Aquascan: Online Water Quality Monitoring System

Athulkrishna V[1], Krishnalal T B[2], Limna Jeejo[3], Vijnyadh A V[4], Simitha K M[5]

[1,2,3,4] *Student, Department of Electrical and Electronics Engineering, IES College of Engineering, Chittilappilly, Kerala, India*

[5]*Assistant Professor, Department of Electrical and Electronics Engineering, IES College of Engineering, Chittilappilly, Kerala, India*

Email_id: athulkrishnav2277@gmail.com, krishnalaltb@gmail.com,limnajeejo@gmail.com,vijnyadhav@gmail.com, simithanishab@gmail.com

Abstract

The online water quality monitoring system by filtration is designed to ensure safe and clean water for consumers by continuously monitoring important water quality parameters such as pH value, turbidity, temperature, temperature, and TDS (TDS dissolved solids). The system uses a variety of sensors to collect actual data and transfer it to the central processing unit for analysis. If a parameter specifies potential contamination or uncertain water beyond a predefined safety threshold value, the system triggers an alarm and immediately sends a notification to the user via a mobile app or SMS. Therefore, users will recognize water quality issues at a good time so that corrective actions can be taken. B. Further filtration. The system also stores historical data and provides valuable insight into long-term trends in water quality. The alarm system is extremely important, and audible and visual warnings are activated when parameters are immediately paying attention beyond acceptable limits. A user-friendly interface that can be accessed via a mobile or web platform shows the actual data and allows users to set personalized threshold values. This system is essentially important to ensure water security in both domestic and industrial environments by providing continuous monitoring and immediate response to possible risks.

Keywords: Online Water Quality Monitoring System, Filtration, Water safety, pH levels, Turbidity, Temperature, Total Dissolved Solids (TDS), Real-time monitoring, Sensors, Central processing unit, Data transmission, Predefined threshold, Contamination, Alarms, Notifications, Mobile app, SMS alerts, Corrective actions, Historical data, Long-term water quality trends, User-friendly interface, Mobile platform, Web platform, Industrial water monitoring, Domestic water monitoring, Immediate response.

DOI: https://doi.org/10.5281/zenodo.15093455

1. Introduction

Access to clean and safe drinking water is extremely important for public health, and the filtration system is often used to remove contaminants. However, filtration does not guarantee continuous water security alone. The continuous monitoring of re -enact is important to ensure that water is safe for consumption. Traditional water quality tests are based on regular samples that can delay in identifying problems, as they do not provide real data. It pursues important parameters such as pH

value, cloud, temperature, total festival (TDS) and provides real -time data that can be accessed through the mobile Blynk app. If the parameter such as pH or turbidity is greater than a predetermined safety limit, the system triggers visual and audio alarm to alert the user. Additionally, distance information is sent through SMS, email, or push notifications to ensure that users are being warned, even if they do not have the filtration unit. The system also stores historical data to allow users to advance trends and analyse the effectiveness of filtration over time. The user -friendly interface allows users to easily adapt their threshold settings to various types of water sources and filtration processes.

2. Objectives

The purpose of an online water quality monitoring system with IoT technology and summer systems is to provide real-time water quality monitoring and management to ensure security and sustainability. The system continuously pursues key parameters such as pH, cloudiness, temperature, and overall dissolved oxygen. Once these parameters exceed predefined security thresholds, summer systems are triggered to provide immediate warnings to ensure that immediate measures are taken to prevent contamination and potential health risks. The integration of IoT technology allows real-time data transmission to cloud platforms, allowing remote monitoring and analysis via web-based dashboards or mobile applications. The system reduces the need for manual water testing and improves efficiency by monitoring water source monitoring around the clock. Data protocols store historical records, enable trend analysis, enable early detection of contamination, and predict forecast expectations. Identifying abnormalities in the early stages allows authorities and users to take proactive measures to prevent illness and contamination. Additionally, the system can be integrated into automated cleaning or filtration mechanisms and responds immediately to poor water quality by triggering corrective measurements. It promotes resource efficiency, reduces operational costs and ensures compliance with water quality standards set by the supervisory authority. By using sensor-based automation, the system not only improves water quality and security, but also supports sustainable water management practices. Ultimately, the combination of IoT and alarm systems in water quality monitoring improves public health, industrial efficiency and environmental protection by ensuring water is protected and available at any time.

