Faculty of Engineering Ain Shams University
MCT431
Design of Autonomous Systems

Milestone 2

TEAM 4

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Table of Contents

Table of Figures

1. FIRST REQUIREMENT

1.1 Gazebo Launched with The Turtlebot3 Mobile Robot Spawned At The Origin.

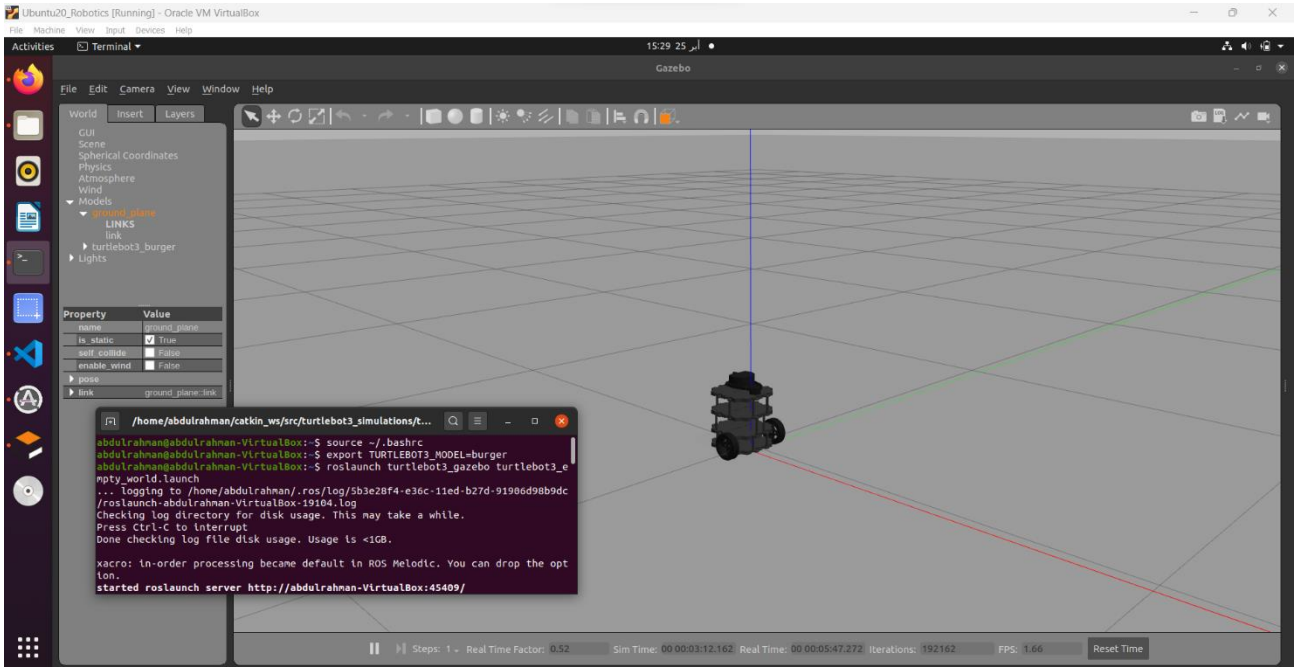

Figure 1: Gazebo launched with the Turtlebot3 mobile robot.

