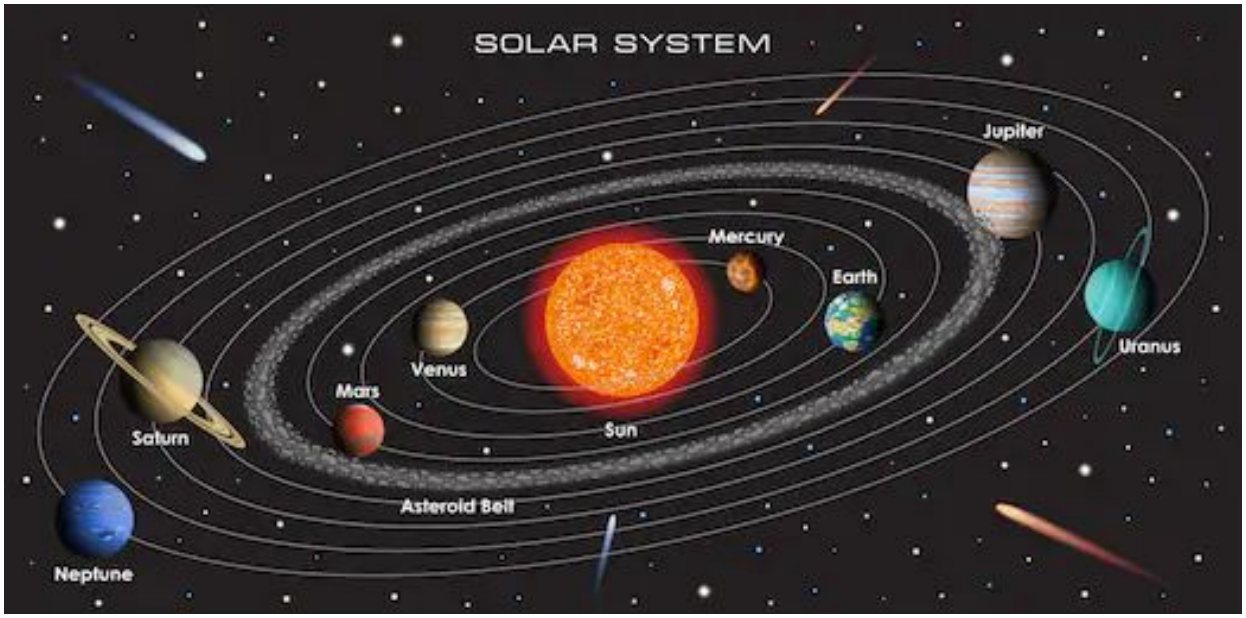


The Solar System

12.03.2020

Brayden Tremper
tremperb@oregonstate.edu
CS450 Fall 2020

Video Link: https://www.loom.com/share/e0dfc5320ab24831b35acd2303d7a80a

Proposal

Like many past ones my proposal is to make the solar system. This sounds very interesting to visualize and create.

