# Aquaponics Monitoring

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#### **Problem and Purpose:**

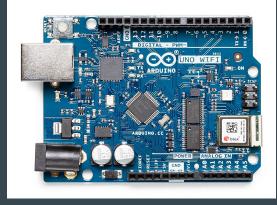
- **Problem:** Currently, there exists no efficient, all-in-one aquaponics monitoring system that provides convenient, accurate information on the go.
- **Purpose**: Create a solution to this problem by developing a **mobile iOS application** that monitors:

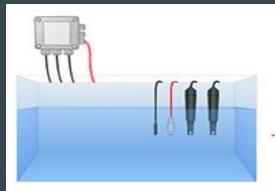
water levels —> a water level sensor will monitor the amount of water available in the aquaponic tank
-plant moisture —> a hygrometer will monitor if the plants are receiving water
-pH levels —> a pH sensor monitors if the pH levels are healthy enough for the fish
-water temperature —> a thermometer monitors if the temperature is safe for the fish
-light —> a light sensor monitors if the plant is receiving enough light

The mobile application will clearly indicate to the user when any of these measurements are **outside of their user specified range.** 

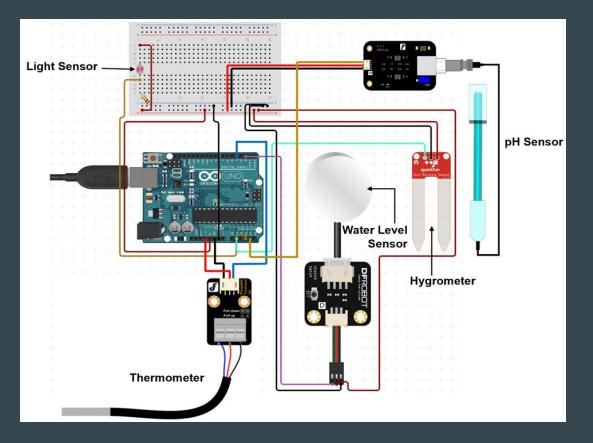
# **Equipment and Software**

- Arduino Uno Wifi Rev2
- Aquaponics Tank
- Arduino supported sensors that measure important factors such as water levels, temperature, plant moisture, pH levels, and light.
- An Arduino IDE, Xcode, and a server hosted through Google Firebase that receives information from the Arduino board.





### Hardware Schematic

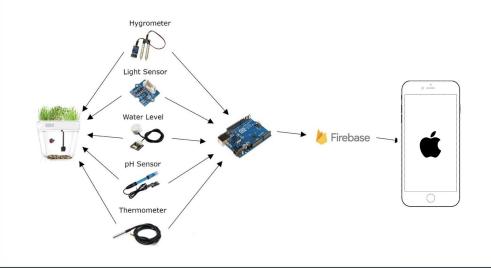


# Key Concepts

- The Arduino board acts as a monitor for the plants by tracking important factors sent from insertable probes.
- Insertable probes track factors like water levels, plant moisture, pH levels, water temperature, and light.
- These factors are sent to a database hosted on Google Firebase.
- A mobile application receives the data pulled from the Arduino software and stored in Google Firebase as JSON objects. Specified boundaries allow the user to control the maximum or minimum values they deem safe for the plants and fish. If a specified boundary is out of range the user interface will illuminate the factor as red.

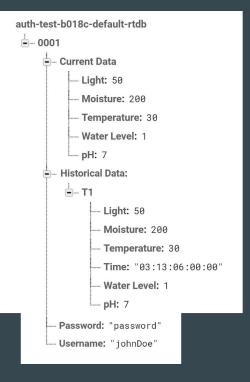
# Design

- Each sensor is placed in the aquaponic system and then connected to an Arduino WiFi Rev2.
- Over WiFi, the Arduino sends all of the data collected to our database, Google Firebase, stored as JSON objects
- Google Firebase transfers this information to the application, where the user is able to view **current data** and **past data received from the sensors.**



# Software:

- Utilizes a Google Firebase realtime database to store data
- Arduino pushes data to the database
- Database stores data as JSON objects
- iOS application listens and pulls data from the database when the database is updated



Database structure

#### **Requirements and Use Cases**





**Requirement:** Measure sunlight, water level, temperature, plant moistu<u>re, and pH</u>

#### **Use Case:**

Allows the user to recognize whether the plants and fish are in a healthy living environment **Requirement:** Collect the data from the probes and sends data to Google Firebase

**Use Case:** Allows the server to update the user via the mobile application

**Requirement:** Must stay connected to internet/WiFi

**Use Case:** Providing reliable and consistent real-time data to be sent to Google Firebase **Requirement:** Receive and store data sent by the Arduino and send it to the application

Server

**Use Case:** Ensures the application receives real time data from the Arduino

**Requirement:** Store an email, password, and Arduino ID for each user

**Use Case:** Accounts that contain a unique email, password, and Arduino ID are specific to the users login **Requirement:** View current data for a specified account and allows the user to set bounds for specific factors

App

**Use Case:** Ensures the user is able to manage the safety and efficiency of their system

**Requirement:** Support for user login

**Use Case:** A specified user can monitor their system from their mobile device

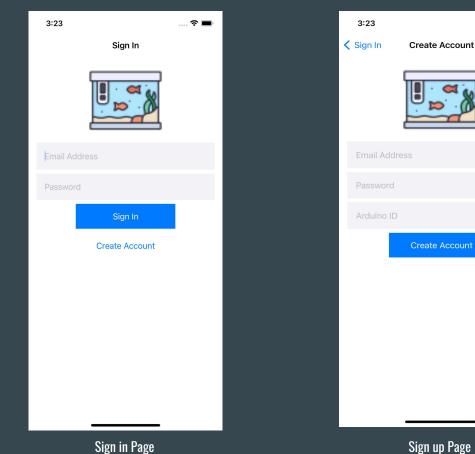
**Requirement**: Refresh data periodically and on command

**Use Case**: Realtime data can be viewed from any location

# **Mobile Application**

- Receives data or information from the Arduino software that's sent to Google Firebase.
- Hosts factors such as water levels, temperature, plant moisture, pH levels, and light.
- Allows a specified user to sign in or create an account with a unique Arduino ID
- If a specified boundary is out of range the user interface will illuminate the factor as red. This could happen if the plant moisture is not wet enough, the water levels are low, the pH levels are too basic or too acidic, the plant is not getting enough light, or the water temperature is unsafe for the fish.

### **User Interface Design**:





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User Dashboard

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Aquaponics Monitor	Aquaponics Monitor	Aquaponics Monitor	Aquaponics Monitor
K Back	<b>&lt;</b> Back	K Back	K Back
	Temperature Settings	pH Settings	Moisture Settings
You are signed in			
Sign Out	Lower Bound 0	Lower Bound 0	Lower Bound 0
ArduinoID 0001	Upper Bound 0	Upper Bound 0	Upper Bound 0
	Current Value 57.0	Current Value 7.6	Current Value 45.0

System Settings

**Boundary Settings** 

# Aquaponics System



# **Application Functionality Demo:**

