Path planning

Path planning consists of two major parts i.e. lane choice and way point generation.

Lane choice

Lane choice is a decision process and is implemented using a decision tree. The process starts once another vehicle is in front of the host vehicle with in 35m or less. If the above condition is satisfied than the host lane is estimated by provided ‘d’ value.

At every measurement of sensor fusion, the closest vehicles’ position i.e. ‘s’ and velocity in all three lanes in front and in the rear are calculated. Since the lane change manoeuvre takes approximately 2sec, the positions of these 6 vehicles are projected in time 2 seconds ahead and the new distance to target “dtt” is estimated.

Choice of the lane makes sure to maximize the forward distance to the target vehicle, however the gain should be at least 5m otherwise it is not worth to change the lane. Moreover, the wished lane should have at least 15m distance free from both front and rear target vehicle in that lane, otherwise the lane change could result in an accident.

If either one of the condition is not satisfied the host lane is kept and the host speed is reduced by constant deceleration to maintain a safe distance to the target vehicle in the front.

Way point generation

As mentioned in the video and code by Aaron Brown the way points are generated by choosing 5 anchor points, using host past and current position and 3 points in future with 30m distance between each. A spline interpolation between these points assures a smooth path and avoids the host to exceed the jerk.

Spline also helps generating a smooth lane change, as the anchor points are a mix of host current lane position and future points in the neighbouring lane, a smooth interpolation fits avoids a student lateral shift between lanes.