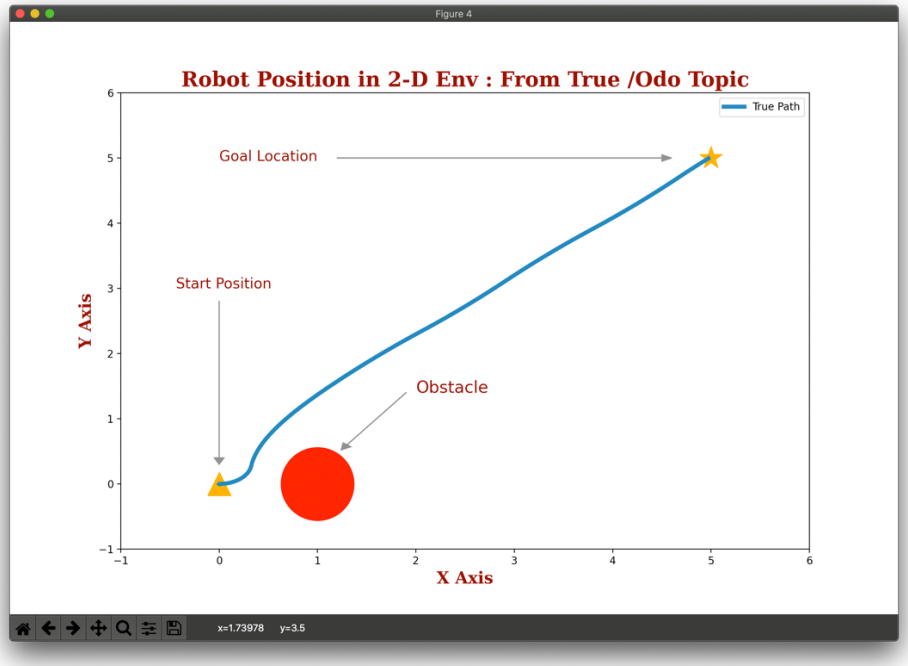
HW : Gazebo 101 Assignment

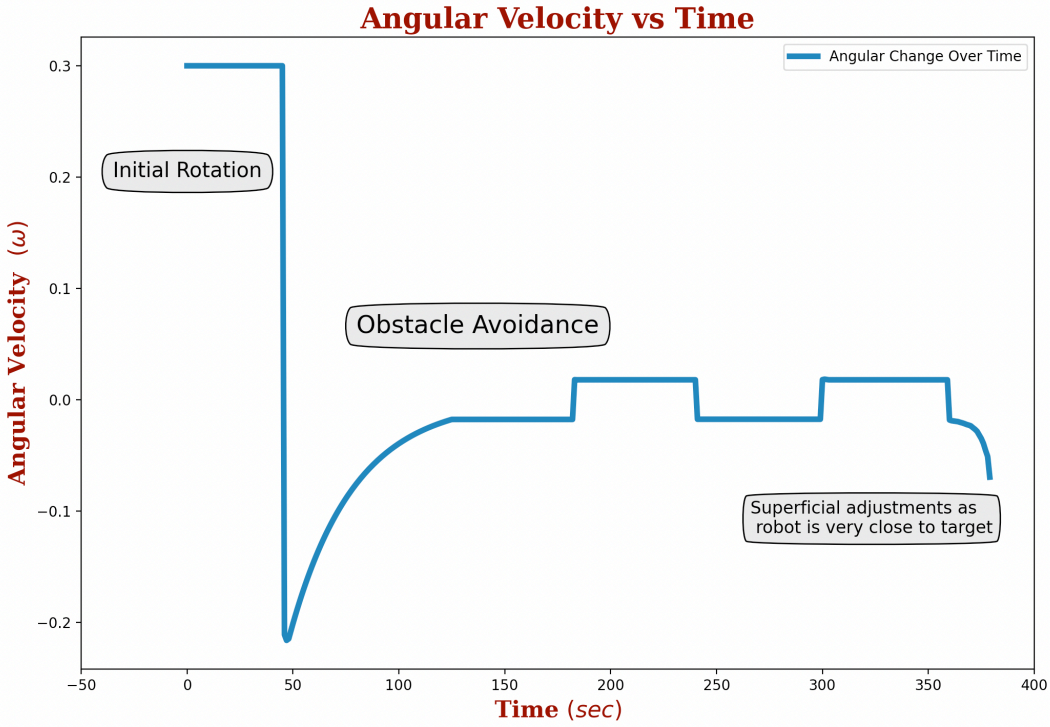
Matthew Postell Hirdayesh Shrestha Dhruv Patel

