Project Title: MARINE DRIVE, COX'S BAZAR using C++ & OpenGL

PROJECT REPORT:

Submitted in partial fulfillment of the requirements for the course **Computer Graphics**

Submitted By:

Name:	Farida Nusrat
Student ID:	C201242
Semester:	7th
Section:	7AF
Department:	Computer Science and Engineerin
University:	International Islamic University C

Submitted To:

Name:	Mrs. Israt Binteh Habib
Designation:	Assistant Professor
Department:	Computer Science and Engineering
University:	International Islamic University Cl

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Abstract

This project presents the design and implementation of a two-dimensional (2D) graphics simulation titled **"Marine Drive, Cox's Bazar"** using C++ and the OpenGL (GLUT) graphics library. The simulation visually represents the scenic Marine Drive area by incorporating animated elements such as roads, vehicles, sea waves, and background scenery. The project demonstrates fundamental computer graphics concepts including object modeling, geometric transformations, animation techniques, and real-time rendering. The developed system serves as an educational tool for understanding basic graphics programming concepts using OpenGL.

Contents

0.1 Introduction

Computer graphics is an important field of computer science that focuses on generating, manipulating, and displaying visual information using computers. Two-dimensional graphics are widely used in simulations, educational software, and visualization systems.

Marine Drive in Cox's Bazar is one of the most beautiful coastal roads in Bangladesh. This project aims to create a digital 2D representation of this iconic location using computer graphics techniques. By implementing this simulation using C++ and OpenGL, the project helps in understanding animation, transformations, and real-time rendering.

0.2 Objectives

The main objectives of this project are:

- To design a 2D graphical simulation of Marine Drive, Cox's Bazar
- To implement animated vehicles and sea wave motion
- To demonstrate real-time rendering using OpenGL
- To apply basic computer graphics concepts such as transformations and animation
- To enhance practical knowledge of graphics programming using C++

0.3 Tools and Technologies

The following tools and technologies were used in this project:

- **Programming Language:** C++
- **Graphics Library:** OpenGL

- **Utility Toolkit:** GLUT
- **Platform:** Windows / Linux
- **Compiler:** GCC / MinGW / Visual Studio

0.4 System Overview

The system renders a 2D scene representing Marine Drive, Cox's Bazar. The graphical scene includes a road, moving vehicles, sea area, and background environment. Animation is achieved by continuously updating object positions and redrawing the scene using GLUT callback functions.

0.5 Scene Description

The scene is designed using basic OpenGL primitives:

- **Road:** Rectangular polygons representing the Marine Drive road
- **Vehicles:** Combination of polygons and circular shapes
- **Sea:** Colored regions with animated wave motion
- **Sky:** Background color to enhance visual realism

0.6 Implementation Details

The project is implemented in C++ using OpenGL functions such as `glBegin()`, `glEnd()`, and transformation techniques. Object animation is achieved by updating position variables within the display loop. Double buffering is used to ensure smooth animation and avoid flickering.

0.7 Algorithm

1. Initialize OpenGL and create the display window
2. Set up the projection and coordinate system
3. Draw static elements such as road and sea
4. Draw animated objects such as vehicles and waves
5. Update animation variables
6. Refresh the display continuously

0.8 Project Output

Figure 1: Marine Drive, Cox's Bazar – 2D Graphics Simulation Output Day

Figure 1, 2, 3 & 4 shows the output of the implemented simulation. The scene illustrates the Marine Drive road alongside the sea with animated vehicles and wave motion, demonstrating real-time rendering and animation.

Figure 2: Marine Drive, Cox's Bazar – 2D Graphics Simulation Output Day rain

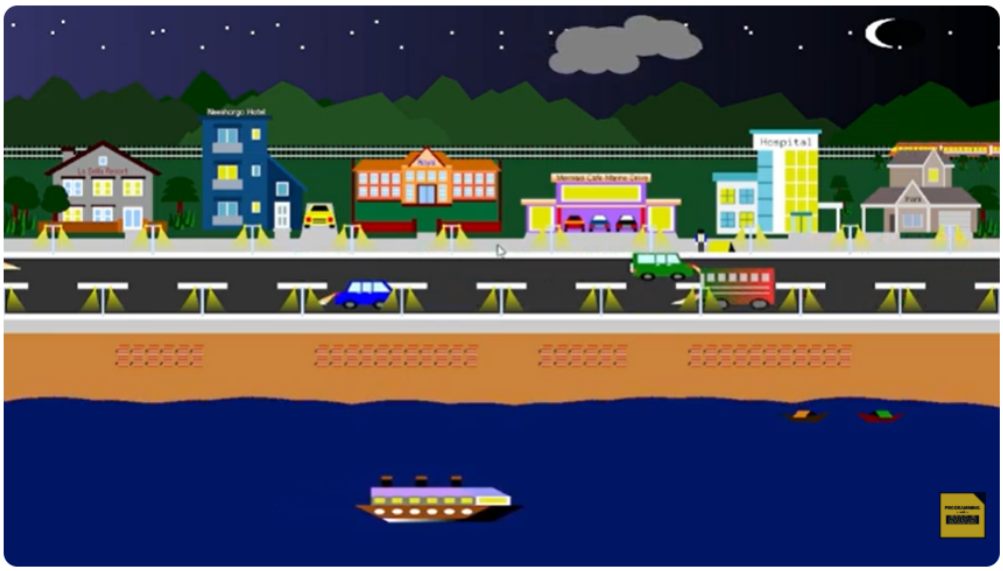

Figure 3: Marine Drive, Cox's Bazar – 2D Graphics Simulation Output night

Figure 4: Marine Drive, Cox's Bazar – 2D Graphics Simulation Output night rain

0.9 Results and Discussion

The simulation successfully renders a visually appealing 2D representation of Marine Drive. Vehicle movement and wave animation operate smoothly, validating the correct implementation of animation techniques and rendering logic.

0.10 Limitations

- The project supports only 2D graphics
- No texture mapping or advanced lighting is implemented
- Physics-based motion is not included

0.11 Conclusion

This project demonstrates the successful design and implementation of a 2D graphics simulation of Marine Drive, Cox's Bazar using C++ and OpenGL. The project

fulfills its objectives and provides a strong foundation for understanding fundamental computer graphics concepts.

0.12 Future Enhancements

- Addition of texture mapping for realism
- Implementation of day–night and weather effects
- Extension of the project to 3D graphics
- Integration of sound effects