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IoT-based Water Pollution Monitoring Boat

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Abstract: *With the global rise in water pollution, the deployment of effective water quality monitoring systems is becoming increasingly critical. Recent advancements in wireless sensor networks (WSNs) and Internet of Things (IoT) technologies have facilitated the development of practical and efficient solutions for this purpose. This study examines the latest progress in smart water pollution monitoring systems, emphasizing their cost-effectiveness and efficiency. The proposed IoT-based system offers continuous monitoring of water quality indicators, leveraging real-time data capture, transmission, and processing to ensure timely and accurate assessments.*

Keywords: IoT, Water Pollution, Boat, ARDUINO, Environment, Water quality, Environmental science

I. INTRODUCTION

Water is essential for human life, but population growth and increasing urbanization have led to significant environmental degradation, particularly affecting groundwater. Contaminated water is responsible for approximately 40% of global deaths. Recent advancements in sensor networks have proven beneficial for monitoring water quality. Initiatives like the National Lake Conservation Plan and the National Wetland Conservation Programme in India rely on laboratory-analyzed data.

This system features a real-time water quality assessment channel integrated with an LCD display mounted on a boat. Key water quality parameters, including turbidity, total dissolved solids (TDS), pH, and conductivity, are measured using dedicated sensors. Turbidity, TDS, pH, and temperature are monitored by their respective sensors.

The analog data collected by these sensors is converted into digital form using an analog-to-digital converter (ADC) before being sent to a microcontroller. An Arduino UNO processes this data and displays the water quality information on the LCD screen. This setup allows for ongoing monitoring and assessment of the water body.

The proposed system aims to enhance environmental management and improve water quality. Its objectives include:

(a) Creating an efficient, boat-based system for tracking water pollutants.

(b) Minimizing or eliminating the need for human intervention in system maintenance.

(c) Providing real-time updates on water quality through an LCD display on the boat.

II. METHODOLOGY

Water Pollution Monitoring System:

The key parameters for effective water quality monitoring are pH, turbidity, total dissolved solids (TDS), and temperature. Therefore, the water pollution monitoring system employs four primary sensors: Turbidity Sensor, TDS Sensor, pH Sensor, and Temperature Sensor.

The measurements from these sensors are initially in analog form and need to be converted to digital format for processing. This conversion is achieved using a 16-bit analog-to-digital converter (ADC), which is typically integrated into the Arduino UNO microcontroller. After processing, the data is displayed on an LCD screen mounted on the boat.

Monitoring water pollution involves a variety of methods and techniques to collect and analyze water quality data, assess pollutant levels, and inform management decisions. Common methods include:

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A. Sampling

- **Water Sampling:** Collecting water samples from different locations and depths within a water body to evaluate its quality. Samples may be taken from the surface, at various depths, or near sources such as wastewater discharge points.
- **Sediment Sampling:** Gathering and analyzing sediment samples to detect pollutants that may have settled in the sediment.
- **Biological Sampling:** Collecting samples of aquatic organisms or other biological indicators to assess ecosystem health and the impact of pollutants.

B. Testing and Analysis

- **Laboratory Analysis:** Examining water samples in a lab to measure nutrient levels, pH, dissolved oxygen, and identify biological organisms. Techniques such as spectrometry may be used to detect heavy metals and other contaminants.
- **On-Site Testing:** Utilizing portable equipment or sensors to measure water quality parameters like pH, dissolved oxygen, and turbidity directly in the field.
- **Remote Sensing:** Employing satellite or drone imagery to monitor large water bodies, detect algal blooms, and assess parameters such as chlorophyll concentration or turbidity.

Effective water pollution monitoring is essential for understanding the state of water resources, identifying pollution sources, evaluating the success of management strategies, and safeguarding human health and aquatic ecosystems. The data collected from these monitoring efforts supports decision-making and aids in developing policies and regulations to mitigate water pollution.

