UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

# ChipCaddy

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ECE 445 FA23: Team 16

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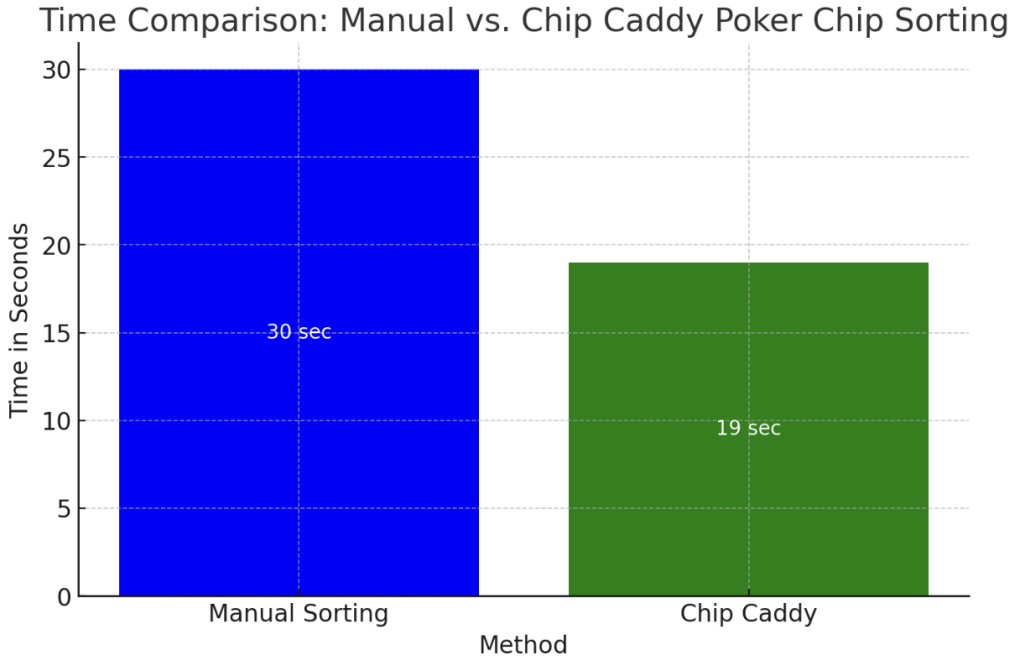
# Problem


Zion Market Research
Global Online Poker Market Size (2023-2030)
CAGR 13.5%
$237.5 Bn
$86.2 Bn
Revenue (USD Mn/Bn)
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Source: zionmarketresearch.com

# What does ChipCaddy do?

## High Level Requirements

1. Pot count should be updated within **5 seconds** of sensor reading.
2. The user will be able to **reset the pot count** to 0.

