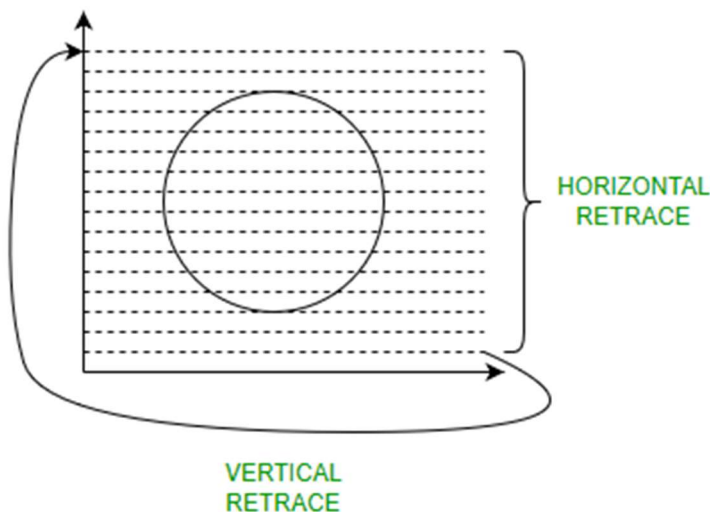


There are two ways (Random scan and Raster scan) by which we can display an object on the screen.

Raster-Scan Displays

Raster Scan Displays are most common type of graphics monitor which employs CRT. It is based on television technology. In raster scan system electron beam sweeps across the screen, from top to bottom covering one row at a time. A pattern of illuminated pattern of spots is created by turning beam intensity on and off as it moves across each row. A memory area called refresh buffer or frame buffer stores picture definition. This memory area holds intensity values for all screen points. Stored intensity values are restored from frame buffer and painted on screen taking one row at a time. Each screen point is referred to as pixels.

In raster scan systems refreshing is done at a rate of 60-80 frames per second. Refresh rates are also sometimes described in units of cycles per second / Hertz (Hz). At the end of each scan line, electron beam begins to display next scan line after returning to left side of screen. The return to the left of screen after refresh of each scan line is known as *horizontal retrace* of electron beam. At the end of each frame electron beam returns to top left corner and begins the next frame.



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.

Picture definition is stored in 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 the refresh buffer and “painted” on the screen one row (scan line) at a time as shown in the following illustration.

Each screen point is referred to as a pixel (picture element) or pel. At the end of each scan line, the electron beam returns to the left side of the screen to begin displaying the next scan line.

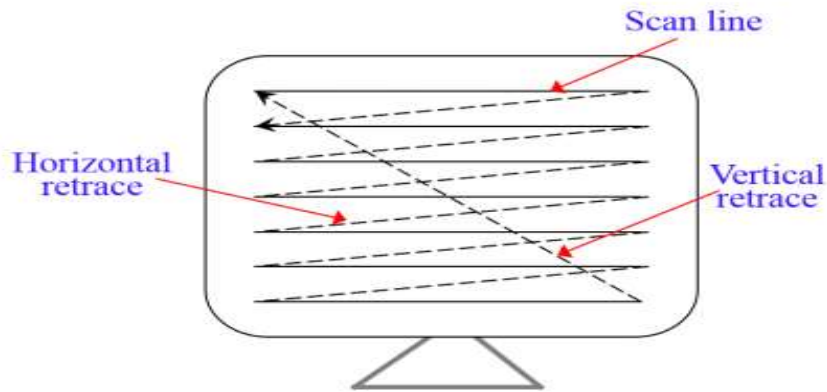
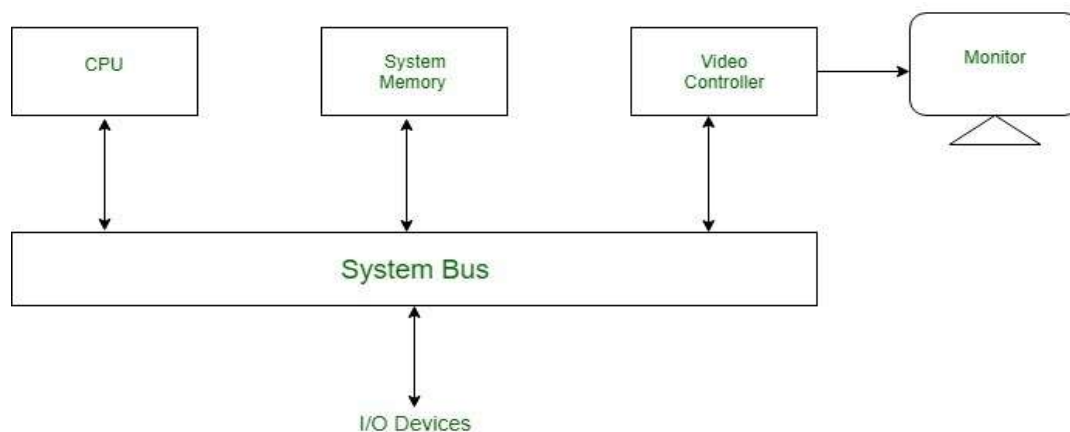


Figure: Raster Scan

Raster-Scan Display Processor:

An important function of display process is to digitize a picture definition given in an application program into a set of pixel-intensity values for storage in refresh buffer. This process is referred to as **scan conversion**. The purpose of display processors is to relieve the CPU from graphics jobs.

Display processors can perform various other tasks like: creating different line styles, displaying color areas, etc. Typically display processors are utilized to interface input devices, such as mouse, joysticks.



