PA7 Solar System

Instruction Manual

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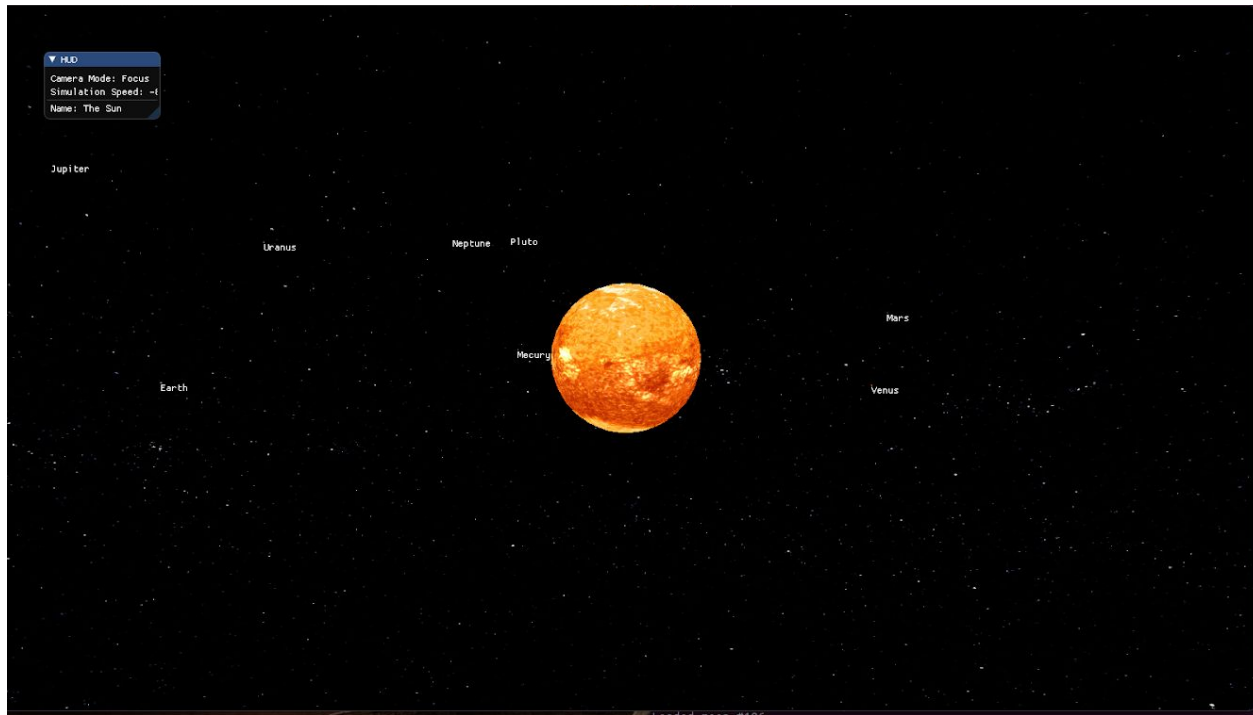
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Overview

Dependencies

For both of the operating systems to run this project installation of these five programs are required GLEW, GLM, SDL2, assimp, and ImageMagick++.

To install GLEW, GLM, and SDL2 the command is:
sudo apt-get update
sudo apt-get install libglew-dev libglm-dev libsdl2-dev

To install assimp, the linux terminal command is:
sudo apt-get update
sudo apt-get install libassimp-dev

To install ImageMagick++, the linux terminal command is:
sudo apt-get update
sudo apt-get install libmagick++-dev

This project uses OpenGL 3.3. Some computers, such as virtual machines in the ECC, can not run this version. In in order to run OpenGL 2.7 follow the instructions at Using OpenGL 2.7

Extra Credit
Rubric Defined Extra Credit:
-This program uses a config file called "planetData.txt" located in the assets folder to determine scales for the planets (Extra for non-grad students)

-This program allows the user to change the simulation speed. (Extra for non-grad students)

-This program has rings on Uranus, Neptune, and Jupiter in addition to Saturn.

