THE PECKER PEEPER

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PAINS AND SOLUTIONS

|	
BIG TIME COMMITMENT WITH LITTLE FLEXIBILITY	ALWAYS ON STANDBY, CAN BE OPERATED WITHOUT 24/7 ATTENTION
DIFFICULT FOR NEWCOMERS TO PROPERLY IDENTIFY BIRDS CORRECTLY	EMPLOYS ML TO CORRECTLY IDENTIFY BIRDS FOR THE USER VIA CAMERA FOOTAGE
BEING PHYSICALLY PRESENT MAY SCARE BIRDS AWAY	BIRD FEEDER CAN BLEND INTO ENVIRONMENT AND DOES NOT NEED A PERSON'S PHYSICAL PRESENCE TO OPERATE
NON-BIRDS DEPLETING BAIT AND FOOD	ANTI-PEST/SQUIRREL FEATURE

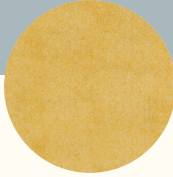# BLOCK DIAGRAM
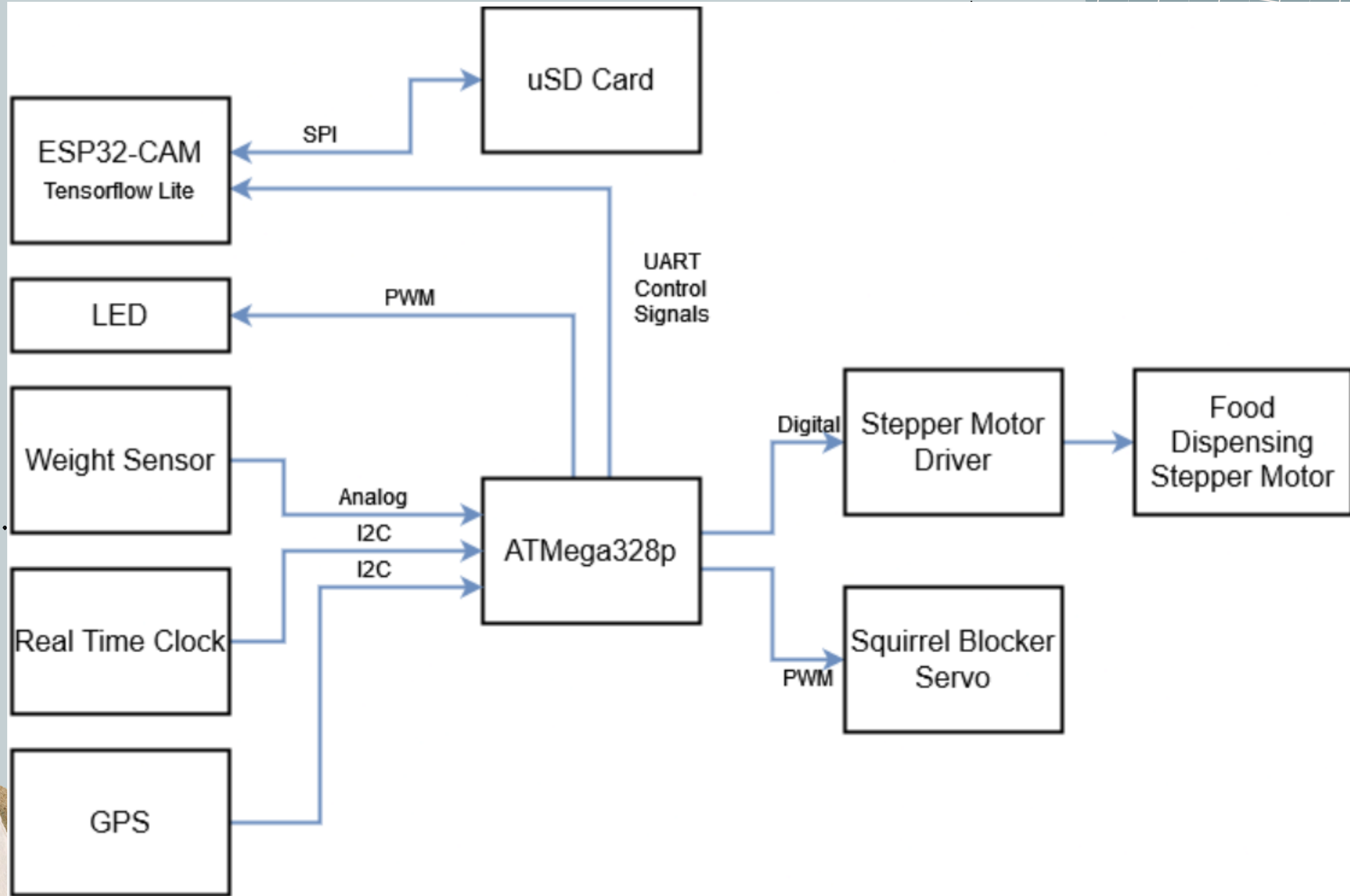
PRIMARY MCU: ATMEGA328P

