E1.09 – The Eggquisitors

Artemio Reyes (PM), David Sharp, Cristian Gutierrez

TEXAS STATE
INGRAM SCHOOL OF ENGINEERING

The Team

Artemio Reyes (PM) | David Sharp | Cristian Gutierrez

Project Overview

Operating autonomously with the use of two micro controllers, a camera, and other sensors, our robot will identify a specified color of plastic egg(s) among a mixed field of eggs and grip the egg(s) determined by user input. Once gripped, the robot will maneuver to the red starting tile on the field and place the egg in it.

D1 Requirements

- Grip an egg without damaging it
- Traverse entire field without leaving the boundaries
- Identify eggs by color
- Detect field colors

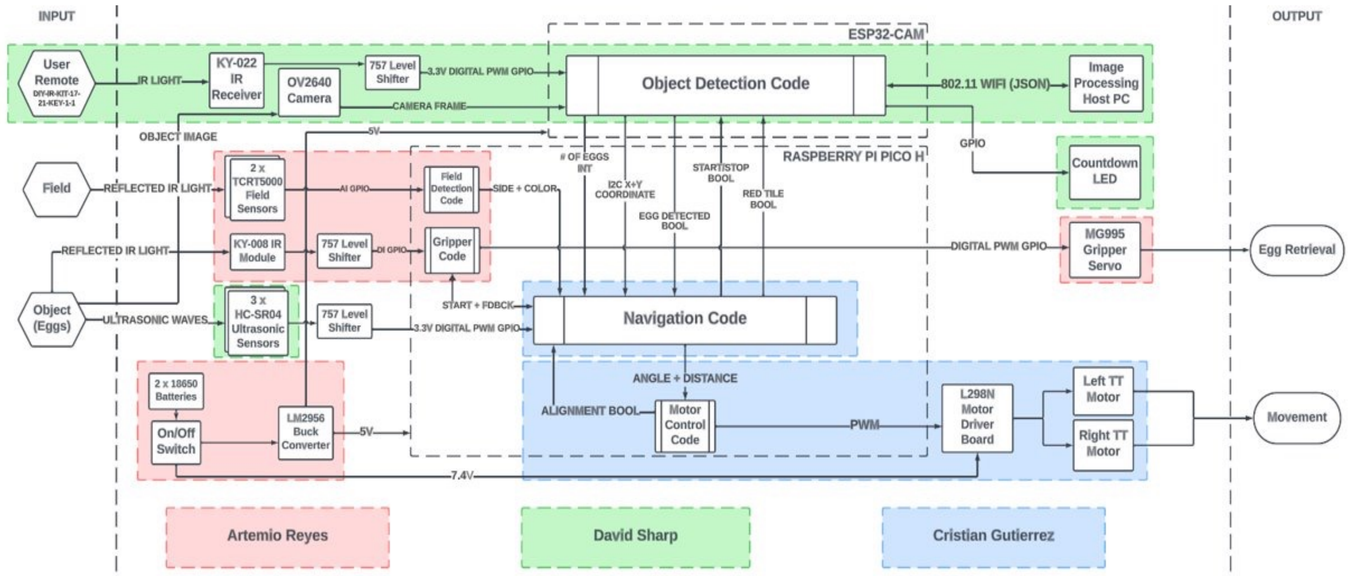
D2 Plan

- Make a new chassis for the bot
- Implement communication between ESP32-CAM, Host PC, and Raspberry Pi Pico
- Integrate all sensors into Raspberry Pi Pico and optimize algorithms
- Measure power output for all subsystems

