Steam engine simulation using OpenGL

Report submitted in fulfillment of the requirements
for the Computer Graphics Project of

Third Year B.Tech.

by

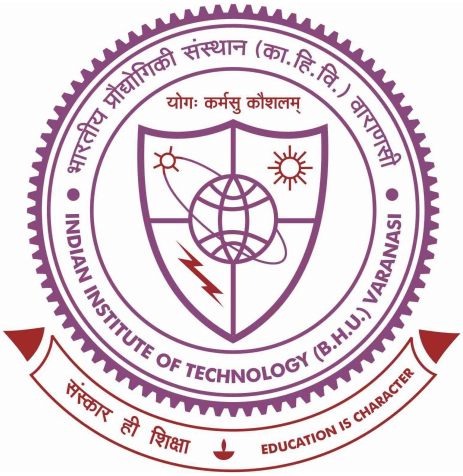
Saurabh Kumar Singh, 16075045

Shrey Tanna, 16075051

Shreyansh Singh, 16075052

Under the guidance of

Dr. Rajeev Srivastava



Department of Computer Science and Engineering
INDIAN INSTITUTE OF TECHNOLOGY (BHU) VARANASI
Varanasi 221005, India

Dedicated to

Our parents, teachers

Certificate

*This is to certify that the work contained in this report entitled "**Steam engine simulation using OpenGL**" being submitted by **Saurabh Kumar Singh, Shrey Tanna, Shreyansh Singh** (**Roll No. 16075045, 16075051, 16075052** respectively) and carried out in the Department of Computer Science and Engineering, Indian Institute of Technology (BHU) Varanasi, is a bona fide work of my supervision.*

Place: IIT (BHU) Varanasi
Date:

Dr. Rajeev Srivastava
Department of Computer Science and Engineering,
Indian Institute of Technology (BHU) Varanasi,
Varanasi, INDIA 221005.

Acknowledgement

We have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and our institute. We would like to extend our sincere thanks to all of them. We are highly indebted to our project supervisor Dr. Rajeev Srivastava for his guidance and constant supervision as well as for providing necessary information regarding the project and also for his support in completing the project.

Place: IIT (BHU) Varanasi

Date: **Saurabh Kumar Singh, Shrey Tanna, Shreyansh Singh**

Contents

List of Figures

Chapter 1

Introduction

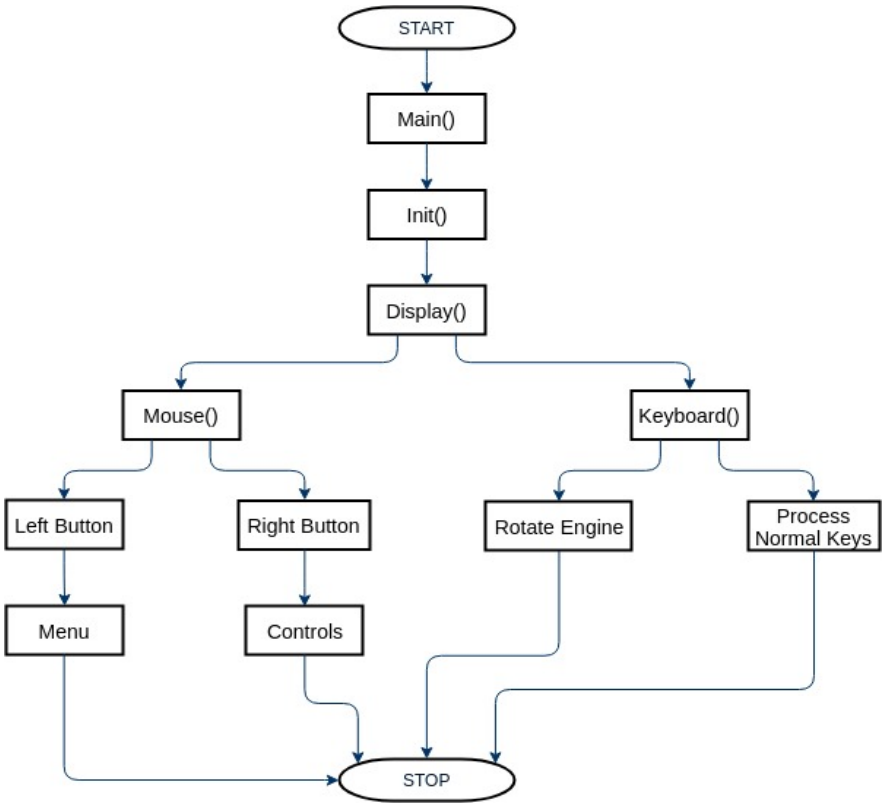
The aim of this project is to create a steam engine using OpenGL [OpenGL] [Kilgard 2008]. The Engine is made up of a Piston, Engine Pole, Cylinder Head, Flywheel, Crank Bell and a Crank. The viewer is allowed to rotate the Engine's Crank either in clock wise or in anti-clock wise direction. The viewer can also slow up or slow down the Crank speed. First a Piston, Engine Pole, Cylinder Head, Flywheel, Crank Bell and a Crank is created using myCylinder() function. The main primitives used inside the myCylinder() function to create a Cylinder is gluCylinder() and gluDisk() . So every time, myCylinder() function is called inside the functions used to create Piston, Engine Pole, Cylinder Head, Flywheel, Crank Bell and Crank. The parts mentioned above are combined to form a Steam Engine image. We can make Steam Engine transparent and display. In display function, at first it clears the drawing buffer and if transparency is set, displays the model twice, first time accepting those fragments with a ALPHA value of 1 only, then with DEPTH BUFFER writing disabled for those with other values. Initially when the animation is not called, the crank angle will not change and the window is idle. When called increments the crank angle by ANGLE STEP, updates the head angle and notifies the system that the screen needs to be updated. When a menu option has been selected, it translates the menu item identifier into a keystroke, then calls the keyboard function. A menu will be associated with the mouse too. The viewer can also see the shaded and textured steam engine The controls are:-

