Homework 5 – Gripper Control and Sonar Setup

Submitted in partial fulfillment of the requirements for the course of

ENPM809T – Autonomous Robotics

By

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INTRODUCTION

The aim of this project is to use complete the mechanical and electrical assembly of the gripper and setup the sonar sensor. Then, a script is written to control the gripper as per the duty cycle of the servo motor and implement movement of the robot with the sonar sensor measuring the distance of objects in front of it.

APPROACH

We first assemble the gripper and sonar sensor as instructed. Then a python class is created to control the gripper and the sonar sensor, finally another script is written which manages the different classes – gripper, motor and camera.

CODE AND OUTPUT VIDEO

The entire repository containing the problem statement and the data can be viewed on https://github.com/adheeshc/raspi-gripper-and-sonar

The YouTube output video can also be viewed on YouTube

- Gripper movement and displaying servo duty cycle - https://youtu.be/KteEj5yTeQM
- We set up the robot to move with the gripper installed and the sonar sensor measuring the distance and displaying it - https://youtu.be/5O5-7ULUocs

OTHER RESULTS

Other questions are solved and answered below -

2) gear ratio → 1:120
wheel d = 65mm ⇒ r = $\frac{65}{2}$mm
encoder ticks = 8/motor rev.

a) circumference of wheel = $2\pi r = \pi d = 0.065\pi$ m

so one wheel rotation covers 0.065π metres, hence to cover 1m → you need $\frac{1}{0.065\pi}$ rotations

= 4.897 rotations.

since gear ratio is 1:~~200~~120

no. of motor revolutions = 4.897 × ~~200~~120

= 587.649 revs for each motor ~~= 979.415 revs for each motor~~

b) since from prev q, we get ~~979.415~~ 587.649 rev. of motor for 1m, we know for 2m we get ~~1958.83 revs~~ 1175.298 rev

since we register 8 ticks/motor rev for each encoder

~~we get ticks = 1958.83 × 8 ticks = 15670.64 ticks~~ ~~4701.192 ticks~~

~~since we have 2 encoders, total ticks are~~

~~∴ 2 × 15670.64 = 31341.28 ticks~~

~~2 × 4701.192 =~~

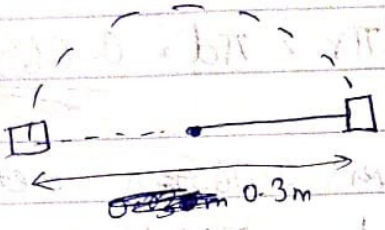
ticks = 1175.298×8 ticks = 9402.384

since 2 encoders, total ticks are ⇒ 2 × 9402.384 = 18804.768

3) gear ratio = 1 : 53

Wheel d = 14cm ⇒ r = 7cm = 0.07m

Width = 30cm (including wheels) = 0.3m



we can assume this similar to a single wheel turning about an axis

∴ the dist to be covered by the wheel is $\frac{\pi d}{2} = \pi r$

dist $= \pi \times 0.15 = 0.15\pi$ m

if the robot covers $2\pi r = 2 \times \pi \times 0.07$ m in each wheel revolution

it needs $\frac{0.15\pi}{2\pi \times 0.07}$ wheel revolutions $= \frac{0.15}{0.14} = 1.0714$

∴ no. of motor revs reqd $= 1.0714 \times 53 = \boxed{56.78 \approx 6}$