TEXAS STATE
INGRAM SCHOOL OF ENGINEERING

E1.10 – Eggstraction Bot

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Overview

Our product is an autonomous robot car tasked with locating and transporting plastic eggs using a combination of sensor and camera equipment, a gripper attachment, and a navigation algorithm.

Requirements

- Motors controlling each wheel.
- Find and retrieve eggs autonomously
- Detect differently colored plastic eggs.
- Battery power lasts entire competition.
- Gripper able to grab, hold, and release the eggs without breaking them.
- User interface to select desired color.
- Robot has size and weight limitations.
- Budget must not exceed $40.

Project Budget & Power

Part	Cost	Current Draw
ESP32-CAM	$9.18	109mA
MPU-6050 Gyroscope	$6.49	60mA
TCRT5000 Analog IR Sensor (x3)	$2.40	183mA
Bi-Metal Gearbox Motor (x2)	$9.00	122mA
BSS138 Level Shifter	$3.95	40mA
Arduino Uno Rev3	N/A[1]	50mA
HC-SR04 Ultrasonic Module	N/A[1]	15mA
MG995 Servo Motor	N/A[1]	170mA
LM2596 Buck Converter	$1.50	5mA[2]
18650 Batteries (x2)	$6.20	N/A[3]
TOTAL	$38.72	754mA

[1] Part is included with provided kit.
[2] Value is calculated assuming a voltage difference from 8.4V to 5V.
[3] Batteries supply a total of 5200mAh, with an estimated total max power operation of 143 minutes.

