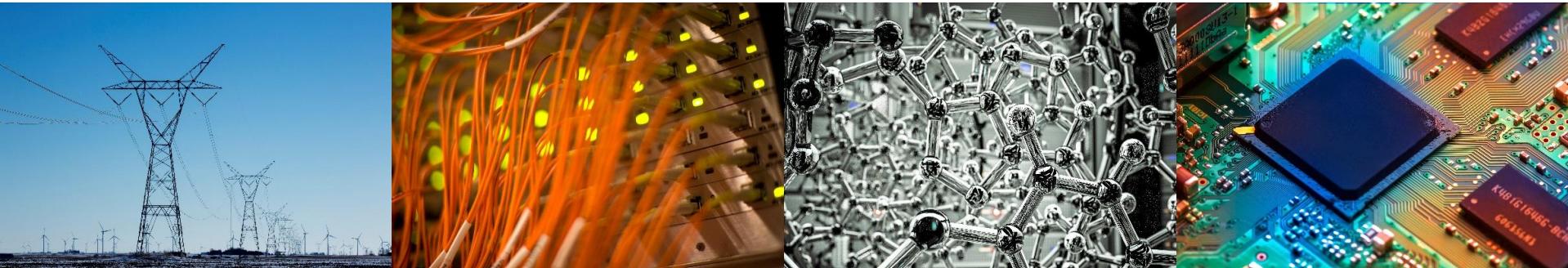


Team 62 Presentation

Automated Multi-Cat Feeder

Qingyuan Liu, Lingxiang Cai, Omolola Okesanjo

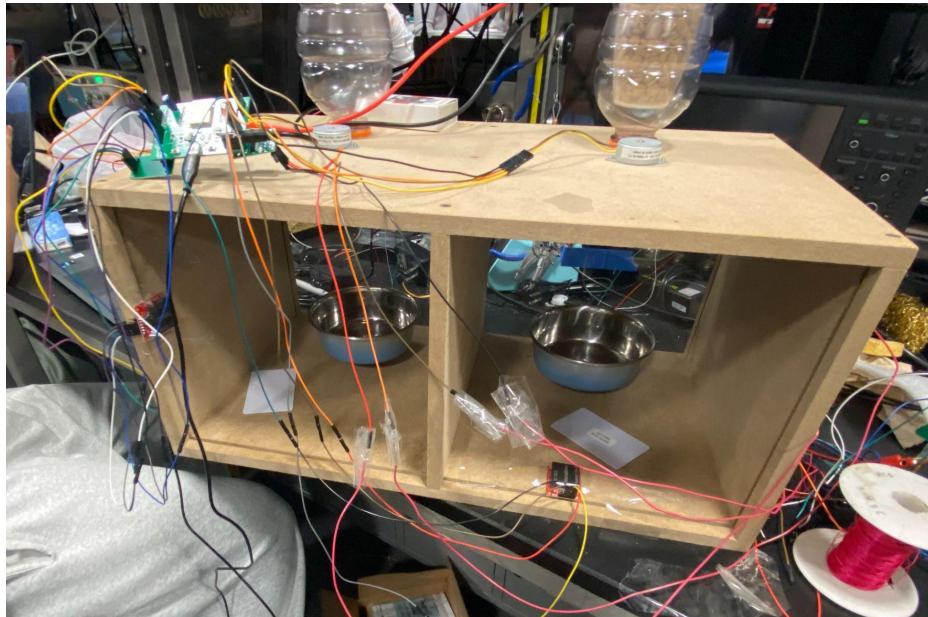


