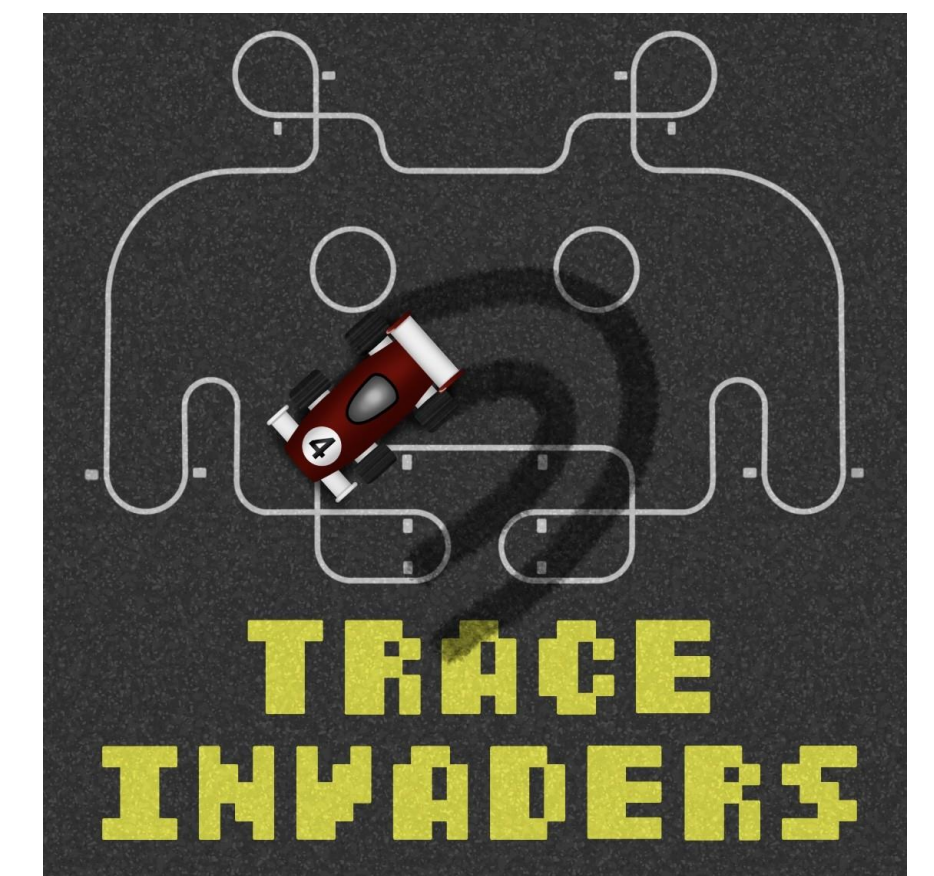


E1.04 – Trace Invaders

Allie Lange, Joel Osho, Owen Ziegler

Sponsors: Dr. Awoniyi and Mr. Stevens



Overview

Our product is an autonomous robot that will follow a line while navigating a course as fast as possible.

EE4390 D1 Requirements

- Traverse the course in less than 5 minutes.
- Demonstrate line detection capable of completing the course without losing the line.
- Full power budget and initial current measurements.
- Schematics and PCB design completed.
- BOM Cost not to exceed \$125 + PC

COST AND BUDGET

Component	Quantity	Unit Cost	Subtotal
TCRT5000 IR Sensor	5	\$2.95	\$14.75
MPU6050 Gyroscope/Accelerometer	1	\$12.95	\$12.95
ESP-WROOM-32 Microcontroller	1	\$19.90	\$19.90
6V Metal Gear TT Motor	2	\$2.50	\$5.00
Motor Driver TB6612	1	\$6.95	\$6.95
I2C LCD1602 LCD Display	1	\$9.99	\$9.99
18650 Lithium Ion Battery (7.4V)	2	\$6.48	\$12.96
ACEIRMC 18650 battery clip 2 slots 7.4V	1	\$1.40	\$1.40
LM2596 DC to DC Buck Converter	1	\$1.59	\$1.59
Total Cost			\$85.49

