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BOREWELL WATER QUALITY AND MONITORING BASED IOT GATEWAY

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ABSTRACT

Water pollution is one of the biggest fears for the green globalization. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. In this project we present a design and development of a low-cost system for real time monitoring of the water quality in IoT methodology and water dispense system. The system consist of several sensors is used to measuring contamination parameters of the water. The water quality is measured using TDS sensor is used to detect the total dissolved solvents. And also measuring the temperature of the motor using DHT sensor. The measured values from the sensors can be processed by the core controller theft and other crimes.

INTRODUCTION

Water pollution poses a significant challenge to environmental sustainability and public health. Ensuring the availability of clean drinking water requires continuous monitoring of its quality. This project focuses on developing a low-cost, real-time water quality monitoring system using IoT (Internet of Things) technology and an automated water dispensing system.

The system is designed to measure key water contamination parameters using various sensors. A TDS (Total Dissolved Solids) sensor detects dissolved substances in water, while a DHT11 sensor monitors temperature variations in the motor. The collected data is processed by a core controller (ESP8266 microcontroller), which enables remote monitoring through an IoT platform.

By implementing this system, it becomes possible to continuously track borewell water quality, ensuring safe and efficient water usage.

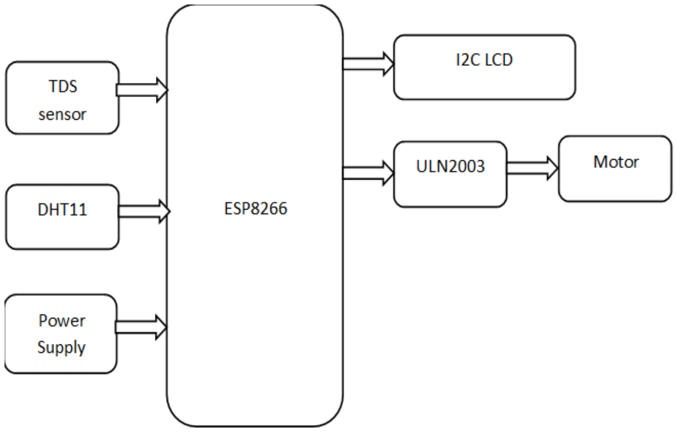

Figure.1 Block Diagram

LITERATURE SURVEY

- Sun, Z., Liu, C. H., Bisdikian, C., Branch, J. W., & Yang, B. (2012). QOI-Aware Energy Management in Internet-of-Things Sensory Environments. 9th Annual IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON).
- Previous research also highlights the importance of integrating smart water management with automated control mechanisms. Some studies have explored the use of actuators to regulate water supply based on real-time sensor readings. For instance , when contamination levels exceed a predefined threshold, the system can trigger an alert or shut down the water supply to prevent health hazards. Such automation enhances the reliability and responsiveness of water quality monitoring systems.
- Several studies have proposed the use of sensors for detecting various water quality parameters. For instance, TDS sensors are widely used to measure the total dissolved solids in water, which indicates the level of impurities. Similarly, temperature sensors like DHT11 help monitor variations in water temperature, which can influence microbial growth. Other research has integrated pH, turbidity, and conductivity sensors to provide a comprehensive analysis of water quality. These sensor-based approaches have proven to be effective in identifying contamination at an early stage.

PROPOSED SYSTEM

In this project, we propose a real-time borewell water quality monitoring system using a TDS (Total Dissolved Solids) sensor. The TDS sensor plays a crucial role in detecting the

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concentration of dissolved substances in water, including salts, minerals, and contaminants. High TDS levels indicate possible pollution, making it essential to continuously monitor water quality for safe consumption.

Our system integrates the TDS sensor with a microcontroller (ESP8266/Arduino) to collect and process data. The measured TDS values are displayed on an LCD screen and transmitted via IoT to a cloud-based platform, allowing remote monitoring. This approach ensures real-time tracking of water quality, reducing manual testing efforts and providing instant alerts if contamination levels exceed safe limits.

