TEXAS STATE®
INGRAM SCHOOL OF ENGINEERING

E2.03 - Robo REAPERS

Our autonomous push-pull robot has been built with the specific purpose of maneuvering a tractor sled and overpowering its opponent within the confines of a Dohyo playing field.

Robotics Enabled Autonomous Proactive Encounter Robot Seeker

Background

The significance of our project lies in designing a robot that enables students to enhance their skills in a swiftly evolving field, fostering an understanding of how these robotics influence safety and productivity in the workplace.

Competitions

First Event: Pull Competition

The robot will pull several weighted blocks down the pull field

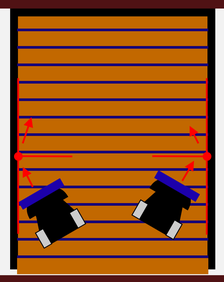
Second Event: Sumo Competition

The robot will compete with Group E2.04's robot on the sumo field.

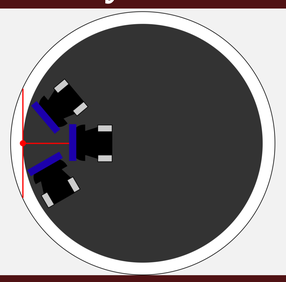
Requirements

Requirement	Product
Max Size: 17 cm X 24 cm	17 cm X 24 cm
Max Weight: 1200 g	1196 g
Budget: $50	$49.44
Low Power Shutoff	4.99 V
3 Second Movement Detection	94% Success Rate
Object Push/Pull Weight: 1000 g	Max at 1.2 kg

Pull Field



Dohyo Arena



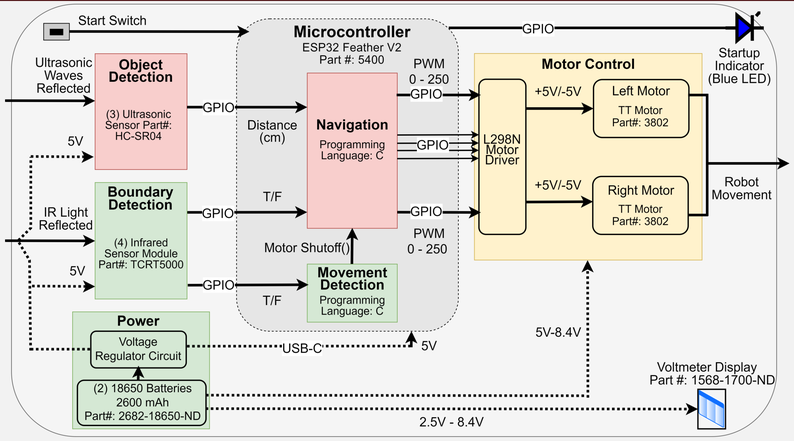
Significant Changes

- Swapped from Arduino Uno to ESP32 Feather V2
- Enabled dual-core programming on the ESP32 for system optimization
- Replaced delays with timers to process interrupts
- Designed and integrated resistor bank to accommodate for the ESP32
- Developed and implemented new search navigation algorithm
- Implemented adjustable weights