1.2 List Of Topics Available When Launching Gazebo with The Turtlebot3 Mobile Robot.

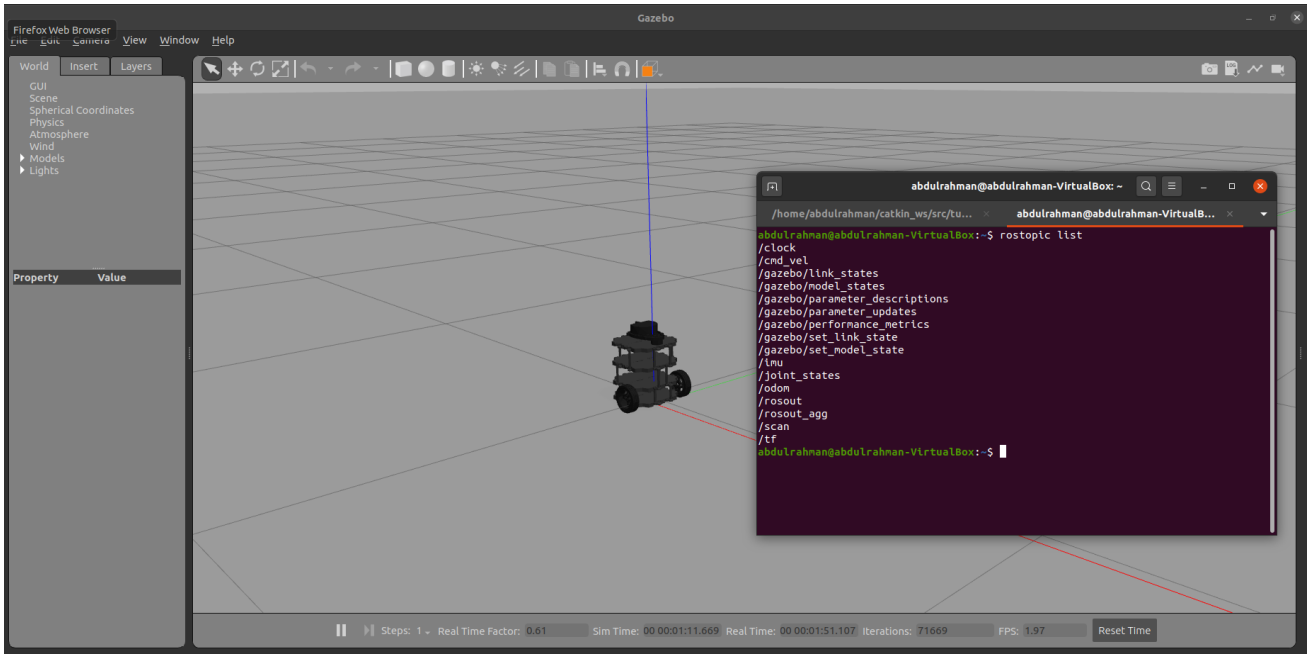

Figure 2: The active topics and nodes when launching Gazebo with the Turtlebot3 mobile robot.

2. SECOND REQUIREMENT

2.1 Implementation Of the Controller To Move Turtlebot3

Our target location or the coordinates we want our mobile robot to travel to would be inputted into the controller, which would then provide us with the appropriate velocity commands to for our mobile robot to travel to the specified location.

The used controller is a state feedback controller, which used in lab 6, but with changing in:

- Gains value.
- Conversion from Quaternion orientation to Euler orientation.
- Treating the roll angle measurements to be read from 0 to 360 deg.

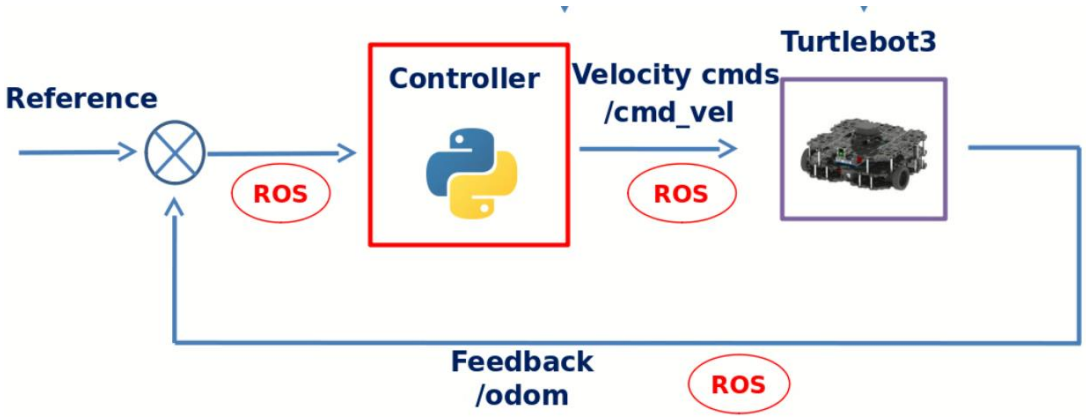

Figure 3: The closed loop of controlling method.

