TEXAS STATE
INGRAM SCHOOL OF ENGINEERING

E1.04 – Sumo ACE

Our product is an autonomous robot designed to compete in sumo and weighted tractor pull events.

Sumo ACE


Aric Easterling


Chris Jenkins


Esteban Padilla

Project Overview

Two algorithms will be deployed to the bot for their respective competitions.
In the sumo competition, the bot will traverse a 4ft Dohyo ring in search of an object an opponent to remove from the ring.
In the object pull field, the Robot will be attached to an object of 1-2kg to pull as far as possible.

Requirements

- **Operate autonomously**
- **Pull a 1-2kg object**
- **Find and push opponent**
- **BOM under $50**
- **Low-power shutoff**
- **Use provided wheels**
- **Bot must be under 24 by 17 cm**

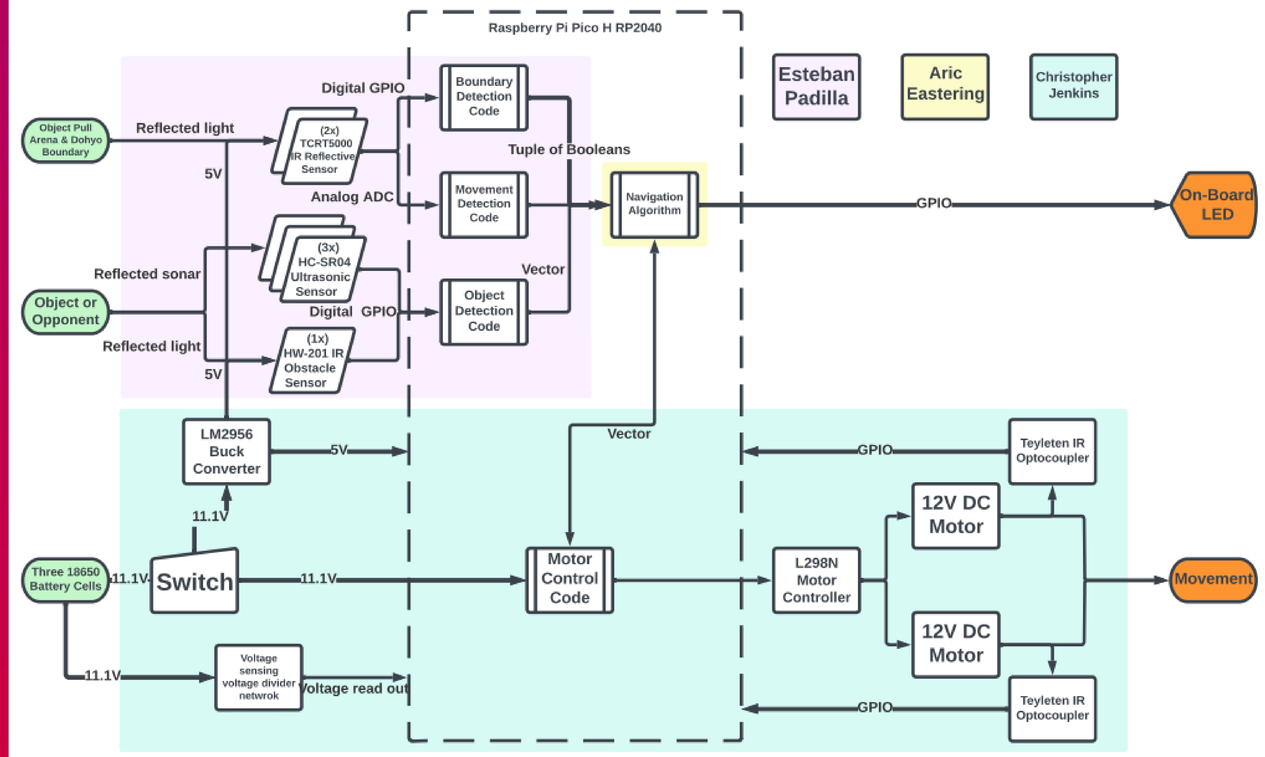
Power Budget

200RPM DC Motors (x2)	**1300mA**
Raspberry Pi Pico H RP2040	**91.6mA**
HC-SR04 Ultrasonic sensor (x3)	**45mA**
TCRT5000 IR reflective sensor (x2)	**120mA**
HW-201 IR obstacle sensor	**60mA**
Total Current:	**1826.6mA**
Expected Battery Lifetime	**1.75 hours**