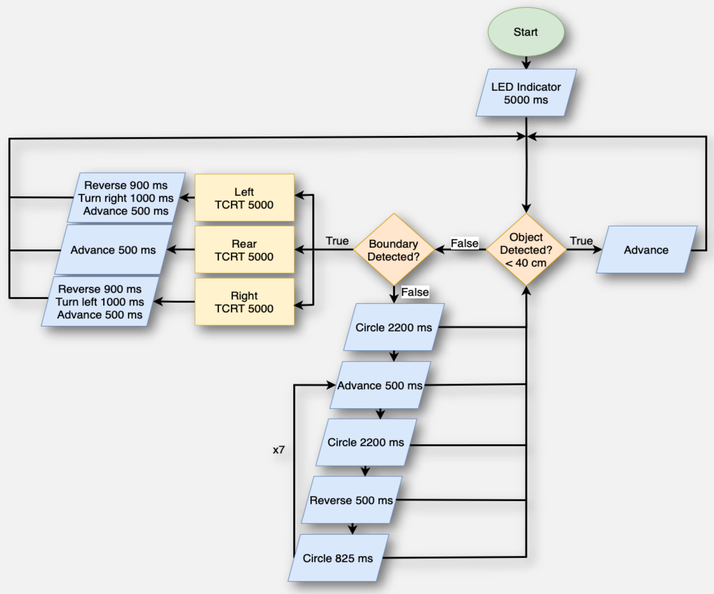
Acknowledgements

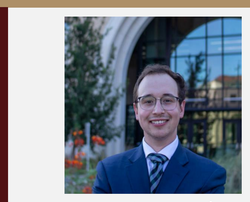
- Sponsor: Mr. Fawzi Behmann
- Advisor: Mr. Jeff Stevens

Hardware Block Diagram



Navigation Flowcharts





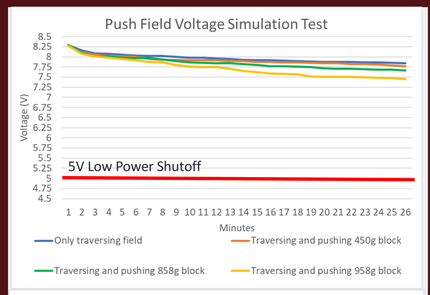
James Strong (PM)

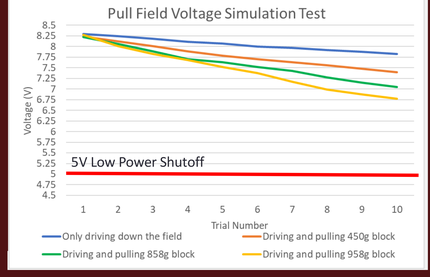
Chadd Mingarine

Jacob Mitchell

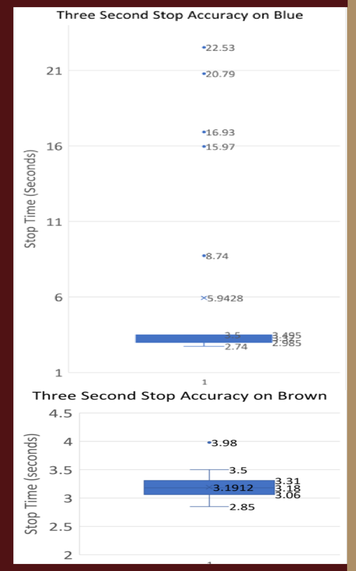
Testing and Characterization

Power



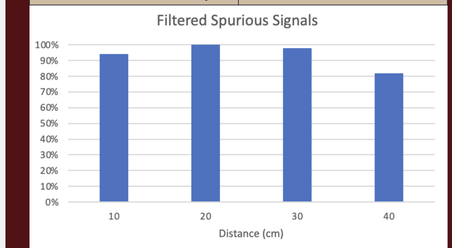


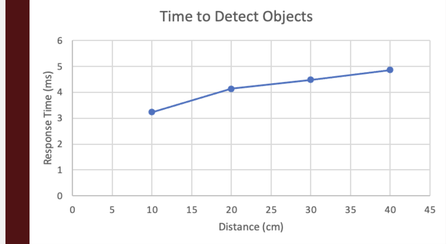
Movement Detection



Object Detection

Max Distance	40 cm
Field of View	15°
Spurious Signal Filter Accuracy	94%





Motor Control

Motor Adjustments	
Left Motor	0 Hz
Right Motor	-10 Hz
Motor Details	
No Object Detected	PWM = 200 Hz
Object Detected	PWM = 250 Hz
Pull Event	PWM = 250 Hz
Reliability	89%