3. Problem Statement

Ensuring the safety of drinking water is an increase in the problems caused by contamination from contaminants, industrial waste and aging infrastructure. Traditional testing methods are slow and inefficient, making it difficult to recognize water quality issues in real time. To improve this, an IoT-based online drinking water quality monitoring system with summer alarm mechanisms is required. The system continuously pursues important parameters such as value, cloudiness, temperature, and cloudiness. Actual data, and immediate warnings, are provided when the value exceeds a safe limit. By activating remote monitoring and rapid response, this helps prevent health risks, ensure compliance with safety standards, and improve the efficiency of water management.

4. Methodology

4.1 Problem Analysis and Data Collection

Problem analysis focuses on increasing risk of drinking water contamination due to pollutants, industrial waste, and poor infrastructure that can lead to health risks. Traditional methods for water quality testing are slow, manual and ineffective

in actual monitoring. To improve this, IoT-based systems are required to continuously pursue important parameters such as pH, cloudiness, temperature, and dissolved oxygen. Data collection provides sensors that collect real-time values that are processed by microcontrollers and forwarded to the cloud platform for storage and analysis. This allows for immediate notifications and remote monitoring, ensuring timely measures to maintain water safety.

4.2 Design of the system

The proposed online monitoring system for drinking water quality integrates IoT, real-time allocation system, and automatic filtration units to improve drinking water safety. The system uses several sensors (pH value, turbidity, temperature, total solids) to continuously evaluate water quality. These sensors process information about Wi-Fi and send data to the ESP32 microcontroller that sends it to the IoT cloud platform. The P10 display system provides real-time updates of water quality parameters, ensuring easy user monitoring. The system compares the sensor values to defined threshold values and triggers summer alarms with notifications via SMS or Blynk apps when contamination is recognized. The filtration system includes pre-filters, pre-carbon filters, deposit filters, RO membranes, UV barrels, alkaline cartridges and mineral cartridges to ensure comprehensive cleaning. The 24-W engine and 24-V magnetic valves regulate water flow and automatically trigger the required filtration process. This effectively implements corrective measurements such as filter activation, UV cleaning and reverse osmosis to restore water quality. This design ensures efficient real-time monitoring, early pollution detection and automatic correction effectiveness, significantly improving drinking water safety.

