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RC BOAT For Water Pollution Monitoring

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Abstract: Nowadays there is an ever increasing strain regarding the provision of clean, consumable water. This particular project aims to detect and display real-time physicochemical quality of the water in a much more cost effective manner, as opposed to the current methods which involve sampling and laboratory methods, through its wireless, multi-sensor network. It takes into consideration multiple factors and presents this real-time quality through the display of its electrical conductivity, pH, total dissolved solids TDS, turbidity, as well as temperature of water that is being tested. Additionally, this remote control system is specially designed for lakes, reservoirs, rivers etc. where we cannot monitor water quality in such complicated scale water environments by just using a stationary system because water parameters vary at every single location. To avoid this, we manufactured a boat which can float and move on the water simply by user controller. This structure is designed as a hull shape which minimizes the resistivity of water flow and this shape also maintains the stability of water. This water quality monitoring boat includes an embedded global positioning system GPS which gives the location of the point wherever water quality is varying and radio frequency module for wireless communication. All the results are generated and displayed with their readings and their graphical analogue meters through the graphical user interface GUI technique, along with water's impurities limitation points and its hazardous level notification. It is proven through various tests conducted in reservoirs, lakes and personal water storage tanks that this project is successfully capable of demonstrating these physicochemical parameters as well as displaying these.

Index Terms **- Water Pollution, Electrical Conductivity, Turbidity. IoT System**

I. INTRODUCTION

The environmental impact of water pollution motivates individuals to take an active role in raising awareness and facilitating data-driven decision-making. The primary motivation lies in the urgent need to safeguard water resources. With increasing concerns about water pollution globally. By monitoring the levels of dissolved oxygen, we can assess the overall health of the water body and identify areas with potential ecological stress. This holistic approach to water quality monitoring ensures a thorough understanding of the environmental conditions and aids in making informed decisions for pollution control and management. The project aims to provide a user-friendly, technologically advanced solution that contributes to the proactive preservation and restoration of water bodies. The project's focus on leveraging collected data for environmental impact assessment, enabling the identification of pollution sources and trends in water quality variations. The objective is to facilitate informed decision-making for environmentalists, authorities, and policymakers. The proactive pollution control aspect aims to detect areas with deteriorating water quality promptly, fostering sustainable water resource management practices. By integrating state-of-the-art technologies, the project endeavors to set a benchmark in water quality monitoring, showcasing a commitment to advancing environmental conservation efforts and promoting the sustainable use of water resources for the benefit of current and future generations. The "IoT-based RC Boat for Water Pollution Monitoring" project seeks to revolutionize water quality

assessment in expansive water bodies through the development of a remote-operated (RC) boat equipped with advanced sensors and cutting-edge technology. The RC boat project becomes a tool for real-time monitoring. By equipping the boat with sensors capable of detecting various pollutants such as chemicals, heavy metals, or microorganisms, individuals can actively contribute to the ongoing efforts to assess water quality. The primary objectives include the implementation of sensors to measure crucial water parameters like pH levels, turbidity, and dissolved oxygen in real-time. This comprehensive data collection is complemented by a GPS module for precise spatial mapping, enabling the creation of detailed maps showcasing variations in water quality across different sections of the water body. The incorporation of a micro SD card ensures reliable local data storage, while an IoT server connection facilitates real-time data transmission over the internet, empowering authorities with immediate insights for timely decision-making and pollution control strategies.

II. LITERATURE SURVEY

Water pollution monitoring multifunctional boat using solar panel with dual axis tracker is proposed in [1]. This structure is designed as a hull shape which minimizes the resistivity of water flow and this shape also maintains the stability of water. This water quality monitoring boat includes an embedded global positioning system GPS which gives the location of the point wherever water quality is varying and radio frequency module for wireless communication. All the results are generated and displayed with their readings and their graphical analogue meters through the graphical user interface GUI technique, along with water's impurities limitation points and its hazardous level notification.

