Automatic Pet Feeder

Senior Design Project - Group 12

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Motivation

Our goal is to build an Automatic Pet Feeder that provides the support that pet owners need in order to keep their pets healthy and taken care of.

- To offer more convenience when feeding pets.
- To provide food and water in a timely and consistent manner.
- To help pets stay healthy and lose weight.

Project Features

- The dispensing of food in a timely manner
- Automatic refilling of a water bowl when it’s low.
- Useful app notifications from sensors.
    - Pressure sensor to determine how full/empty a food or water bowl is.
    - Ultrasonic sensors to determine how much is left in the food and water reservoirs.
- Camera & Microphone (Advanced features)

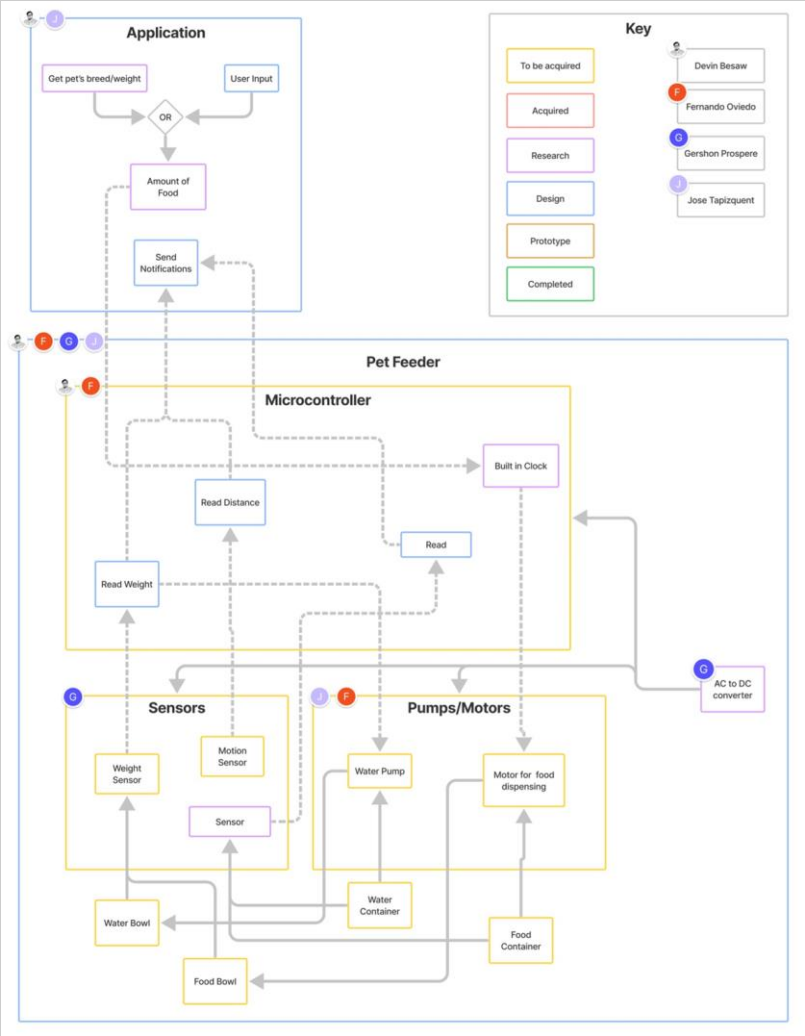
Housing/Casing

We have decided on using an existing housing of an Automatic Pet Feeder and have a separate water containment attached to the main housing and work synchronously.