4.3 Block Diagram

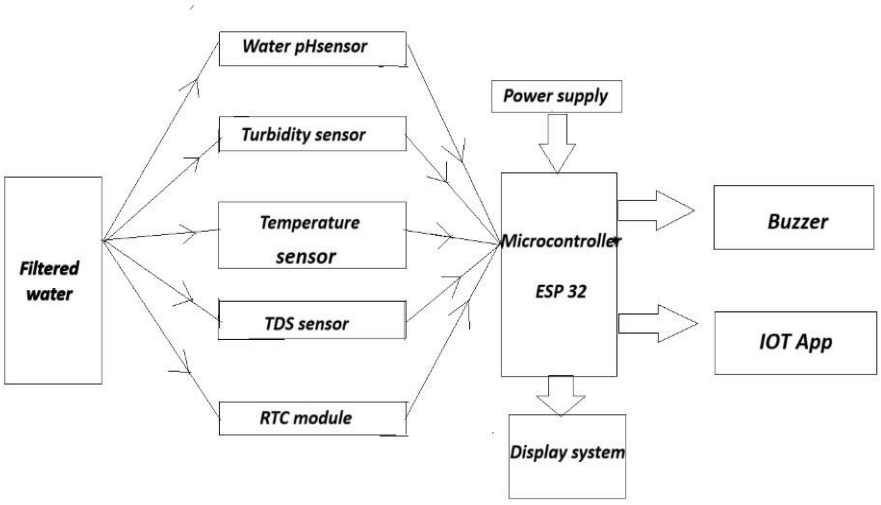

Figure 1: Block diagram of Online Water Quality Monitoring System

4.4 Circuit Diagram

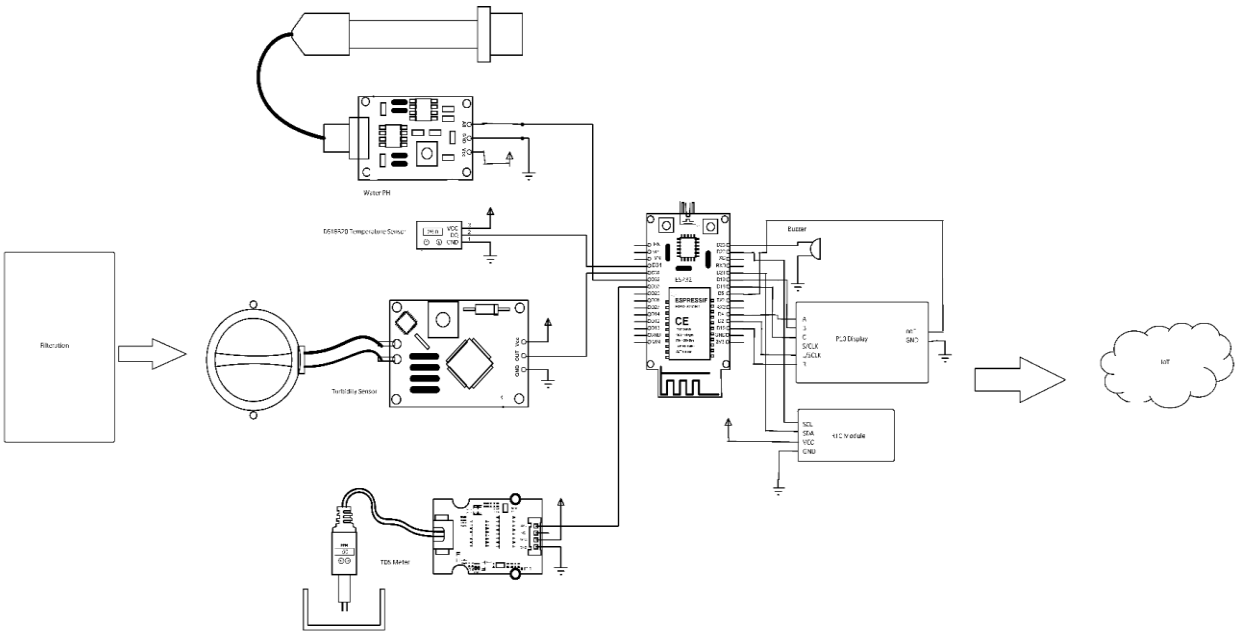

Figure 2: Circuit diagram of Online Water Quality Monitoring System

4.5 Simulation Diagram

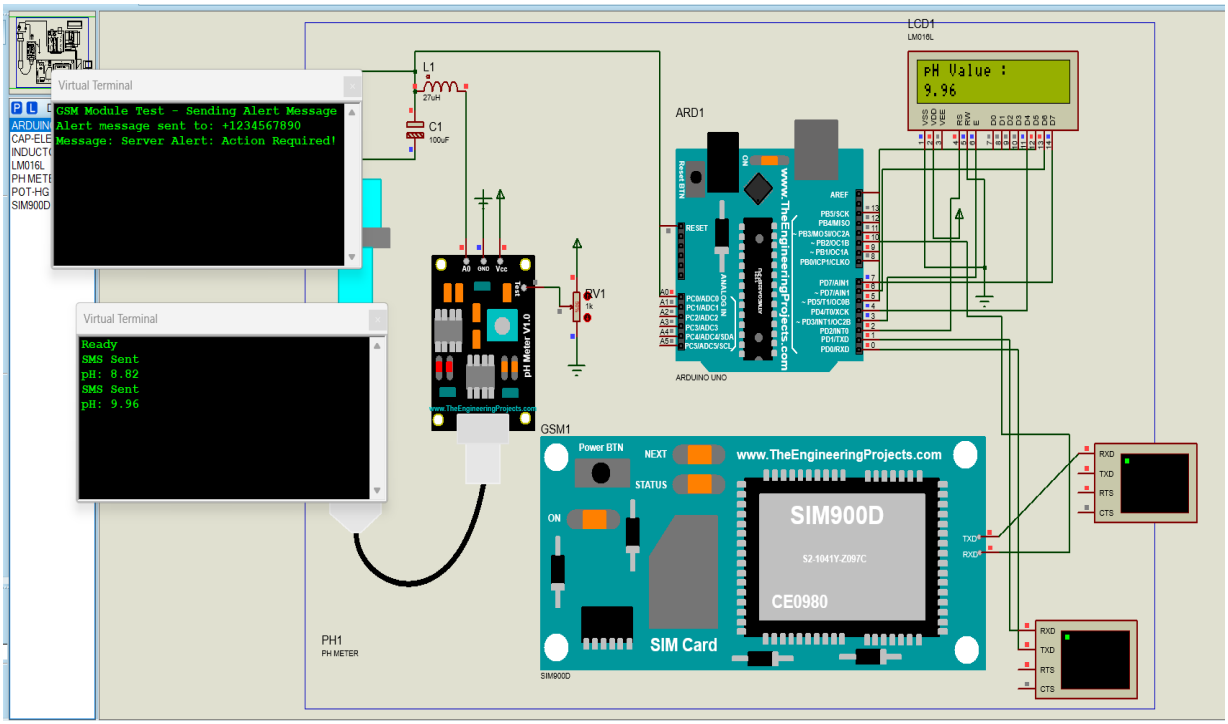

Figure 3: Simulation diagram of Online Water Monitoring System

4.6 Hardware Implementation

Hardware implementation of online monitoring systems for drinking water quality involves the integration of various components to ensure data collection and processing in real time. Measure water quality parameters using sensors such as PH, cloudiness, temperature, and TD. These sensors are connected to the ESP 32-WREOM microcontroller, which processes the collected data. The Wi-Fi module enables data transfer to the IoT cloud platform for remote monitoring. If a parameter exceeds a predefined threshold, the buzzer will activate and provide a warning. Additionally, the P10 display for local monitoring can be used to ensure efficient water quality control.

4.7 Experimental Setup and Testing

The experimental structure includes editing of key components such as water quality sensors (PH, cloudiness, temperature, TDS), microcontrollers (ESP 32), and communications modules (Wi-Fi). The sensor is immersed in a water sample to continuously measure the actual parameters. The microcontroller processes the data and forwards it to the IoT cloud platform for remote access. Various water samples are used during testing to assess the