POLITECNICO
MILANO 1863

School of Industrial and Information Engineering

MSc in Mechanical Engineering

Autonomous Vehicles

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Assignment 3

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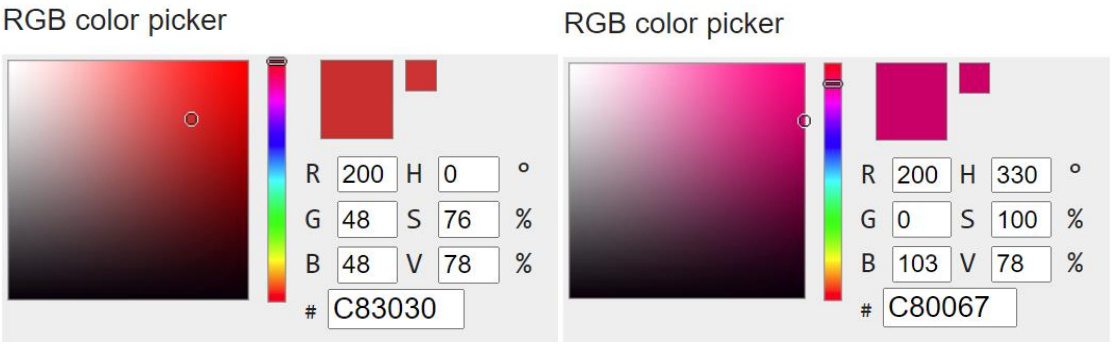
Introduction

To complete this assignment, an empty Gazebo world must be set up in this way: starting from the initial position of the robot, a red (#c83030) sphere of 0.1m of radius must be defined at 6m on the left and a purple (#c80067) sphere of 0.2m of radius has to be placed 6m in front.

The request consists in the implementation of a feedback control that can lead the robot to collide with the red sphere.

Results

Firstly, the Gazebo world has to be set up correctly. The provided codes that indicate the specific shades of red and purple have to be translated to their corresponding RGB values, which can be done with an RGB colour chart.



Once, the correct RGB vectors are known, it is possible to properly set up the Gazebo world from Matlab, as indicated in Figure 1.

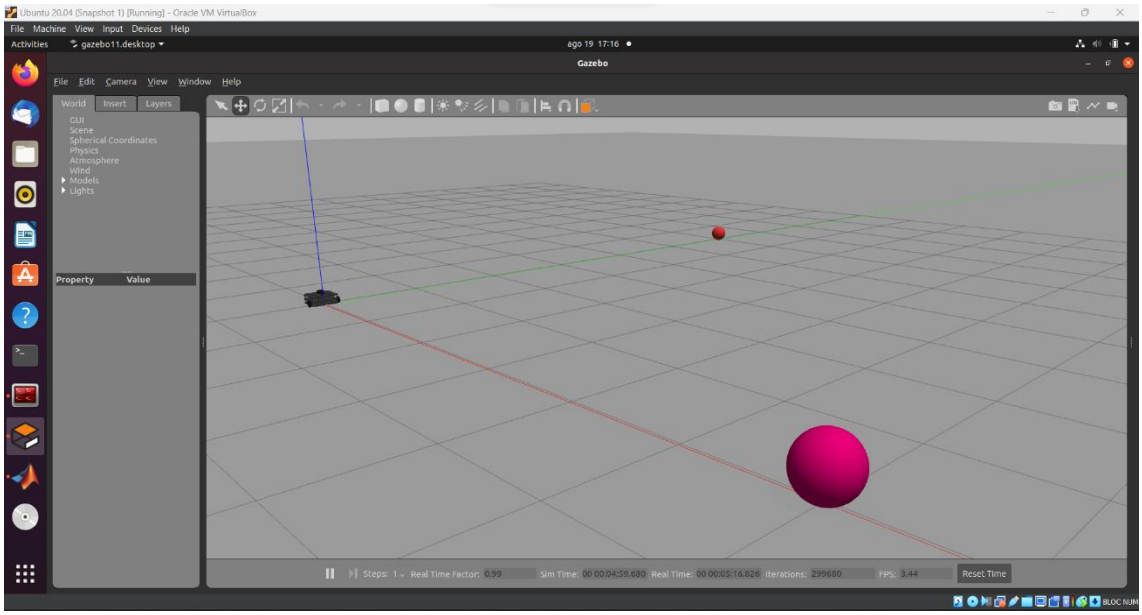


Figure 1. Gazebo world setup.