MCU Specifications

	Arduino UNO	MSP430FR6989	Raspberry Pi
Memory	32 KB	16 KB	1 GB
Clock Speed	16 MHz	16 MHz	1 GHz
Low Power Mode	Yes	Yes	Yes
Architecture	8-bit	16-bit	64-bit
# of GPIO Pins	23 pins	83 pins	40 pins
Operating Voltage	2.7 V - 5.5 V	1.8 V - 3.6 V	5 V/ 2.5 A
RAM size	2 KB SRAM	2 KB RAM	512 MB SRAM
UART	Yes - USART	Yes - 2	Yes
SPI	Yes	Yes - 4	Yes
I2C	Yes	2	Yes
Operating Temperature	-40 C to +125 C	-40 C to +125 C	0 C to 50 C
Cost	$0	$0	$0

Block Diagram



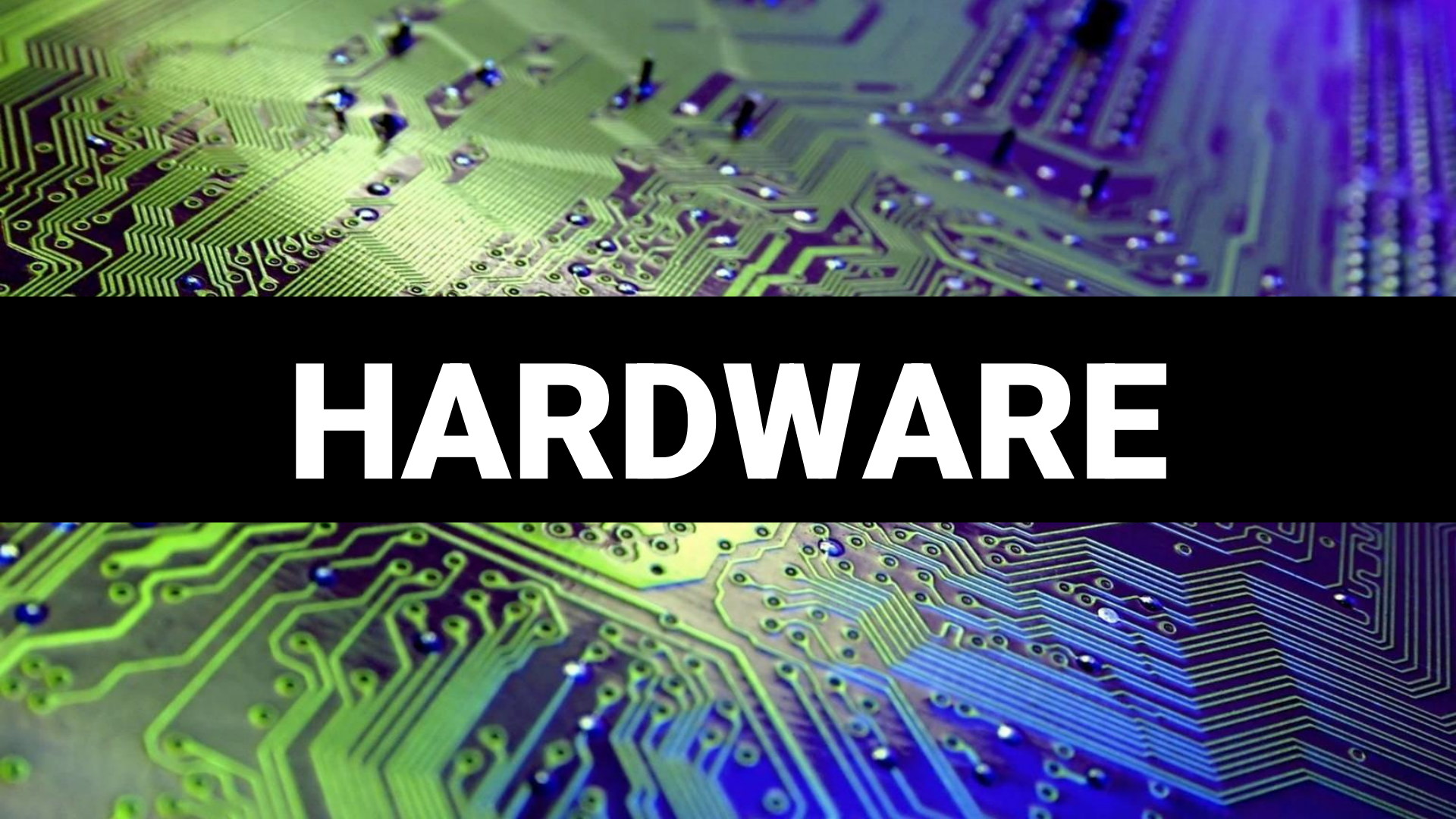
Overall Design Approach and Implementation

