ISTANBUL TECHNICAL UNIVERSITY
COMPUTER ENGINEERING DEPARTMENT

BLG 456E
FINAL PROJECT REPORT

COAVOIDER

GROUP MEMBERS:

150150006 : Yusuf Utku Gül

150170055 : Mustafa Tosun

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Contents

1 INTRODUCTION

The role of robots becomes increasingly important with the growing need for automation. They help unburden workers of repetitive and dangerous tasks, increase productivity and reliability, and save costs. And with the outbreak of COVID-19, their assistance became invaluable. While COVID-19 is dominating the headlines for the strain it's placing on healthcare, hospitals also must continue to manage their typical patient population. Thousands of healthcare workers around the world died last year after being infected while on duty. We believe that this is an important problem because there are many places like this in our world. Healthcare professionals have had to risk their own lives for others. In our project, we took a basic approach to the problem. We designed a robot that autonomously collects garbage in patient rooms and delivers medicines to the patient.

2 ROLES

Mustafa : World, model creation and map design

Utku : Speech Recognition and robot movement

3 PROBLEM STATEMENT

In our project, the main purpose is collecting and carrying the medical materials, in order not to risk the lives of healthcare professionals. In order to put healthcare professionals in less danger, it is aimed to meet the basic needs of patients by robots. Many tasks such as mapping, speech recognition, object detection, obstacle avoidance, grabbing and carrying the objects were fulfilled in the project in order to simulate this problem and generate solutions.

4 SOLUTION DESIGN

In order to solve the problem explained in previous sections, we decided to use a Turtlebot. Also, gazebo was used as simulation environment. In gazebo, a hospital world which contains patient rooms, a garbage room and a medicine room, was created. In order to have realistic success criteria, two object types were considered to be transported, medicine and garbage. The Turtlebot initially sets its mission by receiving a voice command. The voice commands used to determine the task consist of two main parts: the

type of object and the room number. Thanks to the Finite State Machine design in the 'Controller.py' code, the robot becomes waiting for new commands after receiving a voice command and performing the given task.

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1  'Medical'  'Two'
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The example voice command given above, means that, first take a medicine from medicine room and deliver it to patient in Room 2.

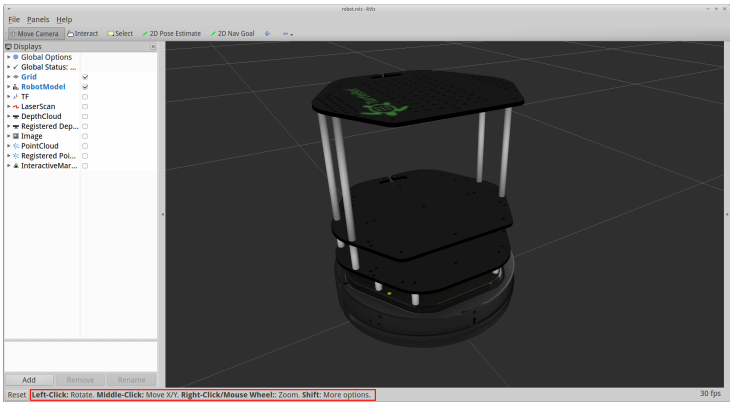

Figure 1: Turtlebot

5 IMPLEMENTATION

5.1 Used robot,platform and etc.

- TurtleBot, as our main robot
- Gazebo, as simulation platform
- SpeechRecognition, as Python Library
- Math, as Python Library

5.2 Speech Recognition

Speech recognition and taking the voice commands from user is the main part of the project. The fact that the robot is working with voice commands makes it suitable for its purpose. In the beginning, the Turtlebot waits for getting the command from user, then it takes action according to the this command. To transform a voice to a command, the SpeechRecognition module was used. As can be stated before, the commands are consist of the room number and type of the object.

5.3 Creating the Hospital World

In order to test the problem realistically, the physical properties of the simulation environment were carefully created.

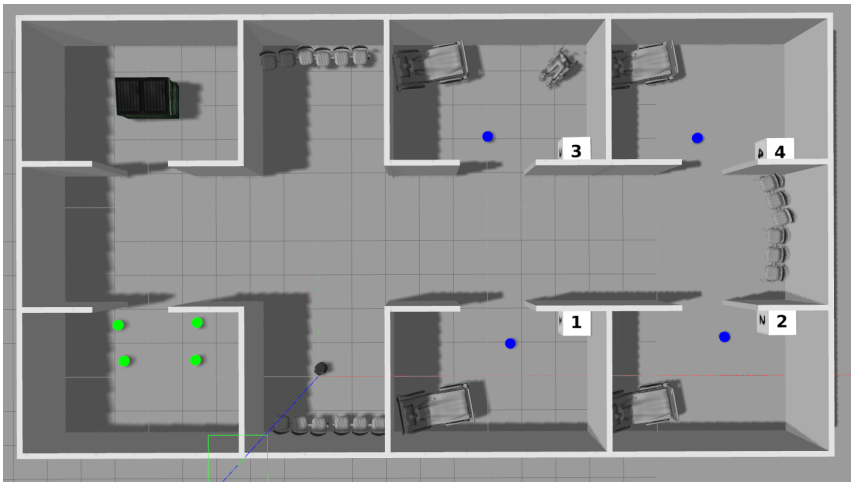

Figure 2: Simulation World

5.4 Path Following

For path following we converted real coordinates to robot's world of frame.Distance to target point is also taken as a parameter.

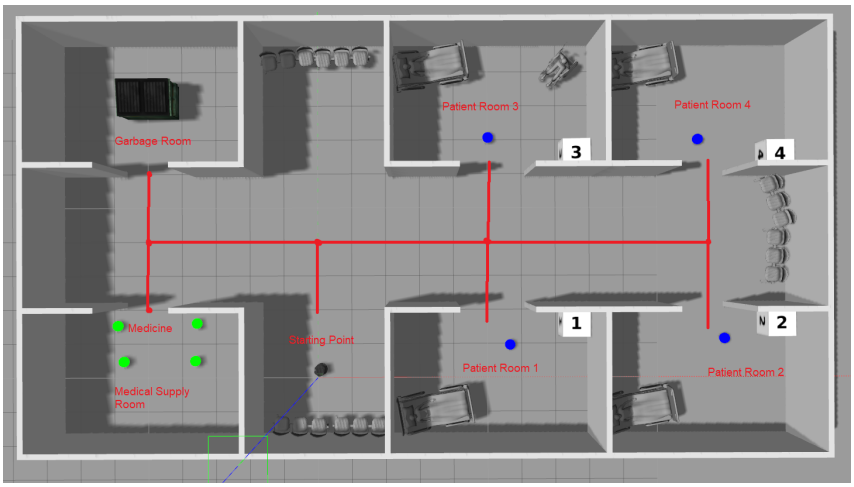

Figure 3: Defined Paths

In the Figure 3. Red lines shows the paths loaded into the robot beforehand. The green balls represent medicines and the blue balls represent the garbages.

6 ANALYSIS

As a testing criteria we tried to reduce the number of collisions between walls and other objects by improving our path following algorithm.And we used different parameters when robot enters into any of the room to avoid any unnecessary collisions. For speech recognition we tried to increase the success rate by manipulating the predicted sentences for eliminating possible unintended mistakes.

7 CONCLUSION

In conclusion, we tested and challenged our robot with various inputs with different garbage spawn occurrences and after these tests, it is safe to say that project solved the major problems that we stated at the beginning of the project.