PID Control Project Description

Project to implement a PID for a self-driving car for following the waypoints given to it by path planning module. The goal is to adjust the car's steering appropriately so that it drives smoothly on the given track.

Reflection

The PID controller is comprised of three components:

P	Proportional term (Reduces the cross-track error)
I	Integral term (Reduces the effect of system bias)
D	Derivative term (Reduces the amplitude of oscillations about the desired path)

After setting up the steering angle in terms of kp, ki, kd, and corresponding error, the main task is to tune these parameters: kp, ki, kd.

I started by initializing all three as zero. Then I introduced a small value of kp to see its effect. The car started getting closer to the desired trajectory. After gradually increasing the value after a point, the car starting oscillating a lot. I choose a value around 0.2 after experimenting. The car was still oscillating at this value about the mean position. To reduce that I tried increasing the kd term. A low value had a negligible effect on the amplitude of oscillation. A higher value decreased the amplitude but ended up increasing the frequency of oscillations. I selected a value around 3 which gave decent results. Then I tried experimenting with ki even though it didn't look like that the system had any bias. A higher value made the car go in circles and a lower value didn't have any significant impact on the car as per my observation. So I choose to keep ki as 0. The next step was to experiment with a combination of kp and kd till I get a decent result.
Here are the values that I finally choose:

kp	0.3
ki	0
kd	5