Hardware

- MCU (Arduino, Raspberry Pi)
- Power Supply & Voltage Regulators
- Servo Motor
- Ultrasonic sensors & Pressure sensors
- PCB
- Water Pump
- Camera/Microphone (Advanced Features)

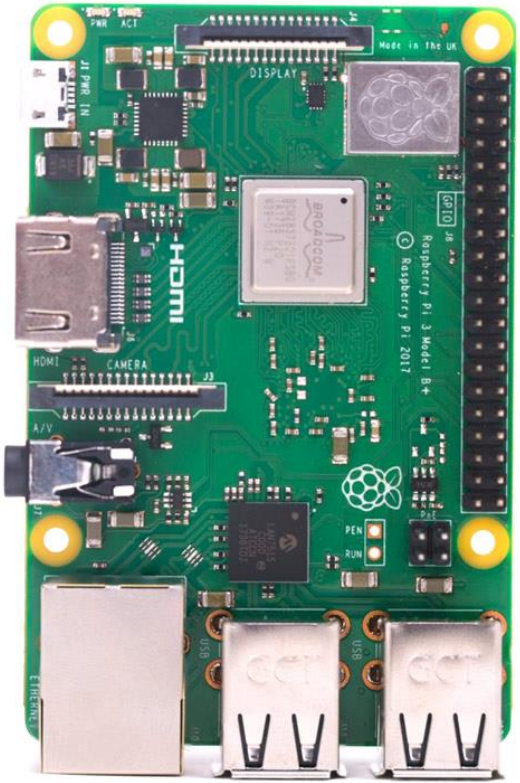
Software

- App (React Native, JS)
- Python, C++ to program the Raspberry Pi and Arduino


HARDWARE

MCU

	Raspberry Pi 3	Arduino UNO R3
GPIO	40 pins	14 pins
Input Power	5V DC via GPIO	5V
Memory	1 GB	32 KB



Parts

Parts	Power Supplied
Ultrasonic Sensor	5V
Force Sensitive Resistor	5V
Motor	5V
Water Pump	12V

Motors

DC Motor

- Input voltage - 5V
- Weight - 4 ou
- Size - 15 x 20 mm
- 4000 RPM

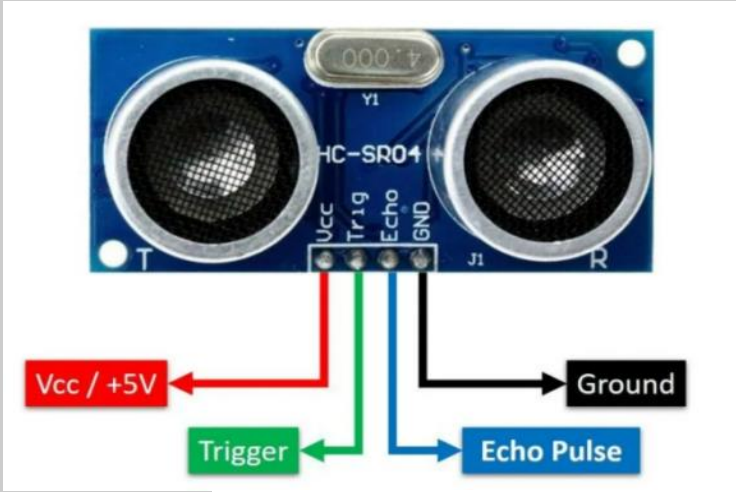
Pump

Water Pump w/ silicone tubing (Peristaltic Liquid Pump)