Electrical & Computer Engineering

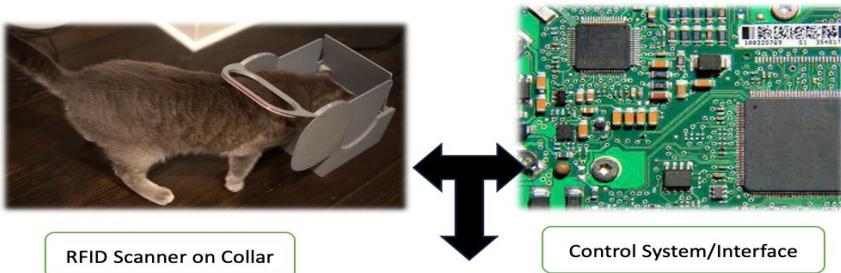
GRAINGER COLLEGE OF ENGINEERING

Overview

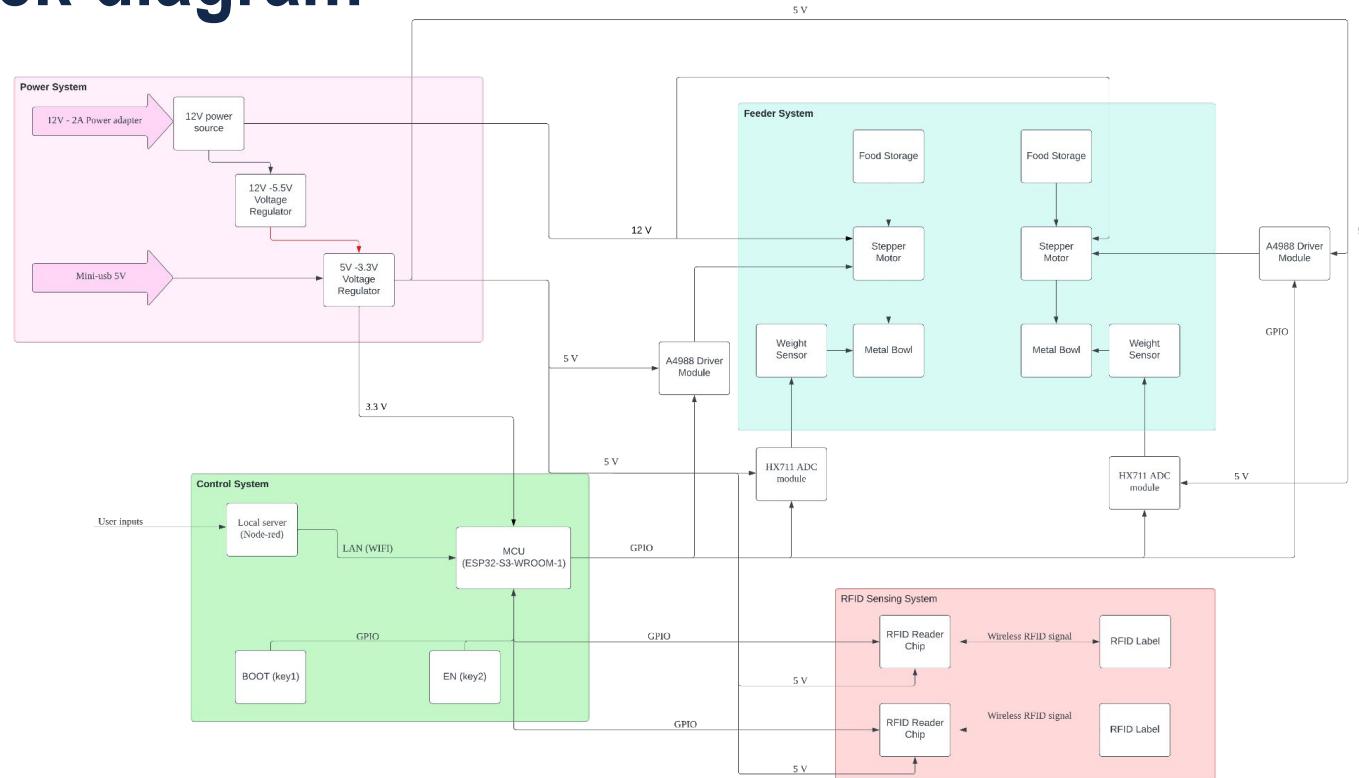
Multi-Cat Feeder System