ADVANTAGES:

- Real life images with different shades can be displayed.
- Color range available is bigger than random scan display.

DISADVANTAGES:

- Resolution is lower than random scan display.
- More memory is required.
- Data about the intensities of all pixel has to be stored.

Random Scan(Vector Scan)

In **Random-Scan Display** electron beam is directed only to the areas of screen where a picture has to be drawn. It is also called vector display, as it draws picture one line at time. It can draw and refresh component lines of a picture in any specified sequence. Pen plotter is an example of random-scan displays.

The number of lines regulates refresh rate on random-scan displays. An area of memory called **refresh display files** stores picture definition as a set of line drawing commands. The system returns back to first-line command in the list, after all the drawing commands have been processed. High-quality vector systems can handle around 100, 00 short lines at this refresh rate. Faster refreshing can burn phosphor. To avoid this every refresh cycle is delayed to prevent refresh rate greater than 60 frames per second.

Suppose we want to display a square ABCD on the screen. The commands will be:

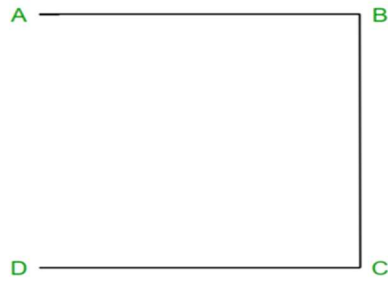
- Draw a line from A to B



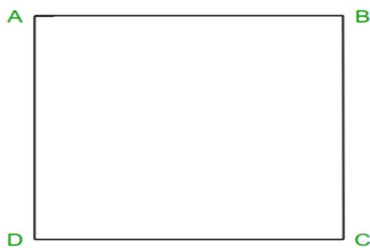
- Draw a line from B to C



- Draw a line from C to D



- Draw a line from D to A



In this technique, the electron beam is directed only to the part of the screen where the picture is to be drawn rather than scanning from left to right and top to bottom as in raster scan. It is also called vector display, stroke-writing display, or calligraphic display.

Picture definition is stored as a set of line-drawing commands in an area of memory referred to as the refresh display file. To display a specified picture, the system cycles through the set of commands in the display file, drawing each component line in turn.

After all the line drawing commands are processed, the system cycles back to the first line command in the list. Random-scan displays are designed to draw all the component lines of a picture 30 to 60 times each second.

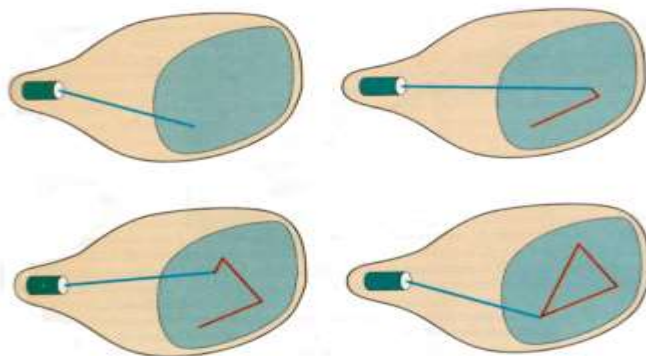


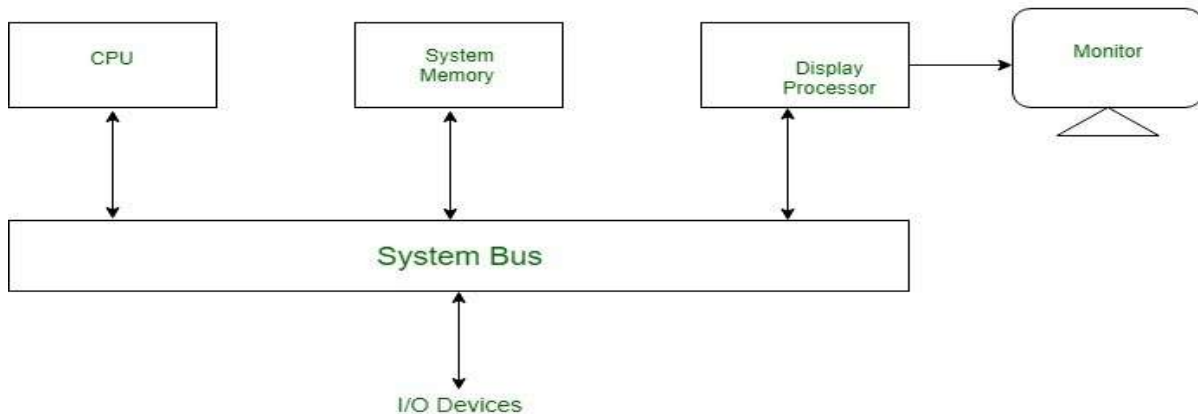
Figure: Random Scan

Random-Scan Display Processors:

Input in the form of an application program is stored in the system memory along with graphics package. Graphics package translates the graphic commands in application program into a display file stored in system memory. This display file is then accessed by the display processor to refresh the screen. The display processor cycles through each command in the display file program. Sometimes the display processor in a random-scan is referred as *Display Processing Unit / Graphics Controller*.

The structure of a simple random scan is shown below:

The structure of a simple random scan is shown below:



ADVANTAGES:

- Higher resolution as compared to raster scan display.
- Produces smooth line drawing.
- Less Memory required.

DISADVANTAGES:

- Realistic images with different shades cannot be drawn.
- Color limitations.

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. |