- Input voltage - 12V
- Weight - 2.4 ou
- 0-100 mL/min
- Inside diameter 2mm
- Outside diameter 4mm

Sensors

- HC-SR04
- Round Force-Sensitive Resistor



Motor Driver

L293D

- Used for both motor and pump
- Supply Voltage Range: 4.5V - 36V
- Output current up to 600 mA per channel

Voltage Supply

AC Adapter

- Transforms to 12 V DC
- Provides 1 A

Voltage Regulator

7805 5V Regulator

- Max input voltage - 25 V
- Max output voltage - 5.2 V


document.getElementById(div)
else if (i==2)
{
var atpos=inputs[i].indexOf("@");
else
document.getElement
} pos=inputs[i].lastIndexOf(".");
if (i==5)
SOFTWARE

Software Design

Objectives	Description
Basic	Programming the MCU's among other components to make sure the functionality is optimal
Advanced	Program the camera to recognize that the proper pet is being fed. Also, by using the speaker, play classical music to calm the pet and preventing separation anxiety.
Stretch	Integrate computer vision to identify that the right pet is fed and enclose the bowls if its an intruder.

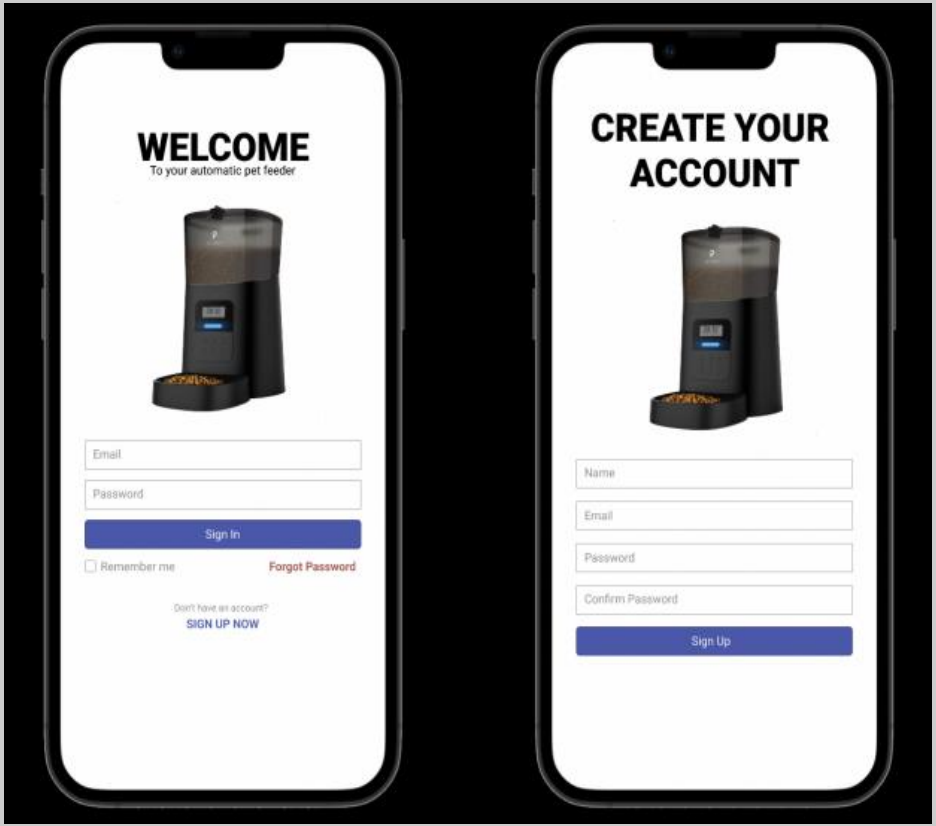
Programming Languages

MCU/Application	Languages	Percentage used for the completion of the project
Arduino	C++	20%
Raspberry Pi	Python	45%
App	React, js, C++	35%

