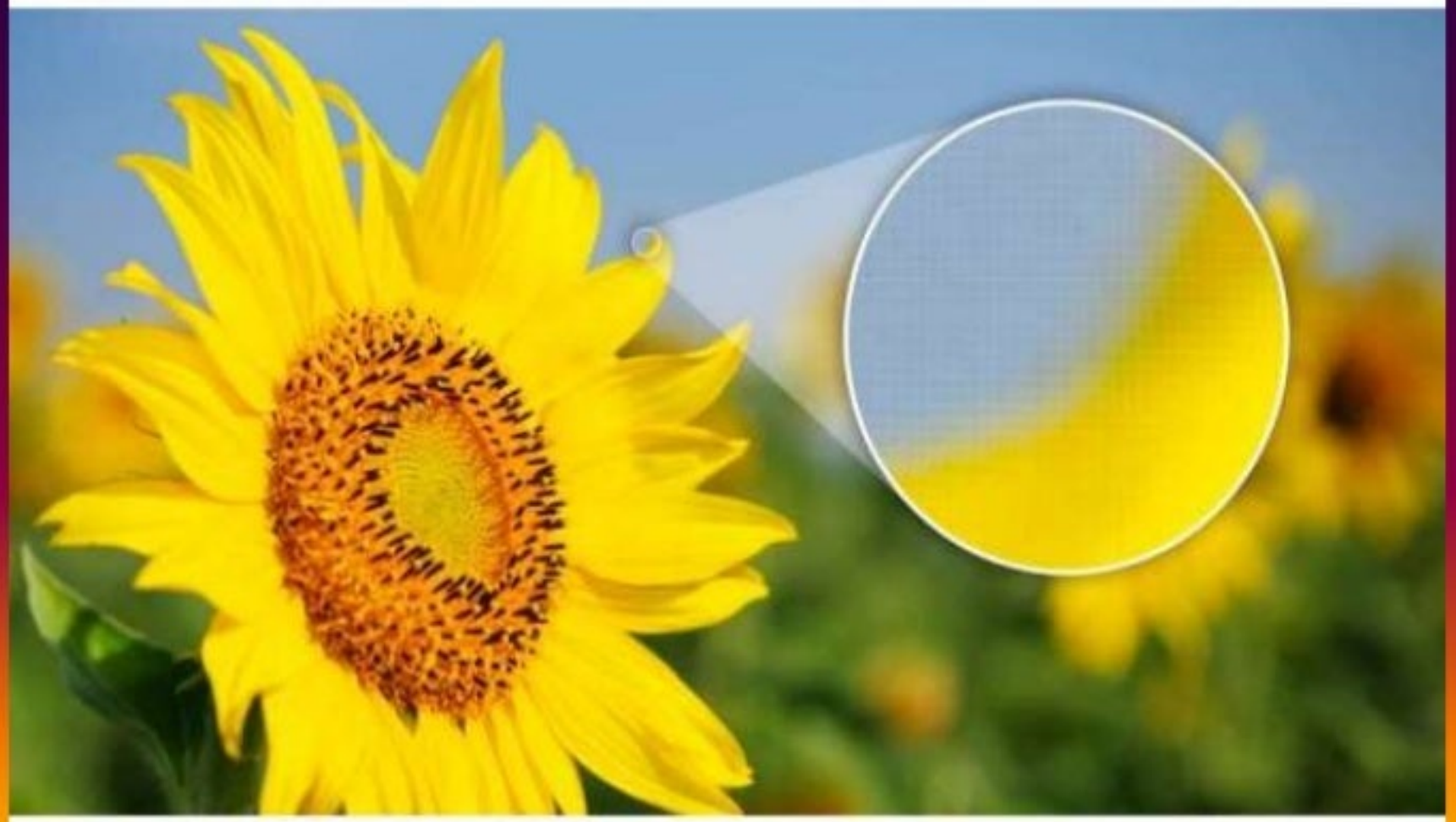
random-scan image



Raster-scan image



RASTER IMAGE

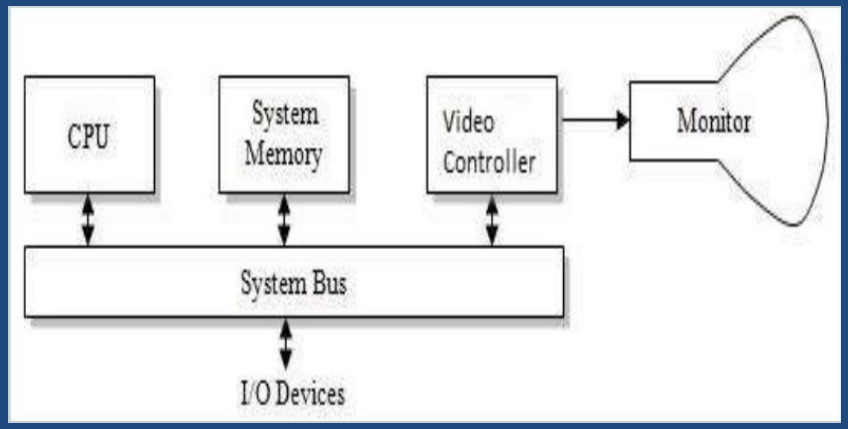


ARCHITECTURE OF RASTER-SCAN SYSTEMS

Interactive raster graphics systems typically employ several processing units.

In addition to the central processing unit, or CPU, a special-purpose processor ,called the video controller or display controller, is used to control the operation of the display device.

Organization of a simple raster system is shown in following Figure