- AVR 8-bit MCU
- 32 kB flash memory
- 1 kB EEPROM
- 2 kB SRAM
- Power Consumption
  - Active mode: 1.5mA at 3V – 4MHz
  - Power-down mode: 1μA at 3V
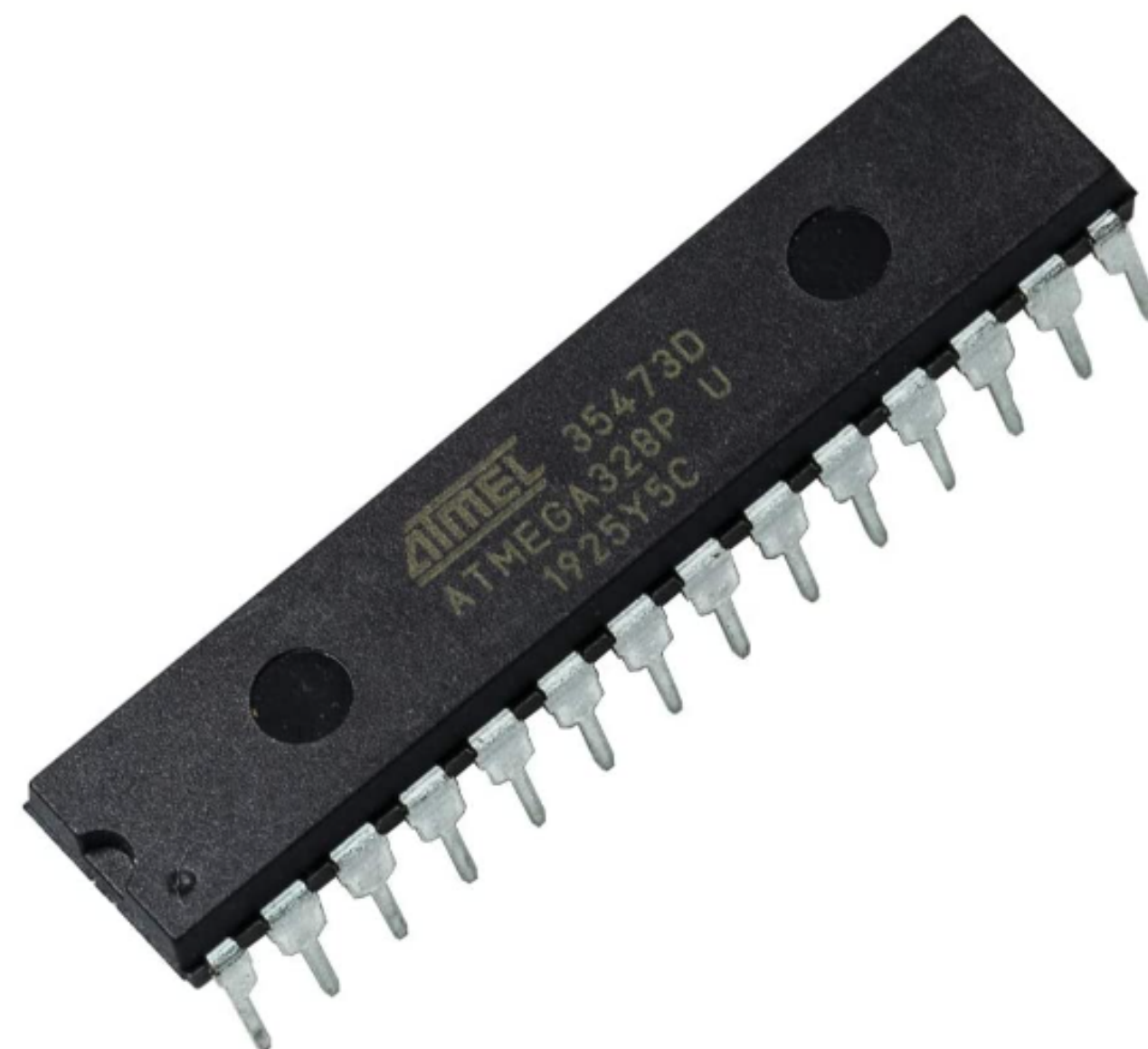
SECONDARY MCU + CAMERA: ESP32-CAM

