CS 680
Computer Graphics

SOLAR SYSTEM

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CONTENTS

1. OVERVIEW

The project is programmed to create a solar system using computer graphics. The Sun, all eight planets and their moons and pluto and its moon are loaded into the solar system. The two important methods of computer graphics used in the project are mainly model loading and texture mapping. The object for the model is built in a software called "Blender", which is called in the program using assimp functions. The texture mapping is done using ImageMagick. The project has Actual Value and Scaled Views.

PLANET NAME	MOON NAME
Mercury	-
Venus	-
Earth	Moon
Mars	Phobos
Jupiter	Europa
Saturn	Titan
Uranus	Ariel
Neptune	Triton
Pluto	Charon

Table with name of planets and its respective moons

i. Dependency

Installation of three programs are required to run this project on the operating systems: GLEW, GLM, and SDL2.

Ubuntu/Linux

> *sudo apt-get install libglew-dev libglm-dev libsdl2-dev*

Mac OSX

Installation of brew is suggested to easily install the libs. Ensure that the latest version of the Developer Tools is installed.

> *brew install glew glm sdl2*

This Project uses imagemagick and Assimp

Ubuntu/Linux

sudo apt-get install libmagick++-dev

It works on the ECC ubuntu machine since they already have it downloaded.

 sudo apt-get install libassimp-dev assimp-utilsev

Mac OSX

Installation of brew is suggested to easily install the libs. Ensure that the latest version of the Developer Tools is installed.

brew install assimp

ii. Extra Credit

- Scaled view
- Menu
- Menu slider for speed (Live adjustment of simulation speed)
- Menu slider for zoom
- Configuration File
- Planet Rings for Uranus and Jupiter

2. USER MANUAL

i. Build Instruction

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

Cmake instructions

mkdir build
cd build
cmake ..
make
./Solar

ii. Keyboard and Mouse Interaction

Keyboard Input

- a: Reverse rotation of planet or moon and its orbit
- s: Reverse the orbit of the planet or moon
- d: Reverse the rotation of the planet or moon itself
- f: Pause, Pressing a,s,d,f keys or Clicking left,right,or middle on the mouse unpauses the planet or moon
- z: changes what you will affect when pressing a,s,d f, middle click, left click, and right click. Before pressing z you will be able your interactions will affect all moons. If you press z, you will affect one of the moons. You can press z any to interact with any of the moons. After you iterate through all of them, you will be able to affect all moons again, and be able to iterate through planets again.
- Arrow Up: Zooms out the planet
- Arrow down: Zooms in the planet
- Arrow Left : Move the camera to the left
- Arrow Right : Move the camera to the right

Mouse Input

- Middle Click: Reverse rotation of planet or moon and its orbit
- Left Click: Reverse the orbit of the planet or moon
- Right Click: Reverse the rotation of the planet or moon itself

Menu options

- Speed Slider : to change the speed of all planets (both rotation and revolution speed) Set slider to 0 to pause the movement or press "f".
- Zoom : zooms in and out of the planet or moon (higher the number, farther the camera)
- Disable Clicks : Used to disable the mouse clicks for interactive controls. (This should be checked to click the menu options)
- Zoom in: This menu has sub-menus with the name of all the planets and moons, which by clicking will near that planet or moon.
- Reverse Orbit: Reverses the direction of planet's or moon's Orbit.
- Reverse Spin : Reverses the spin direction of planet or moon.
- Scaled View: By clicking scaled view once, the scaled view of the solar system can be seen. When clicked again, it goes back to the actual value view. Scaled view have scaled values. It helps to see The Sun, planets and all their moon in a single window.
- Reset View: To reset the view.

Note:

The program takes few seconds to load, so the window will be blank for the first couple of seconds after building.

The initial screen shows the Solar System with actual values that are scaled. You must use the zoom in submenu (the list with the planets) to view planets and moons. This is because they are so far away from each other.

If the planet or moon is not seen by clicking any menu, it is because either the camera is zoomed in too close or zoomed out too far. In this case, adjust the Zoom Slider accordingly. Or use the arrow keys (UP and Down) for precise movements. Arrow keys helps move the camera farther than the slider allows

Please use reset view if you have any issues viewing the planets.

In scaled view, at the beginning the end planet looks like they don't move because they move slow. Increasing the speed can make differences.

