RYERSON UNIVERSITY

School of Computer Science

CPS 607 – Autonomous Mobile Robotics
Final Exercise – NOT Tesla's Autopilot – Fall 2020

Description:
Tesla cars calling their system "autopilot" is irresponsible as it misleads people in thinking that they have a fully autonomous car. While irresponsibly named, some of the features are useful. In this course we will focus on two aspects: one is their enhanced cruise control; and the other is self-parking. For this Final Exercise you will use the Elegoo Smart Car kit to implement enhanced cruise control and parallel self-parking.

Environment:
There are two environments that your robot must operate in. The first is comprised of two sets of lanes as shown in Figure 1. A single lane is marked with a pair of tape lines that are 10 cm apart and their colour contrast with the floor the vehicle is driven on. The lanes are offset from each other by a distance of 10 cm.

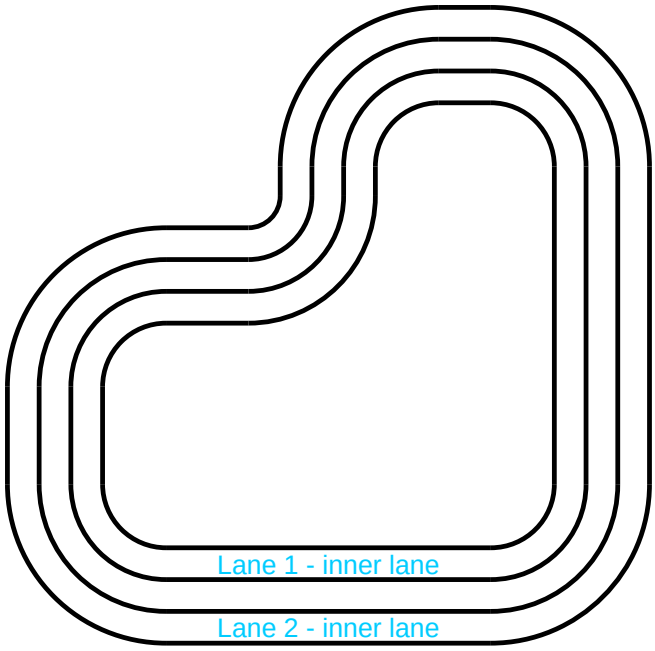

Figure 1 - Lane configuration

The second environment is for the self-parallel parking portion of the exercise. A parking spot is 20 cm in width and 35 cm in length. The parking spot will have an object in front of it and another behind it. There will be a contrasting line that indicates the curb and a guideline located at the centre of the parking spot. An illustration of this configuration is shown in Figure 2.

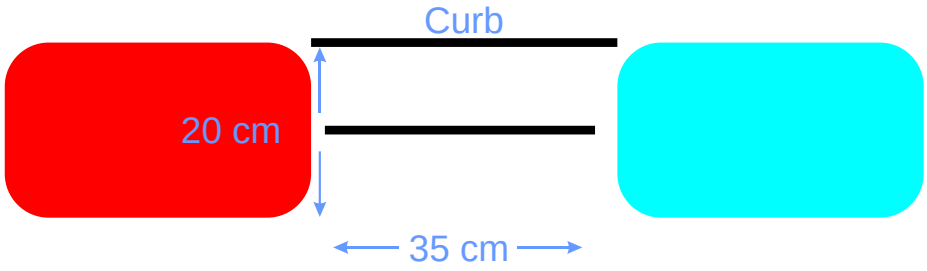

Figure 2 - Self-Parallel Parking Configuration

Tasks:

- Working individually (unless have special permission), you are to program your Elegoo Smart Robot Car v3 (AMR) so that it can do demonstrate these features: enhanced cruise control and parallel self-parking.
- You must make a short video (less than 2 minutes) of your robot on the specified environments.
- You must create a writeup (1 page maximum) describing of your algorithm/strategy.

Enhanced cruise control:

- Setup a 2-lane configuration similar to Figure 1.
- Place the robot in one of the two lanes.
- The robot must be in near-continuous motion while following the path of the lanes describe below.
- The robot must not leave the lane that it is following
- The formal definition of near-continuous motion is that the robot should always be moving, and the robot can stop moving for no longer than 0.5 seconds.
- If there is a stationary object in front of the robot, the robot must change lanes and continue to follow the other lane.
- If the robot encounters another moving object, it should continue to stay in the same lane but avoid colliding into that object. It does not need to pass it, only stay behind it.

Self-parallel parking:

- Setup a parking spot similar to Figure 2.
- Place the robot anywhere in the environment such that no part of the robot is between the two bounding objects.
- Once the robot is turned on or the feature is activated, the robot should autonomously drive itself into the parking spot.
- While entering the spot, the robot must not collide with the objects on either side of the spot.
- None of the wheels of the robot should touch the "curb."

Scoring:

The Final Exercise is marked out of 30 points.

You gain marks for the following:

- 5 marks for being able to follow a lane.
- 5 marks for being able to switch lane.
- 5 marks for being able to distinguish a stationary object from a moving object.
- 5 marks for being able to follow a moving object properly.
- 10 marks for being able to parallel park.

You lose marks for the following (how many marks will be dependent on the TA and instructor):

- Colliding with an object at any point.
- Losing the lane.
- Parking crookedly.
- Touching the curb at any point.
- -10 marks if you do not submit a write up.

BONUS: If your writeup is good, bonus marks may be given to your midterm mark. For a writeup to be considered good, you must have a robot that perform the tasks in this final exercise well and the writeup must clearly describe the algorithm and strategies that made the robot work so well.