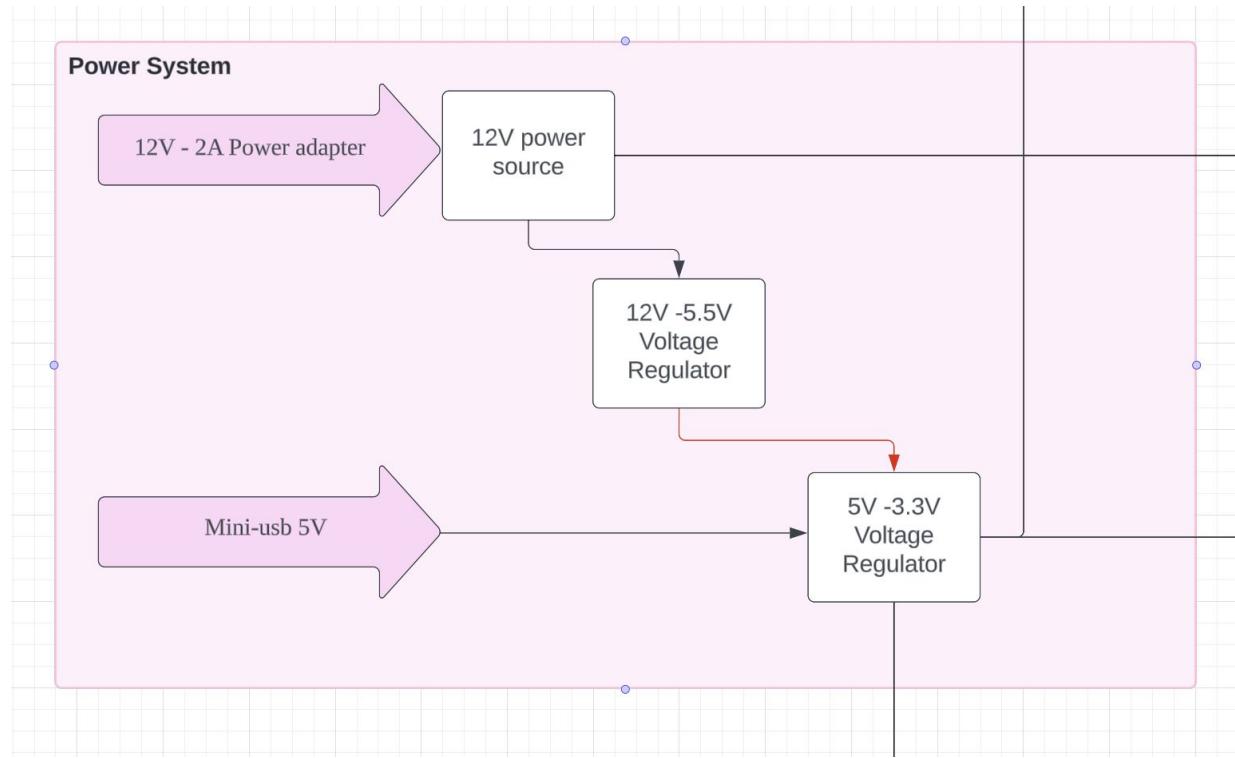
Visual Aid



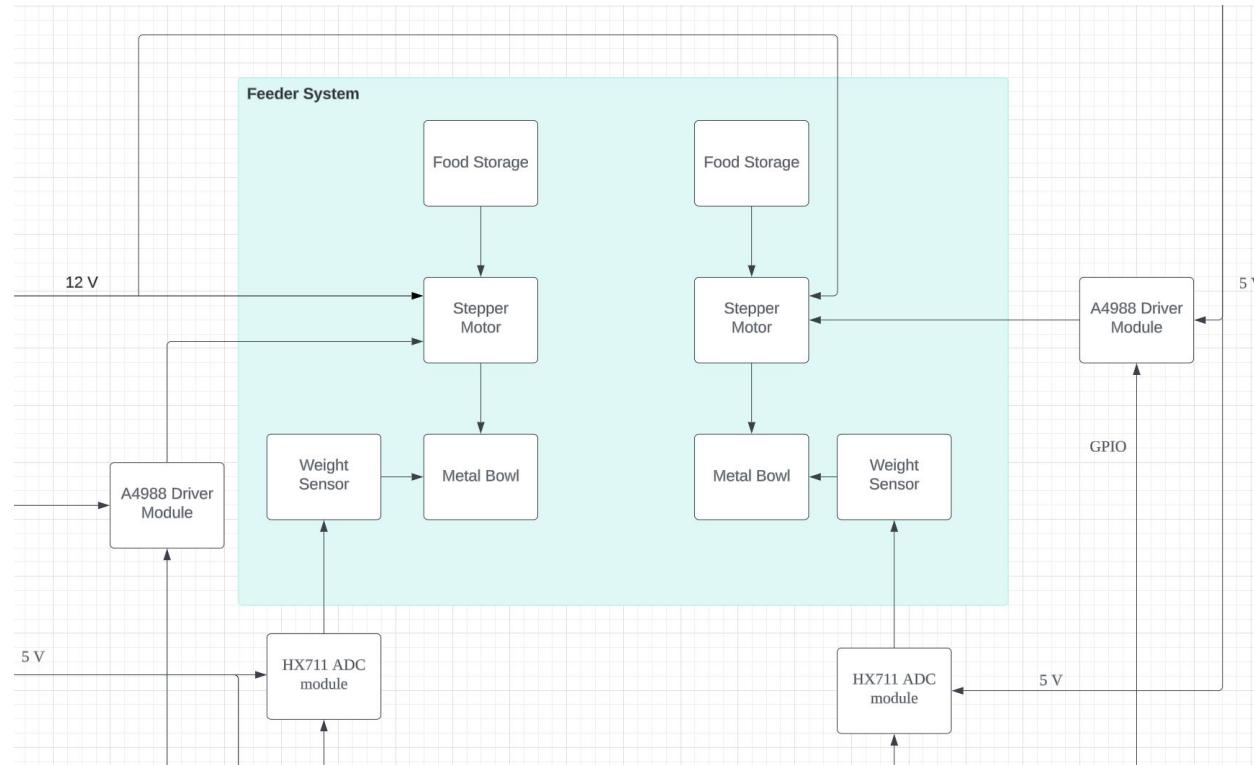
Block diagram



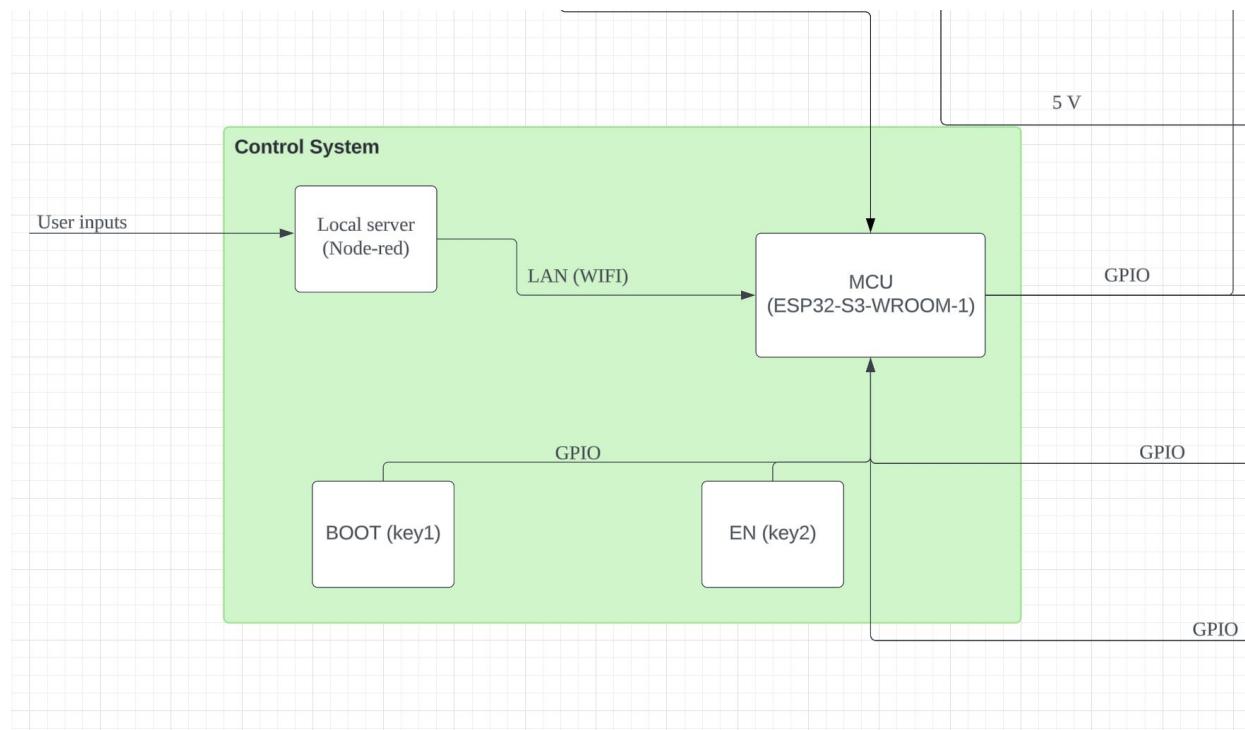
Power System (Close-up)



