POLITECNICO
MILANO 1863

School of Industrial and Information Engineering

MSc in Mechanical Engineering

Autonomous Vehicles

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# Assignment 2

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## Introduction

The aim of this assignment is to define a feedback control that moves the turtlebot in an empty Gazebo world through a series of predefined waypoints and stops at the last one.

The following constraints must be respected:

- Maximum absolute longitudinal velocity: 0.2 m/s
- Maximum absolute angular velocity: 0.4 rad/s
- Maximum distance to waypoint: 0.05 m

The requests are:

- A plot of the robots trajectory and of the waypoints
- A plot of the velocity of the robot versus time
- A bag containing the command velocity and the position of the robot

To complete the assignment, the first step was to introduce a way to look into the waypoints list and choose the one that was going to be the next goal.

## Results

To complete this assignment, the feedback control shown in Figure 1 was implemented.

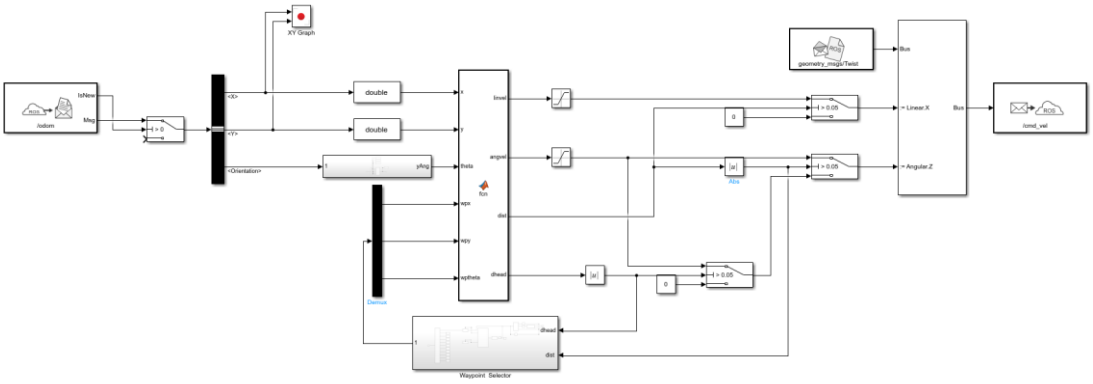


*Figure 1. Path following feedback control*

Figure 2 reports the trajectory of the turtlebot along the complete simulation. The red circles highlight the position of the waypoints, demonstrating that the bot has indeed passed through each one of them. For what concerns the orientation of the bot when reaching the waypoints, the angular position of the robot is reported in Figure 3 in radians [0:2π], together with red circles that signal the reaching of the waypoints.

