ALEXA AUTOMATED PET FEEDER FINAL PRESENTATION

GROUP 18

MEMBERS:

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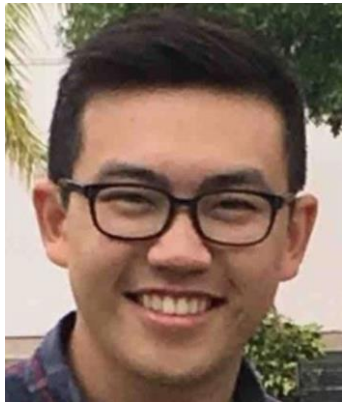
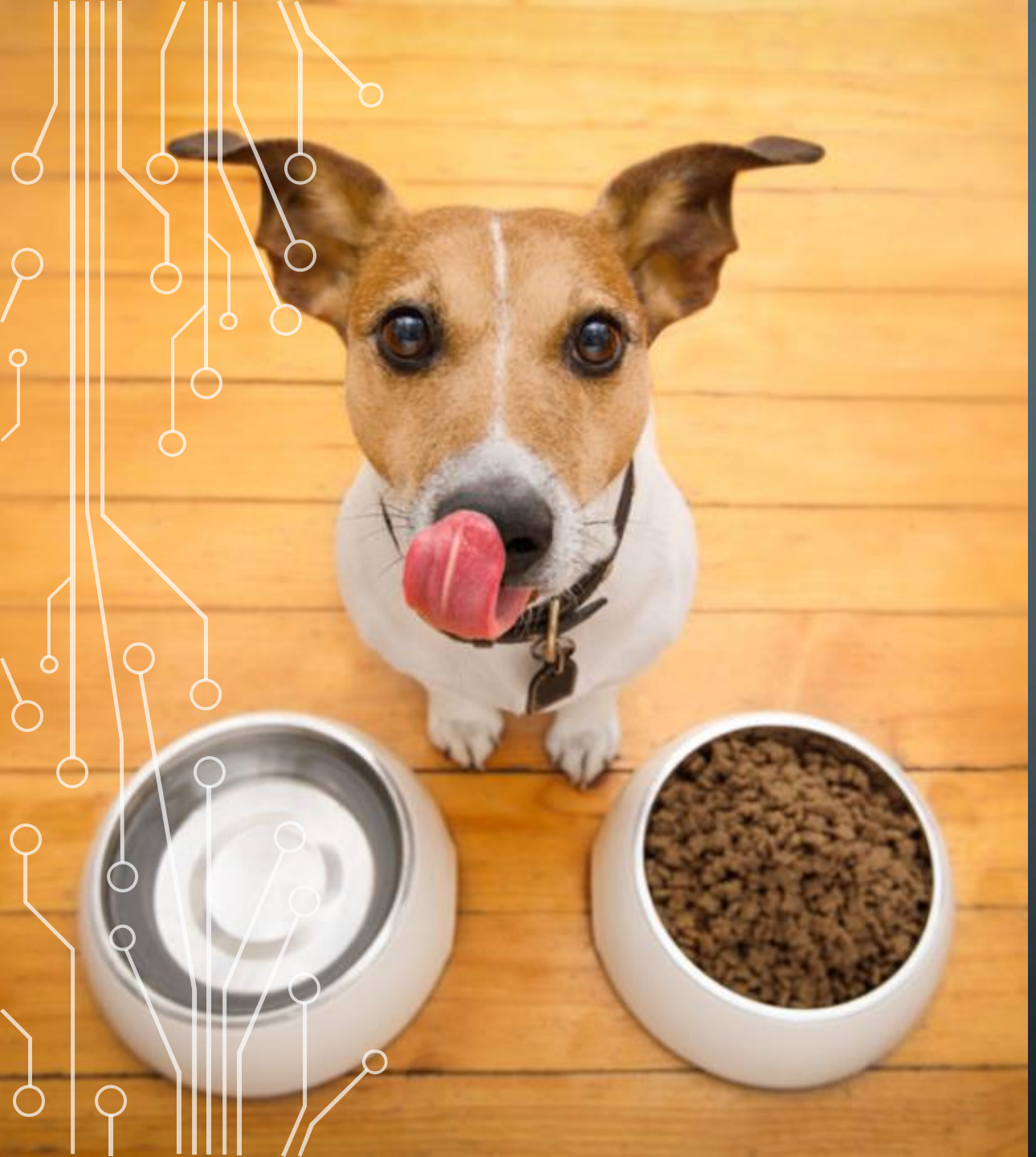




Introduction

- Create an Alexa-Enabled Pet Feeder
- Allow user to feed pet through Amazon Alexa
- See if the Pet has eaten their food through Alexa.

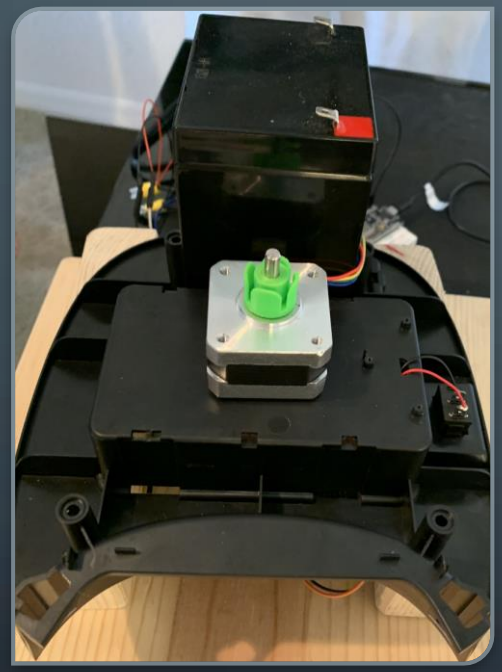
Goals and Objectives

- To provide pet owners with a quick, easy, and hassle-free way to feed their pets
  - Eliminates the need to scoop and measure food for every meal
  - Touch free design doesn't leave the owner's hands smelling like pet food
- To allow owners to care for their pets while away from home
  - Provide piece of mind to owners who get stuck at a long day of work
  - A safer, more regulated alternative to building "food mountain" when leaving for multiple days
- To keep a pet on a routine feeding schedule with regulated food amounts
  - Many pets struggle from over feeding
  - Makes following veterinarian feeding advice easy

Specifications

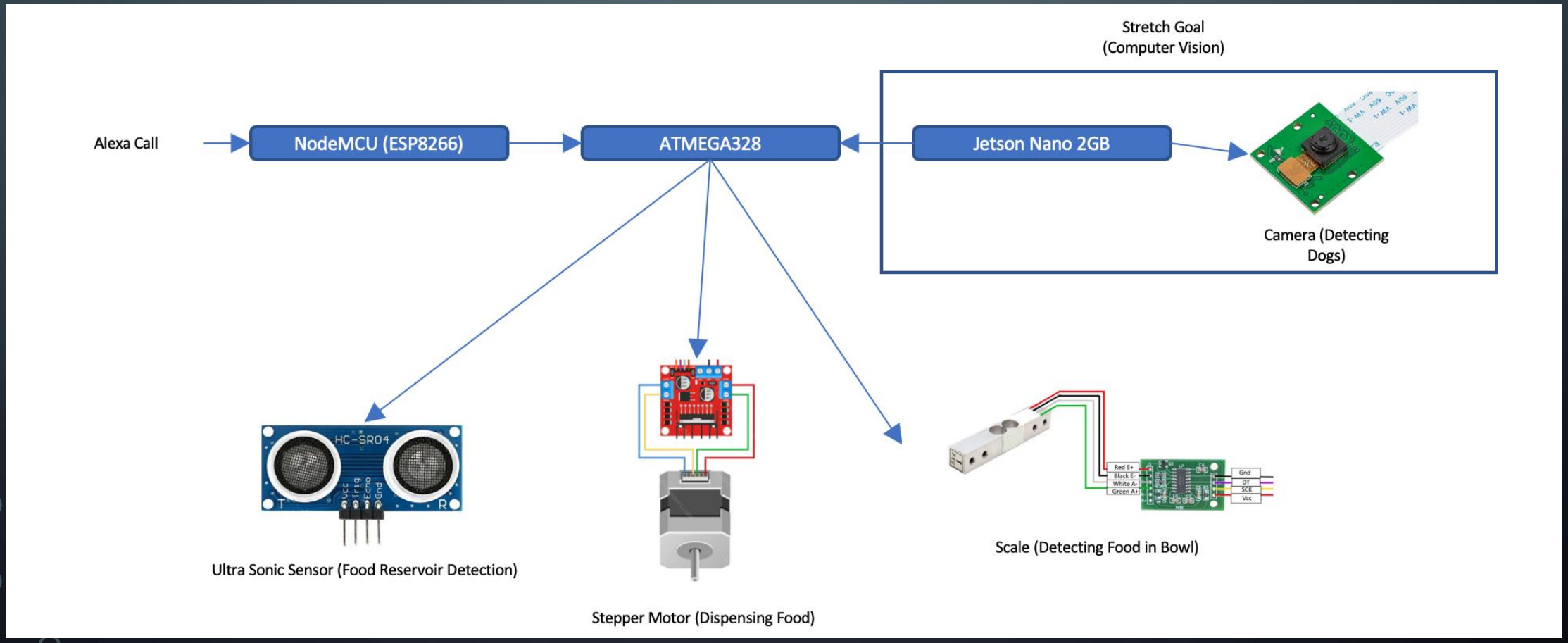
Specification Category	Design Specification
Battery Life	The battery shall last a minimum of 1 week without being plugged in.
Wi-Fi Range	The range of the Wi-Fi module shall cover all the home or at least 100ft.
Reservoir Capacity	Pet Feeder shall be able to contain 3 days' worth of food in the reservoir, or approximately 5 cups.
Weight Sensor Status	Pet Feeder shall stop dispensing once a weight equal to or greater than the threshold weight is reached on the bowl, otherwise the pet feeder will continue to feed.
On Demand Feeding	Pet Feeder shall start dispensing food within 20 seconds after acknowledging command from Alexa.
Reservoir Sensor Status	Pet Feeder shall alert the user, via Alexa, that the reservoir is low once the sensor sees a distance greater than 15cm.

