Gauntlet

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1   Introduction

We chose Level 2 of the Gauntlet, as it aligned with our learning goals for this project. To solve this, we split our project up into multiple files, each achieving a different step. The Collect_lidar.m collects the LIDAR data. The Map_of_Guantlet.mat is the implementation of our RANSAC algorithm. The PotentialField.m file takes the RANSAC lines and creates a potential field (contour plot) and quiver plot.

2   Algorithm Basics

We began by cleaning up our position (r) and angle (θ) values collected from the LIDAR. With these clean r and θ values, we converted them to the global cartesian frame (x and y). This is where the magic struggle bus^{TM} began. [In hindsight, we realize that using the parametric approach (using $\Gamma and \theta$ instead of converting to x and y), would have been a more efficient way of creating an equation for the path the Neato should travel and implementing that path, since we have worked with this method before, it accounts for both horizontal and vertical lines, and because we understand the constraints of r/theta more than those of x/y]. Instead, we moved forward with using x and y. Our RANSAC function generated x and y coordinates for endpoints of the each line in the gauntlet, and we used those endpoints to generate the lines of best fit using RANSAC.

From here, it took us several hours to determine an effective method for defining our potential/gradient fields. Since our RANSAC function outputted the endpoints, slope, and y intercept, we used this information to set a number of points along each line as sources. Since we only had a few small line segments to represent the Bucket of Benevolence (BoB), we set one of the endpoints of the line segments as a point sink. A note on calculating the values for the contour plot: We scaled the data for the sources and the sink (the BoB) differently. The gradient field likely would have worked for our Neato with consistent scaling, but we wanted to emphasize the BoB as the sink on our plot and for the path we intended to generate.
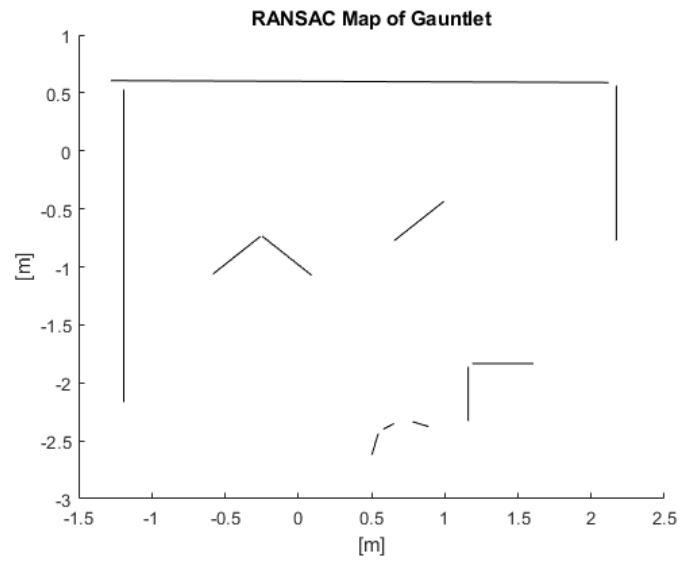
3   Data

