

# Chapter 1

## Introduction to Computer Graphics

### Introduction

- Computer Graphics is a field that is concerned with all aspects of producing pictures or images using a computer with the help of data structure and programming. i.e.

**Computer graphics = Data Structure + Graphics Algorithm + Language where**

**Data Structure** means those data structures that are suitable for computer graphics.

**Graphics algorithm** for picture generation and transformation

**Languages** i.e. high level language for generation of graphics objects or picture.

- Computer graphics is the use of computer to define/create, store, manipulate and present pictorial output.
- We use different input and display devices to generate & perform the modification on the digital images. Some such devices are keyboard, mouse, or touch sensitive panel, monitors etc.
- Computer graphics can be broadly classified into **interactive and non-interactive computer graphics**.
- In interactive computer graphics, the user controls the contents, structure, and appearance of images of the objects by using input devices, such as keyboard, mouse, or touch sensitive panel on the screen. Interactive Computer Graphics involves a two-way communication between computer and user for example, the video game controller of the ping pong game.
- In non-interactive computer graphics, the user does not have any kind of control over the image. Image is simply the result of static stored program and the image is totally under the control of program instructions not under the user. Example: Screen savers.

### Advantage of computer graphics

- It provides tools for producing an image.
- It has ability to show moving pictures and thus it is possible to produce animations with computer graphics.
- With computer graphics, it is possible to change this shape, color or other properties of the objects being viewed.
- With computer graphics, user can also control the animation speed, portion of the view, the geometric relationship the object in the scene to one another, the amount of detail shown and on.
- With computer graphics, we can simulate a new complex system and study it which would be otherwise impossible.

### Application of Computer Graphics

- There is no area in which graphical displays can't be used to some advantage.
- Some major application of computer graphics are as follows.
  1. Computer Aided Design(CAD)
    - CAD is used to design 2D and 3D drawings of various engineering applications like structural and industrial design like design of aircrafts, ships, IC chip, circuit design, etc.
    - These designs are more frequently used to test structural, electrical and thermal properties of system.
  2. Presentation Graphics
    - Presentation graphics is used to produce illustration for reports or generate slides for use with projector.
    - It is generally used to summarize financial, statistical, mathematical, scientific, and economic data for different types of reports.
    - Typical example of presentation graphics are bar charts, line graphs, pie charts etc.
  3. Computer Art
    - Computer art are widely used in both fine art and commercial art applications.
    - Artist use variety of computer methods, including special purpose hardware, specially developed software, artist's paint brush program, CAD packages, animation packages etc. that provide facilities for designing objects shapes and specifying object motions.

4. Entertainment
  - Computer graphics are now commonly used in making motion pictures, music videos, and television shows.
  - Computer graphics can be used to display the scene which would be otherwise impossible.
5. Education and training
  - Different computer graphics and images are used in schools and many training center for the better understanding the subject of interest.
  - It helps trainees to understand the operation of system easily.
6. Computer Simulation
  - Computer graphics attempts to simulate an abstract model of a complex system.
  - Simulations can be done for practice session or training of aircraft pilot, ship captain, heavy equipment operators etc.
7. Visualization
  - Scientist, engineers, medical personnel, business analyst, and other often need to analyze large amount of data or information or study the behavior of certain process.
  - Producing graphical representation for scientific, engineering and medical data sets and processes is called scientific visualization. And the term business visualization is used in connection with datasets related to commerce, industry etc.
8. Cartography
  - Cartography is the subject which deals with making maps.
  - Computer graphics is used to produce accurate and schematic representation of geographical and other natural phenomena from measurement data.
  - For example, Geographical map.
9. Virtual Reality
  - Virtual reality (VR) is a technology which allows a user to interact with a computer-simulated environment.
  - The simulated environment can be similar to the real world, for example, simulations for pilot.
10. Image Processing
  - A Digital image processing is meant for processing digital image by a digital computer which mainly focuses on improvements of pictorial information for human interpretation and machine perception of visual information.
  - Image processing can be applied to modify or interpret and existing pictures.
  - Computer graphics is used to create a picture; image processing applies techniques to modify or interpret the existing pictures.

### **Relation between computer graphics and Image Processing**

1. Computer Graphics is a field that is concerned with all aspects of producing pictures or images using a computer with the help of data structure and programming.  
A Digital image processing is meant for processing digital image by a digital computer which mainly focuses on improvements of pictorial information for human interpretation and machine perception of visual information.
2. Computer graphics focuses on creating image.  
Image processing applies techniques to modify or interpret the existing pictures.
3. The input of a computer graphics system consists of an item list that describes a scene and its purpose is to transform this list into a digital image.  
The input to an Image Processing system is always a real image formed via some physical phenomenon such as scanning, filming, etc.
4. CG includes the creation, storage and manipulation of images or object.  
DIP is the part of computer graphics that handles image manipulation.
5. Example of CG: Drawing a line

Example of DIP: Making a blurred image

### Assignment-1

- **History of Computer Graphics**

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