TEXAS ★ STATE ®
INGRAM SCHOOL OF ENGINEERING

E2.10 - Sumo Bot Team D

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Project Description

Our project is an autonomous robo-car designed for sumo bot style competitions. The product is to traverse a playing ring in search of opponents, avoid the outside boundaries of the ring, and engage opponents once they are found.

Motivation

- Demand for autonomous vehicles is projected to increase
- Hands on experience for future technical positions

Requirements

- Max Dimensions of 17.0 x 24.0 cm
- Weight Less than 1200 g
- Battery Powered
- Must be able to Push an Object out of the ring
- Must be able to traverse a hallway in Ingram
- Must compete in sumo tournament
- Fully Autonomous
- Max Budget of $50

Approach

- Raspberry Pi Pico – Microcontroller selected based off base processing speed of 125 MHz
- L298N Motor Driver Board – interface motors with microcontroller and battery pack
- E18-D80NK IR sensors (x3) – Object detection
- QRE-1113 IR Sensors (x2) – Boundary awareness
- C Programming Language – Primary programming language selected
- 3-D printing – Components such as bumpers and mounts are 3-D printed to improve stability
- Laser Cutting – Cut out the final chassis design

Hardware Block Diagram

Software Flowcharts

Hallway Traversal Algorithm

Sumo Algorithm
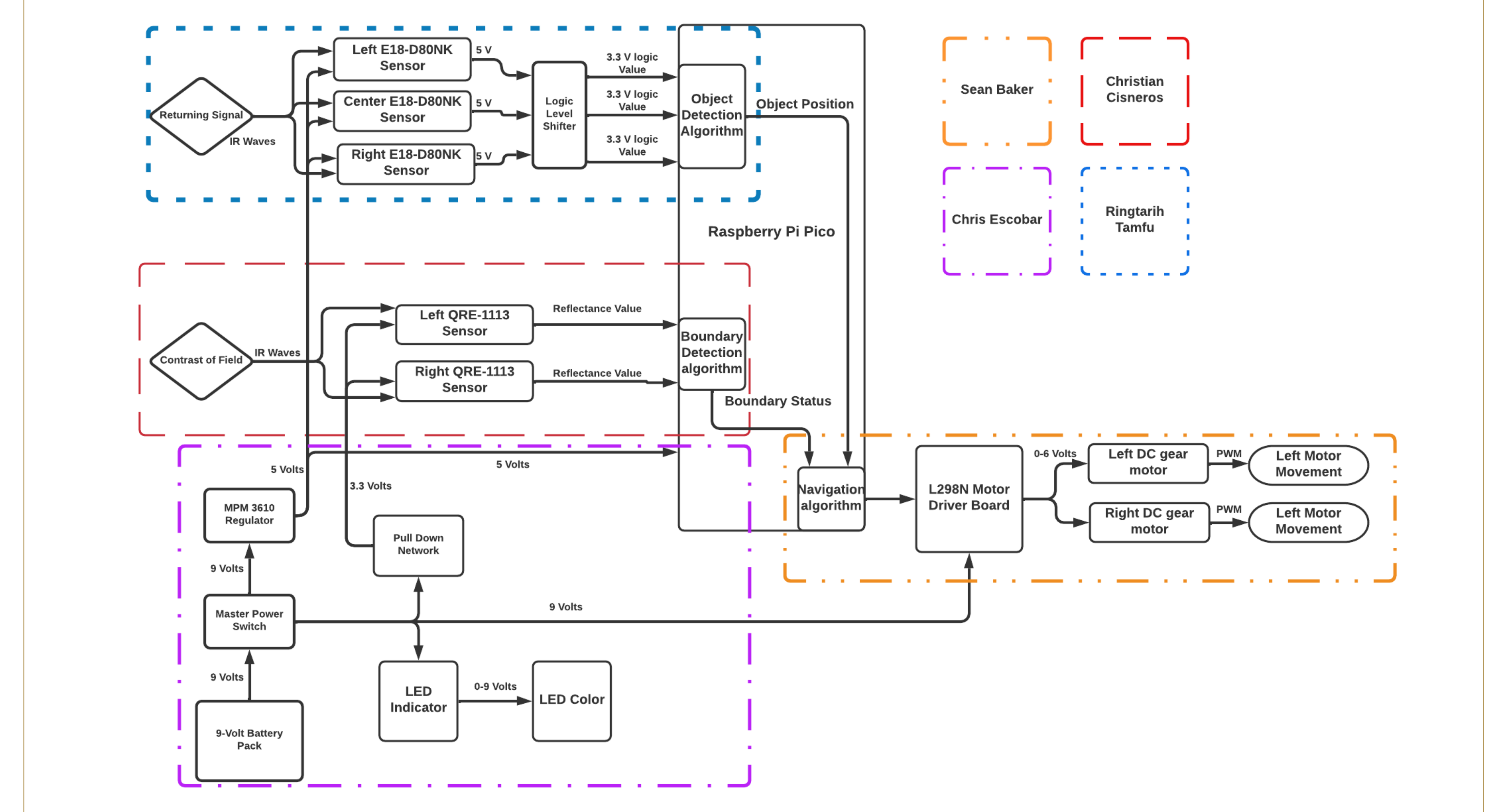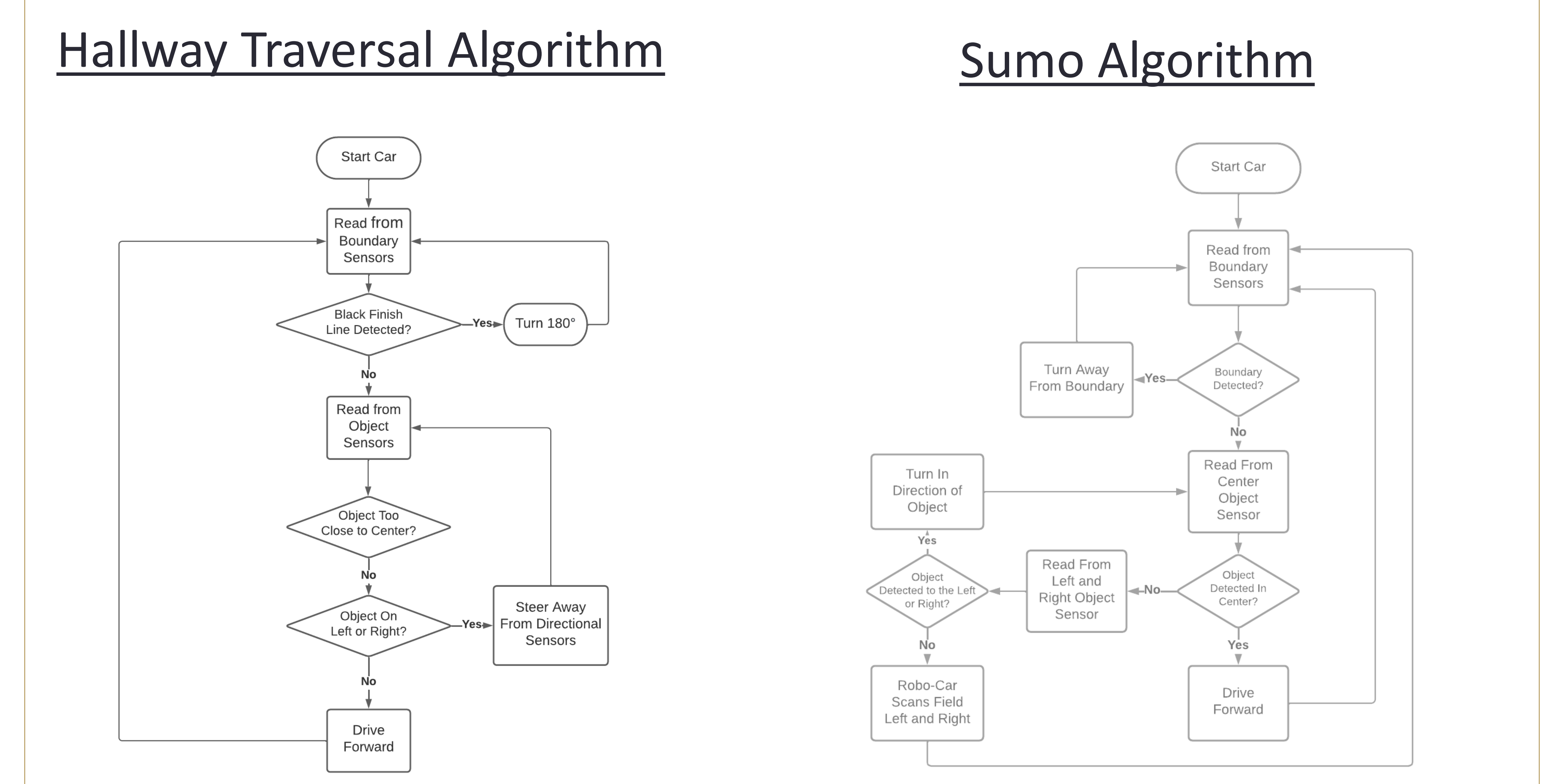
Power Calculations

Component	Operating Voltage (volts)	Current Draw (amps)	Power (watts)
QRE-1113 IR (x2)	3.27 V	.037 A	.121(x2) W
E18-D80NK IR (x3)	5.06 V	.029 A	.147(x3) W
Raspberry Pi Pico (x1)	5.05 V	.02 A	.101 W
DC motors active (x2)	5.17 V	.17 A	.879 W
DC motors stalled (x2)	2.45 V	.98 A	2.117 W
Power budget	N/A	N/A	2.538 W active 5.229 W stalled

- Under the Active operating conditions the car successfully ran for ~78 minutes.

Testing

Requirement	Measured Result	Outcome
Battery Powered	The Car was able to operate for 78 mins before being able to function as needed	Pass
Fully Autonomous	After the programmed 5 seconds delay the Robo-Car performs the pre-loaded algorithm	Pass
Detect a wooden block 70 cm away	The car was able to detect and contact a block in the ring 25 times with an average time of 3.27 seconds	Pass
Traverse the hallway	The car was able to traverse the hallway 25 times with an average time of 20.45 seconds	Pass
Compete in Sumo Tournament	Taking place on senior design day	TBD

Field of View

- E18-D80NK have a detection range of 3 cm to 80 cm
- Pointing angle of 15 degrees