Currently there is an ever increasing strain regarding the provision of clean, consumable water. This problem especially arises in rural areas due to the ineffectiveness of the governments and the increasing population in the country. Therefore, this particular project in [2] aims to detect and display real-time physicochemical quality of the water in a much more cost effective manner, as opposed to the current methods which involve sampling and laboratory methods, through its wireless, multi-sensor network. It takes into consideration multiple factors and presents this realtime quality through the display of its electrical conductivity, pH, total dissolved solids TDS, turbidity, as well as temperature of water that is being tested.

The different sensors are interfaced to the controller viz. ph sensor, Turbidity sensor, conductivity sensor etc. In addition, the camera is interfaced to controller for getting the live video of the present location of boat. The interfaced sensors are placed on boat and the real time data can be obtained once the boat moves over the water surface. This real time data is uploaded on to the cloud server. Once the data is uploaded the parameters are observed and analyzed. The readings of sensor generated on terminal are uploaded on Thing speak cloud server and the real time parameters are uploaded [3]

Wireless communication system and customized buoy detect water temperature, dissolved Oxygen and PH in a preprogrammed time interval. The developed prototype disseminates the gathered information in graphical and tabular formats through a customized web used portal and re-register mobile phones to better save relevant and users. The system has grade prospect can be used for environment monitoring. [4]. In this research IoT platform has been built which consists of water condition monitoring sensor, embedded system capable of processing sensor data and sending to data center, data transmission with MQTT protocol. The system monitoring of Automated Water Quality Device using passive and active sensors that shown in the research result and discussion that report all status monitoring system from Things-to-Things connections through internet while sending data and transmission the report status using MQTT protocol [5].

Based on the Remote-sensing technology, the digital image processing technology, the pattern recognition and ObjectOriented Method, we have implemented RWQMS. RS provides correct, rapid and macroscopic observation data. GPS provides the precise location information of ground monitor point. GIS provides the spatial information management and analysis and the establishment of database, model and images.3S uses will achieve water RWQMS function extending, expand application fields, and promote the water pollution control work [6].

III. PROPOSED WORK

The proposed system designs a solution for easy water quality checking of vast water bodies with ease.

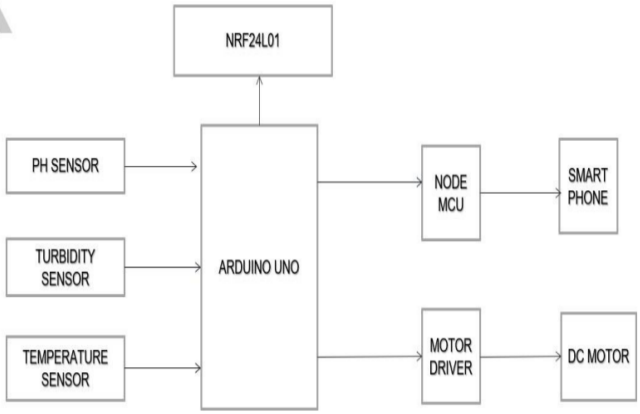

Fig 4.1. – RC BOAT BLOCK DIAGRAM

In this work two modules have being used, the first module is a remote controller. This remote controller is used to control module 2. Module 1 has an Arduino Nano, NRF24L01, and two joystick modules. Arduino Nano is used as a microcontroller for controlling all the components used. The next component is a transceiver module called NRF24L01 is used to transmit and receive signals from the Module 2 and we are using two joysticks for controlling the movement of the rc boat. Module 2 is the main part of this project. It's a RC Boat which has all the main components we are using for finding the quality of water.

The RC Boat has components like Ph sensor, Turbidity Sensor, Temperature sensor, NodeMcu, Motordriver, 12V DC Motor, etc. Ph Sensor ,Turbidity sensor, and temperature sensor is used for checking the quality of water. These sensors are connected to the Arduino Uno and then collected datas are transmitted to a NodeMcu controller. NodeMcu is an open source IOT platform which can connect objects and let data transfer using the Wi-Fi protocol. So the datas can be viewed in any smart device using an application called Blynk IOT.

For the easy travel of RC Boat through water bodies we are using two 12V DC Motor of 1000rpm each. These DC motor are controlled using a motor driver called L298N. We are using these motors for the forward movement of this boat. For turning to the left and right direction we are using a stepper motor which is connected to the rudder of this boat.

