University of Barishal

A Project Report on

”City Flow: A 3D Traffic and Housing Simulation”

COURSE TITLE : Computer Graphics

COURSE CODE : CSE- 4110

Submitted To:

Dr. Md Manjur Ahmed

Associate Professor

Dept. Of Computer Science and

Engineering, University of Barishal.

Submitted By

Rudra Debnath Roll No: 18CSE018

Sabuj Das Roll No: 18CSE031

Dept. Of Computer Science and Engineering

University of Barishal.

Date of Submission: 8 October 2023

Content

	Particulars	Page No.
1	Abstract	3
2	System Specifications	3
3	OpenGL	3
4	OBJECTS OF 3D Traffic and Housing Simulation	4
5	FUNCTIONS OF OBJECTS	4
6	Methodology	6
7	Instructions for Action	6
8	Source Code	6
9	Results	8
10	Discussion	10
11	Conclusion	10
12	RUBRICS	11

1. Abstract

This project presents the development and implementation of a 3D computer graphics project using OpenGL. The project involves the creation of a traffic control system and animated houses. The traffic cars obey traffic signals and stop at red lights, and the houses feature animated doors. User interaction is facilitated through keyboard input.

2. System Specifications

Software Requirements

I. Operating System : Windows 10 or linux or others
II. Compiler : Codeblocks or MS Visual Studio 2013 or later
III. OpenGL
IV. Corresponding Drivers Software
V. Header files installed

Hardware Requirements

I. Graphics System
II. Ram : 4GB(min)

3. OpenGL

OpenGL is a software interface to graphics hardware. This interface consists of about 150 distinct commands that you use to specify the objects and operations needed to produce interactive three-dimensional applications. OpenGL drawing commands are limited to those that generate simple geometric primitives (points, lines, and polygons), GLUT includes several routines that create more complicated three-dimensional objects such as a sphere, a torus, and a teapot. This way

snapshots of program output can be interesting to look at. (Note that the OpenGL Utility Library, GLU, also has quadrics routines that create some of the same

three-dimensional objects as GLUT, such as a sphere, cylinder, or cone. It is a rendering pipeline. The rendering pipeline consists of the following steps:

* Defines objects mathematically.

* Arranges objects in space relative to a viewpoint.

* Calculates the color of the objects.

4. OBJECTS OF 3D Traffic and Housing Simulation

- House
- Car
- Cloud
- Tree
- Traffic
- Road
- Lamp

5. FUNCTIONS OF OBJECTS

- Camera point view from left, right,top, bottom
- Car Control
- Rotation of window
- Translation of Road
- Scaling of House
- House window Control
- Car Animation
- Coloring effect

- Keyboard Controls
- User Interaction
- Animation

6. Methodology

4.1 Development Environment:
- OpenGL: Version [Insert OpenGL Version]
- Programming Language: C++
- IDE: [Insert Your IDE]

4.2 Scene Setup:
- The 3D environment includes houses placed around the scene and roads for traffic movement.
- Traffic signals are strategically positioned at intersections.

4.3 3D Models and Textures:
- 3D models were created for houses, cars, and traffic signals.
- Textures were applied to the models to achieve realistic rendering.

4.4 Animation:
- Traffic Animation:
  - Cars move along the roads.
  - Cars stop at red traffic signals.
- House Animation:
  - Doors can be opened and closed using keyboard input.

4.5 User Interaction:
- Keyboard controls were implemented to allow users to interact with the scene.
- 'G' key activates the green traffic signal.
- 'R' key activates the red traffic signal.
- 'O' key opens the house doors, and 'C' key closes them.

