Middle Term report

M11125016 蕭強

In this mid-term report. The achievement is to make an object on the track and side with the center what is loading from XYZ format. According to the teacher advised that use a 4x4 matrix what have a rotation and transition. The project workflow, as illustrated in Figure 1, was executed in three distinct steps:

**Step 1**: Utilizing Three.js addons such as XYZLoader, OBJLoader, and MTLLoader, the program was equipped to effectively read and interpret the given formats.

**Step 2**: To establish seamless motion along the track, the current point and the subsequent point were employed to determine the vector direction. This direction vector was then utilized to construct a transformation matrix.

**Step 3**: The calculated matrix was subsequently applied to the object, enabling precise alignment with the track's curvature and orientation.

But Reality is always beautiful. There are numerous problems when I write the program.

Figure . Programing processing

# Problems I have met and completed.

1. Animate frame: At the beginning, during the animation frame, the initial idea was to calculate the angle difference between two points and use it to determine the direction of the car's head change. This way, the car could follow the XYZ subpoints, such as turning left or right, while keeping the front of the car forward. However, during execution, the car would rotate chaotically, similar to an amusement park ride. The later approach involved calculating the vector difference between the current point and the next point, obtaining the direction of a vector. Then, a Vector3 was created with the y-axis as 1, and x and z axes as 0, to compute a Quaternion and obtain a unit vector. This unit vector was then placed into a 4x4 matrix, allowing the car to travel on the track and make correct left and right turns.
2. Car direction problem:

const carDirection = new HREE.Vector3().subVectors(nextPointVector, currentPointVector).normalize();

I initially thought my approach to calculating carDirection was correct, but the resulting direction seemed oddly off, with significant deviations. It wasn't until I consulted Stack Overflow that I realized I needed to normalize the vector to ensure the direction is accurate.

However, after completion, it was realized that when at a higher elevation, the Z-axis should rotate correctly in order for the car to travel along the track (Figure 2). Therefore, improvements are needed. I will discuss this in the next section.

A computer screen shot of a race track

Description automatically generated

Figure . The taxi doesn't align on the track

# Problems still to be solved.

1. **The Taxi object direction is upside down.**

Originally, when loading the Taxi obj object, the Z-axis of the object was initially rotated by Pi radians, successfully causing the front and back of the car to turn around. However, when the movement was initiated, it would revert back to its original direction.

1. **Taxi parking issue.**

The original idea was to simply add a vector to the original X-axis to make the entire car drive to the right (or left). However, it was found that depending on the direction, the car would veer left or right, similar to someone being drunk.

**Solution**: Later, the idea of calculating an angle and providing a threshold came to mind. This way, when driving in different areas, the change in angle could be used to determine whether to add or subtract the vector. However, it took too much time to correctly execute driving on the track, so it was not implemented in time.

1. **The Taxi object is not able to align correctly with the track’s normal vector and forward.**

This issue troubled me for a long time, but later on, when I opened the XYZ format, I discovered that there was a normal vector. Therefore, I speculated that if I use the normal vector to obtain an arctan, I could make my car drive correctly on the track and follow the surface of the track for accurate movement. Similarly, for XYZ, I can use my original method to calculate the vector difference and obtain the quaternion, allowing for correct rotation.

It's a bit regrettable that I only started working on the homework this Tuesday. If I had started three or four days earlier, the completion could have been even better. Although I've already submitted the assignment, I still want to achieve the goal.