This RC water pollution monitor boat allows for recording as well as transmitting water quality data to an IOT server online. This will further help us to maintain the water clean. This project is remote-operated and controlled by an RC remote using which it can be maneuverer accordingly, a motorized propeller system to provide the forward propulsion and servo motor arrangement to provide with the steering using a rudder. As per the commands received by the rc receiver the controller operates the DC motor which rotates the propeller through a flexible bearing and shaft. Now we have 2x direction control rudders. attached to a servo motor used to steer the boat as per controller signals received. Additionally, we have two sensors to determine water quality.

IV. RESULTS AND DISCUSSION

The integration of a remote controller using a smartphone and real-time transmission of sensor values to the Telegram app significantly enhances the accessibility and efficiency of water pollution monitoring. In our study, we utilized turbidity, pH, and temperature sensors onboard an RC boat to continuously measure key water quality parameters. Through the remote controller smartphone application, users can effortlessly navigate the RC boat across water bodies of interest while receiving instant updates on water quality conditions. The seamless transmission of sensor data to the Telegram app enables stakeholders to monitor the health of aquatic ecosystems in real-time, facilitating prompt decision-making and intervention strategies when necessary. This innovative approach not only streamlines data collection processes but also fosters greater community engagement and awareness of environmental issues. By harnessing the power of smartphone technology and

instant messaging platforms, our monitoring system empowers stakeholders with timely and actionable insights to safeguard water resources and mitigate the impacts of pollution. The figure 4.1 shows the design RC-Boat for monitoring water pollution.

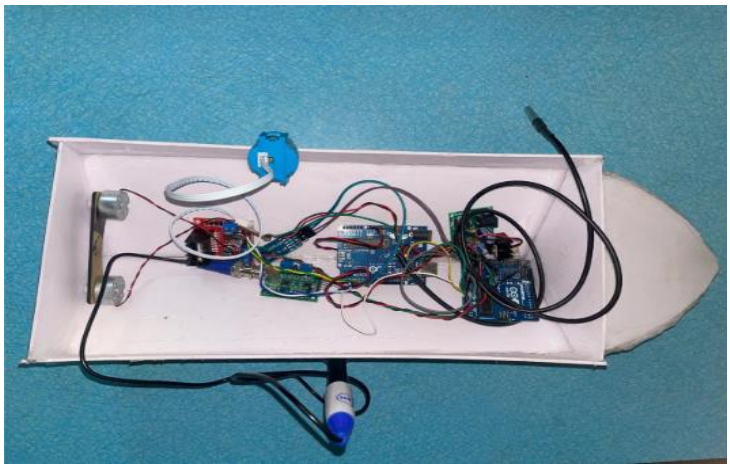

Figure 4.1: RC Boat

The performance evaluation of the RC boat system demonstrates its effectiveness in navigating water bodies, collecting reliable sensor data, and transmitting information in real-time. Field trials conducted in diverse aquatic environments validate the system's robustness and adaptability to varying conditions.

The RC boat's propulsion system allows for precise maneuvering, enabling thorough coverage of target areas for comprehensive data collection. The integration of turbidity, pH, and temperature sensors provides valuable insights into water quality dynamics, allowing stakeholders to identify pollution sources, assess environmental health, and monitor changes over time.

Comparative analysis with conventional monitoring methods highlights the advantages of our approach in terms of efficiency, cost-effectiveness, and accessibility. Traditional methods often rely on manual sampling and laboratory analysis, which can be laborintensive, time-consuming, and expensive. In contrast, the RC boat system offers a scalable and versatile alternative for conducting water quality assessments. Its ability to operate in real-time and transmit data wirelessly enhances monitoring capabilities, enabling stakeholders to respond swiftly to emerging pollution events and implement targeted mitigation measures.

