WATER QUALITY MONITORING RC BOAT

Dr. S. Vijayanand[1], R. Gayathri[2], Harini M[3], Hithaishi U M[4]

[1]Assistant Professor, Sri Venkateswara College of Engineering, Sriperumbudur, TamilNadu
[234]Students of Electronics and Communication Engineering, Sri Venkateswara College of Engineering, Sriperumbudur, TamilNadu

---***---

Abstract - *Water pollution has become a major issue these days due to the dumping of industrial waste, harmful chemicals, and other pollutants. The quality of water plays a crucial role in the health of plants, animals, and human beings. Therefore, improved methods of water quality monitoring are required. The manual collection of water samples at various locations is a traditional method of water quality monitoring. The water quality is then characterized using laboratory analytical methods. So, here we design a solution for easy water quality checking of water bodies. This system measures the pH, Turbidity, Temperature, and humidity levels of water samples using the respective sensors, and based on the values, it gives information about whether the water is fresh or polluted and also what kind of aquatic flora and fauna can be grown. The interfaced sensors are placed on the boat and real-time data can be obtained once the boat moves over the water's surface. This project is based on the Internet of Things, which will be controlled by the Arduino Nano using a mobile application. Accordingly, a propeller system to provide the forward propulsion and a servo motor arrangement to control the boat by moving left or right by means of a mobile device using a joystick module. The values of the sensors, the suggestions of aquatic flora and fauna, and the position of the boat can be viewed through the Adafruit webpage with the help of the Wi-Fi module.*

Key Words: **Arduino Nano, pH, turbidity, temperature, humidity, flora, fauna, Adafruit.**

1.INTRODUCTION

Water is the primary source of economic and social development. It is vital to maintain health, grow plants and crops and manage the environment. The demand for water is not only for human survival but also for aquatic flora and fauna, as they live in the habitat of water. Ensuring the safety of water is a challenge due to the excessive use of chemicals and fertilisers, most of which are man-made. Water pollution has been greatly exacerbated by modern advancements, agricultural pesticides, and the non-enforcement of laws, as well as by the rapid pace of industrialization and its greater impact on agricultural growth. Rainfall that is not distributed evenly can occasionally make the issue worse. When determining the quality of the water, individual practises are also crucial. Poor water quality may spread disease and inhibit socioeconomic progress.

2. LITERATURE REVIEW

Darshana R. Sarnaik, C. M. Jadhao, and Mhaske proposed a work on "Real Time Water Pollution Monitoring RC Boat Using IOT," a system that collects information from wireless sensors linked to a Raspberry Pi model B, processes it, and then compiles the information into a text file that is sent to IOT. A gateway is built on the Raspberry Pi 3 model B using the FTP (file transfer protocol) protocol for data transmission to the IOT. Cloud computing technology, which offers a private local server, is used to monitor the processed data on the internet. Separate IP addresses are offered by cloud computing technologies, enabling data monitoring via the internet from any location in the world. The system is made user-friendly by the introduction of a browser application that uses HTTP to retrieve that monitored data. Therefore, individuals from all around the world can access and monitor the data simply by utilizing this browser application. [1]

Olasupo O. Ajayi, Hloniphani C. Maluleke, and Antoine B. Bagula Zaheed Gaffoor, Kevin C. Pietersen and Nebo Jovanovic worked on the process of collecting data on "WaterNet: A Network for Monitoring and Assessing Water Quality for Drinking and Irrigation Purposes," which proposed a network architecture to gather information on water quality metrics in real-time and employs machine learning techniques to estimate the quality of water automatically for various purposes. This network is based on Lora and takes land topology into account. A partial mesh network topology is the most suitable network, according to simulation results. Here, three ML models have been used. They are Logistic Regression (LR), Random Forest (RF), and Support Vector Machine (SVM). The water classification process took into account these algorithms, and the results showed that Linear Regression performed better for drinking water, while Support Vector Machine was better suited for irrigation water. A recursive feature elimination algorithm was then combined with these three Machine Learning models to identify which water parameter has the greatest influence on the classification efficiency of the respective model.[2]