4.6 Camera Control:
- Users can control the camera perspective to explore the scene.

7. Instructions for Action

Keyboard Actions (Keypress):

- F10 -> Red
- F11 -> Yellow
- F12 -> Green
- Page Up -> Door open/close (circularly)
- left/right arrow -> cloud movement
- F4/F5 -> camera left/right movement
- F6/F7 -> camera up/down movement
- F8/F9 -> camera zoom in/out

8. Source Code:

In this section, we provide key code snippets from our 3D bedroom project to illustrate its functionality and implementation –

Header File :

```
#include <windows.h>
#ifdef __APPLE_CC__
#include <GLUT/glut.h>
#else
#include <GL/glut.h>
```

Main function:

```
int main(int argc, char** argv) {
  glutInit(&argc, argv);
  glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
  glutInitWindowPosition(250, 0);
  glutInitWindowSize(1100, 700);
  glutCreateWindow("Project");
```

```
  glutDisplayFunc(display);
  glutIdleFunc(idle);
  glutSpecialFunc(special);
  glutTimerFunc(25, spin, 0);
  glutTimerFunc(0, update, 0);
  init();
  glutMainLoop();
}
```

Animation of the Car on the road:

```
void init() {

    // Set the current clear color to black and the current drawing color to
  // white.
  glClearColor (0.4, 0.85, 1.0, 0.0);
  glColor3f(1.0, 1.0, 1.0);

  // Set the camera lens to have a 60 degree (vertical) field of view, an
  // aspect ratio of 4/3, and have everything closer than 1 unit to the
  // camera and greater than 40 units distant clipped away.
  glMatrixMode(GL_PROJECTION);
  glLoadIdentity();
  gluPerspective(100.0, 4.0/3.0, 1, 20);

  // Position camera at (4, 6, 5) looking at (0, 0, 0) with the vector
  // <0, 1, 0> pointing upward.


}
```

