Smart Water Quality System For Agriculture Using IoT

Akshita S[1], Rajashree S[2], Priskilla Manonmani[3]
[1, 2, 3] Dept of Information Technology
[1, 2, 3] Meenakshi Sundararajan Engineering College

Abstract- *The smart water quality system is an innovative and advanced solution designed to monitor and manage the quality of water in the agricultural field. It leverages sensor technology, data analysis algorithms, and connectivity to provide real-time information about water parameters. This system enables proactive decision-making, early detection of water quality issues, and efficient resource management. It protects public health, promotes environmental conservation, and contributes to sustainable water practices. The scope of the system encompasses monitoring water parameters, assessing source water, optimizing treatment processes, monitoring distribution networks, providing early warning systems, managing and analyzing data, ensuring regulatory compliance, promoting public awareness and education, and integrating with smart infrastructure. The smart water quality system represents a significant advancement in water management, providing a comprehensive approach to ensure clean and safe water for present and future generations in the field of agriculture.*

Keywords- water quality, controller, prediction, pH, temperature, salinity, water components.

I. INTRODUCTION

Water pollution can have far-reaching ecological consequences. The IoT - based water quality system represents a significant advancement in ensuring the safety and quality of water sources. By leveraging interconnected devices, sensors, and data analytics, this system enables real-time monitoring, early detection of contamination, and proactive management of water resources. The IoT-based water quality system harnesses the power of interconnected devices, data analytics, and remote monitoring capabilities to revolutionize the way we assess and maintain the quality of water sources. The collected data is transmitted in real-time to a centralized monitoring system, where it is processed and analysed to assess the water quality status. Early detection of water contamination is crucial to preventing further harm and taking appropriate action. Water monitoring systems and regular water quality testing plays a vital role in identifying the polluted water and non-polluted water. These monitoring efforts involve measuring various parameters such as chemical composition, pH levels, dissolved oxygen, pH level, salinity, temperature and turbidity. By monitoring the water parameters continuously, any deviations from the defined thresholds can be identified immediately, triggering automated alerts. It is crucial to ensuring that clean and safe water reaches all communities. By prioritizing water quality and safety, we can mitigate the risks of water pollution and ensure a sustainable and healthy future for all.

II. RELATED WORKS

To solve the obstacles and difficulties water presents, various systems have been introduced in the recent times to provide better solution. Smart water quality monitoring has found its way into society. Existing systems provide water management in real time for commercial purposes at a high cost. This system proposes lost cost efficient model for agricultural purposes and uses advanced technologies for accurate prediction and validation.

Yang Chen, Yuhong Wang, and Yinghong Lin, 2022,proposed Real-Time Water Quality Monitoring and Estimation in AIoT for Freshwater Biodiversity Conservation. This system reads pH, temperature, Total Dissolved Salts, Electrical Conductivity, for reading the values of water in real-time and then does the prediction of water quality for freshwater biodiversity for underwater species.

Krishanthi P. Jayasundera, and Subhas Chandra Mukhopadhyay's system proposed in 2022 is an IoT-Enabled Portable Water. Quality Monitoring System for Urban Centers. This system analyses the quality of water in urban cities for metro water. It uses chemical and physical aspects of the water for the quality of aquaculture life using neural deep learning.

Abílio c. da silva júnior 1, Roberto munoz 2, María de losángelesquezada 3, Aloísio v. lira netointroduced Internet of Water Things: A Remote Raw Water Monitoring and Control System, the system Monitors the quality of water in real-time data is collected every minute and sent to the cloud .

The work introduced by Di Wu , Hao Wang , Hadi Mohammed, and Razak Seidu is Quality Risk Analysis for Sustainable Smart Water Supply Using Data Perception, It Studies the risk analysis factors of water quality and provides smart water supply monitoring.

III. HARDWARE AND SOFTWARE REQUIREMENTS

A. pH Sensor Board

The pH sensor board is used to read the pH, temperature and salinity values of the water. The board must be connected to the NodeMCU ESP8266 on one end, and kept in water for testing on the other end. The sensor board is low cost and efficient and produces accurate values. The values that it reads are transferred to the microchip controller which then passes the information onto the software for real-time monitoring and prediction process.