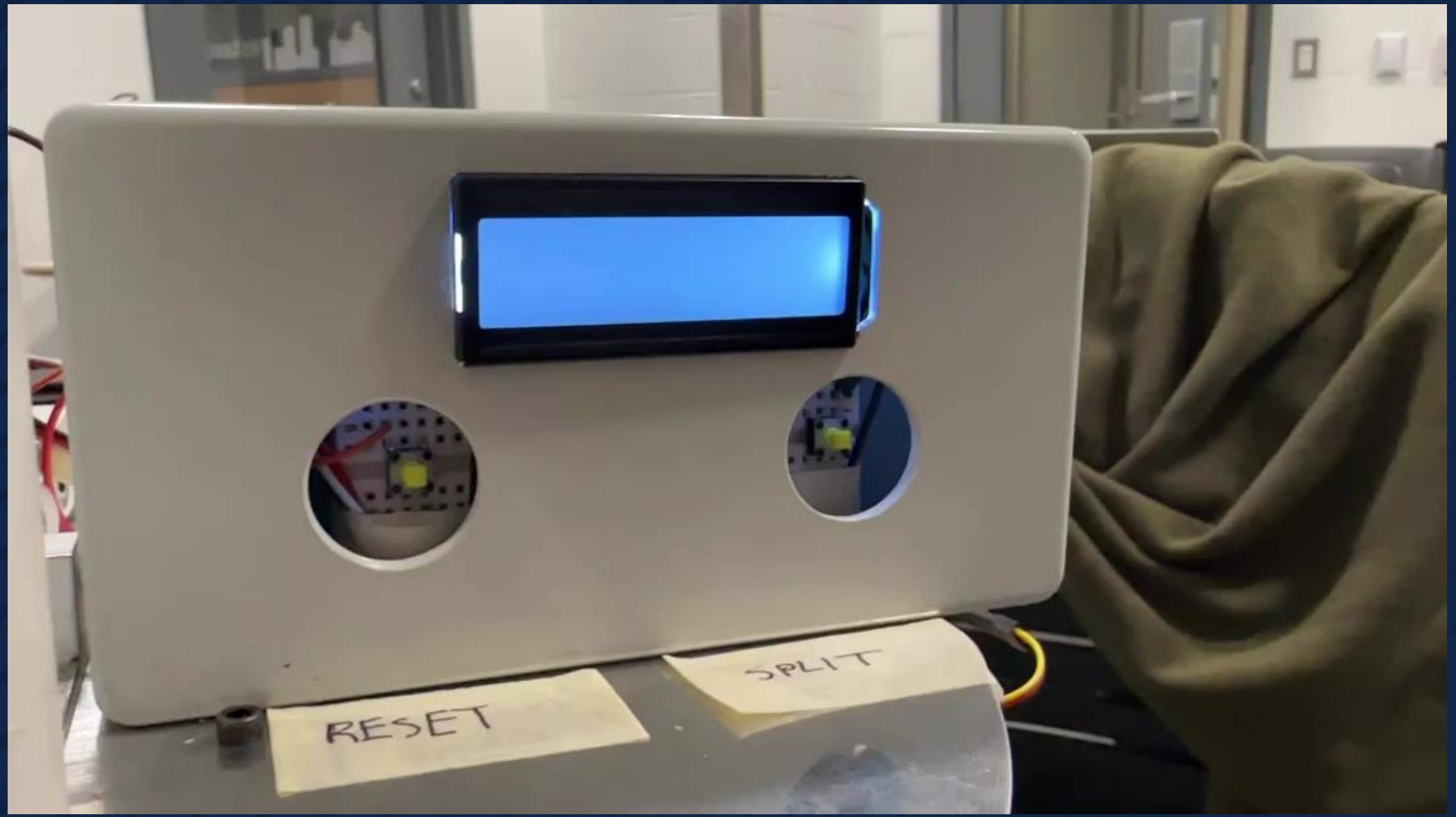


## High Level Requirements

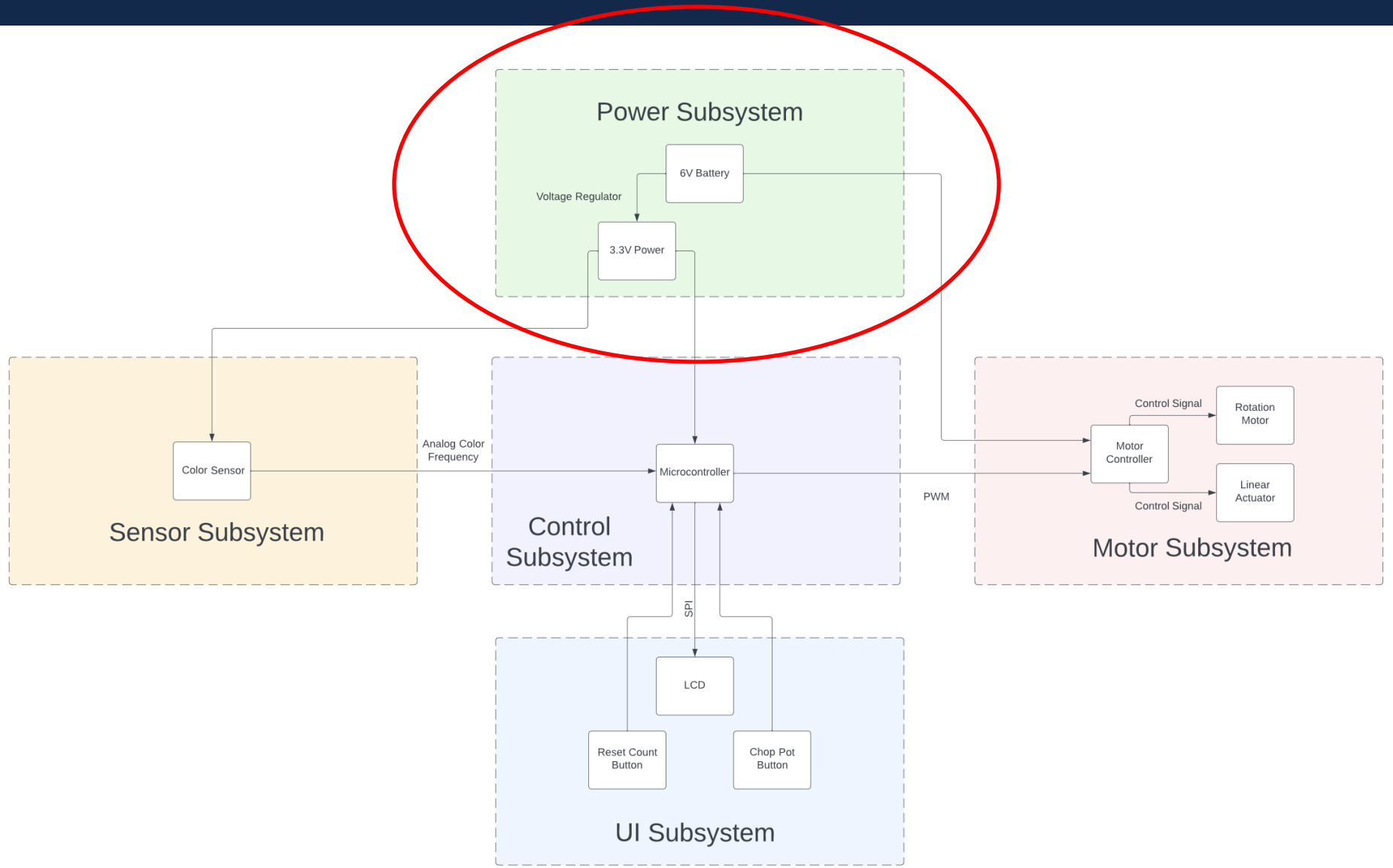
3. The user can **choose the number of ways the pot will be split**, and the respective color denominations will be **shown on the LCD.**

## High Level Requirements

4. The device will keep a **tally of the number of chips** counted

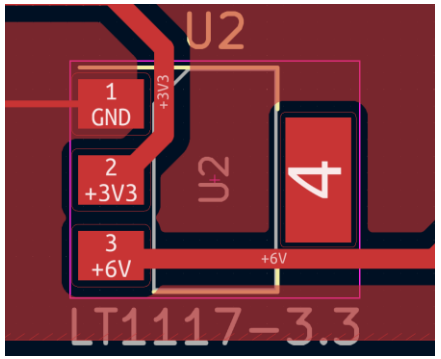

RESET
SPLIT

# Block Diagram

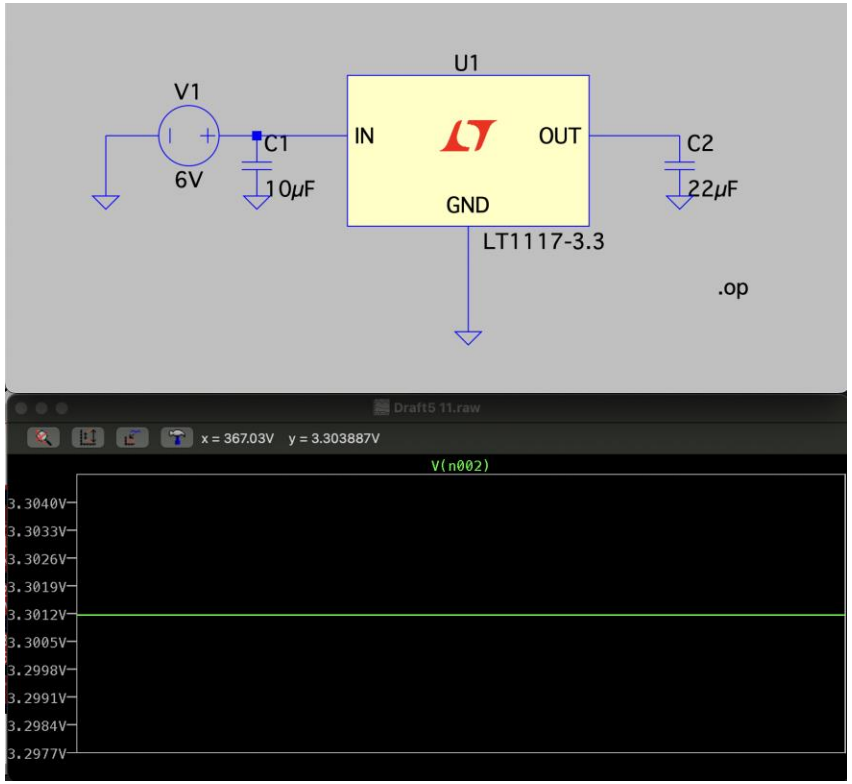


# Power Subsystem

- PCB powered by external 6V battery pack
- 6V are supplied to the linear actuator (pushing motor) and servo (spinning motor)
- 3.3V output of LT1117 regulator to LCD, STM32, and color sensor