DESIGN OVERVIEW



- Prefabricated housing with integrated pressure plate, battery and sensors
- Food reservoir fill port with lid
- Rotor driven food dispenser
- Wireless, battery operated, and rechargeable
- Fully enclosed: pet tamper resistant

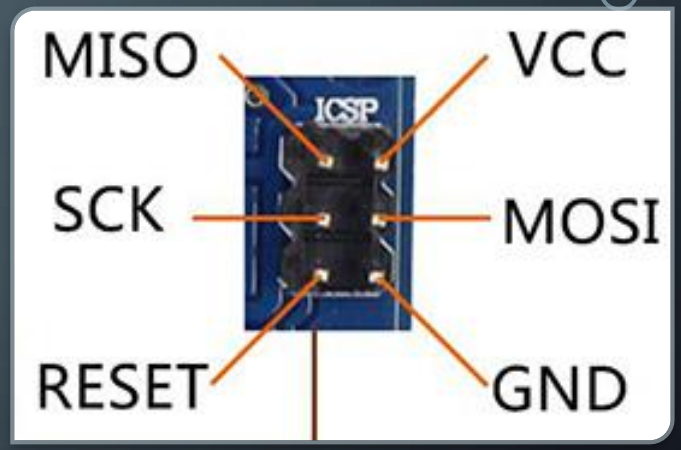
Design Overview (Continued)

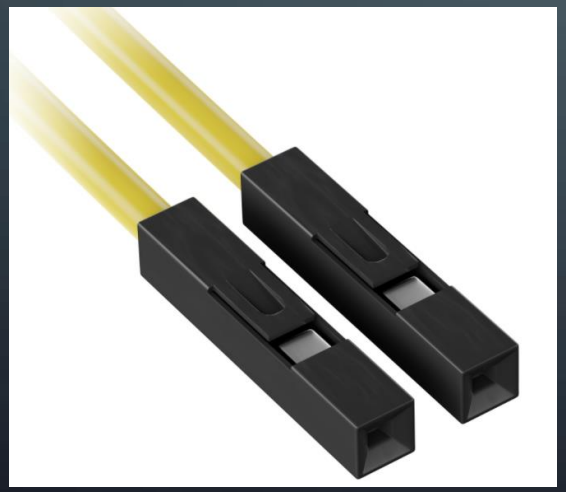


SOFTWARE INTEGRATION

ICSP- IN-CIRCUIT SERIAL PROGRAMMING

- Eliminate dip sockets from PCB
- On board programming

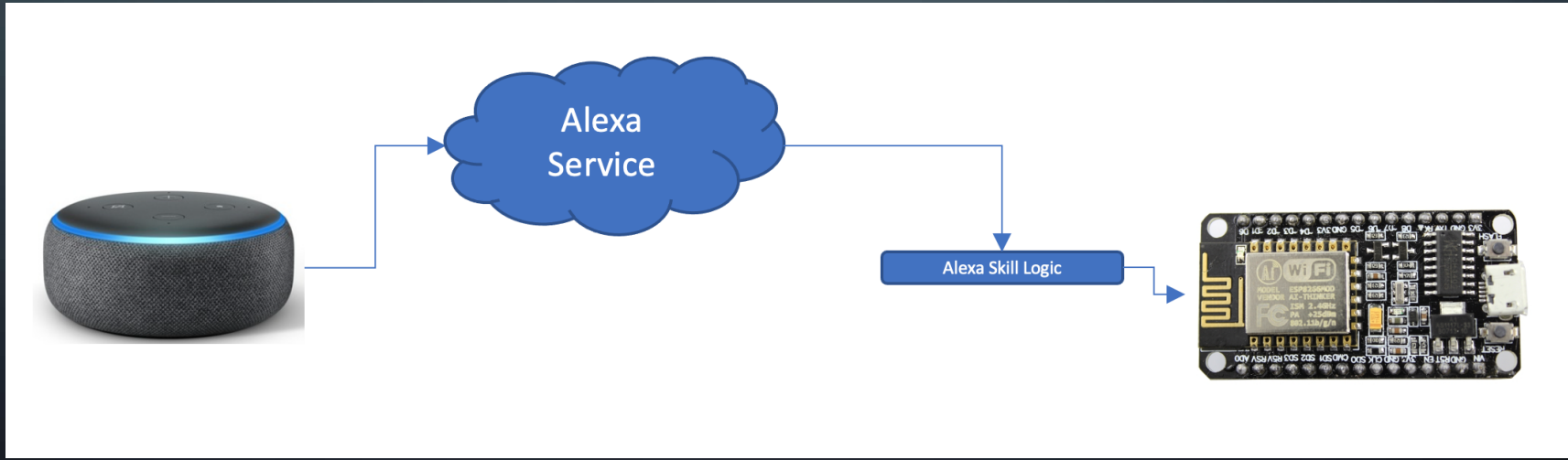




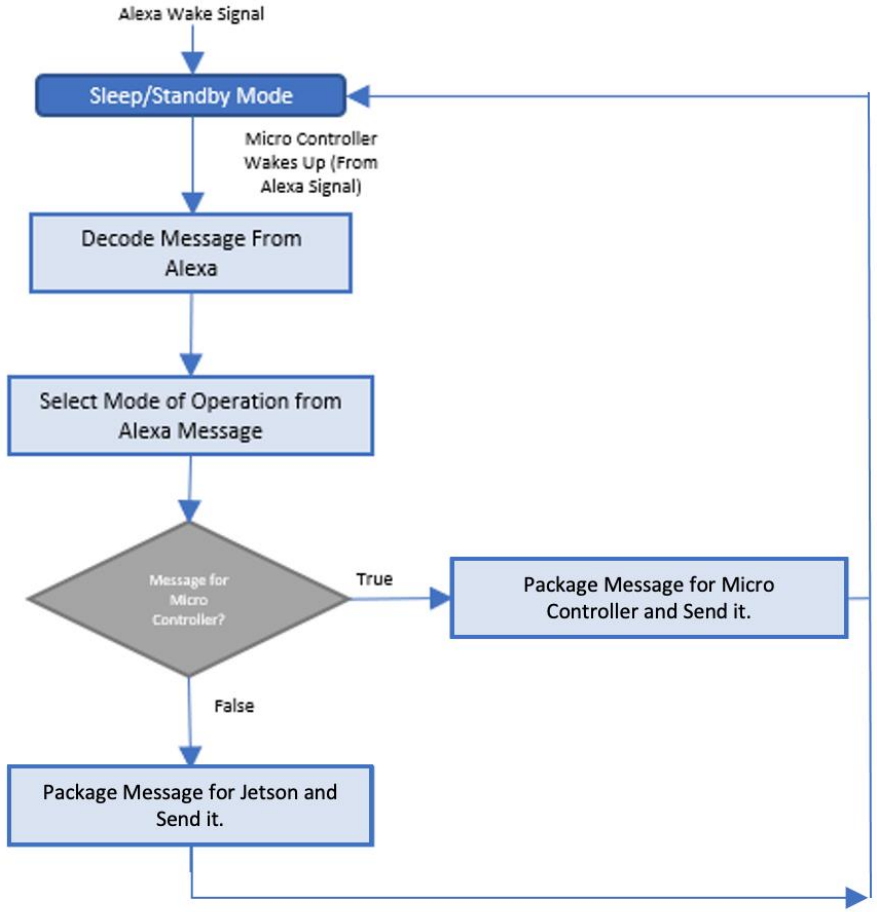
Programmer (Arduino Uno)	Target Board (ATmega328)
SCK (Pin 13)	Pin 19
MISO (Pin 12)	Pin 18
MOSI (Pin 11)	Pin 17
SS (Pin 10)	Reset
GND	GND
+5V	+5V

ALEXA INTEGRATION

- As discussed earlier, the NodeMCU will be the broker between Amazon Alexa and the Pet Feeder.