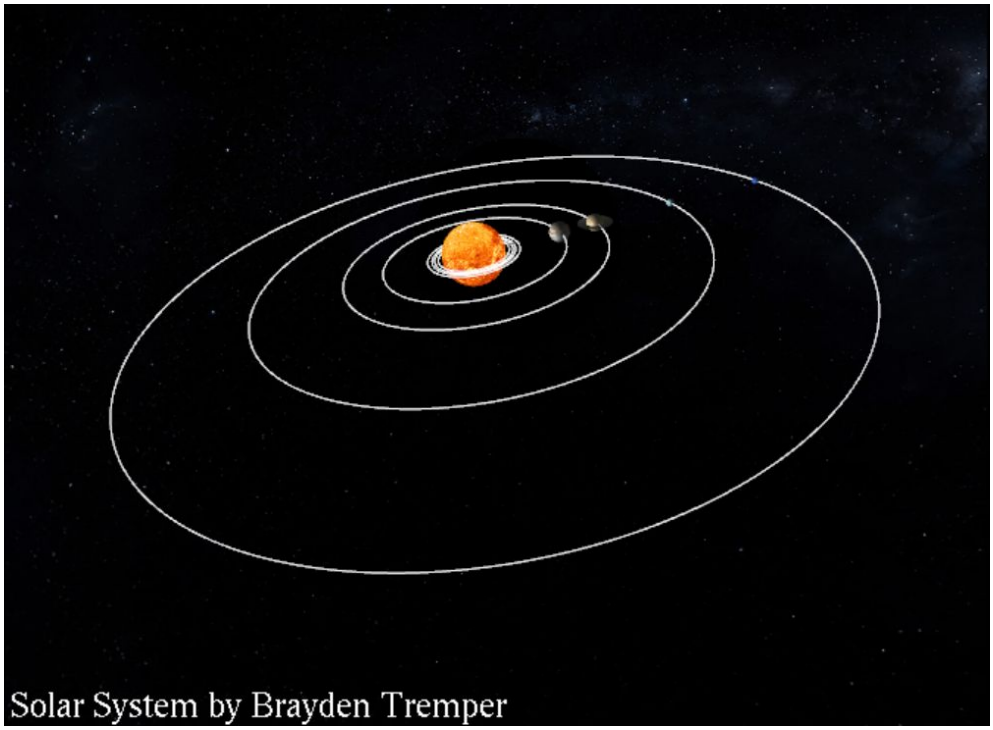
Similar to the comments you listed on this project I will scale the planet's diameter and orbital radius so it will actually be visible on the screen while keeping it proportional. Along with this, I will also implement Kepler's third law for the orbital periods.

Each planet will be a sphere with its according texture applied to it. Thus the spheres(planets) to be included are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune, as well as the sun taking this similar format. All of the planets will orbit around the sun as expected, with the sun not exactly being to scale as it is simply too large, with this the sun in my model will end up being roughly 3 to 5 times the size of Jupiter depending on how this visualization looks. Also, each planet will also have its individual day rotation applied as well. In addition to this, I will also seek to make the rings for Saturn in an easily recognizable format. Following this, I will also create a circle line for the path of each planet orbiting around the sun.

Those listed above are some of the required functionality I am seeking, being similar to the comments you have suggested for the solar system project. However, some additional functionality that can be added would be to include the moon orbiting around the earth in addition to the previous functionality. Also, setting different viewpoints so you can see each planet up close, with the extra possibility of being applied during the planet's movement so you can visualize your chosen planet while it rotates and orbits the sun. Also, I believe creating a star environment in the background would be appealing as well.

Aside from this functionality I am open to any extra as well to make this project more interesting. I am sure the majority of proposals you see regarding the solar system are relatively similar. If you have any additional functions that you are curious to see in this project that you have yet to, I am willing to attempt them as well.