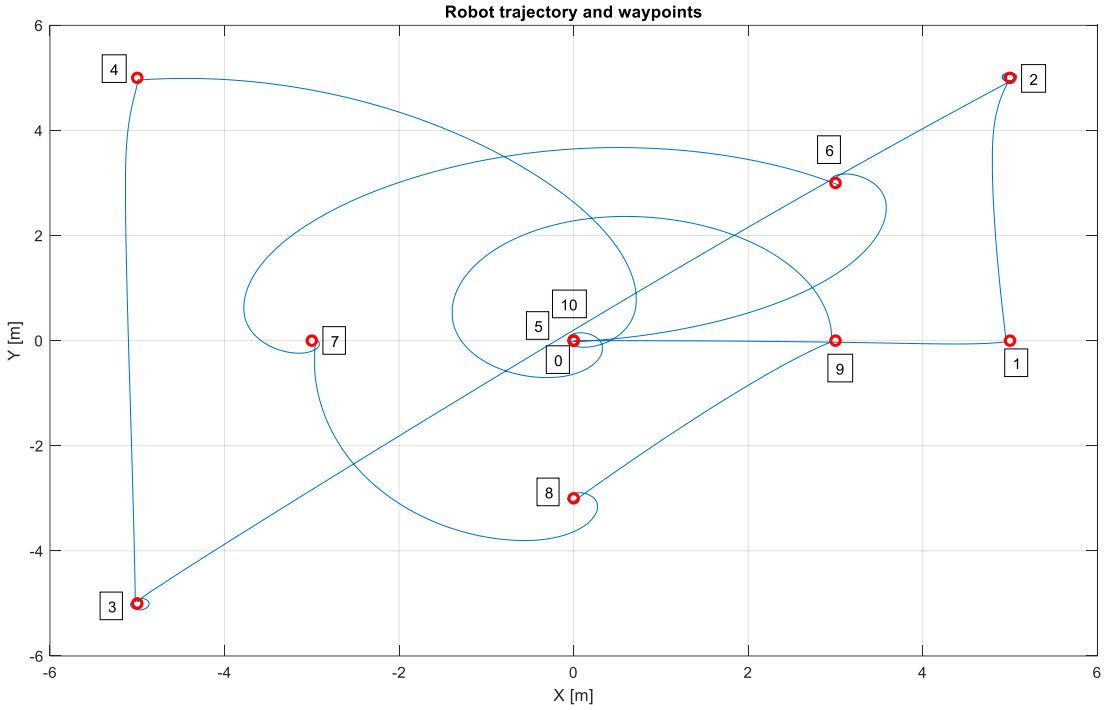


*Figure 2. Trajectory of the robot and waypoints*

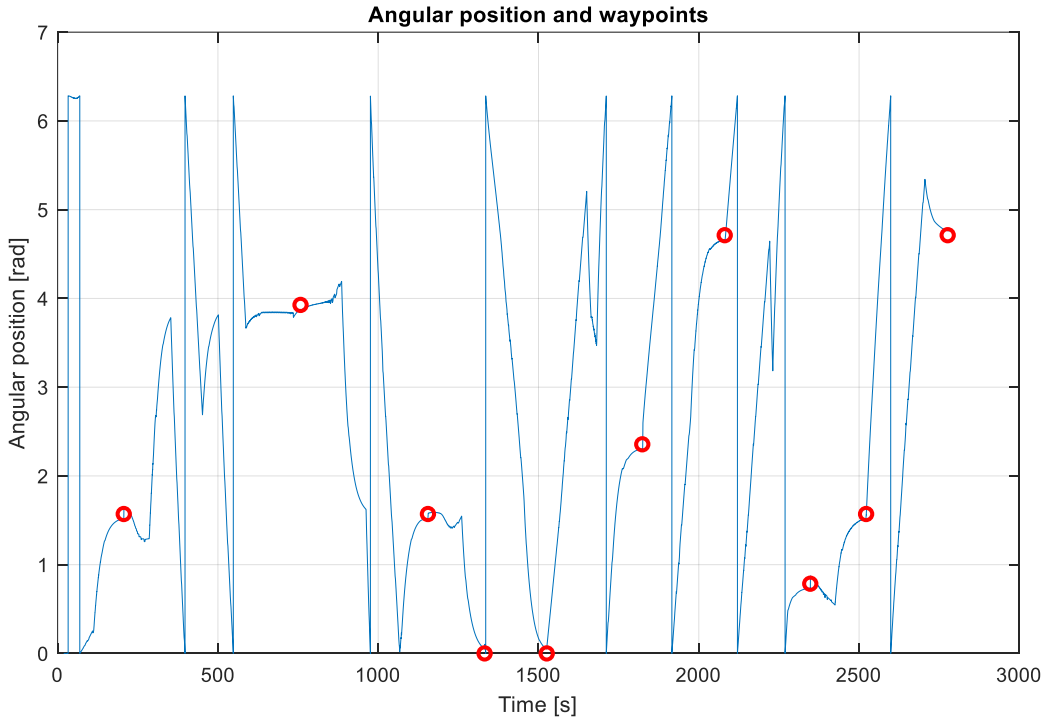


*Figure 3. Angular orientation of the robot and angular waypoints*

Finally, the linear and angular velocity commands, published to the turtlebot through the /cmd_vel topic, are reported in Figure 4 plotted against time.

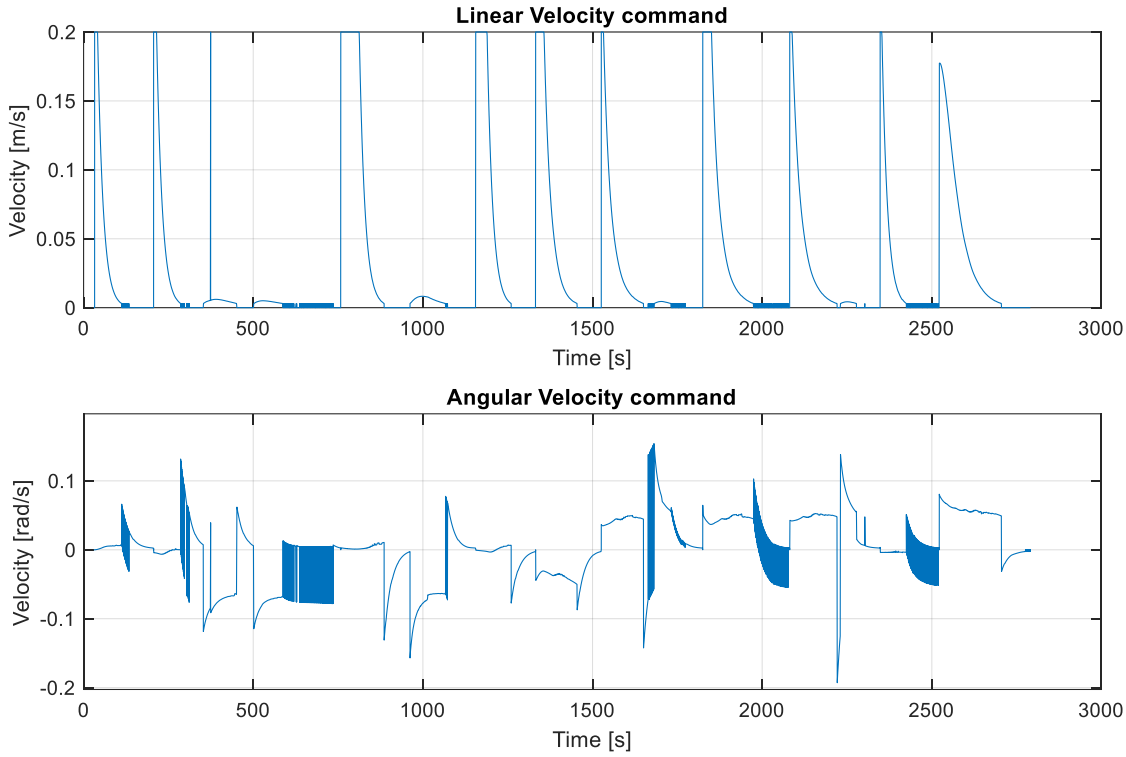


*Figure 4. Linear and angular velocity command*

## Conclusions

The implemented feedback control managed to pass through all of the provided waypoints, reaching them with the requested orientation. However, it could still be improved: the waypoint selector could be made easier and more efficient by using FSM.