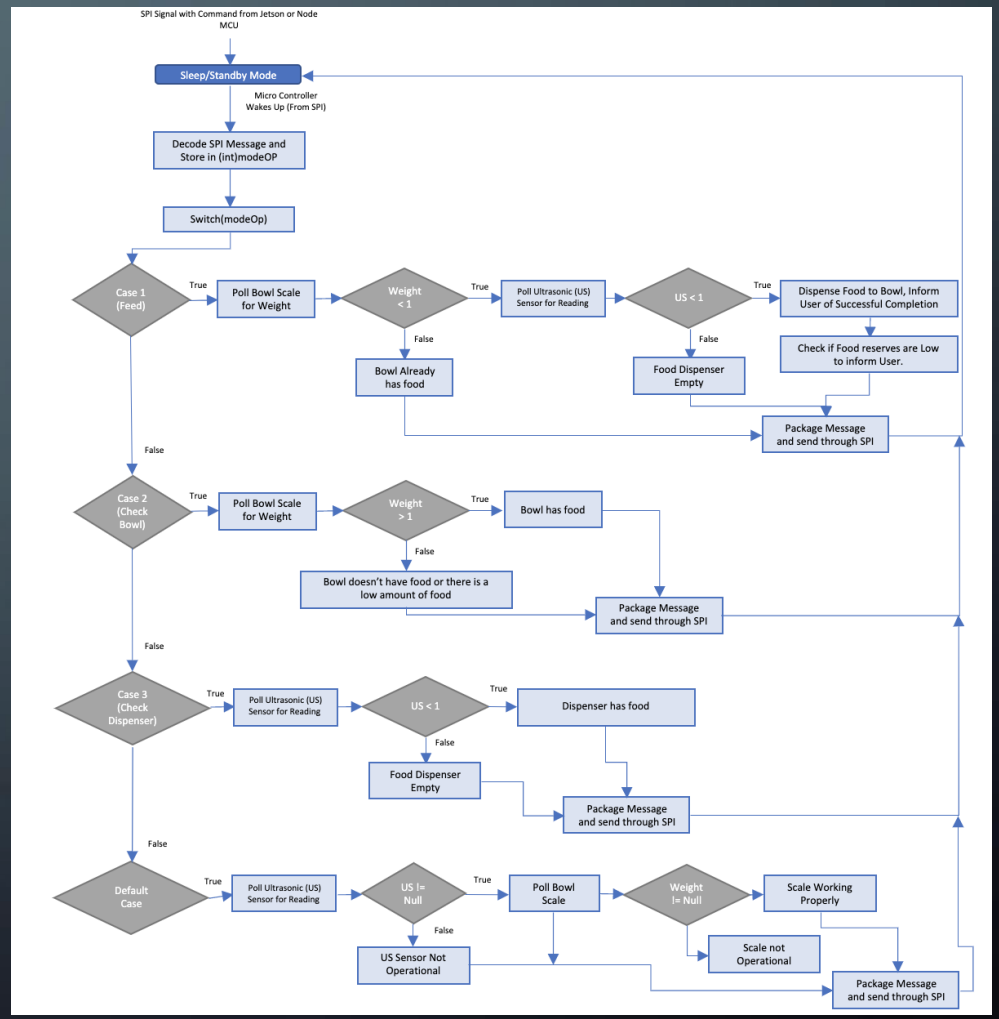


NODEMCU CODE BLOCK DIAGRAM

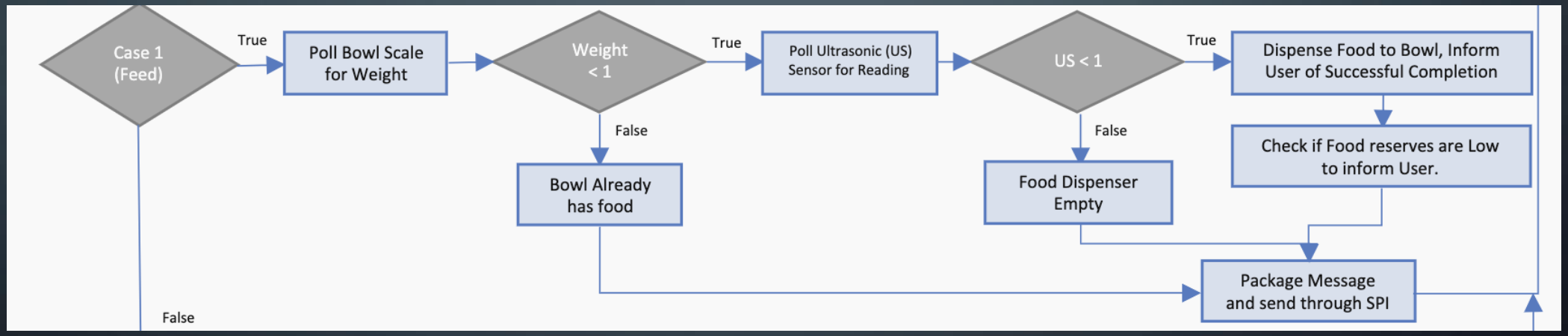


ATMEGA SOFTWARE BLOCK DIAGRAM

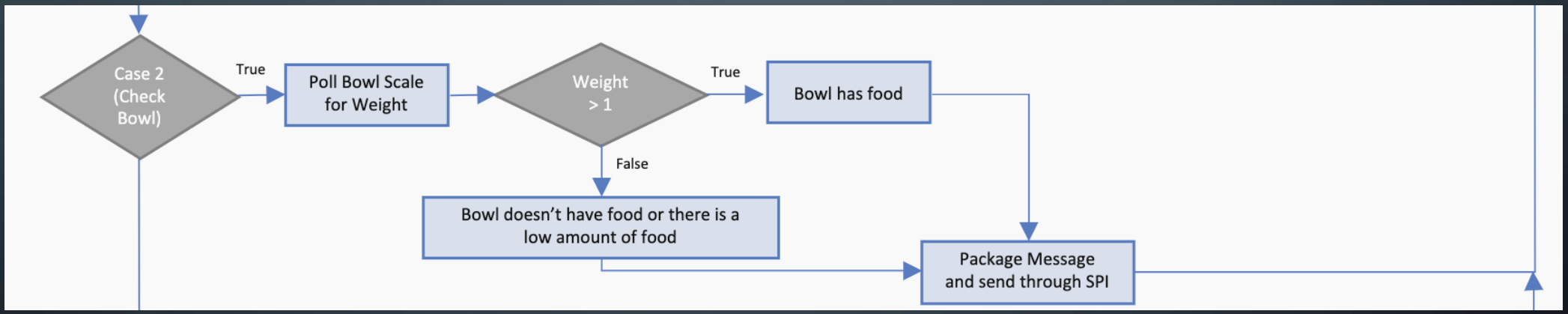
- The microcontroller will be on standby
- Once there is a request then there will be different switch cases