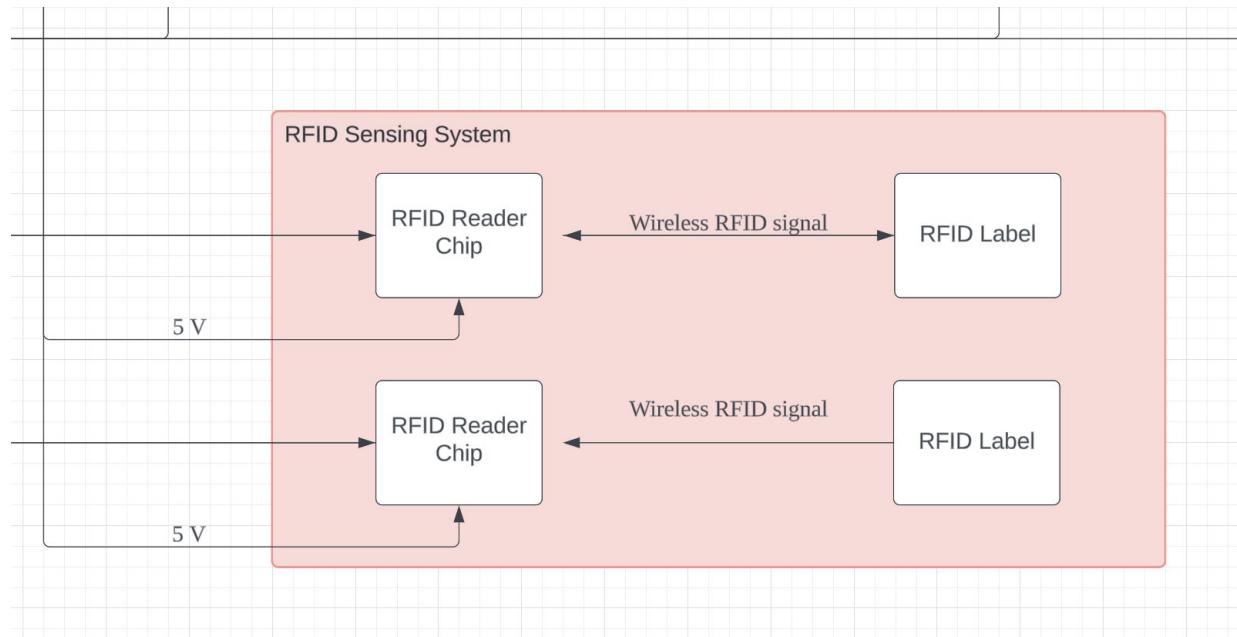
Feeder System (Close-up)



Control System (Close-up)



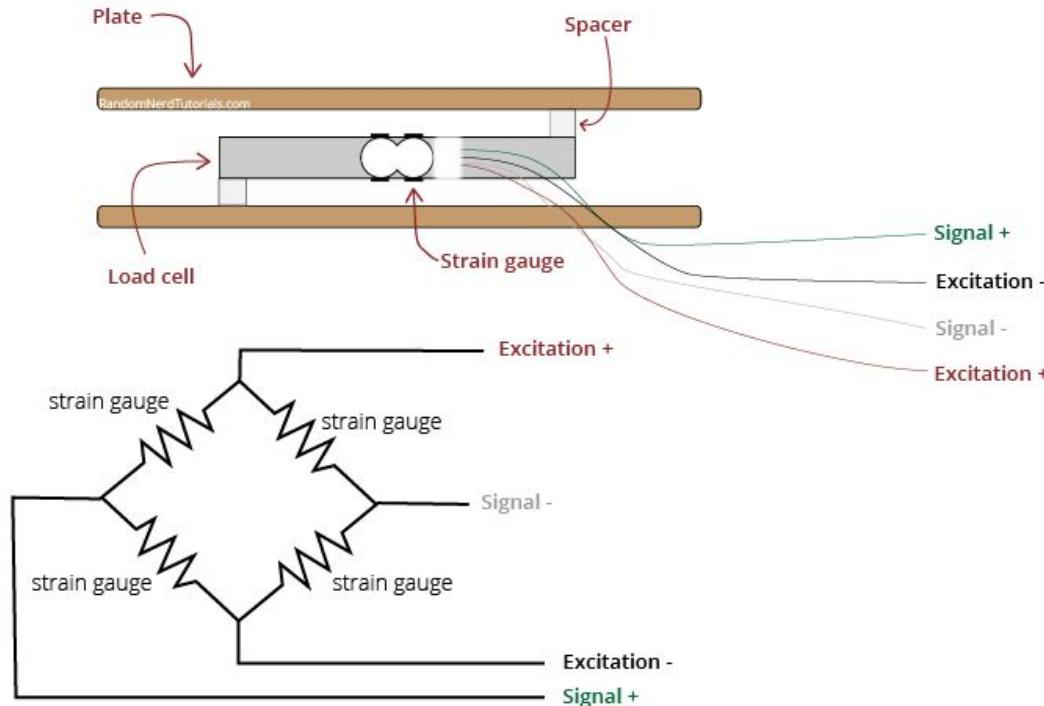
RFID Sensing System (Close-up)