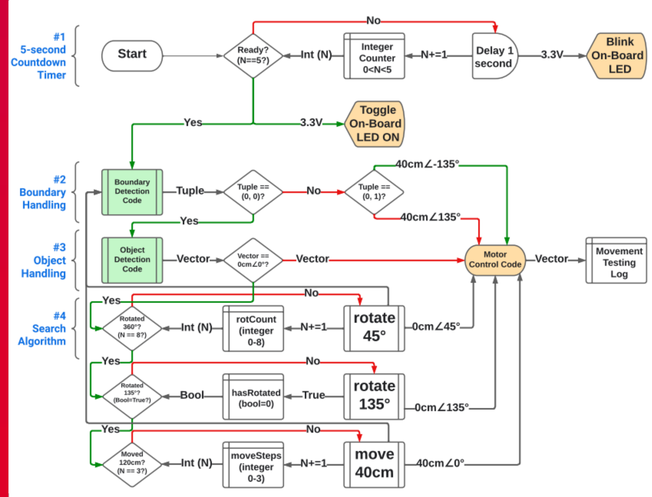
Budget

200RPM DC Motors(x2)	**$25.46**
18650 Batteries(x3)	**$9.30**
Raspberry Pi Pico H RP2040	**$4.00**
HC-SR04 Ultrasonic sensor (x2)	**$2.72**
Optocoupler Assembly	**$3.60**
LM2956 Motor Driver Board	**$1.66**
TCRT5000 IR reflective sensor (x2)	**$1.60**
Total:	**$49.38**

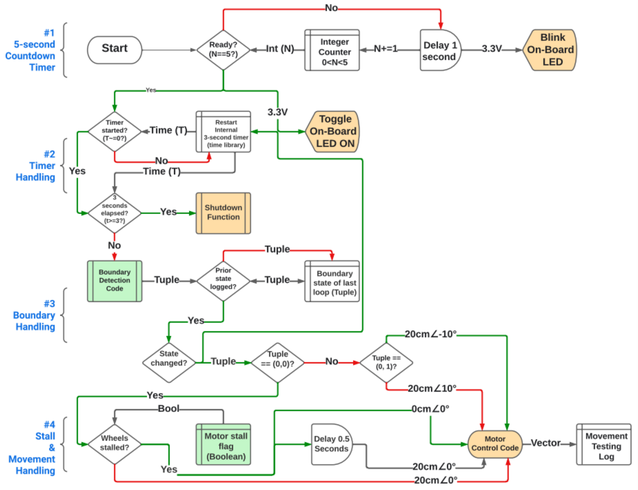
Hardware Block Diagram



Sumo Flowchart

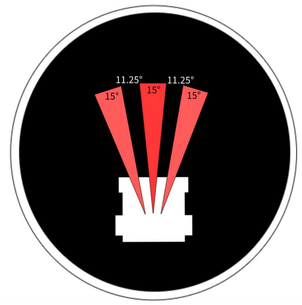


Object Pull Flowchart

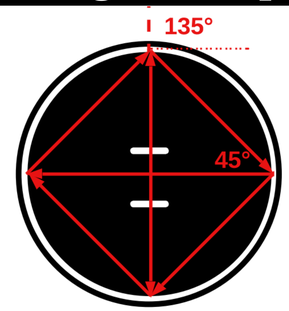


Robo-car object sensor FOV

Left	Right	Center	Vector
False	False	False	0cm ∠ 0°
False	False	True	N ∠ 0°
False	True	False	N ∠ 26.25°
False	True	True	N ∠ 13.125°
True	False	False	N ∠ -26.25°
True	False	True	N ∠ -13.125°
True	True	False	N ∠ 0°
True	True	True	N ∠ 0°



Dohyo ring search pattern



D2 Plans

Sumo/Pull selector switch
Standardize motor movement
Test different methods for increasing torque
Improving battery measuring design
Add buck converter for Motor
Movement Fabricate a scoop for bot fighting

Acknowledgements

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- **Fawzi Behmann**

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- **Jeffery Stevens**