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Real-Time Water Purity Monitoring Using Arduino

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Abstract: Water quality monitoring is essential for ensuring safe drinking water and protecting public health. Traditional methods of testing water quality are often time-consuming and require laboratory analysis. This paper presents a real-time water purity monitoring system using an Arduino-based embedded platform. The system employs a Total Dissolved Solids (TDS) sensor to measure the concentration of dissolved particles in water and assess its purity level.The measured TDS values are displayed on an LCD screen and also transmitted via a Bluetooth module for remote monitoring. An alert mechanism using LEDs and a buzzer is incorporated to indicate safe and unsafe water conditions based on predefined threshold levels. The system continuously monitors water quality and provides instant feedback to the user.The proposed system is cost-effective, portable, and easy to use, making it suitable for household and environmental monitoring applications.

Keywords: Water Quality Monitoring, Arduino, TDS Sensor, Real-Time Monitoring, Water Purity, Embedded System, Bluetooth Communication, IoT

I. INTRODUCTION

Water quality is crucial for human health and environmental safety. Due to increasing pollution and contamination, regular monitoring of water has become necessary. Traditional testing methods are time-consuming and require laboratory equipment, making them unsuitable for real-time use.

This project presents a real-time water purity monitoring system using an Arduino-based platform. A TDS sensor is used to measure dissolved solids in water, which helps determine its purity. The data is displayed on an LCD and can also be transmitted via Bluetooth for remote monitoring.

The system also includes LEDs and a buzzer to indicate safe and unsafe water conditions. It is a cost-effective, portable, and efficient solution for continuous water quality monitoring in domestic and environmental applications.

II. EXISTING SYSTEM AND LIMITATION

· Traditional water quality monitoring systems use **manual sample collection and laboratory analysis**. Water samples are tested for parameters like pH, turbidity, and TDS using specialized equipment.
· These systems are mainly used in **industries and research laboratories** where accurate and detailed testing is required, but they are not suitable for regular use.
· The process is **time-consuming**, as it involves collecting samples and analyzing them in laboratories, leading to delayed results.
· It requires **expensive equipment and maintenance**, making it costly for common users.
· Skilled personnel are needed to **operate the system and interpret results**, increasing complexity.
· There is no **real-time or continuous monitoring**, and results are not instantly available.
· Due to high cost and complexity, these systems are **not suitable for household or portable applications**.

These limitations highlight the need for an intelligent, low-cost, real-time water quality monitoring.

III. PROBLEM STATEMENT

Ensuring safe and clean drinking water is a major challenge due to increasing pollution and contamination. Traditional water quality monitoring methods are **time-consuming, expensive, and require laboratory testing**, making them

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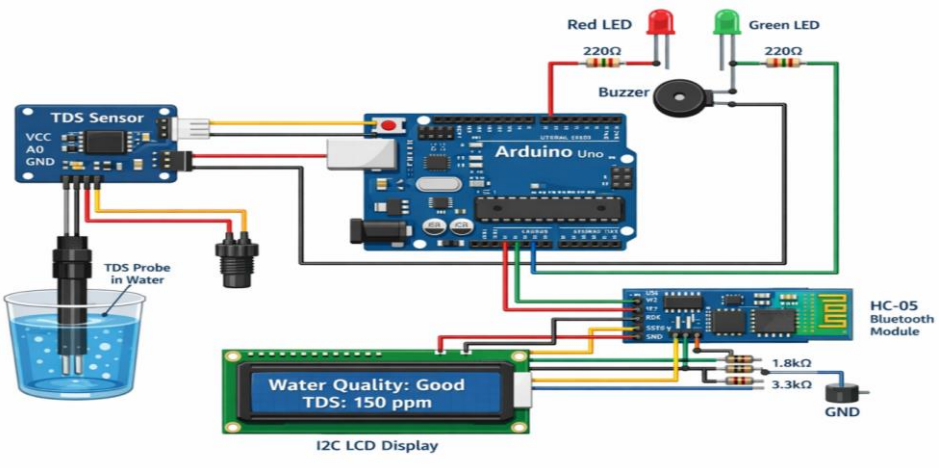
unsuitable for real-time and continuous monitoring. There is a lack of **portable and cost-effective systems** that can provide instant information about water purity.

Therefore, there is a need to develop a **real-time water quality monitoring system** that can quickly measure water parameters, provide immediate results, and alert users about unsafe water conditions. The system should be **simple, affordable, and suitable for both household and environmental applications**.