Additionally, the system can be enhanced by integrating automated water control mechanisms. If the TDS value crosses a predefined threshold, an alert can be triggered, and the water supply can be shut off or redirected to a filtration system. This feature enhances the reliability and efficiency of borewell water management.

The proposed method is a low-cost, scalable, and efficient solution for water quality and monitoring in rural and urban areas. It enables proactive measures to prevent waterborne diseases and ensures access to safe drinking water. By leveraging IoT technology, this is project aims to provide a smart and automated water quality monitoring system, improving public health and sustainable water management. “Switch”.

The borewell water quality monitoring system uses a TDS sensor to measure Total Dissolved Solids and a DHT11 sensor to monitor temperature. The ESP8266 microcontroller processes the sensor data and displays it on an I2C LCD screen. The system transmits real-time data to a cloud platform via IoT connectivity, allowing remote monitoring. If water quality exceeds safe limits, it triggers alerts and can shut off the motor to prevent contamination. A ULN2003 motor driver controls water dispensing based on sensor readings. This smart system ensures continuous monitoring and safe water supply management

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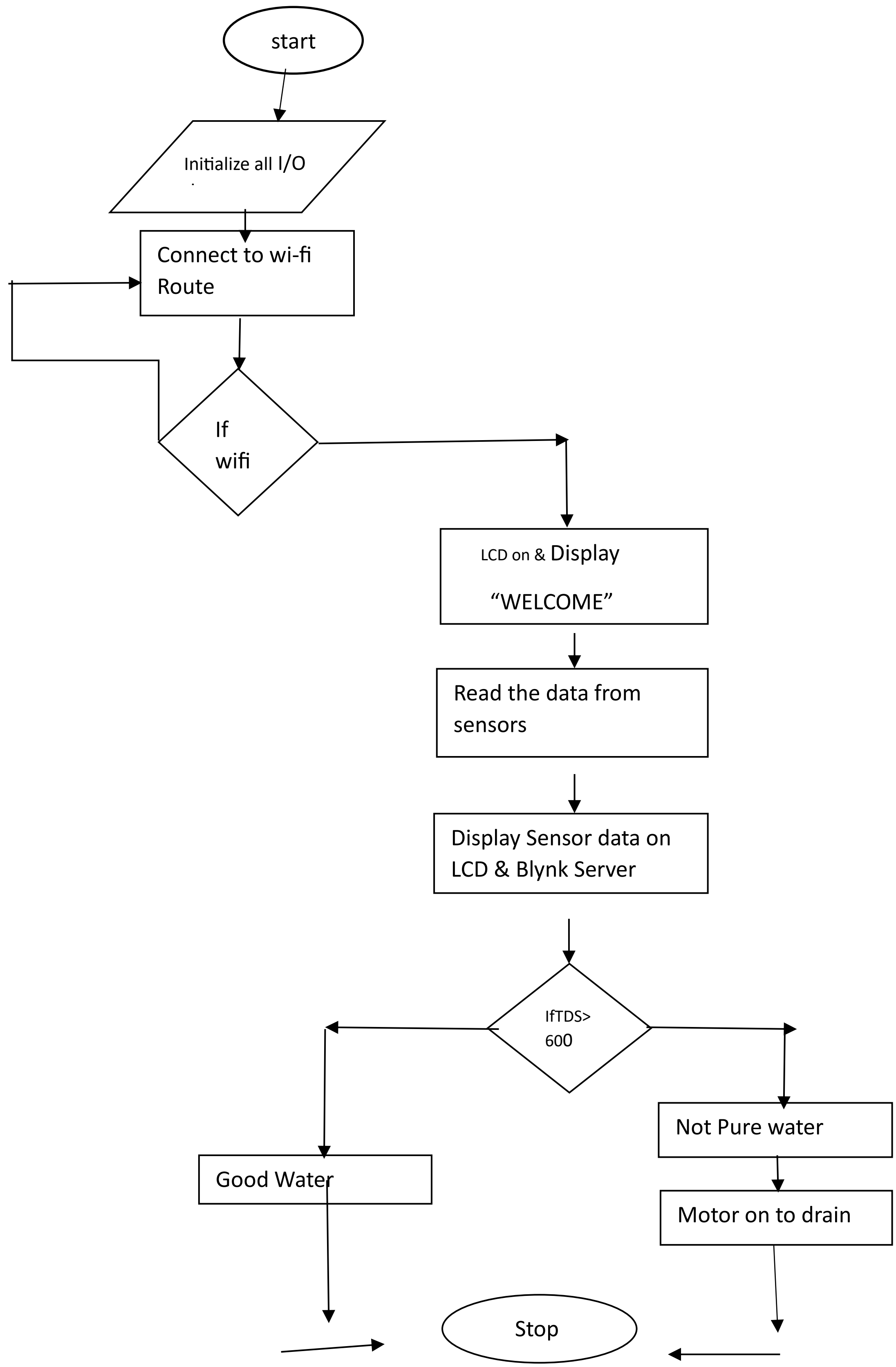