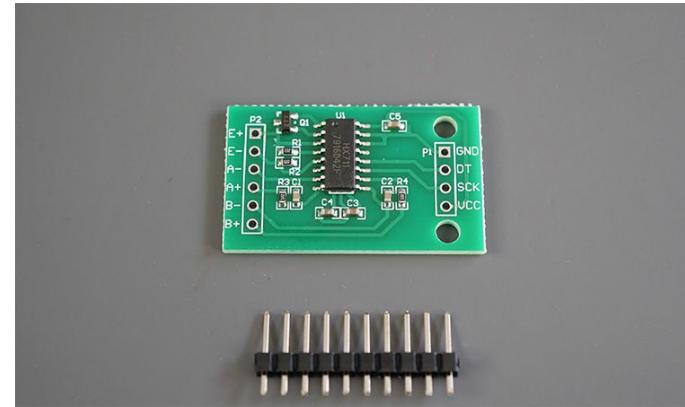
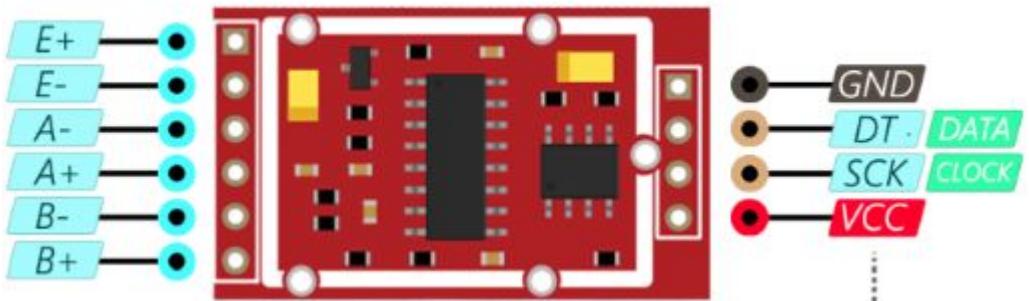
High Level Requirements

- **Dispensing Mechanism:** Drop right amount of food according to the cats specifications

Weight Sensor

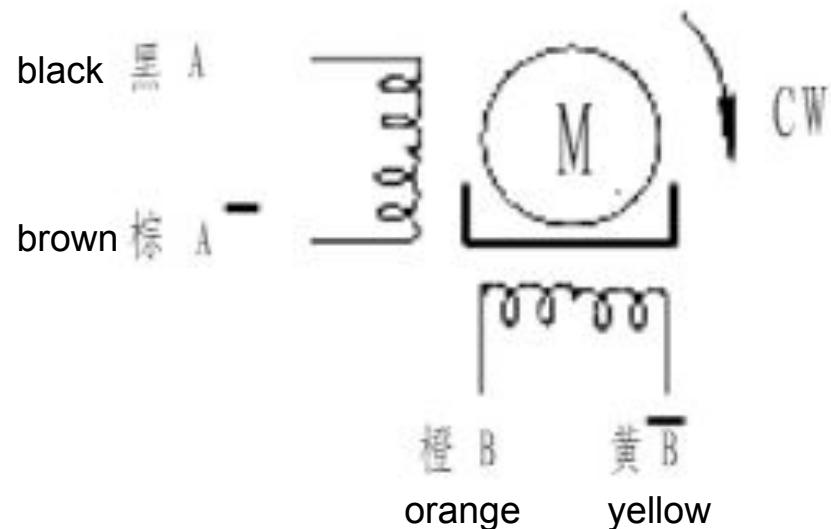


HX711 ADC



*VCC 5V will be provided from USB port on PCB
Convert analog data into digital data(DT) to
microcontroller