- 'a' - > To rotate crank anti-clock wise.
- 'z' - > To rotate crank clock wise.
- '+' and '-' - > To speed up and speed down

- ‘o’ - > Transparency.
- ‘a’ - > To rotate crank anti-clock wise.
- ‘0’ and 1’ - > Right light and Left light respectively
- ‘s’ and ‘t’ - > Shading and Texture respectively

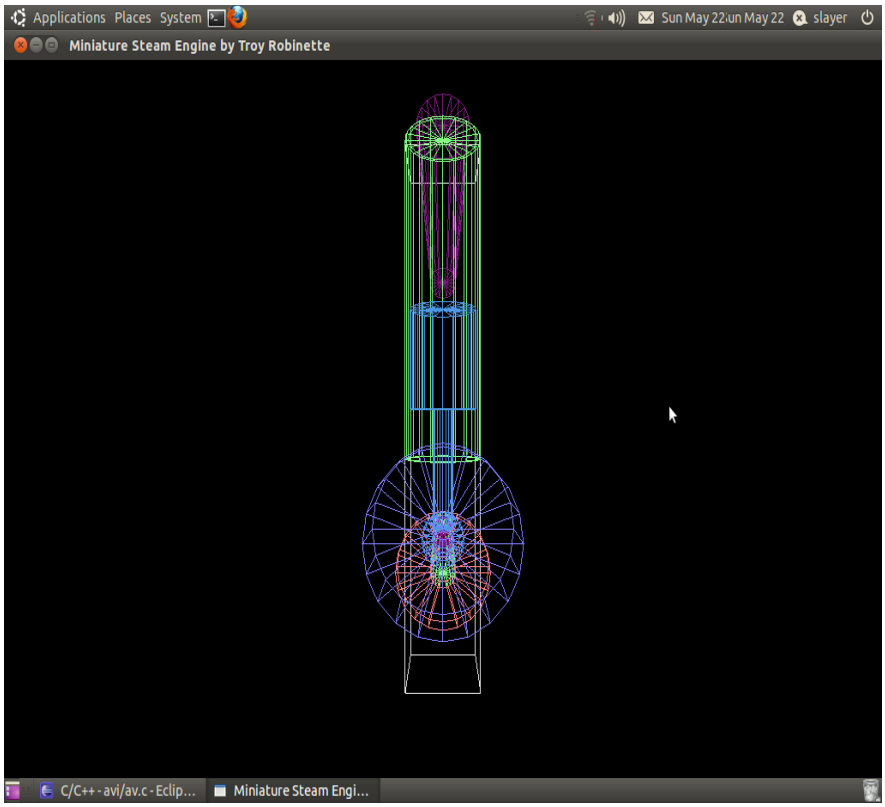
Chapter 2

Software Design



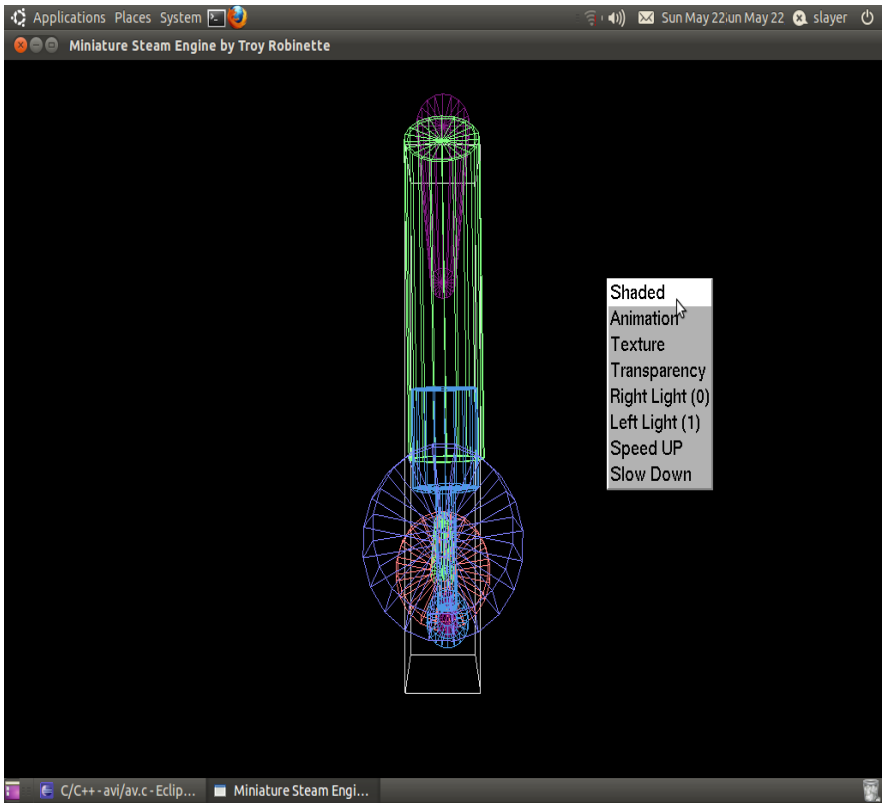
(a)

Figure 2.1: Structure of the code



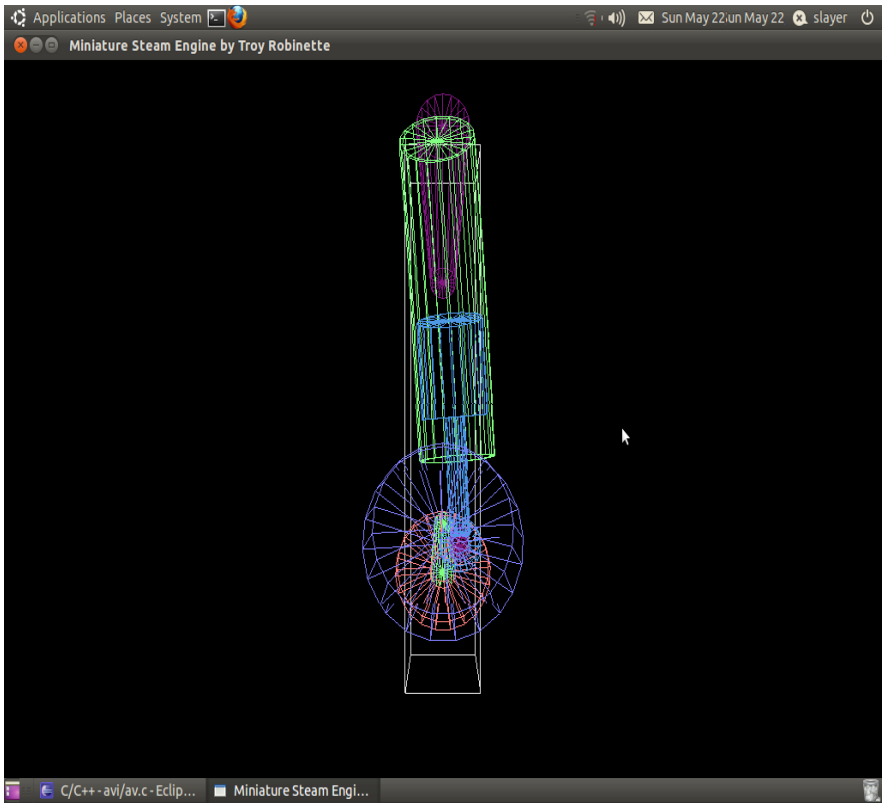
(a)