Mohamad Adhipramana, Rina Mardiati, and Edi Mulyana developed a robot system called "Remotely Operated Vehicle (ROV) Robot for Monitoring Quality of Water Based on IOT" to monitor the parameters of water quality based on the Internet of Things. The main hardware used here is the micro-controller, the Arduino Nano. A remote controller is used to control the robot system. The robot system is made of an Arduino Nano, DC motors, and an L298N motor driver. A pH sensor, a turbidity sensor, and a TDS sensor are among the hardware components utilized in the monitoring system to detect the pH of samples, turbidity units, and PPM. The ESP8266-01 is also functional as a system processor. Here, the cloud server serves as both a data repository and a data reader. [3]

Ajith Jerom B, Ilayaraja V, and Manimegalai R proposed work on "An IoT-Based Smart Water Quality Monitoring System using the Cloud", The goal of this paper is to investigate a real-time system for analyzing and monitoring river water quality. Three levels are proposed for the framework: a layer for monitoring and control, a layer for decision-making, and a layer for data collection. The decision layer analyses the acquired data, compares it to the pre-existing data, and diagnoses the data using machine learning algorithms. Only when there has been a major change in the data that has been received does the Smart Water algorithm permit storage. The database size could be successfully decreased as a result of this. For predicting the samples acquired as data from various sensors, the system is trained with all parameters using five different water classes: Type-I, Type-II, Type-III, Type-IV, and Type-V. In this system, the machine learning method is used to regularize, train, and test thousands of samples. [4]

Swati Chopade, Rahul Mishra, Hari Prabhat Gupta, Tanima Dutta and Preti Kumari proposed "An Energy Efficient River Water Pollution Monitoring System in the Internet of Things", In this paper, the researchers suggested an energy-efficient river water pollution monitoring system that makes use of long-range communication technologies and deep neural networks. The system creates a compressed Deep Neural Network (DNN) to compute the Water Quality Index (WQI) and determine how much energy is needed to communicate the WQI. The system then trains a compressed deep neural network using the knowledge distillation technique. Furthermore, in order to determine appropriate spreading factors in the LoRa network, our work established a Nash equilibrium among the devices. To determine the time period and to make it possible for the long-range network's appropriate spreading factor to transmit the water data, a game theory-based approach is suggested. [5]

3. METHODOLOGY

The theory underlying real-time IoT water quality monitoring is described in this section. The general block diagram of the suggested method is detailed in Section 3.1. Each and every component of the suggested system is thoroughly discussed in Section 3.2.

3.1 Overall Block Diagram

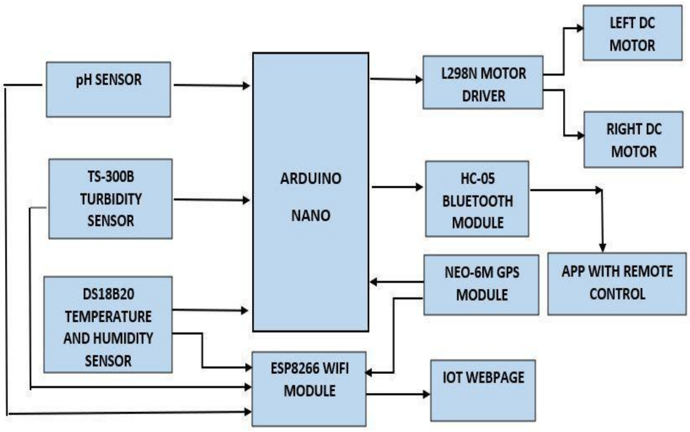

Fig -1: Block Diagram

In this proposed block diagram, the sensors such as pH, turbidity, temperature and humidity are connected to the core controller. To transfer the data over the internet, the core controllers access the sensor values and process them. The Arduino Nano is used as a core controller. The sensors are also connected to the ESP8266 Wi-Fi module to display the data on the IOT Adafruit server.

3.2 Proposed Work

The system is subdivided into two parts.

3.2.1. Water Quality Monitoring System

3.2.2 Remote Navigation System

3.2.1 Water Quality Monitoring System

The first phase of implementation includes the monitoring of water parameters by using sensors such as pH sensor, turbidity sensor, temperature and humidity sensor. The sensors and GPS module are interfaced with the Arduino Nano and ESP8266 Wi-Fi module. The L298N motor driver is connected to the Arduino Nano. This whole setup is interfaced in the boat. Because the characteristics that the sensors are reading from the water bodies are analogue, they must be transformed into digital form before the processor can process the data. After being processed, the data may be viewed on the IOT Adafruit website.