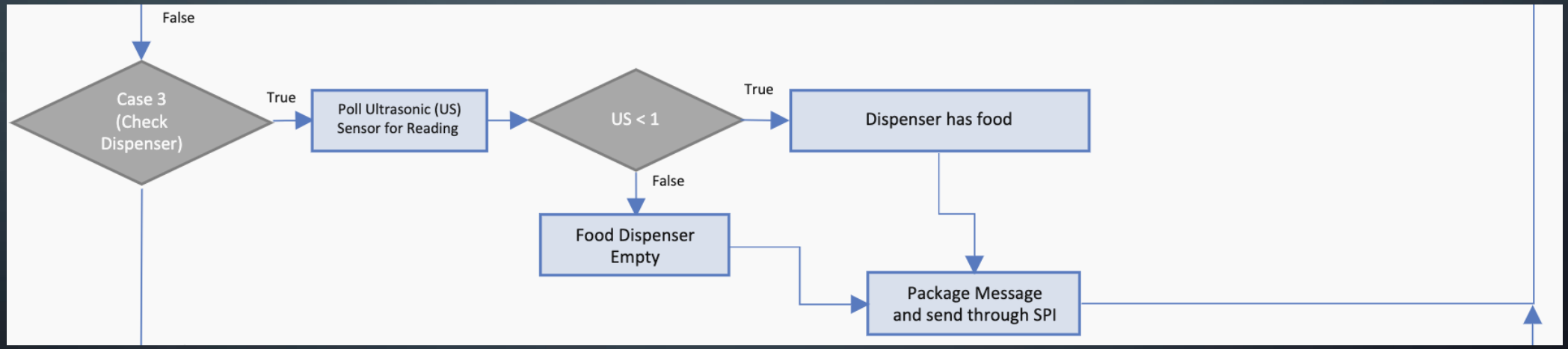
ATMEGA: CASE 1



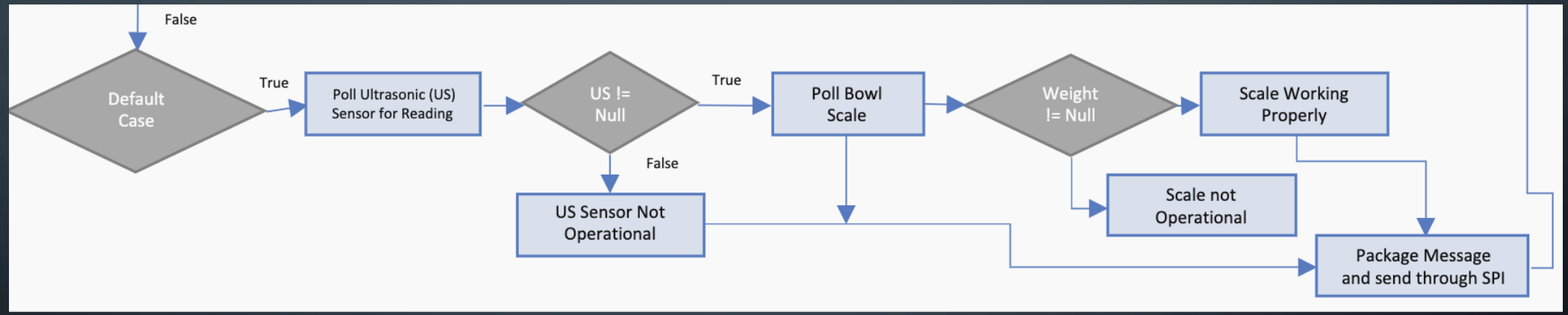
ATMEGA: CASE 2

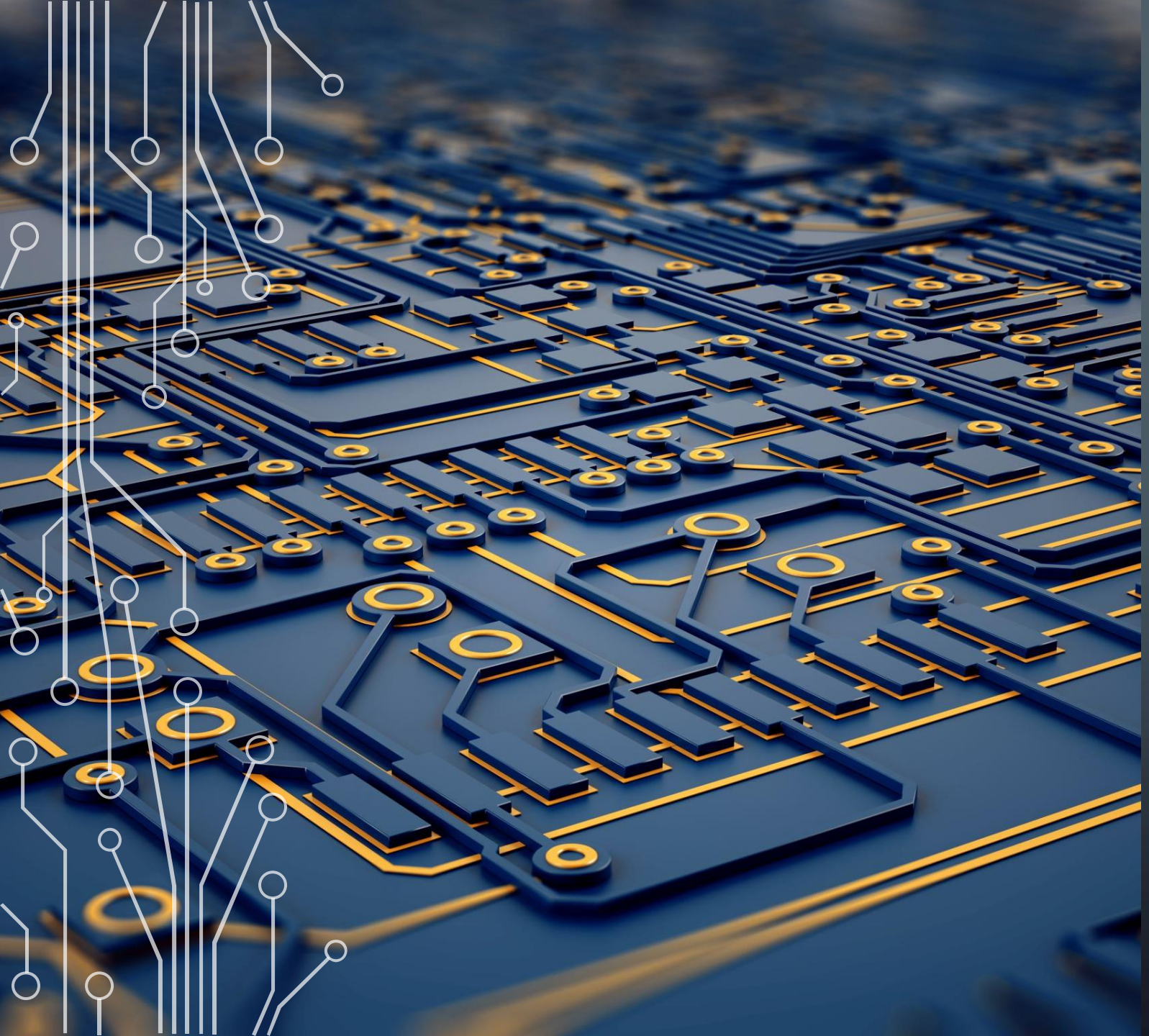


ATMEGA: CASE 3



ATMEGA: DEFAULT CASE

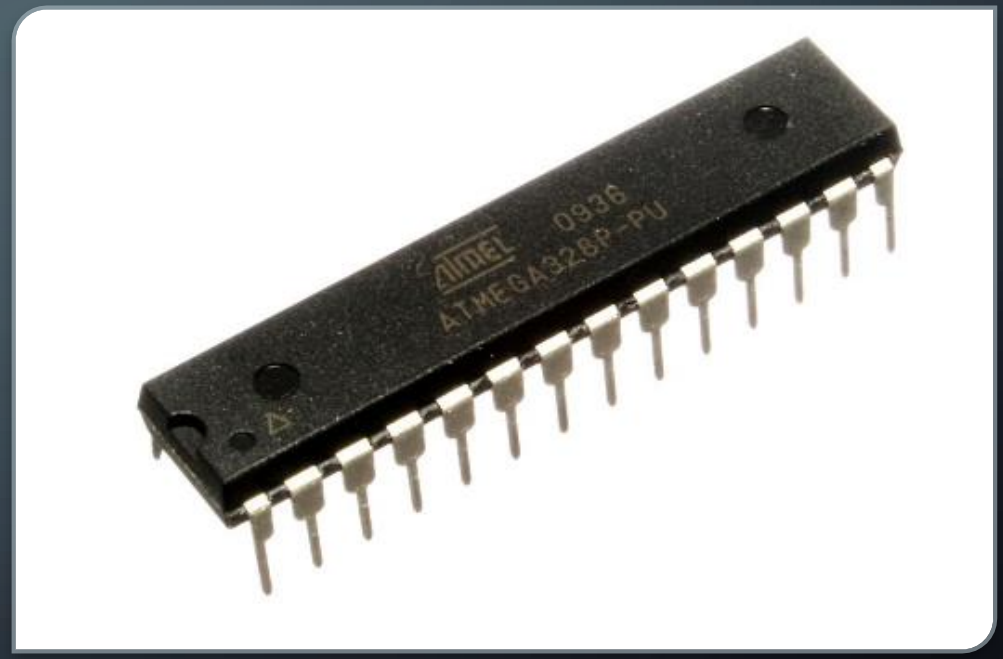




HARDWARE INTEGRATION

Microcontroller Selection

- ATMEGA328P
- Will act as the brain of the project
- Will control all the sensors along with communicating with NodeMCU for Alexa Commands

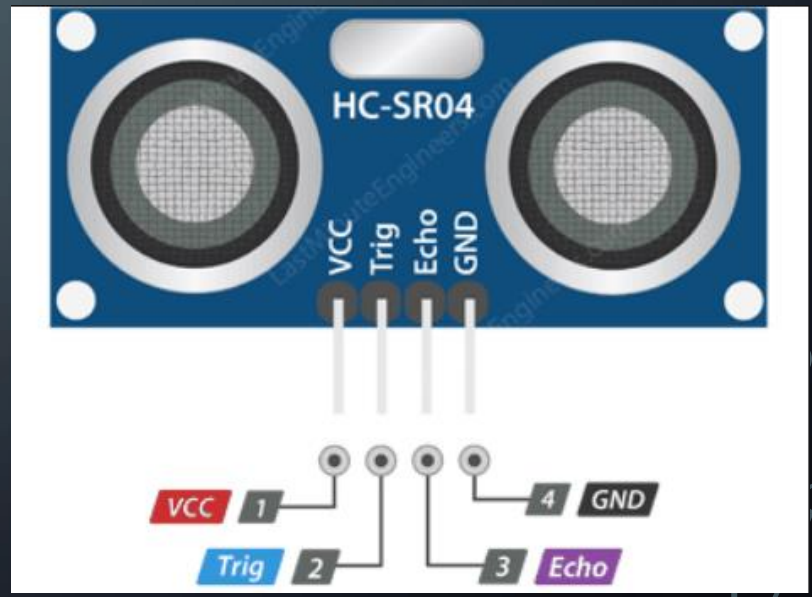


Feature	Specification
Operating Voltage	5V
Memory	32KB
Processing Speed	16MHz
GPIO Pins	23

Ultrasonic Sensor Selection

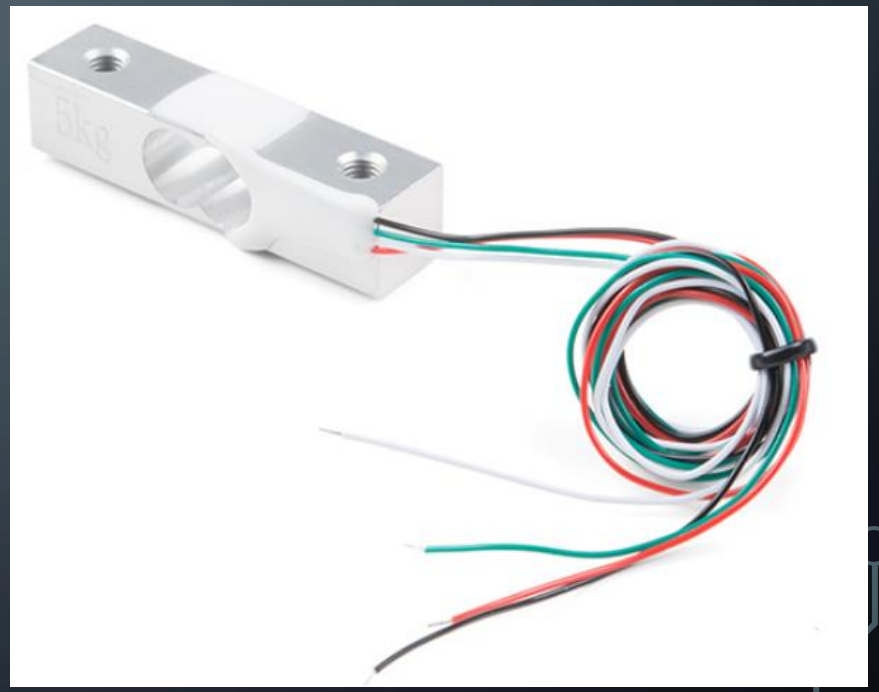
- HC-SR04
- Will act as a food reservoir sensor
- Will alert the user when food level is low and needs to be refilled

Feature	Specification
Operating Voltage	5V
Current Consumption	15mA
Min Range	2cm
Max Range	400cm
Cost	$3.95



Weight Sensor Selection

- Load Cell (wheat-stone bridge)
- A platform will be mounted on the load cell
- When the bowl reaches the user defined weight, the motor will stop spinning, thus not dispensing any more food



Feature	Specification
Operating Voltage	5V
Current Consumption	~2mA
Weight Range	0-5kg
Cost	$12.99 (includes amplifier)

Battery and Charger

Amp hours

Ah = Q = It

Q = 4A * 2mins * 14cycles

Q = (112 A*mins)/60mins

Q = Ah = 1.867Ah

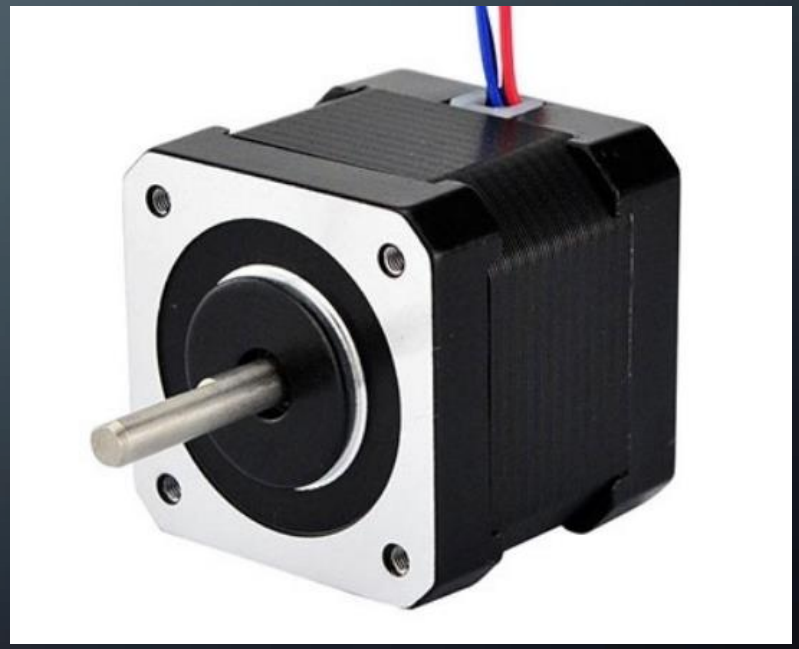
- 12V, 5Ah AGM/SLA battery
- Battery is spill proof, resistant to gas leaks, and shock resistant

- 12V, 750mA automatic battery charger
- Falls within the 20% battery charging rule
- Can be left plugged in, will not over charge the battery

Motor Selection

- Nema 17 Motor
- Will be attached to auger and listen to commands from the microcontroller/NodeMCU.
- The motor will be able to be turned on via Alexa command and stop once a set weight is reached.