Here, the frame buffer can be anywhere in the system memory, and the video controller accesses the frame buffer to refresh the screen.

In addition to the video controller, more sophisticated raster systems employ other processors as coprocessors and accelerators to implement various graphics operations.

Below Figure shows a commonly used organization for raster systems.

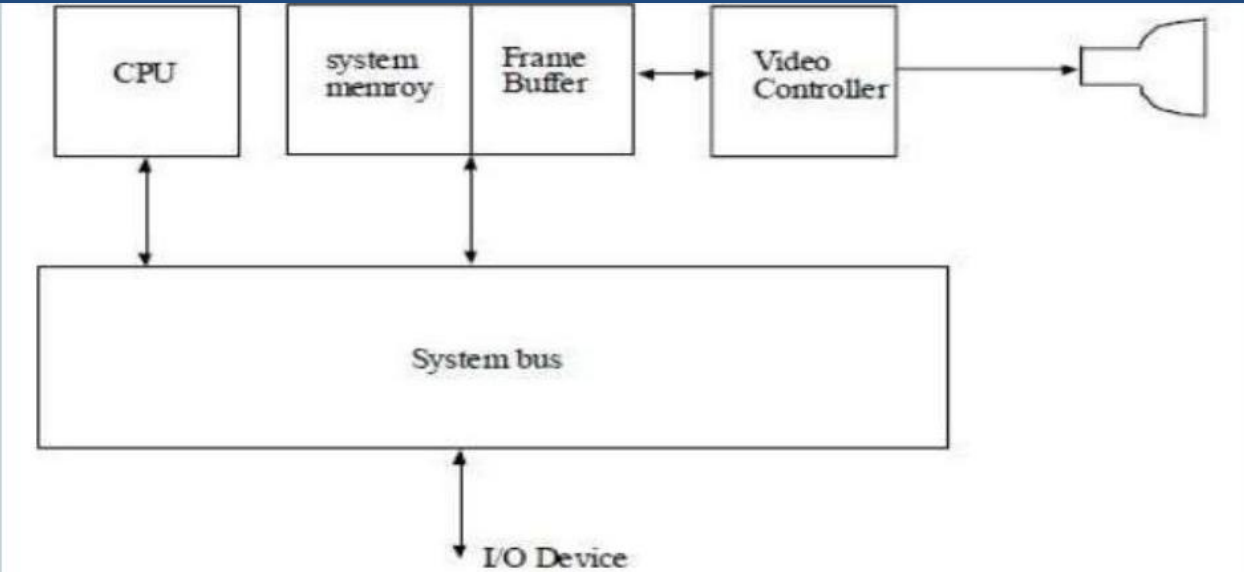


Fig. Architecture of a raster system with a fixed positon of the system memory requred for the frame buffer