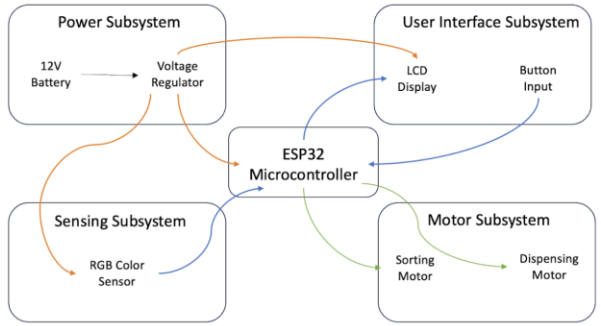


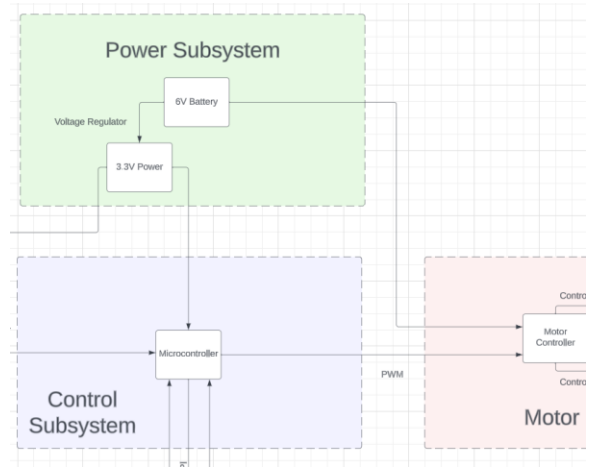




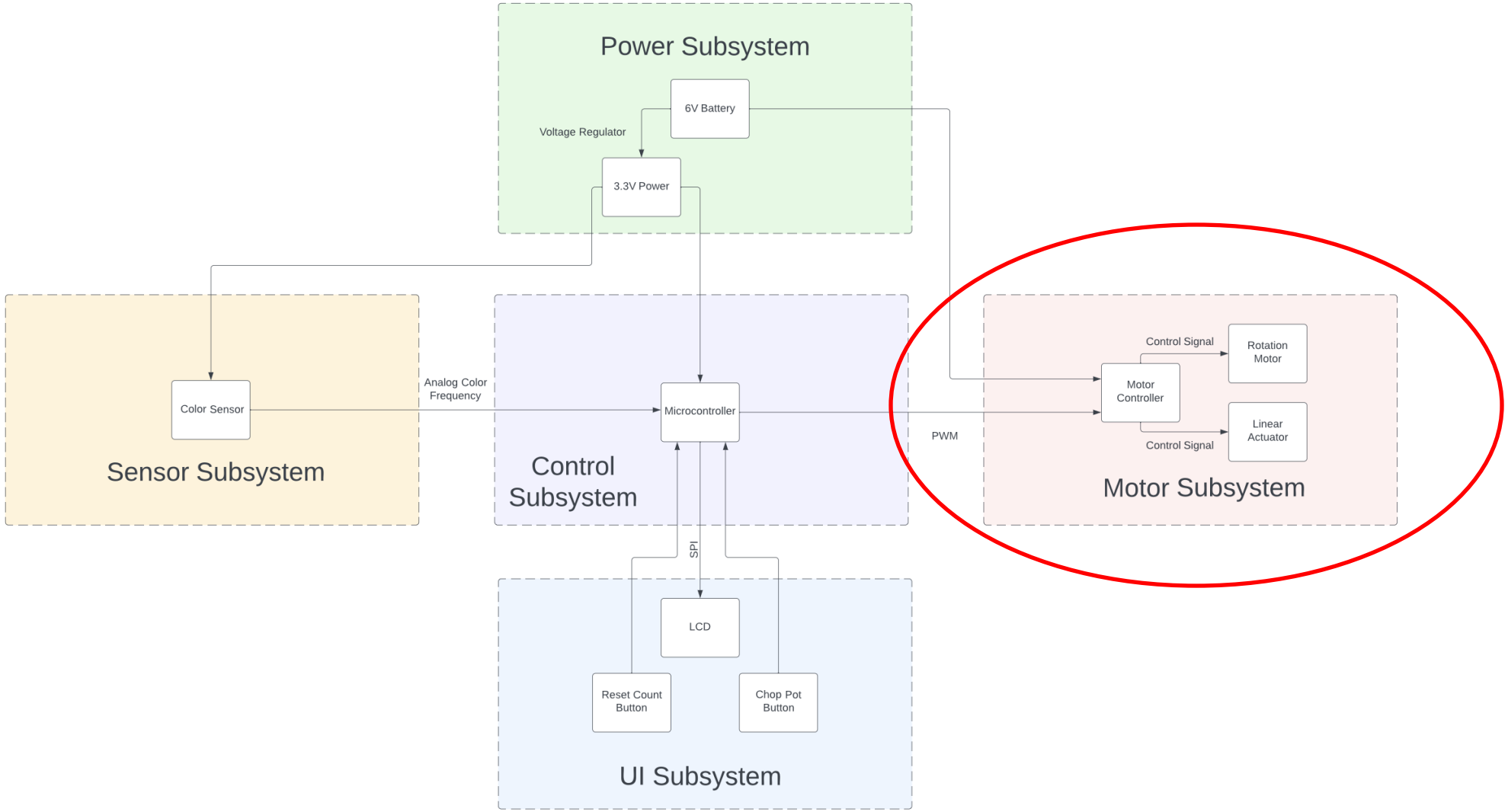
## Power Design Changes

1) From project proposal
   - 12V battery pack with motors being powered by MCU
2) Pre-design document
   - 9V battery pack with two voltage regulators, 3.3V & 6V
3) Final design
   - 6V battery pack with one voltage regulator, 3.3V