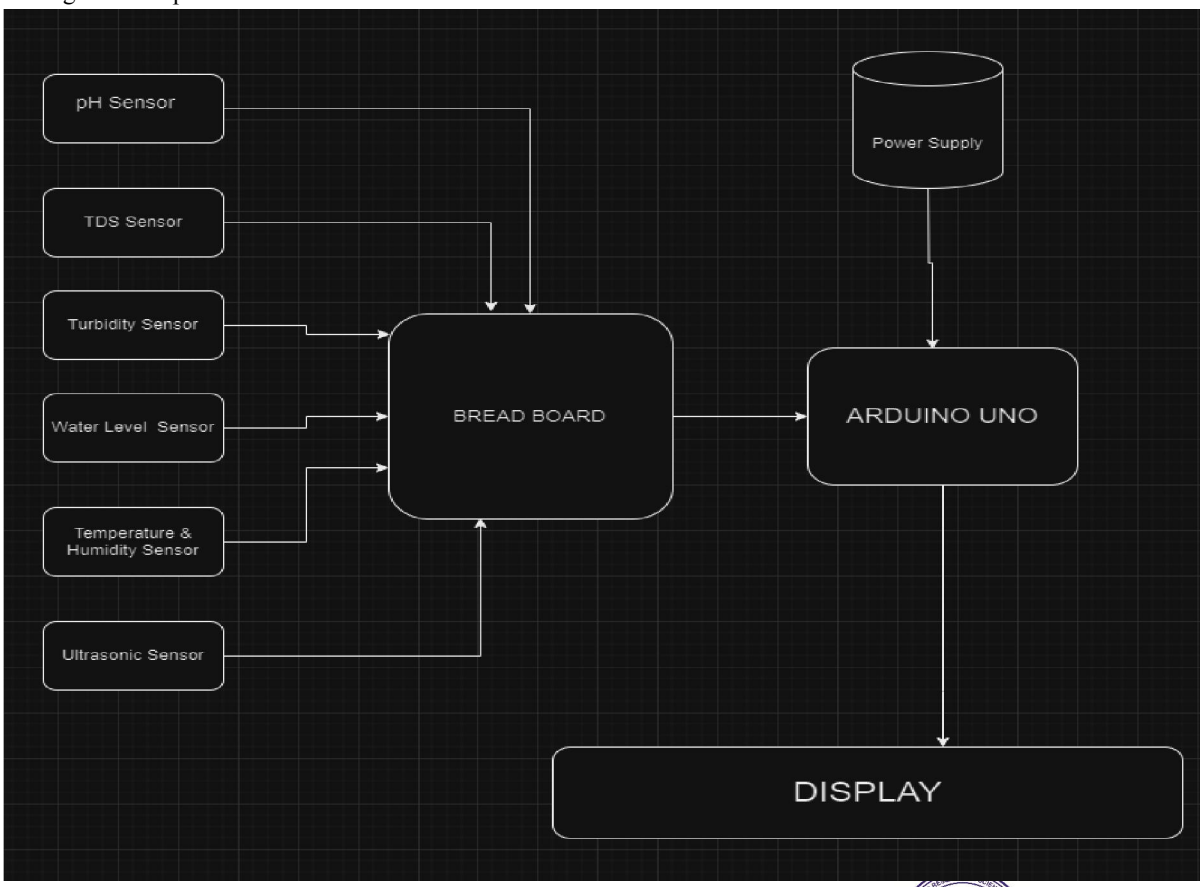

Fig. 1 Schematic block diagram of water quality monitoring system.

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A typical water quality monitoring system includes a range of sensors, such as pH sensors, turbidity sensors, temperature sensors, conductivity sensors, and humidity sensors.

Figure 1 illustrates the general block diagram of a smart water quality monitoring system. In this configuration, controller serves as the central component of the system. It is connected to all the sensors, managing their operations, collecting data, and comparing it against standard reference values. The controller then transmits this information to the designated end user and display.