Considerations for Extra Credit:

-Advanced camera controls

This program has 3 different camera modes: Focus, Free, and Overview/Top-Down. Each mode has different features and controls. Focus mode allows the user to focus on a particular planet or the Sun, allowing them to get a good look at each planet. Free mode allows the user to pan around the solar system. Lastly, Overview/Top-down mode allows the user to see the solar system from the top. The camera modes are defined more in-depth in the Keyboard Controls

-Correct amount of satellites for each planet

This program is able to render and update the correct number of satellites for each planet. Here are the numbers of satellites for each planet:
- Mercury - 0
- Venus - 0
- Earth - 1
- Mars - 2
- Jupiter - 79
- Saturn - 62
- Uranus - 27
- Neptune - 13
- Pluto - 5

These satellites, except for Earth's Moon, are on random scales, orbit paths, rotation speeds, and orbit distances.

-Added a Star Box

This program adds a box of stars around the solar system render area, getting rid of the flat blue background. This is shown in the screenshots provided in the Keyboard Controls.

-Added Names to the planets

Each planet has its name displayed over top of it.

-Added HUD

The top left corner of the screen now has a window that displays the speed value, current camera mode, and focused planet.

User Manual

Building and Running

To build this project there are two options. One is to use CMake which makes including new libraries easier, and handles new files added automatically to the src and include directory. CMake is a small new learning curve but makes things easier in the future. The second option is to use the provided Makefile which is used as usual.

Running the make in a separate directory will allow easy cleanup of the build data, and an easy way to prevent unnecessary data to be added to the git repository.

To install Cmake, the linux terminal command is:
sudo apt-get update
sudo apt-get install cmake

CMake Instructions

The building of the project is done using CMake, installation with apt-get or brew may be necessary. Later use with CMake and Shader files will be require the copy of a directory where those files are stored (ex. shaders). To do this in the add_custom_target function place

COMMAND ${CMAKE_COMMAND} -E copy_directory
${PROJECT_SOURCE_DIR}/shaders/ ${CMAKE_CURRENT_BINARY_DIR}/shaders

Run Instructions

After building the project, the executable can be ran. This program requires a config file to run. The file must be placed in PA7/assets and must be named "planetData.txt"

In the PA7 directory, enter the following commands into the terminal:
mkdir build
cd build
cmake ..
make
./SolarSystem

Format of planetData.txt

All items in the config file must be formatted specifically for the program to run.

The first line must read: "Camera" speedMod(focus mode) speedMod(free mode)

The second line must read: Sun {scale of sun compared to earth}

The third line must read: Star {scale of Stars}

The next 9 lines must be formatted as such: Name moonsNum orbitRadius(per 35mil miles) rotSpeed(in days) orbitSpeed(in years) planetScale(scale to earth)

These formatting rules are also described within "planetData.txt" included with the program

Keyboard Controls and Camera Modes

This program uses an advanced camera feature to traverse the solar system. The camera is split into three different modes that can be toggled by pressing the "M" key on the keyboard.

Overall Controls

ESC - must be pressed to close the window (or right-click on the task bar and select close).

M - toggle camera mode (1. Focus Mode, 2. Free Mode, 3. Top-Down/Overview Mode)

"+" - Speed up simulation

"-" - Slow down simulation

Focus Mode (Default Mode)

This camera mode allows the user to focus on each planet individually. Shown in figures 1-3.

F - Change currently focused planet
W - Zoom in on currently focused planet
S - Zoom out from currently foucsed planet