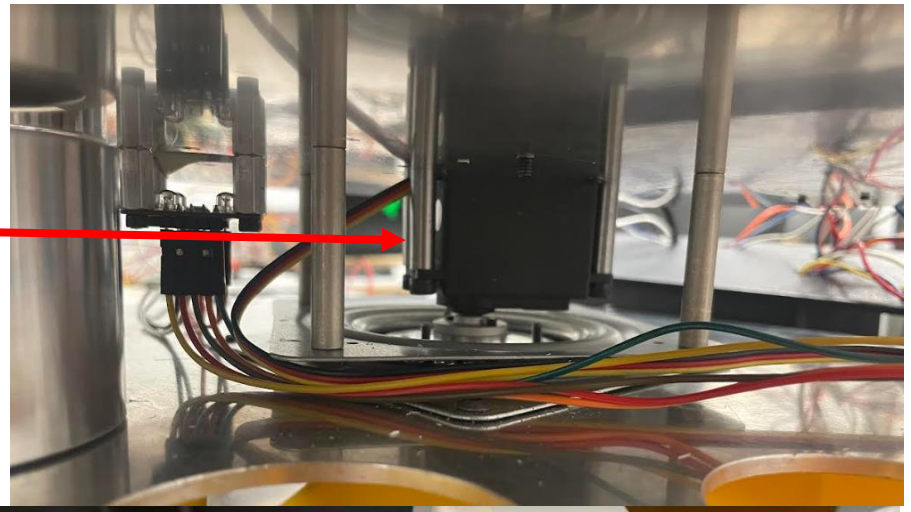



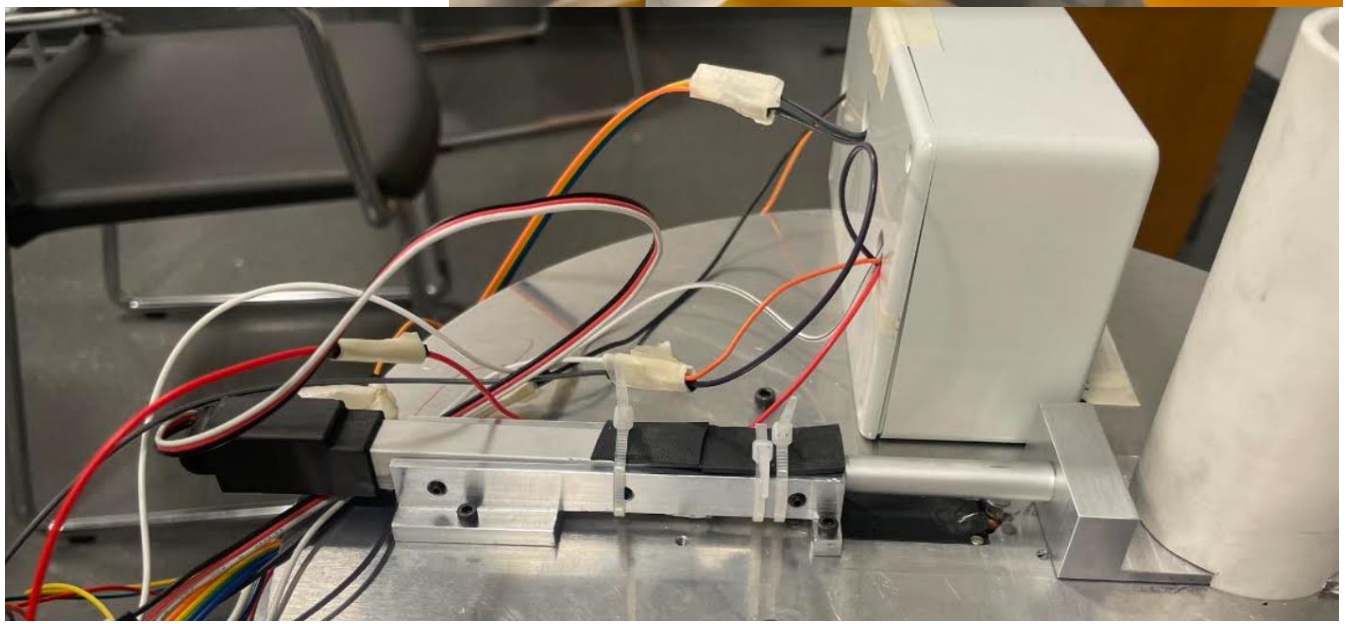
# Block Diagram



## Motor Subsystem

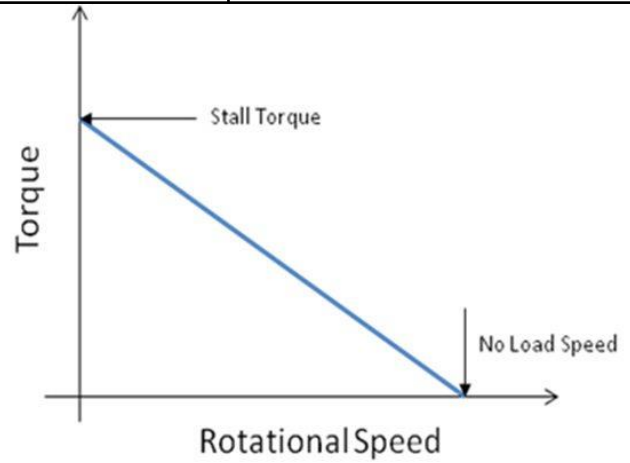
- Servo motor for rotating
  - 210 degrees of freedom
- Linear actuator for pushing chips

