# SMART WATER TURBIDITY AND PIPELINE MANAGEMENT

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**Keywords:**

Smart Water Monitoring, Real-Time Turbidity Detection, Automated Pipeline Control, Real-time Water Pollution Detection

**Introduction:**

In the 21st century, there was a lot of development of industries and infrastructure. This development also led to an increase in water pollution, global warming, other environmental challenges and so on, because of this one of the threats is that there is no safe drinking water for the world's pollution. Nowadays, real-time water quality monitoring faces challenges because of global warming, limited water resources, growing population, etc. This tells us that there is a need to develop better methodologies for monitoring the water quality parameters in real-time. People nowadays always want something that can make their life easier. To fulfil the requirement of the people we develop the smart water monitoring system for home or office. This system focuses on water quality monitoring and water contamination detection. This system is used to avoid the huge amount of water is being wasted by uncontrolled use of home/offices. In this system we use the sensors to check the water quality and contaminants. Turbidity measures the large number of suspended particles in water that is invisible. Higher the turbidity invisible. Higher the turbidity higher the risk of Diarrhea, Cholera. Lower the turbidity then the water is clean. Temperature sensor measures how the water is, hot or cold. Flow sensor measures the flow of water through flow sensor. A mineral sensor capable of detecting contaminants like NaCl can be used to monitor water quality, ensuring safety in drinking water. The traditional

methods of water quality monitor involve the manual collection of water samples from different locations. And Traditional systems using controllers like Arduino are less time-efficient due to limited processing and communication capabilities. Our project uses water's natural flow to automatically determine contaminants such as NaCl. The data is simultaneously up loaded to a cloud server and displayed on an app in real time for observation.

**Objectives:**

- To implement a fully automated water supply system.
- To measure the accurate amount of water consumed by each client.
- To detect contamination and assess the quality of water.
- To stop the water supply if the water quality does not meet the minimum standard

**Methodology:**

The proposed IoT-based water quality monitoring and pipeline management system follows a structured methodology that integrates advanced technologies to ensure real-time water quality assessment, automated control, and efficient distribution management. The ESP32 Microcontroller acts as the central controller, interfacing with multiple sensors, including the Turbidity Sensor, TDS Sensor, Temperature Sensor, and Flow Sensor, to continuously monitor key water quality parameters. The Solenoid Valve is controlled by the ESP32 to regulate water flow automatically based on turbidity levels, ensuring a proactive response to contamination. The collected data is transmitted via Wi-Fi (ESP8266 & ESP32) to a React-based web application, enabling real-time remote monitoring. The system employs cloud storage (Firebase) for storing historical water quality data, facilitating long-term analysis and trend prediction. Additionally, real-time alerts are triggered when turbidity crosses predefined thresholds, allowing immediate action to maintain safe water quality. The seamless integration of these components along with real-time data monitoring and automated control—creates a cost-effective and scalable solution for smart water management. By combining IoT-driven real-time monitoring, automated control mechanisms, and cloud integration, the system ensures efficient water quality management suitable for both domestic and industrial applications

