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Lab 2 Report - Odometry

Data:

Without Correction		
Test #	Delta X (cm)	Delta Y (cm)
1	0.3	0.1
2	-0.3	0.5
3	-0.5	0.5
4	-0.1	0.3
5	0.1	-0.2
6	0	-0.1
7	-0.2	0
8	0	0.1
9	0.1	-0.3
10	-0.1	-0.3

With Correction		
Test #	Delta X (cm)	Delta Y (cm)
1	-0.37	0.15
2	0.29	-0.13
3	-0.02	0.32
4	-0.11	-0.11
5	-0.04	1.74
6	-0.13	-1.43
7	-0.06	-0.6
8	-0.16	5.84
9	-0.02	-0.04
10	-0.23	-0.59

Data Analysis:

Standard Deviation			
W/O Correction		W/ Correction	
X	Y	X	Y
0.214709	0.283549	0.161941	1.933635

What was the standard deviation of the results without correction? Did it decrease when correction as introduced? Explain why/why not.

a) The standard deviation of our values did not decrease for the Y coordinate values, but decreased for the X values. The difference is precision in respect to the Y coordinates could be explained by the abnormally large differences that occurred during tests 5, 6, and 8.

With correction, do you expect the error in the x position or the y position to be smaller?

b) It is most likely that the X values should be more imprecise, as the robot picks up an X line shortly before arriving at its destination, while the last Y reading was before turning the last corner. The turning of the robot, and consequently the angle at which it travels towards its final destination affects the Y value significantly, while the X value gains precision thanks to the last line reading.

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Observation and Conclusion:

Is the error you observed in the odometer (without correction) tolerable for larger distances (i.e. circumnavigating the field requires a travel distance five (5) times larger than that used for this lab)? Do you expect the error to grow linearly with respect to travel distance? Explain briefly.

The error observed for the small 2x2 square was overall negligible (millimetres) and would be tolerable for larger distances. This is in part due to the fact that we took the time to ensure that the *SquareDriver* method was properly calibrated. However it is logical to think that over longer distances these errors that we perceive as being minimal at current scale would grow proportionally until they become significant. The number of turns also has a big impact on the quality of the measurements, as the calculated heading of the robot is crucial to the computation of the X and Y coordinates.

Further Improvement:

Propose a means of, in software, reducing the slip of the robot's wheels (do not provide code).

a) One way to reduce the slipping of the robot through software means would be reducing the acceleration that the motors experience. By decreasing the rate that the motors speed changes it would allow the motor more time to grip the surface, increase friction and properly relate the movement of the robot to the tachometer readings

Propose a means of, in software, correcting the angle reported by the odometer, when (do not provide code): i) The robot has two light sensors; ii) The robot has only one light sensor.

b) i) If we were to place both light sensors on the front of the robot however separate them horizontally (place them in front of each motor) we could determine through software means the robots theta. If both sensor detect the line at the same time it is perpendicular to the line. If however they detect the lines separately the separation of the light sensors and the speed of the robot can be used to calculate theta.

ii) Since we know the orientation of the lines we could use one light sensor to calculate the theta of the robot. If we can find the line and position the robot in a way that it will follow the line we could determine it is travelling solely in the x or y axis.