REMOTE-CONTROLLED WATER QUALITY MONITORING BOAT

***Project Reference No.:** 48S_BE_1463*

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Keywords:

Water pollution monitoring, IoT-based water quality assessment, real-time data transmission, Blynk, environmental conservation.

Introduction:

Industrial pipeline and sewage inspections pose substantial dangers to both human safety and the environment. Water contamination has traditionally been monitored through manual sample collection and laboratory testing, which takes time and does not provide real-time response. With rising environmental concerns and the requirement for rapid pollution response, integrating IoT technology into water monitoring systems provides a disruptive answer. This project describes a water pollution monitoring system that use a remote-controlled boat outfitted with sensors to monitor water quality indicators such as pH, turbidity, and temperature. Data is wirelessly transferred to a cloud platform using the Blynk application, allowing for remote access and real-time updates.

The concept intends to reduce reliance on stationary monitoring and manual sampling, improve spatial coverage, and reduce monitoring costs. It encourages authorities to take preventive action to ensure safe water quality and sustainable resource management.

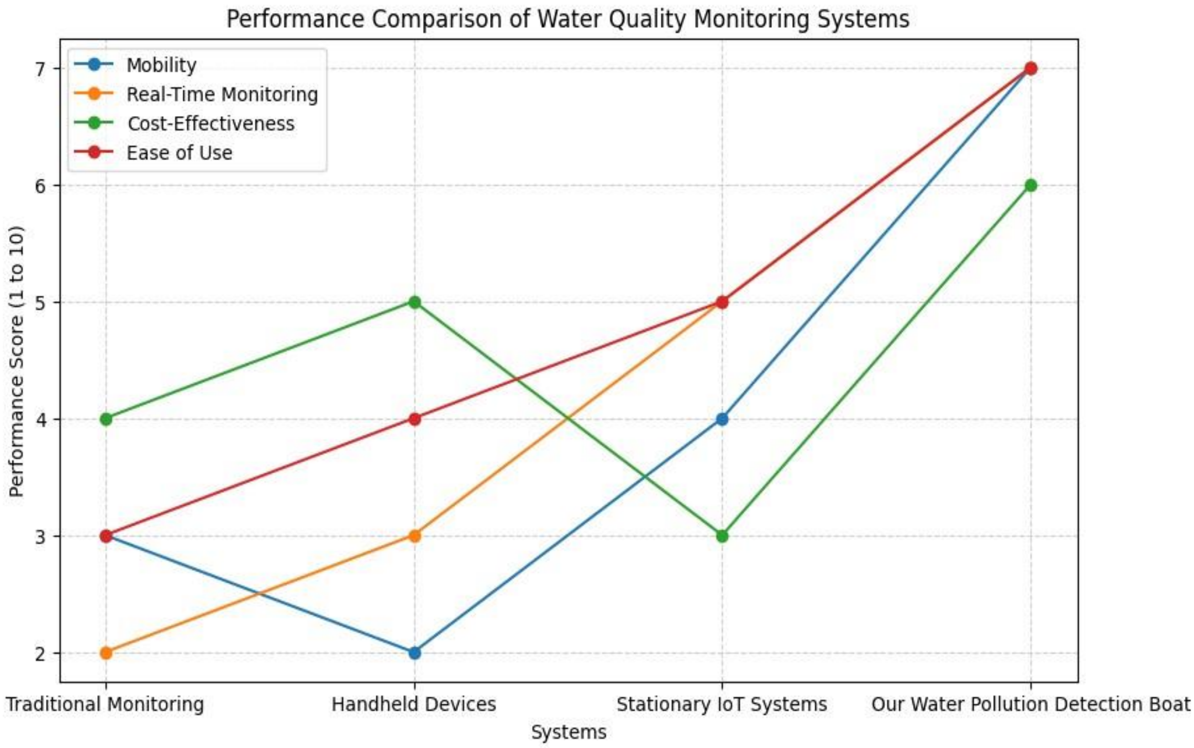

Figure 1: Graph comparing the performance of this project with previous projects

Objectives:

1. To design a mobile, cost-effective system for detecting water pollution in realtime.
2. To integrate sensors for monitoring pH, turbidity, and temperature of water bodies.
3. To implement wireless data transmission using ESP32 and Blynk.
4. To enhance water quality analysis by providing live monitoring from multiple locations.

Methodology:

The system consists of a remote-controlled boat embedded with sensors including pH, turbidity, and temperature sensors. These sensors are connected to an ESP32 microcontroller, which processes the sensor inputs and sends the data to the Blynk cloud via Wi-Fi. The user can remotely navigate the boat to different parts of the water body using a smartphone-based controller. The Blynk dashboard displays real-time water quality parameters for each location visited by the boat. The setup is powered by a rechargeable battery pack to support portability and sustainability. The overall design is optimized to ensure cost efficiency, operational simplicity, and reliable data transmission.