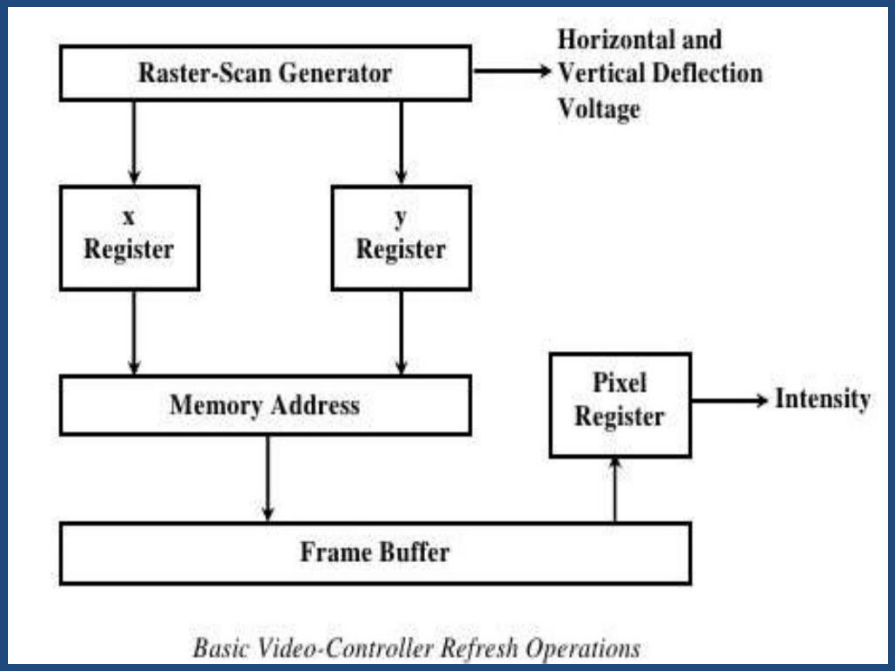
A fixed area of the system memory is reserved for the frame buffer, and the video controller is given direct access to the frame-buffer memory.

Frame-buffer locations, and the corresponding **screen** positions, are referenced in Cartesian coordinates.

For many graphics monitors, the coordinate origin is defined at the lower left screen comer

VIDEO CONTROLLER

the basic refresh operations of the video controller are diagrammed below .



Basic Video-Controller Refresh Operations

1) Two registers are used to store the coordinates of the screen pixels.
Initially, the **x** register is set to **0** and the y register is set to Y_{max}

2) The value stored in the frame buffer for this pixel position is then retrieved and used to set the intensity of the CRT beam.

3) Then the **x** register is incremented by 1, and the process repeated for the next pixel on the top scan line.

4)This procedure is repeated for each pixel along the scan line.

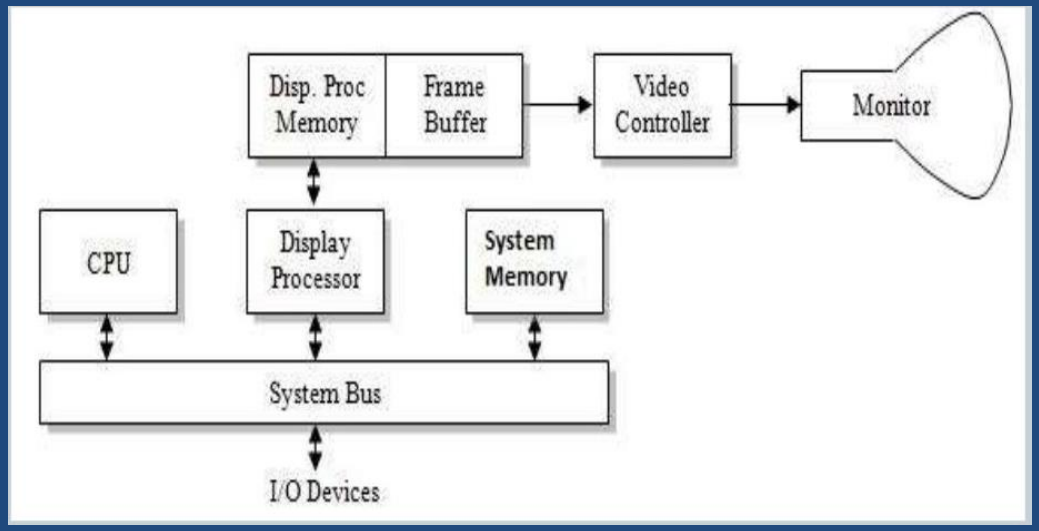
5) After the last pixel on the top scan line has been processed, the **x** register is reset to **0** and the y register is decremented by 1.