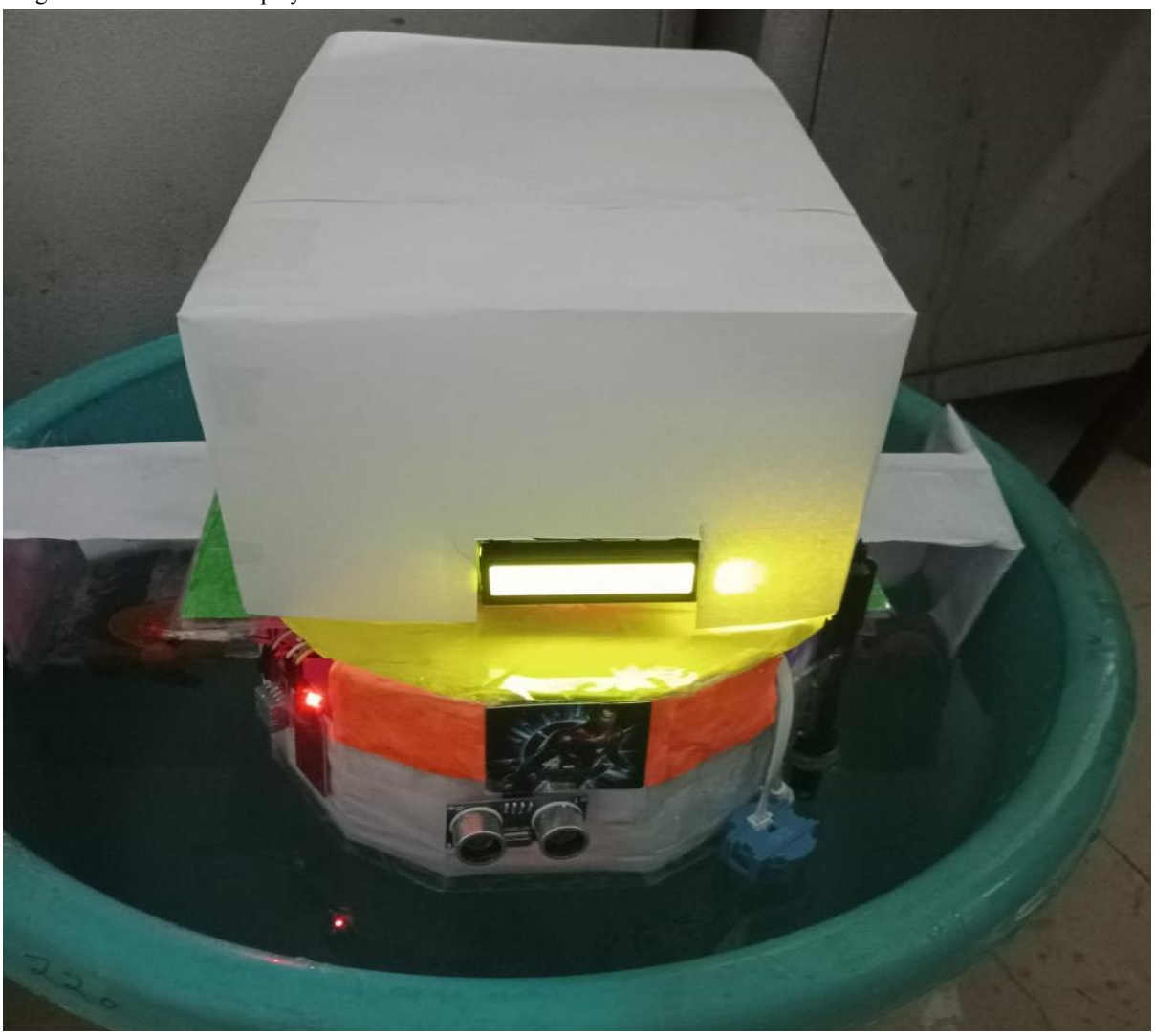

Fig. 2 A Developed model of smart water quality monitoring boat.