Figure 2.2: Initial View



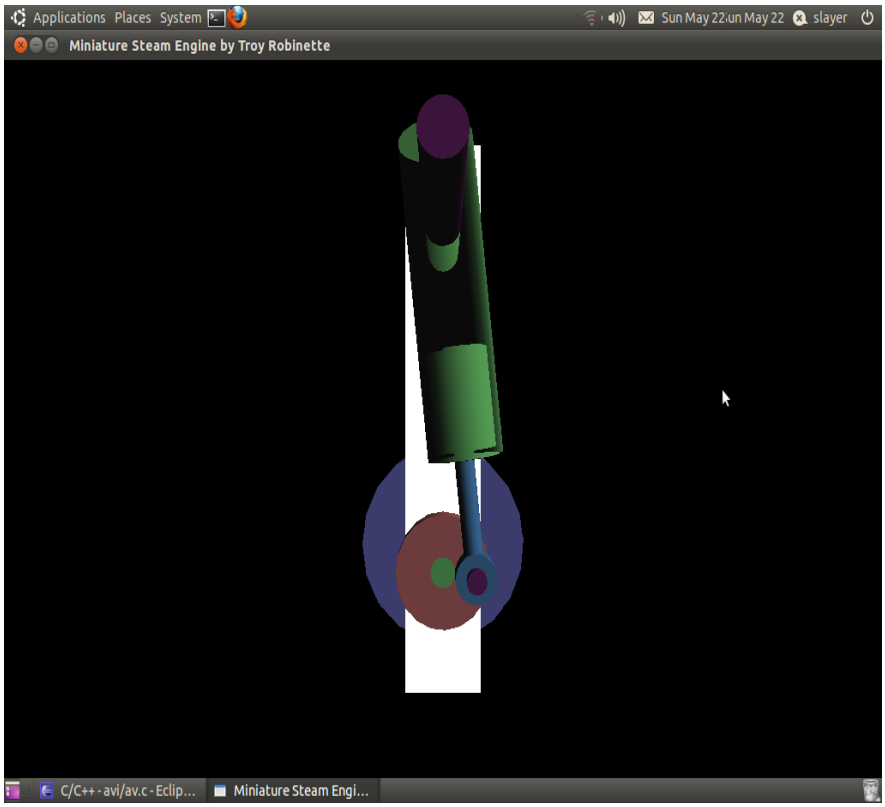
(a)