9. Results:

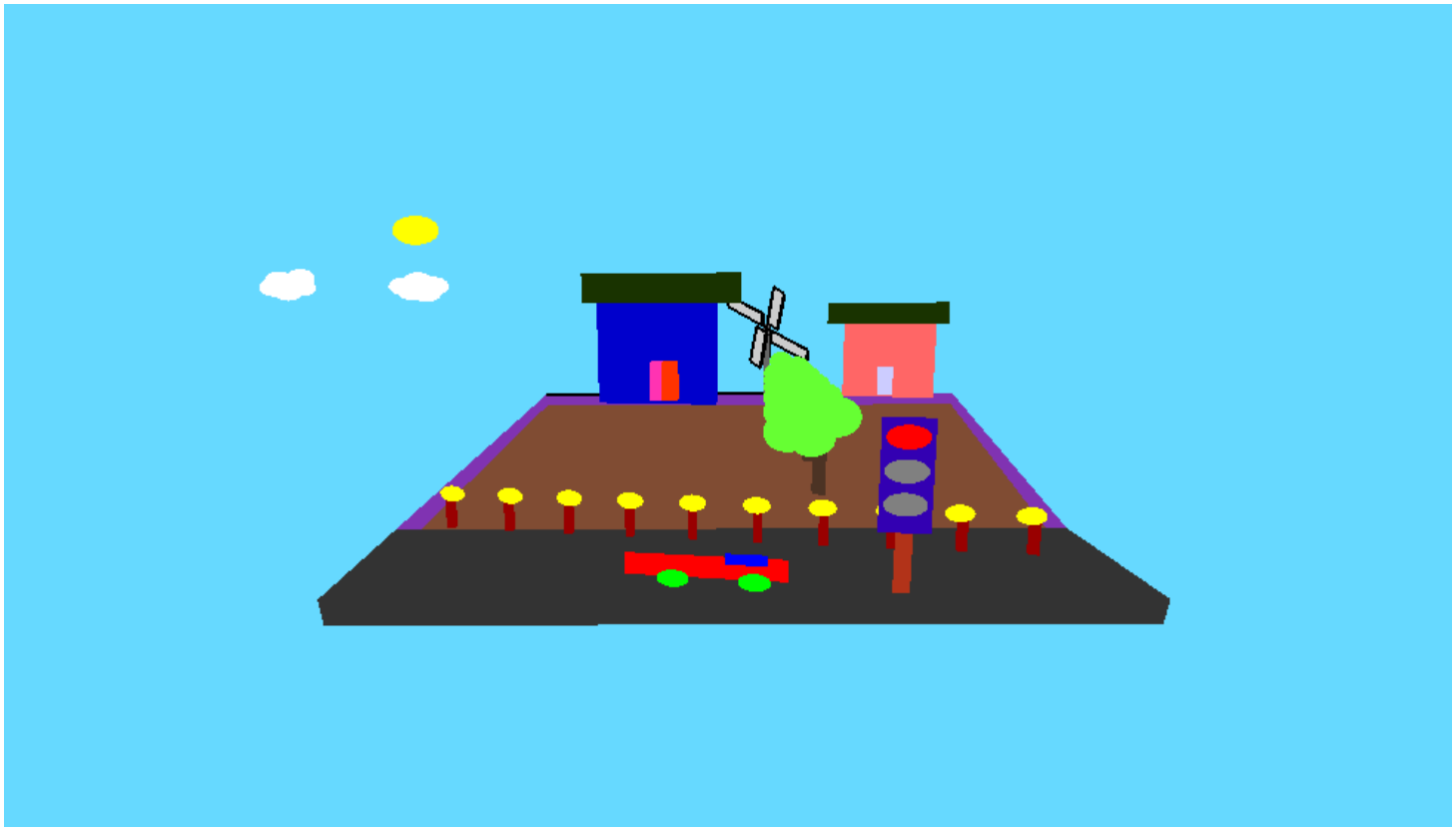

Fig: Car stop when show red signal

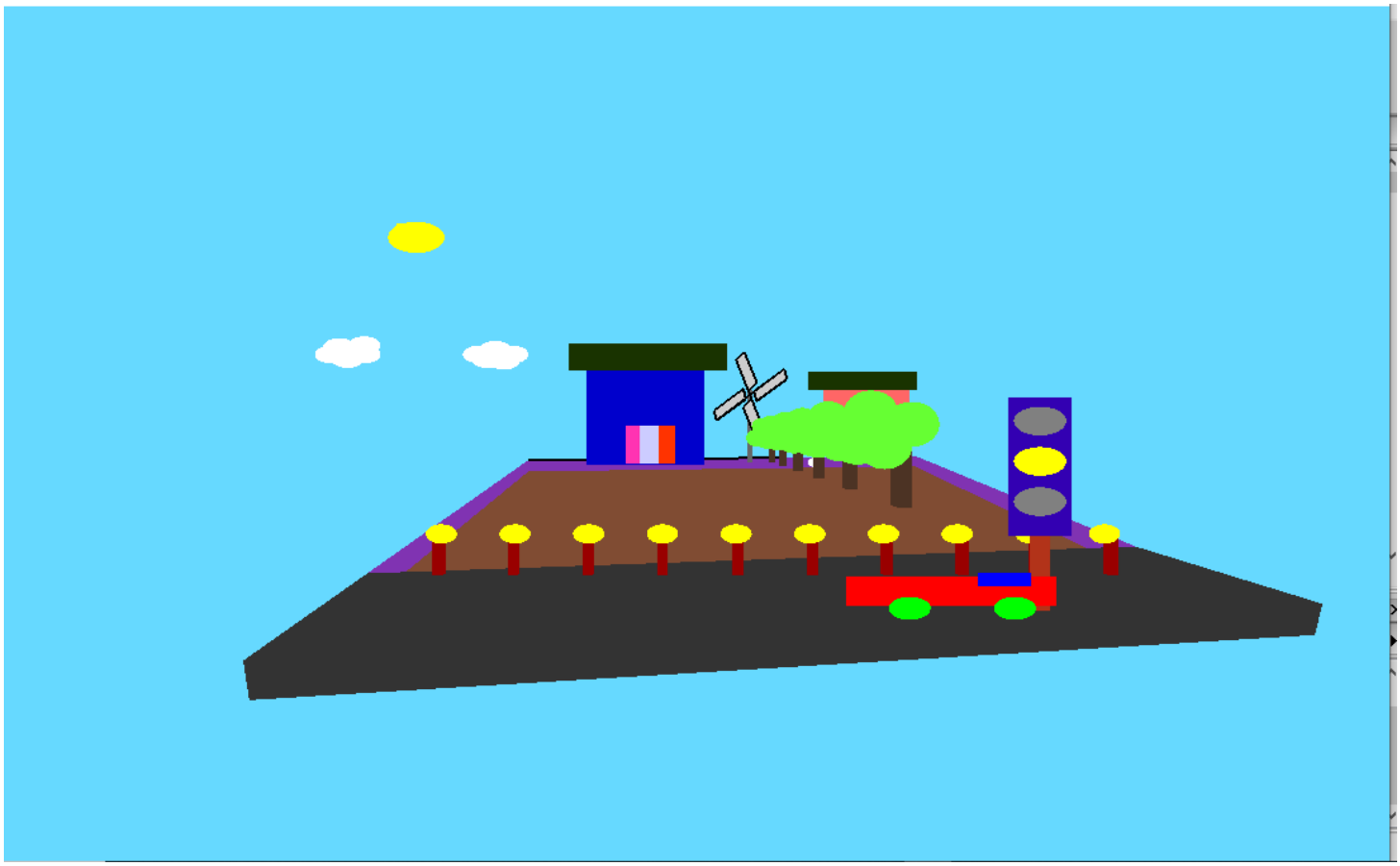

Fig: House door is open

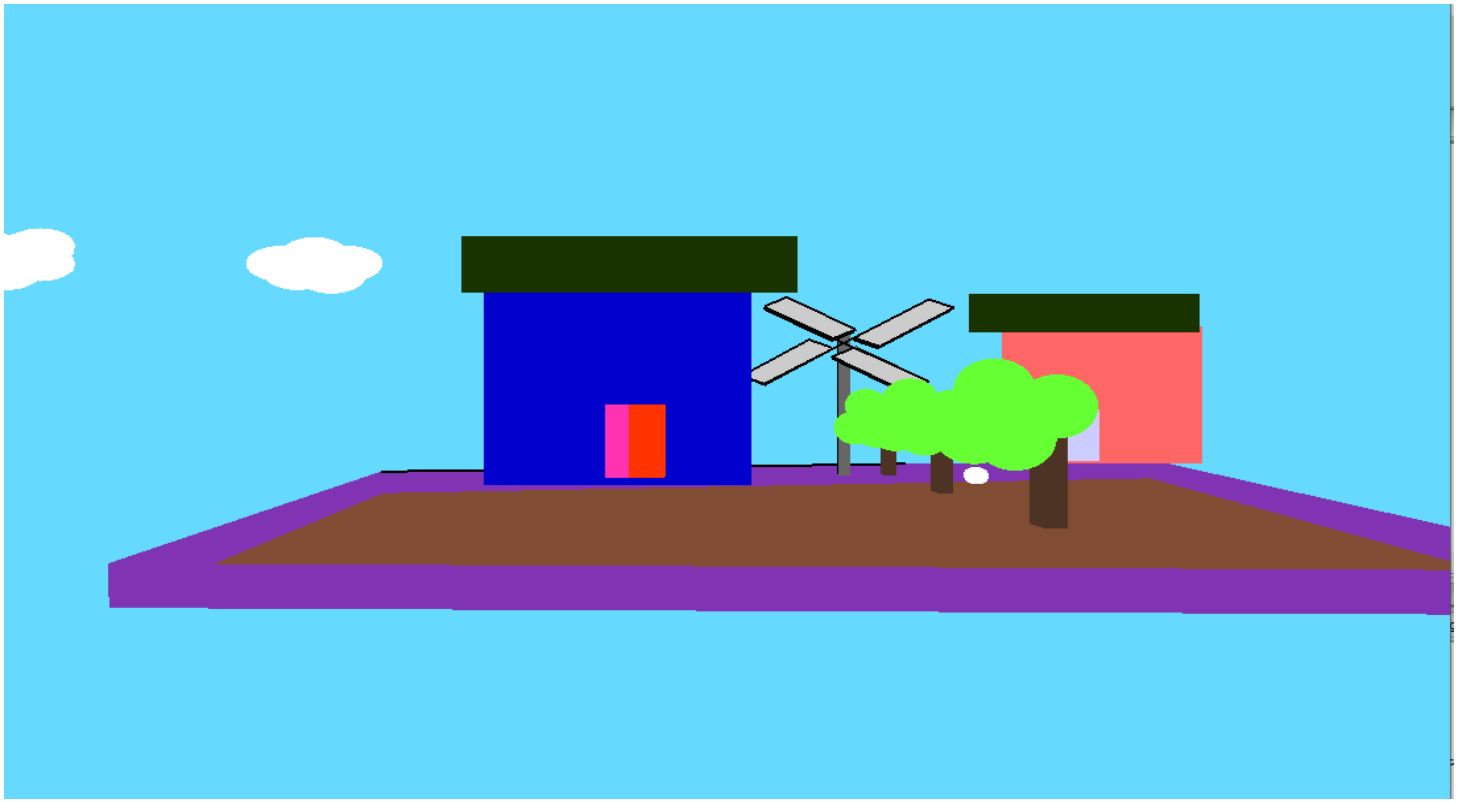

Fig: Font view

9.1 Demonstration:

- The project successfully demonstrates a 3D environment with a traffic control system and animated houses.
- Cars move along the roads, following traffic signals.
- House doors open and close in response to user input.

9.2 Performance:

- The project maintains a smooth frame rate and responsiveness.
- Optimization techniques were applied to enhance performance.

10. Discussion:

The project has achieved its objectives of creating an interactive 3D environment featuring a traffic control system and animated houses. Key points for discussion include:

- The use of keyboard input to control traffic signals and house doors.
- The implementation of realistic traffic animation.
- The application of textures and shading for visual realism.