- ESP32-S SoC
- Takes video, stores video in uSD card
- Will also run CNN bird identification
- Includes OV2640 camera sensor, uSD slot, external RAM, antenna
- Standby power consumption is too high (80 mAh) so power is switched by a relay controlled by ATMega
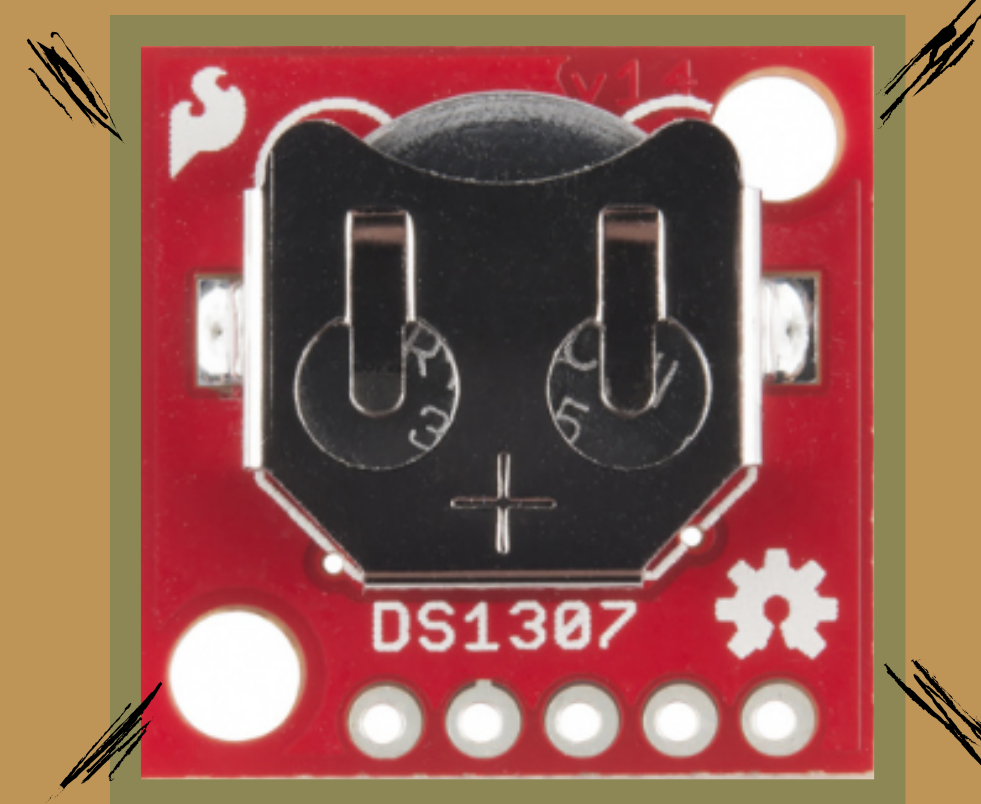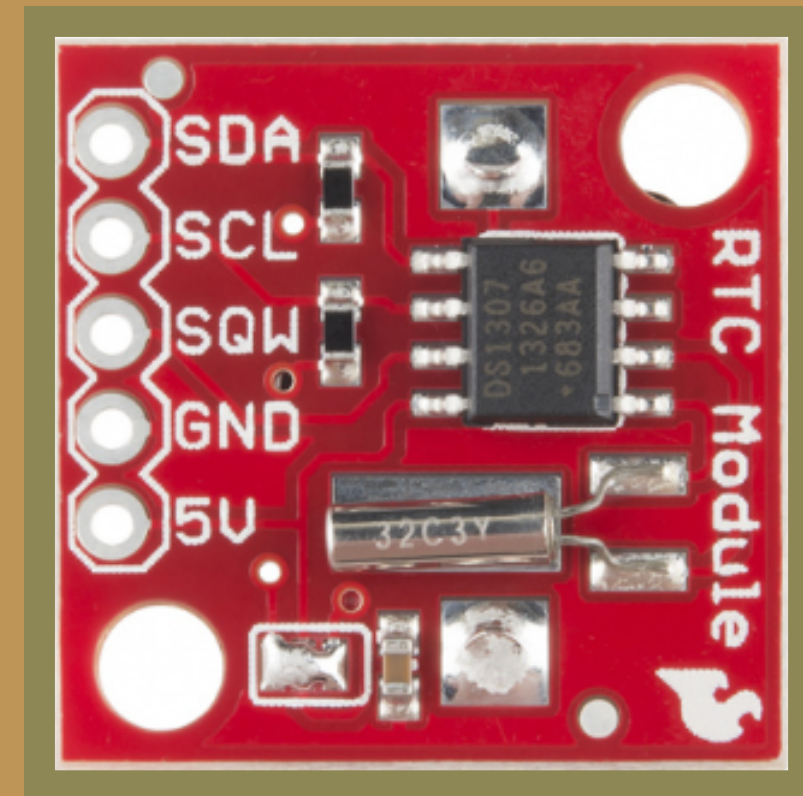- Antenna currently unused but may use in the future
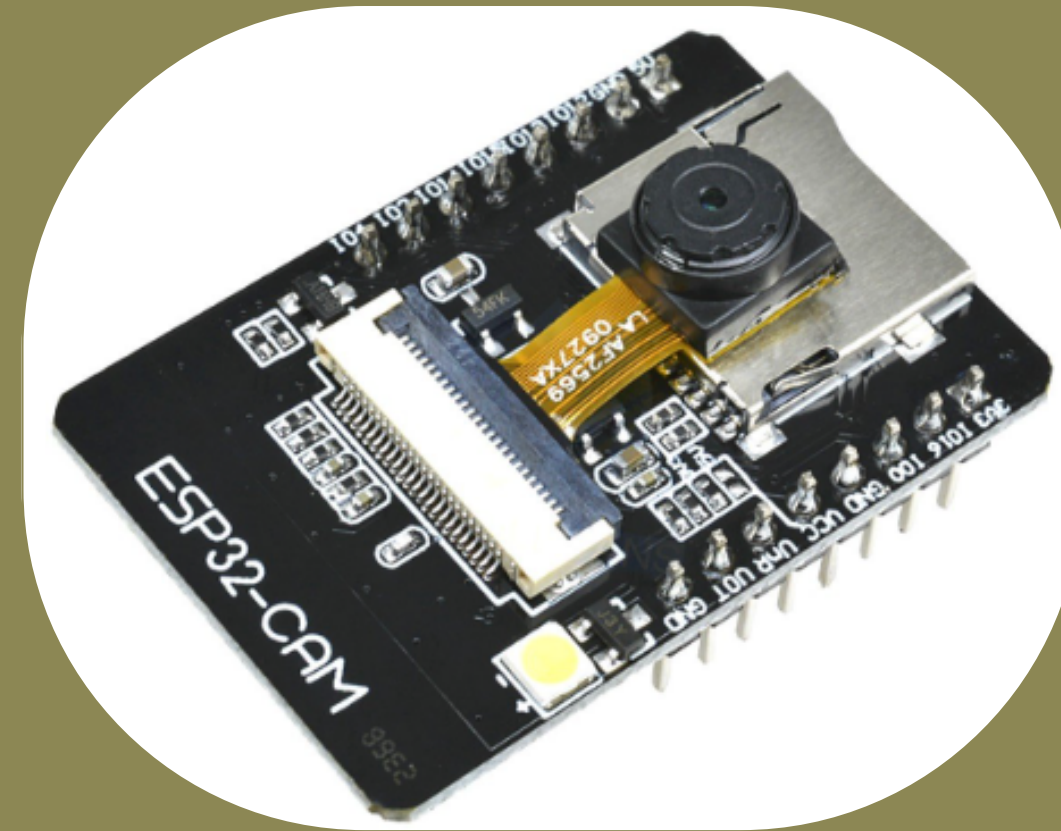
NIGHT-TIME LED