2.2 Turtlebot3 Robot Moves to The Desired Destination.

- **Trial 1, with gains value:**

  $K_p = 0.3$

  $K_{alpha} = 1$

  $K_{beta} = -0.5$

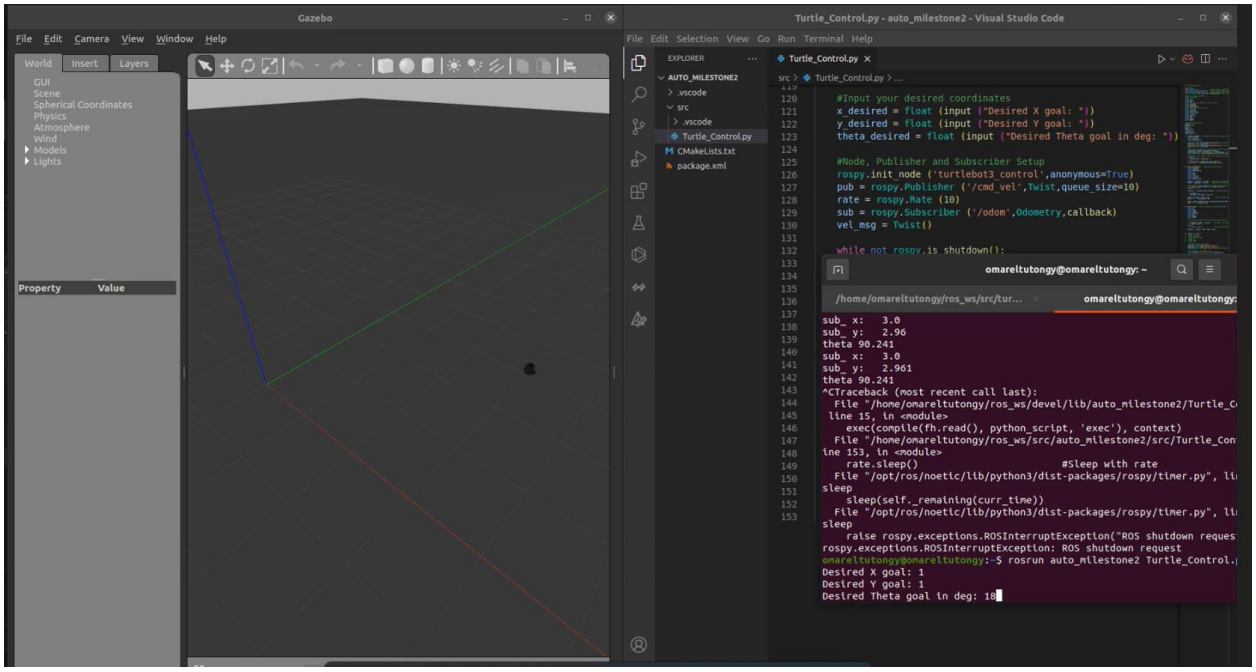

Figure 4: Snapshot of Turtlebot3 Robot moves to the desired destination in trial_1 gains.