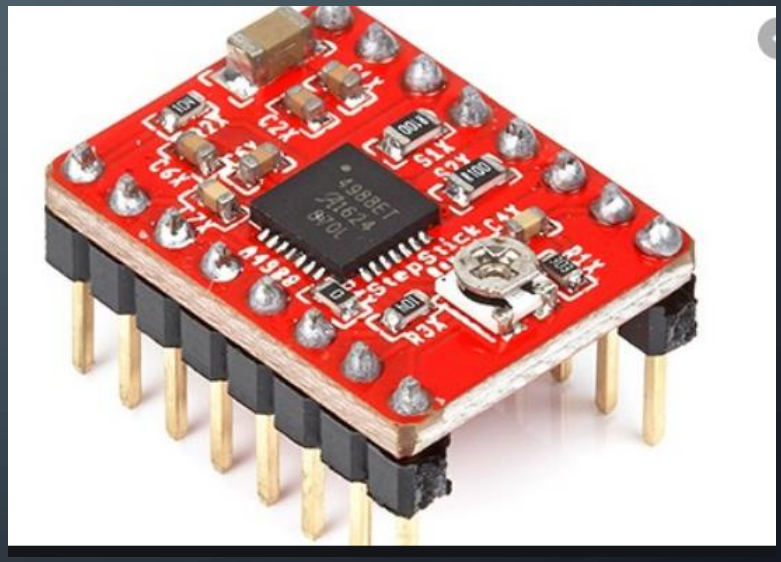
Feature	Specification
Operating Voltage	12V
Current	1.5A
Step Angle	1.8 degrees
Cost	~$10

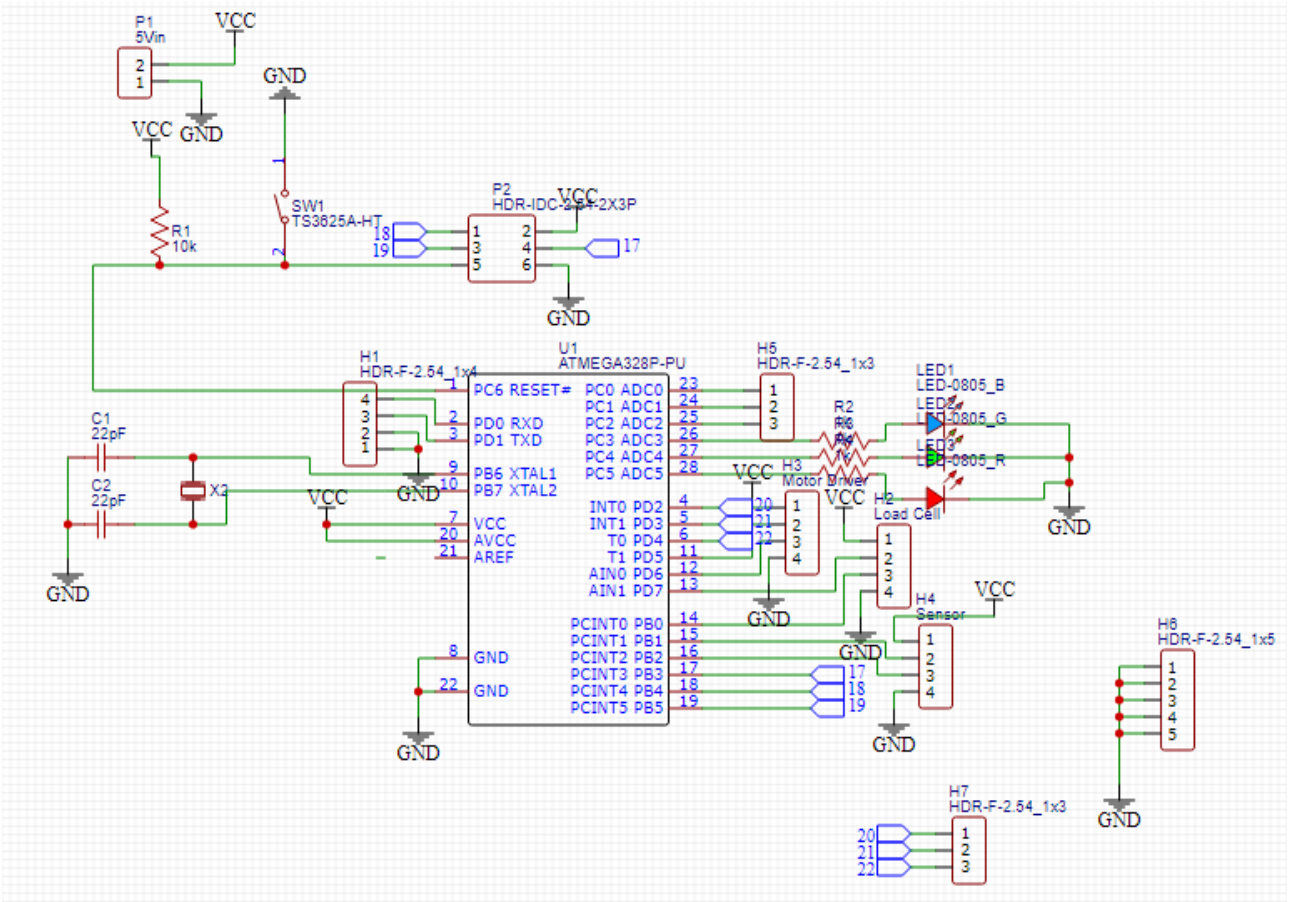


Motor Driver Selection

- A4988 Stepper Motor Driver
- Purpose is for adjustable current limiting.
- Over-current and over-temperature protection.

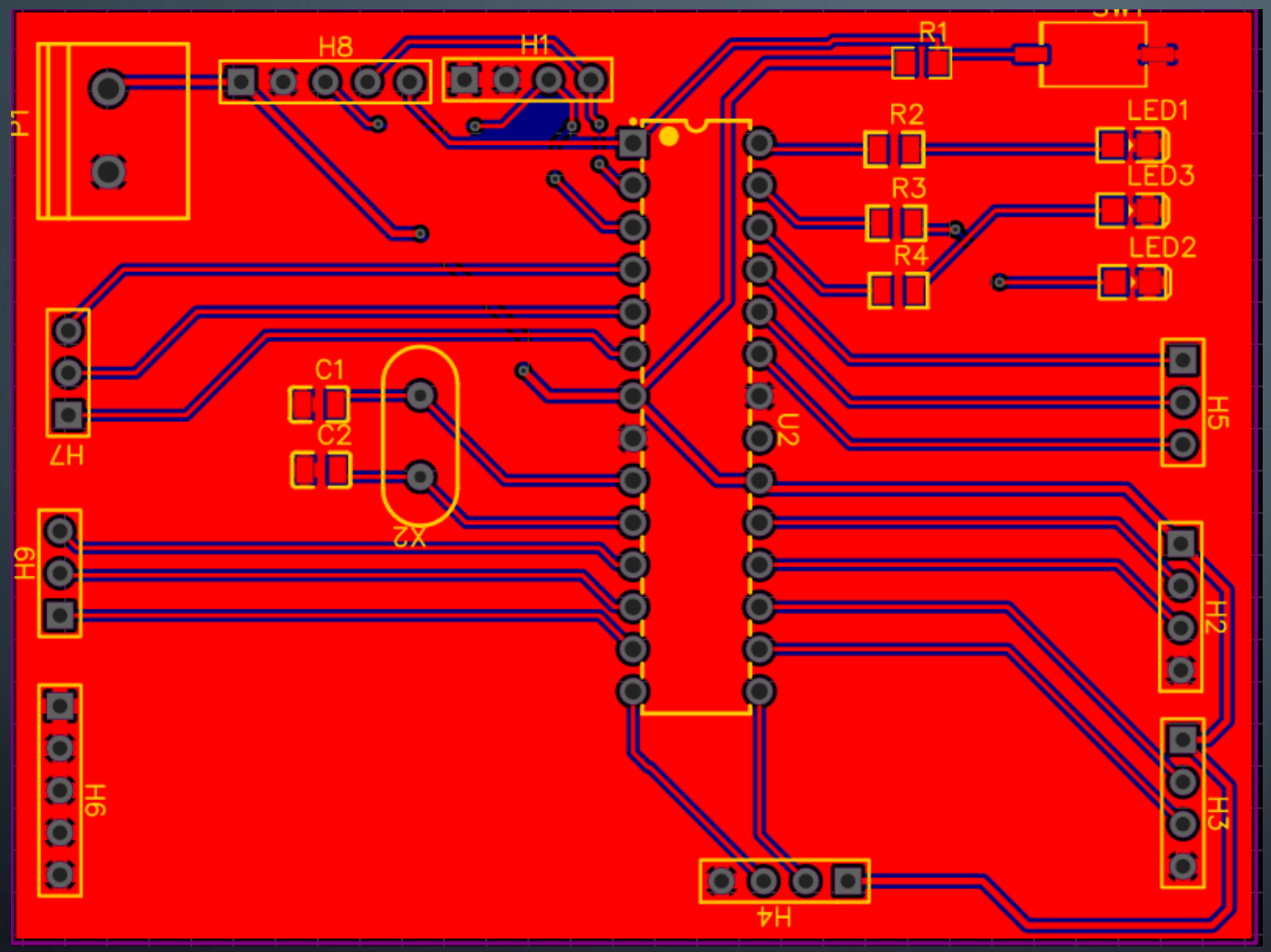
Feature	Specification
Logic Input Voltage	3.3V or 5V
Load Supply Voltage	8-35V
Max Output Current	2A
Cost	~$2





