Fish storage and safty monitoring system

Sadia
department of Computer Science and Engineering University of Liberal Arts Dhaka, Bangladesh
Julkar4.cse@ulab.edu.bd

Rownak
department of Computer Science and Engineering University of Liberal Arts Dhaka, Bangladesh
Julkar4.cse@ulab.edu.bd

Sawda
department of Computer Science and Engineering University of Liberal Arts Dhaka, Bangladesh
Julkar4.cse@ulab.edu.bd

Julkar
department of Computer Science and Engineering University of Liberal Arts Dhaka, Bangladesh
Julkar4.cse@ulab.edu.bd

***Abstract*— The Fish Storage and Safety Monitoring System will store fish in a fresh and safe manner for an extended period. The system primarily uses sensors to monitor changes in terms of temperature, humidity, and levels of harmful gas (ammonia) within the storage unit. Furthermore, actuators are available for establishing the right storage condition. One of the major features of the system is its integration with Arduino Cloud that enhances real-time monitoring and control. Thus, the system is a stepping stone towards achieving sustainable development of fish through reducing wastes associated with fish spoilage and ensuring food safety.**

Keywords—Temperature, Humidity, Monitoring, Ammonia, Hydrogen Sulfide

I. Introduction

A. ***Background**:* Fish is a perishable commodity that has different storage conditions to keep it good. Most of the traditional storage systems have not adopted automation or real-time monitoring systems, leading to spoilage and losses. The rapid progress in IoT technology has generated a heightened demand for intelligent storage systems to tide over these challenges.

B. ***Problem Statement:*** Existing fish storage systems do not provide any form of continuous monitoring nor do they respond automatically based on how the environment conditions change. Such gaps could create an environment where harmful substances and unhealthy storage conditions would thrive with severe food safety issues and much wastage. *C.* ***Objectives:***

1. To carry out real-time monitoring of temperature, humidity, and ammonia.
2. To automate cooling and ventilation based on realtime sensor readings.
3. To avail remote monitoring and control to the user through Arduino Cloud integration.

II. Literatuer Review

Former researches have shown the importance of controlling temperature and humidity in the storage of fish to minimize spoilage. Unfortunately, even though different IoTenabled systems have been developed for such applications, many of them lack the integration with cloud platforms for real-time monitoring and controlling systems. This project takes it further by implementing Arduino Cloud for better functionality and user experience.

IoT-Based Fish Tank Monitoring System

- Focus: Real-time water quality, video surveillance, feeding, and cloud data storage for fish tanks.
- Source: IEEE Conference, 2022.

IoT for Cold Storage Monitoring

- Focus: Low-cost system for monitoring food quality using gas and UV sensors with real-time Android updates.
- Source: IJARCCE, 2024.

IoT-Based Fish Health Monitoring

- Focus: Water quality monitoring in aquaculture farming to enhance fish health and productivity.
- Source: IJITEE, 2019.

IoT in Perishable Inventory Management

- Focus: IoT technologies to optimize inventory management and reduce losses for perishable goods.
- Source: Annals of Operations Research, 2021.

IoT for Fish Feeding and Monitoring

- Focus: Automated fish feeding and water quality monitoring using the Blynk app.
- Source: Global Journal of Computer Science, 2024. *RFID-Based Smart Logistics for Perishables*
- Focus: IoT and RFID to monitor perishable goods during transportation and storage.
- Source: IJERT, 2020.

III. Research Methodology

A. ***Requirement Analysis:***

***Hardware*:** DHT22 Sensor for precise measurement of temperature and humidity.

1. Potentiometer for mimicking ammonia sensor performance.
2. LEDs indicating the functioning of cooling and ventilation systems.
3. Arduino Uno for managing data processing and control functions.
4. Resistors and wiring for electrical consistency.

***Software**:*

1. Arduino IDE for coding and troubleshooting.

2. Arduino Cloud IoT platform for overseeing and managing remotely.

B. *System Design:*

1. Layer of Perception: Sensors (DHT22 and Potentiometer) gather information on temperature, humidity, and ammonia concentrations, mimicking hazardous gas detection.

2. Layer of Processing: The Arduino Uno handles incoming sensor data and utilizes threshold-based rules to turn actuators on or off.

3. Actuation Layer: Actuators such as LEDs mimic the cooling and ventilation systems, illustrating the physical elements that would control temperature and air quality in a given setting.

