AMERICAN INTERNATIONAL UNIVERSITY –BANGLADESH (AIUB)

FACULTY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF CSE

COMPUTER GRAPHICS

SUMMER 2024-2025

Section: I , Group:

Project Name

2D Visualization of Cantonment Area

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Date of Submission:18 SEPTEMBER 2025

Abstract

This project is a 2D computer graphics simulation of a Cantonment area made with OpenGL. The goal of the project is to show a simple visual model of different parts of a cantonment, such as the entrance, army officers' quarters, roads with moving cars, traffic lights, a river with boats, and other important structures. In this project, animations and object movements were created using OpenGL functions like glTranslate(), glRotate(), and glColor3ub(). The work shows how real-life places can be represented on a computer screen with graphics. It also helps in learning the basics of computer graphics, improving programming skills, and understanding how animations and virtual environments are built

Introduction:

Our project is a graphical representation of a **Cantonment Area** using OpenGL. The aim of the project is to create a simple yet effective 2D animated environment that highlights important parts of a cantonment. The environment has been divided into different sections to make it more realistic and structured.

In this project:

- One part represents the **Entrance Area of the Cantonment**, showing how people or vehicles enter and exit through the gate.
- Another part shows the **Army Officers' Quarter Area**, which is the residential area for army officers.
- Additionally, other natural and man-made elements such as roads, vehicles, boats, and rivers are included to make the environment lively and dynamic.

This project mainly focuses on **basic graphics programming, animation using timers, and shapes drawing techniques in OpenGL**. It helped us understand how to use functions like drawing circles, rectangles, and moving objects to create an animated scene.

Implementation:

In our project, we implemented a **2D animated Cantonment Area** using OpenGL. The main things we implemented are:

- **Entrance Area**: A simple entrance gate of the cantonment with proper surroundings.
- **Army Officers' Quarter Area**: Residential area designed for officers.
- **Vehicles (Cars)**: Cars moving smoothly on the road using timer functions.
- **Boats**: Boats moving across the river to make the scene more dynamic.
- **River Animation**: A flowing river effect created using movement.
- **Trees and Environment**: Natural objects like trees, sun, and greenery to make the area realistic.
- **Colors and Shapes**: Different OpenGL functions were used to draw circles, rectangles, and polygons for buildings, roads, and other objects.

Overall, the project shows how different parts of a cantonment look and adds animations to make it interactive.

Significance of the Project:

This project is important because it shows how computer graphics can be used to display real-life places like a cantonment area in a simple and clear way. By using OpenGL, we were able to design a 2D environment that includes roads, cars, boats, traffic lights, and buildings. While doing this, we learned how to make objects move, how to add animations, and how to control colors and shapes on the screen. This improved our skills in graphics programming and also helped us think more creatively to solve problems during the project.

Another significance is that this project makes learning more interesting. Instead of only reading about graphics, we were able to see how theory can be applied in practice. It also shows how visualization can make big or complex areas easier to understand. For example, someone who has never been to a cantonment area can get a clear idea by looking at our simulation. In the future, such graphics projects can also be used in education, training, or even planning real environments.

Targeted Population:

The targeted population of this project primarily includes **students and researchers in the field of computer graphics** who can use this work as a reference for learning the implementation of 2D graphics and animations. Additionally, the project may serve as a visual aid for **general audiences** interested in understanding the layout and representation of a cantonment area.

Tools and Functions Used:

In this project, we used different **OpenGL functions** to design and animate the cantonment area scene. Each function had its own purpose, either for drawing shapes, adding colors, or creating movement. Below is a simple explanation of the main functions we used and how they helped us in the project:

- **glBegin() / glEnd()** → These functions are used to start and finish drawing a shape. Between them, we write the points (vertices) of objects like rectangles, triangles, or circles. In our project, they were used to draw cars, boats, houses, trees, and other objects.
- **glColor3ub()** → This function sets the color of objects using three values (Red, Green, Blue). For example, we used it to make the grass green, the road black, the sky blue, and to give realistic colors to cars, traffic lights, and boats.
- **glVertex2f()** → This function tells OpenGL the position of a point (vertex) in the 2D space. By joining these points, we made the shapes of cars, buildings, trees, and rivers.
- **glClearColor()** → It sets the background color of the window. We used this to create the sky and ground background, so the environment looks like daytime.
- **gluOrtho2D()** → This function creates the 2D coordinate system. It helped us decide where each object should be placed and how large or small they should look on the screen.
- **glTranslatef()** → Moves objects from one place to another. We used it to animate cars moving on the road and boats floating in the river.
- **glPushMatrix() / glPopMatrix()** → These are used to save and restore object positions. They allowed us to move one object without disturbing others. For example, while moving a car, the buildings or trees stayed in their own place.

- **glutDisplayFunc()** → This function tells OpenGL which function will draw the whole scene. In our case, it calls the day() function, which draws all objects of the cantonment area together.
- **glutTimerFunc()** → Used to create animations by calling update functions again and again after a short time. With this, cars, boats, and river waves moved smoothly instead of jumping.
- **glutPostRedisplay()** → Refreshes the window so that every change (like a car moving or a boat shifting) is immediately shown on the screen. Without this, the animations would not look smooth.

Knowledge Applied Field:

This project applies knowledge from several areas of **Computer Science and Engineering**:

- **Computer Graphics** → Implementing 2D shapes, colors, and animations using OpenGL functions.
- **Mathematics** → Using trigonometry (sine and cosine) to draw circles and round objects.
- **Programming (C/C++)** → Writing structured code with functions, loops, and conditionals.
- **Animation Techniques** → Applying transformations and timer functions to move cars, boats, and other objects smoothly.
- **Simulation** → Representing a real-world environment (cantonment area) in a digital, visual form.