- Dim LED to illuminate birds at night-time
- OV2640 image sensor doesn't have infrared but can function in low light levels
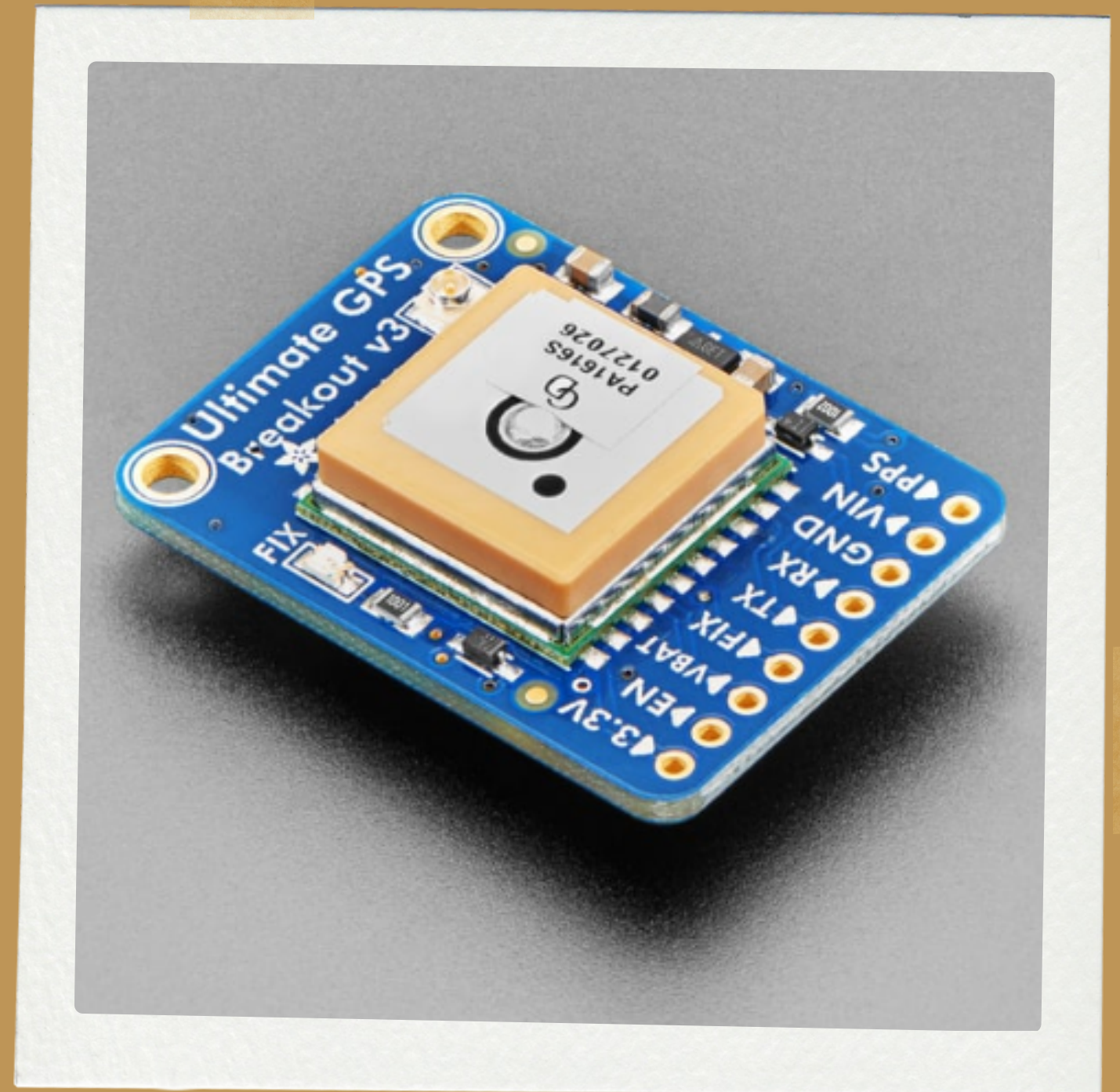
REAL TIME CLOCK: SPARKFUN BOB-12708