User Communication

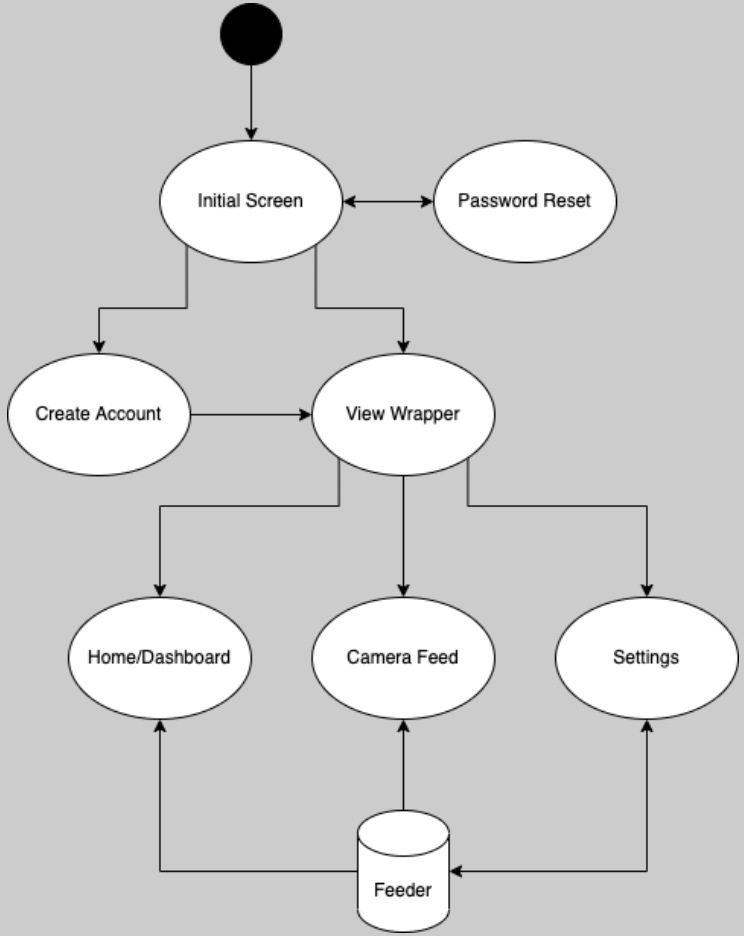
The entire communication will be through an app that will pair with the Automatic Pet Feeder.

This allows the pet owner to customize the timing for the Automatic Pet Feeder and quantity served.