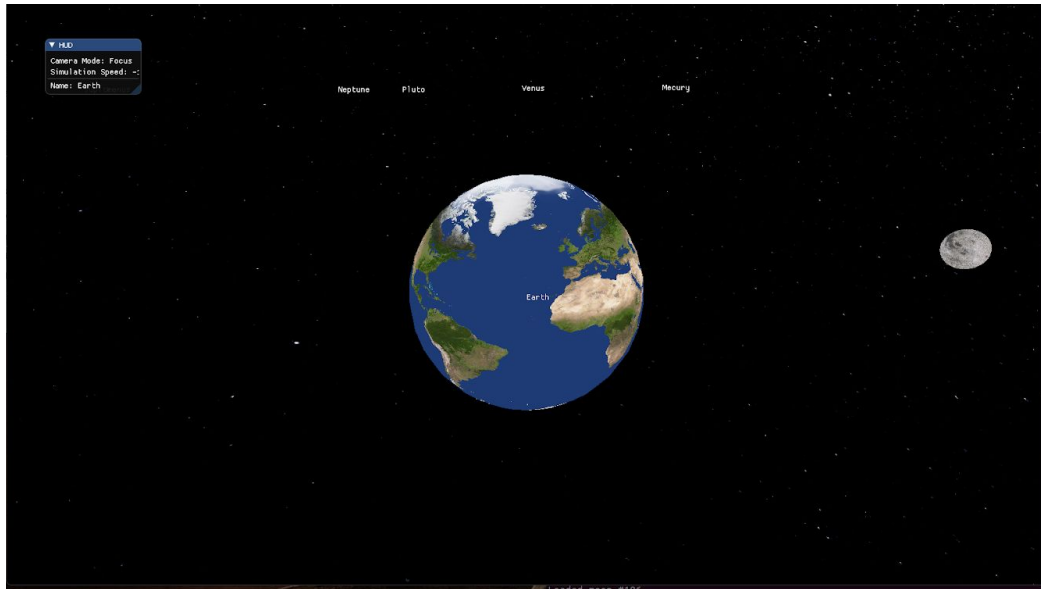UpArrow - tilt camera up
DownArrow - tilt camera down
