Applications of Computer Graphics

1. **Computer Art:**
   Using computer graphics we can create fine and commercial art which include animation packages, paint packages. These packages provide facilities for designing object shapes and specifying object motion.Cartoon drawing, paintings, logo design can also be done.

1. **Computer Aided Drawing:**
   Designing of buildings, automobile, aircraft is done with the help of computer aided drawing, this helps in providing minute details to the drawing and producing more accurate and sharp drawings with better specifications.

2. **Presentation Graphics:**
   For the preparation of reports or summarising the financial, statistical, mathematical, scientific, economic data for research reports, managerial reports, moreover creation of bar graphs, pie charts, time chart, can be done using the tools present in computer graphics.

3. **Entertainment:**
   Computer graphics finds a major part of its utility in the movie industry and game industry. Used for creating motion pictures , music video, television shows, cartoon animation films. In the game industry where focus and interactivity are the key players, computer graphics helps in providing such features in the efficient way.

4. **Education:**
   Computer generated models are extremely useful for teaching huge number of concepts and fundamentals in an easy to understand and learn manner. Using computer graphics many educational models can be created through which more interest can be generated among the students regarding the subject.

5. **Training:**
   Specialised system for training like simulators can be used for training the candidates in a way that can be grasped in a short span of time with better understanding. Creation of training modules using computer graphics is simple and very useful.

6. **Visualisation:**
   Today the need of visualise things have increased drastically, the need of visualisation can be seen in many advance technologies , data visualisation helps in finding insights of the data , to check and study the behaviour of processes around us we need appropriate visualisation which can be achieved through proper usage of computer graphics

7. **Image Processing:**
   Various kinds of photographs or images require editing in order to be used in different places. Processing of existing images into refined ones for better interpretation is one of the many applications of computer graphics.

8. **Machine Drawing:**
   Computer graphics is very frequently used for designing, modifying and creation of various parts of machine and the whole machine itself, the main reason behind using computer graphics for this purpose is the precision and clarity we get from such drawing is ultimate and extremely desired for the safe manufacturing of machine using these drawings.

9. **Graphical User Interface:**
   The use of pictures, images, icons, pop-up menus, graphical objects helps in creating a user friendly environment where working is easy and pleasant, using computer graphics we can create such an atmosphere where everything can be automated and anyone can get the desired action performed in an easy fashion.

Display Devices in Computer Graphics

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

Raster Scan Display

Raster can be explained as a rectangular collection of dots or points plotted.

An image is subdivided into various horizontal lines which are referred to as **scan lines** which are then further divided into different **pixels** which helps in the processing of an image.

Basic working of Raster Scan

- In this system, a beam of an electron is moved across the screen. It moves from top to bottom considering one row at a time.
- As the beam of electron moves through each row, its intensity is alternatively turned on and off which helps to create a pattern of spots that are illuminated.
  When each scan of the line is refreshed it returns to the left side of the screen. This motion is known as **Horizontal retrace**.
- As a particular frame ends, the beam of electron moves to the left top corner of the screen to move to another frame. This motion is referred to as **Vertical retrace**.
- The picture is then stored in an area of memory which is referred to as the **frame buffer** or **refresh buffer**.
- The buffer in a raster scan is that area that is responsible for containing intensity of the various points on the screen.
- The values stored in the buffer are then fetched and traced over scan lines one by one on the screen.