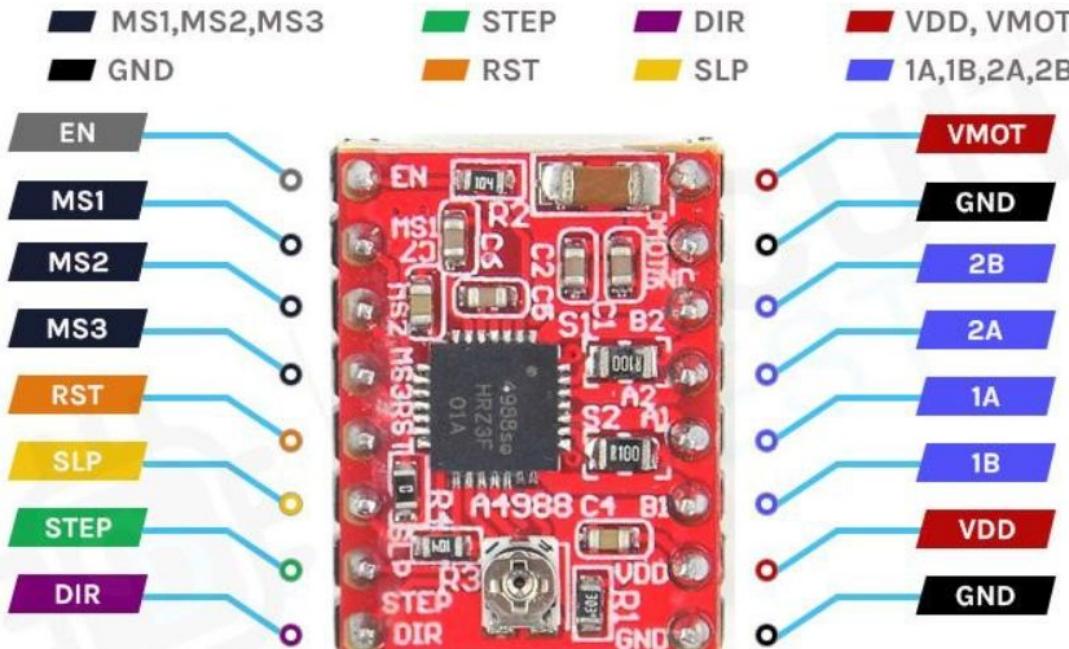
Motor



Two phase mercury(stepper) motor

Wiring inside motor: Two inductors provide full rotation

Motor Driver (A4988)



Verification Tables

Requirement	Verification
12 V for the stepper motor to work and 5 volt for the stepper motor driver A4988 and HX711 to be activated	Use a multimeter to measure the output voltage across the stepper motor driver and motor to see the actual voltage
USB port provided 5 V and the regulator can bring that voltage to 3.3V for the usage of the other parts such as MCU (esp32)	Use a multimeter to measure the output voltage across the USB port and on the MCU voltage supply port.

Requirement	Verification
The ESP32 microcontroller must process user input to set food portions in grams.	Verify the system accurately dispenses the set food portion in grams.
The system must accurately control the stepper motor via PWM signals to dispense the set food portion.	Set various food portions and verify the stepper motor's operation matches the set food portion. Ensure it dispenses exactly 1 gram.
The ESP32 must communicate with the RFID reader module via SPI to identify pets.	Test the system to ensure the RFID reader accurately identifies each pet by its unique tag near the food bowl.

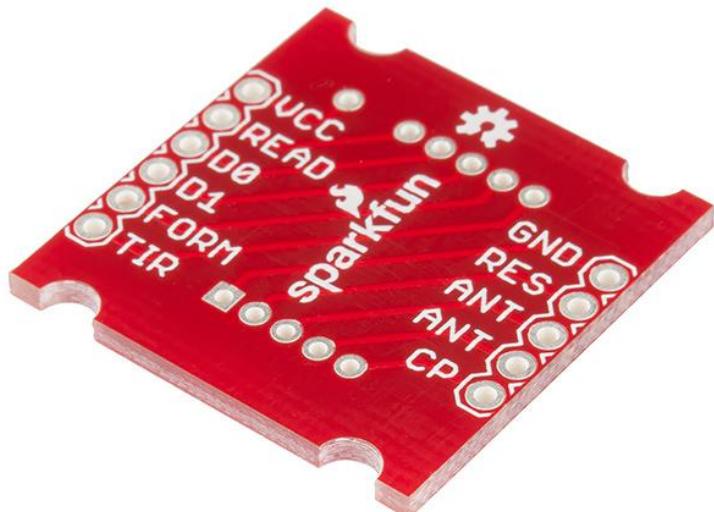
Verification Table



High Level Requirements

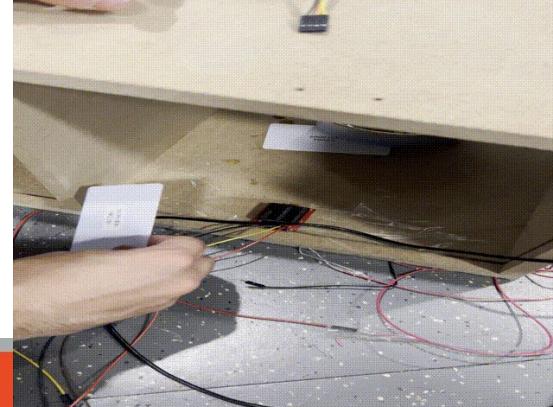
- **Reliable Pet Identification and Differentiation:** Pet feeder can distinguish different cats through the scanning of RFID tags.

RFID System



Verification table

Requirement	Verification
The RFID module must detect RFID labels and send the unique ID to the control system.	Place RFID labels at various distances within the detection range and verify that the IDs are correctly transmitted to the control system.
The module must operate at a lower voltage for efficiency.	Use a multimeter to measure the operating voltage of the RFID module to ensure it is within the specified range for efficiency.
The coil antenna must be adjustable and optimized for a detection range of approximately 5cm.	Adjust the coil antenna and test the detection range with RFID labels to ensure optimal performance within the specified range.

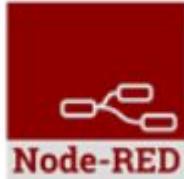


High Level Requirements

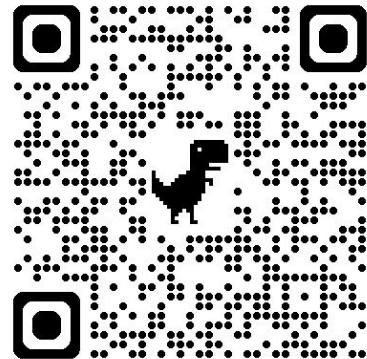
- **User Controlling Panel:** The user can use website to control how much food should be dropped and also add different RFID cat tags.