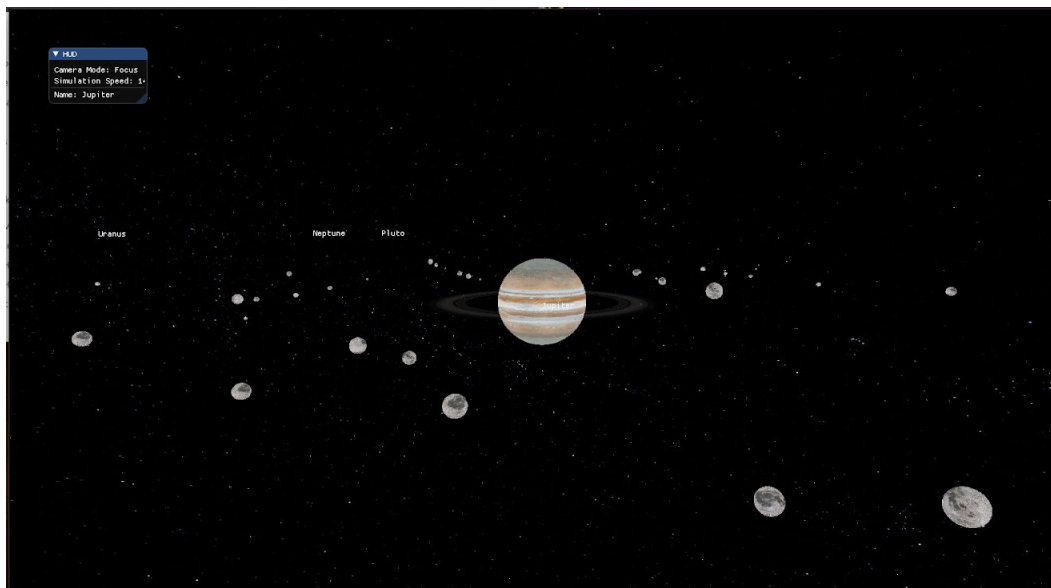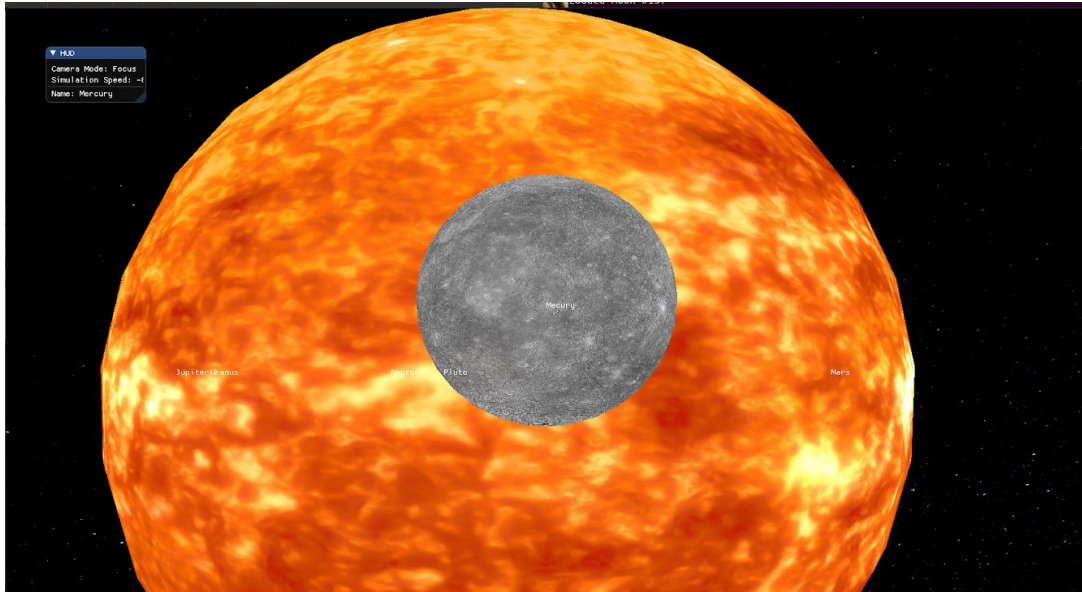