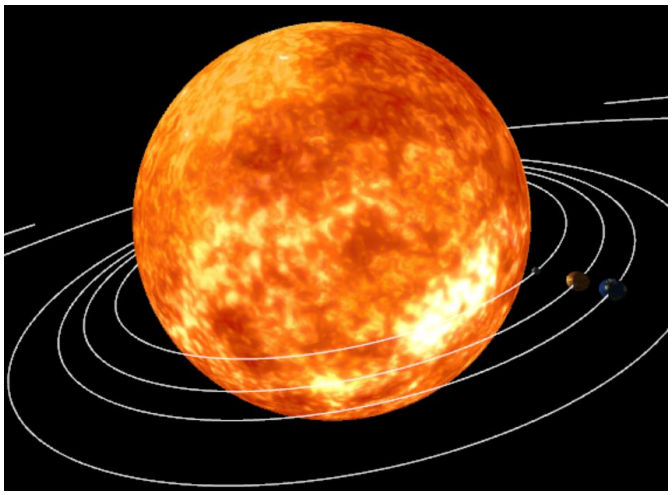
Complete Project



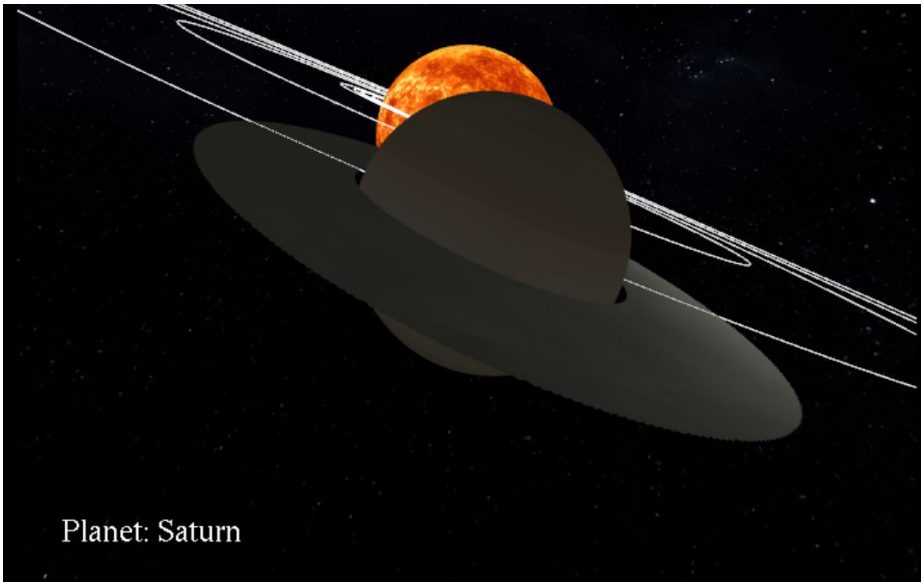
When viewing the completed version of the project, all essential tasks were completed. A planets were created using a display list with the earth being our starting scale of 1. Both the orbital radius and planet diameter abided to this scale factor. Each planet was then scaled and placed in its appropriate location based on the planet diameter and orbital radius shown below.

Planet Name	Orbital Radius (Scale Factor)	Diameter (Scale Factor)
Mercury	0.387	0.383
Venus	0.723	0.949
Earth	1	1
Mars	1.52	0.532
Jupiter	5.20	11.21
Saturn	9.58	9.45
Uranus	19.20	4.01
Neptune	30.05	3.88

With the above method in place all planets and orbitals were scaled accordingly. However, the sun was exaggerated as expected by just being scaled 3 times the size of jupiter. This allows yourself to acknowledge its size without it taking over the entire scene, as shown below.

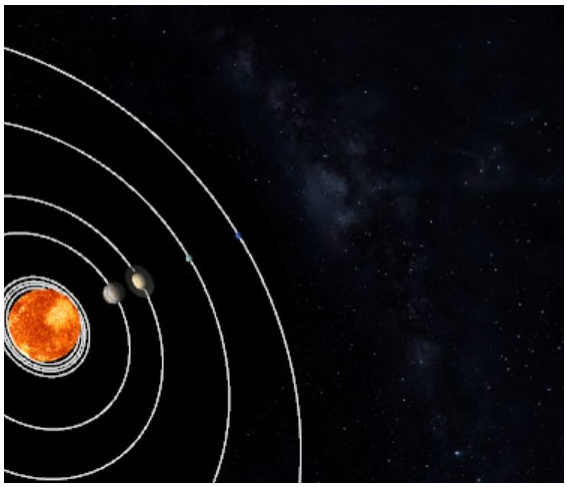


Following this, as you can see in the picture above each orbit for the planets was represented using a GL_LINE_STRIP. This allows you to see the path for each. In the video you can view the planets moving and acknowledge how it sticks to the path. Of cours, in reality it may be slightly different but this focuses on the average orbit which works well for our case. Following this, the final required functionality listed in the proposal was to develop a ring for saturn. This was completed using a GL_TRIANGLE_STRIP, where a sin and cos where calculated each time to create 2 vertices one being the inner circle while the other being the outer. This create the needed effect with a ring. The visualization for this can be seen below.