Figure 1: pH Sensor Board

B. Tower Pro Sg90 Servo Motor

The Tower Pro SG90 is a popular micro servo motor commonly used in robotics and electronics projects. It is a small, lightweight servo motor that provides precise control of angular position. With a torque of 2.0kg/cm at 4.8V and 2.2kg/cm at 6V, it provides ample power for its size. The servo's speed of 0.09s/60° at 4.8V and 0.08s/60° at 6V ensures swift and accurate movements. It has a 180° rotation angle, allowing for a wide range of motion options. Operating within a voltage range of 4.8V to 6V, it offers flexibility in power supply options. The SG90's plastic gears contribute to its lightweight design, weighing just 10.5g. Its dimensions of 22.8mm × 12.2mm × 28.5mm make it suitable for space-constrained projects.

Figure 2: Motor

C. NodeMCU ESP 8266

NodeMCU is an open-source development board that utilizes the ESP8266 microcontroller. It is designed for Internet of Things (IoT) projects and offers built-in Wi-Fi capabilities, making it easy to connect and control devices over a network. The NodeMCU board provides a convenient platform for developing IoT applications, as it combines the ESP8266 microcontroller with a USB interface for programming and debugging. It also includes GPIO pins that allow you to connect and control various electronic components such as sensors, actuators, and displays.

Figure 3: NodeMCU Controller

D.Jumper wires

Jumper wires are essential components in electronics and prototyping projects, facilitating the connection between various electronic components on a breadboard or circuit board. These wires consist of insulated conductive material with connectors on each end, typically male-female or male-male, allowing for easy plug-and-play connectivity. With their flexible and lightweight design, jumper wires enable convenient and temporary connections, simplifying circuit modifications and troubleshooting. They come in various

lengths and colors, aiding in organization and clarity within complex projects.

Figure 4: Jumper Wires

E.PHP

PHP was used for front-end API and connectivity with back-end My-sql and Python.PHP, a widely used scripting language, is primarily employed for server-side web development tasks. Python, on the other hand, is a versatile and highly readable programming language.PHP's syntax is easy to learn and its compatibility with various operating systems and web servers makes it highly accessible. Additionally, PHP has a vast community and a rich ecosystem of frameworks and libraries, enabling developers to expedite development processes and create robust, scalable, and secure web solutions. Overall, PHP empowers developers to create dynamic and interactive web experiences efficiently.

F.Python

Python was used for the prediction of the water quality. Pandas and numpy libraries were imported for manipulating the data in the dataset. The sigmoid function of the logistic regression was used for classifying the water quality as good or bad. Python's simplicity and wide range of applications have led to its widespread adoption in domains such as web development, data analysis, artificial intelligence, and automation. Python's elegant syntax and extensive libraries make it easy to write efficient and concise code. Its interpreted nature allows for quick development and testing.

G.MySQL

My SQL was used for storing the values received. MySQL is a popular open-source relational database management system that provides a robust and reliable solution for storing and managing structured data. With MySQL, users can efficiently create, read, update, and delete data using SQL (Structured Query Language) commands. It offers a wide range of features, including support for multiple platforms, high performance, scalability, and strong security measures. MySQL supports various storage engines, allowing users to optimize their database for specific requirements. It also provides excellent integration capabilities, enabling seamless connectivity with different programming languages and frameworks.

H..Embedded C

To read values from NodeMCU embedded C programming language was used, utilizing the Arduino framework, which provides a convenient and widely adopted platform for programming the NodeMCU board. Embedded C is a programming language specifically designed for embedded systems, which are computer systems dedicated to performing specific tasks. It is a subset of the C programming language and incorporates features to efficiently utilize the limited resources and capabilities of embedded devices. Embedded C enables low-level hardware access, memory management, and control over peripherals. It emphasizes code efficiency, real-time performance, and portability. With Embedded C, developers can write firmware that interacts with sensors, actuators, and other components of embedded systems. It is widely used in industries such as automotive, aerospace, consumer electronics, and IoT, where compact and efficient code execution is crucial.