Fig 1. Earth Focus

Fig 2. Jupiter Focus

Fig 3. Mercury Focus

Free Mode

This camera mode allows the user to move around the solar system freely. Shown in figures 4-6.

W - Move forward
S - Move back
A - Move left
D - Move right
UpArrow - Look up (increase pitch)
DownArrow - Look down (decrease pitch)
LeftArrow - Look left (decrease yaw)
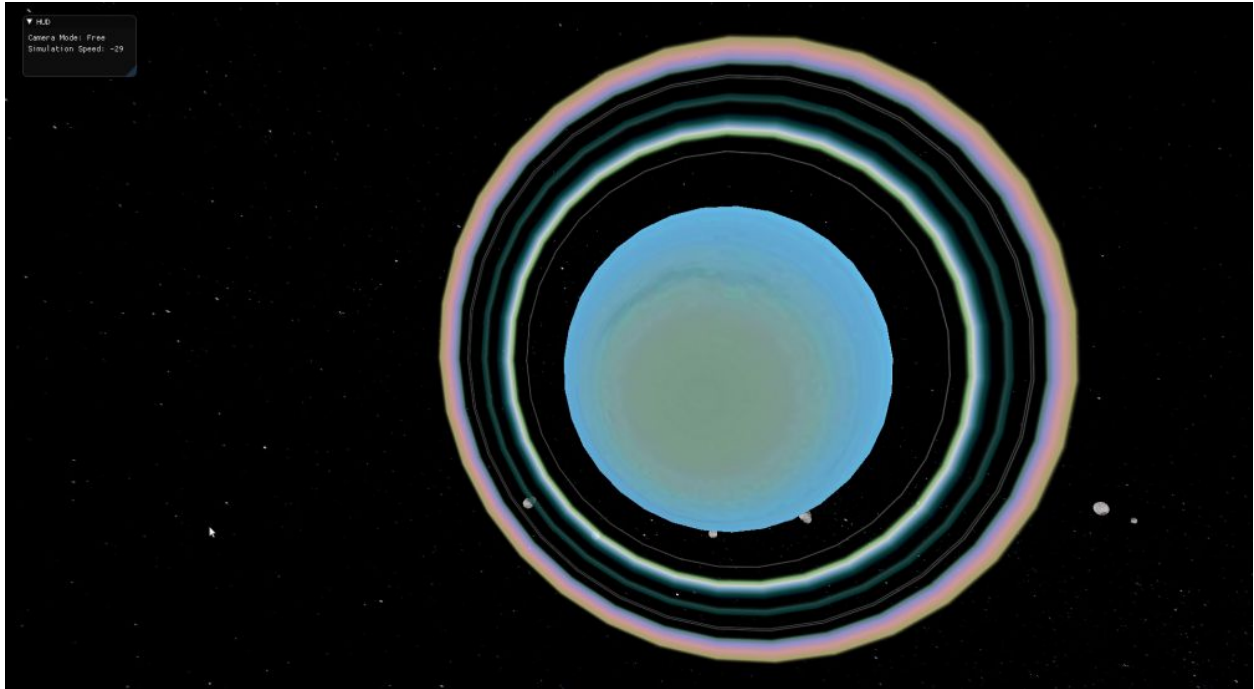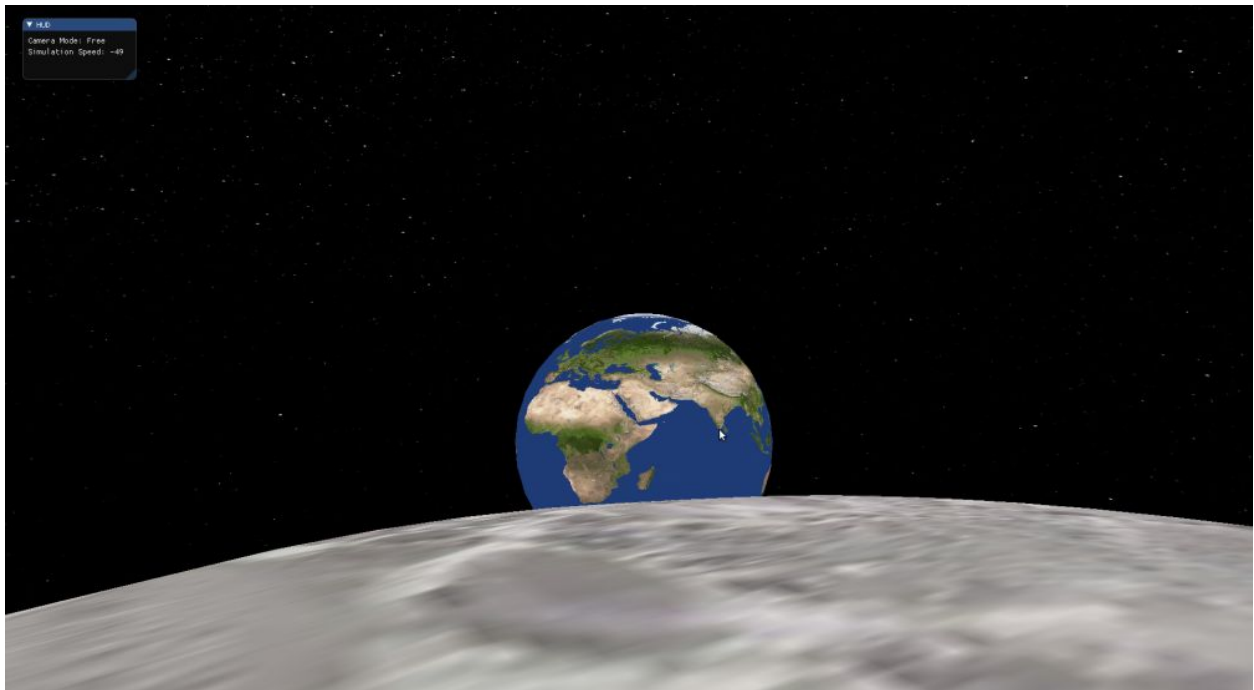RightArrow - Look right (increase yaw)