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Figure.2 Flow chart

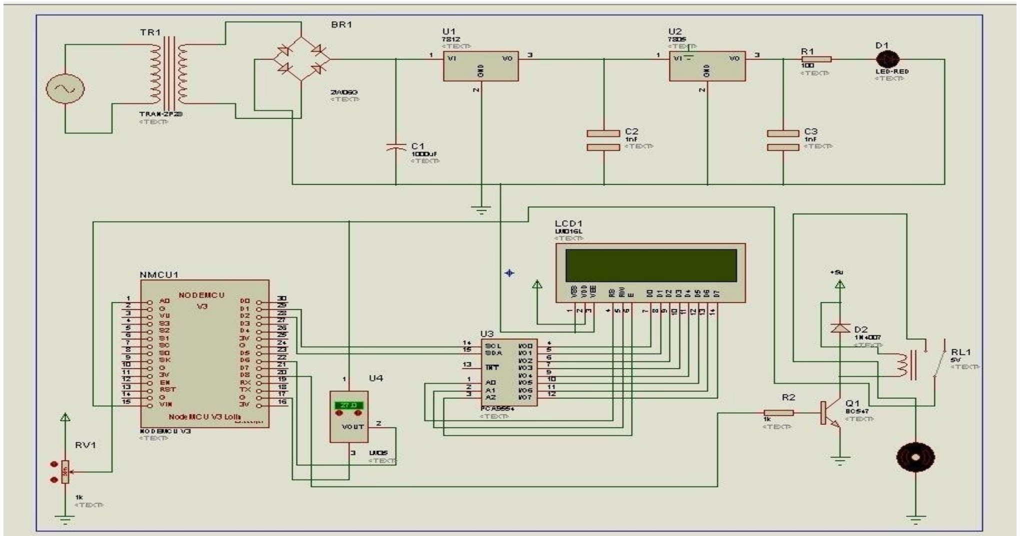

Figure.3 Schematic Diagram

RESULTS

The Borewell Water Quality Monitoring System was successfully designed and simulated using Proteus. The system efficiently measured Total Dissolved Solids (TDS) and temperature using TDS and DHT11 sensors. The ESP8266 microcontroller processed the sensor data and displayed real-time values on an I2C LCD screen. The IoT-based functionality allowed remote monitoring of water quality parameters, ensuring efficient management.