Local area Network

MQTT Client



-



Verification (user control)

Requirement	Verification
User can look up the weight in the bowl, and set the amount per drop.	User can use wifi page to see the amount in ~1s.
User are able to login to wifi pages	User can scan the QR code
User can add cat name and their RFID tag into the control system.	User can use the pet page to add tags and cats' names.

catFeeder

Right bowl cat: **ttcc**

Left bowl cat: **pp**

Right bowl tag: **6B001CF90A84**

Left bowl tag: **3A002E8BB22D**

RFID

setup_mode



Type ur cat name
ttcc

New match tag Right: **6B001CF90A84**

New match tag Left: **3A002E8BB22D**

Select ur bowl

Right



Weights

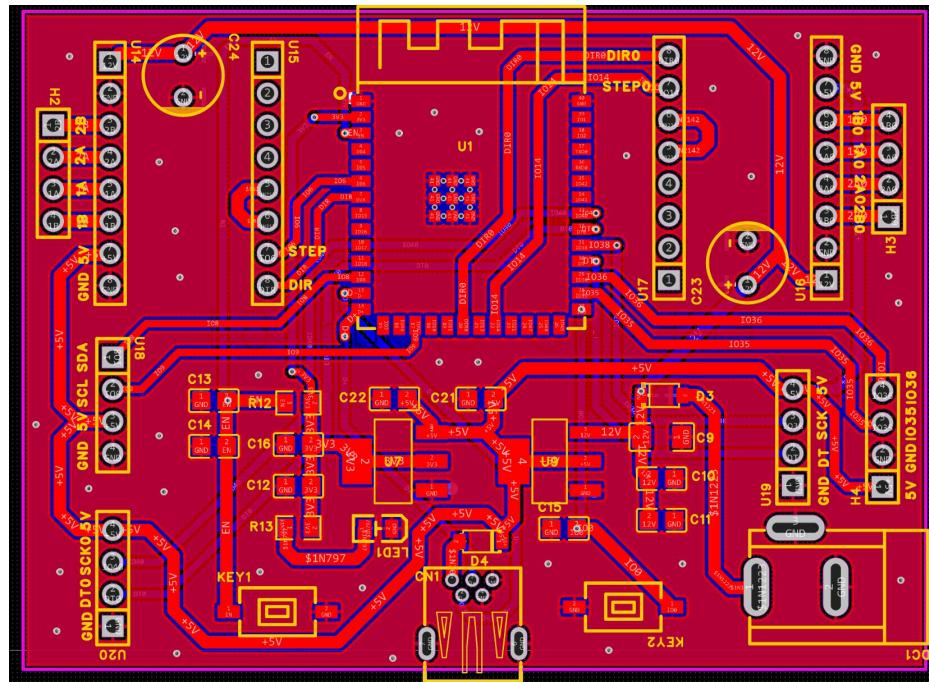
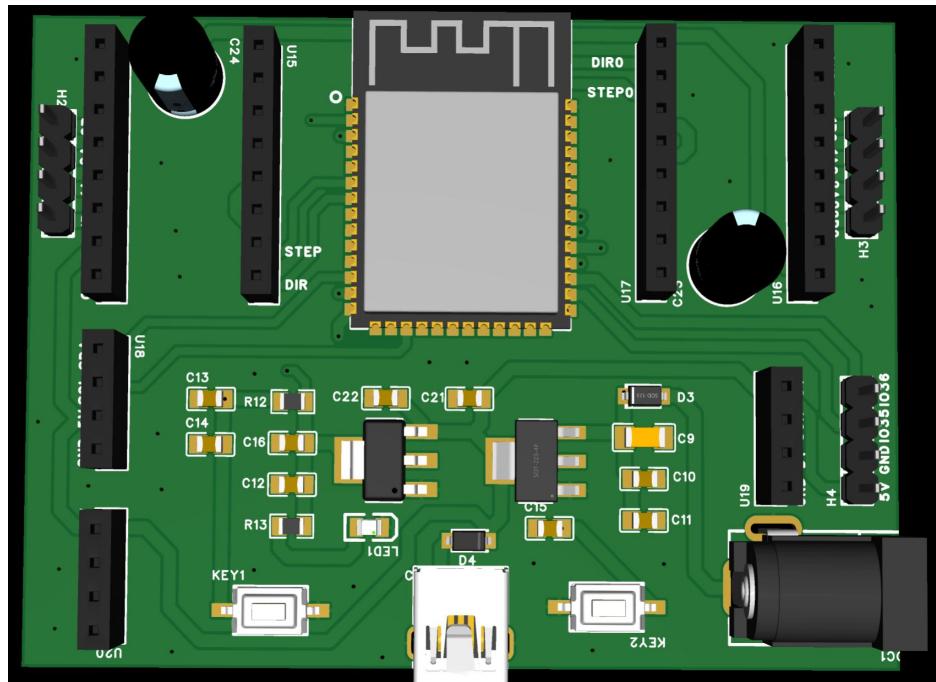
Right bowl weight **40.18**