Fig 4. Uranus
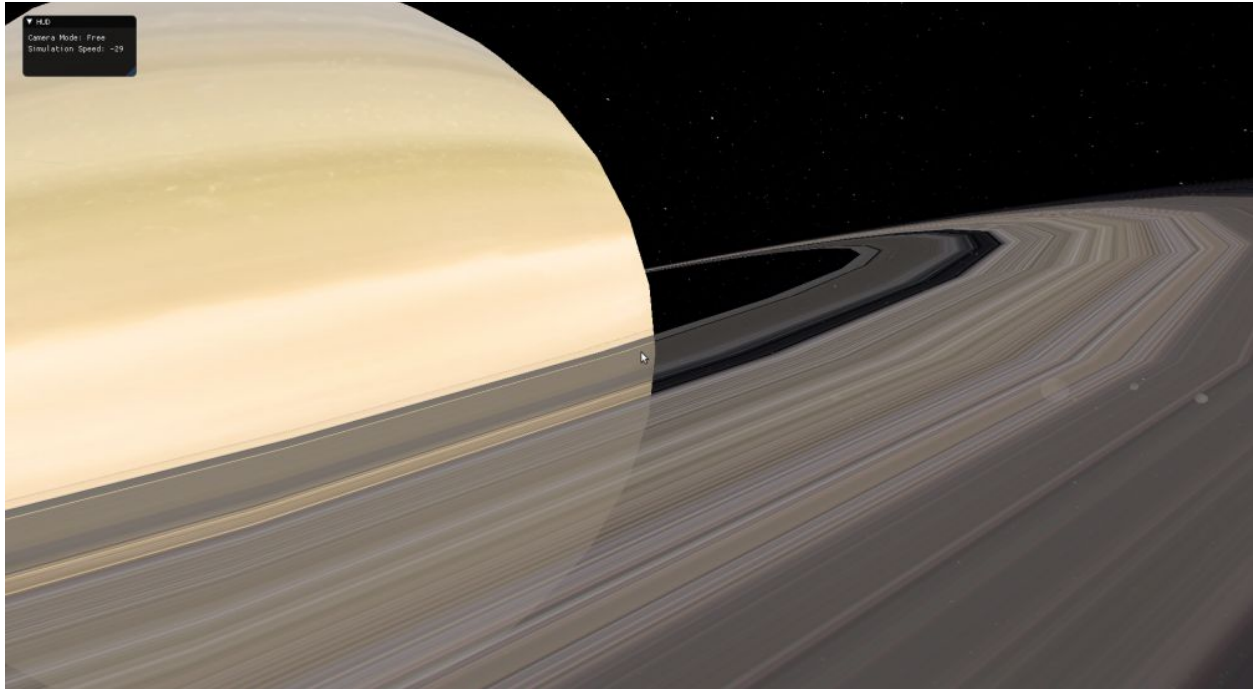

Fig 5. Earth from the Moon

Fig 6. Saturn Close-up

Overview/Top-down Mode
This camera mode gives the user a top down perspective of the solar system. Shown in figure 7.
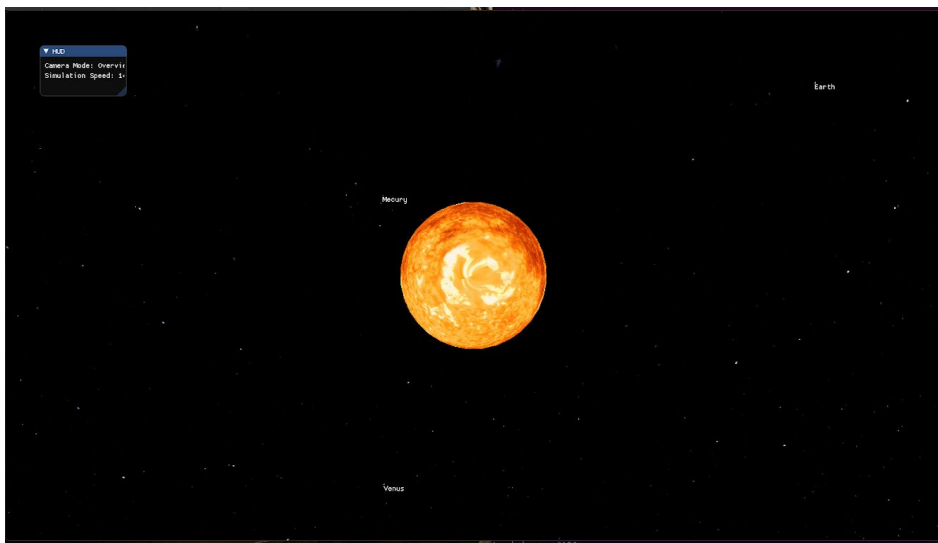
W - Zoom in
S - Zoom out

Fig 7. Overview Mode

Tech Manual

Issues and Bugs
- Pluto's moons are small and blend into the star background; they are hard to see with the background
- Some Textures are tilted; Possible issue with Blender
- Camera move speed is different for every machine; pseudo-fixed by adding a "camera speed modifier" to the config file.

Changes made since Wednesday (Oct. 17, 2018)
- Added Star Box
- Added proper number of moons for each planet
- Added rings to Uranus, Neptune, and Jupiter
- Made Uranus spin sideways and tilted saturn
- Made program able to change simulation speed
- Program now has a Heads up Display(HUD)
- Planets have names displayed above them.