MOBILITY

Introduction

You will create a mobile base to circle three times around a wall in the middle of the playing field situated in the GMlab. There is a 12" gap between the wall and the obstacle. There will be two trials spaced one week apart. In one trial you will drive the robot via wifi and the internet. In the second trial the robot will run autonomously.

TRIAL RULES:

1. Complete 3 circuits around the obstacle in the middle of the 9.5' x 5' field. 2% of grade will be on performance (time to completion) during demonstration.
2. You will have two types of runs at different times about one week apart, one driven manually through wifi and another autonomous.
3. No intentional bumping or obstructing other drivers during a heat.
4. The vehicle must be smaller than 12" x 12" x 12".
5. You must use the Beston Battery as a power source.
6. You must use the ESP32 for wireless connectivity.

You should consider which motor choice will give you the best overall performance before making your choice. Given the lag time for internet control, you will likely get better performance if the vehicle doesn't move faster than a few inches per second. Breadboards on cars for circuits are allowed for the project, but soldering the circuit is **very highly recommended**. Soldering the circuit will make the car more robust, and your wires are less likely to fall out/disconnect during the race.

Any additional components not found in the ministore/RPL can be purchased independently or whatever you may have previously acquired. We will have races in heats (each student assigned to one TA/Coach will be in one heat).

4.1 Fabrication and Motor Driving

Driving Motors

4.1.1 Setup the H-Bridge motor driver SN754420 (or optionally the FAN8100) as in Slide 51 of Lecture 14 so that you can drive one of the supplied yellow motors powered from the Beston battery. Use a NAND chip 74HC00 in your kit to make an inverter (see Lecture 04). Use this inverter so you need only one I/O line to set the direction of the motor (the I/O line drives 1A and the input to the inverter, so the output of the inverter drives 2A). Set up the OscilloSorta to drive the enable pin with PWM and control the direction of the motor by switching voltages manually (or optionally connect a switch and pullup resistor.)
Demonstrate the motor changing speeds with varying PWM and different directions with different speeds. Show a TA for check off. Or if you prefer, you may submit a

video, but in the video show your face before demonstrating. Submit a photo of your circuit where the lines and motor are visible.

Car architecture

4.1.2 Research different types of mobile bases - holonomic drives, differential drives, tank-steering drives. (If you choose to use different motors, be careful about the power capability of the battery and the limits of the motor drivers.) Discuss with your TA/coach about your design. Have a completed draft CAD assembly of your car ready to be reviewed by teaching staff in lecture on Monday 3/15. Be ready to create and submit .dwg files if your TA/coach approves your design. Drafts should be near complete so the TA's can judge how they assemble. Be sure to follow the laser-cutting guidelines (reproduced below for your convenience). **Submit drafts to canvas.**

MEAM 510 FABRICATION PARTS SUBMISSION GUIDELINES

- Parts to be laser cut must be converted into .DWGs with the proper coloring and formatting.
  https://meamlabs.seas.upenn.edu/rapid-prototyping-lab/lasers/usage-guide/
- All of your parts being cut out of the same material **must be consolidated into ONE DWG** file. Be sure to copy parts you want to cut multiples of (for example, if you want to cut two identical circles, the dwg would include 2 circles on it).
- Submit one DWG per each type of material you would like to be cut.
- All DWGs must be dimensioned in **INCHES**
- Etch your name or initials on all laser cut parts. DO NOT RASTER YOUR NAME. Do not put your name on 3D printed parts
- Save parts to be 3D printed as STLs, do not submit the Solidworks file for it.
- Download the Parts Spreadsheet and fill it out to be submitted with your DWGs and STLs to be printed
- Only include the DWGs we will be using to cut the parts and the STLs needed to print the parts in your canvas submission along with the Parts Spreadsheet. DO NOT INCLUDE SOLIDWORKS PARTS FILES, ASSEMBLIES, OR ANYTHING ELSE

DWG File Name Format:
LASTNAME_FIRSTNAME_partname-MATERIALCODE (see table below)

Material Codes:

Material	Material Code
1/8” MDF	.125MDF
¼” MDF	.25MDF
1/8” Clear Acrylic	.125CA
1/8” Yellow Acrylic	.125YA
1/8” Red Acrylic	.125RA
1/8” Blue Acrylic	.125BLA
1/8” Green Acrylic	.125GA
1/8” Black Acrylic	.125BKA
1/8” White Acrylic	.125WA
1/8” Smoke Acrylic	.125SA
¼” Clear Acrylic	.25CA
¼” Smoke Acrylic	.25SA
¼” Black Acrylic	.25BKA
¼” White Acrylic	.25WA

STL File Name Format:
LASTNAME_FIRSTNAME_partname-PRINTQTY