Path planning project

1. Reflections

In the Path planning project, it was developed in C++ a controller capable of driving an autonomous vehicle in a highway with the aim to keep its speed as close as possible to a desired velocity, which in this case was set to be 49.5 miles/h. However, due to presence of other cars in the highway, the controller needs to ensure a safe drive without any collision, maintain low jerk and acceleration, while changing lane lines. For that reason, the difficulty of the path planning lies into considering these constraints when planning the future vehicle path.

To accomplish it, it was used data from sensor fusion to recognized other vehicles around us. By using the current car's position and car's velocity, it was possible to predict the future positions of ourselves (autonomous vehicle) as well as of other cars in the road. In that way, future collisions could be avoided by knowing in advantage where each vehicle will be. Additionally, by implementing finite state machine algorithm, an intelligent controller was conceived only by simple conditions analysis.

Basically, the algorithm is always overseen its front to analyse whether there is a free path to keep its velocity at the desire speed by slight increasing or reducing it (+/- 0.224 miles/s per each 0.2s). If a car in our lane is too close to us (less than 30 miles), the car will take a decision between either keep in its current lane and continue to slow down in order to avoid front collision, or change to other line if it is free.

Actually, when needed to slow down, the car will look at its right and left lane and analyse if there is enough space to change lane safely. For that, the controller takes all the sensor data from left side and analyse if all of them respect the MIN_SPACE_BACK and MIN_SPACE_FRONT regarding our current position – see the following images. Afterward, the controller will do the same for the right side. If only one side respect the safe minimum space for changing lane (that is, either left side or right side), the car will change to lane that respect the safe condition (Figure 1 or Figure 2). If both disrespect the condition of minimum safe space, the car will keep in the same lane and will continue to slow down (Figure 3). Finally, if both sides are safer to change lines, the autonomous car will move to the direction of larger space (Figure 4).

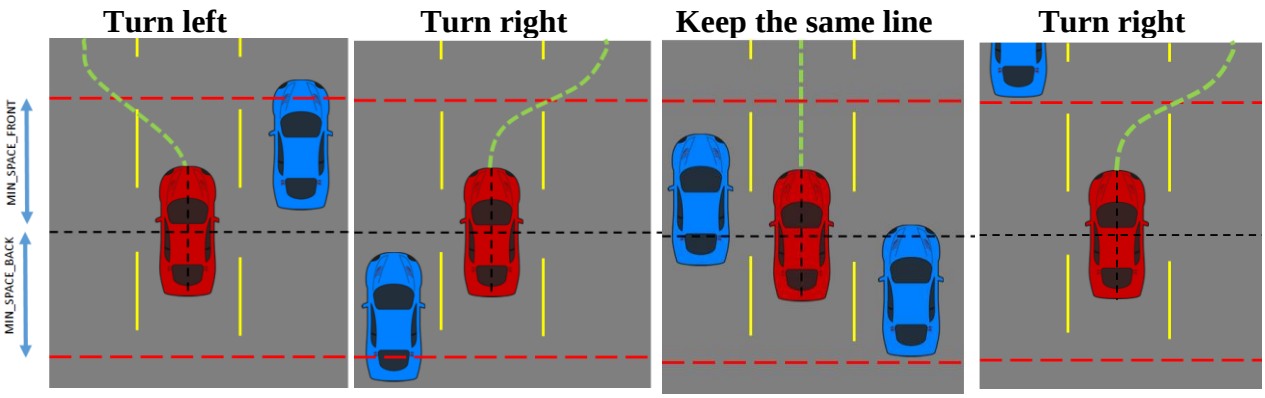

Figure 1 Figure 2 Figure 3 Figure 4

By implementing this strategy, the car could run safely for more than 4.32 miles, which makes the controller stronger enough to planning path in a full highway.