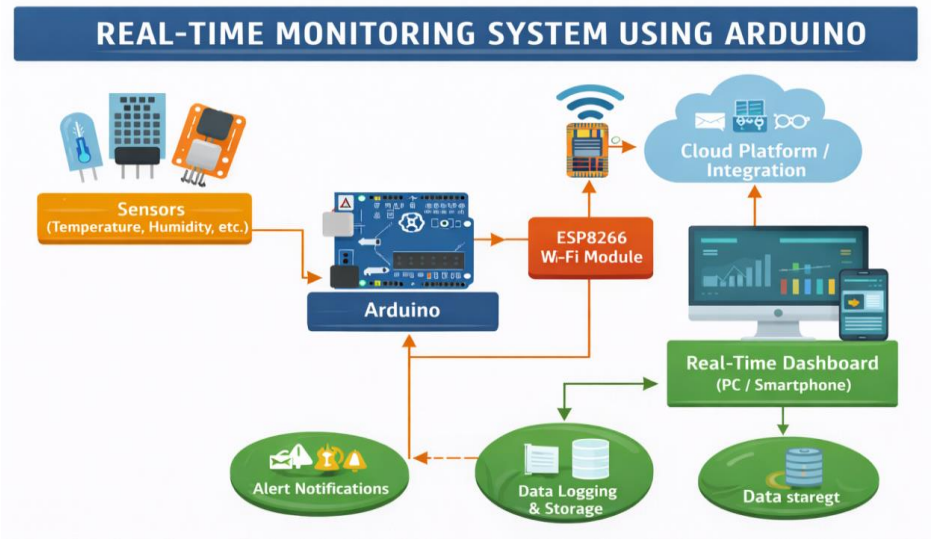
IV. SCOPE OF PROJECT

The scope of this project is to design and develop a real-time water purity monitoring system using an Arduino-based platform. The system measures water quality using a TDS sensor and provides instant results, eliminating the need for traditional laboratory testing. It enables continuous monitoring of water quality, ensuring timely detection of contamination.The system can be effectively used in households, small-scale industries, and environmental monitoring applications to ensure safe water usage. It also incorporates Bluetooth communication for wireless data transmission, allowing users to monitor water quality remotely through mobile devices. An alert mechanism using LEDs and a buzzer is included to indicate safe and unsafe water conditions.Additionally, the project is designed to be cost-effective, portable, and user-friendly, making it accessible for common users. In the future, the system can be further enhanced by integrating additional sensors such as pH, turbidity, and temperature sensors to improve accuracy and expand its applications.

SCHEMATIC DIAGRAM



FLOW CHART



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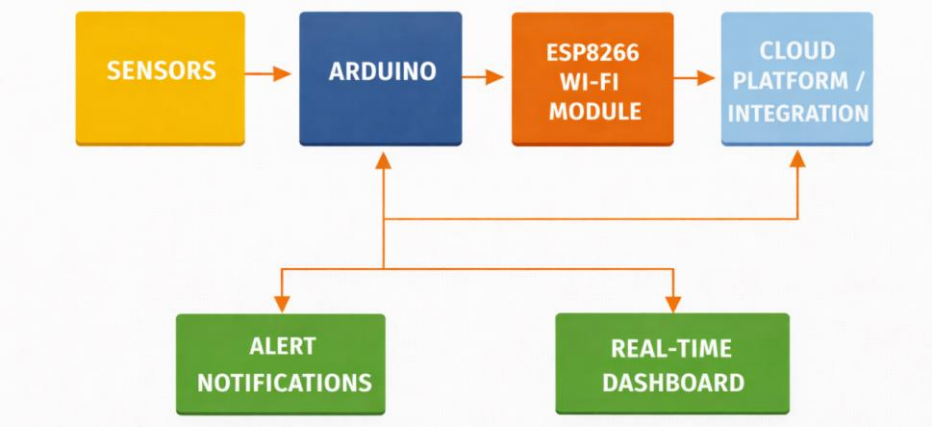
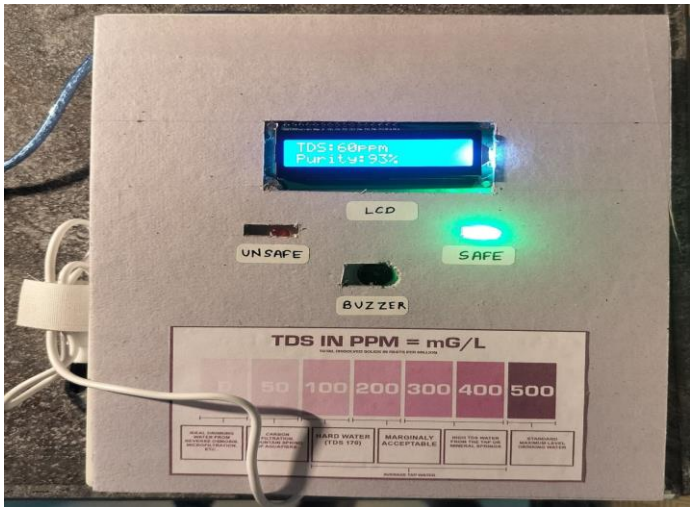
BLOCK DIAGRAM



V. WORKING

- The system starts by powering the Arduino and initializing all components like TDS sensor, LCD, Bluetooth module, LEDs, and buzzer.
- The **TDS sensor** continuously senses the water and sends analog signals to the Arduino.
- The Arduino reads the analog value and converts it into **TDS value (ppm)** using a mathematical formula.
- Based on the TDS value, the system calculates the **water purity percentage**.
- The measured TDS and purity values are displayed on the **LCD screen** in real-time.
- The data is also transmitted wirelessly to a mobile device using the **Bluetooth module**.
- The system compares the TDS value with a predefined threshold (e.g., 500 ppm).
- If the water is **safe**, the green LED turns ON; if **unsafe**, the red LED and buzzer are activated.
- The system continuously repeats the process to provide **real-time monitoring** of water quality.
- Users can also send commands via Bluetooth (like *status, tds, purity*) to get specific information.

SETUP IS GIVEN BELOW



COMPONENTS USED

- Arduino UNO
- 16×2 LCD Display
- 100R Resistor x 3
- 4.7k Resistor
- Green LED
- Red LED

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- Buzzer
- Male to Male Jumper Wires
- Male to Female Jumper Wires
- Battery 9V
- TDS Sensor Meter
- HC-05 Bluetooth Module

VI. CONCLUSION

The Real-Time Water Purity Monitoring System using Arduino provides a simple, cost-effective, and efficient solution for monitoring water quality. The system successfully measures TDS levels and displays real-time data, helping users determine whether water is safe or unsafe for consumption. The integration of LCD display, Bluetooth communication, and alert mechanisms enhances usability and convenience.

Overall, the project overcomes the limitations of traditional methods by offering continuous monitoring, instant results, and easy operation. It is suitable for household and environmental applications and can be further improved by adding more sensors for enhanced accuracy and functionality.

VII. ACKNOWLEDGEMENT

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