PID Project Reflection

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

P Component
Factor: 0.09
This component steers the vehicle towards the intended trajectory at a rate proportional to how far the vehicle is from that trajectory (the error). This is especially useful during turns, but on its own, will cause the vehicle to oscillate if the intention is to travel in a straight line. The oscillation is more apparent as the vehicle moves faster, especially if the steering value is high. I tuned this value with the aim of having the vehicle be responsive to turns and bends, but keep the oscillation to a minimum.

I Component
Factor: 0.00005
This component steers the vehicle with a factor of sum of all errors. The intention is to correct any misalignment of the vehicle, which the P or D component will be unable to do. Over time, if the error builds up, the I-Component sum will increase and will eventually correct this misalignment.

D Component
Factor: 4.5
This component steers the vehicle based on how much error was reduced from the previous observation. If the error is reduced, the component knows to ‘counter’ the effects of the steering so it does not overshoot. However, this is also useful in the sense that if the error DOES increase, the D component will add even more pressure towards the right direction. I noticed this component must be balanced finely together with the P component, otherwise the steering can be very nauseous.

Describe how the final hyperparameters were chosen.

I did not have time to properly implement a Twiddle tuning system, so I did it manually. I used a mix of intuition, observation, and also applied the twiddle principle by hand to arrive at my results. My aim was to have a set of parameters that is able to drive fast, safely, but also keep the oscillation and unnecessary movements to a minimum. This was the best ‘local peak’ that I could find.

Additionally, I also adjusted the throttle to be faster if the CTE is small, and slower if the CTE is large. I also applied a simple filter to the steering angle so that it would be a bit smoother.