For the given Gazebo Assignment, we had to make a simple PID controller for the turtlebot3 model ("waffle-pi" in our case) while having an obstacle in the line of sight of the bot. So, the PID control would be visible and we could see how the bot moves under such scenario. Also, as the purpose of this homework was to get acquainted with ROS + Gazebo environment, we didn't fine tune the controller enough so that it would give us smoothed angular velocities over the entire run-time. We would explain as we would go over each result.

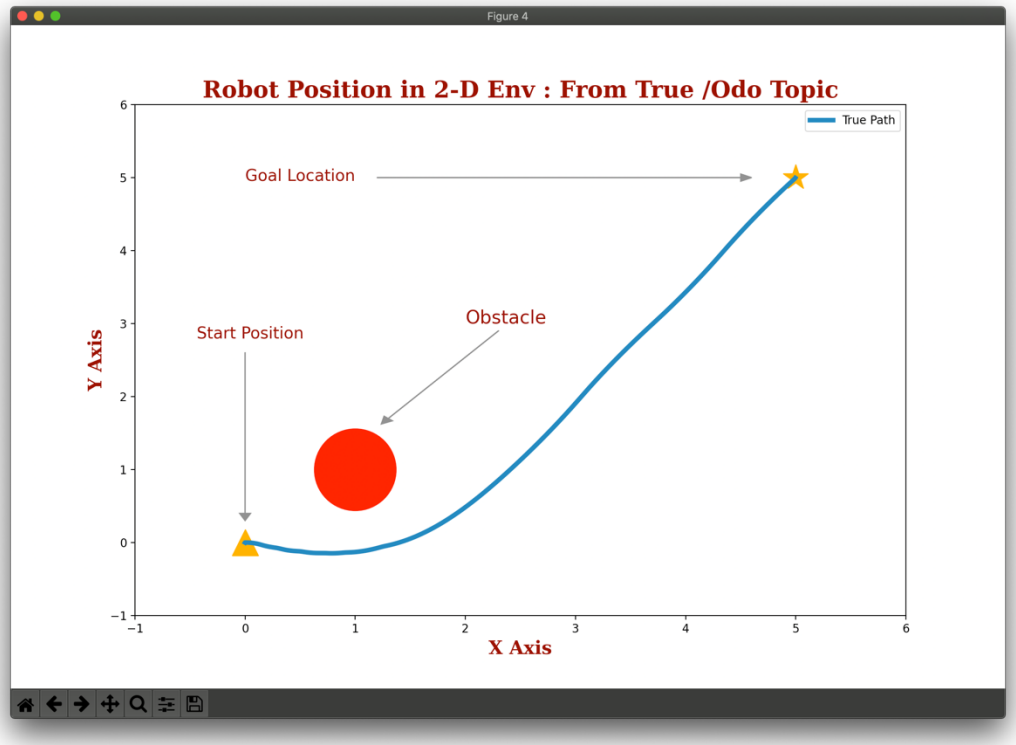
We evaluated three cases, two of them had one obstacle and the third case having two obstacles. In all scenarios, the robot starting position is kept at x = 0 ; y = 0. While, the Goal location is at x = 5 ; y = 5. We would plot 2 graphs: one where the true path is shown (data taken from /true_odo topic) and the other representing angular velocity over run-time (data taken from /cmd_vel topic).

