TEXAS STATE UNIVERSITY ®

E2.08 - Robo-Fetch 2

Michael Black (PM), Sammy Girma, Zachary McLeod, Daniel Ontiveros

Project Overview

Our project is the **E**gg **G**rabbing **G**adget, an autonomous robot that can identify both plastic and real chicken eggs of a specific color, navigate to, acquire, and return them to the chosen starting position. This is useful because technology is trending towards autonomous operation. The global autonomous mobile robots market value is expected to more than double by 2026.[1]

Requirements

- Traverse the field without crossing the outer boundary.
- Discern between green, blue, and purple plastic eggs.
- Grip and return eggs to starting square.
- Final measured power budget and practical battery life measurement.

Secondary Requirements

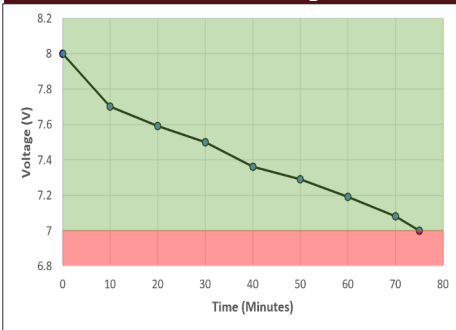| Requirement	Results
Max Budget = $30	$24.46
Max Weight = 400 g	752 g
Max Size = 20 cm x 20 cm x 20 cm x 20 cm	24.8 cm x 16.5 cm x 18.5 cm

Power Consumption

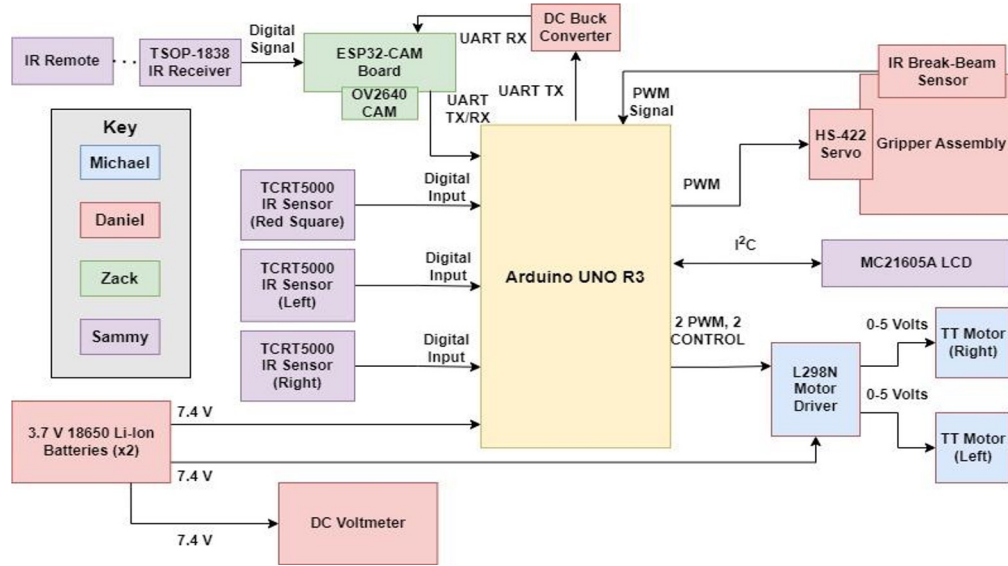*Figure 1: For reliable operation, battery voltage must remain above 7 volts and below 20 volts.*

References:

[1] https://www.marketwatch.com/press-release/autonomous-mobile-robots-market-size-with-swot-analysis-is-likely-to-accelerate-industry-growth-in-machinery-and-equipment-2022-10-29#

Hardware Block Diagram

Functional Test Results

Test	Procedure	Result
Battery Life	Robot was run with with two fully charged batteries until reaching a voltage of 7 V. Voltage level checked every 10 minutes and recorded. This is displayed in *Figure 1*.	Batteries stayed above 7 V for 75 minutes
Navigation Reliability	Created code that makes the robot stop when it is within gripping range of an egg. Put an egg in 5 different locations and tested it 4 times each. Let the robot attempt to stop in front of the egg 20 times.	17/20 attempts successful
Gripper Reliability	A reliable capture region (*Figure 2*) was determined and used to test successful capture of eggs. This is detailed in accompanying test documentation.	70/70 attempts successful
Color Detection	After calibration, verified ESP-32 CAM was able to differentiate between egg colors in its test field shown in *Figure 3*.	28/30 attempts successful
Boundary Detection	Ran the robot for an hour to traverse the field and detect the boundary line.	774/780 attempts successful
Egg Delivery	Created code that opens the gripper when the IR sensor detects the red square.	17/20 attempts successful
Overall Functionality	Two eggs of each color were placed in different locations and the egg-retrieval operation was run to retrieve and return both eggs of a chosen color.	6/20 attempts successful

All tests that involved the robot moving were run with the motors at ~40% duty cycle.

The E.G.G. Boys

Michael -Navigation

Sammy -Boundary Detection -User Interface

Daniel -Gripper -Power
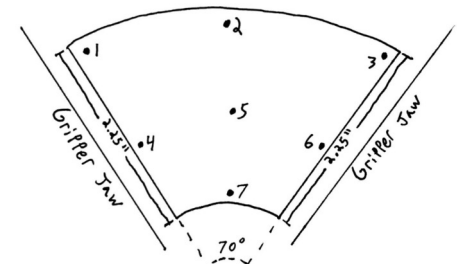
Zachary -Object Identification

Test Fields

Figure 2: Gripper reliability test field.

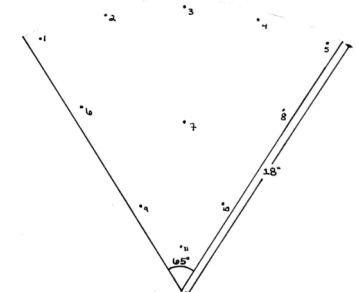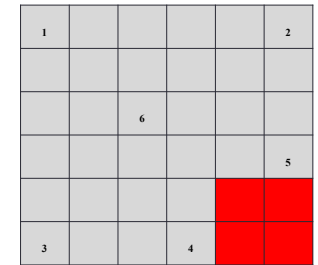*Figure 3: Object detection test field.*

Figure 4: Playing field layout for overall functionality test

Acknowledgements