Figure 2.3: Menu associated with Right Mouse Button



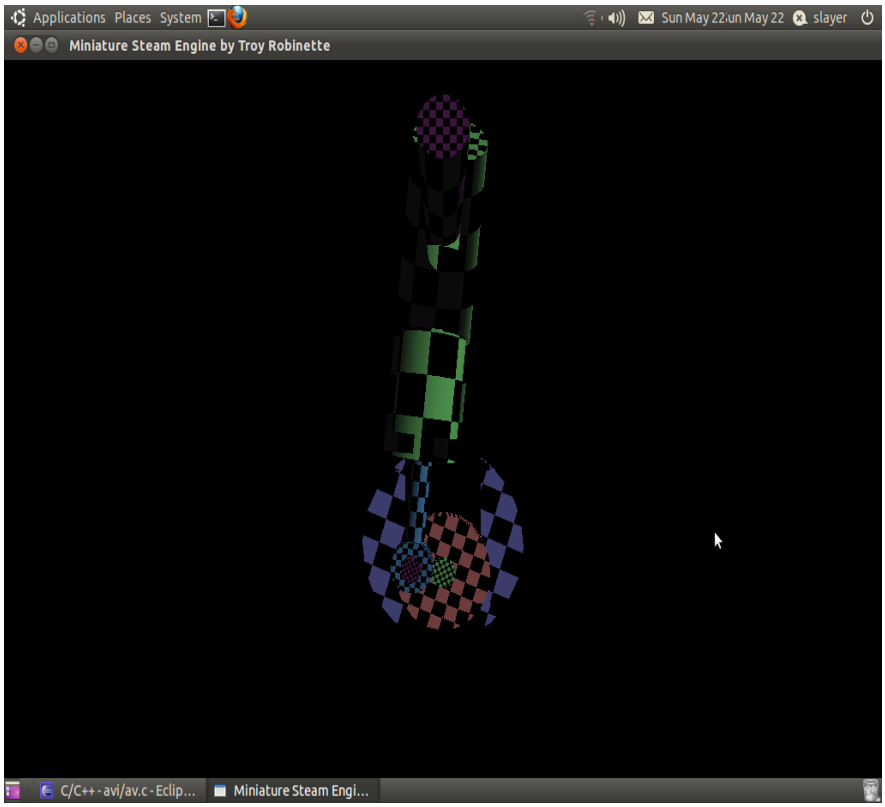
(a)

Figure 2.4: Rotating Steam Engine



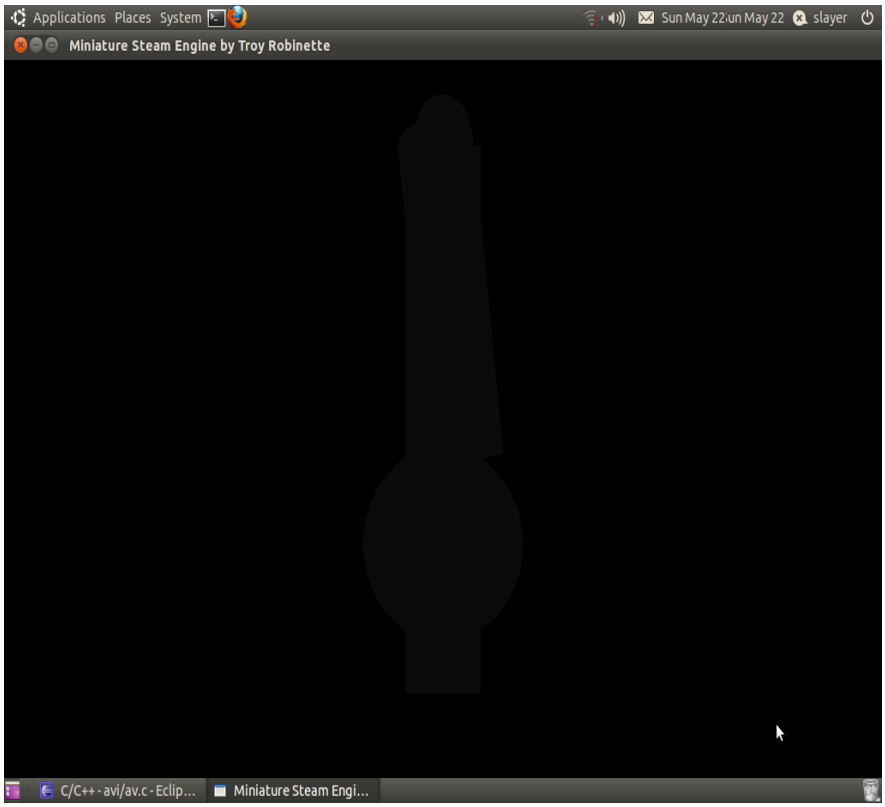
(a)

Figure 2.5: Shading



(a)