accuracy of the system when contamination is recognized. If a parameter exceeds the threshold, a buzzer is triggered and notifications are sent via mobile applications such as the SMS or Blynk app. The reliability and responsiveness of the system are analyzed for performance verification.

4.8 Performance Evaluation

The performance evaluation of the online drinking water quality monitoring system is conducted by analyzing its accuracy, response time, and reliability in detecting water quality deviations. Sensors are tested with different water samples to measure parameters like pH, turbidity, temperature, and TDS.

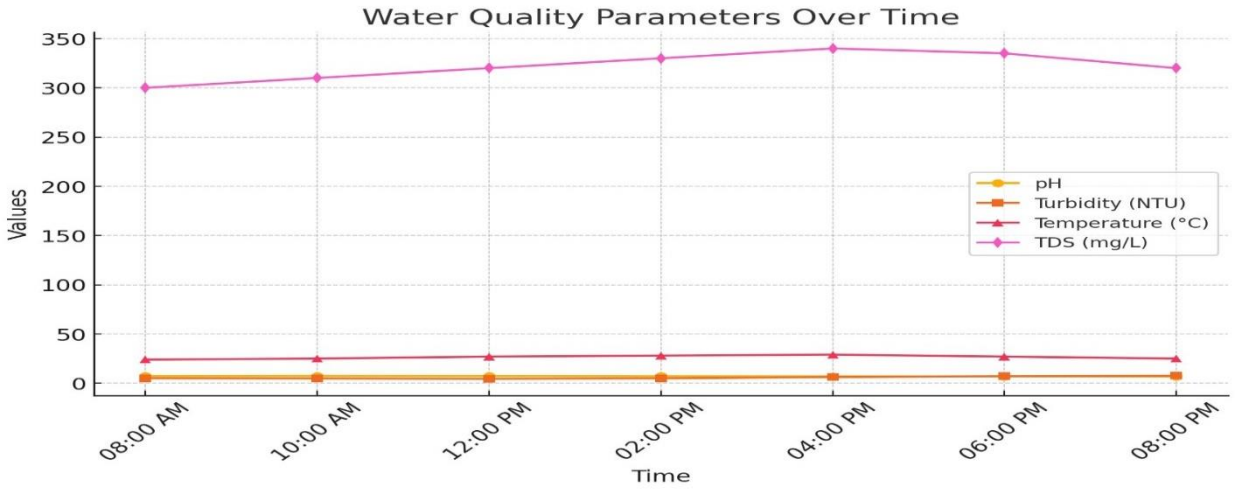

Figure 4: Graph represents the variation of pH, turbidity, temperature, and TDS over a specific time period.

Here's what each line represents:

1. pH (Yellow Line - Circles)

The pH remains relatively stable between 6.8 and 7.4, indicating a neutral water condition. A slight decrease is observed in the evening (08:00 PM), which might be due to natural variations in water chemistry.

2. Turbidity (Orange Line - Squares)

Turbidity (measured in NTU) fluctuates, with a notable increase in the evening. Higher turbidity levels in the evening (7.5 NTU at 08:00 PM) suggest more suspended particles in the water, possibly due to environmental factors or human activities.

3. Temperature (Red Line - Triangles)

The temperature rises throughout the day, peaking at 29°C at 04:00 PM, and then gradually drops. This trend follows natural diurnal temperature variations due to sunlight exposure.

