

Summary:

I took the normal steps to complete this project, first thing was to predict surrounding traffic, based on the traffic, I used safety distance check for traffic ahead and traffic behind to plan the behavior: go straight, change to left lane or right lane, update speed; finally, I used spline to generate the trajectory for next a few circles.

Traffic Prediction:

A few assumptions were made: the traffic would stay in same lane as constant speed during my prediction. A point was taken by the simulation each 0.02 second, multiplied by the leftover point size from previous trajectory, I get the vehicle estimate position for current circle.

A better approach would be recording traffic history and use the history to predict the position for the future. However, we don't know how many points the simulation digested from previous circles and how the traffic changed during those circles.

Behavior Planning:

From traffic prediction, I got the traffic information at this moment.

By checking leftover point from previous path, I get my starting point information.

With those, I first check if it's good to stay in current lane by checking distance from the nearest vehicle ahead in same lane. If good to stay, I stay and accelerate if speed is smaller than the speed limit. I gradually accelerate to make sure I wouldn't violate acceleration limit.

If it's too close to the vehicle ahead, I then check if I can change to left lane or right lane. In order to know if I can change lane, I check the distance from nearest vehicle ahead and nearest vehicle behind in that lane; I picked a bigger distance for nearest vehicle ahead since the vehicle may decelerate which I don't know.

If it's safe to change to left lane and safe to change to right lane, I pick the lane where the nearest vehicle ahead is farther from my current position.

Otherwise If I can change to left lane or to right lane, I will change lane.

In case I can't change lane and too close to the vehicle ahead in my current lane, I decelerate.

Trajectory Generation:

Once I decide which lane to go in which speed, I start calculating my trajectory.

I used spline to generate the traffic.

I picked up last two points from my previous path, and appended three 30 meters evenly spaced point along the estimate lane. I transferred those point to local frame and feed them into spline.

I feed leftover points from previous path to the trajectory so I can have a smooth transition. The remaining points were generated from the spline, where I got each point from evenly spaced block based upon estimate speed and transformed it to global frame.

Questions:

In the beginning, I tried to use JMT to generate trajectory but it ends up generating weird path, it seems the JMT technology from classroom is good for straight line. Maybe an enhanced JMT approach for curved path?