1. Path generation - Much of the code was from the project video for path planning. By making use of waypoints to project the path trajectory up to about 100 meters ahead, the car detects the other car in front of the it. If the gap is less than 30 meters, then car will decide if it is safe to change lane. If the left lane is free of traffic (no cars within 20 meter ahead and behind in the target lane and the target gap is larger than the ego lane gap, then car will switch lane. Else it will check if right lane is open for lane change (20 meters front and back clearance and right lane gap is larger than ego lane gap). The smooth path is calculated with the use spline library. (main.cpp lines 371-437)
2. The car will remain in the ego lane if lane change is not possible because it is not safe or that ego lane is next to the edge of the road.
3. Deceleration/braking is set to slow about 7MPH at 0.02 second interval. If the gap is more than 30 meters, and the car is under the speed limit, it accelerates at about 5MPH/0.02 sec. The car was able to travel at an average speed of about 40MPH for 2 laps without any accidents or errors. The car can change lane to the left or to the right when safe without going off the highway.
4. Some of hard code values such as speed limit value (of 49.5), number of lanes (max_lane = 3), 50 path points, 30/60/90 sparse point values should be tunable parameters in the real world. Also the ref_vel should be adjusted with some weight to accelerate to decelerate based gap and speed of cars to keep a safe distance and to maintain traffic flow.
5. Testing turned out to be fairly time consuming. Reviewing the accidents and correlate that to the code logic took me a few days. Each testing cycle could as much as 15 minutes, 12 of which is watching the video displayed by the simulator. I sometimes have to run 2 laps to cover most driving conditions.
6. To help with testing and debugging, it may make sense to output a log of all accidents/errors along with the nature of the incident, mile traveled before accident, time stamp, etc. This way, I don't have to watch the video during test run.