Figure 2.6: Texture

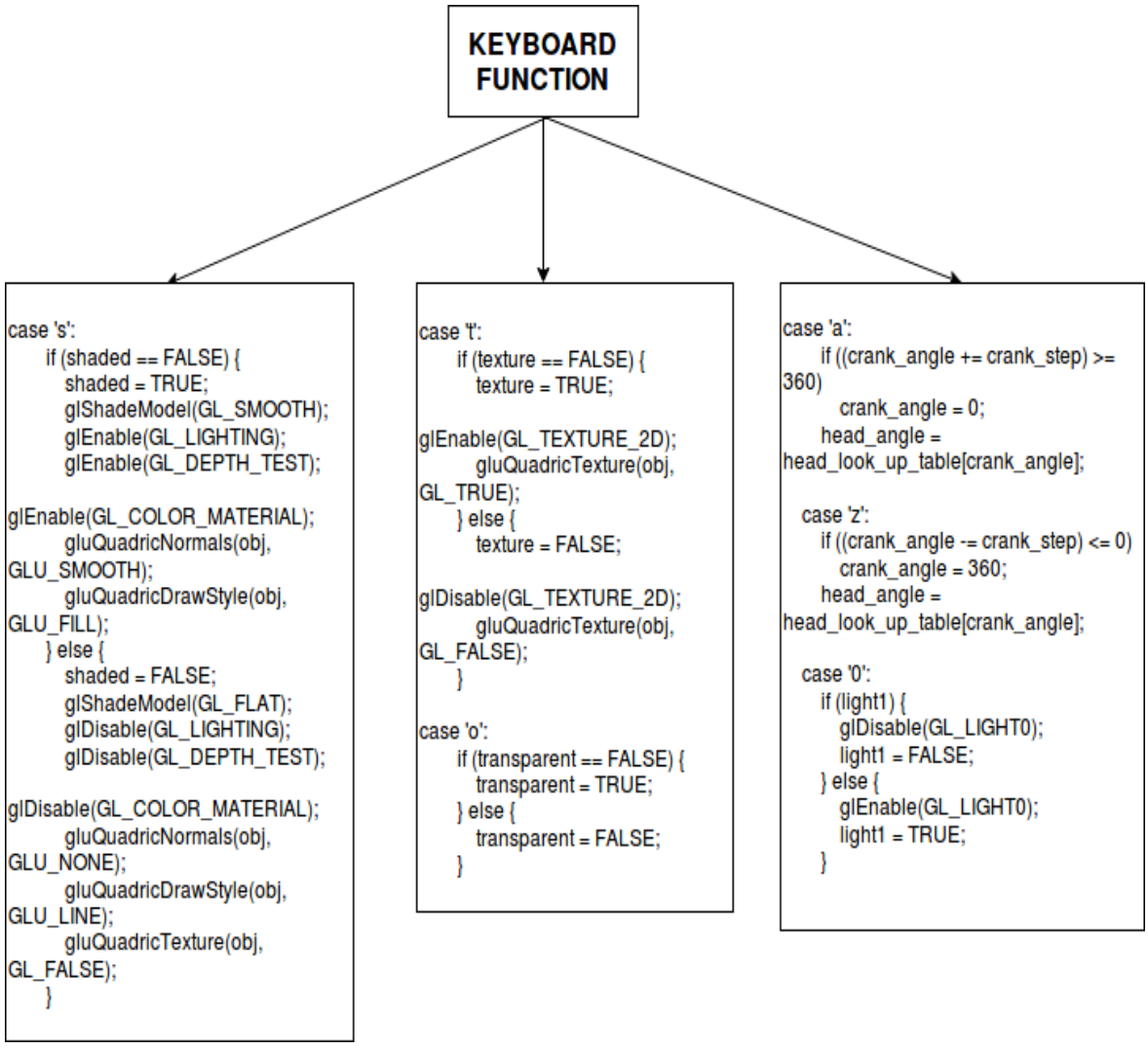


(a)

