SC635: Advanced Topics in Mobile Robotics Labwork Report

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Assignment 01:
Waypoint Generation and Trajectory Tracking with *turtlebot*

Progress

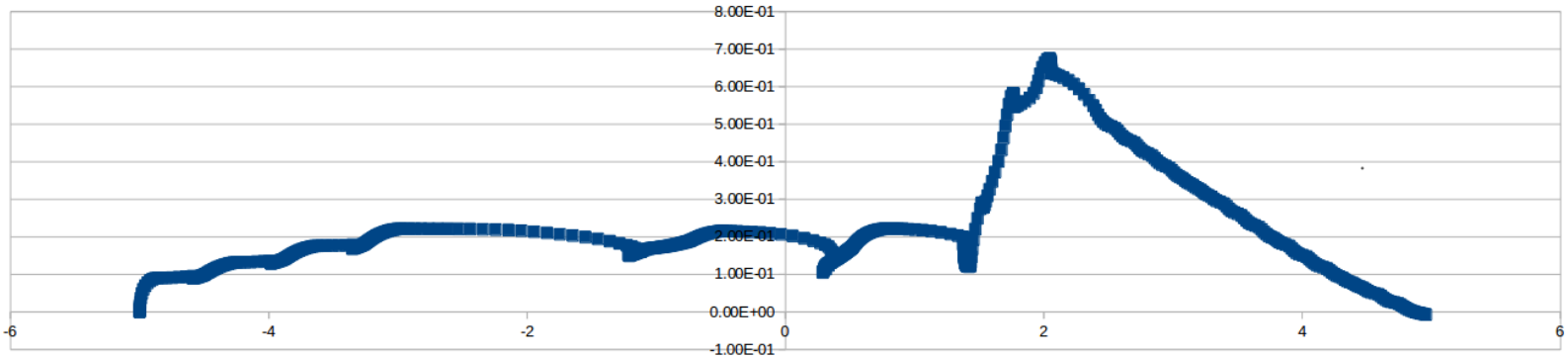
- The developed scripts for waypoint generation as well as trajectory tracking had been submitted as part of the entire workspace
- Due to issues on my laptop, I had used a friend's laptop. The successful debugging of the code was not possible at that point of time

Assignment 02:
Obstacle Avoidance with Range Sensing

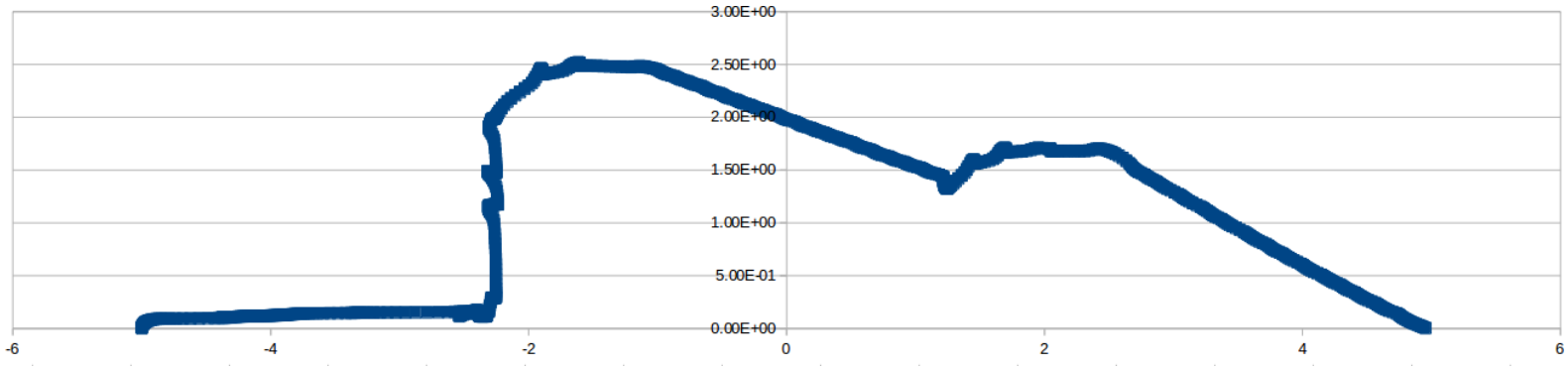
Progress

- Tangent Bug has been completed successfully, working in both worlds.
- Bug 2 has been designed. However, the simulation is not working and several efforts to debug have turned out futile.

