Udacity CarND Path Planning Project

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I took the simplest possible approach for completing this project and built a little bit on top of the project walkthrough.

Goal

The goal of the project was to create a path planner which can make the car safely navigate the track with violating the mentioned criteria:

- The car can drive up to 4.32 miles with incident.
- Obeys speed limit.
- Avoids jerk and max acceleration.
- Doesn't collide with other cars.
- Stays in the lane unless changing lanes.
- Is able to change lanes.

Methodology

First of all, using the sensor fusion data, we see if there is any car ahead of us in our current lane. If a car is detected, we slow down and look for changing lanes if possible. We can trigger lane change preparations for both left lane change and right lane change unless:

- We are in left most lane, can't go any more left.
- We are in the right most lane, can't go any more right.

Lane Change Left

If the car is in lane 1 or lane 2, the lane change left is triggered. Here, using the sensor fusion data, we look for the lane left to us for any possible cars. If there are no cars detected by the sensor fusion module, it's safe to change to the left lane. Otherwise, there can be more than one cars, so we check for the car closest to us using Frenet coordinates. If the closest car ahead or behind us is far enough, it's safe to change otherwise we stay in our lane.

Lane Change Right

Lane change right is triggered only if we are in lane 0 or 1. We use the same method as for lane change left.

Using this approach, the car is able to change lanes all the time if safe and it was able to drive 25 miles in 30 minutes without any incidents.

Jerk and Max Acceleration Avoidance

To avoid jerk and max acceleration, I followed the Project Walkthrough approach. What it does is takes two 5 points in total for fitting spline. Two of the points are from the previous path if available, otherwise created, and the other 3 are far spaced points at 30, 60 and 90 meters. It then fits a spline on these points.

Then it makes up the path by taking points left from the previous points and finding next points which are interpolated between the spline and are spaced such that the car doesn't go beyond the speed limit.

Using previous points ensure the trajectory is smooth enough so the jerk is avoided and the interpolated points between the spline make sure obeying speed limit and avoid max acceleration.