Menu options

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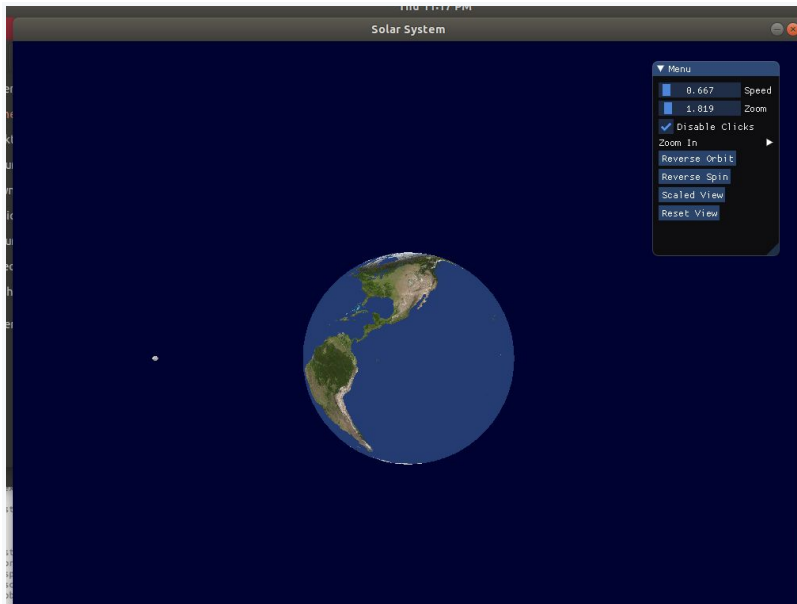- Reset View: To reset the view.