- Convenient module incorporation DS1307 RTC w/ oscillator
- I2C Communication
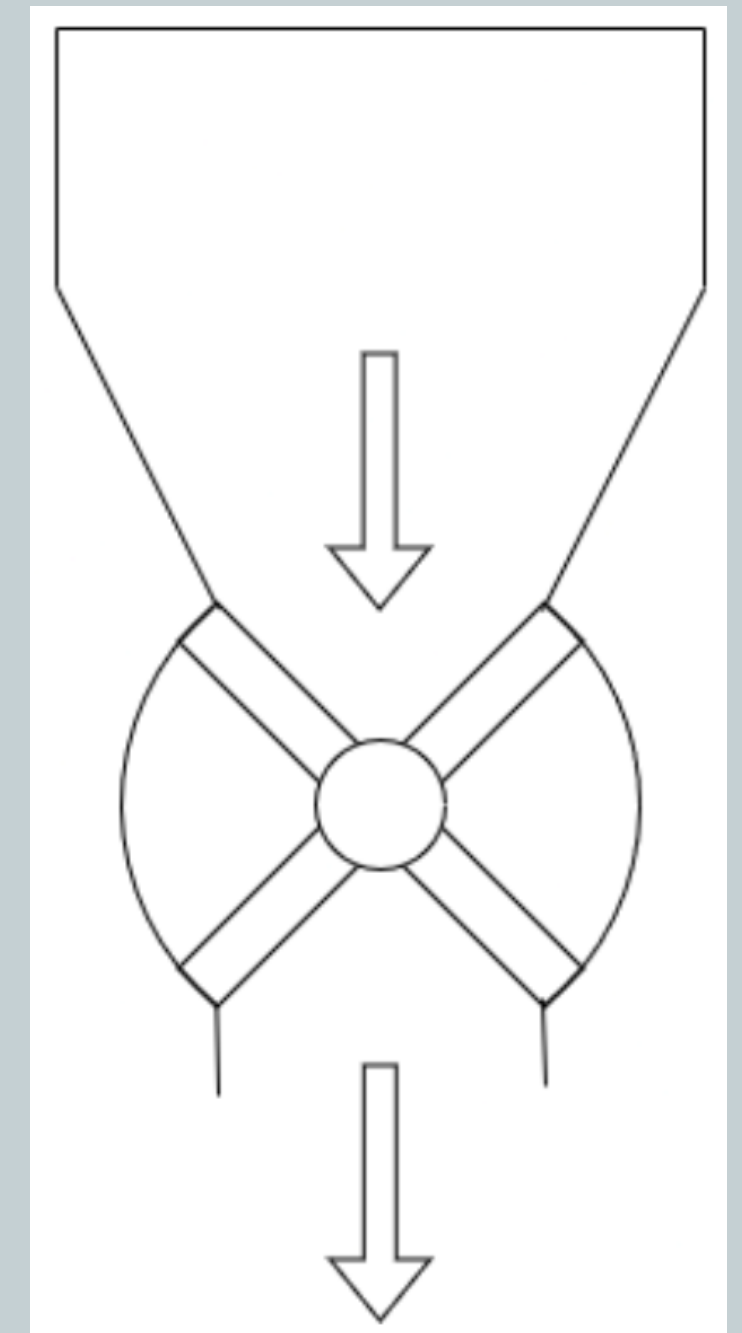- Includes coin cell battery backup

GPS: ADAFRUIT 746

- MTK3339 GPS module
- Used to record location of saved videos

FOOD DISPENSING: STEPPER MOTOR

- Food is stored above feeding area
- Stepper motor dispenses food in discrete amounts by rotating a rotor

ANTI-SQUIRREL DEFENSE SERVO: TOWER PRO SG90
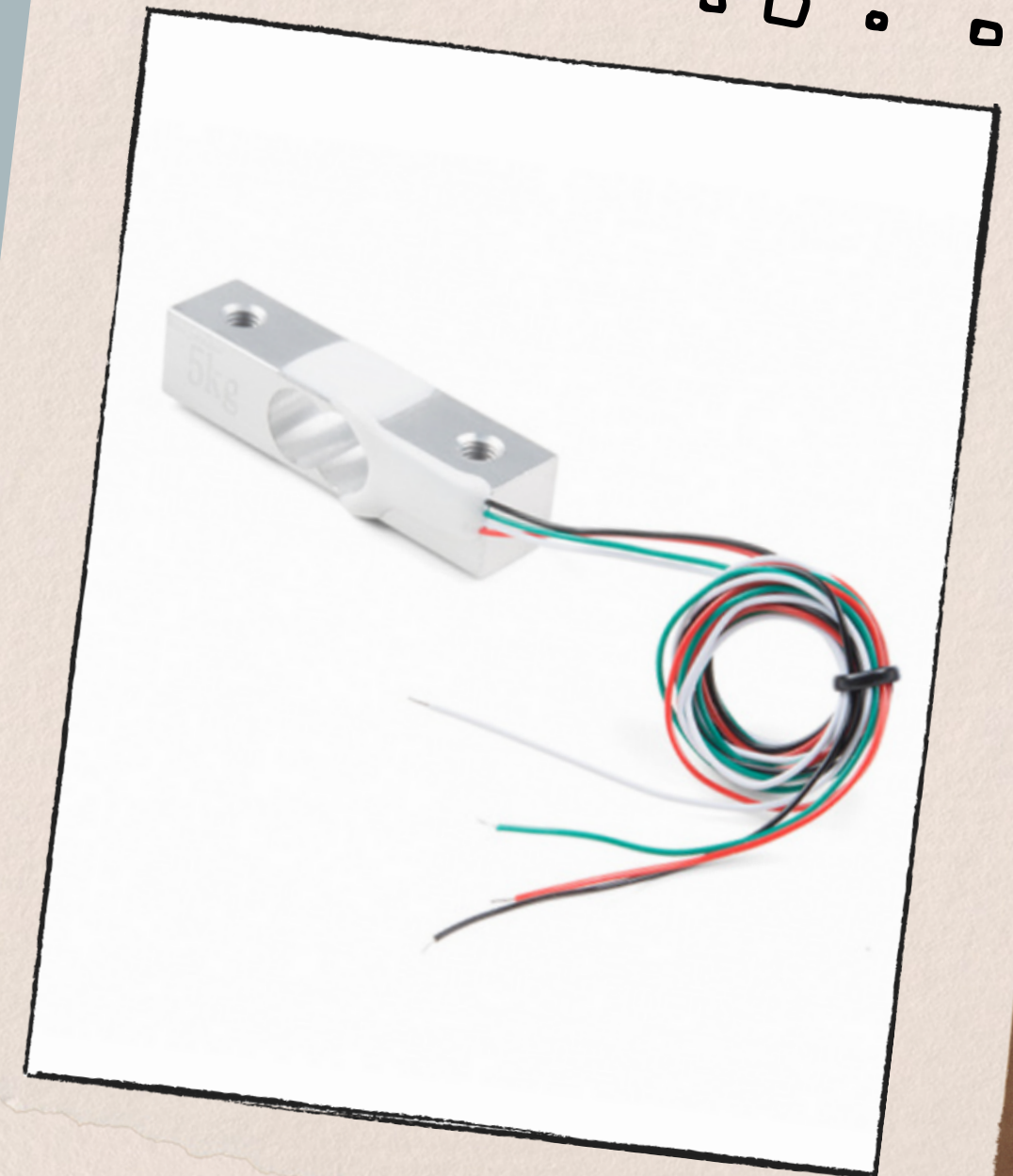
- When the weight on the load cell is above a certain threshold, close a door using a servo to block access to the food
- Possibility of overlap between light squirrels and heavy birds
- Optional because squirrels are cool too