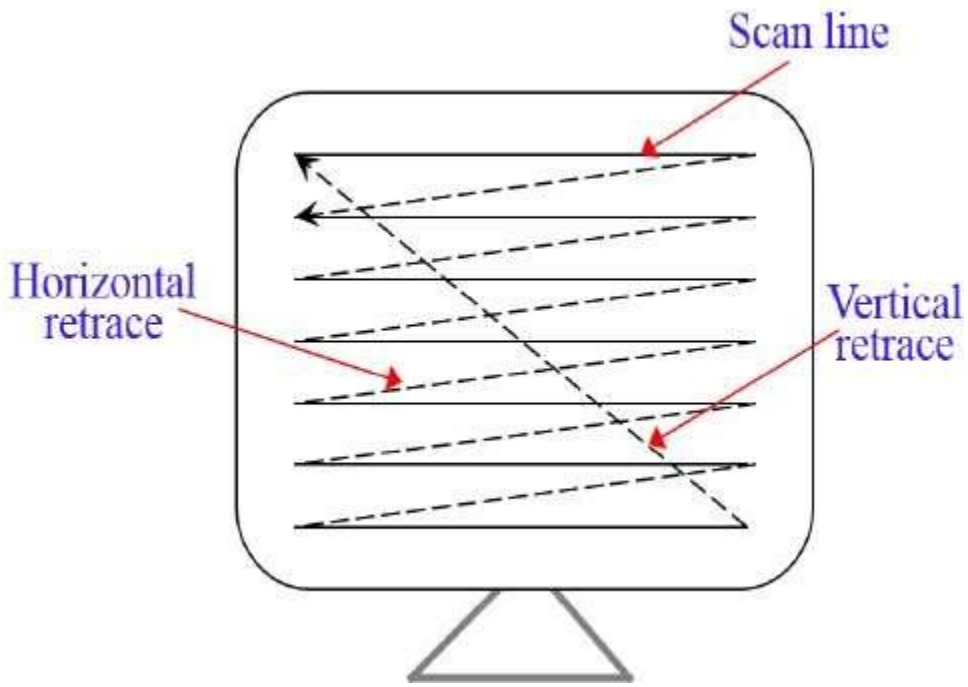

Image source: https://www.tutorialspoint.com/computer_graphics/computer_graphics_basics.htm

- The image formed through this raster scan is known as a raster image. The quality of this image is determined by the number of pixels which is termed as the **resolution of the image**.
- The amount of information each pixel represents is known as the **color depth of the image**.
- The raster graphics system of high quality contains 24 bits per pixel in the frame buffer. This is referred to as a **full color** or **true color** system. Refreshing of raster scan displays is carried out at the rate of 60 to 80 frames per second.

Random Scan Display

In Random Scan Display a beam of the electron is directed only to the screen areas where any picture has to be displayed or drawn on the screen. It is also termed as vector display, as it displays or draws a picture in the form of one line at a time. It can draw and refresh lines on the screen of a picture in any sequence not particularly specific.

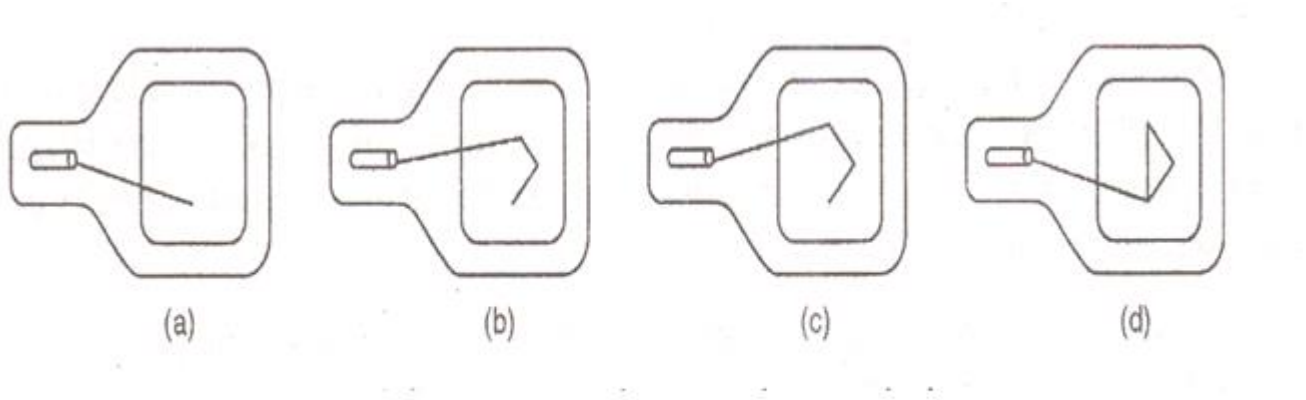

Fig: Random Scan Display

Basic working of random scan display

- Random scan monitors are used to draw a picture in one line at a time and are thus also referred to as **vector displays**.
- The cathode ray tube when operates as a random scan display device directs the beam of an electron only to those areas of the screen where display or a picture has to be drawn.
- To draw a picture or display it on the screen the system goes through a line or set of commands and draws each of them one at a time in a line turn by turn.