Result and Conclusion:

The proposed system was successfully implemented and tested in a controlled water body environment. The boat was able to navigate effectively while transmitting realtime sensor data to the Blynk app. The readings were accurate, stable, and reflective of real conditions, making it suitable for practical use. This project demonstrated the advantages of using a mobile platform over stationary systems in terms of spatial coverage, cost, and user interaction. It can be a useful tool for environmental authorities, researchers, and NGOs engaged in water quality assessment.

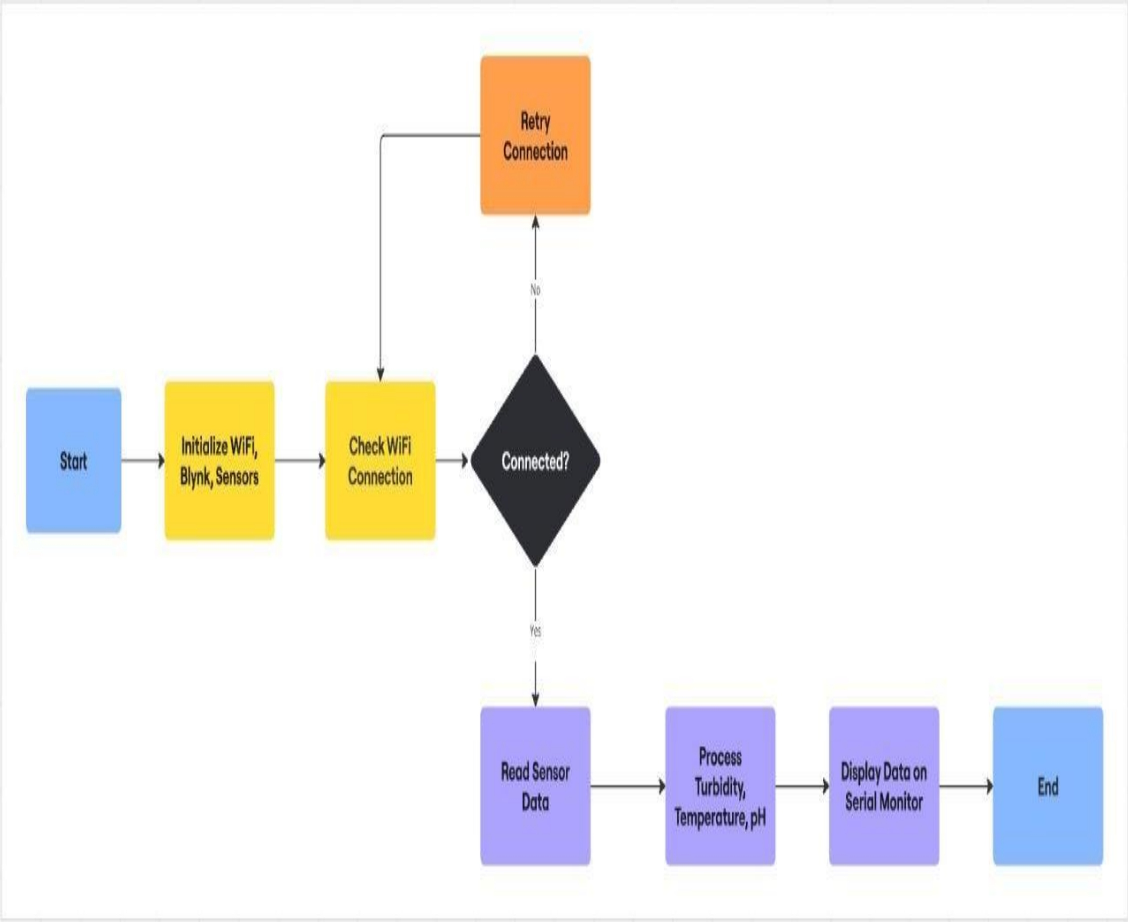

Figure 2: This flowchart represents a WiFi-connected sensor system for monitoring water quality. It initializes WiFi, Blynk, and sensors, checks connectivity, reads sensor data, processes parameters like turbidity, temperature, and pH, and then displays the data on a serial monitor.

Figure 3: The image shows a serial monitor output displaying real-time sensor data, including pH values, temperature readings (~32°C), and turbidity conditions (CLEAR or DIRTY). The data suggests an IoTbased water quality monitoring system.

