Arduino Car Final Report

EC ENGR 3

Lab 1B

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Development

The plan that our team followed was to develop the code for the car incrementally — each additional feature would have to work proficiently before adding more code. We decided that the first feature we should develop was to have the car accurately detect and follow a straight black line. After finishing that, we planned to calibrate the code so that the car would turn smoothly when detecting a curve in the track. Finally, we developed a method for the car to identify horizontal lines and precisely make 180° turns and stop once completing the track. After this, the plan was to optimize the speed so that we could have the car finish the course in under 25 seconds.

For our first step of having the car follow a straight black line, we knew that we could move on once we could start the car from various orientations and have it be able to find and follow the line without veering off to the side. We were confident that our code for turns was complete once we could observe the car making it to the end of the track without swerving off the curves. It was simple to check the code for making the car detect the horizontal lines and turn around or stop — we just had to have the car complete the entire track, then we knew our basic code was complete and we could begin optimizing. Our optimization process would be completed once we could get the car to complete the entire track in under 25 seconds.

Testing

While testing the car, we varied parameters such as Kp, Kd, sensor weightings, base speed, and turning delay to optimize the speed and smoothness of the car traversing the track. Battery voltage was the only variable that we measured but did not directly control, as this just depended on what batteries we picked up at the beginning of each lab session.

We tested if the car could follow a straight black line by placing it on a straight portion of the track at various orientations as this showed whether or not the car could correct itself and make its way through the straight path. To test the car's ability to turn smoothly we followed a similar procedure of placing the car at different orientations right at the start of a curve and seeing if the car could make it all the way through without going off the track. Finally, to test if the car could perform the proper behavior at the horizontal lines we would just have the car run the entire course while noting where it was having difficulties so we could make adjustments.

Analysis

Our trial runs were documented in the logbook below:

https://bit.ly/31Cfq7G

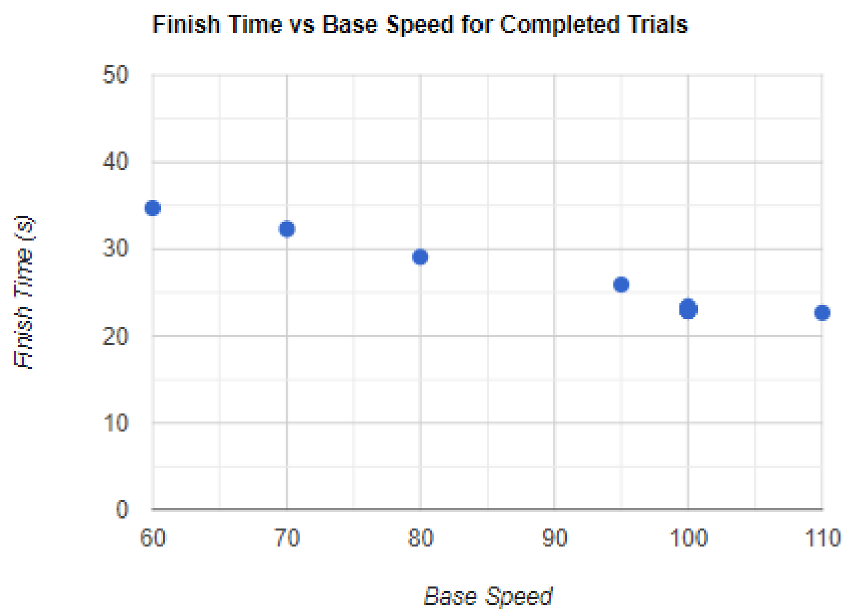

Figure 1.

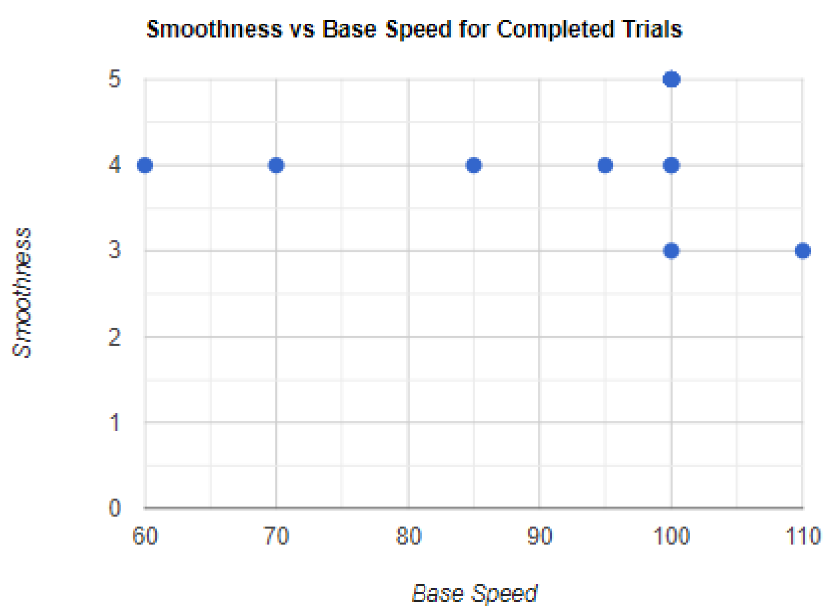

Figure 2.

Interpretation

Figure 1 shows us that as the base speed increases, the finish time decreases, but we were not able to finish the track in its entirety if we set the base speed to be over 110 with our current constraints.

Figure 2 shows us that the optimal base speed for smoothness given our constants was 100, as we were able to achieve a maximum smoothness rating of 5 out of 5.