WEIGHT SENSOR: 5 KG LOAD CELL

- Measures weight of what is perched eating food
- Used to activate trail camera
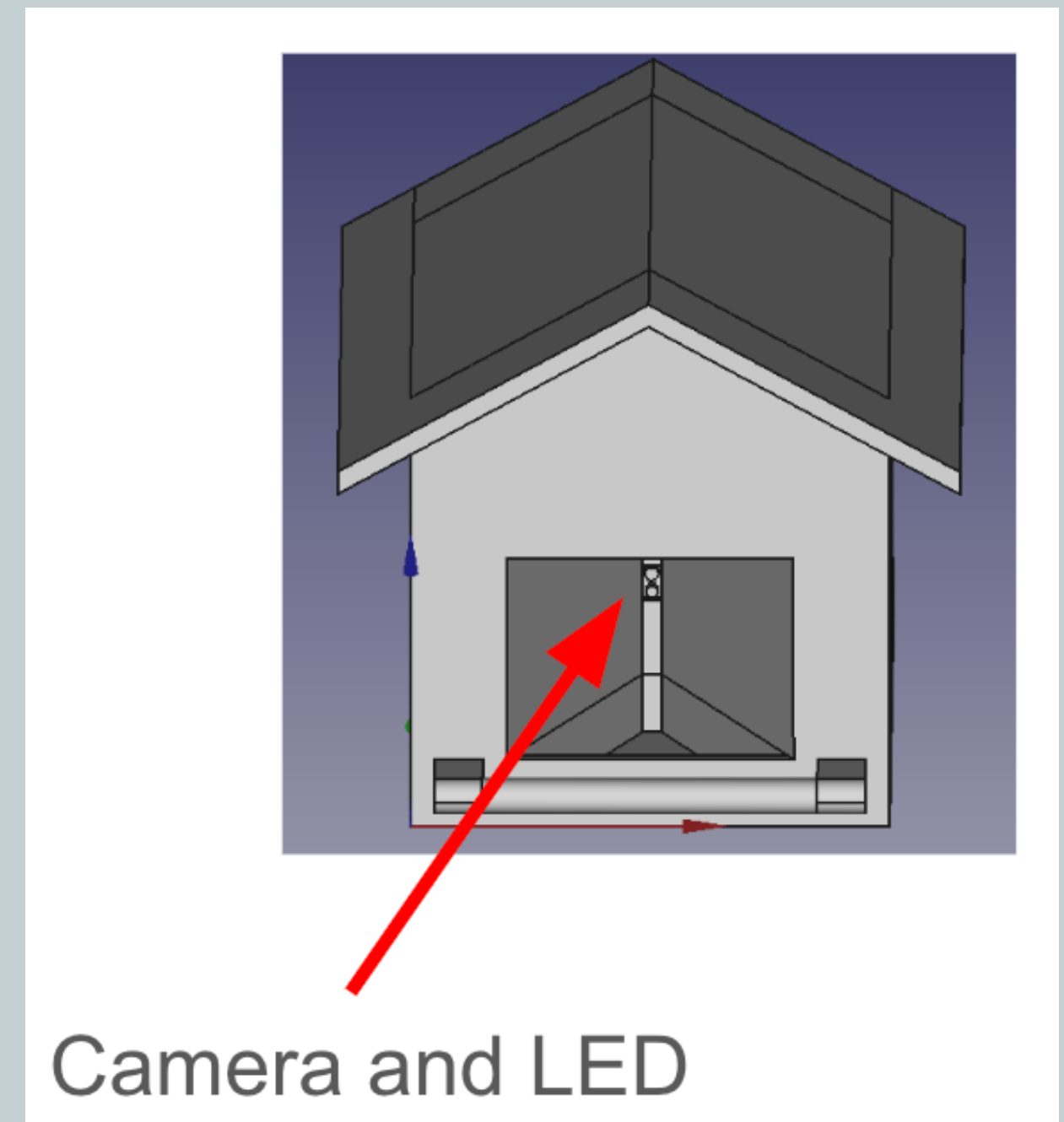- Used for anti-squirrel defense

POWER

- Primary power: 5V USB/barrel jack power input
- Can use wall-wart if available or USB power bank for easy remote deployment
- Issue: can't monitor USB power bank capacity
- However, data is saved on uSD card which will retain data even if power is lost
- Basic power calculations required to estimate desired battery capacity
- Considering solar panels