The implemented Simulink control model is shown in Figure 2 is made of two sections. The first one is a colour detecting system that subscribes to the robot's camera, detects the red sphere by filtering the video for the Hue value of the shade of red of the sphere and publishes the centroid coordinates to a custom topic, named 'centroid_xy'. The second section consists in the feedback control that moves the bot.

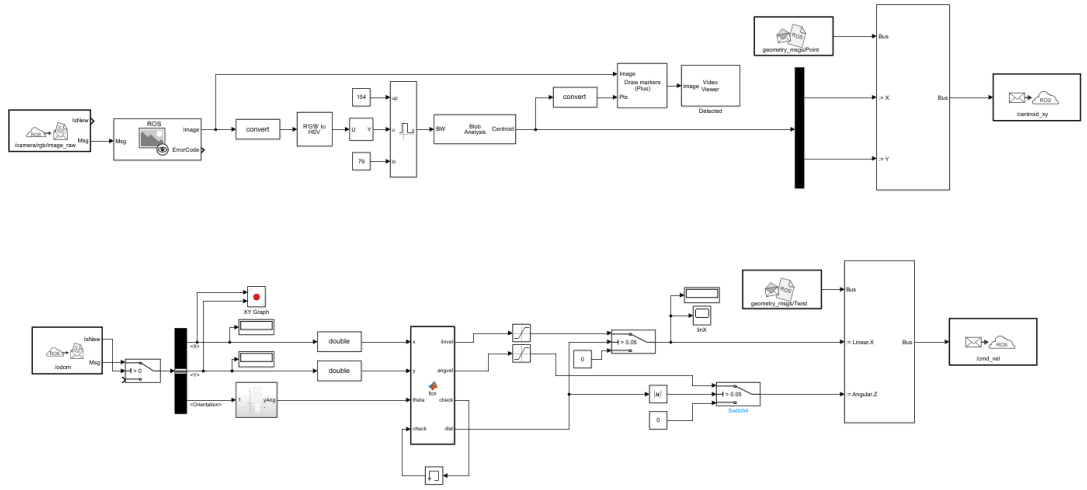


Figure 2. Simulink control model

The trajectory of the robot is shown in Figure 3, where the position of the centre of the red sphere is also signaled by the red dot. It can be seen that the trajectory stops slightly before the red dot: this is due to the bot colliding with the sphere.

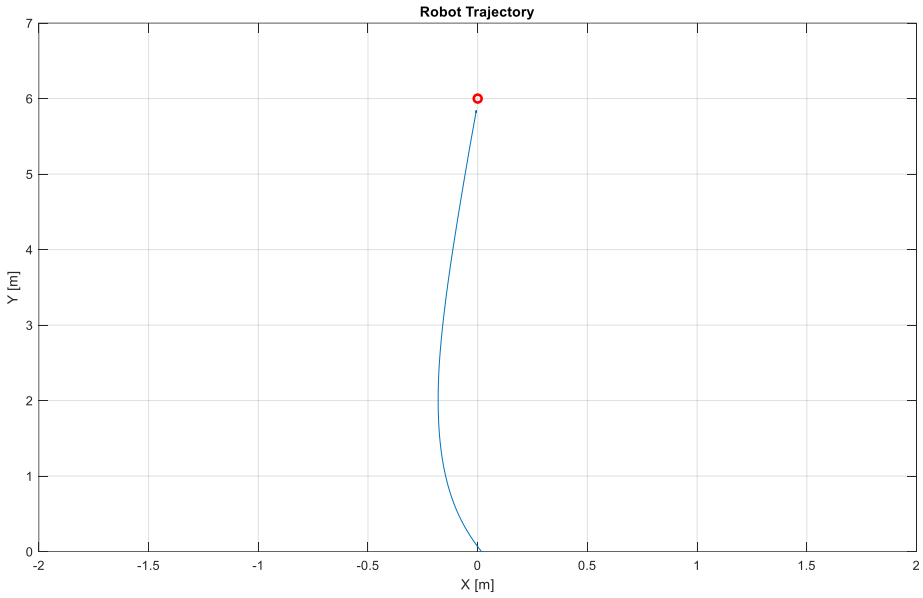


Figure 3. Robot trajectory and red sphere position

Figure 4 reports the trajectory of the centroid position inside the field of view of the turtlebot's camera.