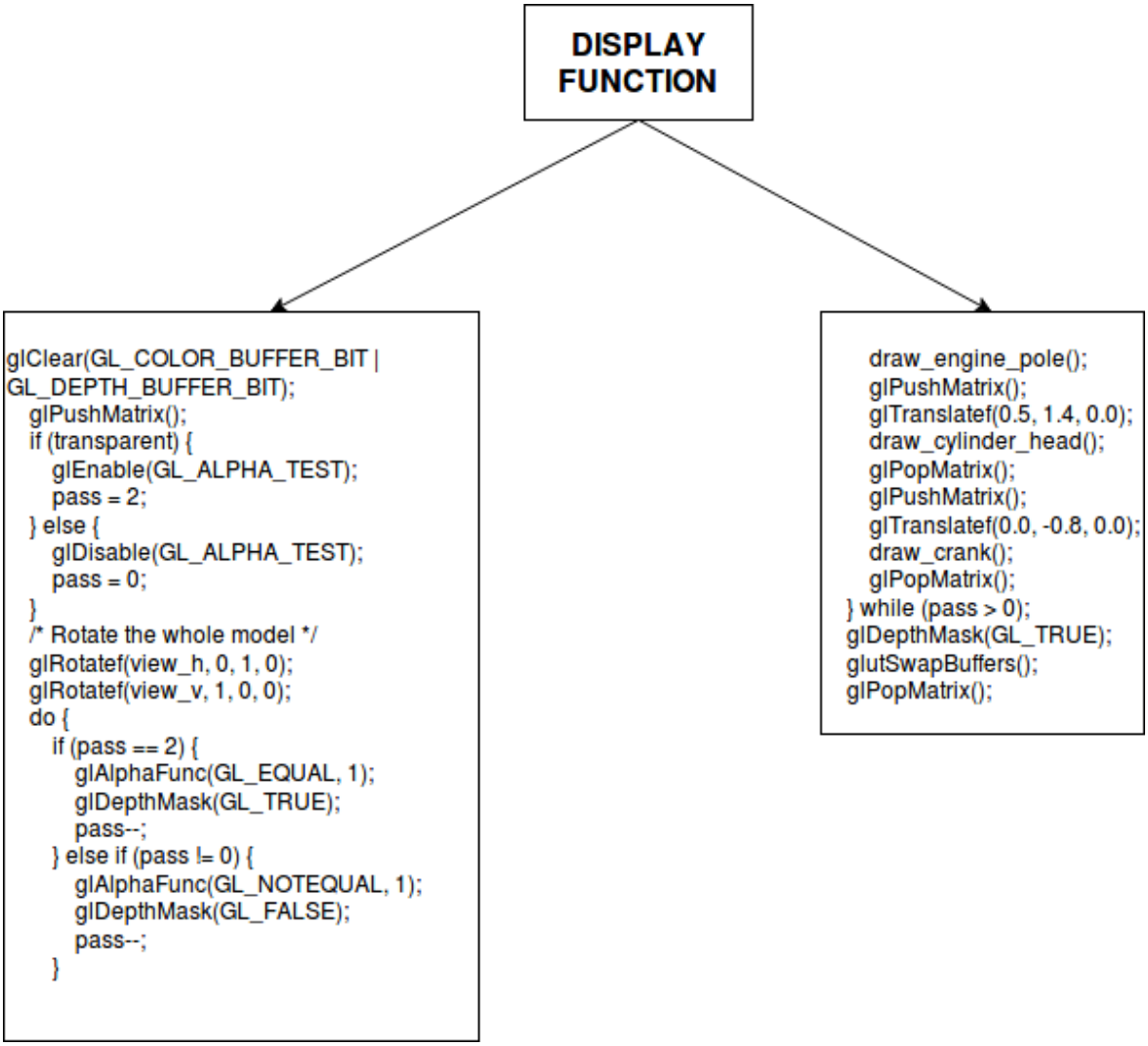
Figure 2.7: No Light(Transparency)

