Group Project 2 - MEC830

(Group Work)

1. Purpose

The purpose of this project is to gain in-depth hands-on experience with microcontrollers.

2. Scope

You will work with sensors, actuators, and controlling a system with Arduino.

3. Documents

The following documents will help you through the Lab:

- Lecture notes
- ELEGOO programing examples

4. Procedure

Familiarize yourself with the ELEGOO Starter Kit.

- Try loading the examples from class and the kit.
- Use the serial monitor to help debug your program.

This is an open-ended project. The objective is to use the electronics provided with the ELEGOO kit to build a robot that is able to travel the path shown, p0 to p3. L = max(W, D), where W and D are the width and depth of the robot, e.g. if the size of your robot is (WDH) 4cm x 5cm x 6 cm, L is 5cm. The robot should navigate to waypoints p1, p2, and p3. If the robot gets anywhere inside the circles shown (radius = L cm), it is considered a successful navigation. The time that it takes to navigate from p0 to p3 is another metric for a successful navigation. You should demonstrate that you can

Task 1) manually control the robot to navigate from start to end (Figure 1) ,

Task 2) program the robot to autonomously navigate from p0 to p3. The use of sensors, actuators is left for you as a design problem. (Figure 1)

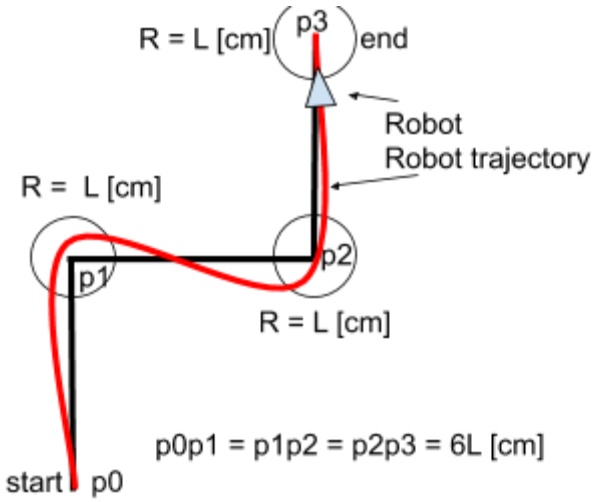

Figure 1

Task 3) navigate autonomously from A to B avoiding the obstacle. The position of the obstacle is not fixed, but during the navigation, it is stationary. Your performance is measured in terms navigation speed and also the distance from B when you get to the finish line (Figure 2)

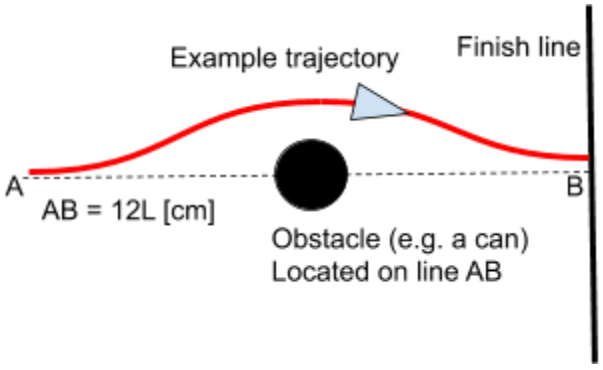

Figure 2

Your constraints are:

- **Design-** Electronic components: only the parts provided with the ELEGOO kit should be used.
- **Design-** Mechanical Components: use commonly available objects around you such as bottle caps, cardboard, etc.
- **Design-** Use the minimum number of actuators possible. You will get bonus marks, if you are able to use only one actuator to achieve the task.
- **Cost:** You are allowed to spend maximum 15$, if you need any particular mechanical part for your design. The university will not provide the cost. 0$ cost will get you a bonus mark.
- **Time-line:** The project should be delivered according to the deadline given in the course outline

Your work will be evaluated based on the following metrics:

1) Novelty of the design.
2) How accurately you can navigate (task 1-3)
3) How long it takes to finish the task(task 1-3)
4) Length of the trajectory and avoiding the obstacle (task 3)
5) Quality of the report.
6) Design steps, including all the concepts presented in the lectures, e.g. requirements, concurrency, safety, etc.
7) Evidence of effective communication between team members, including use of version control, documentation etc.

5. Report

Your lab report should include:

- Signed report cover page: http://www.ryerson.ca/mie/documents/
  (make sure you put your lab group number on the front)
- Abstract
- Introduction
- Experimental Equipment (ie. what was used); including diagrams, schematics, components, etc.
- Description of the Program with Flowchart.
- Conclusions & Recommendations
- Appendix: Program Listing
- Report file name convention:
- Report_[Section#]_[Student_ID]_ [Last_Name}_[First_Name]_Project2.pdf, e.g. Report_09_00099887766_Smith_John_Project1.pdf
- Your code also should be submitted in a zip file, if more than one file needs to be submitted. Otherwise submit the code unzipped.
- Code file name convention:
  Code_[Section#]_[Student_ID]_[Last_Name}_[First_Name]_Project2.pdf, e.g. Code_09_00099887766_Smith_John_Project1.[c, zip]

- The project's due date is on D2L and .
- Submit to D2L→ Assessment → Assignment → Project2
- Late submissions will be penalized at a rate of 10% per day, where weekends count as two days for online submission.
- Each group of max four people should submit one report. This is not an individual work.
- Lab attendance is mandatory. If you submit a report without attending the lab, you will get zero marks.