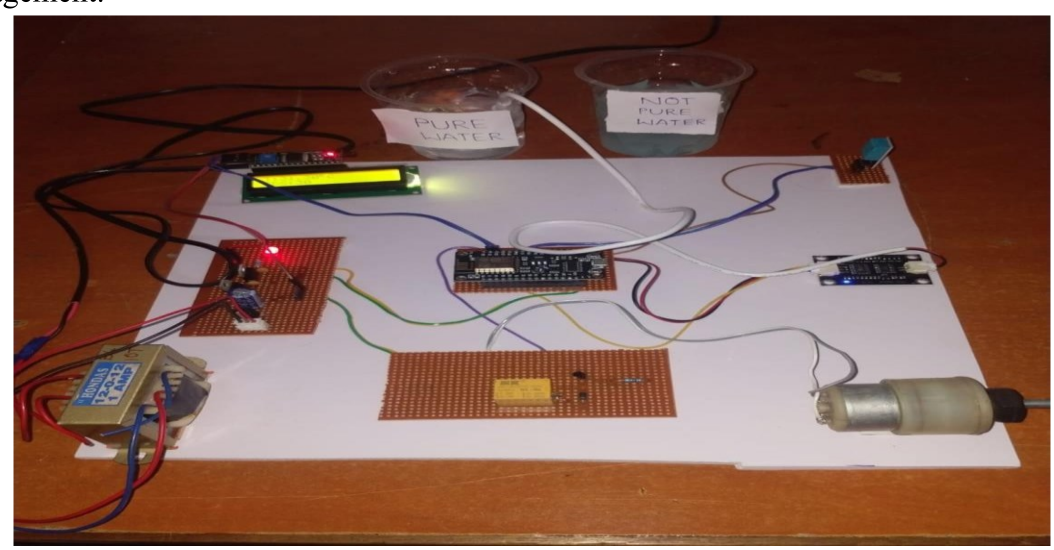

Fig 4 Design Implementation

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The system evaluates borewell water quality using a TDS sensor and classifies it as pure or not pure based on the TDS value. The ESP8266 microcontroller processes the sensor data and displays the result on the I2C LCD screen.

Output Conditions:

1. If TDS < 600 ppm → Water is Pure
2. The LCD displays: "TDS: XXX ppm" and "Water is Pure"
   The motor continues operation, allowing water to be dispensed.
3. If TDS > 600 ppm → Water is Not Pure
   The LCD displays: "TDS: XXX ppm" and "Not Pure Water"