Chapter 3

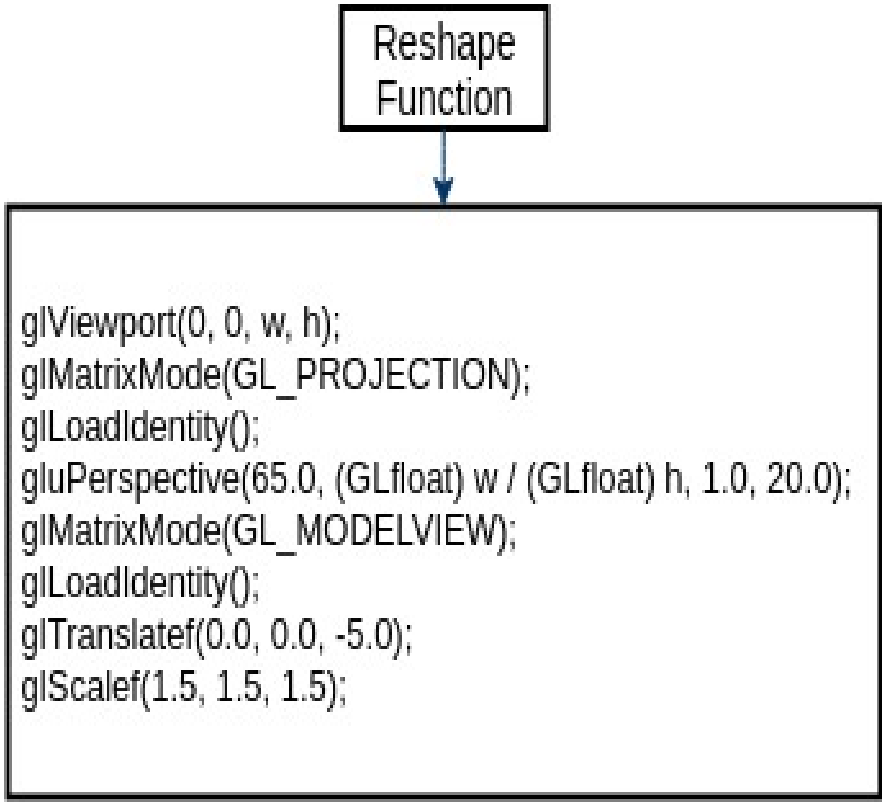
Implementation



(a)


DISPLAY FUNCTION
glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
glPushMatrix();
if (transparent) {
glEnable(GL_ALPHA_TEST);
pass = 2;
} else {
glDisable(GL_ALPHA_TEST);
pass = 0;
}
/* Rotate the whole model */
glRotatef(view_h, 0, 1, 0);
glRotatef(view_v, 1, 0, 0);
do {
if (pass == 2) {
glAlphaFunc(GL_EQUAL, 1);
glDepthMask(GL_TRUE);
pass--;
} else if (pass != 0) {
glAlphaFunc(GL_NOTEQUAL, 1);
glDepthMask(GL_FALSE);
pass--;
}
draw_engine_pole();
glPushMatrix();
glTranslatef(0.5, 1.4, 0.0);
draw_cylinder_head();
glPopMatrix();
glPushMatrix();
glTranslatef(0.0, -0.8, 0.0);
draw_crank();
glPopMatrix();
} while (pass > 0);
glDepthMask(GL_TRUE);
glutSwapBuffers();
glPopMatrix();

(a)


Reshape
Function
glViewport(0, 0, w, h);
glMatrixMode(GL_PROJECTION);
glLoadIdentity();
gluPerspective(65.0, (GLfloat) w / (GLfloat) h, 1.0, 20.0);
glMatrixMode(GL_MODELVIEW);
glLoadIdentity();
glTranslatef(0.0, 0.0, -5.0);
glScalef(1.5, 1.5, 1.5);

(a)

Chapter 4

Conclusions and Future scope

This project allows the user to rotate the piston in a Steam Engine. Its like a Miniature Steam Engine Simulation.

4.1 Future Scope

4.1.1 Simulator

Not only the movement of piston, we can make the whole parts in the steam engine working so that it will be a simulator of steam engine. By modifying this project we can construct a fully fledged simulator. Students who are studying about the steam engine can work through this and it will be very helpful for them. Almost a complete picturization of a steam engine can be done through this.

4.1.2 Design of Steam Engines

Engineers who build Steam Engines can design their model by looking this project. They get a good picturization by seeing this and it will be helpful for them in building steam engines. So this project will be benefited by Engineers.

Bibliography

[Kilgard 2008] Mark J Kilgard et Kurt Akeley. *Modern OpenGL: its design and evolution.* In ACM SIGGRAPH ASIA 2008 courses, page 13. ACM, 2008.

[OpenGL] OpenGL. *OpenGL online man Pages.* `http://www.opengl.org/`.