SWROB2
Exercise 5 - Point cloud operations
Mandatory

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1 Exercise: Extract range and angle from scan

Turtlebot and PC konfiguration

1.0.1 Connection to the TurtleBot3 from powershell

For making the connection to the turtlebot we are connecting to the WiFi

- **ssid:** turtlebot
- **password:** turtlebot3

from powershell type:

ssh ubuntu@192.168.72.251, password: turtlebot

1.0.2 Starting ROS on turtlebot from powershell

from powershell type

roscore

1.0.3 Connection to TurtleBot3 from Matlab

For setting the ros environment variable and setting the IP on the host (turtlebot):

```
setenv('ROS_MASTER_URI','http://192.168.72.251:11311')
```

For setting the IP on the local machine

```
setenv('ROS_IP','192.168.72.220')
```

The following command is closing existing connection to be ensure that when the user is connection the robot isn't connected to anyone else

```
rosshutdown();
```

This command will be doing the initialization of the connection between ROS and Matlab

```
rosinit('http://192.168.72.251:11311','NodeHost','
192.168.72.220');
```

Matlab script for init

```
setenv('ROS_MASTER_URI','http://192.168.72.251:11311')
setenv('ROS_IP','192.168.72.220')
rosshutdown();
rosinit('http://192.168.72.251:11311','NodeHost','
192.168.72.220');
```

1.1 Introduction

This section introduces the importance of extracting range and angle data from scanning data in localization methods. It briefly describes the context and applications of this task in robotics and specifically with the TurtleBot platform.

1.2 Objective

The objective of this exercise is to develop an algorithm capable of extracting range-angle coordinates from scanning data obtained from the TurtleBot. This involves capturing range data, processing it to determine the distance and angle to a wall, and validating the results against true measured values.

1.3 Methodology

1.3.1 Data Acquisition

Describe the process of capturing range data from the TurtleBot using the ROS Laserscan (2D) message. This includes setting up the TurtleBot at a known distance and fixed angle relative to a wall.

1.3.2 Algorithm Development

Detail the development of the algorithm for extracting range-angle coordinates. Discuss the implementation of line fitting or similar techniques to enhance robustness against irregularities on or near the wall.

1.4 Experimentation and Testing

1.4.1 Algorithm Testing

Explain how the algorithm is tested, including the procedure for driving the robot along a wall at a fixed distance and adjusting its driving angle to maintain this distance.

1.4.2 Optional Enhancements

Discuss optional methods for improving algorithm robustness, such as the implementation of k-means clustering or the Hough transform, to focus on fitting lines or planes to the most significant wall area while ignoring corners and other non-relevant features.

1.5 Results

Present the results of the algorithm testing, including comparisons between the extracted data and true measured values. Include any relevant data visualizations or statistical analyses.

1.6 Discussion

Analyze the performance of the developed algorithm, highlighting its strengths and limitations. Discuss any discrepancies between the extracted data and true values, and suggest possible explanations and improvements.

1.7 Conclusion

Summarize the findings of the exercise, emphasizing the importance of accurate range and angle data extraction in localization methods. Reflect on the potential applications of this work in robotics and future research directions.