

Virtual Reality and its Applications

Assignment

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Satellite Deployment Simulation Using OpenGL

This simulation models a multi-stage rocket launch, from liftoff to the final deployment of a satellite into Earth orbit. The project is an educational and visual demonstration of core physics principles, including gravitational forces, thrust, and orbital mechanics, all rendered using OpenGL.

Key Features

- **Multi-Stage Simulation:** Experience a full rocket launch cycle, including main booster liftoff, stage separation, and a final orbital insertion burn.
 - **Realistic Physics:** The simulation incorporates gravitational forces, with thrust applied to the rocket stages to overcome gravity and achieve orbital velocity.
 - **State Machine:** The mission's progression is managed by a state machine that smoothly transitions through key events: Pre-Launch, Liftoff, Stage Separation, Orbital Insertion, and Mission Success.
 - **Interactive Controls:** The user can initiate the launch with a simple keystroke and reset the entire simulation at any time.
 - **3D Rendering:** The scene is built with custom 3D models for the rocket (with fins and exhaust), the satellite (with solar panels), and a textured Earth.
 - **Dynamic Scene:** The background features a randomly generated starry field, and the camera automatically orbits the Earth to provide a dynamic view of the launch.
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How to Compile and Run

Prerequisites: To compile and run this project, you will need to use Visual Studio. Ensure that you have the OpenGL and GLUT libraries configured within your project settings. The code also relies on the `stb_image.h` header for texture loading.

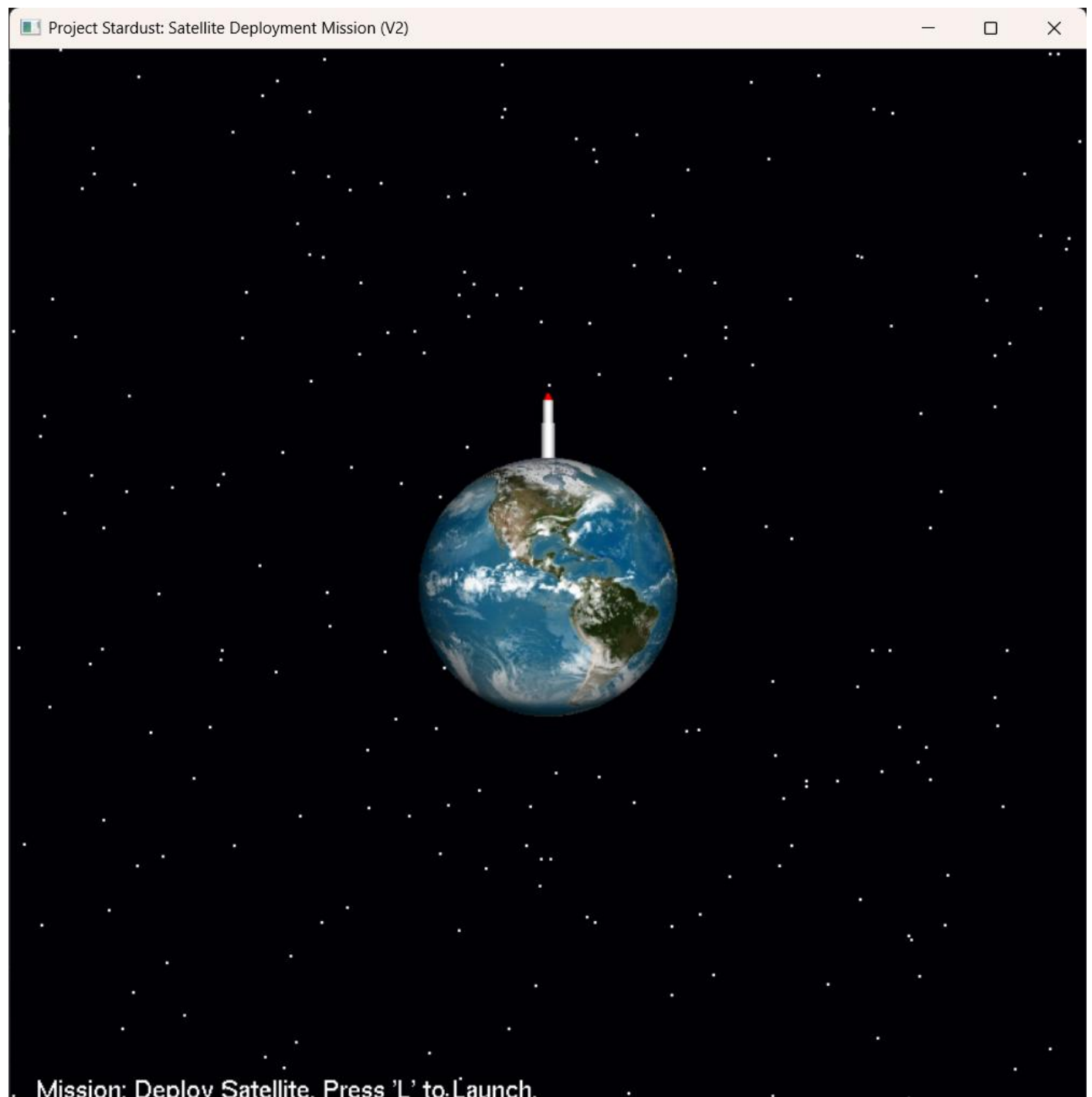
Required Files: This project requires an image file named `earth_texture.jpg` to be placed in the same directory as the source code.