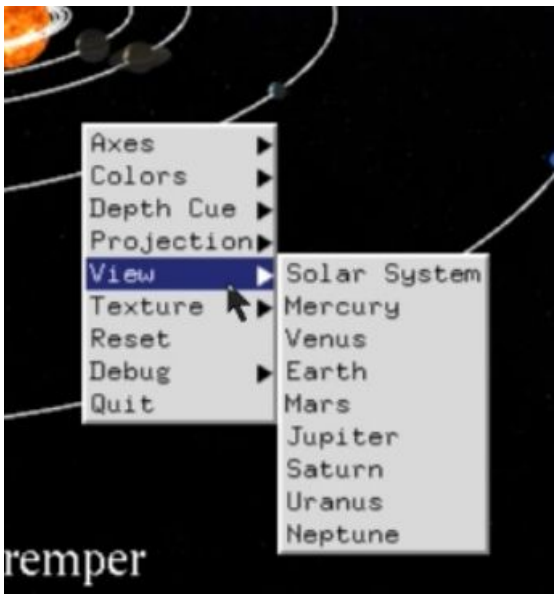


Finally, all animation were completed successfully according to keplers law. Branching off of the required functionality I also implemented two other sections which I briefly discussed in the proposal.

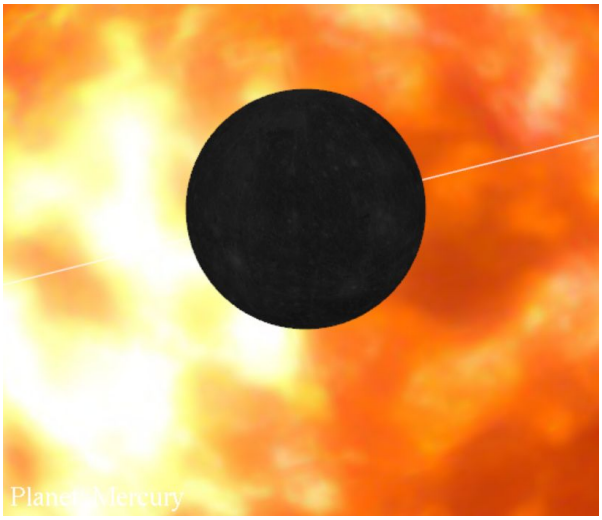
Firstly, I created a star environment for the scene. This is difficult to see in the screenshots for some reason but it is a lot more visible in the video. To complete this I simply created another sphere using the sphere list for our planets. WIth this, I scaled it to be greater than the total size of the scene, I then applied a star texture to it allowing it to be seen and acknowledged in our viewport. A prominent view of this effect can be seen below.