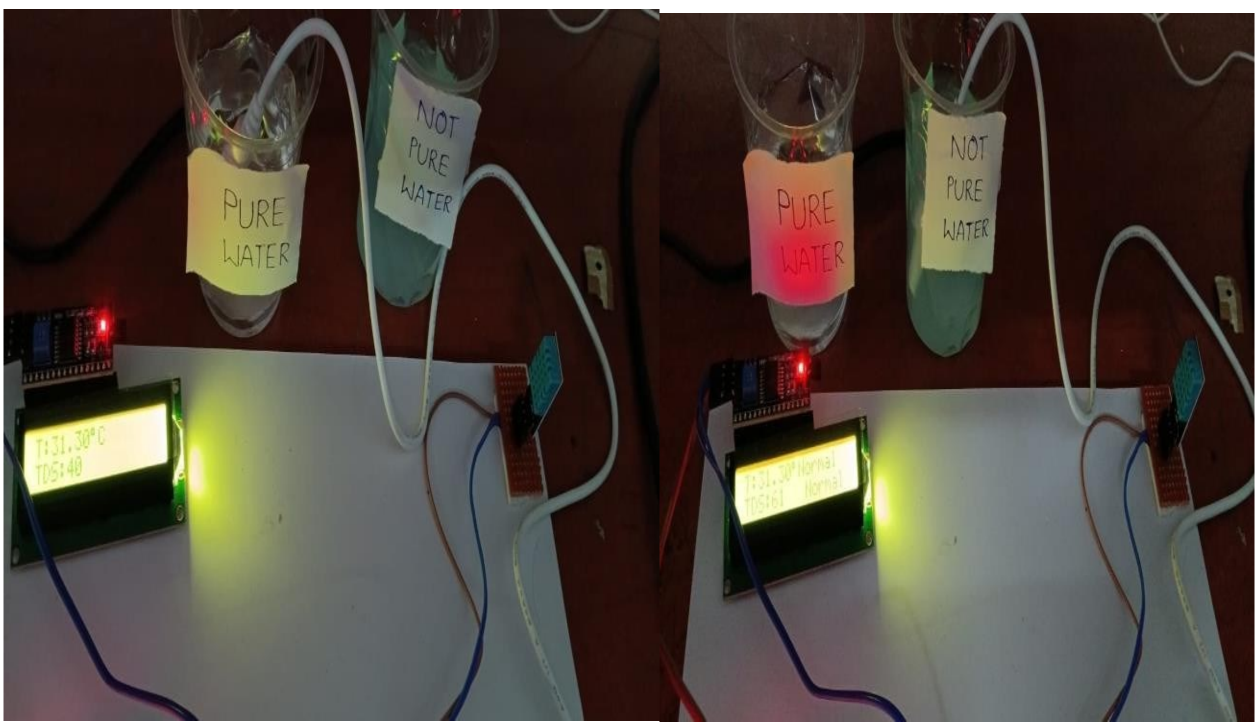

Fig.5 OUTPUT

In this project, Blynk IoT platform is used to monitor borewell water quality in real time through a mobile application. The system integrates sensors with ESP8266 to measure TDS, temperature, and humidity and sends the data to the Blynk app for remote monitoring.

Displayed Outputs in Blynk App:

- TDS Value: Displays the water quality status (Pure or Not Pure) based on the threshold (600 ppm).
- Temperature and Humidity: Collected using the DHT11 sensor and displayed in real time.
- Motor Status: Shows whether the motor is ON or OFF, based on the water quality condition.

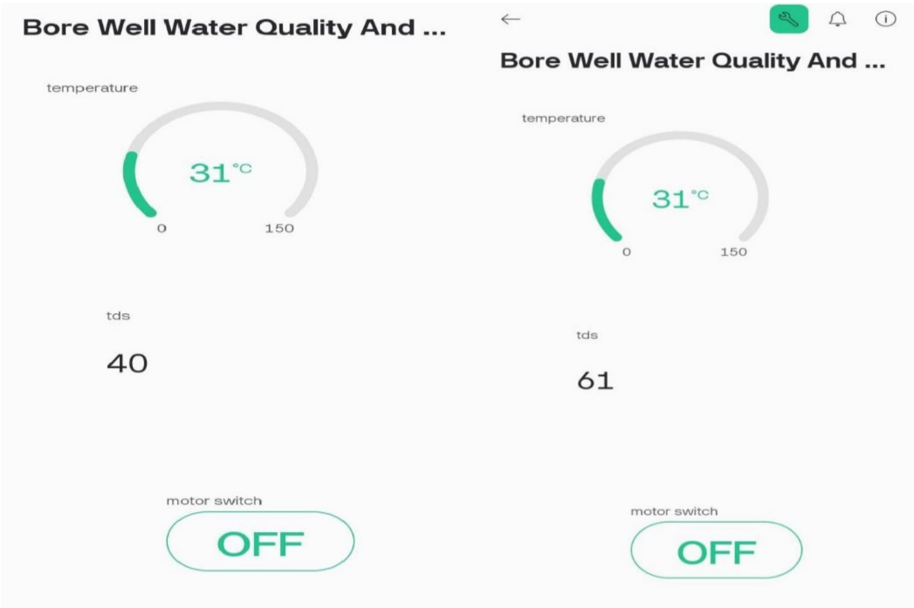

Figure.6 Blynk Output

ADVANTAGES

Early detection of contamination enables swift action to prevent further pollution, safeguarding public health and environmental well-being. Prompt intervention reduces remediation costs and mitigates ecological damage.

