SYSEN 5411 Fall 2025

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Lab 3 Report – Inverse Kinematics

Time difference in seconds between STST and TST algorithms for the three target vectors are included as .txt files attached.

Measured error distance for each waypoint navigation run was measured from expected final point (0,0,0) and the center of the robot at the Raspberry Pi microprocessor.

|  |  |
| --- | --- |
| Waypoint Navigation Run, radius = 50 cm | Measured Error (cm, cm, deg) |
| N=4 | (-9, 0, 0 deg) |
| N=8 | (9, 3, 13 deg ) |
| N=12 | (6, 2, 4.5 deg) |

This was definitely the lab I spent the most time on so far. There was significant debugging to be done with the waypoint algorithm. I spent maybe 15 hours on it all told, a certain portion of that on getting proper data reporting on the robot, and a major portion of that struggling to realize that I needed to subtract initial heading from the atan2 output to get the proper alpha turn.

Some challenges were with the provided circle function. Copy pasting it into its own .py file had issues as many of the indents didn’t transfer correctly, resulting in errors passed on that I only caught after exhausting other error sources. I also didn’t realize for some time that the circle algorithm assumed the robot would be starting facing -90 instead of 0 degrees theta. I ended up modifying the step count to be n\_points instead of n-1 for closed loops as the final point wasn’t getting outputted correctly. N=4 points was only giving me a triangle instead of a square, and changing that line properly resulted in a square output with 5 points returning back to home.

I used GitHub Copilot through VS Code on some of the data logging and file generation code to provide starter code and debugging help. It’s remarkably helpful.