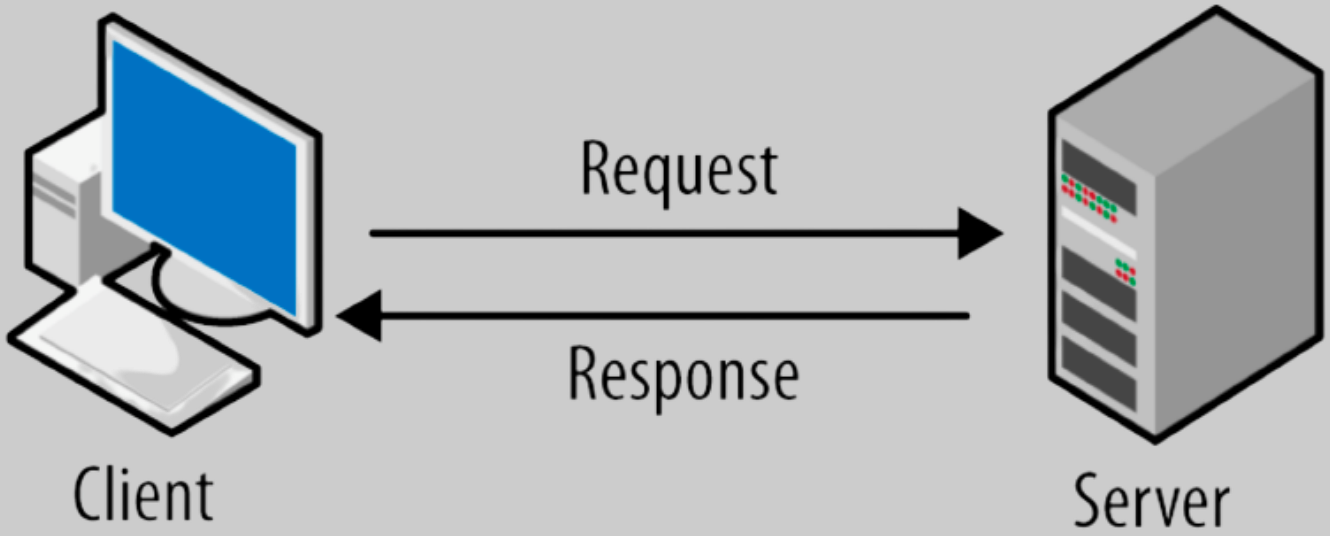
Mobile Application Flow

Describes the flow the user’s experiences when interacting with the mobile application



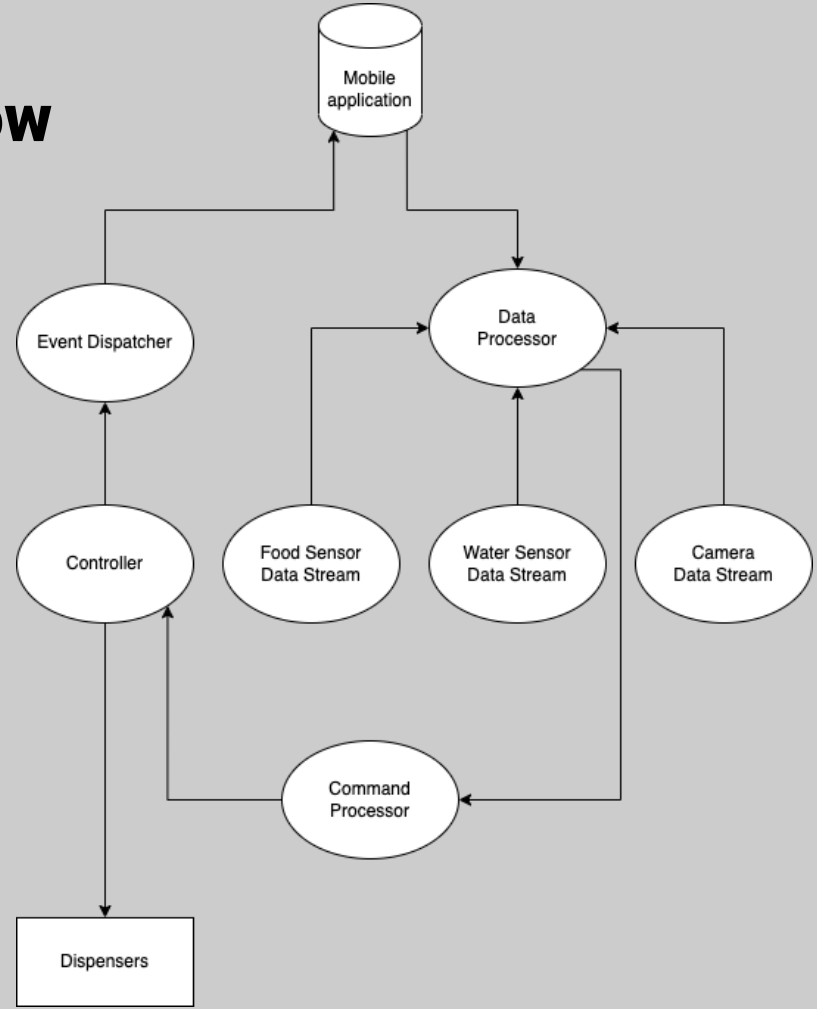
Communications

Web API server to handle communications between mobile application and the Automatic Pet Feeder



