Ain Shams University, Faculty of Engineering

Mechatronics and Automation Program

MCT 431: Autonomous Systems

Milestone 3

Deadline: 9 May, 2023 @11:59 PM

1   Milestone Objective

The objective of this milestone is to implement the path planning techniques we learned in the course to provide our Turtlebot3 with a safe path that allows it to reach its goal in gazebo without hitting any obstacle. In this milestone we will also combine and communicate with the controller we developed in the previous milestone so that it allows our robot to move in the resulting path of our path planner.

2   Requirement 1

2.1   Description

1. You are required to create a 10x10 map in gazebo and place **Multiple** random obstacles in the map. The map should be **Unique** for each team, meaning exchanging maps between teams is not **Allowed**.

2.2   Submission

1. For this requirement your going to submit a screenshot showing Gazebo launched with the map you built.

2. You are required to submit the model and world files of your built map as a zip file.

2.3   Hints & Tips

Refer to the recording and code of Lab 7 to guide you through out your implementation.

3   Requirement 2

3.1   Description

1. You are required to import the Turtlebot3 in the map you created using a launch file.

3.2   Submission

1. For this requirement your going to submit a screenshot showing Gazebo launched with the map you built and the Turtlebot3 imported at position (1,1) in gazebo. You are also required to send a screenshot of the terminal showing the command you wrote to launch the map with Turtlebot3.

2. You are required to also send at the end the launch file you created.

3.3   Hints & Tips

Refer to the recording and code of Lab 7 to guide you through out your implementation.

4 Requirement 3

4.1 Description

1. You are required to implement **Both** the BFS & DFS path planning techniques using python programming language. To test your implemented path planners you are required to give **Both** your path planners multiple different starting and goal points and comment on the results of each algorithm stating their differences.

4.2 Submission

1. You are required to write a report stating the difference between each path planner and mentioning the different points you tested your path planner with. Mention the result of each path planner and comment on it. Support your answers with screenshots of the terminal when running your path planner.

2. You are required to also send at the end the package you created along with any scripts or files you created in the package.

4.3 Hints & Tips

Refer to the recording and code of Lab 7 to guide you through out your implementation.

5 Requirement 4

5.1 Description

1. It is required that each team must control the imported Turtlebot3 on the map to navigate and follow the path obtained using each path planning technique. The robot should be able to navigate from a point to another point in the obtained path using the previously implemented controller in Milestone 2.

5.2 Submission

1. you are required to send a video showing Gazebo running in the background with the Turtlebot3 robot spawned in the map you created. You are then required to open a new terminal and run **Both** the path planner python file and the controller python file. You should give your path planner the starting point and the desired goal. Your path planner should then give your controller the suitable path that Turtlebot3 should move in. Your controller should finally calculate the suitable velocity commands that allows your Turtlebot3 to reach the destiantion safely while avoiding the obstacles your placed in the created map. In the video you should try multiple different goals in front and behind the robot.

2. You are required to also send at the end the package you created along with any scripts or files you created in the package.

5.3 Hints & Tips

Although this might seem like a difficult task, it is actually an easy one ☺. In lab 7 you already know how to implement the BFS path planner and in Milestone 2 you already implemented the

controller. All you need to think of is how to pass the information from the path planner to the controller. Think of the type of message you are going to use and when should the controller change its desired coordinates?

6 Rules and Final submission

1. Cheating in any way is not accepted, any team that copies the Milestone from another team, both teams get a **Zero**.

2. A late submission will result in grade deduction.

3. You are requested to send the entire package you created as a zip file including any codes, folders and files you create inside the package.

4. You are required to send the screenshots you took for each requirement. The screenshots should have a clear view of the terminal (including the lines written), and the name of the computer must be clear and unique for each Team.

5. Send your zipped package, videos and screenshots to the following email: auto.systems.submissions@gmail.com. In the email subject write "Milestone 3 submission". In the body of the email mention your names, IDs and team number. It is required that only **One** person from the team submits the Milestone.