MPC Project - Ahmad Chatha

1) Student describes their model in detail. This includes the state, actuators and update equations.

The model consists of the x and y position of the vehicle along with the velocity, angle of orientation (psi), the cross-track error (cte) and the orientation error(epsi). The actuators are the steering angle and the throttle value. Following equations are used to calculate the next state of the model:

$$x_{t+1} = x_t + v_t * cos(\psi_t) * dt$$

$$y_{t+1} = y_t + v_t * sin(\psi_t) * dt$$

$$\psi_{t+1} = \psi_t + \frac{v_t}{L_f} * \delta_t * dt$$

$$v_{t+1} = v_t + a_t * dt$$

$$cte_{t+1} = f(x_t) - y_t + (v_t * sin(e\psi_t) * dt)$$

$$e\psi_{t+1} = \psi_t - \psi des_t + (\frac{v_t}{L_f} * \delta_t * dt)$$

2) Student discusses the reasoning behind the chosen N (timestep length) and dt (elapsed duration between timesteps) values. Additionally the student details the previous values tried.

The final values that were chosen are N = 25 and dt=0.03. The values for N and dt were chosen in order to maximize the prediction accuracy and minimize the calculation time. Other combinations were tried such as (20, 0.05), (15, 0.1), (25, 0.1) e.t.c but the car kept getting off the track for those.

3) Polynomial Fitting and MPC Preprocessing

Before fitting the polynomial, the points were converted from map coordinates to vehicle coordinates. After the conversion, we fit a 3rd order polynomial.

4)The student implements Model Predictive Control that handles a 100 millisecond latency. Student provides details on how they deal with latency.

I tried to eliminate latency by introducing multiplying factors in the cost calculations of delta and gap. The values were chosen via trial and error.