OpenGL Project Documentation

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2. Project Overview

The project implements an interactive 3D scene using OpenGL, allowing the user to control a car and explore the surrounding environment. The scene includes a game map model ("de_dust2"), a car, an arrow, and a skybox to create a realistic environment.

3. Scenario

3.1 Scene and Objects Description

- Scene: The de_dust2 model serves as the game's environment.
- Car: A 3D car model placed in the scene, which the user can control.
- Arrow: Rotates around the car to indicate its direction.
- Skybox: A background with textures for a realistic setting.

3.2 Features

- Car movement forward and backward.
- Car turning left and right.
- Adjusting fog density in the scene.
- Rotating the camera around the car.
- Switching between solid mode and wireframe display.
- Detecting collision between the camera and the car

4. Implementation Details

4.1 Functions and Algorithms

4.1.1 Possible Solutions

- Car Movement: Using modeling matrices for smooth car movement and rotation.
- Camera Control: Calculating view matrices to enable camera control.
- Arrow Animation: The arrow rotates around the car to indicate direction.

4.1.2 Justification for Chosen Approach

- Matrices: Efficiently manage object and camera transformations in 3D space.
- Shaders: Enable realistic lighting, fog, and wireframe display flexibility.

4.2 Graphics Model

- Scene: 3D model of the city loaded into the scene.
- Car: Includes movement and rotation management.
- Arrow: Indicates the car's direction.
- Skybox: Realistic background textures.

4.3 Data Structures

- Matrices: For efficient transformations.
- Vectors: To manage directions and positions in 3D space.

4.4 Class Hierarchy

- Window: Manages the OpenGL window.
- Shader: Implements shaders for lighting and wireframe rendering.
- Camera: Handles camera manipulation and view matrix calculations.
- Model3D: Loads and renders 3D models.
- SkyBox: Manages and renders the skybox.

5. User Interface Presentation / User Manual

- Movement: Control the car with the W, S, A, and D keys.
- Camera Rotation: Mouse movement rotates the camera around the car.
- Fog Mode: Press M or N to adjust fog density.
- Display Mode Switch: Press L to toggle between fill and wireframe modes.

6. Conclusions and Future Developments

The project provides a strong foundation for developing a 3D interactive game. Future enhancements may include adding interactive objects, a collision system, and improved lighting.

7. References

- OpenGL Documentation: https://www.opengl.org/documentation/

- GLFW Documentation: https://www.glfw.org/documentation.html

- GLM Documentation: https://glm.g-truc.net/0.9.9/index.html