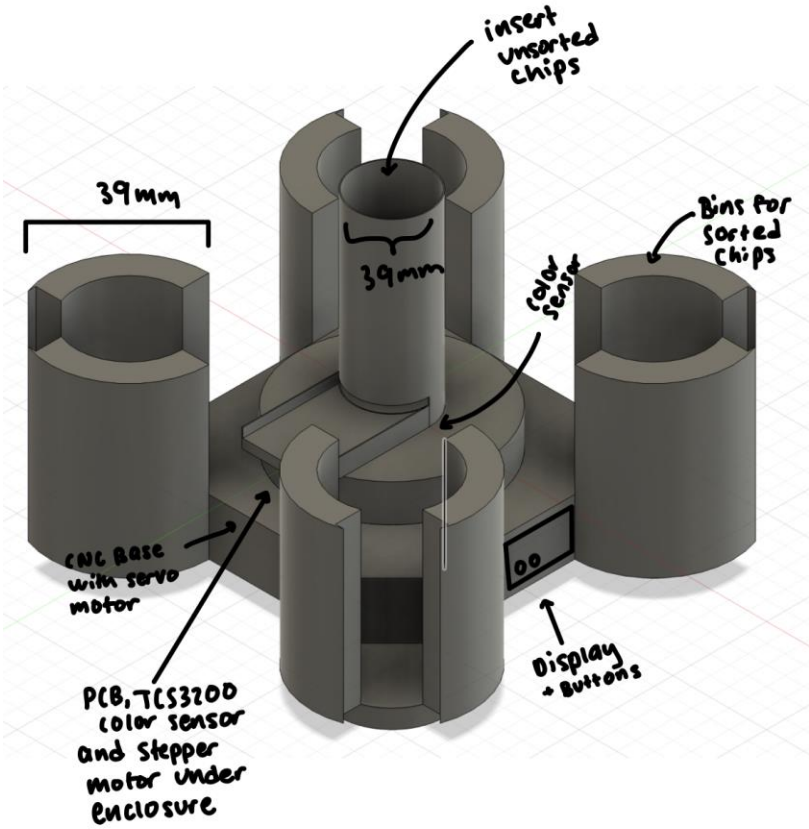


# Motor Design Considerations

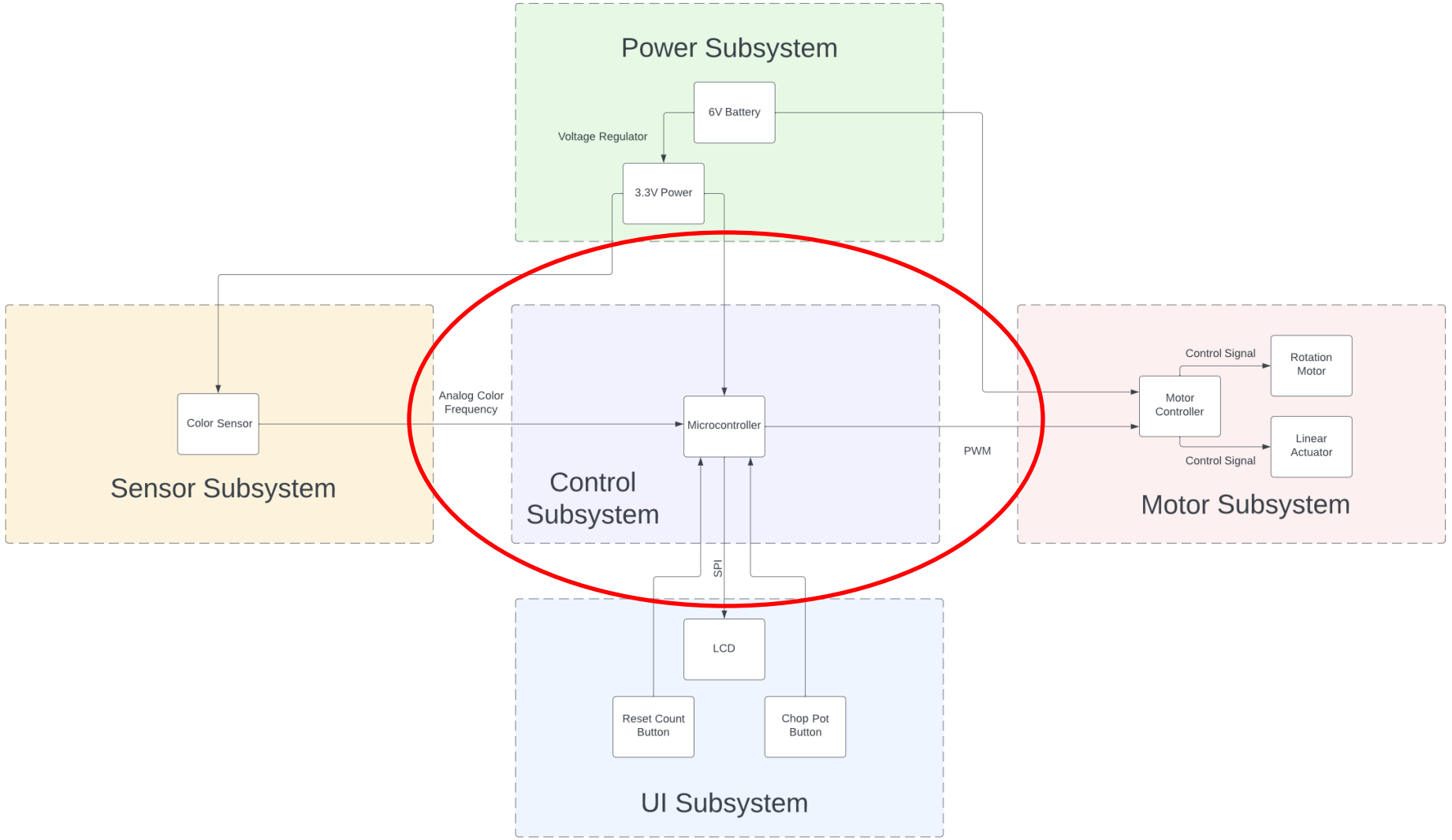
| Requirements | Verification |
|---|---|
| 1.Both motors receive 6 +/- 0.5% Volts from the power subsystem. | 1.Insert three chips into the contraption.<br>2.Apply a voltmeter to both motor connections and record the values in a table for all the chip ejections. |




| | |
|---|---|
| Stall Torque (4.8V) | 42 oz-in (3.0 kg/cm) |
| Stall Torque (6.0V) | 51 oz-in (3.7 kg/cm) |

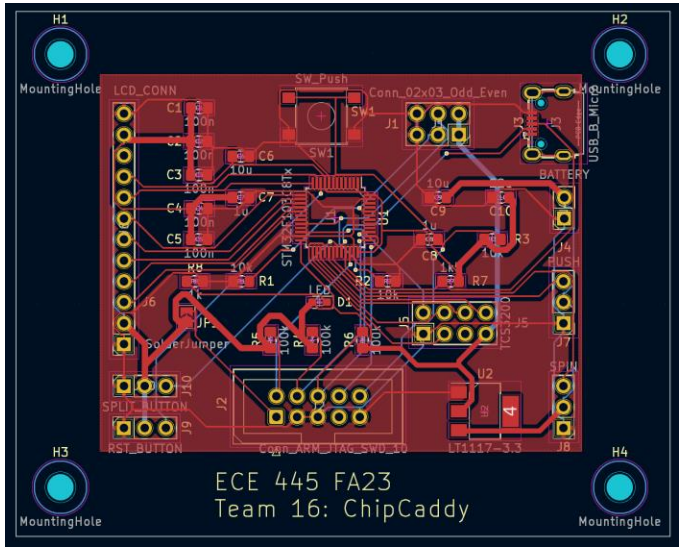


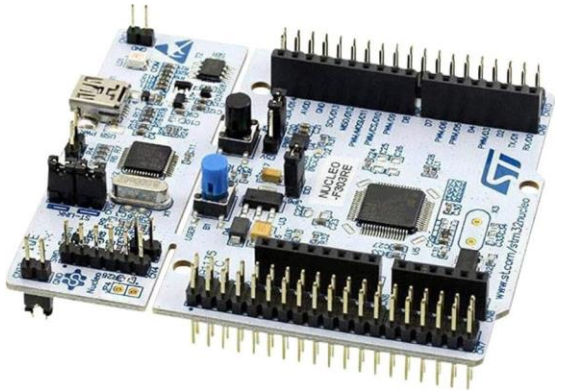
# Block Diagram



## Control Subsystem

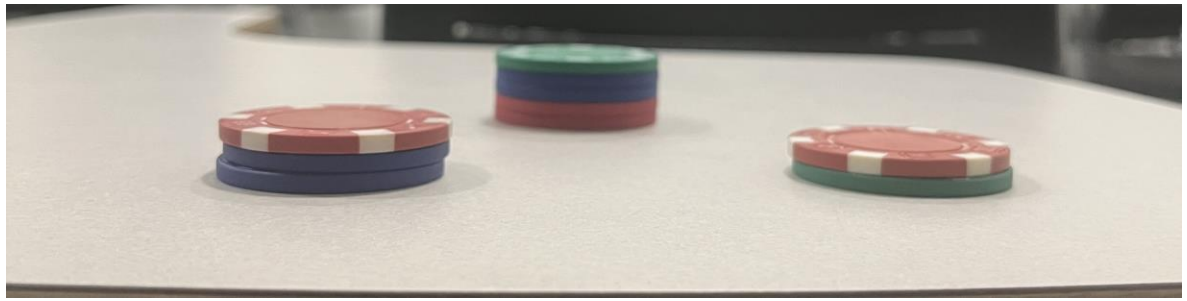
- STM32F103C8T6 microcontroller is the brain
- Nucleo-64 development board for prototyping and system integration
- Handles timing, internal logic, and control of LCD, buttons, motors, and sensor