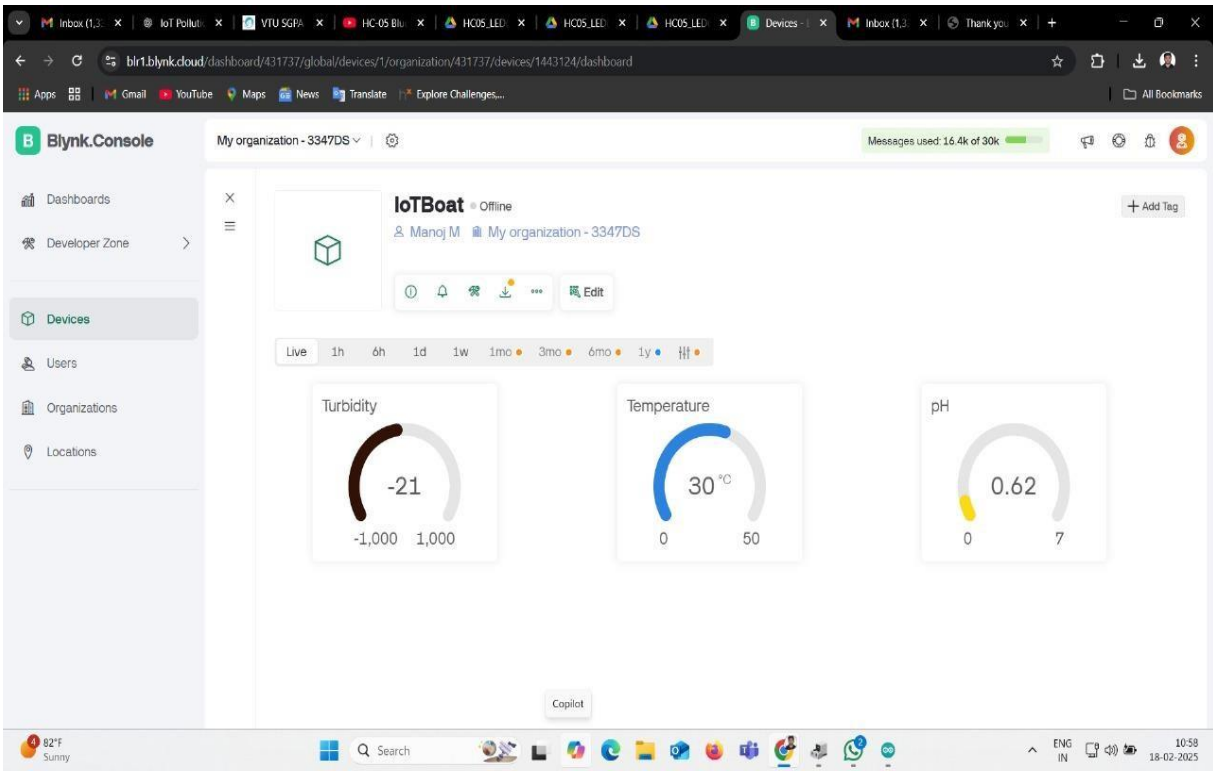

Figure 4: The image shows the Blynk Console dashboard for an IoT device named IoTBoat, which is currently offline. It displays real-time sensor data, including turbidity (-21), temperature (30°C), and pH level (0.62).

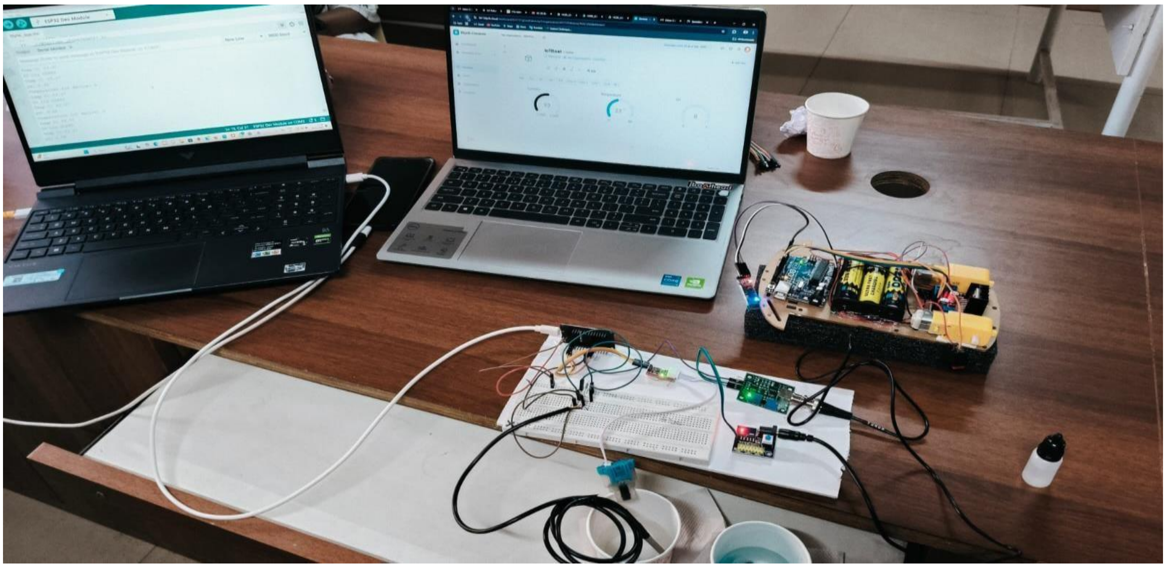

Figure 5: This image shows a real-time water quality monitoring system setup. It includes two laptops running Arduino and Blynk software, a sensor circuit on a breadboard, and a floating device with batteries and microcontrollers, likely designed to measure water parameters like pH, turbidity, and temperature.