Knowledge Applied for Job Market:

This project demonstrates practical skills that are valuable in the job market:

- **Computer Graphics and Visualization** → Useful for game development, simulation, and UI/UX roles.
- **C/C++ Programming** → Strong foundation for software development and system programming jobs.
- **Animation and Simulation Techniques** → Applicable in virtual reality, 3D modeling, and animation industries.

- **Problem-Solving and Logical Thinking** → Shows ability to break down complex tasks and implement solutions.
- **Project Development Skills** → Understanding of structuring, organizing, and implementing a complete project from start to finish.

Knowledge Applied for Higher Study:

This project provides a foundation for advanced studies by:

- Enhancing understanding of **computer graphics and simulation**, which is useful in research and development.
- Applying **programming concepts in C/C++**, helping in algorithm design and software projects.
- Developing **analytical and problem-solving skills**, essential for academic research.
- Demonstrating **project planning and implementation**, which prepares for complex thesis or research projects.

References:

Github Link :
https://github.com/zayedkhan1/Cantonment_Area_2D_simulation_GLUT_Project

Scrreenshot:

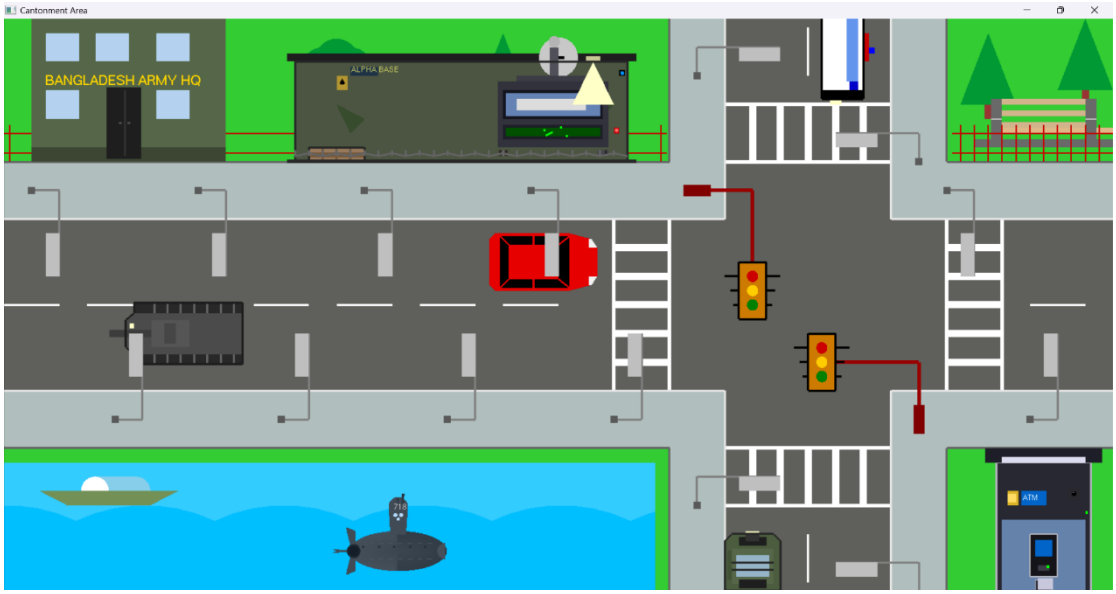

Figure 7: Cantonment area overview

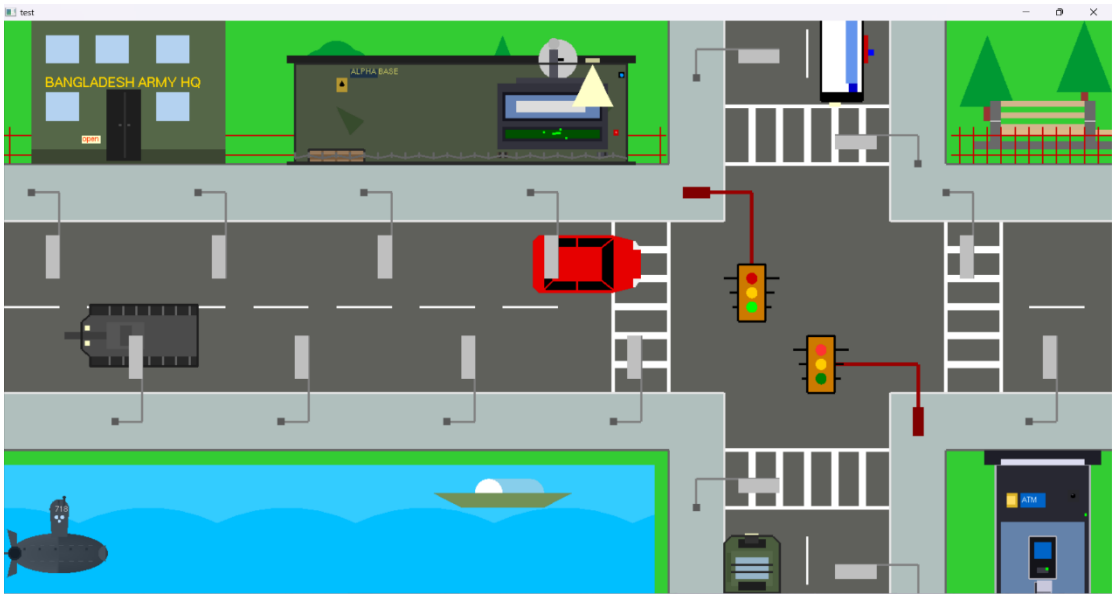

Figure 8: Moving object overview