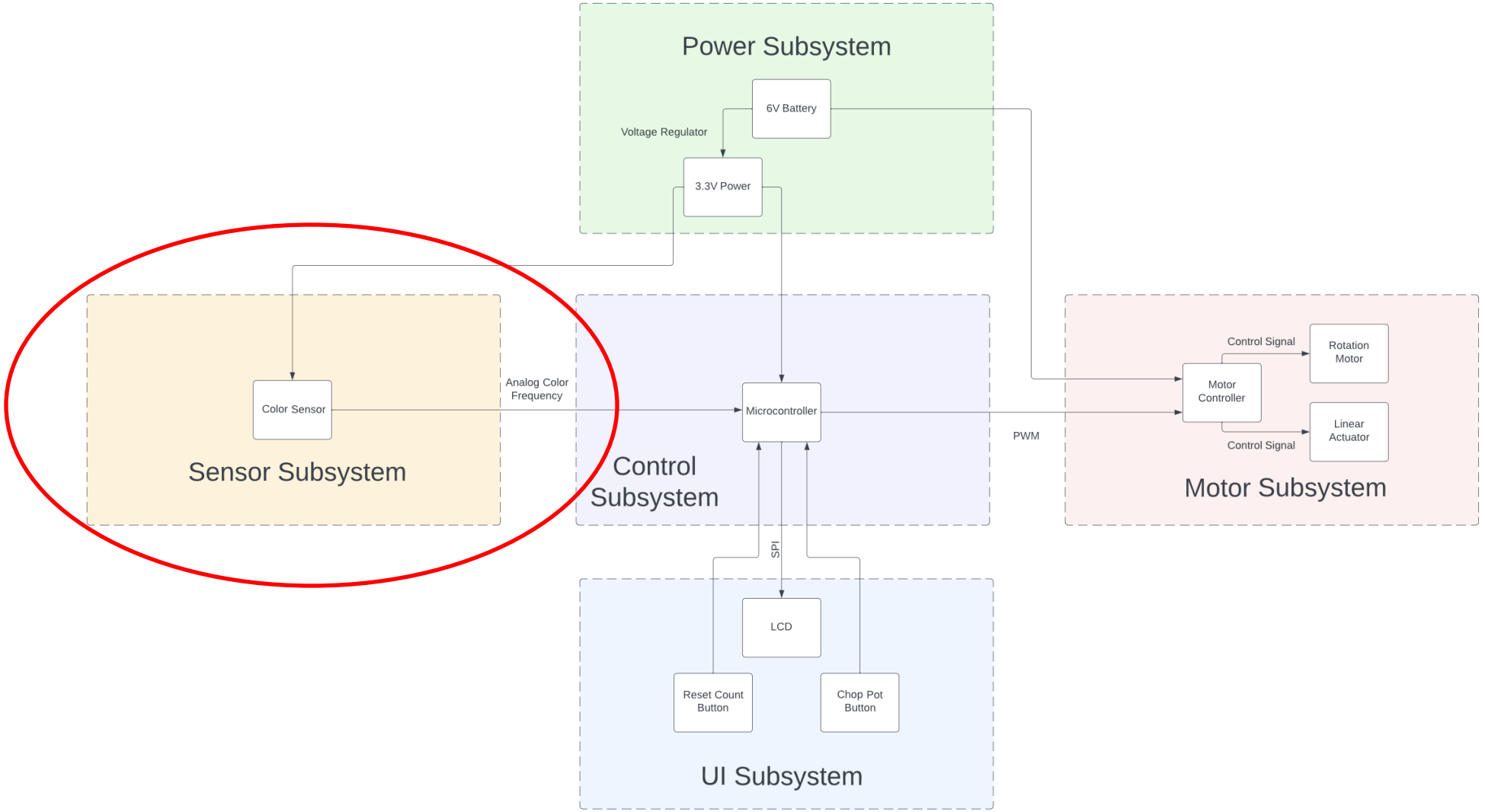
## Control Design Considerations


1) MCU selection
    - ESP32 to STM32
2) PCB programming
    - STMCube to STMduino
3) Algorithm for split pots
    - Greedy algorithm



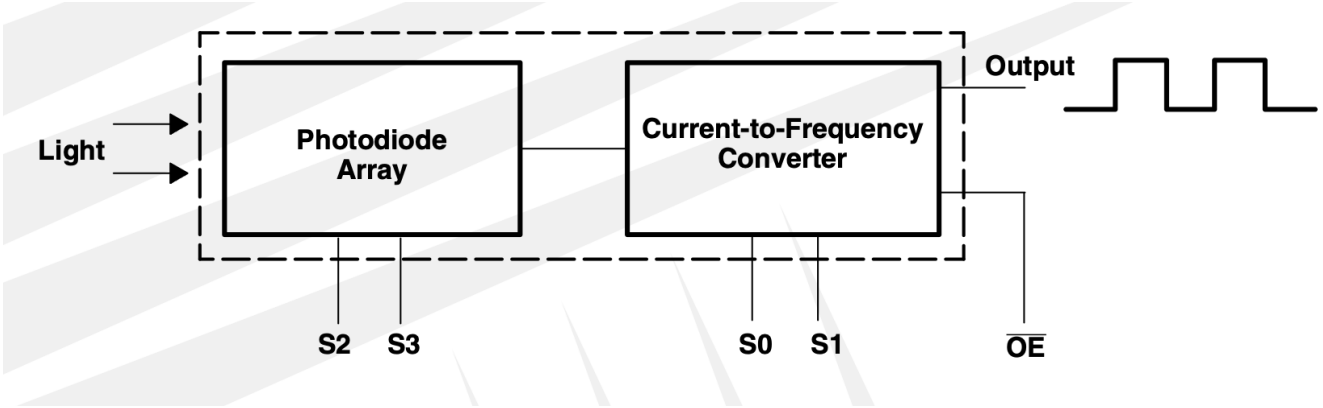
4) Incorrect soldering of STM32
    - Soldered MCU incorrectly, used Nucleo board for the demo