Controls

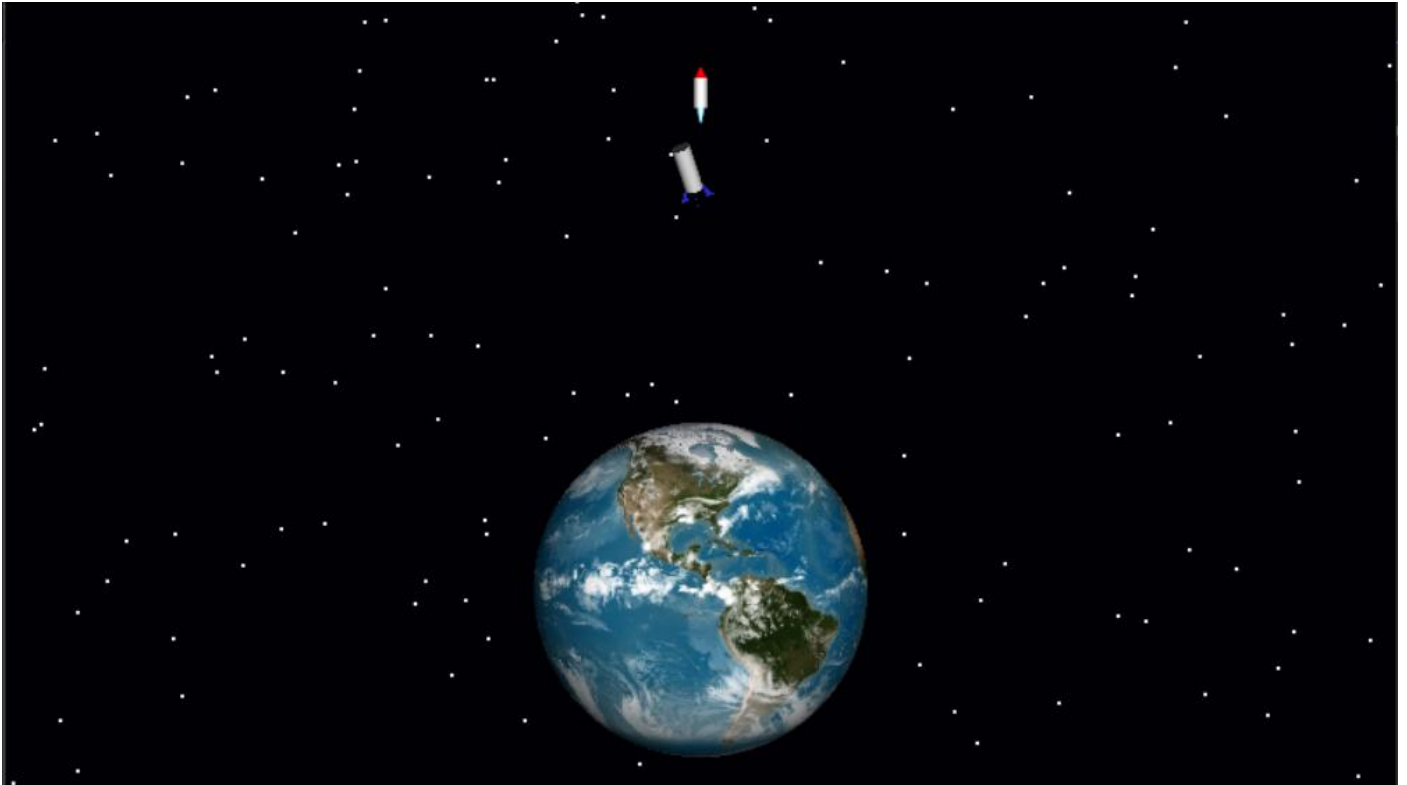
- **'L':** Press 'L' to initiate the rocket launch.
- **'R':** Press 'R' to reset the simulation back to the pre-launch state.
- **'ESC':** Press the Escape key to close the application.

SNAPSHOTS

INITIAL LAUNCH PHASE



SEPARATION STAGE



SATELLITE IN ORBIT

