PID Controller

Describe the effect of P, I , D components of the PID algorithm:

Proportional:

This component tries to steer the car towards the center line using the cross track error. If the cross track error is two large the correction will cause an overshoot of the central line. This would create an unstable controller.

Integral:

The integral part of the controller tries to eliminate a possible bias in the system. In the case of the simulator, there is no bias present.

Differential:

This check the rate at with the proportional error is being reduced and counteracts the tendency of the proportional controller from overshooting.

How the final hyper-parameters were chosen:

The hyper-parameters were chosen using manual tuning. The first test was to make sure the car could drive straight with all parameter set to zero. If not, tune the 'I' component of the controller, which I set to 0.001. Then I added the 'P' component of the controller at 0.1 increments, where I stopped at 0.2. Next, I used the 'D' component to minimize the overshoot of the controller and the value I stop at for this was 3. I gradually moved this component at 0.5 increments until it got stable at 3.