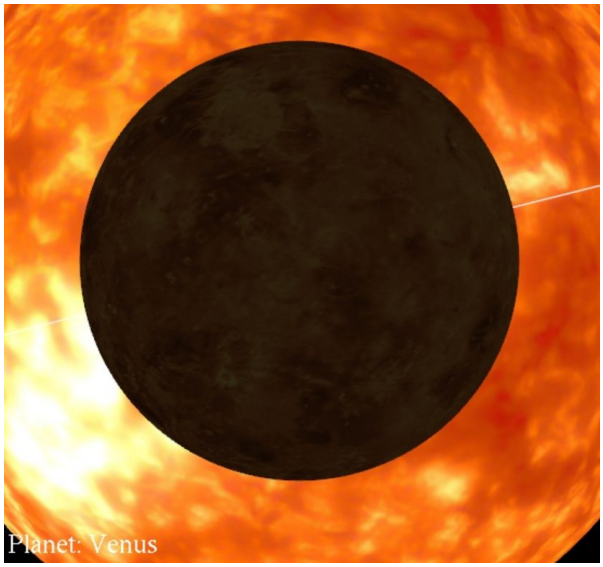


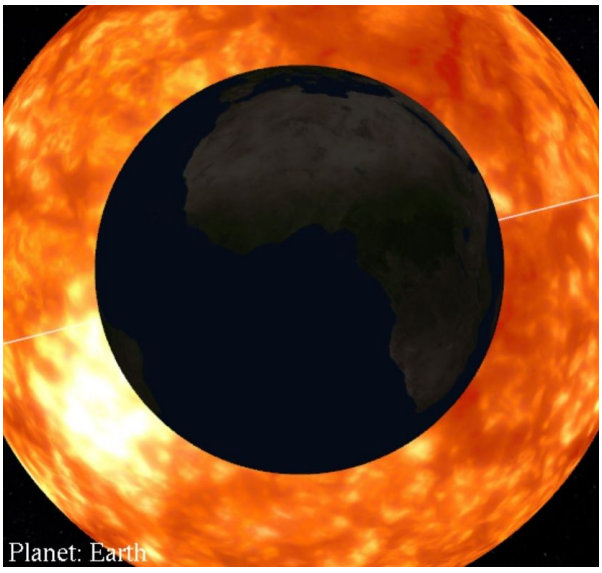
Secondly, I implemented a menu option to adjust the view by creating a different viewpoint for each planet. This was accomplished using the glulookat call. An overview of this can be seen below.

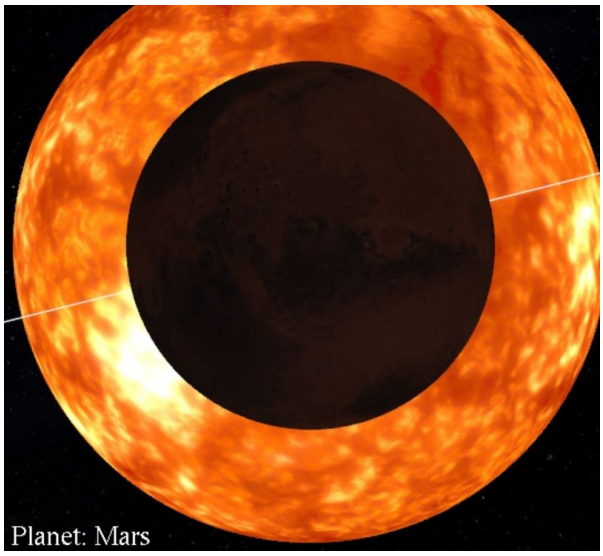


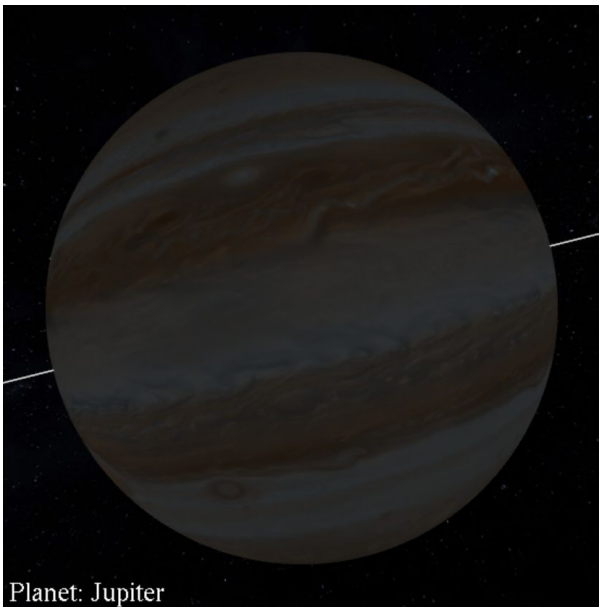
The individual viewpoint for each planet can also be seen below. Along with it, the planet name is updated for each varything viewpoint. As you can see each viewpoint stares at the back of the planet so it will appear dark as it is not an area being hit by the point light from the sun. The images from each viewpoint can be seen below.

