

Lab 2 Report

[Task 1 – Rectangle] Task one is to design a controller that will drive our e-puck robot in a rectangle at user given distances and a constant speed. Being able to use the IMU helped a lot in stopping my robot during a spin or turn. The rectangle simply takes four 90 degree turns and drives a specific length between them.


[Task 2 – Circles] Task two is to design a controller that will drive our e-puck robot in two clockwise circles without stopping using two user given radiuses and a constant speed. The infinity shape with two clockwise circles seemed to be done easiest by having the first circle move my bot in reverse with a faster right motor and after stopping, driving the second circle forward with a faster left motor. I'm glad I decided to do it this was because it went much faster.

[Task 3 – Waypoints] Task three is to design a controller that will drive our e-puck robot in an oval "running track" shape using a user specified radius for the curves on either side and a distance for the drive between, as well as a constant speed. With this task I finally learned how to read the IMU in a 0-360 range and was forced to backtrack to the other labs and make everything a bit more accurate and much less clunky.

I cleared up my confusion with unit conversions with a TA. In lab one the reason my circles weren't completing fully was because I wasn't considering the wheel's radius. Dividing by a factor of .8 completes my circles correctly. Working with the IMU was a great chance to try a different method of completing circles. It was tricky going from radians to degrees because the IMU reads from a scale of $[-\frac{\pi}{2}, \frac{\pi}{2}]$ and the requested range for degrees is $[0, 360]$; this problem was solved using the modulo operator % 360. I'm comfortable with Python but I was not able to spend sufficient time on this lab due to having other projects in different classes that require learning languages ive never used before (JavaScript, Node.js, VHDL). I will try to dedicate more time to the next lab.

Calculations

Clockwise



$V = \frac{D}{t}$ $\omega = \frac{x}{R}$

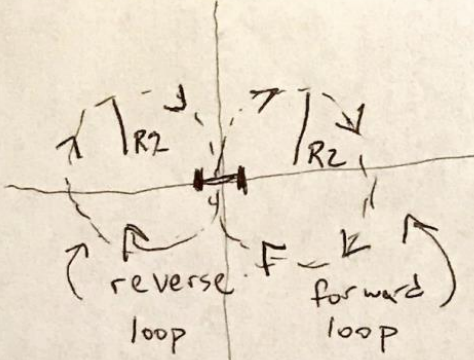
$V_L = \omega(R + \frac{d}{2})$
 $V_R = \omega(R - \frac{d}{2})$

$C = 2\pi r$
 $S = r\theta$

$V = (\text{wheel radius})\omega$

YAW

0 = North ≈ 0
 $\frac{\pi}{2}$ = West ≈ 1.570796327
 $\pm\pi$ = South $\approx \pm 3.141592654$
 $-\frac{\pi}{2}$ = East ≈ -1.570796327



Reverse & Clockwise R1:

left Motor = $-X_L$
right Motor = $-X_R$
Right Motor must have faster speed $\omega(R + \frac{d}{2})$

Forward & Clockwise R2:

Left motor must have faster speed

IMU: $[0, -0.3, -0.6, -\frac{\pi}{2}, -2, -\pi, \dots]$
START \rightarrow

time = $\frac{\text{distance}}{\text{speed}}$

endTime = time, maxTime - Start