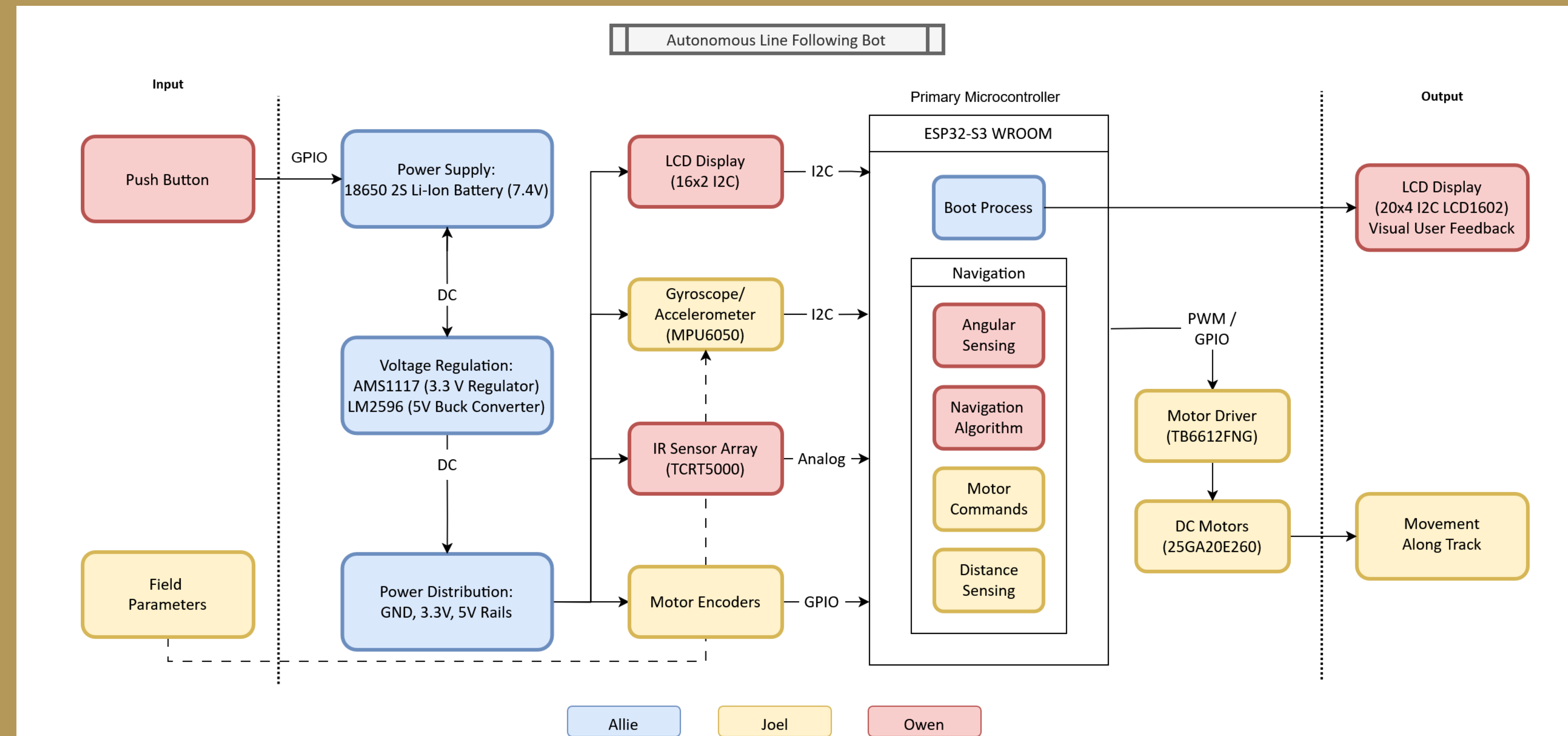
Theoretical Battery Life

Components	Current Draw
ESP-WROOM-32	250mA
2 X All Metal Gear Motors @7.4V	800mA
5 X TCRT5000 IR Sensors	125mA
MPU6050 Gyroscope	5mA
TB6612 Motor Driver	10mA
LM2596 Buck Converter	800mA
LCD Display	100mA
Total Current Draw	1.9A
TOTAL	1.8 Hours

