PID Controller

1. Describe the effect each of the P, I, D components had in your implementation.

The effect of Proportional (P) controller-

The proportional controller directly affects the amount of error of the control system. For example, if the value of P is increased, then the error of the system also increases proportionally, which further increases the yaw motion values.

The effect of Integral (I) controller-

As the name suggests, this controller helps in controlling the accumulating error of the control system. For example, if the control system has a bias term, then over time, the I controller will help reduce the overall error of the system.

The effect of Derivative (D) controller-

The derivative controller helps in controlling the rate of change of error. For example, if the control system behaves as a rogue system with a high degree of yaw motion, then this controller subsides the effect and further reduces the error of the system.

2. Describe how the final hyperparameters were chosen

Initially, the values of P, I and D were chosen to be 0.5, 0.0 and 2.0 which then resulted in the vehicle crossing the road track and also often got stuck in many places. Then I final values which resulted in a smooth path with around 30kmph was 0.15, 0.0, and 2.5 with an acceleration of 0.3m/s. The vehicle maintained a constant speed. However, when the value of P, I, and D was chosen to be 2.0, 0.0 and 4.0, and increasing the acceleration to 0.5m/s, the vehicle was behaving very differently and it had rogue behaviour which is the reason I chose 0.15, 0.0 and 2.5.