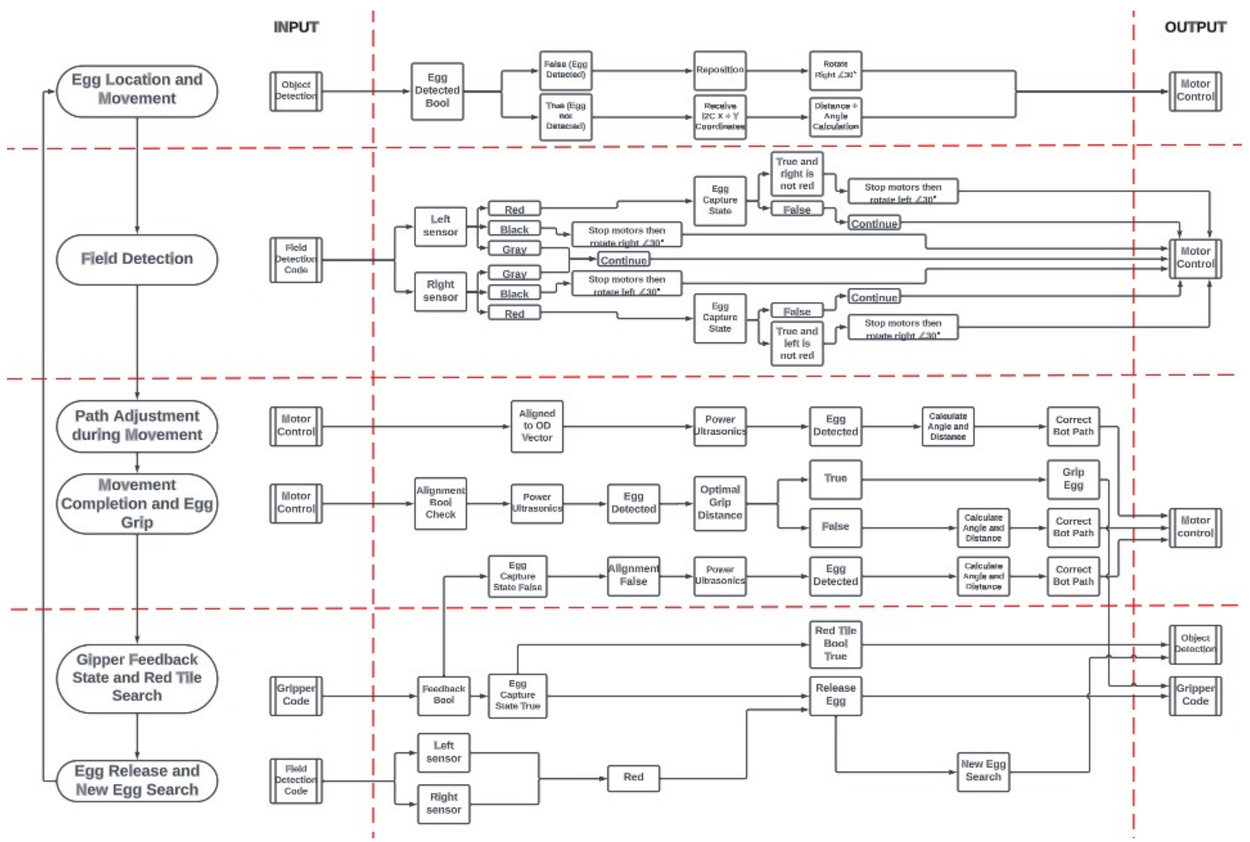
Budget

Component	Price Per Unit	Quantity	Subtotal Cost
ESP32-CAM	$9.25	1	$9.25
Raspberry Pi Pico H	$5.00	1	$5.00
18650 Batteries	$4.17	2	$8.33
LM2956 Buck Converter	$4.90	1	$4.90
Adafruit 757 Level Shifter	$0.75	1	$0.75
KY-008 IR Module	$2.30	1	$2.30
HC-SR04 Ultrasonic Sensor	$2.30	2	$4.60
TCRT5000 IR Reflective Sensor	$0.88	2	$1.76
		Total:	$36.89
		Original Budget:	$40.00

Top-Level Block Diagram



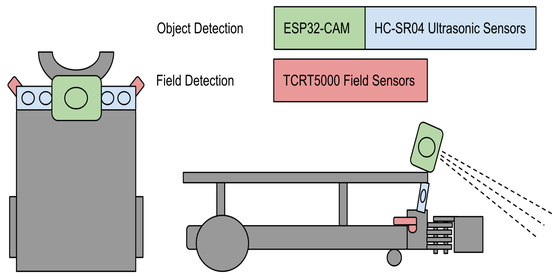
Navigation Flow Chart



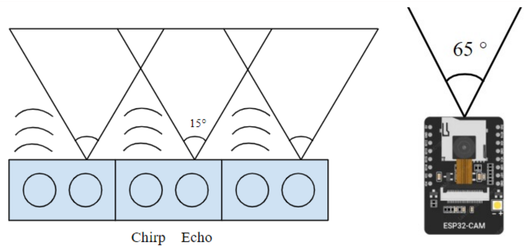
Power Budget

Device	mA
ESP32-CAM	6 mA – 180 mA
Raspberry Pi Pico H	40 mA – 100 mA
TT DC Motor (x2)	300 mA
HC-SR04 Ultrasonic Sensor (x3)	45 mA
TCRT5000 IR module (Field Detection)(x2)	120 mA
MG995 (servo grip)	170 mA – 400 mA
L298N (driver control)	35 mA
KY-008 IR Module	40 mA
KY-022 IR Receiver	1.5 mA
Total max usage	1222 mA
Batteries	2200mAh
Total Time	102 minutes

Sensor Placement



Sensor FOV



HC-S04 Ultrasonic Sensor FOV ≈ 15°

ESP32-CAM FOV ≈ 65°

Acknowledgements

Sponsor: Mr. Fawzi Behmann
Advisor: Mr. Jeff Stevens
D2 Mentor Team: Sumo ACE 2.04