Tangent Bug



(a) World 1



(b) World 2

Figure 1: X-Y Plot

Tuning Parameters

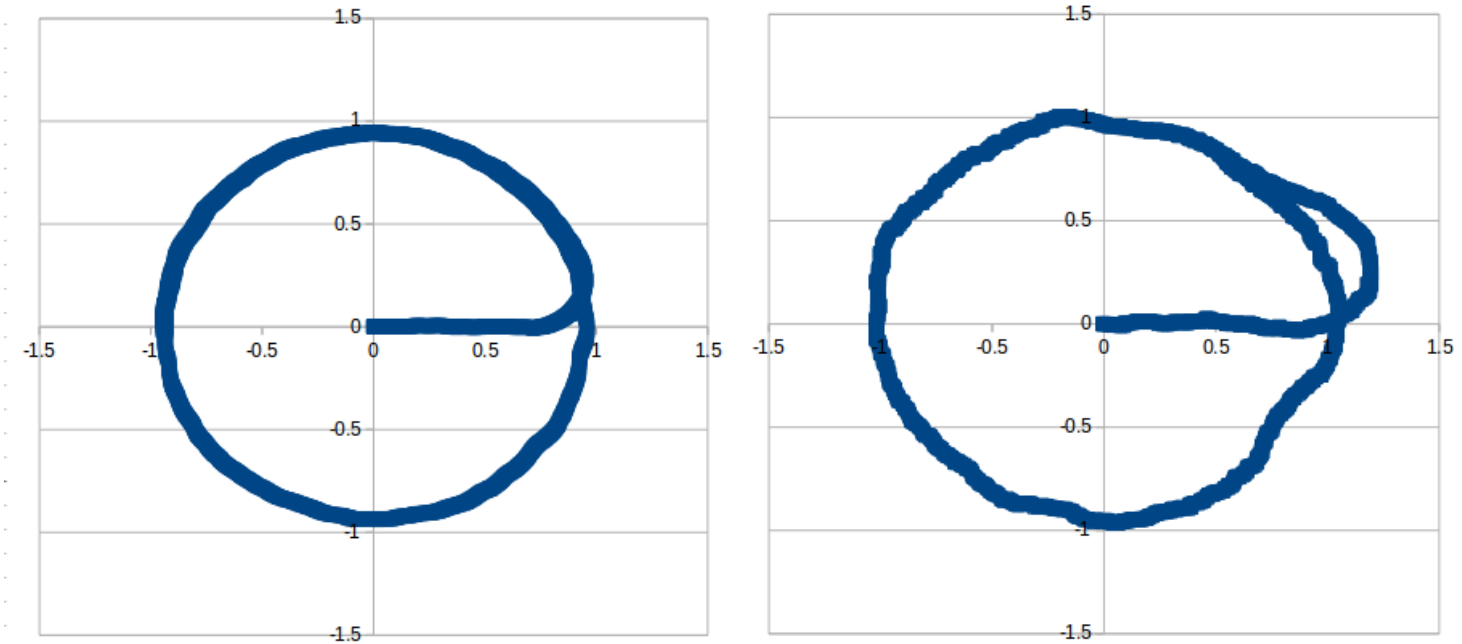
- The distance cutoff chosen was 0.3 m; i.e., when the robot was closer than 0.3 m to the destination, the iterator was incremented
- The proportionality constant for linear motion was 0.40 and that for angular motion was 0.15
- The maximum angular error permitted for high linear velocities was 2°; i.e., at a heading with an angular error more than 2°, the robot corrects the heading before moving forward significantly

Assignment 03:
Trilateration with Ground Mobile Robot

Progress

- The labwork has been successfully completed with variances up to (0.10, 0.10, 0.10).

Trajectory



(a) $\Sigma^2 = [0.001\ 0.001\ 0.001]$ (b) $\Sigma^2 = [0.1\ 0.1\ 0.1]$

Figure 2: Trajectory Tracking

Root Mean Square Error

- Due to lack of individual state variable data in the above plot, the RMSE has been calculated as the distance from the required trajectory, which is the unit-radius circle about the origin.
- The RMSE has been calculated as follows:

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N} \left((x_i^2 + y_i^2) - 1 \right)}{N}}$$

- The hence calculated RMSE for variance $\Sigma^2 = [0.10\ 0.10\ 0.10]$ turns out to be 0.319

Assignment 04: Kalman Filter

Progress

- The scripts for this assignment has been completed.
- There exist certain bugs with respect to the matrix multiplication and inversion for the development of the Kalman filter. As a result, the workspace is not completely functional.