- **Seamless Communication**
  Seamless communication ensures real-time information exchange between stakeholders, enhancing collaboration and prompt decision-making. This facilitates a cohesive and responsive system.

- **Data Accuracy**

  Data accuracy guarantees reliable and trustworthy information, enabling informed decision-making and minimizing errors. Accurate data also optimizes resource allocation and reduces waste.

- **Early Detection of Contamination**

  Early detection of contamination enables swift action to prevent further pollution, safeguarding public health and environmental well-being. Prompt intervention reduces remediation costs and mitigates ecological damage.

- **Cost Efficiency**

  Cost efficiency streamlines operations, reducing expenditure on manual labor, resources, and infrastructure. By minimizing waste and optimizing processes, cost efficiency contributes to a more sustainable and profitable system.

- **Remote Access and Control**

  Remote access and control enable real-time monitoring and management of systems from anywhere, enhancing flexibility and responsiveness. This capability reduces the need for on-site visits, minimizing logistical challenges and costs.

- **Environmental Conservation**

  Environmental conservation ensures the long-term sustainability of ecosystems and natural resources, safeguarding biodiversity and ecological balance. By minimizing pollution and waste, environmental conservation protects public health and well-being.

- **Improved Resource Management**

  Improved resource management optimizes the allocation and utilization of resources, reducing waste and minimizing environmental impact. Effective resource management contributes to a more efficient, sustainable, and resilient system.

APPLICATIONS

- **Agriculture**

  Precision farming and crop management through real-time monitoring of soil moisture, temperature, and nutrient levels, optimizing irrigation and fertilizer application.

- **Industrial Use**

  Efficient monitoring and control of industrial processes, such as water treatment, chemical processing, and manufacturing, to ensure compliance with regulations and optimize resource usage.

- **Drinking Water Supply**

  Real-time monitoring of water quality and pressure, enabling prompt detection of contaminants and leaks, ensuring safe and reliable drinking water supply to communities.

- **Environment Monitoring**

  Tracking of environmental parameters such as air quality, noise pollution, and weather patterns, enabling authorities to take proactive measures to mitigate pollution and ensure public health and safety.

- **Ground Water Management**

  Monitoring of groundwater levels, quality, and flow, enabling effective management of this vital resource, preventing over-extraction, and ensuring sustainable use for future generations.

- **Research and Education**

  Advancing scientific knowledge and understanding of complex environmental systems, providing valuable insights for researchers, educators, and students, and informing evidence-based policy decisions.

CONCLUSION

In conclusion, the implementation of a borewell water quality monitoring system utilizing IoT gateway technology has demonstrated significant potential in ensuring real-time water quality assessment and management. Through the integration of sensors and data processingcapabilities, this project offers a comprehensive solution for continuous monitoring, analysis, and remote management of borewell water quality parameters.

By harnessing the power of IoT, stakeholders can access timely and accurate information. about water quality, enabling prompt decision-making and intervention to address any detected issues. This proactive approach to water quality management not only safeguards public health but also supports sustainable resource management practices.

Furthermore, the scalability and adaptability of this system allow for its deployment in various settings, ranging from individual households to community water supply networks. Its ability to provide actionable insights in real-time empowers users to take preventive measures and optimize resource utilization effectively.

As we continue to face challenges related to water scarcity and pollution, the integration of innovative technologies such as IoT-based water quality monitoring systems becomes increasingly crucial. This project serves as a testament to the potential of technology- driven solutions in addressing complex environmental challenges and underscores the importance of ongoing research and development in this field. Through collaborative efforts and continued innovation, we can strive towards a future where access to safe and clean water is ensured for all.

FUTURE SCOPE

Furthermore, advancements in data analytics and machine learning algorithms hold great potential for enhancing the predictive capabilities of the monitoring system. By analyzing historical data patterns and incorporating predictive models, the system could anticipate Volume 12, issue 1, March/2024 changes in water quality, enabling preemptive measures to mitigate potential risks or contamination events.

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