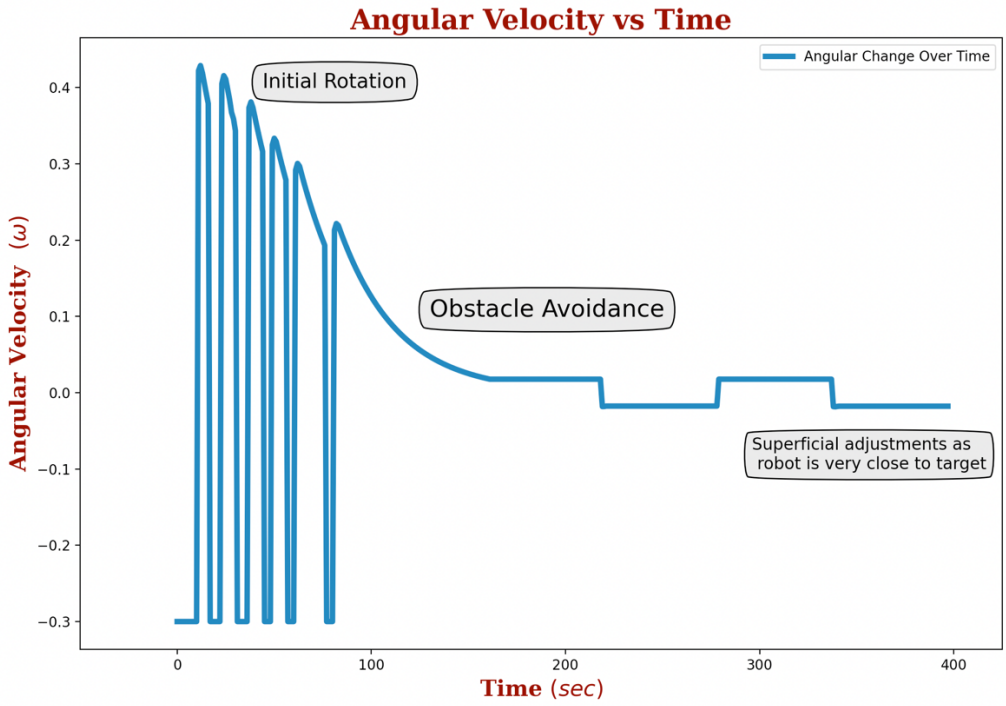
Case 1: One obstacle at x = 1 and y = 0



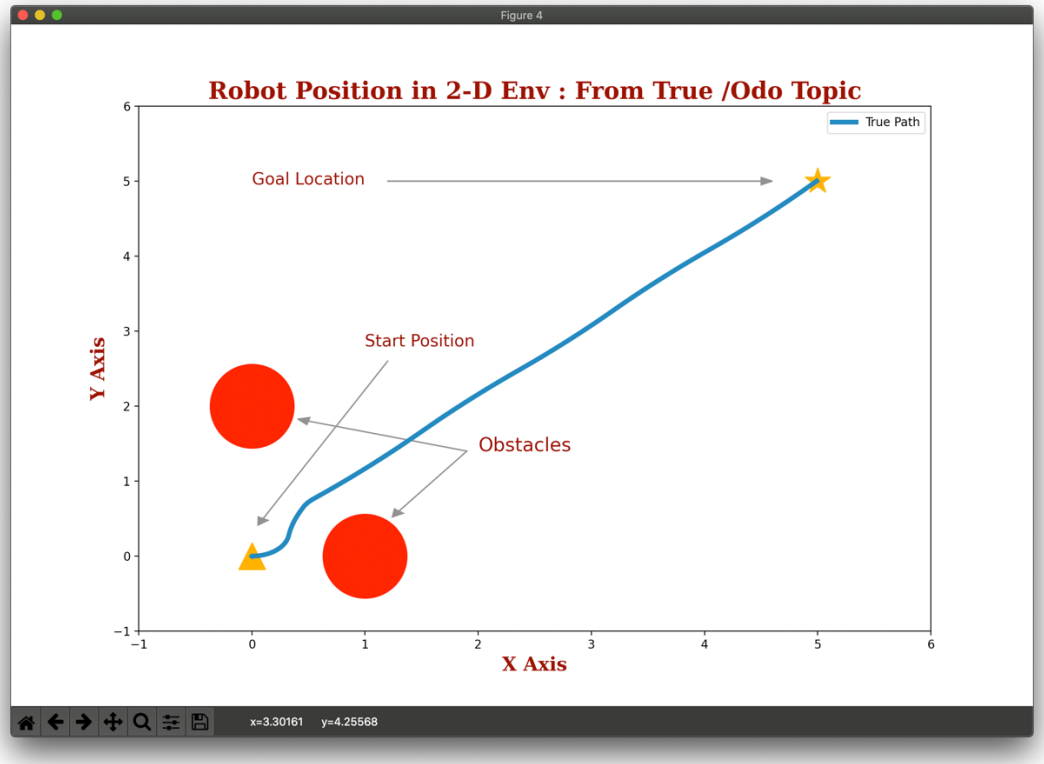


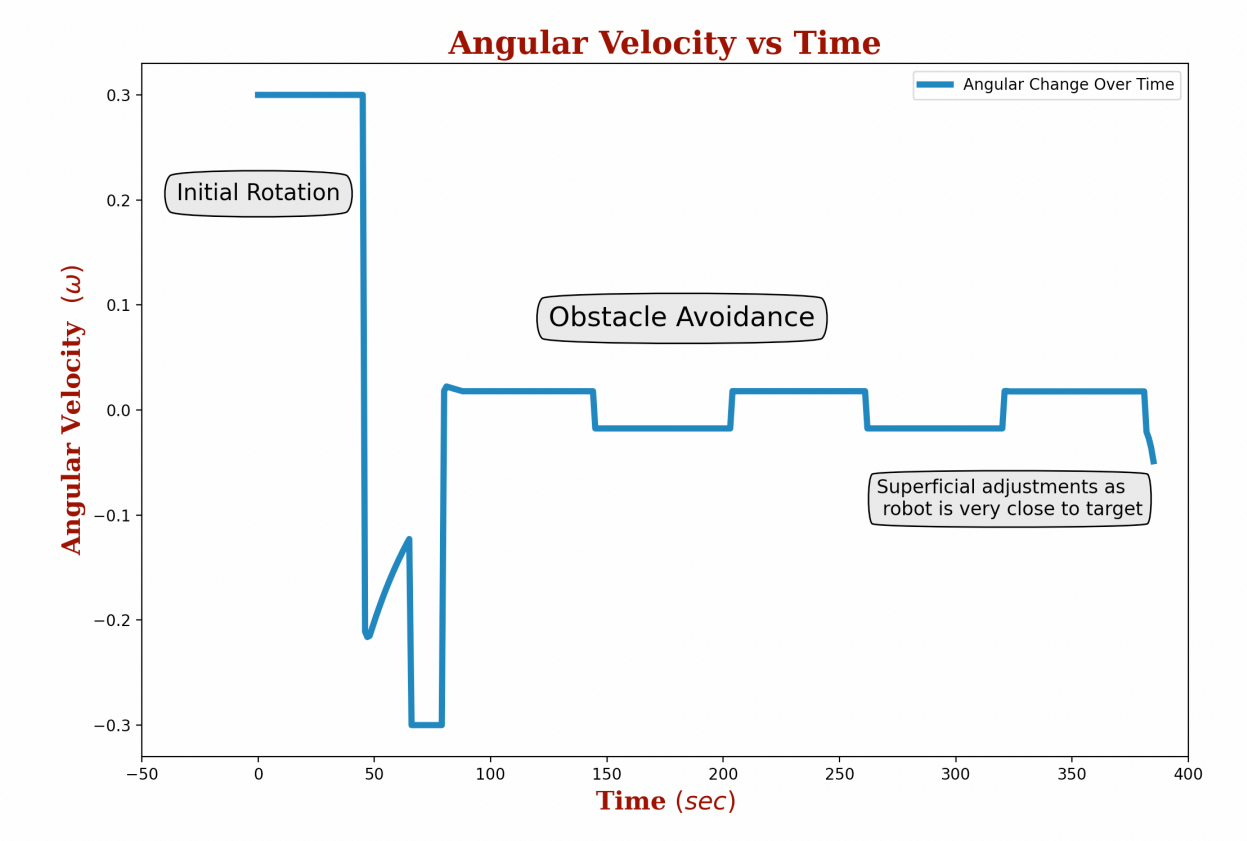
Case 2: One obstacle at x = 1 and y = 1





Case 3: One obstacle at x = 1 and y = 0 ; Another obstacle at x = 0 and x = 2





Result Analysis

As we can see in the plots, between the initial rotation and the obstacle avoidance, there exists a surge (rapid change) in the angular velocity. We think it is because the bot is trying to correct itself as it goes around the obstacle and since we only have one overhead camera on the bot, during the movement around the obstacle, there exists a time-step where, the obstacle is not visible through the camera stream. Therefore, the bot thinks that it is past the obstacle and tries to rotate towards the goal point only to find out that the obstacle is still there. So, to avoid this, the bot turns through some angle and this happens as long as the obstacle is not cleared. Once it is cleared, we can see that the angular velocity curve is fairly smooth.

It is also good to notice that, we are not just going to a temporary waypoint to avoid the obstacle and this controller model is independent to the number of obstacles in the system.