E2.06 - Pathfinders

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Sponsor: Dr. Awoniyi

Overview

Our project develops an autonomous navigation system that uses real-time adaptive algorithms and sensors to track paths and adjust speed and direction for accurate, efficient movement.

Design 2 Requirements

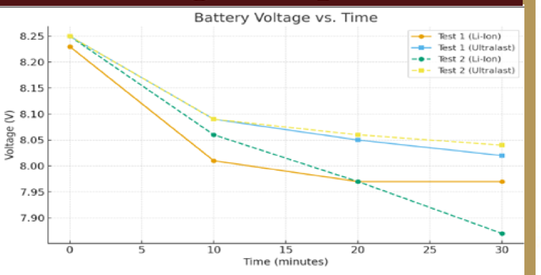
Requirements:

- 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.
- Fully autonomous

Budget

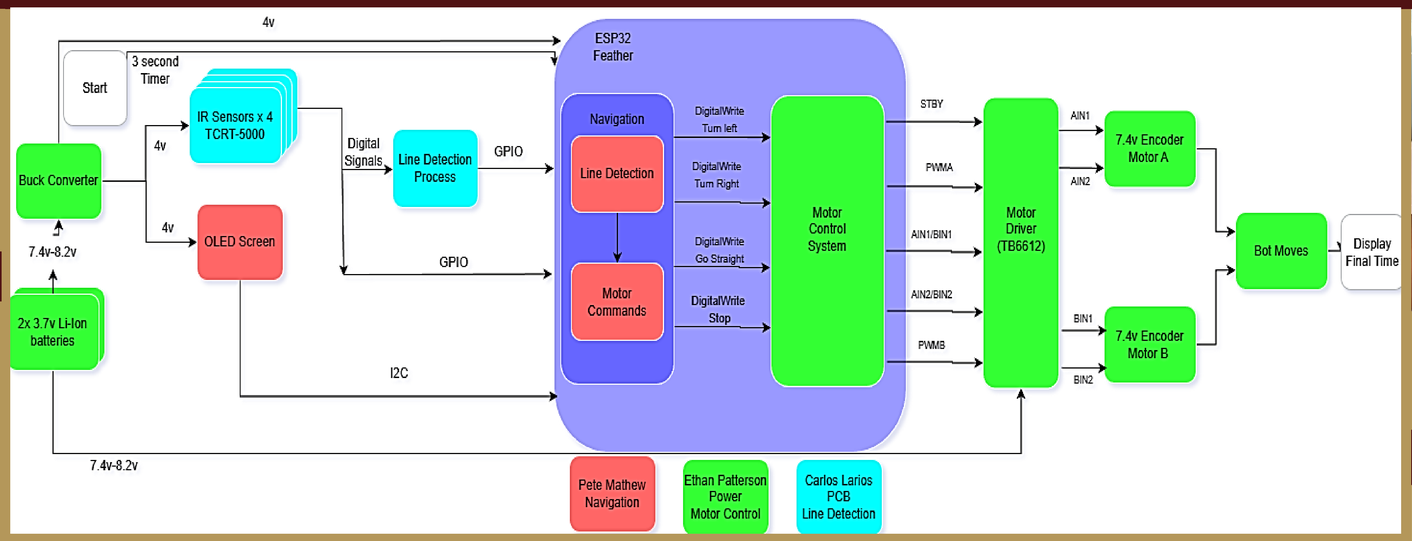
Component	Quantity	Price Each	Subtotal Cost
ESP-32-Feather	1	$8.99	$8.99
Button	1	$.56	$.56
PCB	1	$10.00	$0.00 (Not Included in Budget)
7.4V DC Motors	2	$11.99	$24.98
Wheels + Couplings	1pk	$10.99	$10.99
18650 3.7V Lithium-Ion Battery	2	$4.85	$9.70
Buck Converter	1	$2.49	$2.49
TCRT5000 IR Sensors	1pk = 5	$7.89	$7.98
Original Unit Cost Requirement: $125			$65.69