MAIN PCB SCHEMATIC

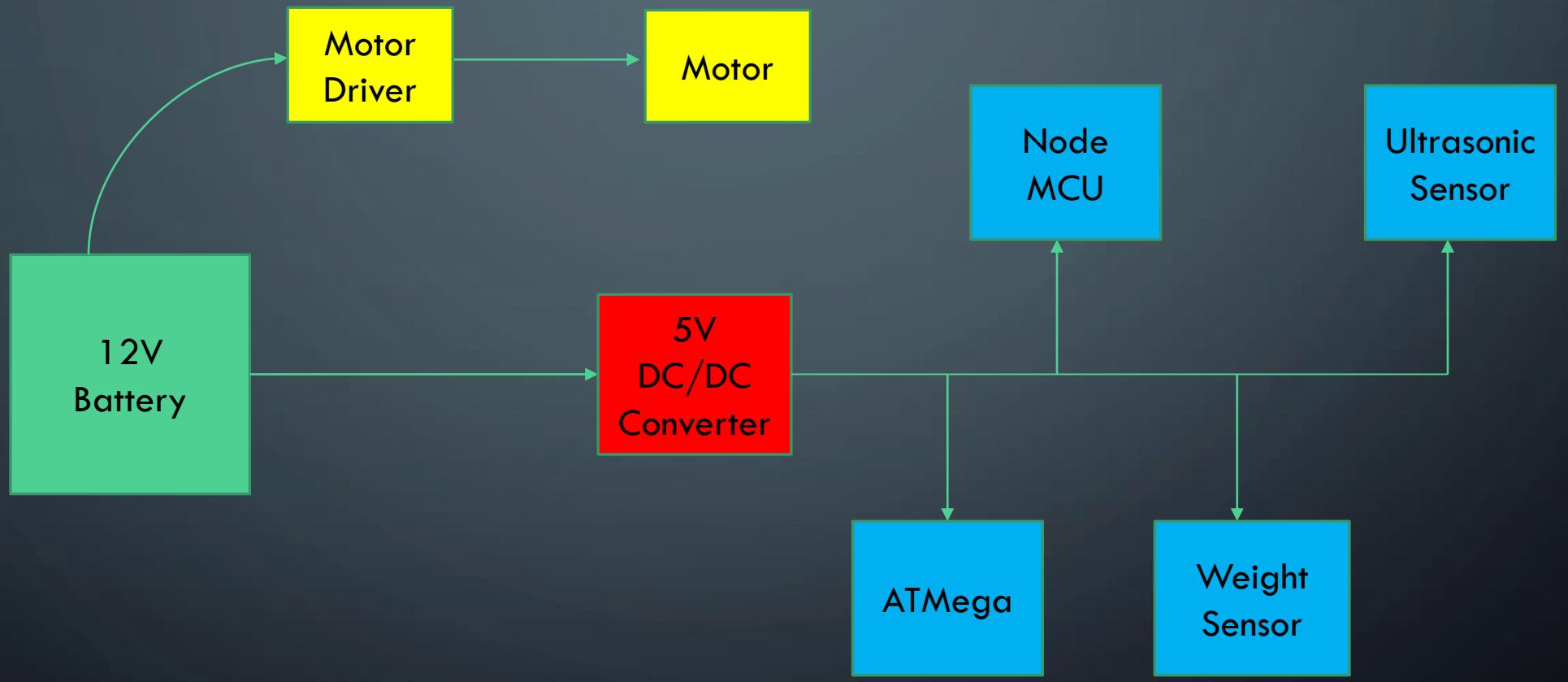
- Supporting parts (i.e 16MHz crystal).
- Pin headers for all peripherals.
- Three status LEDs that give the user feedback if needed.
- Reset button also included for debugging purposes.



MAIN PCB LAYOUT

- Board Size: 75mm x 56mm
- 2-layer, 1 oz copper design
- BOM Total: 21

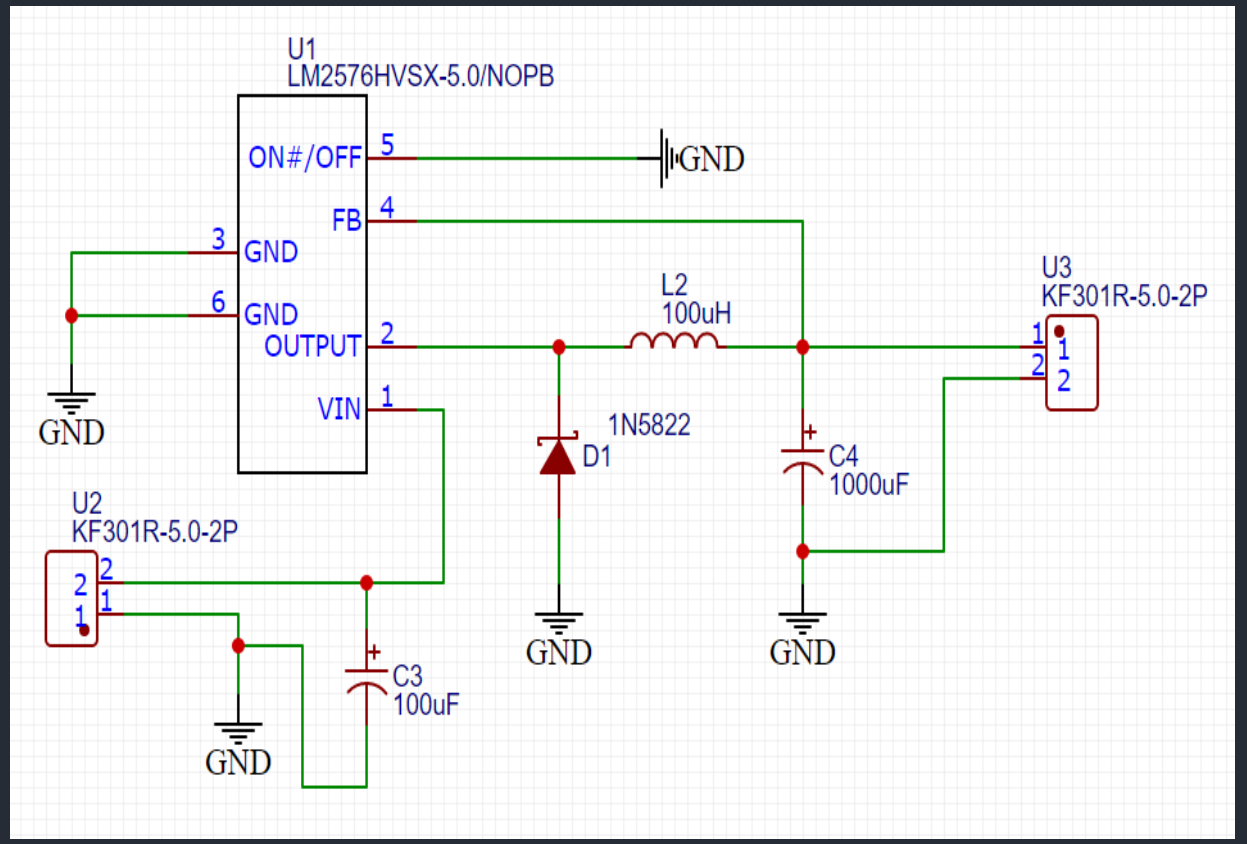
Power Distribution Block Diagram



DC/DC BUCK CONVERTER

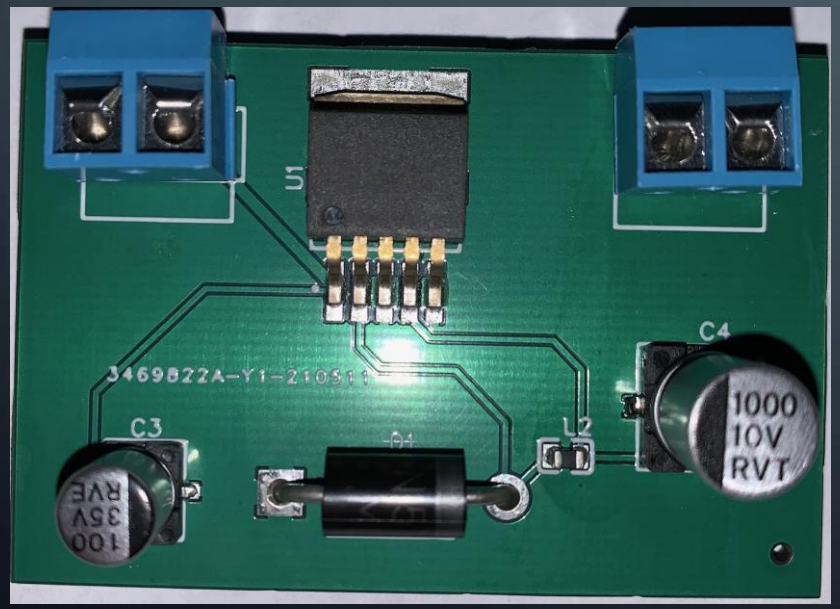
- LM2576HV
- Switching Regulator
- Input voltage range of 4V-60V
- Capable of driving 3A load with good load regulation
- Efficiency of >77%
- Low number of components required