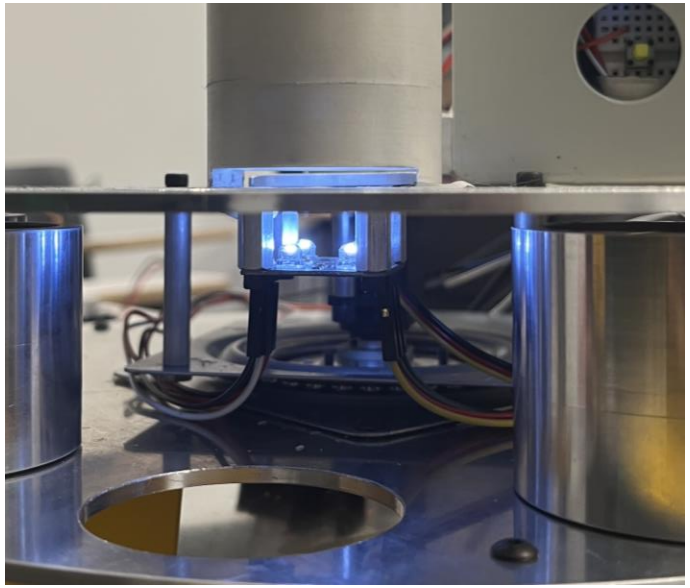
# Block Diagram



## Sensing Subsystem

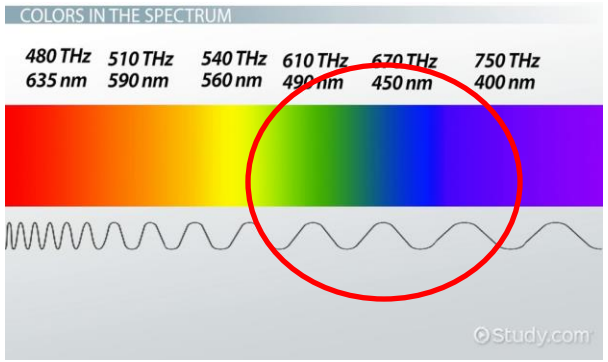
- TCS3200 color sensor
  - Photodiode converts reflected light to current
  - Current then converted to frequency

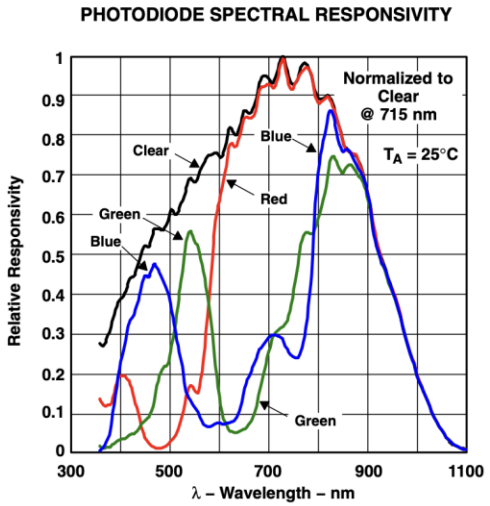


# Sensing Design Considerations

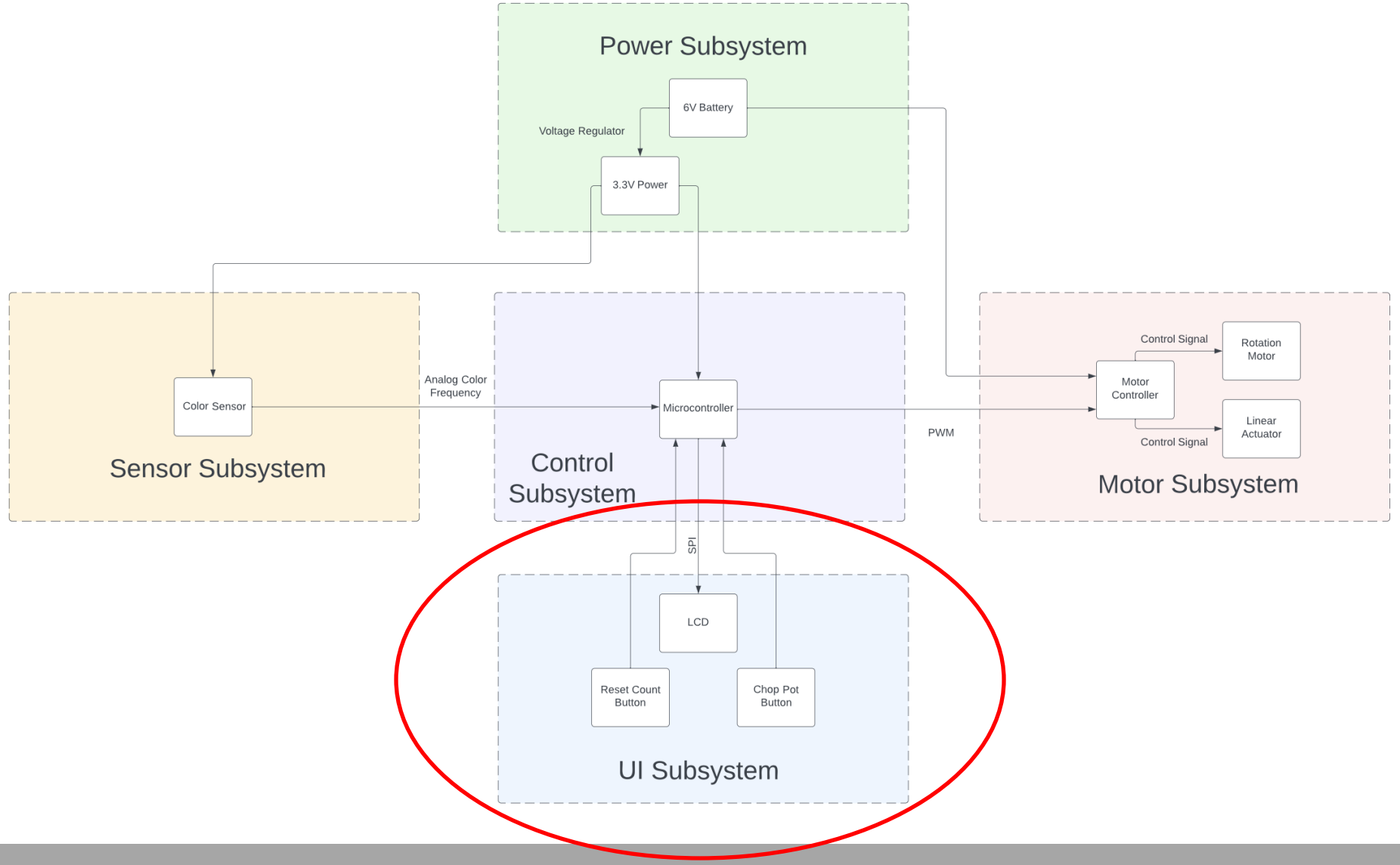
| Requirements | Verification |
|---|---|
| •The microcontroller receives the right RGB value corresponding to the chip that is inserted, based on information relayed from the TCS3200 sensor. | 1.Insert the *x* amount of chips the contraption supports, of varying colors. **2.Record the values** received by the microcontroller that corresponds to the TCS3200, ensuring that each value is within a standard tolerance from a central value. E.g. if we chose Green to have a central value of 200, all chips should be between 180 and 220 if the tolerance value is set to 20. |