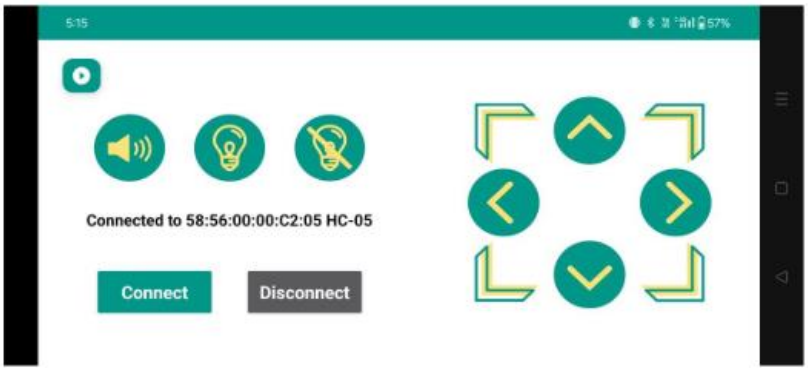

Figure 4.2: Mobile Interface of RC-Boat

Feedback from stakeholders underscores the utility and usability of the smartphone interface for controlling the RC boat and monitoring water quality. The intuitive design of the smartphone application enables users to navigate the boat with ease, adjust sensor settings, and visualize real-time sensor readings. Stakeholders express satisfaction with the system's performance, highlighting its potential for enhancing environmental management practices and promoting community engagement. The integration of the Telegram messaging app further enhances communication and collaboration among stakeholders, facilitating data sharing, decision-making, and public outreach efforts.

Case studies illustrate the diverse applications of the RC boat system in different environmental settings. In urban waterways, the system can be deployed to monitor stormwater runoff, industrial discharges, and sewage outflows, helping local authorities identify sources of contamination and prioritize remediation efforts. In agricultural areas, the system can assess the impact of fertilizers, pesticides, and livestock waste on water

quality, informing land management practices and promoting sustainable agriculture. In recreational areas, the system can monitor swimming beaches, lakes, and rivers for harmful algal blooms, bacterial contamination, and other hazards, ensuring public safety and enjoyment of water resources.

Figure 4.3: Arudino IDE Serial Montior Interface

Technical considerations include optimizing sensor accuracy, reliability, and calibration procedures to ensure consistent data quality. Regulatory compliance issues may arise concerning the use of RC boats in protected water bodies, requiring permits, approvals, and adherence to environmental regulations. Data management and security concerns also need to be addressed to protect sensitive information and ensure data integrity throughout the monitoring process.

Future research directions include exploring advanced sensor technologies, such as spectroscopy, fluorescence, and microbial sensors, to expand the capabilities of the RC boat system for detecting a wider range of pollutants and contaminants. Integration with satellite imagery, remote sensing, and geographic information systems (GIS) could enhance spatial and temporal resolution in monitoring water quality at larger scales. Collaborative initiatives involving government agencies, academic institutions, non-profit organizations, and citizen scientists are essential for advancing knowledge, sharing best practices, and fostering innovation in water pollution monitoring.