6) Pixels along this scan line are then processed in **turn,** and the procedure is repeated for each successive scan line.

7) After cycling through all pixels along the bottom scan line **(y** = **O),** the video controller resets the registers to the first pixel position on the top scan line and the refresh process starts over

RASTER-SCAN DISPLAY PROCESSOR

Figure below shows one way to **set** up the organization of a raster system containing a separate display processor, sometimes referred to as a graphics controller or a display coprocessor.



1) bThe purpose of the display processor is to free the CPU from the graphics chores.

2) In addition to the system memory, a separate display processor memory area can **also** be provided.

3) A major task of the display processor is digitizing a picture definition given in an app lication program into a set of pixel-intensity values for storage in the frame buffer.

4) This digitization process is called scan conversion.

5) Graphics commands specifying straight lines and other geometric objects are scan converted into a set of discrete intensity points.

6) Scan converting a straight-line segment, for example, means that we have to locate the pixel closest to the line path and store the intensity for each position in the frame buffer.

7) Similar methods are used for scan converting curved lines and polygon outlines.

8) Characters can be defined with rectangular grids

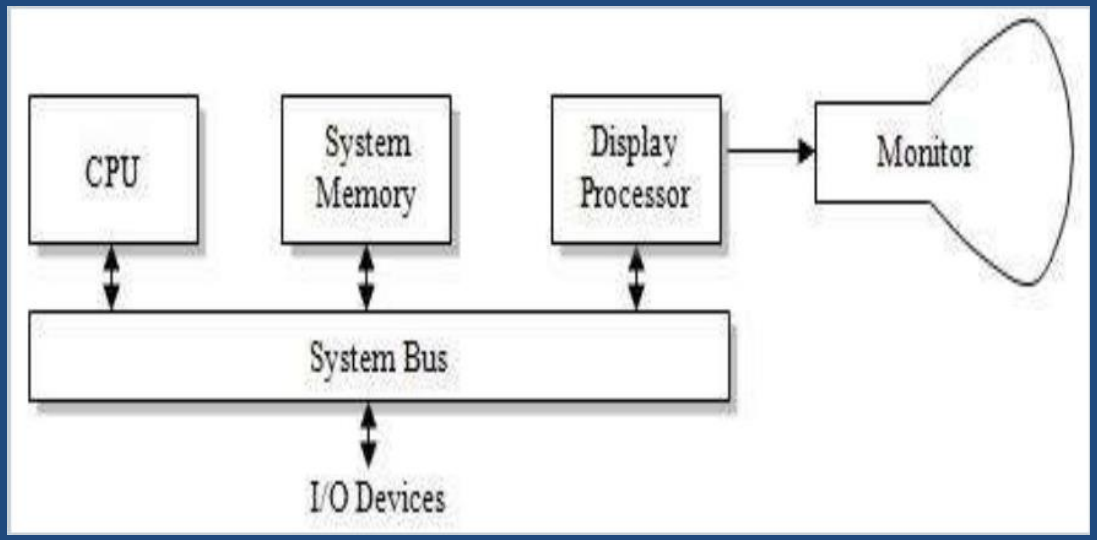
9) Display processors are also designed to perform a number of additional operations.

10) These functions include generating various line styles (dashed, dotted ,or solid), displaying color areas, and performing certain transformations and manipulations on displayed objects.

11) Also, display processors are typically designed
to interface with interactive input devices, such as a mouse.

ARCHITECTURE OF RANDOM-SCAN SYSTEMS

The organization (Architecture) of a simple random-scan (vector) system is shown in Figure below



1) An application program is input and stored in the system memory along with a graphics package.

2) Graphics commands in the application program are translated by the graphics package into a display file stored in the system memory.

3) This display file is then accessed by the display processor to refresh the screen.

4) The display processor cycles through each command in the display file program once during every refresh cycle

5) Sometimes the display processor in a random-scan system is referred to as a display processing unit or a graphics controller.

6) Graphics patterns are drawn on a random-scan system by directing the section electron beam along the component lines of the picture.

7) Lines are defined by the values for their coordinate endpoints, and these input coordinate values are converted to x and y deflection voltages.

8) A scene is then drawn one line at a time by positioning the beam to fill in the line between specified endpoints.