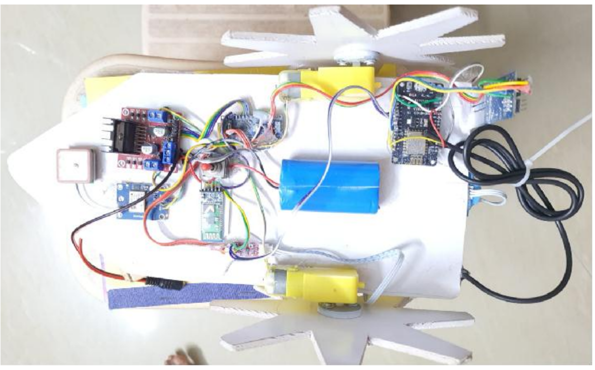

Fig -2: RC Boat

3.2.2 Remote Navigation System

The second phase of implementation includes connecting the boat to the Bluetooth module and then interfacing it with the mobile application. Then the boat is controlled using the mobile application. The values of the water quality parameters and the graphs are displayed on the IOT Adafruit web server. Also, the position of the boat is obtained on the web server by using the GPS module. Based on the sensor values, the quality of the water is determined and classified as fresh water, slightly polluted water, or polluted water. Also, based on the quality of the water and water parameters, it recommends what kind of aquatic flora and fauna can be grown.

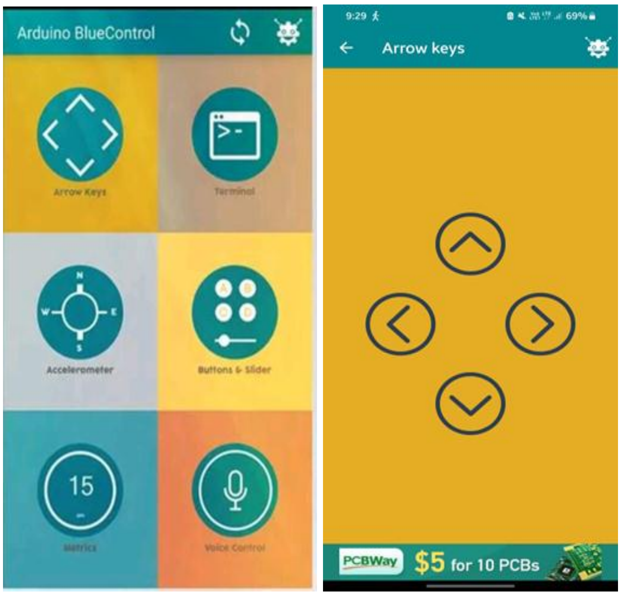

Fig -3: App Interface and Joystick module

4. WORKING

When we switch on the toggle switch and place it in water, the sensors, such as the pH sensor and the turbidity sensor, get initialized. Then, by turning on Bluetooth on the mobile phone, the mobile application gets connected to the RC boat with the help of the Bluetooth module. Then the boat is controlled using the joystick module present in the Arduino Bluetooth Controller application. When the boat is moving in the water, the real-time data gets displayed on the Adafruit webpage with the help of the ESP8266 Wi-Fi module that is connected to the MQTT server. The Arduino Nano and the ESP8266 Wi-Fi module are connected with the help of an API key regenerated on the IOT Adafruit server. Now, the water quality is determined with the help of PyCharm using the logistic regression algorithm. Based on the water quality and the sensor values, the aquatic flora and fauna will be displayed using the same logistic regression algorithm. The username of the Adafruit server and the regenerated API key are given to the Arduino IDE as well as the PyCharm IDE. Also, the real-time location (latitude and longitude) and the graphs obtained on the web server.

5. RESULTS

Here we have used a pH sensor to calculate the pH value of different water samples. The Ph values range between 0 and 14. The pH range of 5.5-6.5 is ideal for plant development because of the accessibility of supplements. Then, we used a turbidity sensor with the supporting module to calibrate the turbidity of the water as well as determine the total suspended solids in the water. The presence of high turbidity levels limits the amount of light that can penetrate the water's surface. Plant growth is impacted because their capacity for photosynthesis is decreased. Hence, turbidity is an important factor.

Also, the DS18B20 temperature and humidity sensor is used to calculate the surrounding temperature as well as the water temperature. Aquatic life is influenced by water temperature, which also regulates the rate of metabolic and reproductive processes. The solubility of oxygen decreases as the water temperature rises.