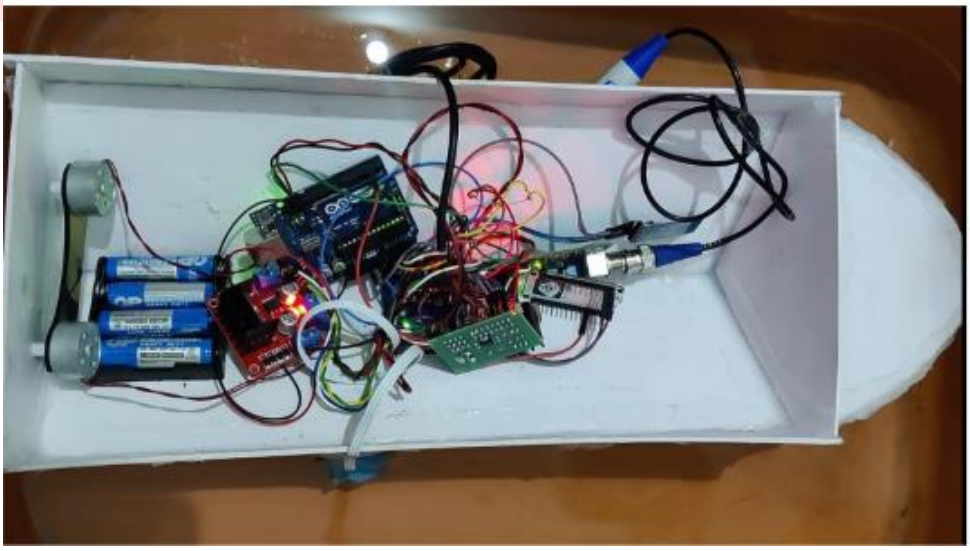

Figure 4.4: RC-Boat in Water

V. CONCLUSION

To check the quality of water, the current method is to sample the water manually. These samples were sent to the laboratories to test the quality which takes extra human effort, cost and time. In our proposed system it will give the properties of the water automatically on the screen without any extra effort. With the help of these properties monitoring of Turbidity, PH & Temperature of Water makes use of a water detection sensor with unique advantage and existing GSM network. The system can monitor water quality automatically, and it is low in cost and does not require people on duty. So the water quality testing is likely to be more economical, convenient and fast. The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters. The operation is simple. The system can be expanded to monitor hydrologic, air pollution, industrial and agricultural production and so on. It has widespread application and extension value. By keeping the embedded devices in the environment for monitoring enables self protection (i.e., smart environment) to the environment. To implement this, we need to deploy the sensor devices in the environment for collecting the data and analysis. By deploying sensor devices in the environment, we can bring the environment into real life i.e. it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi.

In conclusion, the integration of remote-controlled (RC) boats with smartphone technology and real-time data transmission to messaging platforms presents a highly promising approach for enhancing water pollution monitoring. Our study demonstrates the effectiveness of this innovative system in providing stakeholders with timely, reliable, and actionable insights into water quality conditions. By leveraging the capabilities of RC boats equipped with turbidity, pH, and temperature sensors, users can navigate water bodies remotely while receiving instant updates on key parameters. The intuitive smartphone interface and seamless integration with messaging apps facilitate efficient communication, data sharing, and decision-making among stakeholders.

Looking ahead, the future scope of this technology is vast and multifaceted. Further advancements in sensor technology, including the development of novel sensors for detecting additional water quality parameters and pollutants, will expand the capabilities of the RC boat system. Integration with satellite imagery, remote sensing, and geographic information systems (GIS) holds promise for enhancing spatial and temporal resolution in monitoring water quality at larger scales. Collaborative efforts involving government agencies, academic institutions, non-profit organizations, and citizen scientists will be crucial for advancing knowledge, sharing best practices, and fostering innovation in water pollution monitoring. Addressing challenges related to technical optimization, regulatory compliance, data management, and stakeholder engagement will be essential for the widespread adoption and implementation of RC boat technology. Continued investment in research, development, and capacity building will be necessary to overcome barriers and unlock the full potential of this approach. By harnessing the power of technology, collaboration, and innovation, we can strengthen our ability to protect water resources, safeguard public health, and promote environmental sustainability for current and future generations.

REFERENCES

[1] Syed Ishtiaque Haque Bhagwan Deen Verma, Dr. Mukesh Pandey, Anurag Gour – "A Review paper on Water pollution monitoring multifunctional boat using solar panel with dual axis tracker" (2023).

[2] T.Nishtiha , S. Yuvraj, S K Reashma , A. Anoroop, Vishnuvardhan-"A Review paper on IOT Based water pollution Monitoring RC Board" 2023 may volume 10**.**

[3] Nikhil Kecia, Water Quality Monitoring for Rural AreasA Sensor Cloud Based Economical Project, In 1st International Conference on Next Generation Computing Technologies (Ngct-2015) Dehradun, India, 4-5 September 2015. 978-1-4673-6809- 4/15.

[4] Jayti Bhatt, Jignesh Patoliya, Iot Based Water Quality Monitoring System, Irfic, 21feb,2016.

[5] Michal Lom, Ondrej Priby & Miroslav Svitek, Internet 4.0 As A Part of Smart Cities, 978-1-5090-1116-2/16

[6] Zhanwei Sun, Chi Harold Liu, Chatschik Bisdikia_, Joel W. Branch and Bo Yang, 2012 9th Annual Ieee Communications Society Conference on Sensor, Mesh And Ad Hoc Communications And Networks (Secon), 978-1- 4673-1905-8/12