

CS 550 Fall 2020

Final Project

Yu-Hsiang Liu

933-951-866

E-mail: [liuyuhs@oregonstate.edu](mailto:liuyuhs@oregonstate.edu)

Video Link: [https://media.oregonstate.edu/media/1\\_sxtslo4x](https://media.oregonstate.edu/media/1_sxtslo4x)

## Space Adventure

### Introduction

In the final project, I tried to build a scene about a spaceship traveling in space. The background is an unknown place in the universe. Therefore, some physical theories are the same as the solar system, but some of them are not.

For example, the motion of planets follows Kepler's Third law as the solar system, but the size, and the amount of planets are different. The mission is to rescue the other missing spaceship in this place.

### Implement

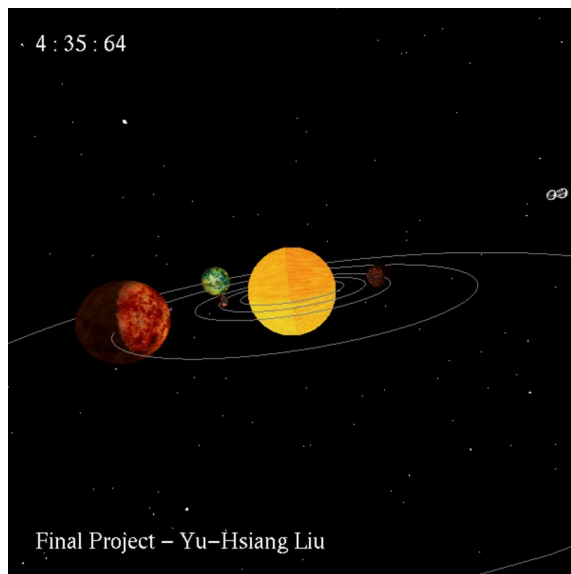
There are totally five different planets and a star. As we mentioned above, the planet follows Kepler's law. In addition, I add some small dust in the universe to make the scene more abundant.

For the two spaceships in space, which load from the obj file, one is immovable, the other one can be controlled by users. On the left-top of the screen, there is a count-down timer. To complete the mission, not only find the ship, but also close to it. The distance should be less than one between the mission ship and broken ship. If we could not find the broken spaceship in time, the scene will show the mission failed.

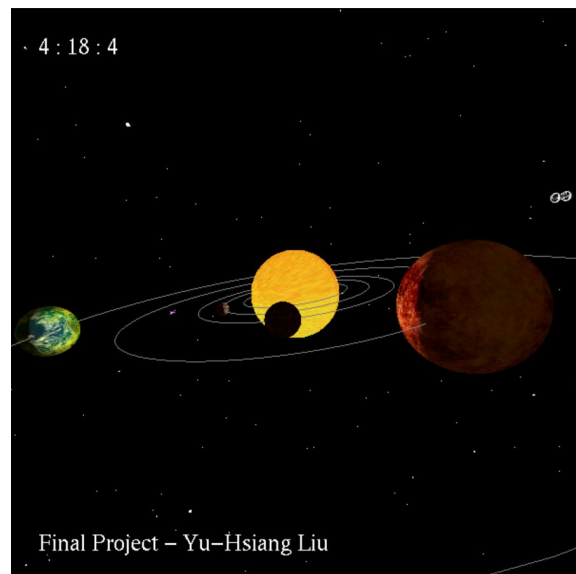
There are two view options for users, one is inside the spaceship, the other is outside the spaceship. If you are inside the spaceship, key = 'w', 'a', 's', 'd' (up, left, down, right)

can change the direction we are looking, key = 'n', 'm' for forward and backward. In the outside mode, we can use the mouse to zoom in/out as usual.

a.outside mode I



b. outside mode II



## Difference

The difference can be separated into two parts. First part is the thing I did not do but in the proposal, second part is the thing I did but not in proposal

1. I canceled the spotlight from the spaceship, because the sunlight is enough to watch the whole scene. Also I change our mission target from UFO to another spaceship, because rescuing a spaceship is a more realistic setting.
2. I add the small dust in the universe to make the scene more abundant. Also, I draw the orbit for each planet, so it is easier to observe the moving. From the top-left side, I add a countdown timer that makes the user feel like being in a game.