Left bowl weight **0.03**

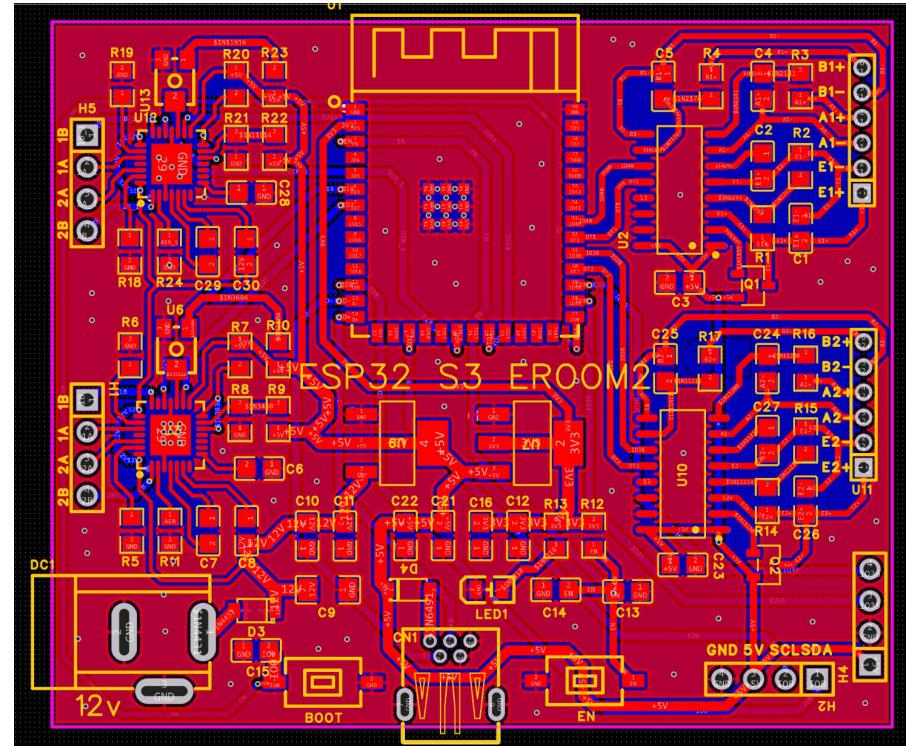
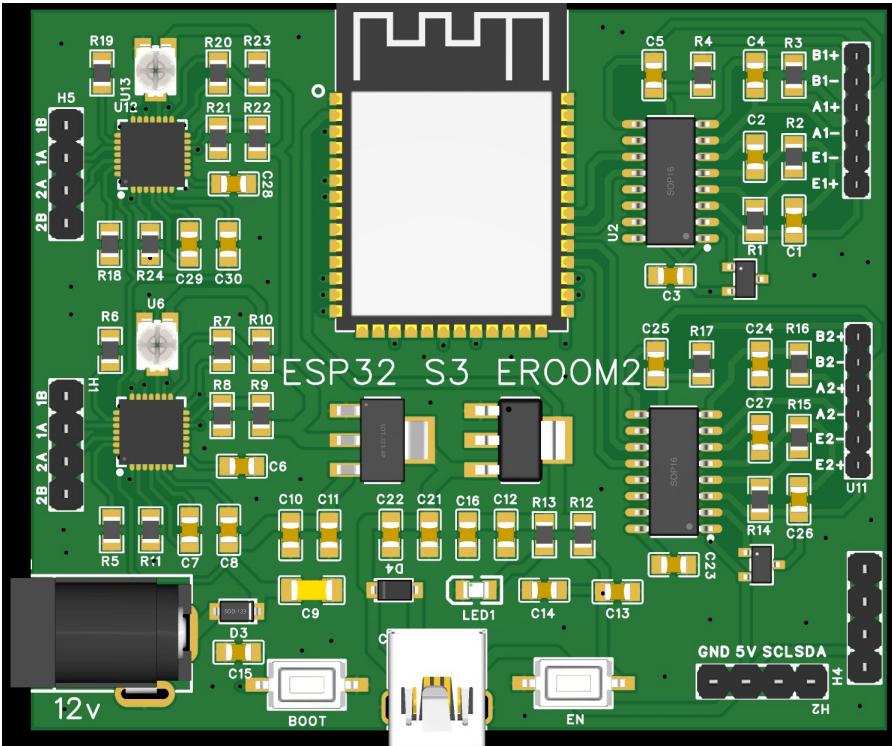
weightL ▼ 30 ▲

weightR ▼ 50 ▲

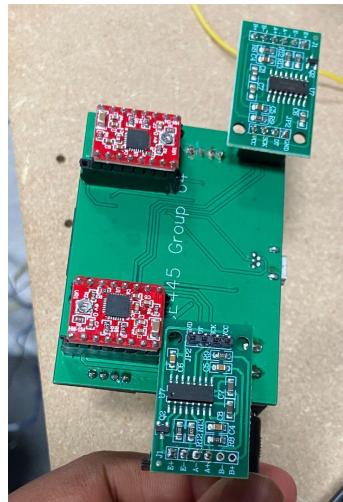
PCB Layout (Plug and play)



PCB Layout



PCB



Future work

- Work on antenna to amplify our RFID detection range
- Put all the wires inside the wood box
- Have the buffer system to make the food drop slowly
- Include the shield part that would block other cats to eat wrong food

Reference

- [1] A. Clivant, "How to use an ESP32 development board to read RFID tags from a sparkfun RFID USB Reader," Techcoil Blog,
<https://www.techcoil.com/blog/how-to-use-an-esp32-development-board-to-read-rfid-tags-from-a-sparkfun-rfid-usb-reader/> (accessed Apr. 25, 2024).
- [2] "ESP32 with load cell and HX711 amplifier (Digital Scale)," Random Nerd Tutorials,
<https://randomnerdtutorials.com/esp32-load-cell-hx711/> (accessed Apr. 25, 2024).
- [3] "Esp32 MQTT publish subscribe with Arduino Ide," Random Nerd Tutorials,
<https://randomnerdtutorials.com/esp32-mqtt-publish-subscribe-arduino-ide/> (accessed Apr. 25, 2024).
- [4] "Control Stepper motor with A4988 driver module and ESP32," Microcontrollers Lab,
https://microcontrollerslab.com/stepper-motor-a4988-driver-module-esp32/#google_vignette (accessed Apr. 25, 2024).

Thank You!