IV. PROPOSED SYSTEM

The system reads the pH, temperature, and salinity values of the water from the pH sensor board using the NodeMCUESP8266 microchip controller. The controller is the central system of the system that is connected to two other motors. The controller has a WiFi module that connects to the internet which helps in passing the information to the cloud. An LCD monitor displays the detected values. The values are also updated in real-time to the cloud. A website in the cloud has been created for this purpose. pH, temperature, and salinity along with the date/time stamp are noted in a table. A second table is additionally present to display the times when the quality of water is not good. The continuous values are then used in Python to develop a model that predicts the quality of water in the future. Logistic regression has been used for this purpose. The graph derived from the function is then plotted. The sigmoid function was used with the values of temperature, pH, and salinity.

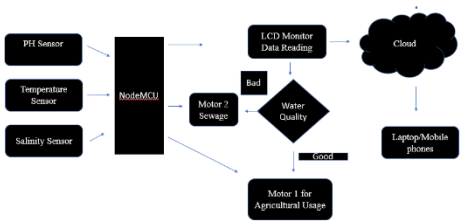

Figure 5: Architecture Diagram

V. RESULT AND ANALYSIS

The final outcome of the system if a hardware that uses sensors to read values, and software that updates the values and predicts the water quality and displays so when the water is not good.

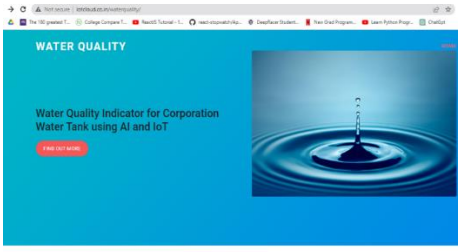

Figure 6: Home Page

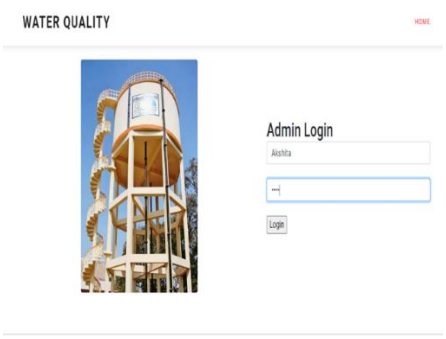

Figure 7: Login

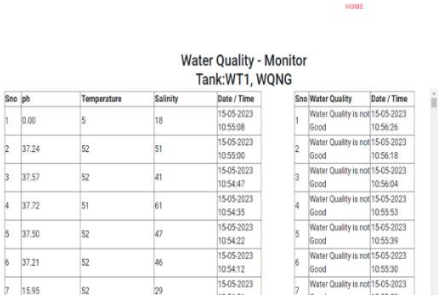

Figure 8: Table values

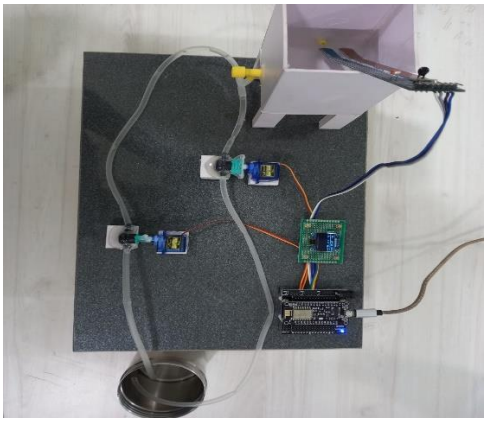

Figure 9: Working System

REFERENCES

[1] Yang Chen, Yuhong Wang, and Yinghong Lin ,"Real-Time Water Quality Monitoring and Estimation in AIoT for Freshwater Biodiversity Conservation", volume 9,2022 August

[2] Krishanthi P. Jayasundera, and Subhas Chandra Mukhopadhyay,An IoT-Enabled Portable Water Quality Monitoring System With MWCNT/PDMS Multifunctional Sensor for Agricultural Applications", volume 9,2022 August.

[3] Abílio c. da silva júnior 1, Roberto munoz 2, María de losángelesquezada 3, Aloísio v. lira neto, Internet of Water Things: A Remote Raw Water Monitoring and Control System,bolume 9, January 2021.

[4] Et-taibibouali, Mohamed Riduan Abid, Tareq Abu Hamed, Renewable Energy Integration Into Cloud & IoT-Based Smart Agriculture, volume 10, December 2021.

[5] K. P. Rasheed Abdul Haq, V. P. Harigovindan, "Utilizing hybrid deep learning models to predict water quality in smart aquaculture."Volume 10, March 2022.