Acknowledgements

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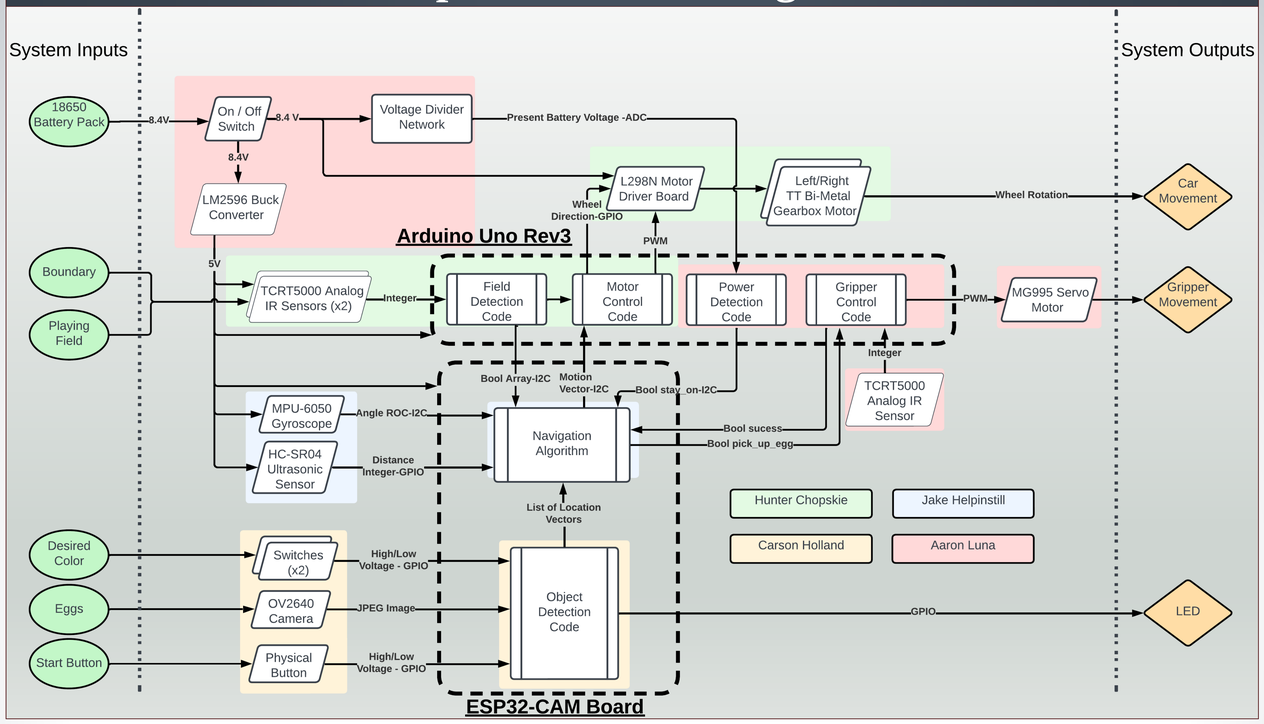
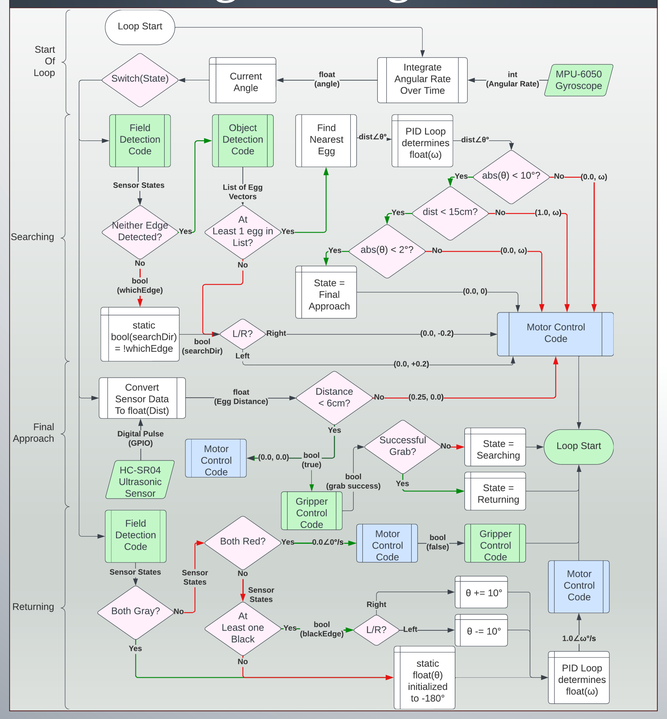
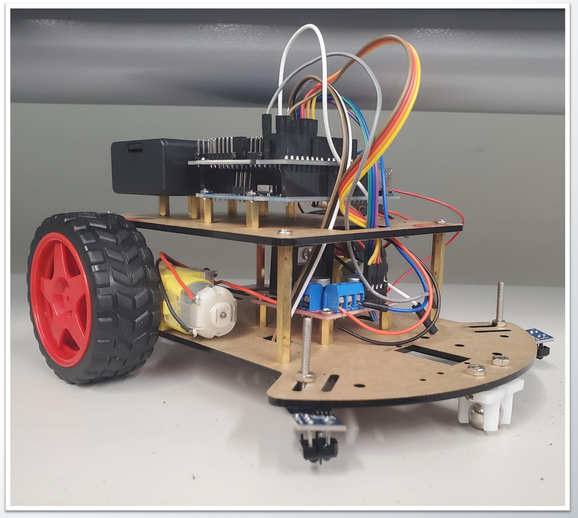
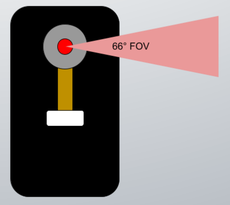
Top Level Block Diagram

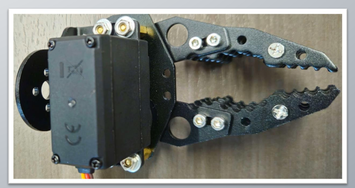


Navigation Algorithm

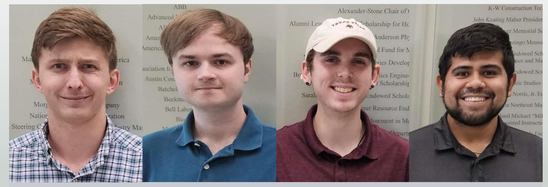








Meet the Team



D1 Accomplishments

- Closed-loop gyroscope-based positioning.
- Inter-board communication via I2C.
- Local color detection.
- IR sensing all 3 distinct field values.
- Motors controlled to avoid boundary from sensor output.
- Hardware user interface for color selection.
- Communication of boundary position between Field Detection and Navigation.
- Functional gripper grabs, holds, and releases eggs without breaking them.

D2 Plans

- Mount gripper onto front of the robot.
- Include level shifter and buck converter for module voltage differences.
- Communicate egg location data to the navigation algorithm.
- Characterize various performance metrics: optimal lighting conditions, maximum egg detection distance, motor angle fidelity.
- Upgrade motors to minimize error.
- Confirm successful egg captures using a sensor for the gripper.