

Graphics and Multimedia

Course Overview

- Introduction to Computer Graphics
- Scan Conversion
- 2D Transformations
- 2D Viewing
- 3D Transformation & Viewing
- Curves
- Hidden Surface
- Colouring and Shading Models
- Multimedia
- Audio
- Video
- Animation

Unit- 1: Introduction to Computer Graphics and Graphics System

Computer Graphics, Image processing and Visualisation, Interactive and non-interactive graphics, RGB Colour Model, Direct Coding, Lookup tables, Graphics Devices

Learning Objectives

At the end of this topic, you will be able to:

- Overview of Computer Graphics
- Explain the Interactive and Non-interactive Graphics
- Discuss Visualisation and Image processing
- Discuss Direct and lookup tables
- Explain Graphics Devices

Computer Graphics

The term computer graphics includes almost everything on computers that is not text or sound. Today, almost every computer can do some graphics, and people have even come to expect to control their computer through icons and pictures rather than just by typing. Here in our lab at the Program of Computer Graphics, we think of computer graphics as drawing pictures on computers, also called rendering.

The pictures can be photographs, drawings, movies, or simulations - pictures of things that do not yet exist and may never exist. Or they may be pictures from places we cannot see directly, such as medical images from inside your body. We spend much of our time improving the way computer pictures can simulate real-world scenes.

What is Computer Graphics?

- Creation, Manipulation, and Storage of geometric objects (modelling) and their images (rendering)
- Display those images on screens or hardcopy devices
- Image processing
- Others: GUI, Haptics, Displays (VR)...

What drives computer graphics?

Movie Industry

- Leaders in quality and artistry
- Not slaves to conceptual purity
- Big budgets and tight schedules
- Reminder that there is more to CG than technology
- Hey, how'd they do that?
- Defines our expectations

What drives computer graphics?

Game Industry

- The newest driving force in CG
 - Why? Volume and Profit
- This is why we have commodity GPUs
- Focus on interactivity
- Cost-effective solutions
- Avoiding computation and other tricks
- Games drive the baseline

What drives computer graphics?

Medical Imaging and Scientific Visualisation

- Tools for teaching and diagnosis
- No cheating or tricks allowed
- New data representations and modalities
- Drive issues of precision and correctness
- Focus on presentation and interpretation of data
- Construction of models from acquired data

What drives computer graphics?

Computer-Aided Design

- Mechanical, Electronic, Architecture,...
- Drives the high end of the hardware market
- Integration of computing and display resources
- Reduced design cycles == faster systems, sooner

Image Processing and Visualisation

- Computer graphics is a collection, contribution, and representation of real or imaginary objects from their computer-based models.
- However, the related field of image processing, sometimes called picture analysis, concerns the analysis of scenes or the reconstruction of models of 2D or 3D objects from their picture. The image processing can be classified as-
 - Image enhancement
 - Pattern recognition
 - Scene Analysis

Interactive Graphics

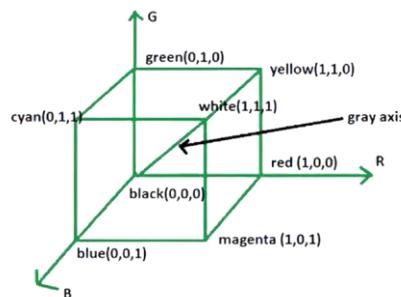
In interactive computer graphics, users have some control over the picture, i.e. user can make any change in the produced image. One example of it is the ping pong game.

Non-Interactive (Passive) CG

A computer graphics operation that transfers automatically and without operator intervention. Non-interactive computer graphics involves one-way communication between the computer and the user. The picture is produced on the monitor, and the user does not have any control over the produced picture, for eg. In TV

RGB Colour Model

The RGB colour model is one of the most widely used colour representation methods in computer graphics. It uses a colour coordinate system with three primary colours.



