Assignment 2.2: Final Team Project Introduction and Proposal

TEAM 6: Bin Lu, Trevor McGirr, Olympia Saha

Shiley-Marcos School of Engineering, University of San Diego

AAI-530-03-SP23 – Data Analytics and Internet of Things

Professor An Tran

January 22, 2023

Introduction

Our project topic is an IoT system for monitoring water quality in an aquaponics fish pond that would be used to monitor the health of the fish and plants by measuring various water quality parameters. The system will be able to detect any abnormalities in the water quality and alert the farmer to take action.

1. **What is the source of your dataset?**

   Our data is selected from Kaggle.com following is the link to the data set https://www.kaggle.com/datasets/ogbuokiriblessing/sensor-based-aquaponics-fish-pond-datasets

2. **How was the data collected?**

   According to dataset information on Kaggle.com: The datasets are generated from freshwater aquaponics catfish ponds every five seconds. ESP 32 Microcontroller was used to collect data from and drive the following sensors:

   - Dallas Instrument Temperature sensor (DS18B20);
   - DF Robot Turbidity sensor;
   - DF Robot Dissolved Oxygen sensor;
   - DF Robot pH sensor V2.2;
   - MQ-137 Ammonia sensor;
   - MQ-135 Nitrate sensor.

3. **How many observations are in the dataset?**

   The data set consists of 12 different sub-datasets from each aquaponics catfish pond. Pond 1 was deployed three weeks earlier. Therefore, there are approximately 50928 entries, while the other data sets are about 24,000. With 12 ponds, the total data points in the overall data set are over 315,000 entries.

4. **What variables are in the dataset?**

   The variables measured were the water conditions measured with six different sensors (temperature, turbidity, dissolved oxygen, pH, ammonia, nitrate), fish data (Population, length, and weight), and the timestamp of when the data was collected for each sensor.

5. **What is your IoT application/system? Who will use it?**

We are building an IoT system for monitoring water quality in an aquaponics fish pond by following these general steps:

- We have identified the parameters to be monitored: Some standard water quality parameters in aquaponics systems in our dataset include pH, temperature, dissolved oxygen, and ammonia levels.
- We are selecting and assembling the necessary hardware: Using sensors to measure the identified parameters, an ESP-32 microcontroller to process the sensor data and develop an automatic data collection, and a wireless communication module to transmit the data to a remote device or the cloud.
- Configuring the system: Programming the microcontroller to read the sensor data and send it to the cloud.
- Develop a web or mobile application: This will allow us to view the data remotely and receive notifications when the water quality falls outside a particular range.
- Deploy the system: Once it is built, it can be deployed in the fish pond and continuously monitor water quality.
- Machine Learning: To improve the accuracy of the predictions, we will use machine learning techniques on the system's historical data to predict future water quality and for data analytics and decision-making.
- Agricultural consultants, policymakers, and government agencies such as the ministry of agriculture will advise farmers and governments in planning and predicting the performance of the fish.
- The insights this dataset will provide when subjected to machine learning and data analytics will benefit fish farmers, informing them when to change the pond water, what stocking density to apply, giving knowledge about feed conversion ratios, and predicting the growth rate and patterns of their fishes.

6. **What industry does your IoT application/system fit into? (smart home, healthcare, smart city, personal devices, industrial IoT)**

Smart Aquaponics- An IoT system for monitoring water quality in an aquaponics fish pond is typically integrated into an overall aquaponics system. Aquaponics is a method of farming that combines raising fish(aquaculture) with growing plants (hydroponics) in a closed-loop system. In an Aquaponics system, fish produce waste, which is converted into fertilizer for the plants. The plants, in turn, filter the water for the fish.