Voltage Drop Test



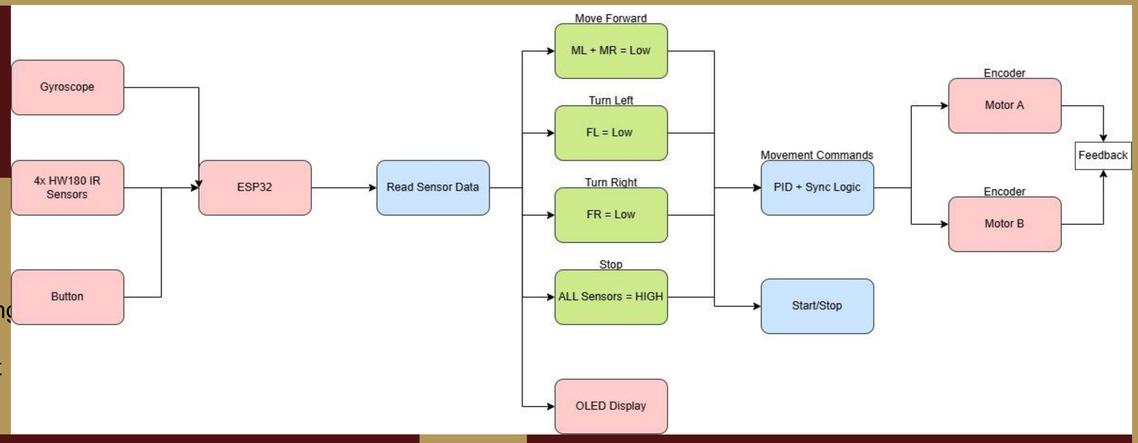
- Identified the battery with the most stable voltage to keep the robot at peak performance.
- Improved reliability by analyzing voltage sag to avoid brownouts and sensor or speed issues.

Top Level Diagram

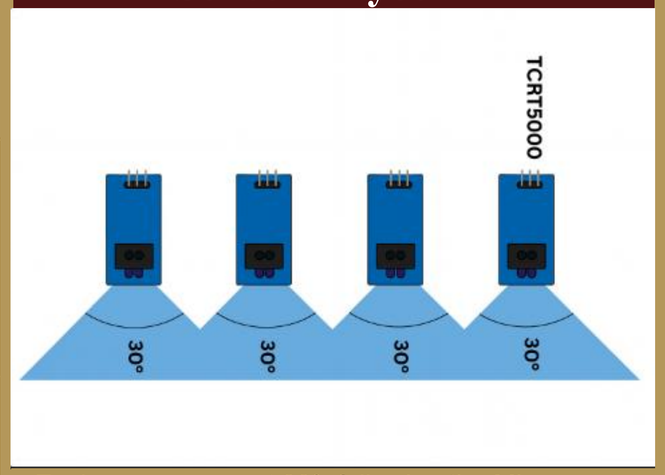


Line Detection Algorithm

- Reads sensor inputs
- Determines robot position
- Calculates steering corrections
- Sends movement commands to motors



Sensor Layout

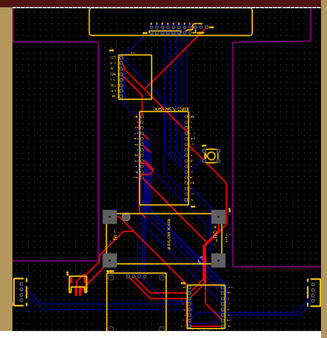


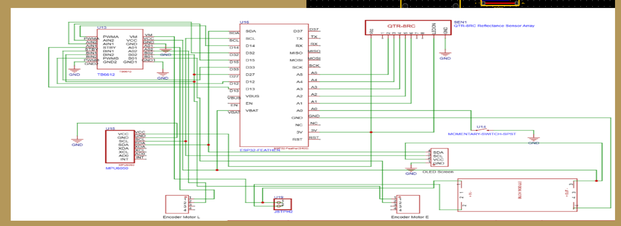
Each sensor sees at 30°, following the ML sensor, and with one sensor being used to stop

PCB Chassis

Design Specs

- PCB
- Internal wiring to minimize external wires
- Ability for components to be plug and play





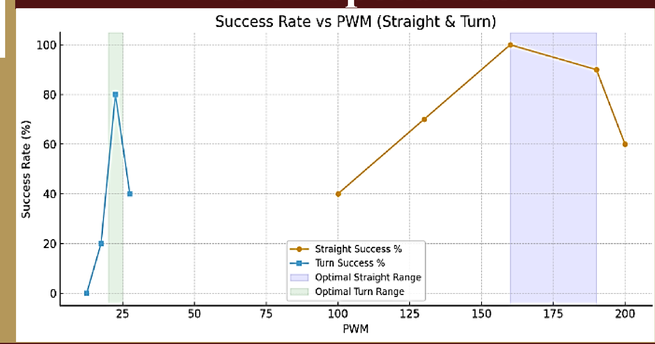
Meet The Team

Pete Mathew
- Navigation

Ethan Patterson
- Power
- Motor Control
- Hardware

Carlos Larios
- Line Detection
- PCB

Motor Speed Test



D2 Achievements

Requirements	Results	Pass/Fail
Traverse the course in less than 2 minutes.	14.59 seconds	Pass
BOM Cost not to exceed $125 + PCB.	$65.69	Pass
Demonstrate line detection capable of completing the course without losing the line.	Only falls off if going to fast	Pass
Fully autonomous	No human interaction	Pass
Schematics and PCB design completed and Integrated.	All PCB functions work	Pass

Acknowledgements

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- Dr. Awoniyi

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