Final Project: PID Controller

Self-Driving Car Engineer Nanodegree

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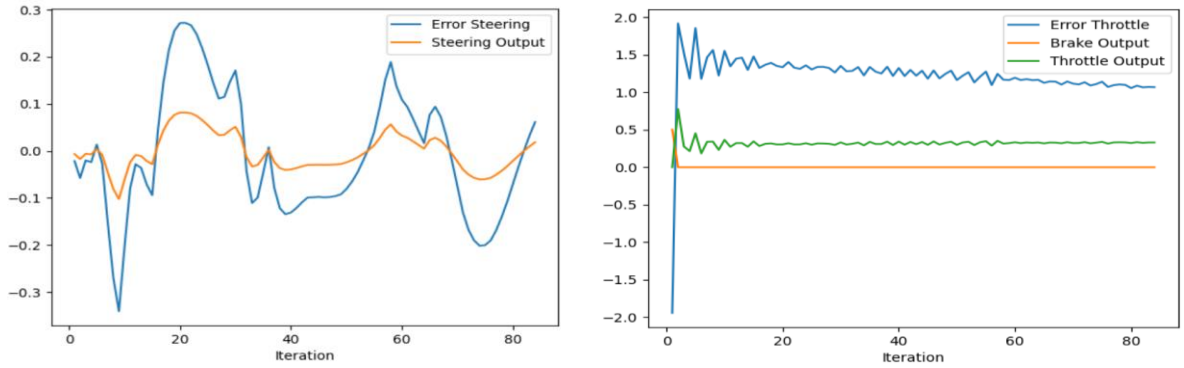
Project Questions

- Add the plots to your report and explain them



In the steering plot above we have the calculated error and the steering output plotted. The error is difference of actual car yaw that of planned path yaw. Using this error is as sterring maneuver is not good since we could end up taking sharp turn which are uncomfortable. So we had made the steering output smother and also navigate through the road pleasantly. As can be seen the in left graph we follow the error but the steering output is much smother than the actual error.

For the Brake throttle plot, it is apparent that we don't want a stop start ride and we want to move with minimum jerk through the road. As can be seen in the graph the brakes are minimum and the car throttle is almost constant.

Although, there is dependency between the steering and velocity, the more faster we move the more sharp steer we might need to take.

- What is the effect of the PID according to the plots, how each part of the PID affects the control command?

Considering the example of the steering angle, the more the weightage given to proportional part then the car keeps oscillating , higher the differential weight increase it sensitive to sudden change in the turn and for the integral value, higher the value the more the lesser the effect the steering error produces.

- How would you design a way to automatically tune the PID parameters?

We can us the twiddle algorithm to continuously change the hyperparameter of PID controller by analyzing the error and keeping track of the smaller value of error. Other way is to fix constant value for 2 parameter and change the other one and keep repeating we reach a proper values for PID parameters

- PID controller is a model free controller, i.e. it does not use a model of the car. Could you explain the pros and cons of this type of controller?

  A model free controller will be simple and faster to design. Although the interdependency between the model is not taken into account in model free controller. As pointed out the steering and velocity is depended for path planner.