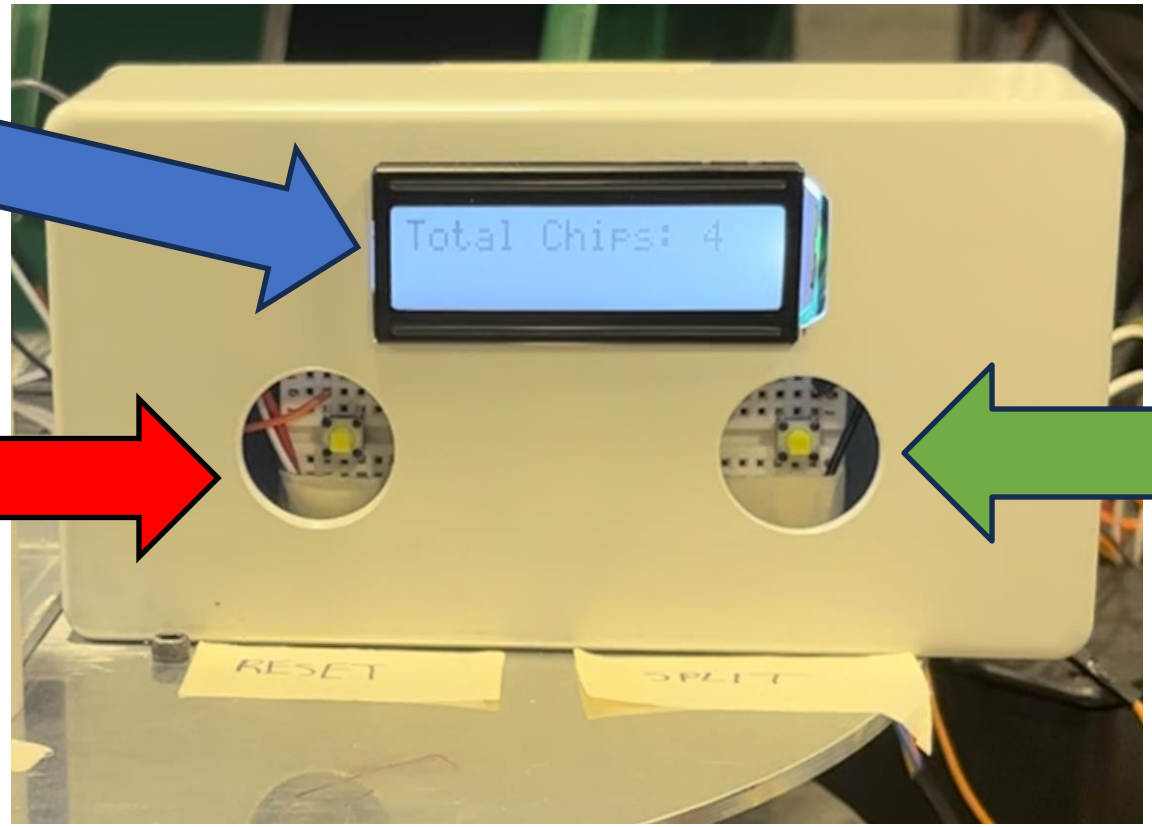




Red: 46Green: 38Blue: 22
Blue
Red: 44Green: 31Blue: 29
Green

# Block Diagram



## User Interface Subsystem

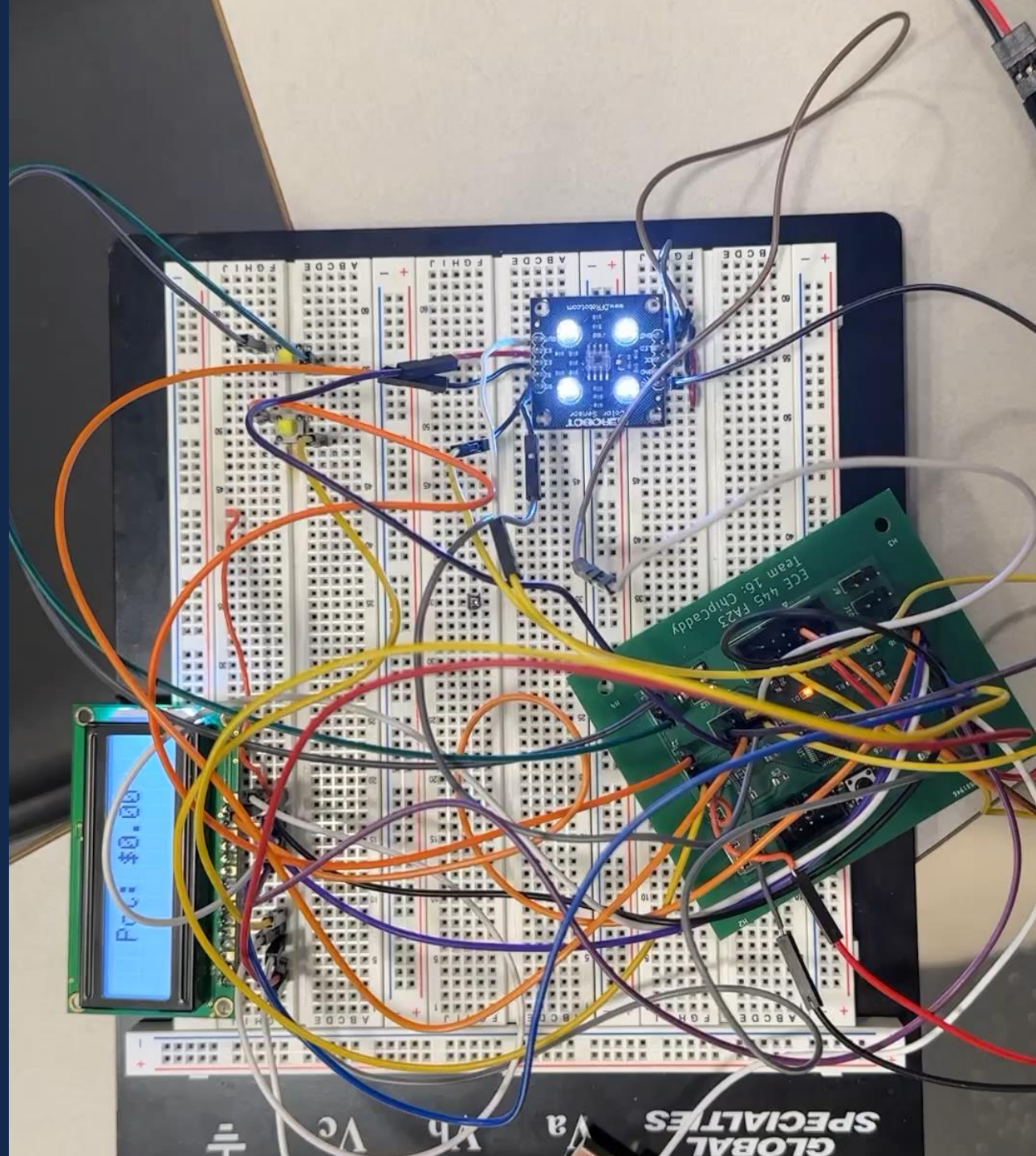


# Final Design

- Full functionality on development board and PCB
- Nucleo-64 board for final demonstration
- Difficulties differentiating between green and blue chip
- Small issue with motor torque

# Next Steps

- PCB integration
- Accommodation of side pots, all-ins
- Improve packaging, noise, and speed



# Final Thoughts

- Gained experience soldering, low-level programming, debugging, PCB layout, mechanical design

# Works Cited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# Thank You!