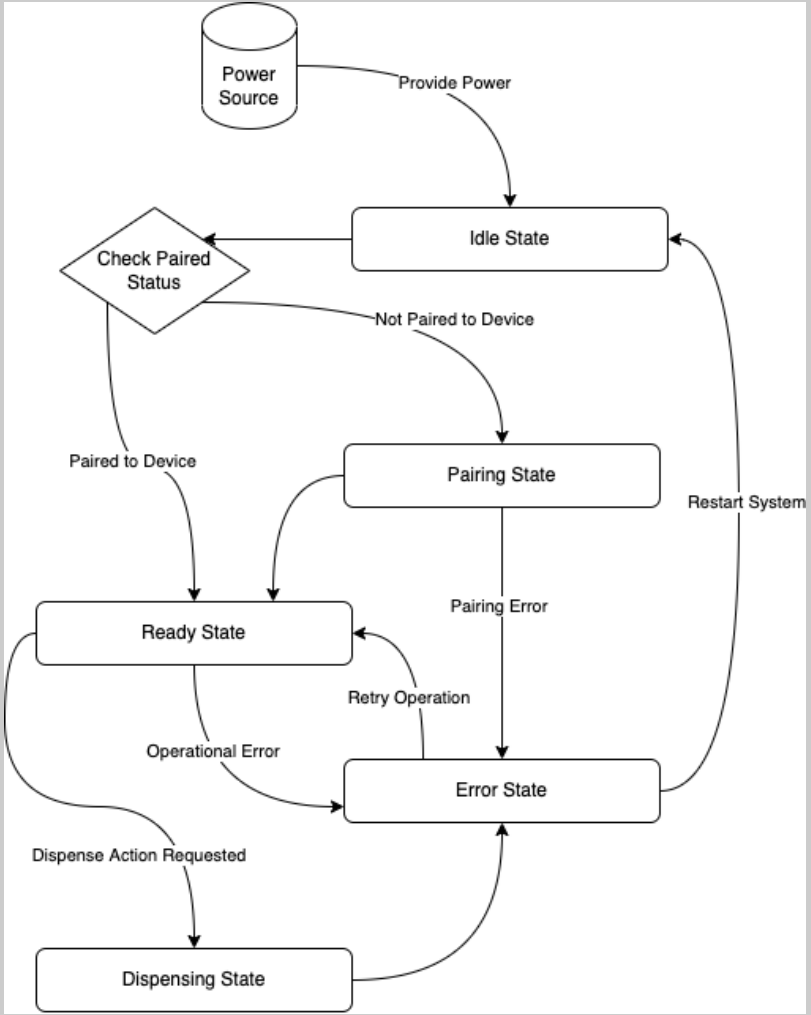
Pet Feeder Operations Flow

Describes the processing of data and operating interpreting



Operating States

Different states that the system might be in when turned on and enabled



Budget and Financing

Item	Price
Casing	$50
Pump with Tubing	$25
Microcontrollers	$0
PCBs	$10 - $50
Power Supply	$20
Motor	$5-$20
Motion Sensor	$0
Water level sensor	$0
IR sensor	$16
Pressure Sensor	$10
Total	**$150-$200**

Project Success and Challenges

Successes

- The availability of the PCB.
- Having most components in our disposal.
- Already started on the creation of the app and software needed to program the MCU’s.

Challenges

- PCB was printed with the wrong size motor pinout, have to re-order.
- Time Constraint due to work schedule not meshing.

Remaining Tasks

- Solder components onto PCB
- Finish coding the Arduino and Raspberry Pi
- Connect both MCUs to PCB
- Test functionality of motor and pump through MCUs
- Assemble parts into pet feeder

Current Progress

	Percentage Completed
Research	95%
Parts Gathered	90%
Design	50%
Software Completed	50%
Testing	10%
Overall	~60%

Plan for Completion

- Meeting more frequently in person with all components on hand.
- More test benching overall productivity.
- Develop the app to effectively communicate with the MCU’s.
- Time Management.


QUESTIONS