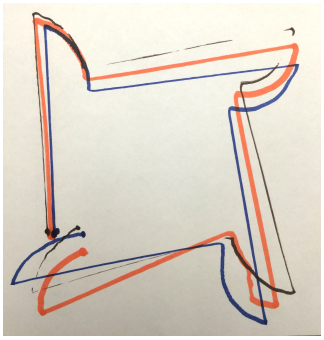
CMPUT 412
Assignment 1
January 25, 2015
Simon Fessehaye
Jonathon Machinski

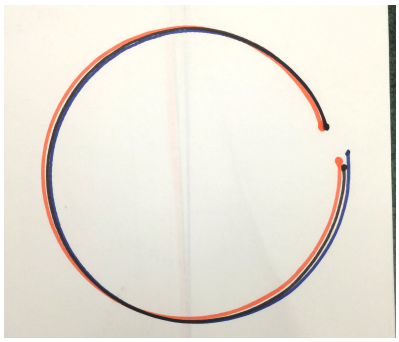
2. k) Drawn Shapes:
The shapes drawn by our robot were largely consistent within a window of error. The issues with drawing a shape on a piece of paper are that the tires can move the paper, it is difficult to hold the pencil consistently with pressure over trials, it is difficult to have the robot start consistently at the same point, and have the robot point in the same direction over trials. Also, to draw shapes correctly around corners, the pencil needs to be at the exact pivot point in between the two motors. Since our pencil's position is not exactly between the two motors, this is why our rectangle drawings have oddly shaped triangles on each of the corners. Battery life and wheel slip from motor torque were other factors that manipulated results between trials.

A marker was eventually substituted for a pencil, it was easier for the robot to grasp and apply the needed pressure to write on the paper. This made the drawings easier to view. In the drawings, orange is the first trial, brown is the second, and blue is the third.

Square



Circle



Line

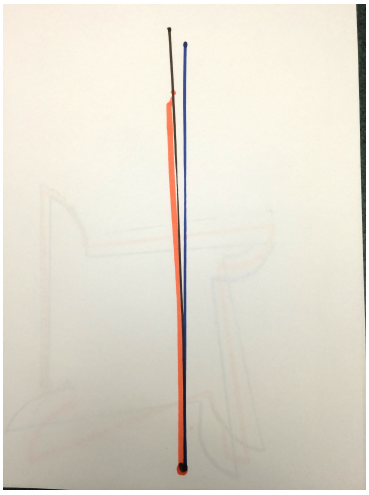
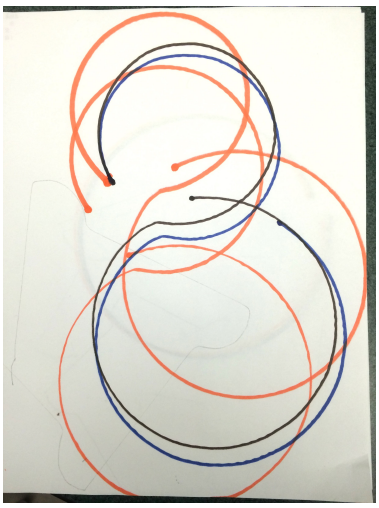


Figure Eight



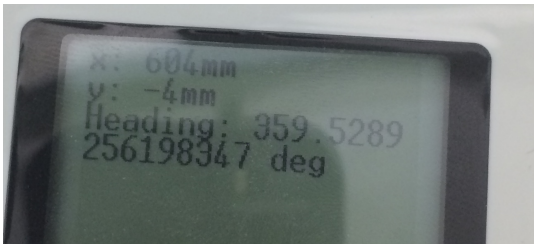
It can be seen in front the trials above, especially in Square and Figure Eight that any initial alignment error compounds the error in motion. In the Square trials, it can also be seen that any variance in the motor movements taking the corners from 90 degrees, compounds the error after every corner (Eg. 91+ 94 + 89 + 93 = 367 degrees). For all aforementioned reasons, it can be concluded that only relying on the motor tachometers for movement accuracy is quickly inadequate over a small period of time.

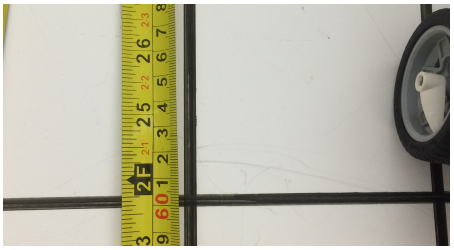
3. Reckoning_Position used the motor tachometers to calculate the change in distance each wheel experienced over a 10ms time period. Once this was known, the change in heading of the robot could be determined from this difference, then the change in x position was calculated and the change in y position was calculated. The robot would always start at (0,0) along the x-axis (so initial forward movement results in positive x). For rotation, it was calculated positively from the x-axis in a counter-clockwise fashion.