BASIC UGLY CONCEPT CAD

Food

Perch with
weight sensor

Electronics
stored in back

Food dispensing slot
(Food stored above)

Camera and LED
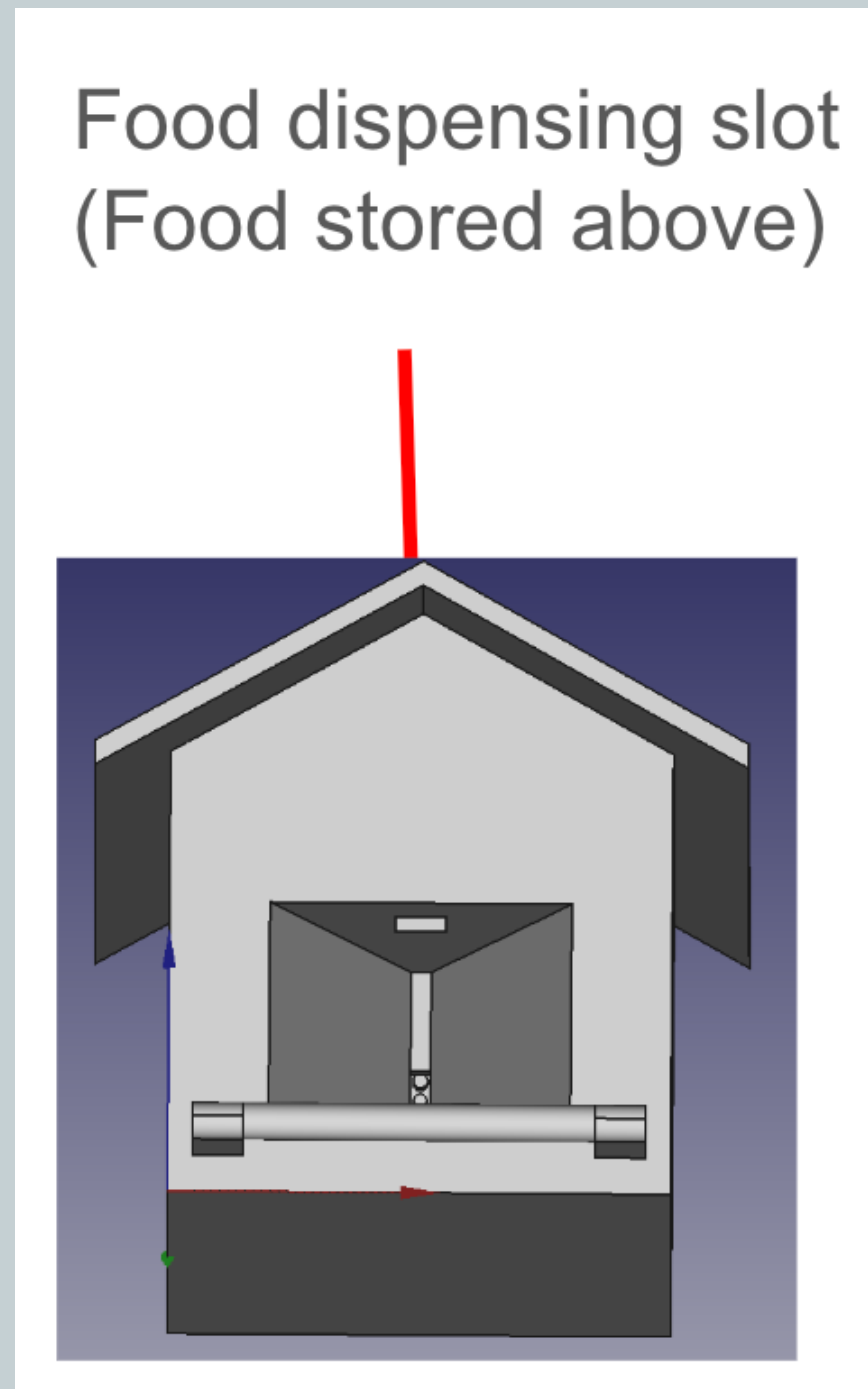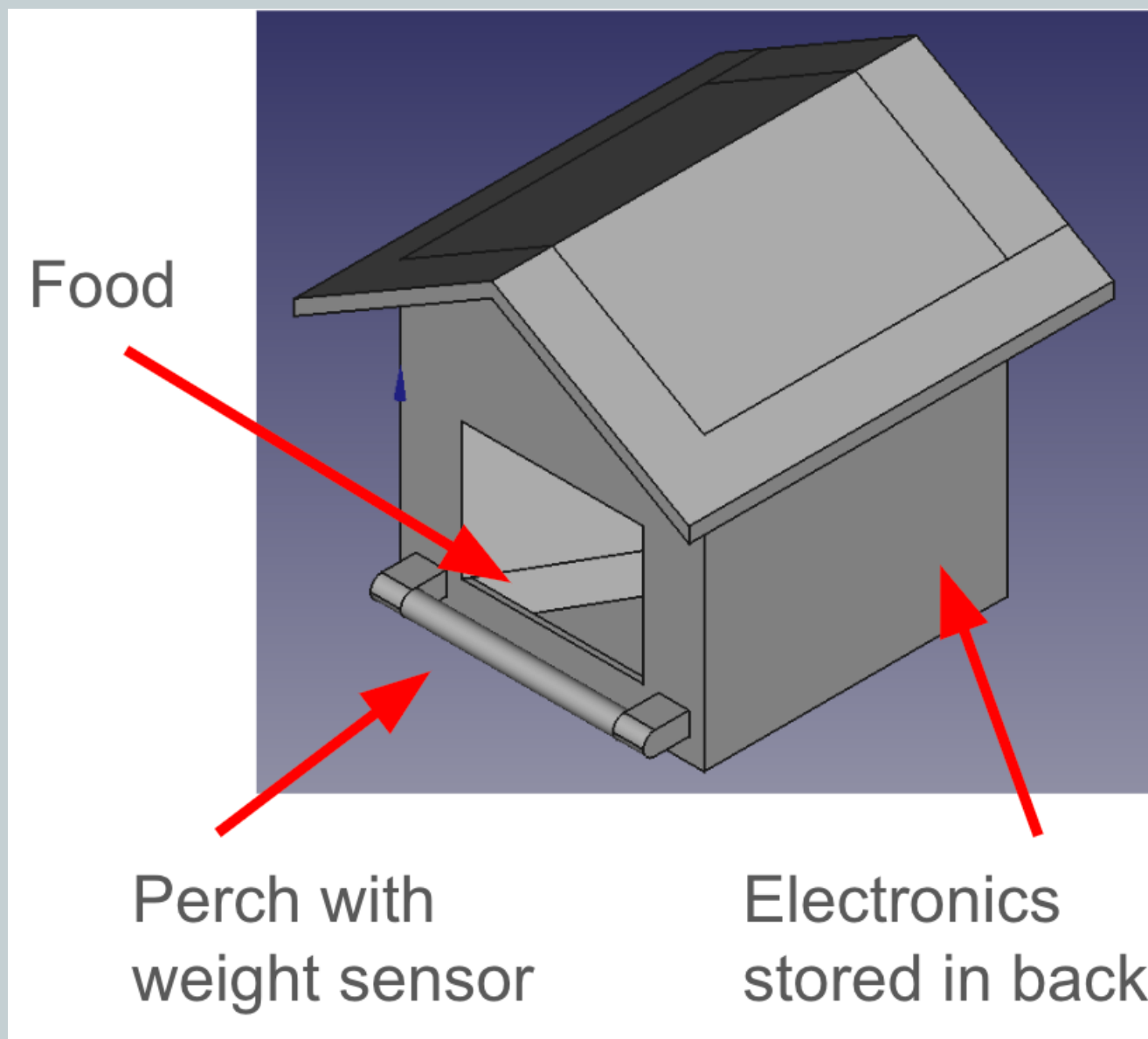
SOFTWARE OVERVIEW