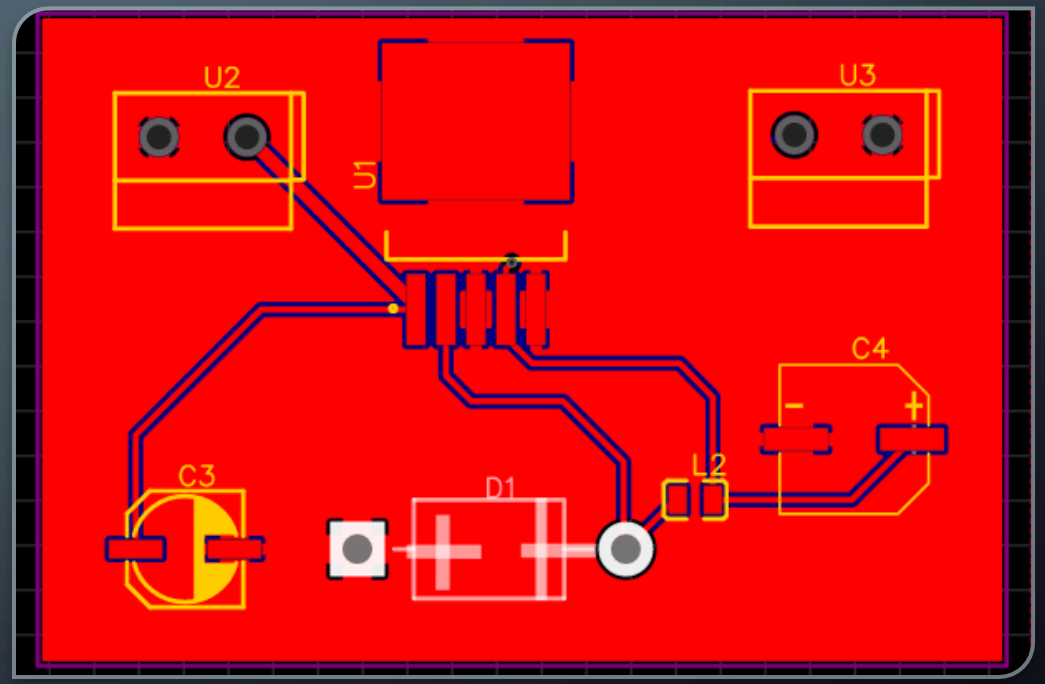
DC/DC CONVERTER SCHEMATIC



DC/DC BOARD LAYOUT

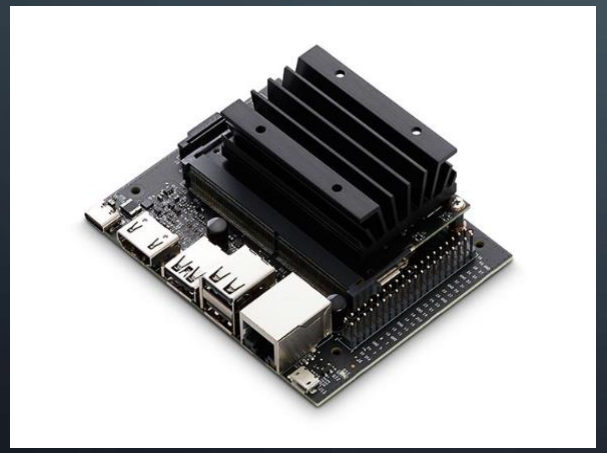
- Board Size: 55mm x 37mm
- 2-layer, 1 oz copper design
- BOM Total: 7





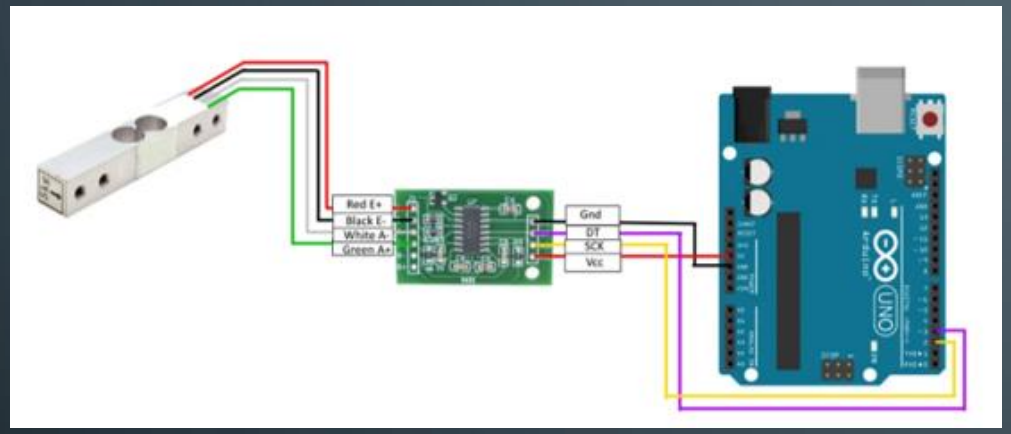
STRETCH GOALS

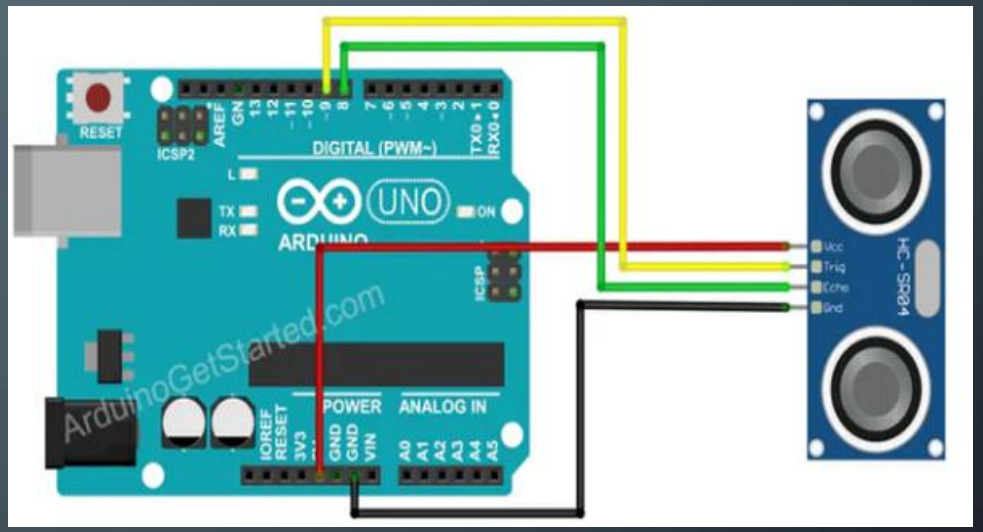
- Computer Vision with Jetson Nano
- If time and budget allows, computer vision will be added to the project.

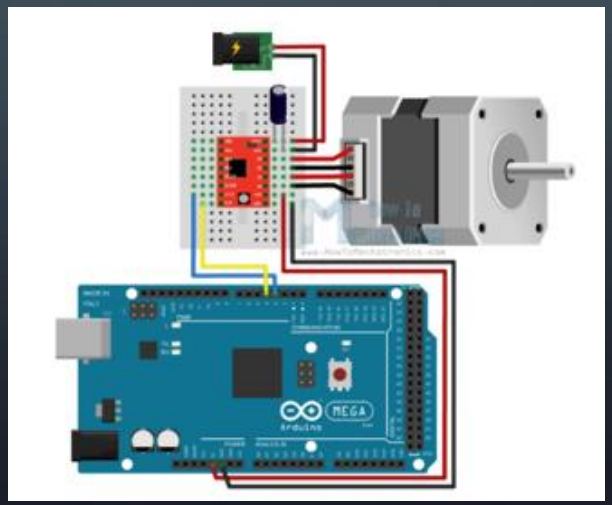


TESTING PLANS/RESULTS

PROTYPING TESTING PLANS



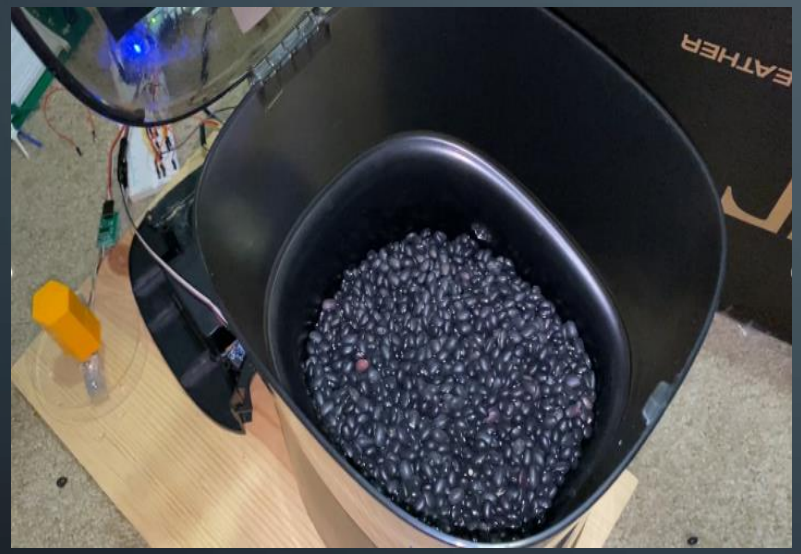




SPECIFICATION #1 – ON DEMAND FEEDING

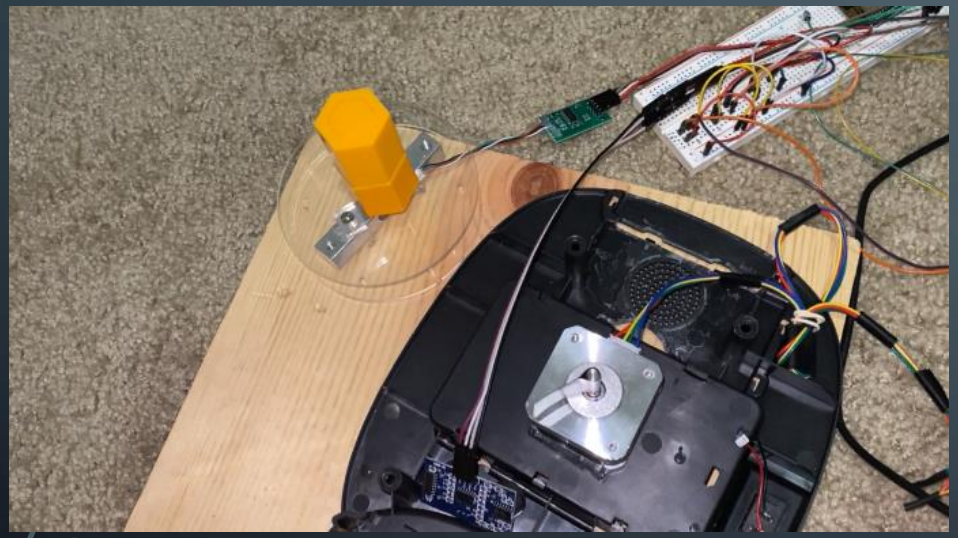
- Specification states that the pet feeder shall start dispensing food with 20 seconds after acknowledging the command from Alexa.
- As seen in the photo, it took approximately 12.9 seconds for the motor to begin turning/dispensing after telling Alexa to feed the pet.
- This specification was passed successfully.