The **refresh rate** here depends on the number of lines that are to be displayed on the screen and are designed so that they draw the component lines of the picture 30 to 60 times in a second.

They have a high resolution of pictures and produce smooth line drawing. It's that smooth that while zooming also it doesn't spread.

Input Devices in Computer Graphics

An Input device is the piece of computer hardware equipment used to give input to the computer. The input can be in the form of graphics, text, sound, audio, video, and image, etc. **"Input devices are those devices through which we can give the data and instructions to the computer."**
For Example- Mouse, Trackball, Keyboard, Light pen, etc.

Classification of Input Devices

- Manual data entry devices
- Direct data entry devices

Manual Data Entry Devices

Manual input devices are those peripheral devices through which the user can enter the data manually (by hand) at the time of processing.
It also includes-
Keyboard: It is the commonly used input device. It is designed to input text and characters.
A keyboard contains approx. 108 keys. **For Example**- Alphanumeric keys, Numeric keys, Function key, and cursor key, etc.
Types of keys: These keys include:
Alphanumeric keys: These are located in the center of the keyboard. These keys consist of alphabet (A-Z), Number (0-9), and symbols (@, #, $, %, ^, &, *, !, =, +).
Numeric Keys: A part of keypad contains 17 numeric keys. In which we can include number up to 0-9, mathematics operator like +, -, /, *, and enter key.
Function keys: These keys are placed at the top of the keyboard. In which we can include F1, F2 up-to F12. The function key performs many tasks according to the software.
Cursor Keys: The cursor keys include Up, Down, Left, and Right. These are used to move the cursor on the screen.
Types of Keyboard: The type of keyboard is:
1. Normal Keyboard: These are the commonly used keyboard. It is used by the user in their PCs. It contains 108 keys. The normal keyboards are connected to the CPU through the wire.

2. Wireless Keyboard: The wireless keyboard connected to the computer without the wire. It works for a limited distance. It is more expensive than a normal keyboard. The user faces technical complexity in it.

3. Ergonomic Keyboard: It gives the user comfort and ease during the typing; that's why it is called the "Ergonomic keyboard." This keyboard is used to increase the efficiency of the user. It also reduces wrist pain during typing.

Advantages of Keyboards

1. Easy to use
2. Enable fast data input
3. Well tried technology

Disadvantages of Keyboards

1. Sometimes it is difficult to use
2. Need desk space to keep

Mouse: It is used as a popular pointing device. It is used to create images, graphics as well as to click on any button or menu. The mouse has two or three buttons.
Functions of the mouse:

- Clicking
- Double Clicking
- Right Clicking
- Dragging
- Scrolling

Types of Mouse
There are three type of mouse are as follow:

- Mechanical Mouse
- Optical Mouse
- Wireless Mouse

1. Mechanical Mouse: This mouse has a rubber ball at the bottom, when we rotate the mouse on the surface than the rubber ball also rotates inside the shell. Now the sensors inside the mouse give a signal to the computer.

2. Optical Mouse: It is a type of Non-mechanical mouse. A light beam is emitted from the surface below it. Based on the light beam, the mouse determines the distance and speed of the object.

3. Wireless Mouse: This mouse communicates to the computer with the help of radio-frequency.
It has two main components:
Transmitter- It is used to send the information of the mouse's speed and its click in the form of an electromagnetic signal.
Receiver: It connects to the computer and used to receive the signals sent by the transmitter.
Advantages of Mouse

1. Easy to use.
2. Less Expensive.
3. The Cursor moves faster than the arrow keys of the keyboard.

Disadvantages of Mouse

1. Required flat surface to move
2. Needs regularly cleaning
3. Damaged easily

Joystick: It is a pointing device. It is used to play video games. It has a rounded ball at both ends. The joystick can be moved in all directions.
The Joystick is similar to a mouse. It is also used in computer-aided designing (CAD).