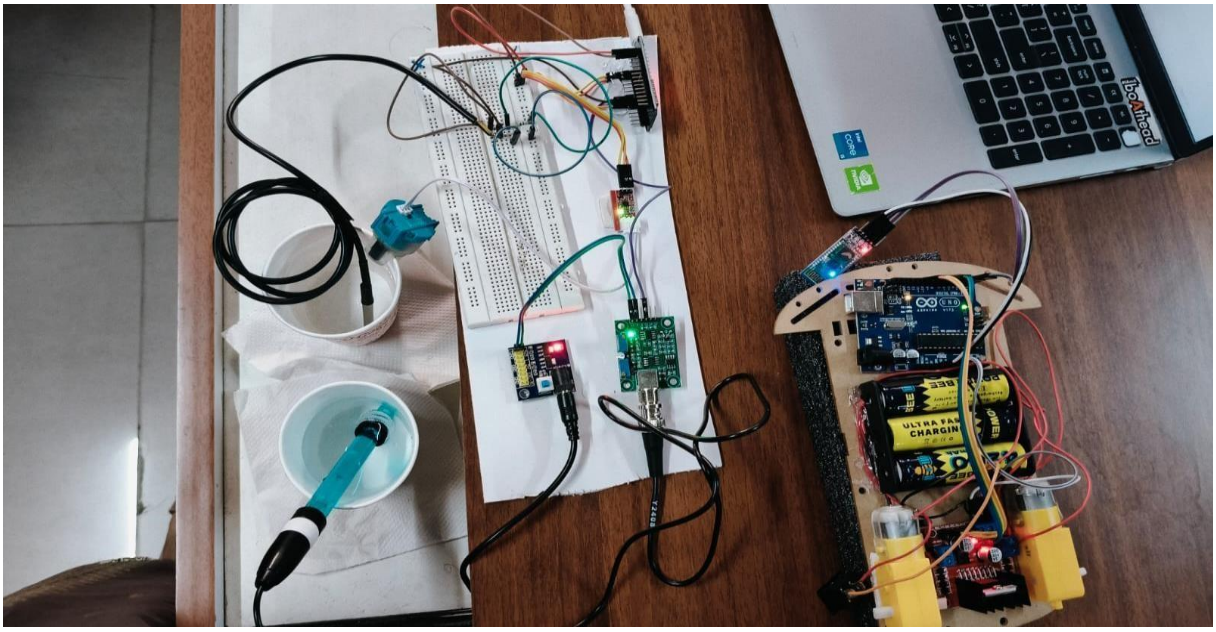

Figure 6: The setup includes pH and turbidity sensors submerged in water, connected to a breadboard circuit with microcontrollers.

Project Outcome & Industry Relevance:

This project offers a practical solution to the increasing need for real-time water quality monitoring. The remote-controlled boat can assist municipalities, environmental agencies, and research organizations in assessing pollution levels in lakes, rivers, and reservoirs without requiring manual sampling. Its cost-effective and scalable design makes it suitable for deployment in both urban and rural settings. By enabling real-time data access, the system supports proactive decision-making and environmental conservation efforts.

Working Model vs. Simulation/Study:

This project involved the development of a fully functional working model. The prototype includes a remote-controlled boat equipped with sensors and a microcontroller, successfully tested to capture and transmit real-time water quality data. No simulations or purely theoretical studies were conducted.

Project Outcomes and Learnings:

The key outcome of this project is a mobile and affordable water monitoring system that delivers real-time results. Throughout the design and implementation phases, we gained hands-on experience in IoT integration, sensor calibration, wireless communication, and remotecontrol technologies. The project also enhanced our skills in team collaboration, problem-solving, and system optimization under real-world conditions.

Future Scope:

The future scope of this project includes:

1. Integrating additional sensors like dissolved oxygen and conductivity to broaden water parameter analysis.
2. Using solar panels to enable continuous outdoor operation.
3. Automating navigation using GPS and predefined routes.
4. Creating a historical data log for trend analysis and AI-based prediction models.
5. Collaborating with environmental bodies for real-world deployment in lakes, rivers, and reservoirs.