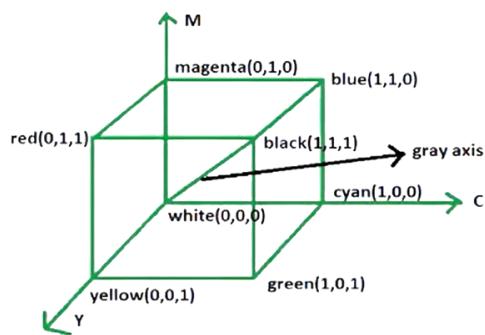
RGB Colour Model (continued)

- Typical RGB input devices are video cameras, image scanners, and digital cameras
- Typical RGB output devices are TV sets of various technologies (CRT, LCD, plasma, and so on), computer and mobile phone displays, video projectors, multicolour LED displays, and large screens such as Jumbotron.
- Colour printers, on the other hand, are not RGB devices, but subtractive colour devices (typically CMYK colour model).

CMY Colour Model

- The CMY colour model uses a subtraction process, and this concept is used in the printer.
- In the CMY model, we begin with white and take away the appropriate primary components to yield a desired colour.

The corner of the CMY colour cube that is at $(0, 0, 0)$ corresponds to white, whereas the corner of the cube that is at $(1, 1, 1)$ represents black.



Conversion between RGB and CMY Colour Model

[Slide shows the matrix conversion: $C = 1 - R$, $M = 1 - G$, $Y = 1 - B$ (matrix form)]

Director Coding:

In computer graphics, direct coding is an algorithm that allocates storage space for each pixel so that it can be assigned a colour.

Images are just collections of pixels with colours. For example, one may allocate 3 bits for each pixel, with one bit for each primary colour.

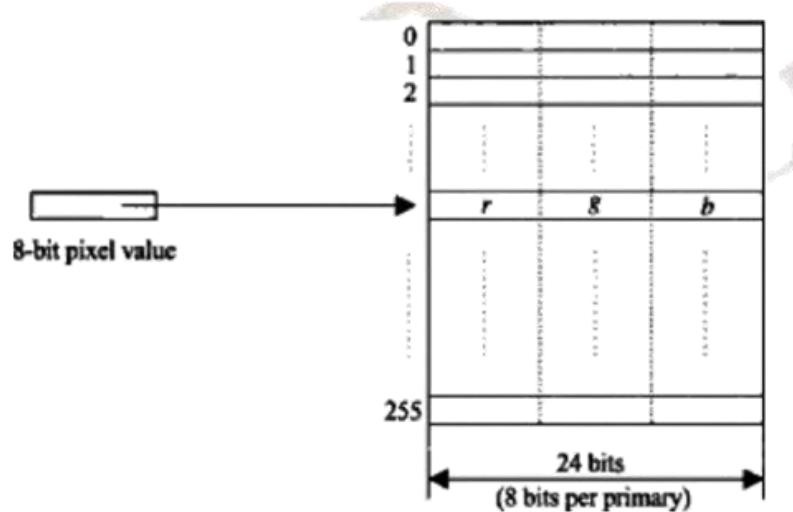
bit 1: r	bit 2: g	bit 3: b	color name
0	0	0	black
0	0	1	blue
0	1	0	green
0	1	1	cyan
1	0	0	red
1	0	1	magenta
1	1	0	yellow
1	1	1	white

Direct coding of colors using 3 bits.

Lookup Tables:

Image representation using a lookup table can be viewed as a compromise between the desire to have lower storage requirements and the need to support a reasonably sufficient number of simultaneous colours.

In this approach, pixel values do not code colours directly. Instead, they are addresses or indices in a table of colour values. The colour of a particular pixel is determined by the colour value in the table entry that the value of the pixel references.



24-bits 256-entry lookup table

Graphics Devices

Input Devices	Output Devices
Keyboard	Monitors
Mouse	<ul style="list-style-type: none"> Printers [SEP] Dot-Matrix Printers Inkjet Printers Drum Printers Laser Printers
Trackball	<ul style="list-style-type: none"> Plotters Drum Plotters Flatbed Plotters
Joysticks	
Data Glove	

Digitizers	
Image Scanners	
Touch Panels	
Light Pens	

Types of Graphics Software are:

- Vector graphics software
- Raster graphics software
- 3D graphics software
- Animation software

Terminal Questions:

1. Give the overview of computer graphics
2. List The advantages of interactive graphics
3. Explain the image processing as picture analysis
4. Define visualisation
5. Explain RGB colour model
6. Explain direct coding and lookup tables
7. How has graphics improvised the field of architecture
8. What are the two types of graphic input devices
9. Explain scientific visualisation
10. What are the different types of computer software