4. Communication Layer: Sensor data is presented at the Serial Monitor for debugging and is forwarded to Arduino Cloud for remote monitoring and user interaction.

C. *Components*

Component	Quantity	Per Unit Price	Total cost
Arduino Uno	1	\$25	\$25
Potentiometer	1	\$10	\$10
DHT22	1	\$5	\$5
LED & Resistors	2 sets	\$1	\$2
Wires		\$3	\$3
Total			\$45

B. Arduino Cloud Integration: The system uses Arduino Cloud for remote monitoring and controlling. Sensor data is uploaded into the cloud via the ArduinoIoTCloud library. Users can fully interact with the system through a specific dashboard interface.

V. Discussion on SDG

The system aligns with the following Sustainable Development Goals (SDGs):

- *SDG 12 (Responsible Consumption and Production): Ensures proper storage conditions to guarantee fish efficiency and resource use, reducing waste.*
- *SDG 14 (Life Below Water): Prevents losses in weight and maintains quality.*

IV. Implementation

A. *Pseudocode*

```
#include <DHT.h>

#define DHTPIN 2        // Pin connected to DHT22 SDA
#define DHTTYPE DHT22    // DHT22 sensor type
DHT dht(DHTPIN, DHTTYPE);

#define POT_PIN A0      // Pin connected to the potentiometer
#define COOLING_PIN 8    // Pin connected to the cooling system LED
#define VENTILATION_PIN 9  // Pin connected to ventilation system LED

#define TEMP_THRESHOLD 30      // Temperature threshold (in Celsius)
#define AMMONIA_THRESHOLD 400  // Ammonia threshold (Potentiometer raw value)

void setup() {
Serial.begin(9600); dht.begin();
pinMode(COOLING_PIN, OUTPUT);
pinMode(VENTILATION_PIN, OUTPUT);
}

void loop() { float temperature = dht.readTemperature(); float humidity = dht.readHumidity(); int ammoniaLevel = analogRead(POT_PIN);

if (temperature > TEMP_THRESHOLD) {
digitalWrite(COOLING_PIN, HIGH);
} else {
digitalWrite(COOLING_PIN, LOW);
}

if (ammoniaLevel > AMMONIA_THRESHOLD) {
digitalWrite(VENTILATION_PIN, HIGH);
} else {
digitalWrite(VENTILATION_PIN, LOW);
}

delay(2000);
}
```

VI. Conclusion

The Fish Storage and Safety Monitoring System is a readily adaptable real-world solution for food safety improvement and spoilage reduction. Such integrated IoTenabled monitoring would allow real-time monitoring and automated responses and remote-activated control of storage conditions for optimally enabling food safety. Further development could include extra sensors specific for more hazardous gases, predictive AI-based maintenance, and improved cloud functionalities that might allow the system to grow to meet potential large-scale operations.

ACKNOWLEDGMENTS

Do it This work was made possible by our department head, Prof. Dr. Muhammad Golam Kibria, for whom I am really grateful. I was able to write our project through every step thanks to his direction and counsel.

The foundation for the system's operation was laid by Sadia (1st Author), whose technical proficiency in executing the system code and carrying out extensive simulations on the Arduino Cloud platform is much appreciated.

Additionally, Rownak (2nd Author) and Sawda (3rd Author) are thanked for their hard work gathering data and carrying out exhaustive literature research. Their input strengthened the project's base and offered important insights into current approaches.

Julkar (4th Author) deserves special recognition for his thorough examination and selection of relevant models from research literature, which guaranteed the suggested system's robustness and scientific validity.

We believe that our contributions will open the door for creative developments in fish storage and safety monitoring, and this project is a prime example of the strength of teamwork and commitment.

REFERENCES

[1] [1] D. G. Davies, "Handling and Processing of Fish," FAO Fisheries Technical Paper 348, Food and Agriculture Organization of the United Nations, 1995.

[2] [2] K. H. Park, "IoT-based Smart Storage for Perishable Goods," International Journal of Food Engineering, vol. 13, no. 2, pp. 45-56, Feb. 2019.

[3] [3] Arduino, "Arduino Cloud Documentation," Arduino, 2024. [Online]. Available: https://www.arduino.cc

[4] [4] S. Roy and J. Smith, "Integration of IoT in Food Supply Chain Management," Journal of IoT Applications, vol. 6, no. 4, pp. 123-132, 2023.

[5] [5] World Health Organization, "Food Safety and Quality," WHO, 2023. [Online]. Available: https://www.who.int