$$\text{Battery Life (hrs)} = \frac{C_{\text{battery}}}{I_{\text{load}}}$$

- Battery capacity is 3500mAh with two 18650 batteries in series to achieve a total of 7.4V.
- Buck Converter is used to step down voltage to useable voltages for each component.
- Peukert's Constant- 1.1-1.6

Top Level Block Diagram



Meet The Team



Allie Lange

- Project Manager
- Power and Battery Life
- PCB Design



Joel Osho

- Motor Driver
- Movement Distance Sensing



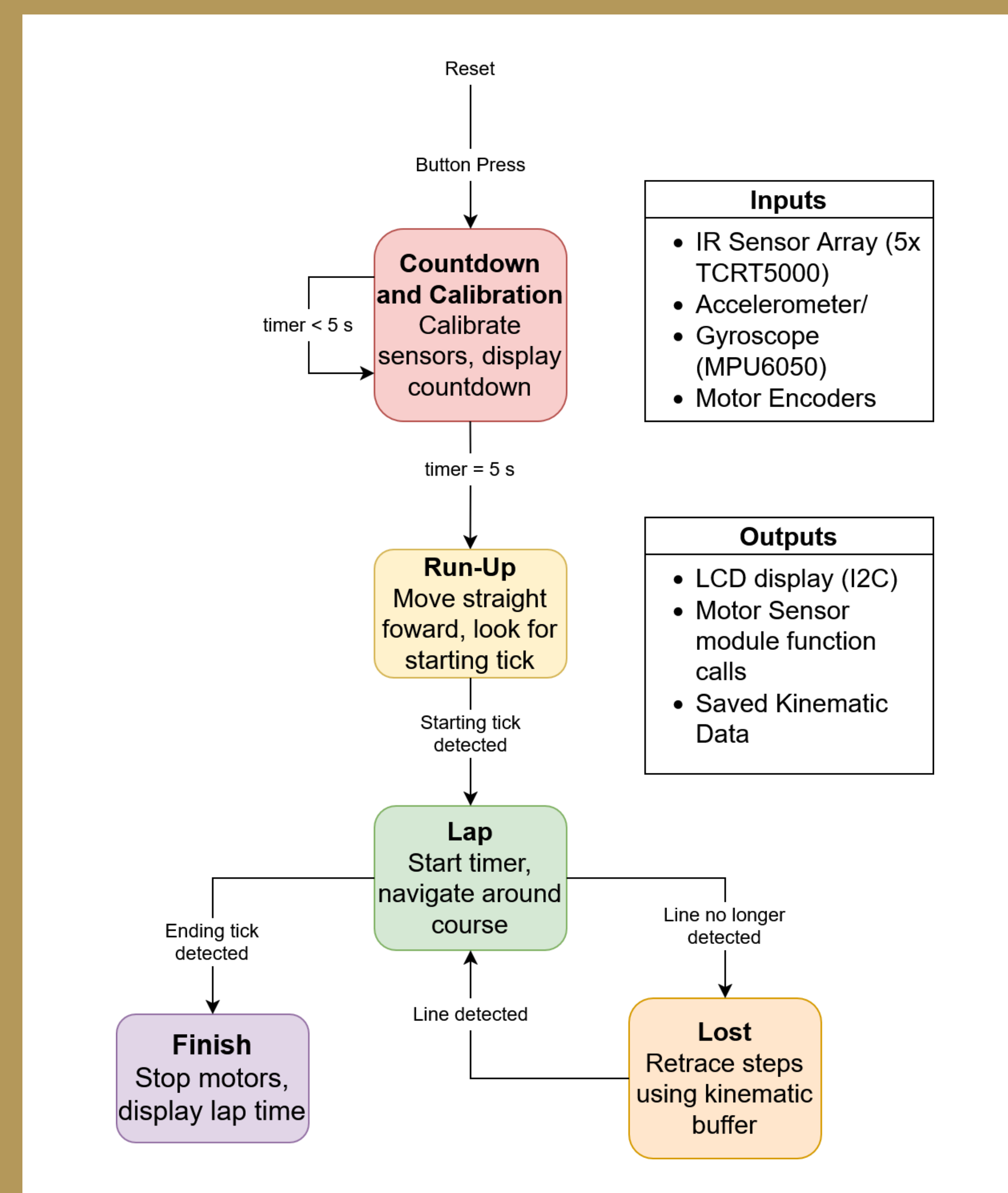
Owen Ziegler

- Line Sensing
- Navigation Algorithm
- LCD and Timing

D1 Achievements

- Sensors have been integrated and tested.
- Full preliminary navigation algorithm complete.
- Motors reach max speed.
- Design is under budget.
- Robot traverses' course within time allotment.

