

# E2.04 — Trace Invaders

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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 D2 Requirements

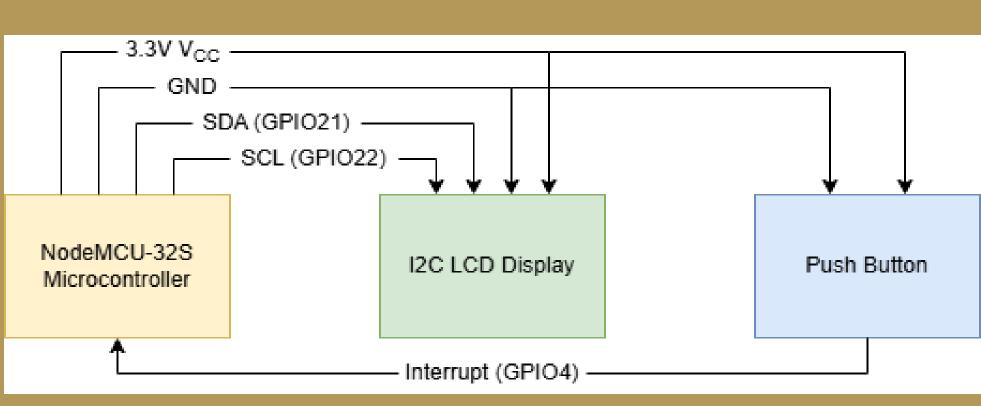
- Traverse the course in less than 2 minutes.
- Demonstrate line detection capable of completing the course without losing the line.
- Full power budget and initial current measurements.
- Schematics and PCB design completed and Integrated.
- BOM Cost not to exceed \$125 + PCB.

#### **COST AND BUDGET**

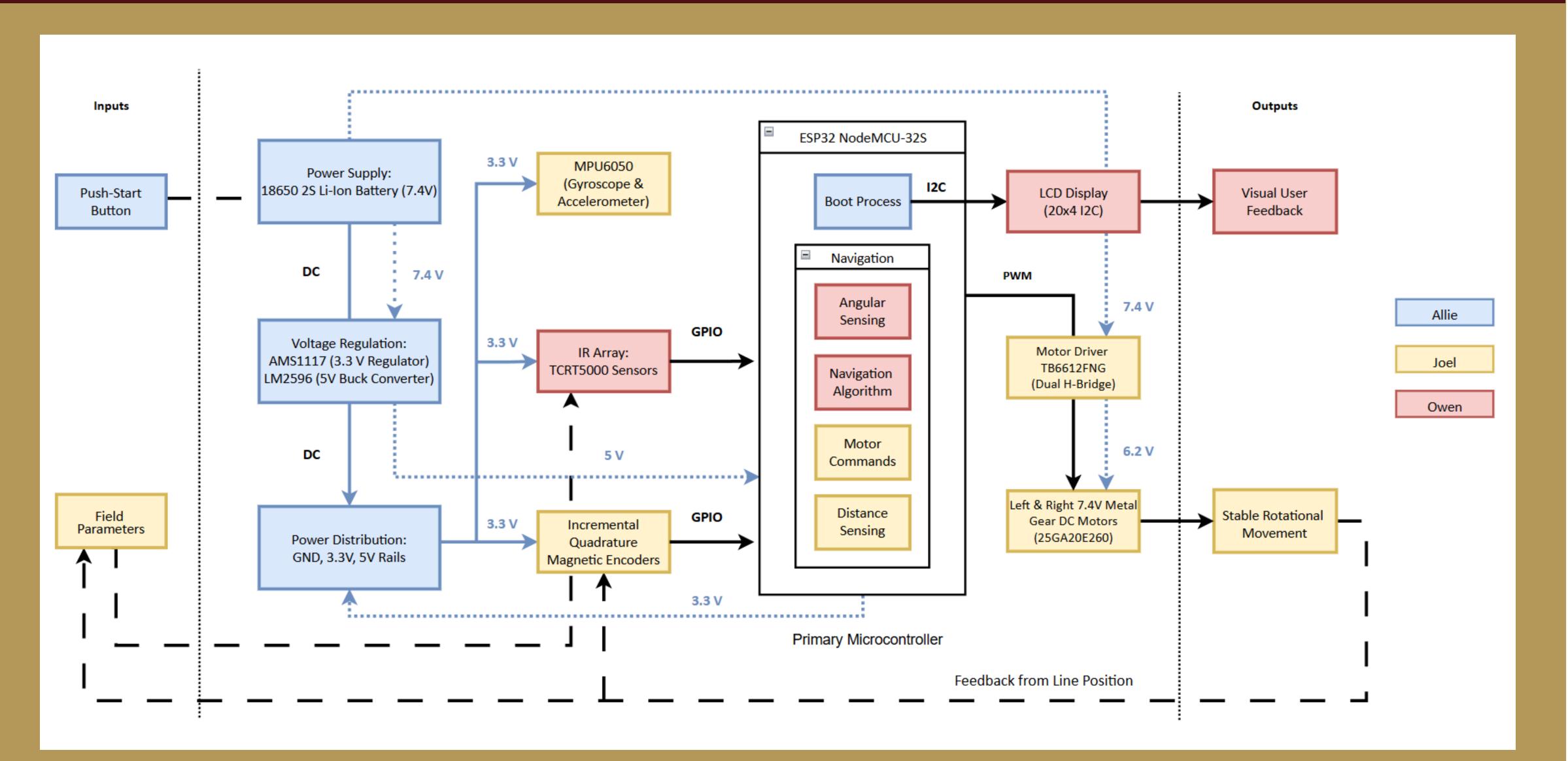
Component	Quantity	Price Each	Subtotal Cost
ITR20001/T IR Sensor	5	\$2.95	\$14.75
MPU6050 Gyroscope/Accelerometer	1	\$12.95	\$12.95
ESP-32s NodeMCU Micro-controller	1	\$4.99	\$4.99
Geared DC Motor with magnetic encoder outputs –7VDC 1:20 ratio	2	\$13.50	\$27.00
Motor Driver TB6612	1	\$6.95	\$6.95
I2C 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 Unit Cost	92.58\$