- The user-friendly camera control for exploring the scene.

11. Conclusion:

In conclusion, the project successfully demonstrates the capabilities of OpenGL in creating interactive 3D graphics. It provides an engaging simulation of a traffic control system and animated houses. The project's user interaction and animation features showcase the potential of computer graphics in real-world applications.

12. RUBRICS

Course Outcome	Notes	Marks
CO1: Demonstrate the concept of computer graphics and ability to use the computer graphics technology.	25 marks	
Overall program structure: - Free from error	5 marks	
OpenGL Function:- Apply functions of keyboard handling a. Rotation b. Translation c. Scaling	15 marks	
-Apply functions of texture/color mapping	5marks	
CO2: Construct 2D and 3D graphics by implementing concepts of computer graphics and computer graphics programming.	25 marks	
Object: -All required objects are provided	10 marks	
Texture Mapping: Apply functions of texture/color mapping for appropriate color	5 marks	
Camera / Lighting: -Appropriate technique is implemented and suitable with the environment	10 marks	
CO3: Respond to instruction by listening actively and give feedback	25 marks	
Camera moving	10 marks	
-Animation	10 marks	
Answer the questions regarding basic of computer graphics	5 marks	
CO4: Work together effectively to achieve the same goal by building	25 marks	

a good relationship and interaction among team members.		
Student 1 Rudra Debnath 18CSE-025	Objects (% of contribution) = 50% 5 Marks	
	Camera (% of contribution) = 50% 5 Marks	
	Animation (% of contribution) = 50% 5 Marks	
	Report (% of contribution) = 50% 10 Marks Objects (% of contribution) = 50% 5 Marks	
Student 2 Sabuj Das 18CSE-031	Objects (% of contribution) = 50% 5 Marks	
	Camera (% of contribution) = 50% 5 Marks	
	Animation (% of contribution) = 50% 5 Marks	
	Report (% of contribution) = 50% 10 Marks Objects (% of contribution) = 50% 5 Marks	