IoT technology facilitates the integration of sensors with data networks, enabling seamless communication and data sharing. Through IoT, water quality data can be transmitted in real-time to central servers, where it is analyzed and acted upon. Continuous monitoring of water quality is facilitated by the use of a smart water quality monitoring system. The generated model of the smart water quality monitoring system is displayed in Fig. 2.

III. RESULT

The sensor's successfully worked and generated output of water pollution parameters such as pH, turbidity, total dissolved solids (TDS), and temperature data as depicted in figure 3.

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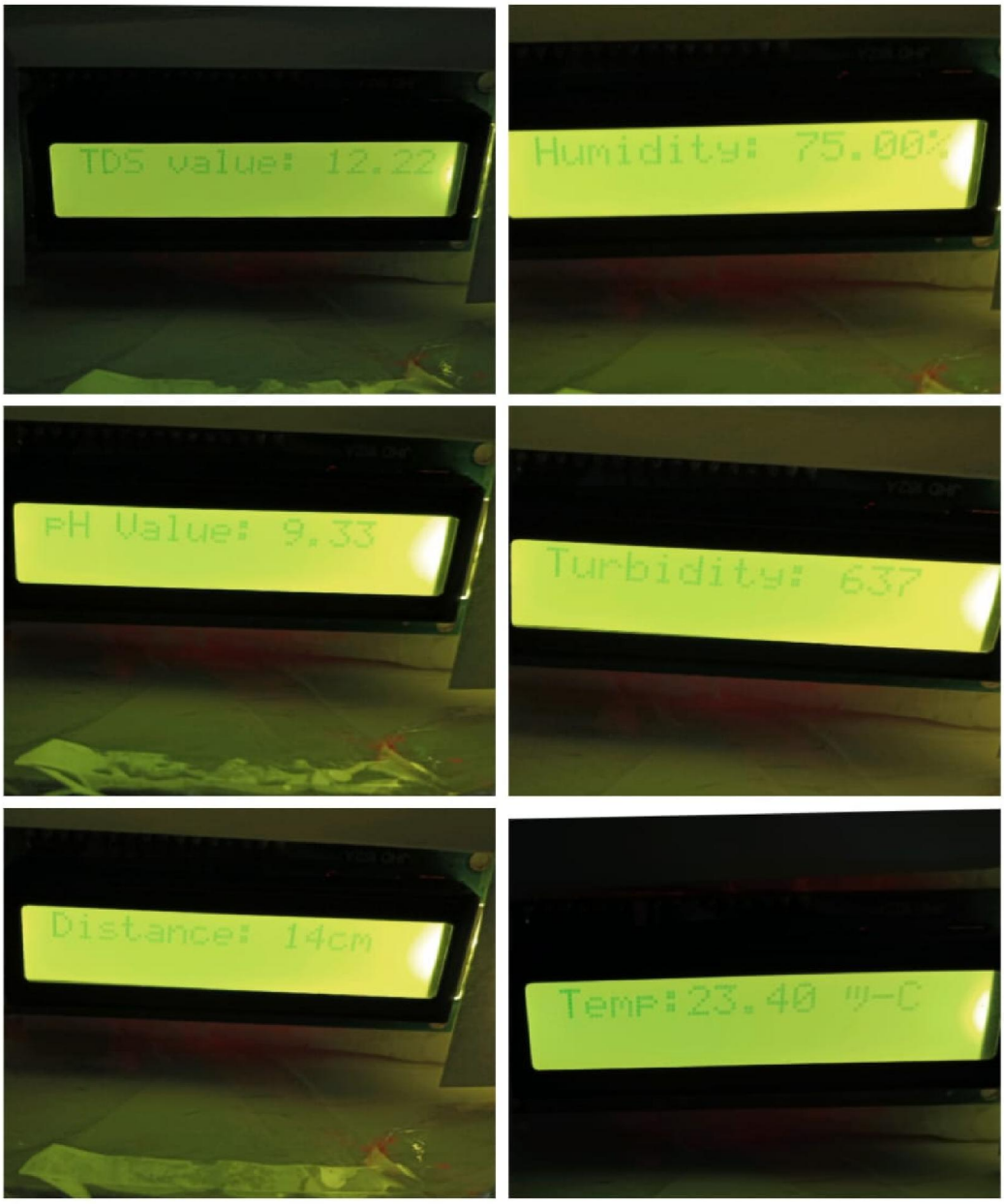