## Learning & Impressive

Before doing the final project, I think controlling the spaceship is an easy thing by just using the translate function. However, I am totally wrong. Since in my project, there is an inside view in the spaceship, we need to change the parameters such as eye-vector and up-vector in lookat function. In fact, I have a poor sense in direction.

By searching the information on the website, I find the Rodrigues' rotation formula. It is an efficient algorithm for rotating a vector in space. Given the vector we are looking at, a unit vector describing an axis of rotation and the rotate degree, we can calculate the vector after we rotate. For turn left and right, we do not need to calculate the unit vector, because it is the third vector in the lookat function. For turn up and down, we must calculate the cross product of the first vector and third vector in the lookat function.

A little flaw in this project is that I didn't add the collision between the spaceship and planet, but overall, the scene is beautiful.

## More Screenshots

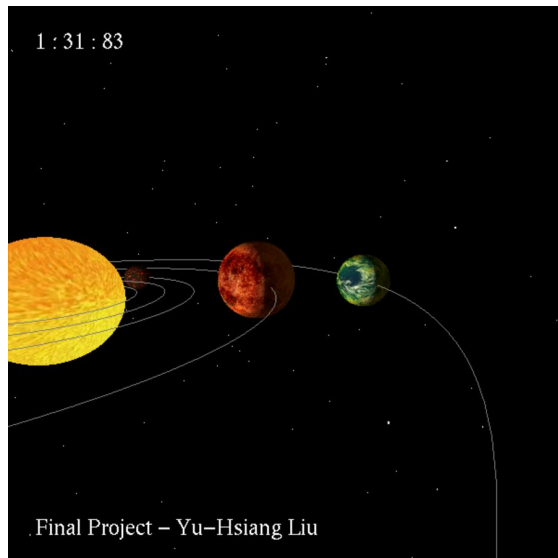
c. outside mode III



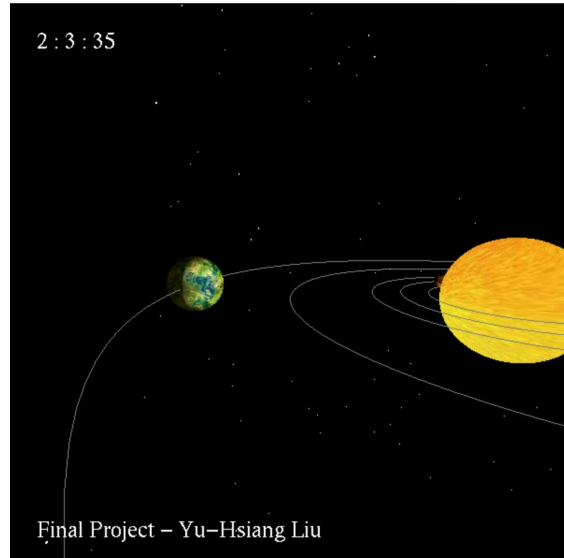
d. outside mode IV



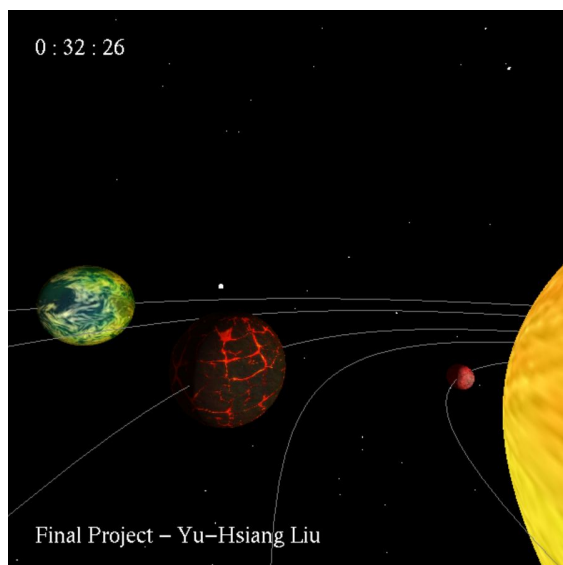
e. Inside mode (turn right)



f. Inside mode (turn left)



g. Inside mode (travelling)



h. Inside mode (brokenship)

