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**MEEM 4707: Autonomous system**

**Spring, 2024**

**Lab - 4**

**By**

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# **Problem 1.** For the given gazebo environment, it is given that the TB3’s x-axis is approximately parallel to the wall, and the wall is on the left (towards + y-axis). The LiDAR sensor senses 360 degrees counterclockwise, starting from 0 degrees at TB3’s forward axis. A student used the scan array data received from the TB3’s Lidar and reported that the minimum distance from that wall is approximately 0.4 m. Still, the student did not mention the index number of the point with the minimum distance.

1. Guess the index number of the point with the minimum distance and explain the reason briefly for the guessed value? You can also explain using a hand-drawn figure/sketch.

A computer generated image of a zigzag

Description automatically generated  
***Figure 1:*** *Perpendicular turtlebot setup.*

Assuming an angular resolution of 1 degree, there should be exactly 360 distances measured. If the robot is faced perpendicular to the wall (as shown in Figure 1) and scans CCW, then the closest measurement should be at 90 degrees, or index 89.

# **Problem 2.** In this problem, you need to open the gazebo environment.

1) Initially, when the TB3 is located at (0,0), what is the minimum distance of the robot from the wall?

The minimum distance is initially 0.9189 m.

1. And what is the angle of the minimum distance point with respect to the x-axis of the robot?

The angle is initially 55 degrees CCW of the X+ axis.

**Problem 3.** Read the "wall\_follow.py" code script and summarize your understanding. Provide the variable names and commands in the code that 1) stores the lidar scan data, 2) the minimum distance value in the scan array, and 3) the index of the minimum distance value in the scan array that we intend to use. Additionally, explain how you can utilize these variables to detect and navigate along the wall.

1. The Lidar data is initially defined in lines 29-34, where scn\_arr represents one full sweep worth of data, and res represents the amount of data points per degree.