SPECIFICATION #2 – RESERVOIR CAPACITY



- Reservoir Capacity specification states, that it must be able to hold 3 days worth of food, or 5 cups.
- As seen in the image to the left, it is only halfway full when 5 cups of food was added into the bowl.
- The pet feeder could hold approximately 10-11 cups of food when completely filled.
- Therefore, this specification was all passed successfully.

SPECIFICATION #3 – WEIGHT SENSOR STATUS

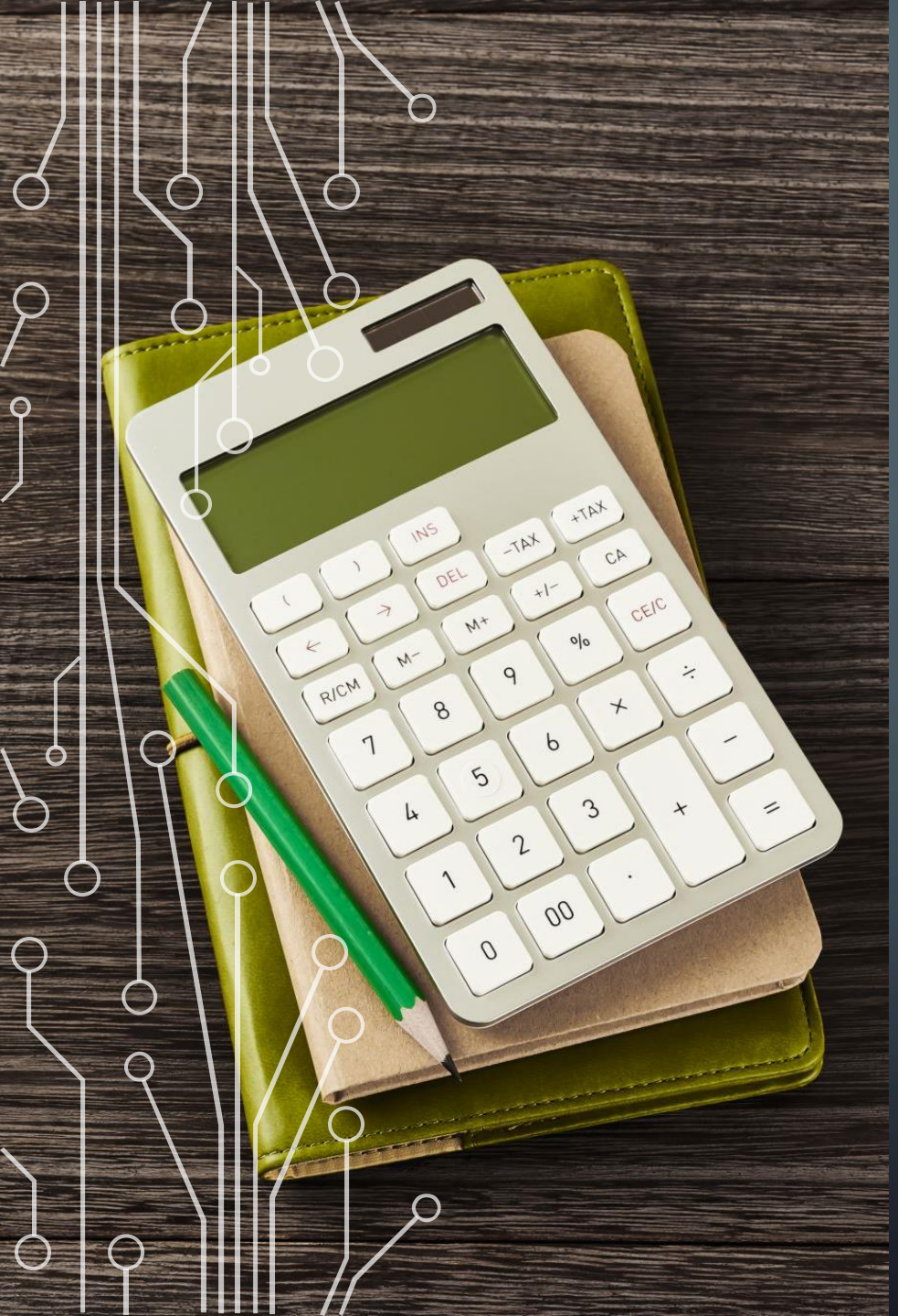


- The weight sensor status specification says that the pet feeder shall stop dispensing once a weight greater than or equal to the threshold weight.
- For testing purposes, we set a maximum weight of 80g.
- Once the motor began to turn, we placed an 80g weight on the load cell and we saw the motor stop instantly.
- The weight sensor status specification was passed successfully.

SPECIFICATION #4 – RESERVOIR SENSOR STATUS

- Reservoir Sensor specification states. “Pet Feeder shall alert the user, via Alexa, that the reservoir is low once the sensor sees a distance greater than 15cm.”
- For testing purposes, we placed the ultrasonic sensor face up to emulate the sensor seeing a distance greater than 15cm.
- After this, we then asked Alexa to dispense food and it gave us an error stating, “Food Reservoir is low, please refill to dispense food.”
- Therefore, the Reservoir Sensor Status specification was passed successfully.

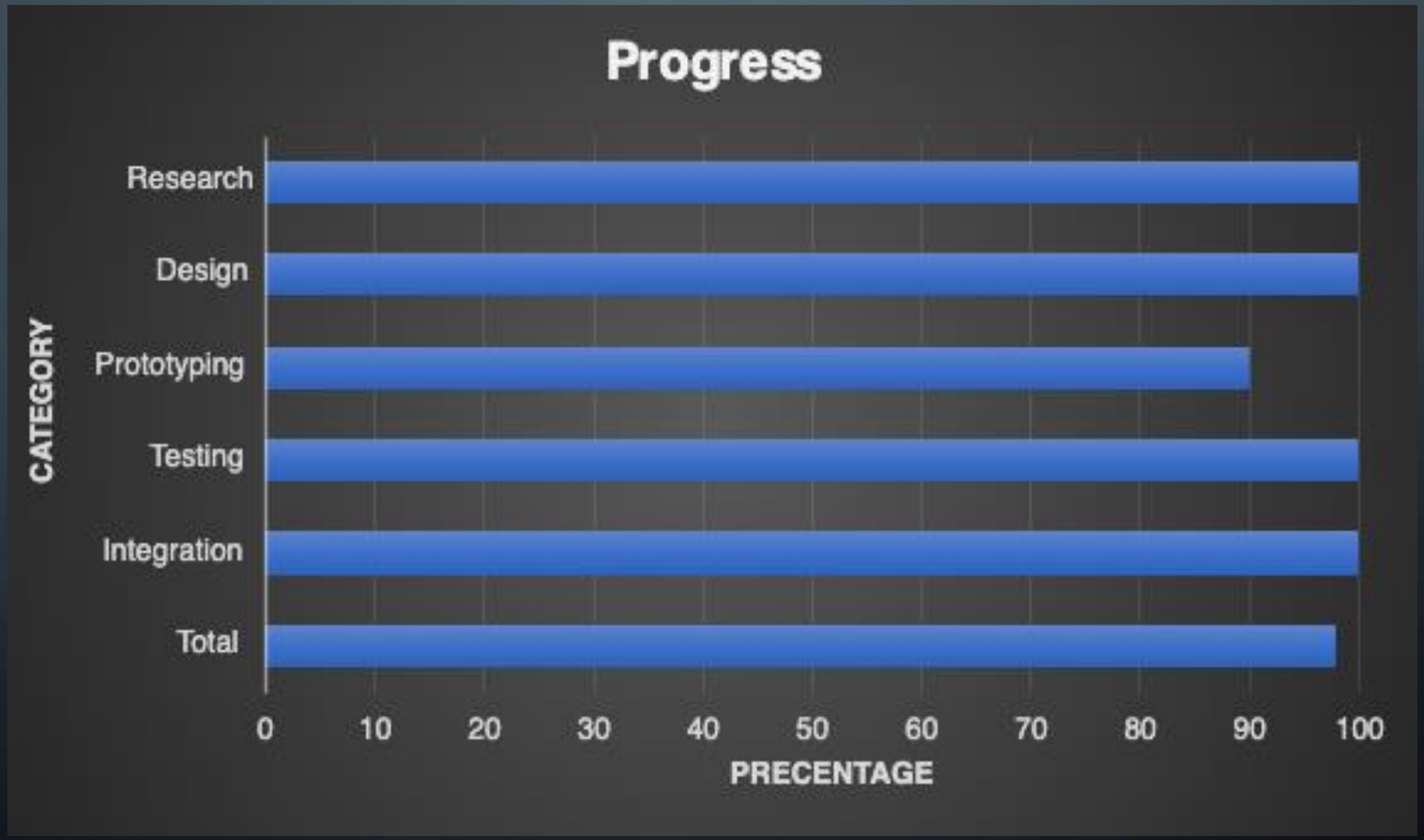
ADMINISTRATIVE CONTENT



Budget

Item	Cost
Weight sensing module	$12.99
NVIDIA Jetson Nano 2GB	$63.13
Arduino Uno R3 x 2	$37.87
DC/DC PCB	$39.11
Proto PCB #1	$45.11
Miscellaneous Matrials	$30
Auger	$10
Jumper Wires	$6.00
BJTs & Resistor Kit	$21.00
Battery	$15.60
Battery Charger	$17.98
Motor	$19.69
Motor Drivers (5)	$8.00
Ultrasonic Sensors (2)	$9
Node MCU (2)	$8
Chip puller	$3.34
PVC Pipe	$4
Housing mats (wood, glue, screws, finish	TBD
Total	$350.82

Progress


Progress
Research
Design
Prototyping
Testing
Integration
Total
CATEGORY
0
10
20
30
40
50
60
70
80
90
100
PRECENTAGE

Work Distribution

	Cameron Nero	Jacob Paul	Liam Tsoi	Carlos Lairet
Alexa Integration			Secondary	Primary
MCU Integration			Primary	Secondary
PCB Design	Primary	Secondary		
Power Design	Secondary	Primary		
Hardware Integration	Primary	Primary		
Computer Vision(Stretch)			Primary	Primary

Challenges

- Low Budget, since it is funded by the group.
- Mechanical Design.
- Time
- Parts/Tools Availability

QUESTIONS?