

Path Planning Project

The main objective of the project is to drive the host vehicle using path planning algorithms and generate a smooth jerk free navigation trajectory for lane-change maneuvers. In this project, we had to implement a spline model that generates the trajectory and this trajectory is further used as a reference trajectory for lane-change maneuver.

The pseudo logic for a lane change maneuver is given below-

1. Firstly check whether the host vehicle is too close to a vehicle in front.
2. If the host vehicle is too close, then reduce the velocity.
3. If the left lane is free for a lane-change maneuver, then slightly reduce the speed and perform lane change. However, if the lane is blocked, then do not perform a lane-change.
4. If the right lane is free for a lane-change maneuver, then slightly reduce the speed and perform lane change. However, if the lane is blocked, then do not perform a lane-change.
5. The condition used to check whether a vehicle is in front of the host vehicle is, $((\text{check_car_s} > \text{car_s}) \ \&\& \ (\text{check_car_s} - \text{car_s}) < 30)$.
6. The condition to check whether the left lane is blocked or unblocked is -
 - a. Distance between the left vehicle (in front) and the host vehicle is at least 30m
 - b. Distance between the left vehicle (behind) and the host vehicle is at least 15m.
7. The condition to check whether the right lane is blocked or unblocked is -
 - a. Distance between the right vehicle (in front) and the host vehicle is at least 30m
 - b. Distance between the right vehicle (behind) and the host vehicle is at least 15m.
8. Various different values of distance thresholds were chosen such that we do not exceed the maximum acceleration threshold and have a jerk-free experience.

9. We have also come up with a modified deceleration parameter. If the vehicle is too close, then reduce the velocity by 0.224. However, if we want to change lanes, then reduce the velocity by $(0.224 * 1.5)$. We use this factor of 1.5 to smoothly reduce the velocity and not exceed the maximum acceleration threshold parameter.

The below pictures represent the maximum distance which was tested on the simulator. We drove it for around 12 miles without any incident.

