PID Controller Reflection:

The effects of the different coefficients of the PID controller are as follows:
P: The P coefficient, which stands for Proportional, is responsible for tracking how much the controller deviates from the target value and based on this parameter making changes in the actuators to get closer and closer to the target value. In the context of this project this reflects how much the current position of the car deviates from the middle of the street lane and hence forcing the car to change the steering angle value to get closer to the middle of the street. The larger this value becomes the sharper the change in the steering angle will be and the car will reach the center sooner. On the other hand coefficient causes overshoots from the target value, meaning that when the car reaches the center it still will go a little further and then decide to get back to the center again and hence if the value of P is too large the car becomes unstable and will not converge to the middle of the street.
D: The D coefficient, which stands for Derivative, is used to cancel out this overshoots caused by the P value coefficient. The D coefficient basically is the value that will be multiplied in the error change rate, meaning how much has the error change since the last feedback came back to our car. With this value the movement of the car to the center becomes smoother and hence the car will reach the center of the lane more gracefully and also more stable which leads to a reasonable solution.
I: This coefficient, which stands for Integral, is used to make sure that the car is not constantly pulled to the left or right for example when the wheels are out of alignment and hence the car is pulled to a direction this term is here to cancel out the effect.

For choosing the values for the coefficient, called the parameter tuning, I chose the manual approach. My approach was to first find a suitable value for P and then changing D until I have a working car and then fine tuning everything by adding the I coefficient. I first tried only by setting the P coefficient and choosing the value 0 for the D and I terms. After reaching a suitable value for the P coefficient, which was -0.05 started changing the P value. I started with -1 and continued changing the value in 0.05 steps until I reached -0.75 as the best value. During this process I also had to change the value for P again such that these coefficients could work together and constructively made a better impact in steering the car. After this step and reaching the values -0.09 and -0.75 for the P and D values the car could drive a whole lap without falling out of the road. For making everything smoother and reducing the right and left pooling of the car I also introduced the I value. I first also put it to -1 but that made the car completely unstable so I reduced the value by an order and magnitude and continued this process until reaching the value -0.0025. After this the P, I, and D values for the controller are selected and the car drives autonomously around the lap itself.