- **Trial_1 gains Video Link:** https://drive.google.com/file/d/1mwPMUIw2q3CeF0mH9kKnmum_GLTvET3Z/view?usp=sharing

❖ **Trial 2, with gains value:**

$K_p = 0.8$

$K_{alpha} = 1$

$K_{beta} = -0.5$

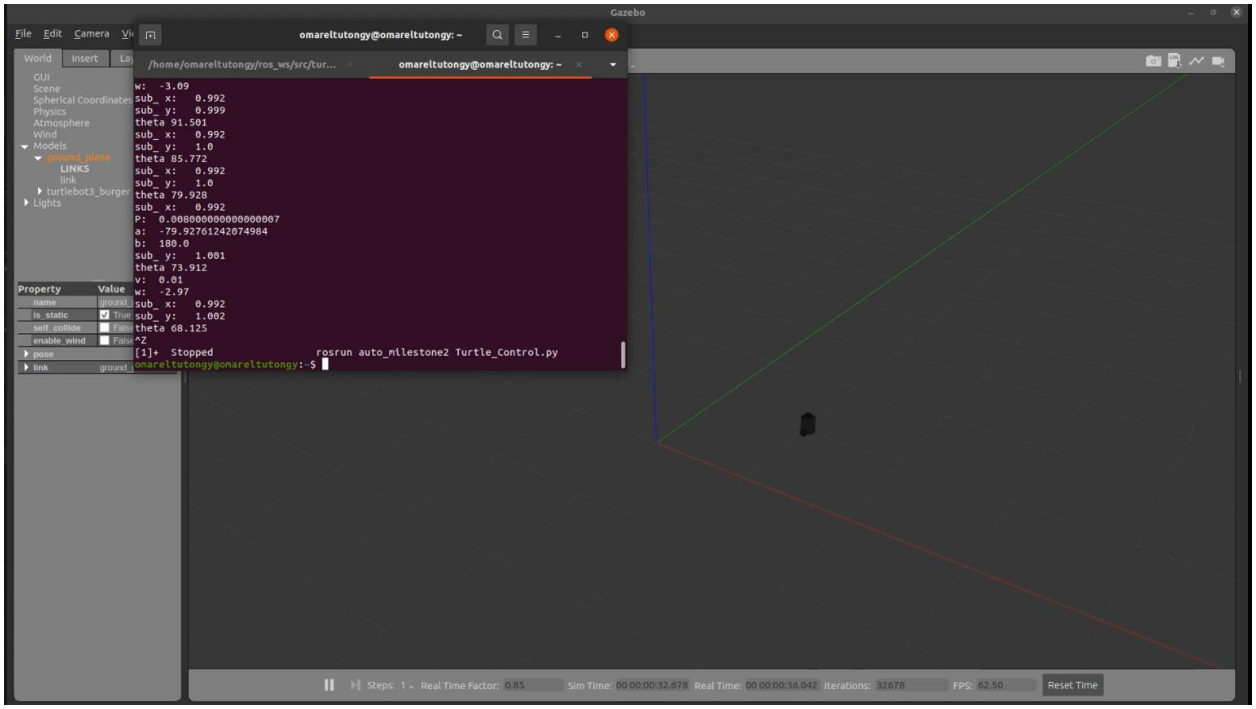

Figure 5: Snapshot of Turtlebot3 Robot moves to the desired destination in trial_2 gains.

- **Trial_2 gains Video Link:**
  https://drive.google.com/file/d/17-zCuRLP1CkT4BWZFusIv0k9jlK3EQbd/view?usp=sharing

❖ Comment:

The natural of the Turtilebut3 as a differential robot makes an unsuitable behaviors at large velocities and angular velocities. So, we modify the Kp value to become a small value, where the velocity at large distance is decreased with a ratio of Kp. This is illustrated clearly in Trial_1 and Trial_2, where in Trial_2 at large distance in x and y behaves unproperly and cannot reach the target position. The values of angular velocities can be tuned slightly to give a better response than in Trial_1, especially increase the value of K_{alpha} to change the initial direction to go to goal then rotates to the required angle at the destination.

3. DRIVE LINK

https://drive.google.com/drive/folders/1K0gPufFa3EzeMKw53mCgccAO9HKCo3fY?usp=sharing