Figure 1: Plot of our Gauntlet arena after implementing our RANSAC algorithm.
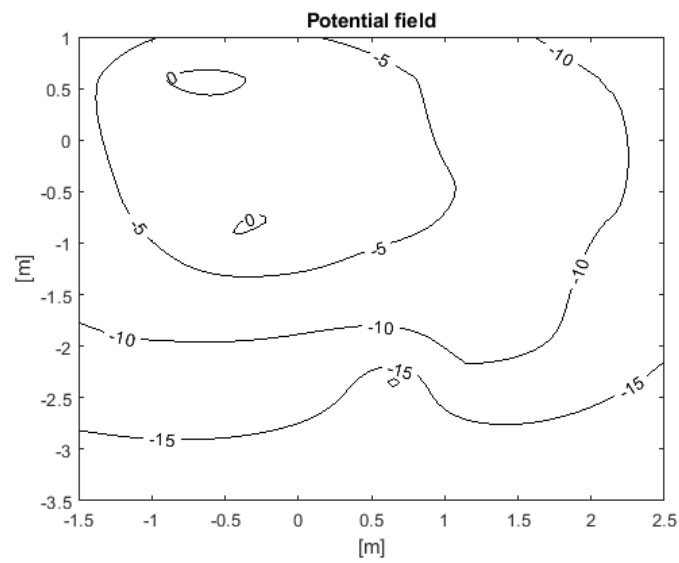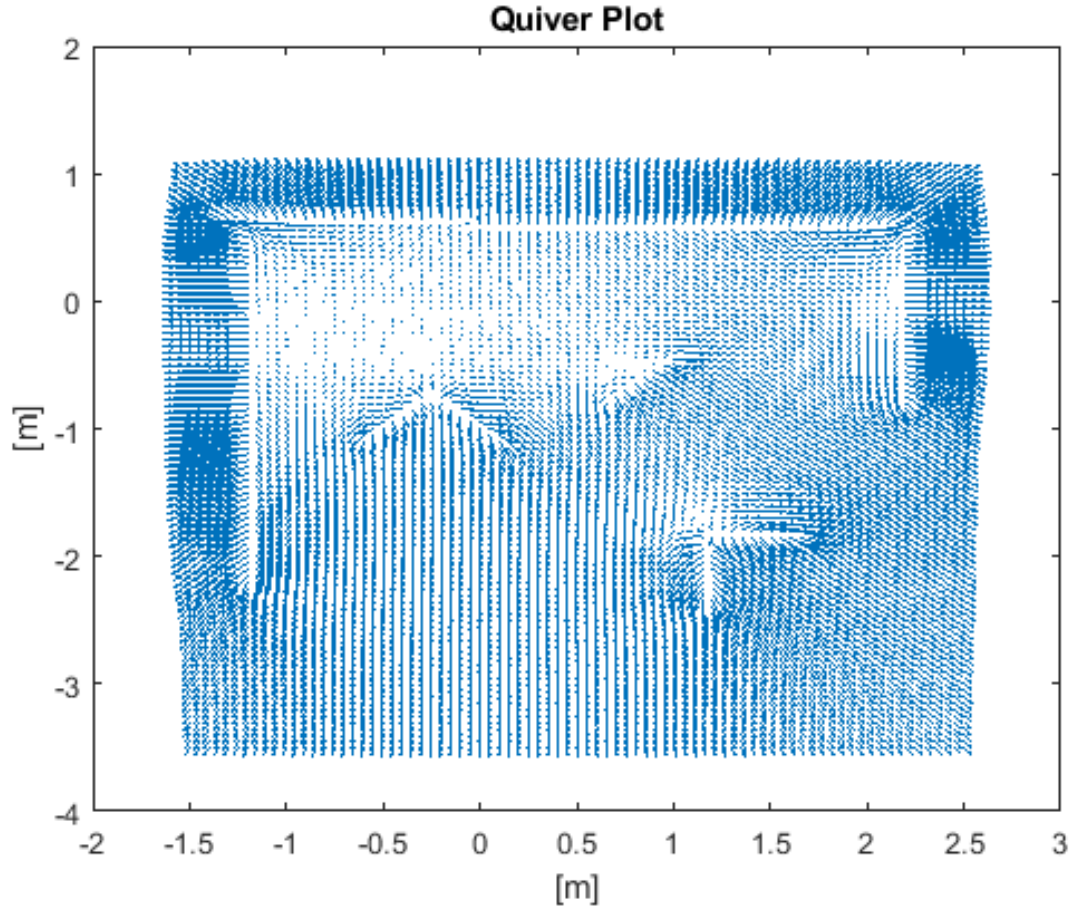

Figure 2: Our potential field.

Figure 3: Our quiver plot showing gradient descent from the origin.

4   Intended Next Steps

If we had more time, here are the steps we would have taken to complete the Gauntlet challenge:

- Converting individual source/sink points from gradient plot into a path for our Neato to traverse in the Gauntlet. This would have required creating an equation that represents the gradient field without the thousands of points that make up each line of the Gauntlet.

- Using the flatland code as a reference to use the equation we build to drive our Neato to the BoB.

- Attempting (and succeeding) at driving the Neato from the origin and initial position to the BoB.

5   Documentation

- GitHub Repository
- Collect Lidar Data
- Run RANSAC algorithm to create map
- Create potential field and quiver