# Current Draw/UI

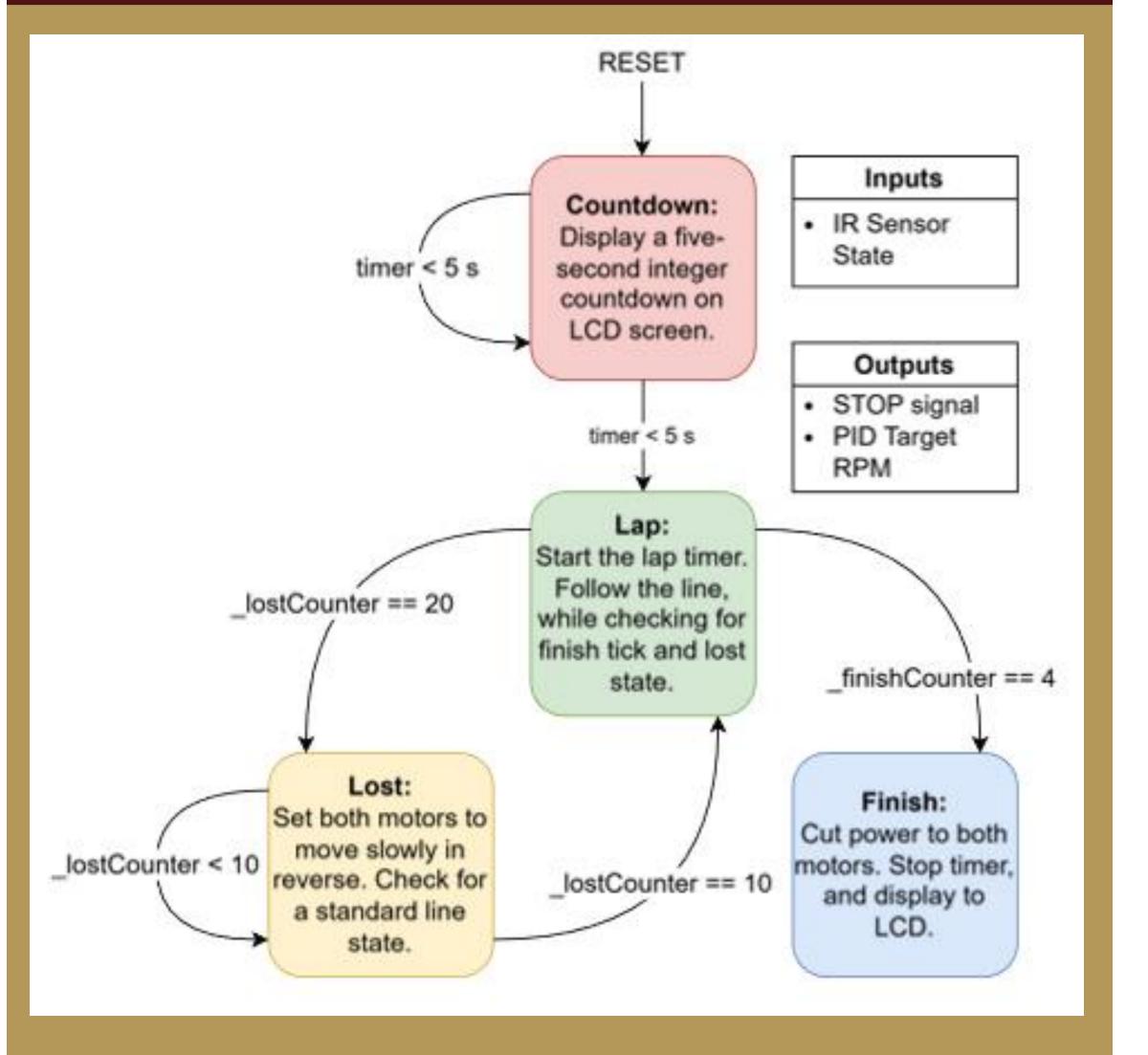
ESP-32s NodeMCU Micro- controller  Geared DC Motor with magnetic encoder outputs –7VDC 1:20 ratio		ESP-32s NodeMCU Micro- controller  Geared DC Motor with magnetic encoder outputs –7VDC 1:20 ratio	2.3mA 123mA
magnetic encoder		magnetic encoder	123mA
		outputs / VDC 1.20 latio	
TCRT5000 IR Sensor 15mA		TCRT5000 IR Sensor	13mA
MPU6050 Gyroscope 4mA		MPU6050 Gyroscope	0.00mA
LCD Display 1mA		LCD Display	0.39mA
Total Current Draw 420mA		Total Current Draw	313.69mA
TOTAL BATTERY LIFE 5.95 Ho	ours	TOTAL BATTERY LIFE	7.97 Hours



