Udacity – PID Controller Project

Submitted by: Neeraj Gulia

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Objective

The objective of this project is to create a PID controller and using it to drive the car in simulator successfully.

PID

PID stands for Proportional-Integral-Derivative.

P – Proportional Component

The P component is directly proportional to the CTE (Cross Track Error). The more the CTE the more effect it will have on the correction

I – Integral Component

The I component is the sum of all CTE at the given time.

D – Derivative Component

The D component is the rate of change of CTE and is also known as anticipatory control.

Effect of P, I and D components

Effects of *increasing* a parameter independently					
Parameter	**Rise time**	**Overshoot**	**Settling time**	**Steady-state error**	**Stability**
K_p	Decrease	Increase	Small change	Decrease	Degrade
K_i	Decrease	Increase	Increase	Eliminate	Degrade
K_d	Minor change	Decrease	Decrease	No effect in theory	Improve if small

Table 1 Effect of PID parameters (source: Wikipedia)

Final Parameters

I started with the base parameters as suggested in the Udacity quiz for PID implementation and then used manual tuning to arrive to the final parameters.

	P	I	D	Remarks
Initial Values	.29	.00001	5.0	Started with the initial values as given in the Udacity PID implementation quiz
Final Values	.233	.000001	5.333	This is the final parameters that I found satisfactory to run on the default throttle.

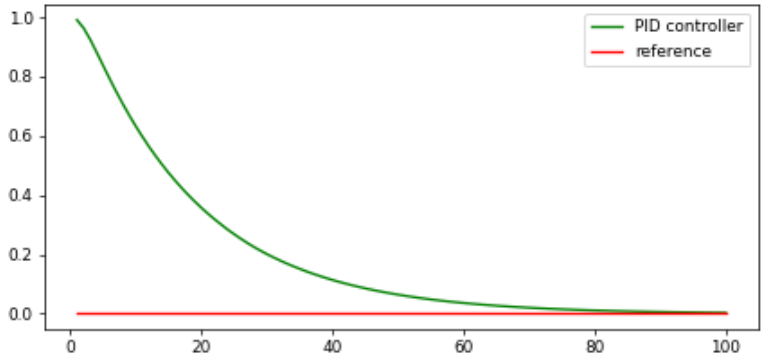

Table 2 PID controller with final values

Final Thoughts

I tried implementing the Twiddle approach but found that the parameters are not a straight fit and requires further manual tunings.

This project is a very good learning of PID and gives a very fair idea on how and where we can implement the PID Controller.