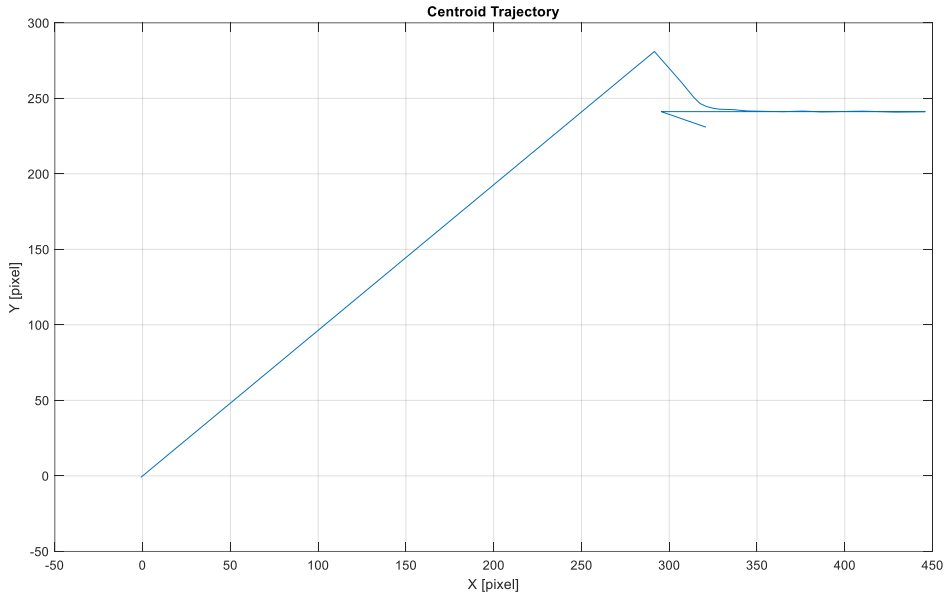


Figure 4. Centroid trajectory in visual field of view of the bot

Finally, linear and angular velocity commands are reported in Figure 5.

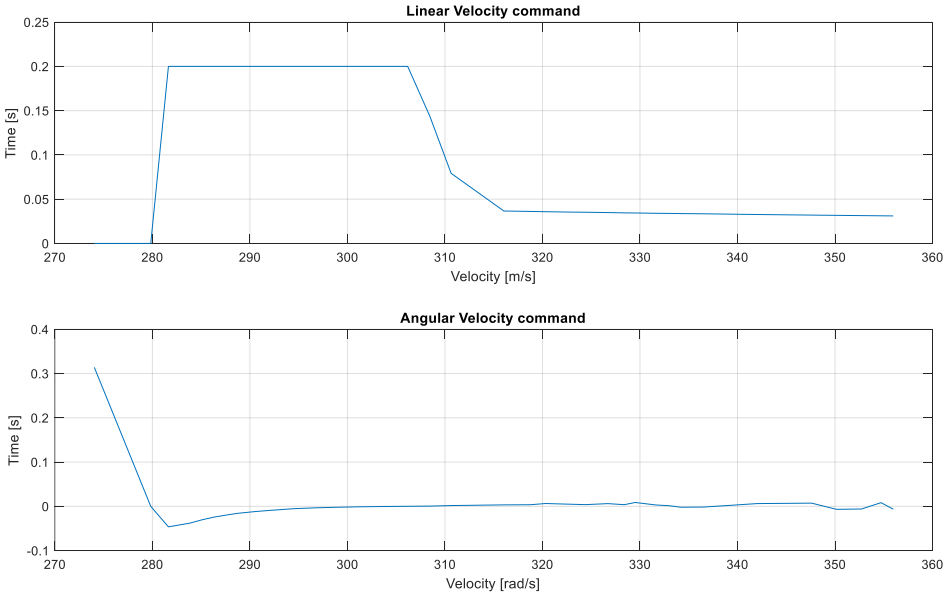


Figure 5. Linear and Angular velocity commands at every time instant.