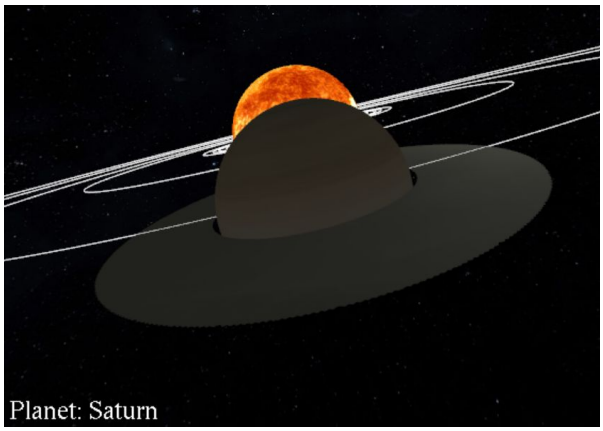


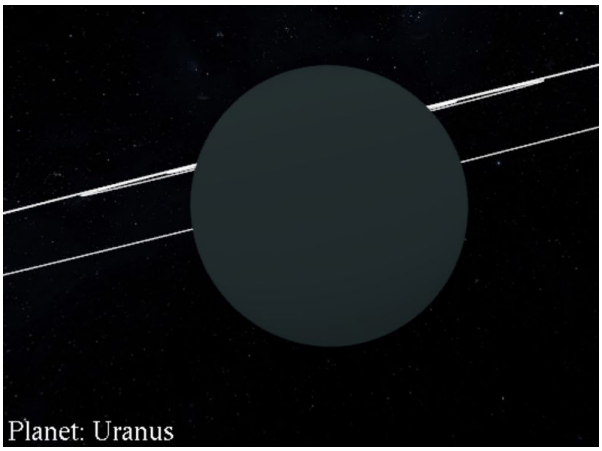


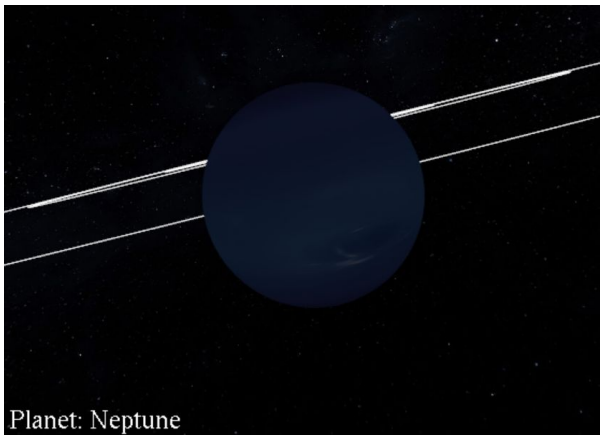












With the implementation of all these features I believe I was able to implement a satisfying solar system which completed all requirements.

Differences

When viewing the differences from what was proposed and what was actual completed, few come to miind. In regards the required functionality, all items were completed successfully as I had envisioned them while writing the proposal. Some extra options that I suggested I may try in the proposal were not completed these included, allowing the viewpoints to follow the planets during animation, this proved difficult and unreasonable, especially for the inner planets which rotated at a high speed likely causing a jarring experience. Also, adding a moon to rotate the earth was not implemented as the completed items took longer than expected. However, all required functionality was met.

What I learned

This project allowed me to use nearly everything learned in this course and apply it to a single project. This combination proved difficult at first, due to everything being grouped seperately throughout the term, applying everything into a single program proved difficult but was ultimately accomplished making a great learning experience. Also, using multiples textures was a great learning experience as it allowed myself to understand how to manage multiple textures. Additionally, I also learned how to move multiple objects in a scene at a different speed. This animations has been attempted before but this allowed great depth into it while targeting a specific speed. Finally, I learned greater insight into the importance of display lists. I new the were important before but this truly illustrated that idea as I tried calling a sphere for each planet outside a list causing a low optimized program. Thus, this concreted an understanding of display lists. Overall, this project brought many new ideas while also creating an opportunity to build off, implement, and fully learn previous ideas.

Link

Video Link: https://www.loom.com/share/e0dfc5320ab24831b35acd2303d7a80a