Final Project Proposal

CS 441

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1 Introduction

The purpose of a final project in CS441 is to perform a project of approximately thirty (30) hours of work of the students choosing that applies and expands upon concepts learned in this class. This document outlines a proposal for a final project as developed and implemented by Adam Case. I propose the implementation of an interactive solar system model where the user can select different planetary bodies or space objects and look around and zoom from that objects point of view (POV).

2 Goals

1. Model the solar system using available data.
2. Allow user to interact with the model.
3. Apply texturing and shadow projection.

3 Tenets

Communication: While doing a project can be fun and challenging, it does not mean anything if it cannot be presented and the lessons learned cannot be shared.
Interdisciplinary: The project shall combine what is taught in the class with my experience in aerodynamics.
Understanding: The project shall utilize and expand upon concepts of computational graphics.

4 Proposal

A project that I think would be really cool to perform will be to model the solar system utilizing OpenGL. Utilizing the NASA API, planetary body world space data can be pulled and utilized to place objects in proper locations. Planetary information can then be utilize to rend the bodies based on another bodies POV and allowing a user to pan/tilt/zoom to look around from that perspective. Shadows can then be projected from one body onto another which will mostly be seen of earths shadow on the moon. Further tasks can then be completed to make it easier for the user to zoom in on other bodies that are not immediately visible, atmospheric lensing to apply color as light passes through an atmosphere, and selection of additional spacecraft.

5 Plan of Action

All task items for the project are listed in Table 1. The plan for the project will be to complete items #1-5 with all other items being stretch goals for the project. A detailed explanation of each item is covered following Table 1.

Item No.	Description	Estimated Time (Hours)
1	Model Solar System	10
2	User JWS POV	5
3	Date-time selection and model update	5
4	Body specific properties	10
5	Shadow Projection	5
6	Planetary tags above small objects	10
7	Earth Atmospheric Lensing	5
8	Additional Near Earth Objects (NEOs)	10
9	User selection of different space telescopes/probes	5
10	Texture Mapping Earth/Moon/Mars	10

Table 1: Task Items

1. Model Solar System
    - Model all planetary bodies, Earth's moon, and Sun
    - Model JWS
    - Apply textures and appropriate sizing for all bodies
    - Utilize static date-time data for body positions as pulled from NASA API
2. User JWS POV
    - Place the camera in the position of JWS
    - Let the user move/zoom the camera around using the mouse
3. Date-time selection and model update
    - Allow the user to type or exit looking around to change the date-time
    - Limits the user to the date-time of JWS in orbit (launch to now)
4. Body specific properties
    - Apply material properties to each body
5. Shadow Projection
    - Apply shadow of earth onto the moon.
    - Based on light physics apply umbra and penumbra lighting
6. Planetary tags above small objects

- To allow easier ability to spot and zoom add tags above bodies in view
- Adjust size of tags based on visibility and real estate it takes up on the screen

7. Earth Atmospheric Lensing
    - Apply atmospheric refraction to show red color from lunar eclipses
8. Additional Near Earth Objects (NEOs)
    - Add additional NEOs
9. User selection of different space telescopes/probes
    - Allow the user to select different telescopes/probes popular in space exploration
    - Example Telescopes: Hubble Space Telescope
    - Example Probes: Voyager 1/2, Parker Solar Probe
    - Allow dates to be expanded for all probes
10. Texture Mapping Earth/Moon/Mars
    - Apply texture mapping to earth/moon/mars
    - Textures to be larger than reality for visual appeal