**CHAPTER 2**

**LITERATURE SURVEY**

People use the term “computer graphics” to mean different things in different context. Computer graphics are pictures that are generated by a computer. Everywhere you look today, you can find examples, especially in magazines and on television. Some images look so natural you can’t distinguish them from photographs of a real scene. Others have an artificial look, intended to achieve some visual effects.

There are several ways in which the graphics generated by the program can be delivered.

* Frame- by- frame: A single frame can be drawn while the user waits.
* Frame-by-frame under control of the user: A sequence of frames can be drawn, as in a corporate power point presentation; the user presses to move on to the next slide, but otherwise has no way of interacting with the slides
* Animation: A sequence of frames proceeds at a particular rate while the user watches with delight.
* Interactive program: An interactive graphics presentation is watched, where the user controls the flow from one frame to another using an input device such as a mouse or keyboard, in a manner that was unpredictable at the time the program was written. This can delight the eye.

**2.1 History**

OpenGL was developed by **‘Silicon Graphics Inc‘**(SGI) on 1992 and is popular in the gaming industry where it competes with the Direct3D in the Microsoft Windows platform. OpenGL is broadly used in CAD (Computer Aided Design), virtual reality, scientific visualization, information visualization, flight simulation and video games development.

OpenGL is a standard specification that defines an API that is multi-language and multi-platform and that enables the codification of applications that output computerized graphics in 2D and 3D.

The interface consists in more than 250 different functions, which can be used to draw complex tridimensional scenes with simple primitives. It consists of many functions that help to create a real world object and a particular existence for an object can be given.

**2.2 Characteristics**

* OpenGL is a better documented API.
* OpenGL is also a cleaner API and much easier to learn and program.
* OpenGL has the best demonstrated 3D performance for any API.
* Microsoft's Direct3D group is already planning a major API change called Direct Primitive that will leave any existing investment in learning Direct3D immediate mode largely obsolete.

**2.3 Computer Graphics Library Organisation**

OpenGL stands for Open Source Graphics Library. Graphics Library is a collection of APIs (Application Programming Interfaces).

Graphics Library functions are divided in three libraries. They are as follows-

1. GL Library (OpenGL in Windows)
2. GLU (OpenGL Utility Library)
3. GLUT ( OpenGL Utility Toolkit)

Functions in main GL library name function names that begin with the letter ‘gl’.

* GLU library uses only GL functions but contains code for creating objects and simplify viewing.
* To interface with the window system and to get input from external devices GLUT library is used, which is a combination of three libraries GLX for X windows, ‘wgl’ for Windows and ‘agl’ for Macintosh.
* These libraries are included in the application program using preprocessor directives. E.g.: #include<GL/glut.h>
* The following figure shows the library organization in OpenGL.

Open GL application

program

GLU

GL

GLX

GLUT

Xlib, Xtk

Frame

Buffer

Fig 2.1 Library Organization

**2.4 Graphics System and Functions**

* Graphics system and functions can be considered as a black box, a term used to denote a system whose properties are only described by its inputs and output without knowing the internal working.
* Inputs to graphics system are functions calls from application program, measurements from input devices such as mouse and keyboard.
* Outputs are primarily the graphics sent to output devices.

Application

Program

Graphics

System

Input Output Devices

Function calls

Data

Output

Input

Fig 2.2 Graphics System as a Black Box

API’s are described through functions in its library. These functions are divided into seven major groups.

1. Primitive Functions:

Primitive functions define the low level objects or atomic entities that a system can display, the primitives include line segments, polygons, pixels, points, text and various types of curves and surfaces.

1. Attribute Functions:

Attribute Functions allow us to perform operations ranging from choosing the color to display a line segment, to packing a pattern to fill inside any solid figure.

1. Viewing Functions:

Viewing functions allow us to specify various views.

1. Transformation Functions:

Transformation functions allow us to carry out transformation of objects such as rotation, translation and scaling.

1. Input Functions:

Input functions allow us to deal with the diverse forms of input that characterize modern graphics system. It deals with devices such as keyboard, mouse and data tablets.

1. Control Functions:

Control Functions enable us to communicate with the window system, to initialize the programs, and to deal with any errors that occur during the execution of the program.

1. Query Functions:

Query Functions provides information about the API.