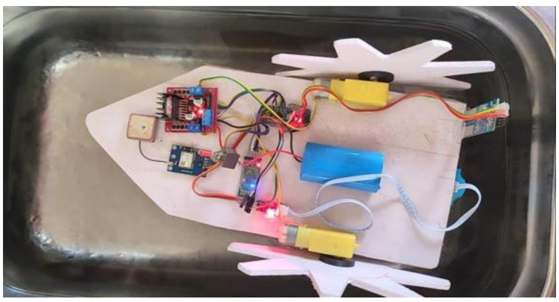

Fig -4: Boat placed in Tub

This system displays the water quality as well as recommends aquatic flora and fauna based on real-time monitoring. This is a unique feature of the existing systems.

Fig -5: Real time values obtained in the Adafruit Webpage

6. CONCLUSION

Our water quality monitoring RC boat system is economical and fast as it can monitor water quality automatically and doesn't require any man on duty other than controlling the boat. This system has been proven to be capable of showing these physicochemical parameters as well as properly displaying these results through a variety of experiments in reservoirs, lakes, and personal water storage tanks.

REFERENCES

[1] Darshana R. Sarnaik, C. M. Jadhao, Mhaske, “Real Time Water Pollution Monitoring RC Boat Using IOT”, International Journal of Advanced Research in Science, Communication and Technology, Volume 2, Issue 5, June 2022.

[2] Olasupo O. Ajayi, Antoine B. Bagula, Hloniphani C. Maluleke, Zaheed Gaffoor, Nebo Jovanovic, And Kevin C. Pietersen, “WaterNet: A Network for Monitoring and Assessing Water Quality for Drinking and Irrigation Purposes”, IEEE, Volume 10, May 2022.

[3] Mohamad Adhipramana, Rina Mardiati, Edi Mulyana, “Remotely Operated Vehicle (Rov) Robot for Monitoring Quality Of Water Based On IOT”, IEEE, December 2020.

[4] Ajith Jerom B, Manimegalai R, Ilayaraja V, “An IoT Based Smart Water Quality Monitoring System using Cloud”, International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), 2020.

[5] Swati Chopade, Hari Prabhat Gupta, Rahul Mishra, Preti Kumari and Tanima Dutta, “An Energy Efficient River Water Pollution Monitoring System in Internet of Things”, IEEE Transactions on Green Communications and Networking, Volume 5, No. 2, June 2021.

[6] Gayatri Gunjal , Renu Guraddi , Sonal More , “IOT Based Water Quality Monitoring System Using RC Boat”, International Research Journal of Modernization in Engineering Technology and Science, Volume 4, Issue 4, April 2022.

[7] Abhishek Tiwari, Sanjay Shahi, Prabhat Kumar Sharma, “Water Quality Monitoring System: IOT Based Technique”, International Journal for Research Trends and Innovation, Volume 7, Issue 8, 2022.

[8] Amey S. Shirodkar, Kadam Akshay M. Mali Vipul H, Mestry Gaurav S, Singh Aniket D, “Design & Development of RC Speed Boat”, International Research Journal of Engineering and Technology (IRJET), Volume 7, Issue 4, April 2020.

[9] Mr. Aakash Pramod Adake, Dr. Manasi Dixit, “Water Quality Monitoring System using RC Boat with Wireless Sensor Network”, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 7, Issue 4, April 2019.

[10] Miss Darshana R. Sarnaik, Dr. C. M. Jadhao, Prof. S. S. Mhaske, “Real Time Water Pollution Monitoring RC Boat Using IOT”, International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), Volume 2, Issue 5, June 2022.

[11] Mohamed Aslam, Sreerag K, Stebin T Jose, Mr. G. Chandrashekar, “IoT Based Water Pollution Monitoring RC Boat”, International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 2, Issue 7, May 2022.

[12] Mr. Aakash Pramod Adake, Dr. Manasi Dixit, “Water Quality Monitoring System using RC Boat with Wireless Sensor Network”, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 7, Issue 4, April 2019.

[13] C.Ashwini, Uday Pratap Singh, Ekta Pawar, Shristi, “Water Quality Monitoring Using Machine Learning And IOT” - International Journal of Scientific & Technology Research, Volume 8, Issue 10, 2019.