4. For straight line motion, we used numbers calculated from the motor tachometers in Reckoning_Position, compared to physical measurements from a fixed starting location. For rotation, Reckon_Position was again used and compared against an average of the left and right wheel alignment per trial using a protractor. Rotation and Straight Line used their own respective test input for Reckoning_Position over 3 Trials. Here is what we found:

Straight Line:

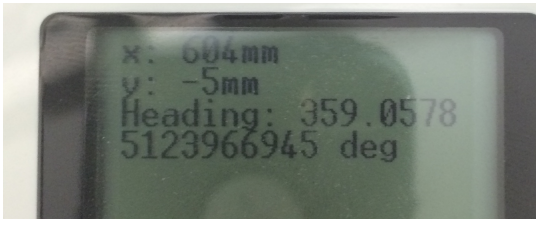
Trial 1

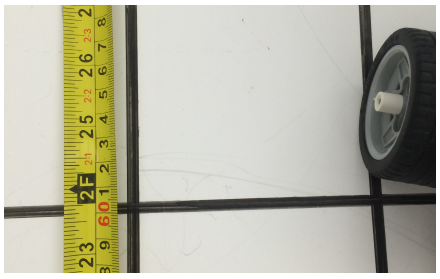




Distance: ~620mm
Difference 16mm

Trial 2





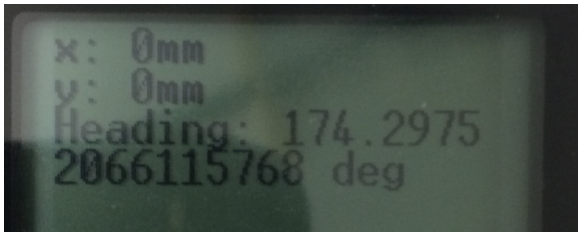
Distance: ~620mm
Difference 16mm

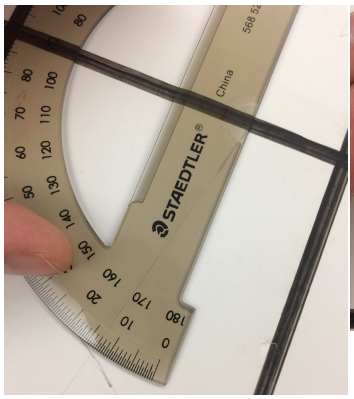
Trial 3

Distance: ~620mm
Difference 20mm

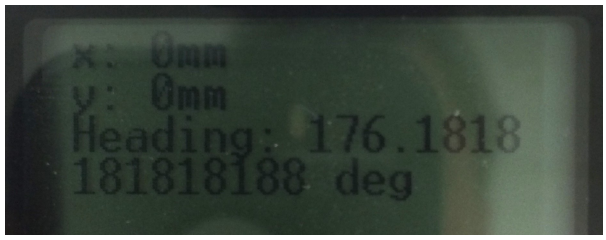
Rotation:

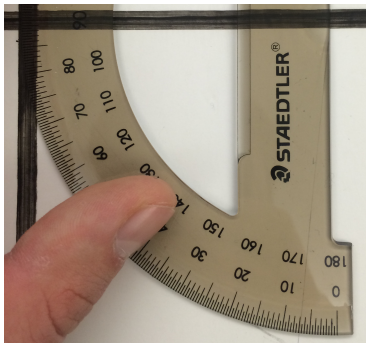
Trial 1

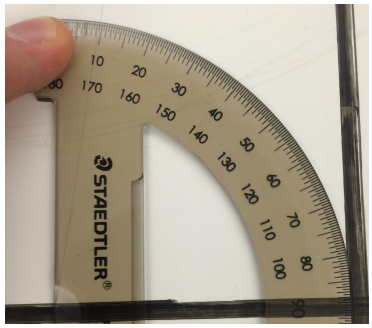




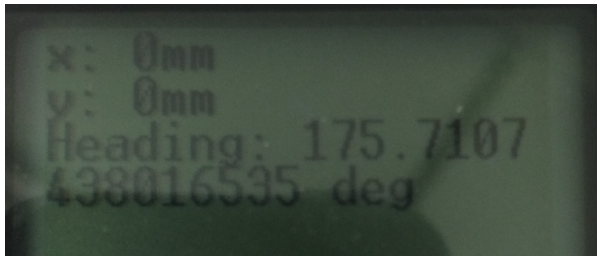
Trial 2

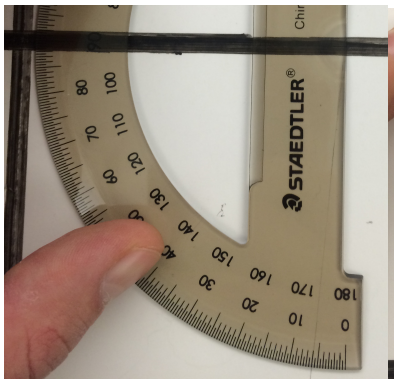






Trial 3





Trial	Left (Degrees)	Right (Degrees)	Average (Degrees)	Difference To Reck. (Degrees)
1	167	171	169	5.3
2	173	171	172	4.2
3	177	174	175.5	0.2

There were many possible source of error using the protractor and measuring tape. Angle lines with tires, protractor position on thick black line, measuring tape position on thick black line. Also, the robot could still fall victim to the issues discussed above in 2. k) (especially torque causing wheel spin). On these basic trials of straight line motion, the amount of error is not huge, but this was after dialling in wheel diameter to reduce error. These trials shows that the using the tachometer sensors for keeping track on motion is reasonable for an estimate, but cannot be relied on for precision. The same can be said for rotation the comparison of the heading found by the robot to the physical measurements show roughly the same heading within 6 degrees, but the error will on compound over time so the sensor measurements can only be used for a general estimation of heading, not a precision heading.