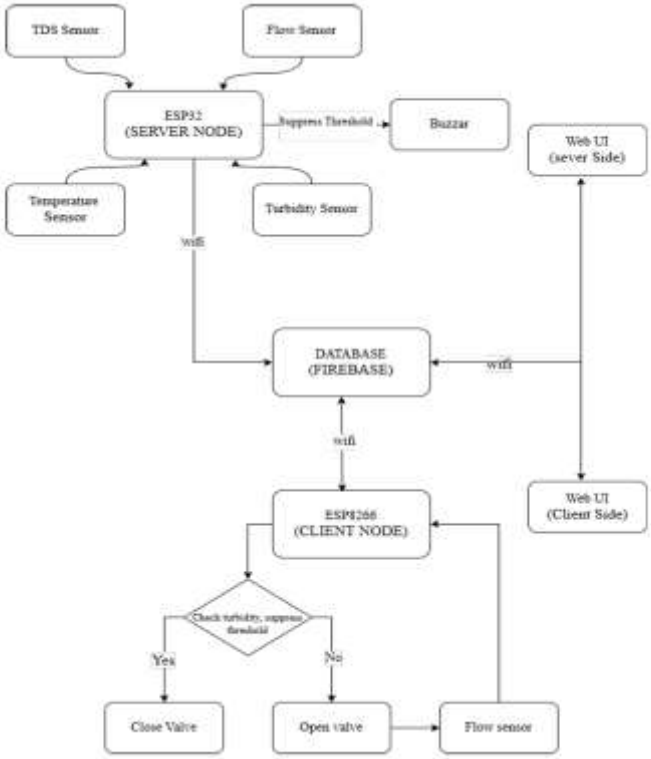


Figure 1: Block Diagram of Server Node And Client Node

**Result and Conclusion**:

The IoT-based Smart Water Management System provides a comprehensive solution for efficient water monitoring, quality assessment, and leakage prevention. With real-time data collection, predictive analytics, and automated control mechanisms, the system significantly enhances water usage efficiency and safety. The integration of IoT and machine learning improves its ability to provide insightful recommendations, enabling users to make informed decisions based on their water consumption patterns. By ensuring continuous monitoring and proactive management, the system offers a scalable and smart solution for both domestic applications.

The IoT-Based Water Monitoring System developed in this project effectively demonstrates an innovative and practical solution for monitoring water quality parameters, including turbidity, temperature, and Total Dissolved Solids (TDS), in real-time. By utilizing IoT-enabled sensors, NodeMCU controllers, and Firebase integration, the system automates data collection, analysis, and storage, significantly reducing operational costs and minimizing the need for manual intervention. The integration of a React-based web application ensures that the collected data is easily accessible to users, enabling informed decision making for water quality management.

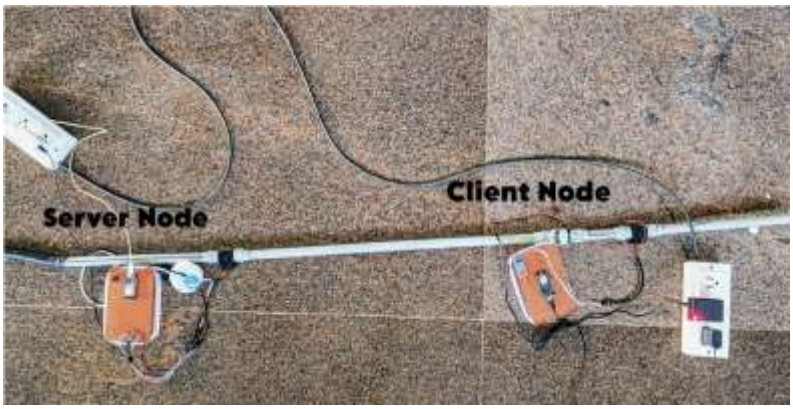


Figure 2: Working Prototype


Figure 3: Admin Dashboard

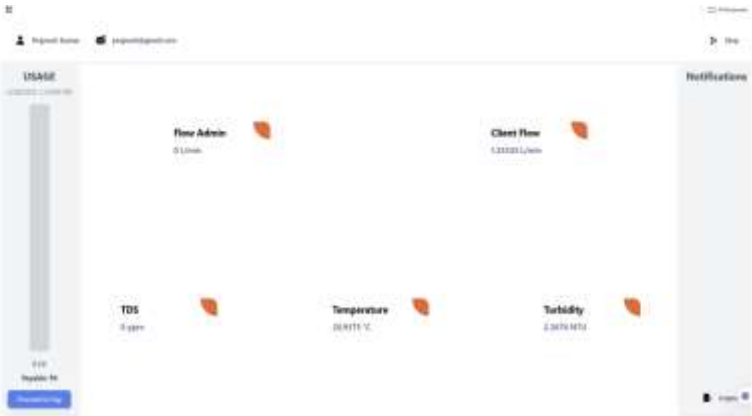


Fig 4: Client Dashboard

**Future Scope:**

- Integrating additional sensors (e.g., pH sensors) for a more comprehensive water quality assessment.
- Implementing AI-based predictive analytics for early contamination detection.
- Adopting blockchain technology for secure, automated billing.
- Expanding communication options by incorporating LoRa WAN for extended monitoring range.
- Enhancing the mobile application to support additional functionalities such as water treatment integration.