4. TDS – Total Dissolved Solids (Pink Line - Diamonds)

TDS increases gradually from 300 mg/L at 08:00 AM to 340 mg/L at 04:00 PM before slightly decreasing in the evening. This could be due to increased evaporation during the day, leading to a higher concentration of dissolved solids.

Key Takeaways:

- Turbidity increases in the evening, which may indicate water quality deterioration.
- Temperature follows a natural daily cycle, peaking in the afternoon.
- TDS is relatively stable, with minor fluctuations.
- pH remains within a safe drinking water range (6.5–8.5).

5. Conclusion

After filtration, an online water quality monitoring system is guaranteed by continuous monitoring of key water quality parameters after the filtration process. Filtration systems effectively remove contaminants, but do not always guarantee that water will meet health standards. Sources such as filter drops, heights, and lowering sources can degrade water quality. The system provides a reliable, automated solution for maintaining water security, providing real-time monitoring of required parameters. The main parameters monitored by the system include pH values, cloud, temperature, and total festival (TDS). These are all important indicators of water quality. The pH value reflects the acidity or alkalinity of the water, indicating the presence of particles that affect the clarity of the cloudiness. Temperature affects biological and chemical activity and measures the concentration of lytic substances in TDS. By integrating the sensors for each of these parameters, the system continuously collects actual time data for evaluation after water filtration. If any of these parameters are greater than the specified limit, the system will trigger an alarm and notify the user immediately via a mobile app or SMS to ensure that it is reported quickly through possible issues. This immediate notification allows users to take corrective actions such as further filtration and system maintenance to lengthen the risk of uncertain water. This feature is particularly important in both national and industrial environments where maintaining continuous water quality is important. The system also includes historical data storage features that allow users to track and analyze water quality trends over time.

6. References

[1]. M. N. Alam, A. Shufian, M. A. A. Masum and A. A. Noman, "Efficient Smart Water Management System Using IoT Technology," in 2021 International Conference on Automation, Control and Mechatronics for Industry 4.0 (ACMI),

Rajshahi, Bangladesh, 2021.

[2]. C. D. S. Júnior, R. Munoz, M. D. L. Á. Quezada, A. V. L. Neto, M. M. Hassan and V. H. C. D. Albuquerque, "Internet of Water Things: A Remote Raw Water Monitoring and Control System," IEEE Access, vol. 9, pp. 35790-35800, 2021.

[3]. *L. Lavalle, T. Patriarca, B. Daulne, O. Hautier, A. Tofani and E. Ciancamerla, "Simulation-Based Analysis of a Real Water Distribution Network to Support Emergency Management," IEEE Transactions on Engineering Management, vol. 67, no. 3, pp. 554-567, 2020.*

[4]. Y. Wang, S. M. S. M. Rajib, C. Collins and B. Grieve, "Low-Cost Turbidity Sensor for Low-Power Wireless Monitoring of Fresh-Water Courses," IEEE Sensors Journal, vol. 18, no. 11, pp. 4689-4696, 2018.

[5]. D. Wu, H. Wang, H. Mohammed and R. Seidu, "Quality Risk Analysis for Sustainable Smart Water Supply Using Data Perception," IEEE Transactions on Sustainable Computing, vol. 5, no. 3, pp. 377-388.

[6]. R. Rathna, U. V. Anbazhagu, L. Mary Gladence, V. M. Anu and J. Sybi Cynthia, "An Intelligent Monitoring System for Water Quality Management using Internet of Things," in 2021 8th International Conference on Smart Computing and Communications (ICSCC), Kochi, Kerala, India, 2021.

[7].S. Wadekar, V. Vakare, R. Prajapati, S. Yadav and V. Yadav, "Smart water management using IOT," in 2016 5th International Conference on Wireless Networks and Embedded Systems (WECON), Rajpura, 2016.

[8]. K. Gupta, M. Kulkarni, M. Magdum, Y. Baldawa and S. Patil, "Smart Water Management in Housing Societies using IoT," in 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), Coimbatore, 2018.

[9]. S. Staroletov, "Developing Automata-Based Control Software for Water Purification and Normalization," in 021 International Conference on Industrial Engineering, Applications and Manufacturing (ICIEAM), Sochi, Russia, 2021.

[10]. S. Zamzam, E. Dall'Anese, C. Zhao, J. A. Taylor and N. D. Sidiropoulos, "Optimal Water–Power Flow-Problem: Formulation and Distributed Optimal Solution," IEEE Transactions on Control of Network Systems, vol. 6, no. 1, pp. 37-47, 2019.