3. FIGURES

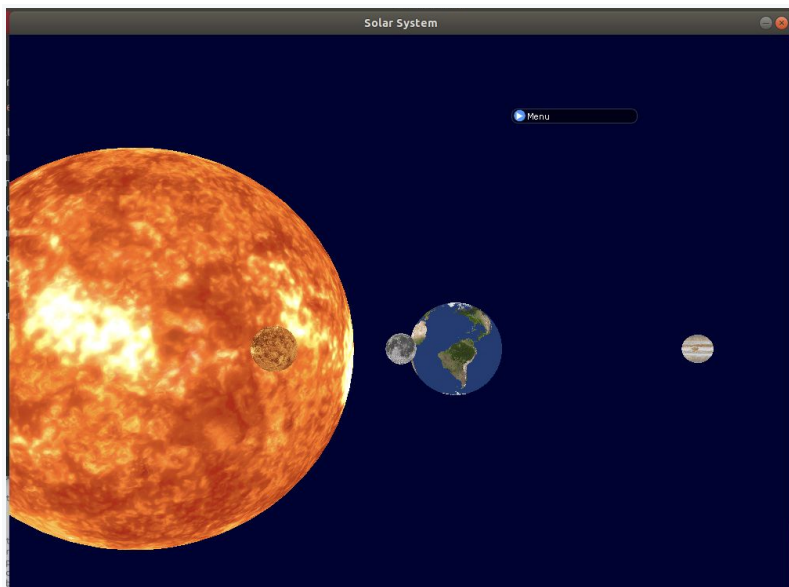## Actual Value Option
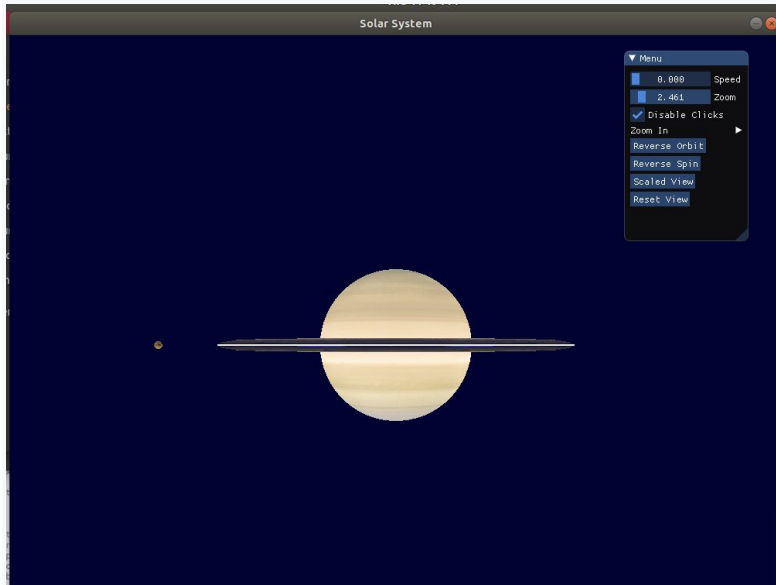
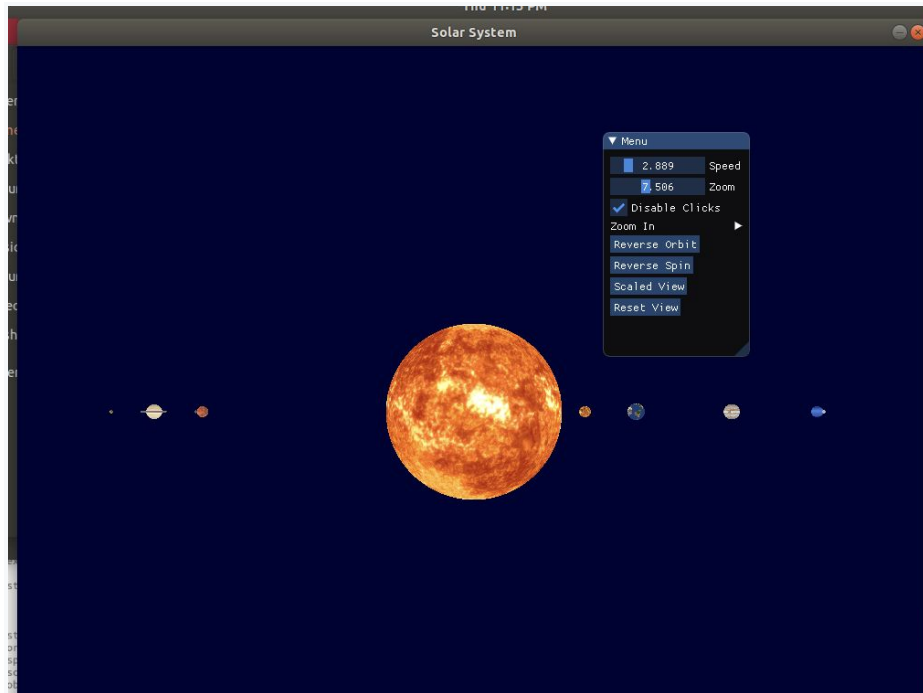Saturn and its moon Titan
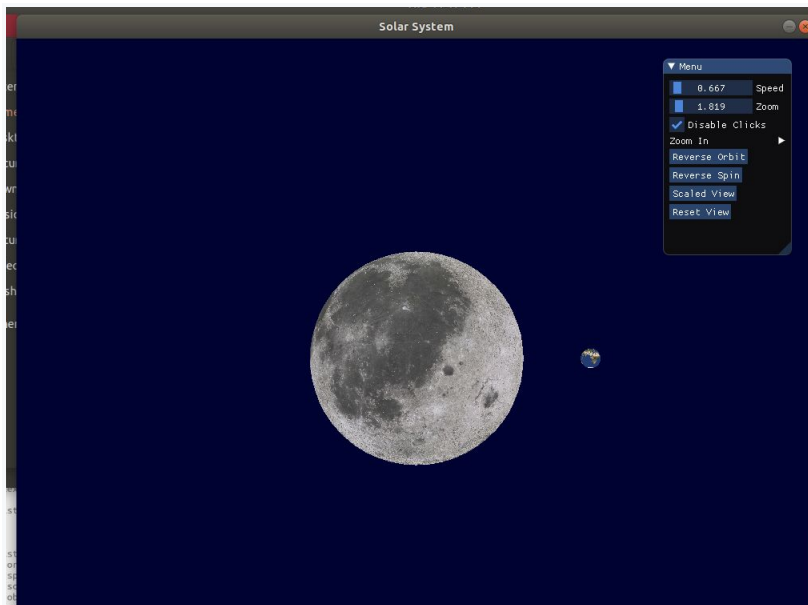
Earth from Moon
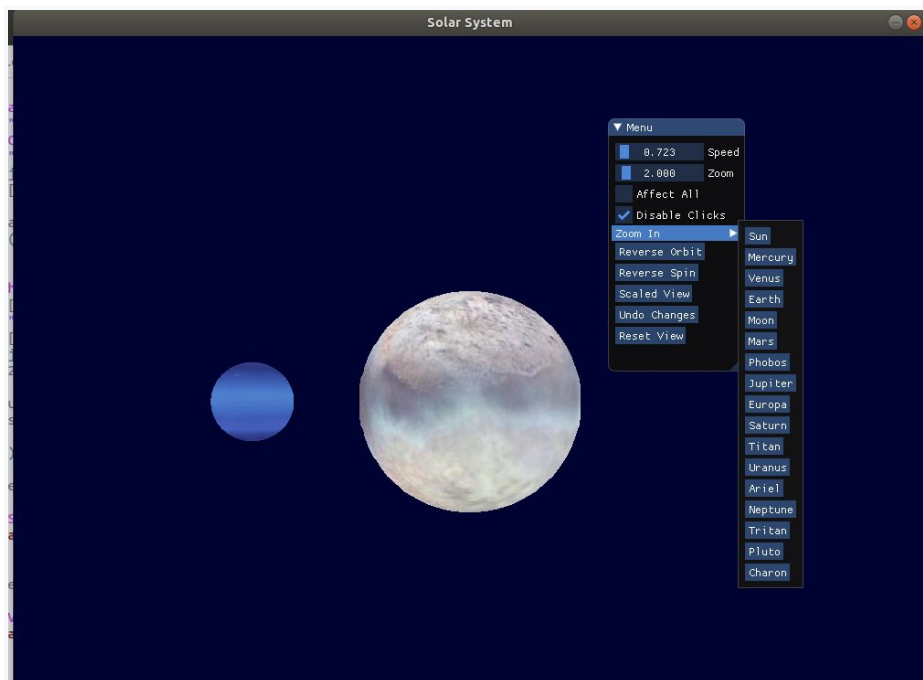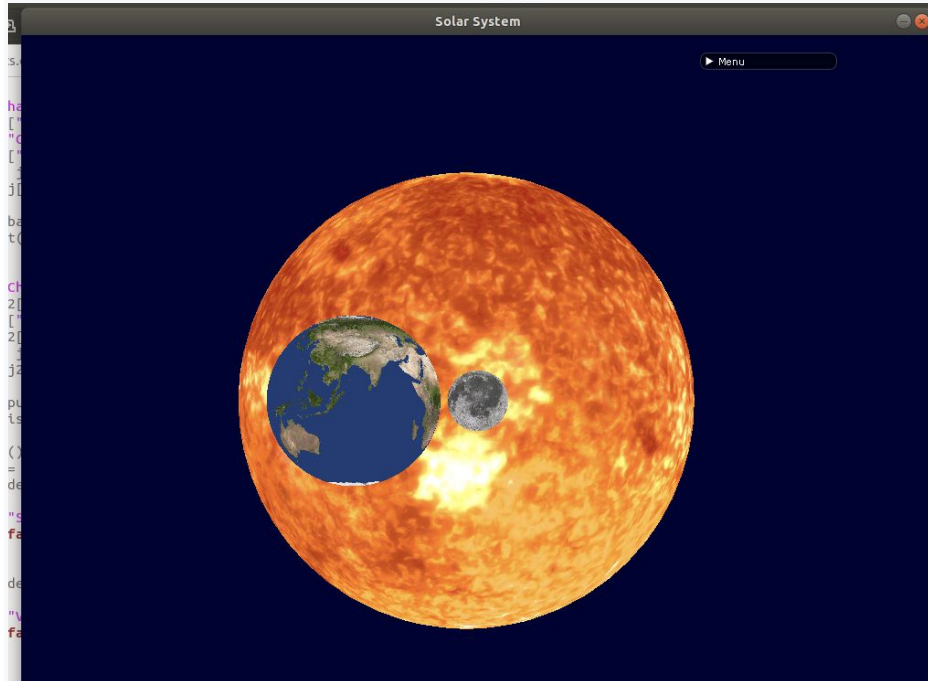
Moon from Earth

Scaled View

Planets around Moon

The whole solar system

Uranus from its moon Tritan

Sun, Earth and Moon

4. TECHNICAL MANUAL

i. Changes Made

Worked on the Scaled view

Camera rotation

Updated the zoom in functionality to set the zoom value so that it is more user friendly.

Added rings to Uranus and Jupiter.

Updated the readme

ii. What we could have done differently

For creating the scaled view loaded the objects twice to add different properties to planets. Instead of loading the objects twice, we could have tried to just change the properties of the objects.

We would have added more options for camera rotation.

We would try to find a way to make sure that some of the small moons don't act weird. It may have to do with floating point precision. The way we fixed it for now was by making them larger.

We would also have added better controls and more controls, so that the user is not forced to use just menus or just keyboard input or just mouse clicks for certain interactions with the program. Also, more options to interact with the program could be useful.

We could also have added a sky box by making a large cube with a texture on it follow the camera around.

Orbit lines and labels for planets would also have been nice features