COMPUTER GRAPHICS

COURSE OVERVIEW

What is this course About?

The primary goal of computer graphics is to introduce many important data structures and algorithms that are useful for presenting data visually on a computer, computer graphics does not cover the use of *graphics design* applications such as Photoshop and AutoCAD. Nor, does it focus on the various graphics programming interfaces or graphics languages such as OpenGL or Renderman. In short, computer graphics is a programming class. The goal of this class is to provide you with sufficient background to write computer graphics applications.

Roughly speaking, the first half of this course will address a broad range of topics that that we refer to as *Raster Methods*. These include introduction to graphics, interactive building blocks, Basic raster graphic algorithms, scan conversion algorithm, two dimensional computer graphics, raster operations, Transformation, geometrical representation, matrices, Clipping algorithms. The second half of the course will cover topics related to three-dimensional computer graphics, including 3d representation, illumination, shading, visibility determination, projection techniques, raytracing and animation concepts.

This is a lot of stuff to cover in 36 class meetings, and you can expect the pace to be frantic at times. But, I am sure that you will find that computer graphics is a blast.

What do I need to know before I take this course?

You must be familiar with elementary algebra, geometry, trigonometry, and elementary calculus. Some exposure to vectors and matrices is useful, but not essential, as vector and matrix techniques will be introduced in the context of graphics as needed.

You must have at least an experience of writing computer programs in C, C++, or Java. Ideally, you have taken Computer Graphics or equivalent. We will mostly use C/C++ throughout the course, but much material will be familiar to someone whose computer language background is Java.

You need to be familiar with programming constructs such as memory allocation, reading and writing of files, pointers, structures, pointers to functions, or object oriented programming. We also assume that you can read the C/C++ code fragments that are handed out without problems. For any basic programming related questions we refer you to a textbook on C/C++.

Objectives

By the end of semester, students should:

- Have an understanding of the computer graphics its application ,interactive building block.
- Have an understanding of the operation of graphics hardware devices and software used.
- Have experience with implementing 2D graphics algorithms including scan conversion, clipping , transformation , representation , matrices.
- Have experience with implementing 3D graphics algorithms including hidden surface removal, ray tracing , representation , matrices ,projection
- Have knowledge of the major application areas of computer Animation including key frame animations and tricks.

SYLLABUS

Content

UN1 Introduction and Image Representation

Introduction to computer graphics and its applications, Interactive graphics, Raster graphics, Basic raster graphics algorithms for drawing 2D primitives -Scan conversion algorithms of line circle and ellipse

UNII Graphics Hardware

Graphic display devices - Hardcopy technologies, display technologies, raster and random- scan display systems, Video controller

UNIII Clipping

Windowing and clipping - Clipping in a raster world, Clipping lines, Cyrus beck and Cohen - Sutherland Algorithms

UN IV Two-dimensional Transformations And Viewing

20 Geometrical Transformations, Matrix representations, Composition of 20 transformations, Window-to-Viewport transformation, Matrix representation of 3D Geometrical transformations, Viewing in 3D

Projection

Introduction to Projections, Perspective projections, Parallel projections.

UN V Geometric Representations

Hidden line/ surface removal method - Z-buffer algorithm, Introduction to Ray-tracing Illumination and Shading: Illumination models

UN VI Curves and Models

Curves and Surfaces: Polygon meshes, Parametric Cubic curves, Hermite curves, Bezier curves, Animation: Introduction and Key frame animation.