# Top Level Block Diagram

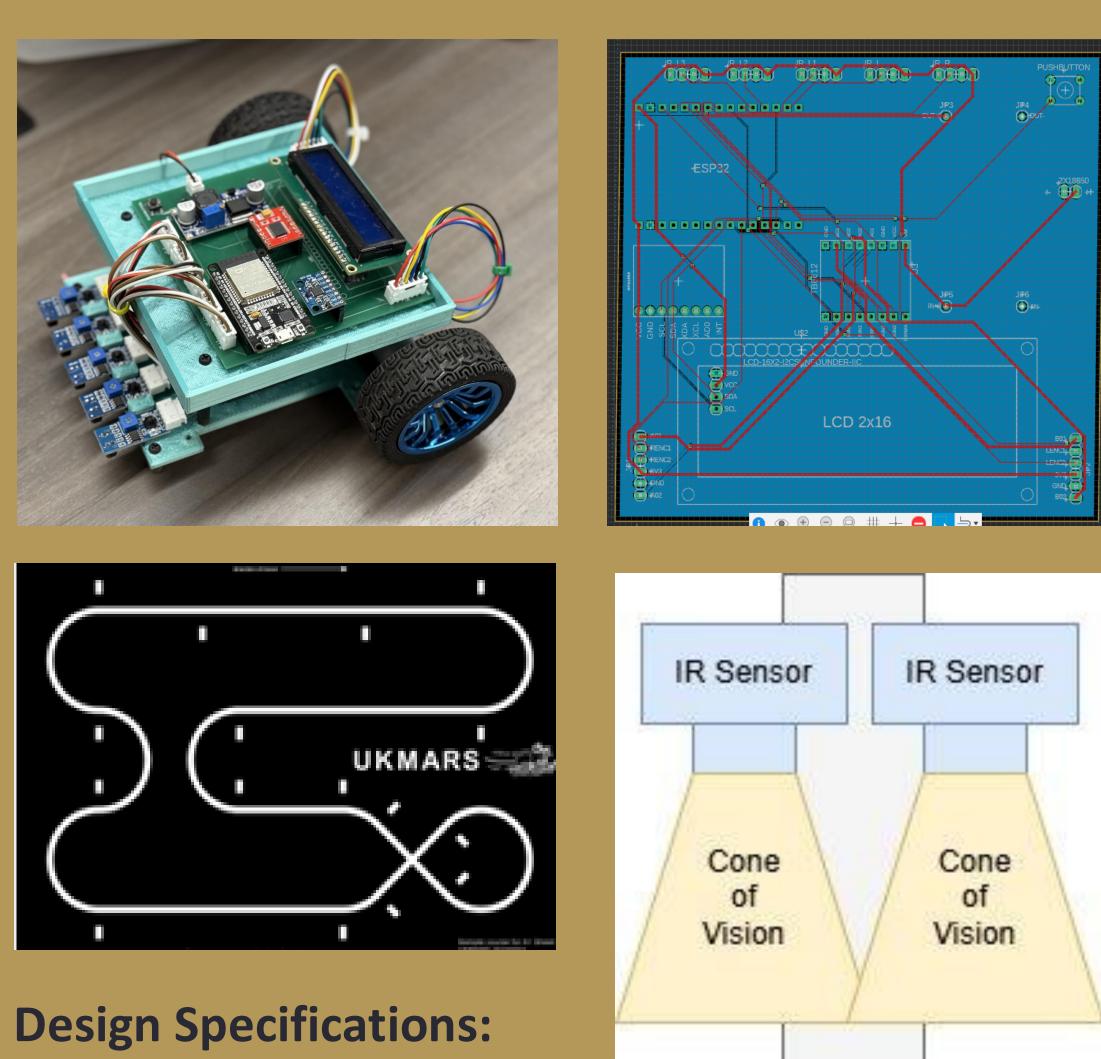


# Navigation State Diagram



 Using information from the Line Sensing subsystem to guide the robot around the track without straying from the line.

# Design



Line

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

## Meet The Team



## Allie Lange

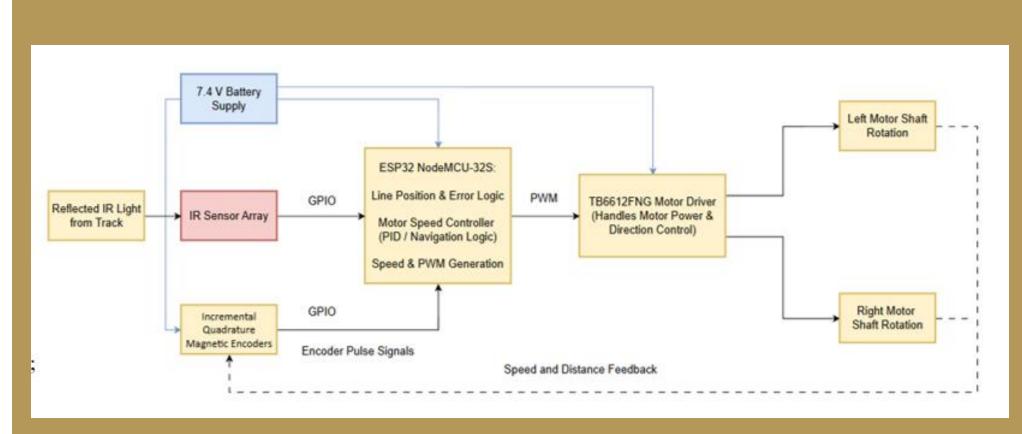
PCB Design

- Project Manager
   Motor Driver Power and
   Movement **Battery Life**
- Distance

Sensing

- Navigation
- Algorithm LCD and Timing

# Motor Design/Diagram



### D2 Achievements/Results

Requirement	Measured Results	Outcome
Traverse Course in less than 2 minutes.	Traverses course in under 40 seconds.	PASS
Functional PCB Design	Everything works and has been incorporated and tested on the PCB.	PASS
Be able to traverse a more complicated course in regards to D1.	Approved course by Professors. (closer lines, sharper turns, etc.)	PASS
Full power budget and initial current measurements.	Measurements have been taken and tested during the trials and testing phase.	PASS
Demonstrate line detection capable of completing the course without losing the line.	Line detections has been proved and tested during the trials and testing phase.	PASS

# Load Testing

Load vs. No Load	Specifications	Time	Battory Life (bre) - Chattery
With Load	100% battery, Targeting 490 rpm	1hr, 9 min, 34 sec	$ ext{Battery Life (hrs)} = rac{C  ext{Battery}}{I_{ ext{load}}}$
With No Load	99% battery, targeting 343	7hrs, 29 min, 33 sec	

# Acknowledgments

Sponsor: Dr. Steve Awoniyi Faculty Advisor: Jeff Stevens