GAUNTLET WRITE-UP

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STRATEGY

To navigate the Gauntlet, we first took our LIDAR data, 'cleaned up' the data points, and translated it into the global/room frame. Then, using the RANSAC method of linear fitting, we fit line segments to the data (excluding gaps in the data, signifying spaces the NEATO could move through. Using these line segments, we generated a potential field. From there, we used the potential field to create a gradient. The walls were defined as repulsive objects and the BoB as an attractive point.

We primarily build off of what we learned with RANSAC and potential points in this challenge, and gradients in the last challenge.

RANSAC

RANSAC stands for Random Sample Consensus. It is a process that iteratively picks random data points as inliers, and determines which line maximizes the amount of inlier points. Depending on a number of factors, like the threshold value for determining an inlier point, the number of lines to try, and the number of points needed to define a line, this can very effectively (even more so than linear regression and principle component analysis) draw lines for data points.

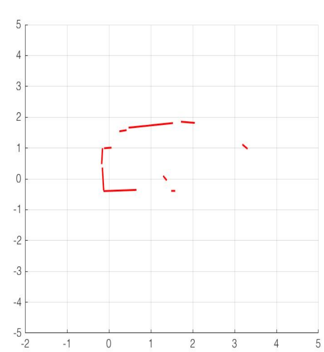

FIG. 1. Robust Line of Fit by using RANSAC method

LIDAR

But how do we get the data points for RANSAC to fit lines? This is using LIDAR. NEATOs have a LIDAR that will return distance to the object and the angle at which it is located. An obstacle will have a bunch of data points in the shape of the perimeter of that object, so lines are easily about to fit within the data.

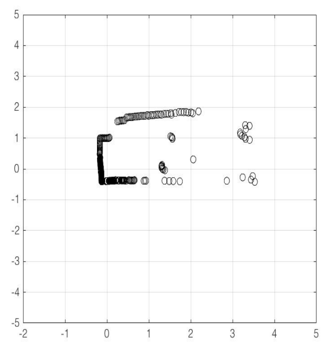

FIG. 2. LIDAR scanned data

Potential

Potential fields are helpful in defining attractive and repulsive points/lines. This was helpful in this gauntlet challenge, when we wanted to steer the NEATO away from the walls and towards an end goal. If the walls are defined as high potential, and the BoB as low potential, the gradient can move the NEATO down the potential gradient.

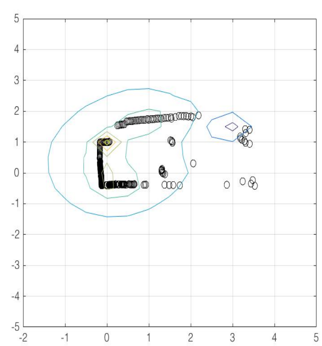

FIG. 3. Figure of the potential contour field

GRADIENT

In the previous challenge we used gradient ascent, to go up the path of the steepest slope (which would help get to the highest point). In this case, we want

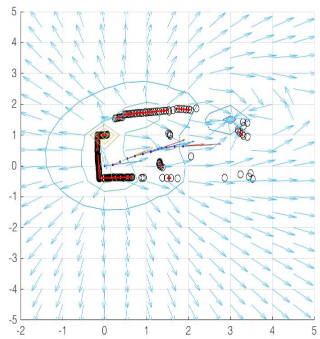

FIG. 4. Figure of the gradient vectors and NEATO's path vectors

gradient descent, to go down the potential gradient and get to the lowest point, which is the attractive point.

EXPERIMENTAL DATA

Time took NEATO to complete the pathway	35 sec

DESCRIPTION OF PROCESS

The general process we felt best fit our understanding and our learning goals was building code by segments until our MVP was reached. We created multiple functions, testing each to see if they worked as expected, before incorporating them into our main script. We started with the LIDAR and RANSAC codes we had previously written for homework assignments, and fixed them until they fit the purpose of our overall project.We modified VMacro to work for the multiple line segments (found using RANSAC), and added the BoB as an attractive point in our potential field.

We have to admit that at points, our methodology included 'magic numbering' the data - sometimes randomly making a variable negative. However this either a) didn't work, or b) turned out to be right all along. We also relied extensively on the mind of Paul Ruvolo in order to debug along the way (we pretty much knew what to do, but sometimes the actual doing it just . . . didn't work). Anyways, we learned a lot but are glad to be done with QEA Semester 1.

VIDEO

link to Youtube video of NEATO in Gauntlet challenge.