Data:

# Overview:

In order to test the accuracy of this algoritm, 3 different sets of data were taken, with points identified as corners marked in blue.

Note that the corners identified on the first and last points in each scan are invalid. This is an artifact of the algorithm requring a point directly before and after in the array, and can be resolved by checking if the first or last point is used and using the data from array position 360 instead of 0 and 1 instead of 361. This problem will be fixed for future usage, but for now these points should be ingored.

# Measurements:

The three scans taken are shown in Figures 1-3. The LIDAR was placed into the approximate center of the environment at a semi-random angle and the outline of the enclosure is revealed as a series of measurement points. The curvature of the sides of the scan is due to the natural flex in the material used to make the testing environment. Each scan is an array of 360 different clusters of 4 values each constituting a point on the plot and consisting of the raw data from the sensor indicating the location of that point (magnitude in milimeters and phase in degrees), as well as the calculated angle between that point and its adjacent points, and a boolean identifying whether or not the calculated angle is a corner. Points identified as corners are also hilighted blue on the scans. Figures 1 through 3 show the environment which the Lidar was placed in including the four walls and the convex movable corner. Figure 4 shows two different examples of clusters of data.

Figure 1: A scan taken, with an unexplained gap in the bottom of the environment.

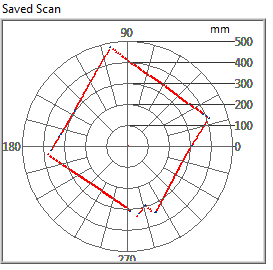


Figure 2: Scan taken in a non-square environmet.

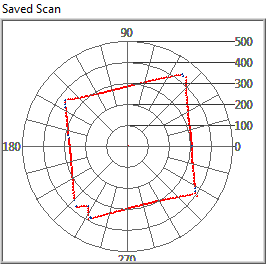


Figure 3: Scan taken with a large gap in the corner.

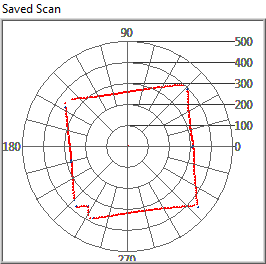
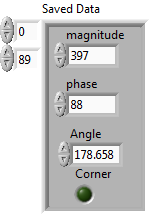
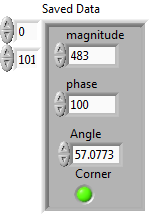


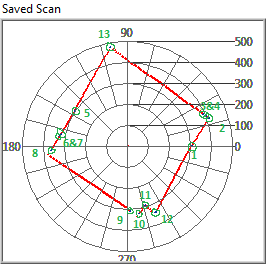
Figure 4: Two different sets of data, one identified as a corner.



# Calcualted Data:

In order to test the robustness of this method, the number of corners that were detected that were not part of actual corners (corners detected – actual number of corners (6)) will be compared to the number of points taken by the scan to calculate the regularity of false positives. Figure 5 shows an annotated list of all of the points in Figure 1.

Figure 5: Corners identified in Figure 1



1. This point is the first point in the scan, and is not correctly identified as a corner, as discussed earlier in the section, and will be subtracted from the total number of detected points.
2. Valid corner.
3. Invalid corner, created by a gap between 3&4.
4. Invalid corner, created by a gap between 3&4.
5. Invalid corner, created due to unknown circumstances
6. Invalid corner, created by a gap between 6&7.
7. Invalid corner, created by a gap between 6&7.
8. Near a valid corner, although the actual corner is not hilighted. This is not expected, and we be investigated with further research, and is a false negative.
9. Near a valid corner, in conjunction with 10. This is similar to corner 8.
10. Near a valid corner, in conjuction with 9. This is similar to corner 8.
11. Valid corner.
12. Valid corner.
13. Valid corner

Table 1: Number of Corners Detected

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Scan | Corners | False Positives | False Positives Rate (out of 360) | False Negatives | False Negatives Rate (out of 6) |
| 1 | 12 | 6 | 1.67% | 2 | 33% |
| 2 | 13 | 7 | 1.94% | 2 | 33% |
| 3 | 9 | 3 | 0.833% | 1 | 16% |

In all three scans, there are examples of invalid corners which were created on the sides of the environment. The exact cause of this is unknown, and needs further investigation.