Test analysis:

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| --- | --- | --- | --- | --- | --- |
| Odometer Test | | | | | |
|  | X | Y |  |  | Error |
| 1 | -14.64 | -15.68 | -8.7 | -18.6 | 6.62 |
| 2 | -15.15 | -15.32 | -12.7 | -19.9 | 5.20 |
| 3 | -14.71 | -15.85 | -16.4 | -10.9 | 5.23 |
| 4 | -14.71 | -14.6 | -15.01 | -13.1 | 1.53 |
| 5 | -14.57 | -15.22 | -13.2 | -16.1 | 1.63 |
| 6 | -14.4 | -15.53 | -11.2 | -18.8 | 4.58 |
| 7 | -14.56 | -15.15 | -12.9 | -15.9 | 1.82 |
| 8 | -14.67 | -15.62 | -9.6 | -17.8 | 5.52 |
| 9 | -14.42 | -15.51 | -12.9 | -18.8 | 3.62 |
| 10 | -14.42 | -15.96 | -12.4 | -17.8 | 2.73 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Odometer Correction Test | | | | | |
|  | X | Y |  |  | Error |
| 1 | -20.08 | -11.9 | -16.3 | -12.1 | 3.78 |
| 2 | -21.28 | -11.68 | -17.2 | -11.8 | 4.08 |
| 3 | -18.72 | -11.97 | -16.3 | -11.3 | 2.51 |
| 4 | -19.07 | -11.43 | -15.9 | -11.3 | 3.17 |
| 5 | -17.06 | -10.95 | -13.8 | -12.5 | 3.60 |
| 6 | -18.2 | -11.86 | -15 | -12.8 | 3.33 |
| 7 | -19.01 | -11.95 | -16.4 | -12.5 | 2.67 |
| 8 | -18.57 | -11.94 | -16.7 | -12.7 | 2.02 |
| 9 | -18.06 | -10.25 | -15 | -10.5 | 3.07 |
| 10 | -16.86 | -10.46 | -14 | -11.2 | 2.95 |

|  |  |  |
| --- | --- | --- |
|  | Odometer Test | Odometer Correction Test |
|  | -14.63 | -18.70 |
|  | 0.22 | 1.31 |
|  | -15.44 | -11.44 |
|  | 0.40 | 0.65 |
|  | 3.85 | 3.12 |
|  | 1.84 | 0.62 |

From the test data we get above, we can see that the standard deviations of X and Y for the one with correction are larger than that for the one without correction. While the standard deviation of error for the one with correction is smaller. Because with the correction the odometry readings will be closer to the actual traveled distance which varies at each trial. However, for the one without correction, the odometer reading will always tend to be around (-15,-15) due to our design. Thus, the one with correction will have a larger scattering and thus a bigger standard deviation. While for errors, as the X and Y after correction will be closer to and the errors calculated from these values will be more precise and will have a smaller standard deviation. So, the correction program can provide us a more accurate travelling distance.

Due to the logic of our design, we added one square length to the axis of corresponding travelling direction and adjust the odometer’s reading accordingly. Because the final edge is along X-axis, so our reading for X will be closer to the actual traveling distance. Thus, for the calculating the errors, we shall get a smaller value for the X-axis.

Observations and Conclusions:

According to the data we observed from odometer with no correction the error for now is quite large, though sometimes we could get a small error but the standard deviation for it is around 3 times of that of the one with correction which means we tends to get a random result. And for it to run a longer distance the error will only get bigger and will have a larger scattering. So, for it to run 5 times of the 3-by-3 grid’s distance with no correction will be intolerable.

The odometer’s error shall grow linearly with respect to the distance. Because as our measurement of the wheel radius and track length can not be the same as the real value, the more distance it travels and the more turning it does will all accumulate the error. So the error will increase with the increasing of the total distance.