TENSORFLOW MACHINE LEARNING MODEL

Will be used to identify and classify birds based on their species from camera images

KERAS

Tensorflow High-level API used for classification

DATASET

Online database of 450 species and over 70,000 images
Papers with Code
GitHub

MODEL TRAINING

1. Identify Bird species of choice (commonly found in the area) and select desired training data
2. Configure dataset for performance, then standardize it
3. Create and compile model
4. Train Model
5. Optimize and update model
6. Convert to a tensorflow lite model that can be uploaded onto the on-board microprocessor

BIRDS

MORE BIRDS!

CONVOLUTIONAL NEURAL NETWORK (CNN) BIRD IDENTIFICATION

- Utilize pre-trained CNN model and fine-tune it for various bird species
- Deploy the model on ESP32 with Tensorflow Lite
- On command from ATMega, run the model on stored video to assign a bird per video (using a select number of frames from the video)

BIRD IDENTIFICATION PROCEDURE

- ML model is not regularly used due to power limitations; will activate upon user request
- ATMega sends UART command to ESP32 to run identification
- For every video stored on the SD card without identification data already stored in metadata, the ESP32 pulls a frame from halfway through the video and inputs it into the model. If a prediction over ~80% certainty is present, the result is saved in metadata. If not, the frames are sequentially pulled from the middle of the remaining video segments until a good prediction is found or a preset limit is reached.


ME WHEN HUNGRY

ME WHILE EATING

VIDEO-TAKING PROCEDURE

1. ATMega328p (abbrev. ATM) polls weight sensor; object is detected
2. ATM reads real-time clock and gps
3. ATM restores power to ESP32
4. ATM communicates timestamp, gps location, and start video command to ESP32
5. ATM polls weight sensor; nothing is read anymore
6. ATM sends command to ESP32 to stop recording and save video along with metadata to uSD
7. ATM shuts ESP32 off
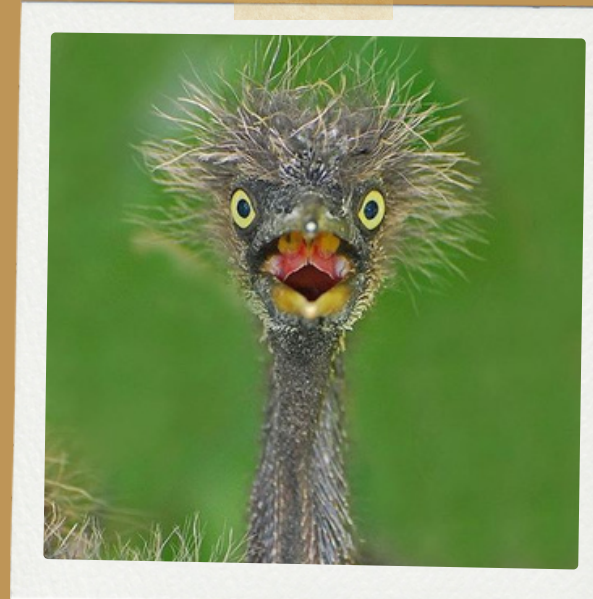
YOU

YOUR CRUSH

HER EX

HER BROTHERS

THANK YOU

me and who?