CS 405 Project 3

Selim Gül

29200

Fall 2023

Introduction

This report outlines the development and implementation of a WebGL-based solar system simulation. The project, leveraging the power of WebGL and JavaScript, aimed to create an interactive 3D representation of the solar system. The project involved three key tasks: implementing a scene graph structure for hierarchical object management, enhancing light rendering through shader programming, and expanding the solar system model by adding a detailed representation of Mars. Each task was carefully executed to ensure a realistic and accurate portrayal of the solar system, focusing on both graphical fidelity and performance efficiency.

Task 1: Scene Graph Implementation

Implemented the **'draw'** function for the **SceneNode** class in **sceneNode.js**. This function ensures that transformations applied to a parent node are propagated to its child nodes. The method combines transformations of the current node with its parent, updating matrices for position, normal, and model-view-projection (MVP) for each node and its children, ensuring a hierarchical transformation structure within the scene graph.

Task 2: Diffuse and Specular Lighting in Fragment Shader

Modified **meshDrawer.js** to enhance the fragment shader for supporting both diffuse and specular lighting. The updated shader calculates the diffuse component using the Lambertian reflectance model, and the specular component using the Phong reflection model. This enhancement contributes to a more realistic rendering of objects with respect to light source positioning and viewer perspective.

Task 3: Adding Mars to the Solar System

Enhanced **project3.html** to add Mars as a child node of the Sun in the solar system scene graph. Mars was rendered using a sphere mesh with a texture representing its surface. The planet was positioned, scaled, and rotated according to specified requirements, making it orbit the Sun. This addition expanded the solar system model, increasing its educational and visual appeal.