Fig. 3 The water quality parameters are checked by one by one and values are displayed in the LCD display.

IV. 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. This IoT pollution monitor boat provides the following advantages:

- pH & Turbidity Sensing
- Total Dissolved Solids (TDS) Level Sensing
- Temperature Sensing

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- Long Range Operation
- Data Logging as well as LCD Operation
- Obstacle and Water Level Detection
- Efficient Propeller Driven Navigation system
- Easy to Operate

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.

V. FUTURE SCOPE

Looking to the future, there are numerous opportunities to enhance water pollution monitoring efforts and maximize their effectiveness in protecting water resources. Some of these opportunities include:

1. Improved Methods: Advances in analytical techniques, sensor technology, and data analysis could lead to more accurate and cost-effective methods for monitoring water pollution. Developing faster, more sensitive and more efficient methods for detecting and quantifying pollutants could provide more timely and actionable data for decision-makers.
2. Data Sharing: Sharing water quality data among stakeholders, including regulatory agencies, environmental organizations, academia, and the general public, can increase collaboration and leverage collective knowledge to better understand and address water pollution issues.
3. Integration with other Monitoring Efforts: Integrating water pollution monitoring with other environmental monitoring efforts, such as weather and climate monitoring could provide a more comprehensive understanding of how different environmental factors interact and impact water quality.
4. Citizen Science: Engaging the public in water pollution monitoring efforts, such as through volunteer monitoring programs or the use of crowd sourced data collection can increase data collection capacity, raise awareness, and foster community stewardship of water resources.

VI. ACKNOWLEDGMENT

The authors would like to express their heartfelt gratitude to the management of GITAM Institute, HoD, and everyone who helped us directly and indirectly throughout the project.

Declaration of Competing Interest

We, the authors of the publication titled "IoT Based Water Pollution Monitoring Boat," thus declare that the work featured in the above paper is original and the result of research conducted by the authors listed therein. Furthermore, we affirm that the work provided has not previously been published or is currently being considered for publication in any journals, conferences, symposia, or seminars.

REFERENCES

[1]. G. N. Satya Sai, R. Sudheer, K. S. Manikanta, S. G. Arjula, B. N. Rao and D. V. Sai Maneeswar Mutyala, "IoT based Water Quality Monitoring System," 2021 IEEE 9th Region 10 Humanitarian Technology Conference (R10-HTC), Bangalore, India, 2021, pp. 01-06, doi: 10.1109/R10-HTC53172.2021.9641630

[2]. Varsha Lakshmikantha, Anjitha Hiriyannagowda, Akshay Manjunath, Aruna Patted, Jagadeesh Basavaiah, Audre Arlene Anthony. "IoT based smart water quality monitoring system", Global Transitions Proceedings, Volume 2, Issue 2, 2021, Pages 181-186, ISSN 2666-285X, https://doi.org/10.1016/j.gltp.2021.08.062.

[3]. M.J.V. Kumar, K. Samalla. "Design and Development of water quality monitoring system in IoT". Int. J. Recent Technol. Eng. (IJRTE), Volume-7 (Issue-5S3) (2019), pp. 2277-3878

[4]. S. Pasika, S.T. Gandla. "Smart water quality monitoring system with cost-effective using IoT." Heliyon, 6 (7) (2020), 10.1016/j.heliyon.2020.e04096