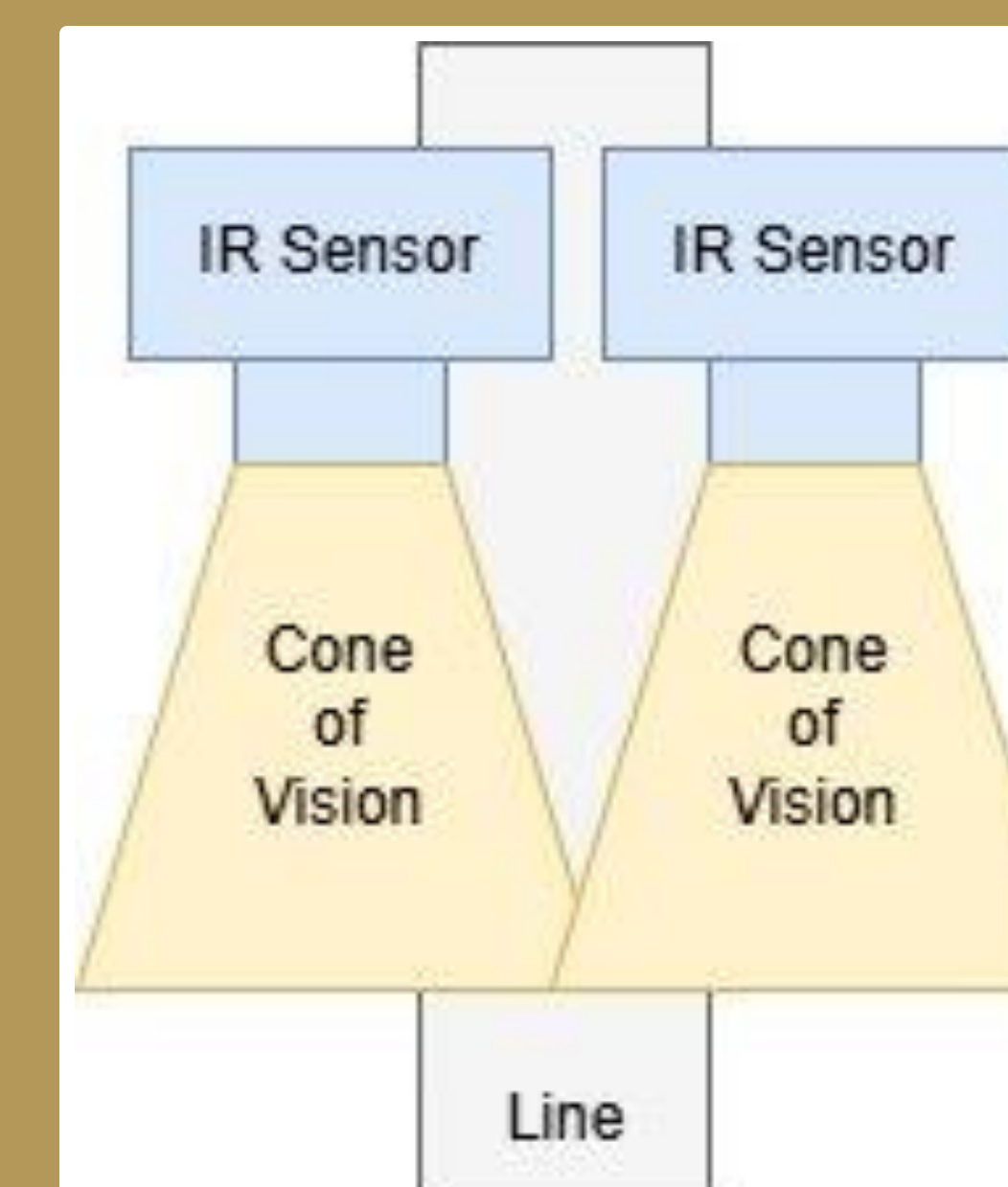
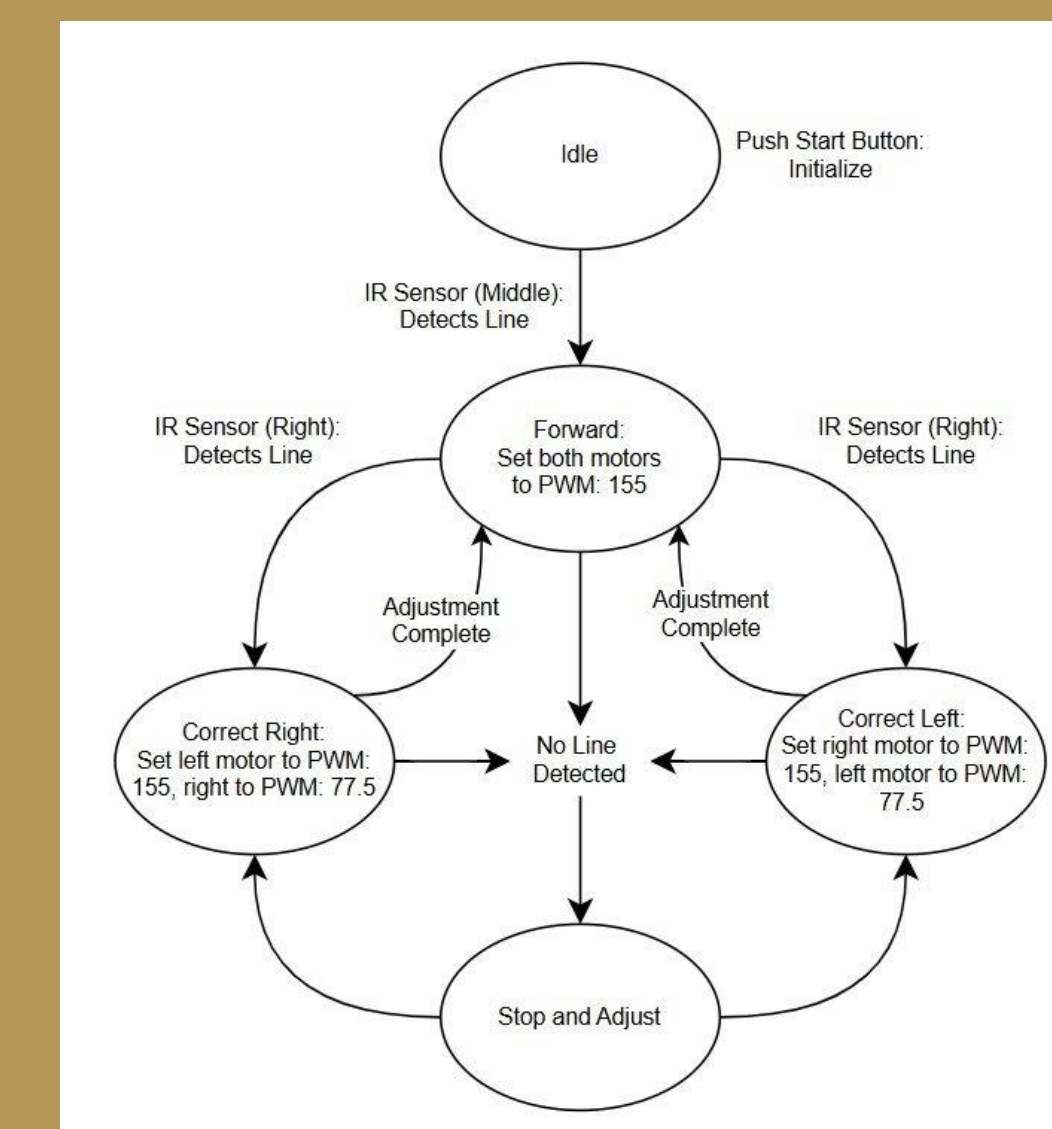
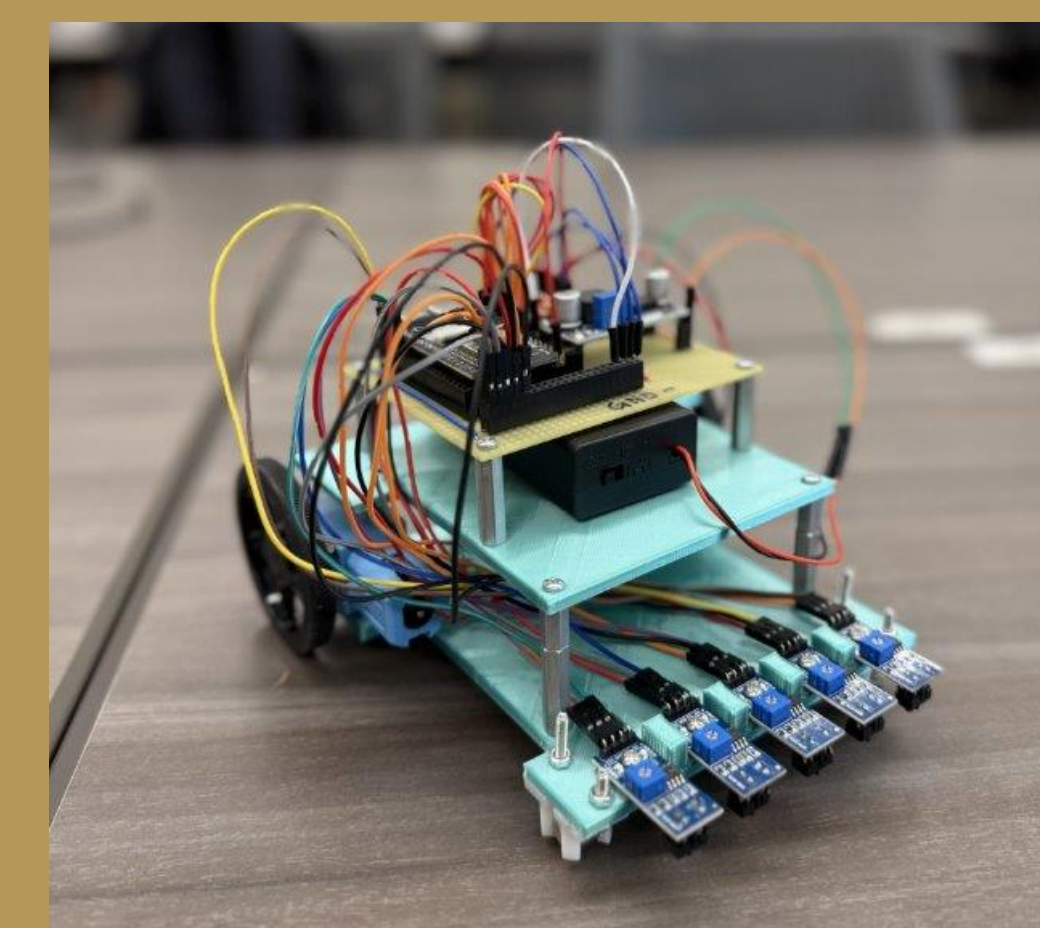
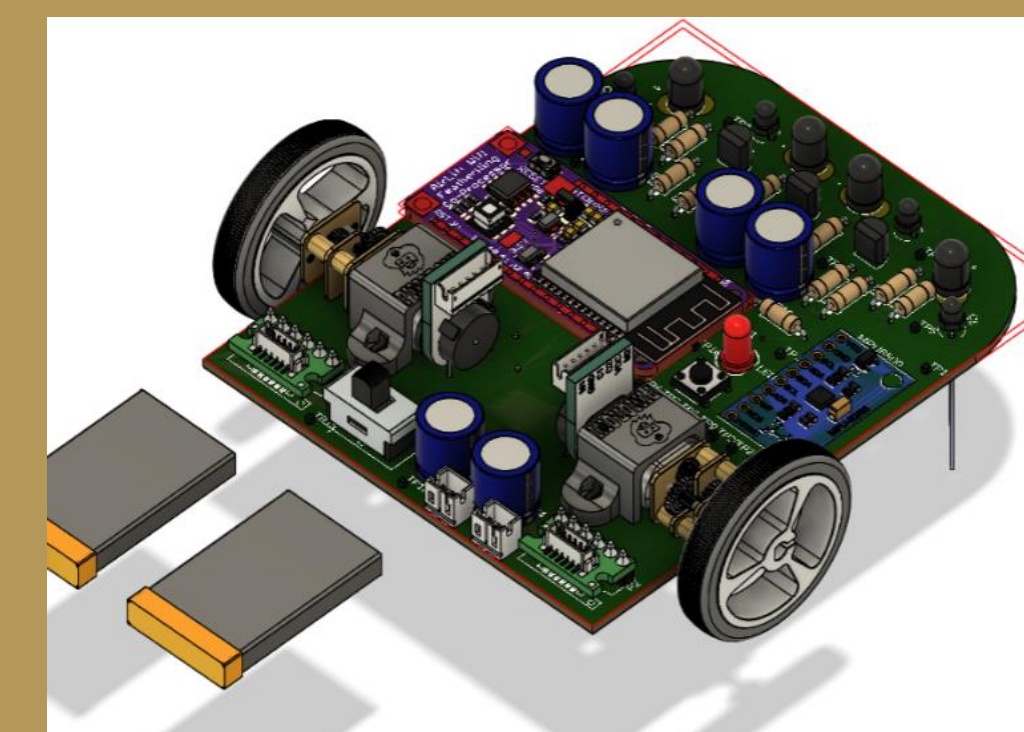
State Diagram



Design

Design Specifications:

- 3D Printed Chassis.
- IR Sensor Array.
- Two all metal gear motors.



D2 Plan

- A functional PCB based design will be implemented.
- Full testing methodology for all subsystems.
- Run the course in less than 2 minutes with a more sophisticated navigation algorithm.
- Upgrade motors for speed and agility.
- Maximize power and battery life.

Acknowledgements

Sponsor:
• Dr. Steve Awoniyi
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• Jeff Stevens

D2 Mentor Team:
• 2.08-Artist Robot
• 2.02-L³ Energy