Write up intro.

There is no template, so I will go with a rubric.

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

I struggled a lot with numerical representation at first, so really recommend checking out videos for high-level intuition for:

➔ P - https://www.youtube.com/watch?v=27lMKi2inpk
➔ I - https://www.youtube.com/watch?v=5CncRd8O2r4&t=174s
➔ D - https://www.youtube.com/watch?v=d_LuA-SwWQE

After understanding how different parameters affect different kind of wobble, setting up took no time. I will go into the details in the next section. Basically, P and D affect each other big time. High P lead to more wobbliness, D contradicts it, but if set too high can lead to understeering.

"I" seems like a parameter for small tweaking and more separate from other 2, so good strategy to keep it low.

Describe how the final hyperparameters were chosen.

First I set up:

➔ P – 1
➔ I – 0.1
➔ D – 1

To set up a baseline. Car immediately pulled over to go in circles. That told me to get higher D and lower P. Too high of a D is risky on the real equipment, but I am sure that simulated simulated engine will be all right.

Second set up:

➔ P – 0.1
➔ I – 0.01
➔ D – 2

As mentioned above I reduced P to reduce turning and increase D to counter exact same thing. "I" parameter is more separate, then P & D, so I just kept it 10 times lower then lowest of 3.

This improved vehicle behaviour, but it still found itself off the road. So I kept on with a trend.

Third set up:

➔ P – 0.01
➔ I – 0.001

➔ D – 3

Vehicle made it across the bridge for the first time. However, during multiple turns was not able to turn fast enough. That told me, that I am close, but in order to increase sharpness of movement, I will need to reduce D or increase P. I decided to bring back up P first.

➔ P – 0.1
➔ I – 0.001
➔ D – 3

And that worked. Vehicle is a bit wobbly, but further adjustments involved extremely sharp turns during multiple turns period and larger wobbliness on the wide bridge. So I kept them as the last ones.

I did try to implement TWIDDLE, but any attempt to mess with coefficients only made things worse. There are segments of my better attempts in the commented section of the code, so if someone can reach one and explain where I am wrong, would be awesome!

The vehicle must successfully drive a lap around the track.

In the video bellow car go around the track 2 times. It had a little bit of issue before the 2-nd bridge turn. However, general behaviour is great considering that we are not regulating the throttle. Moreover, there is not real time adjustment of hyperparameters. I did not expect that at the beginning.

https://youtu.be/kQFW4aEh6L4