IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IOT Based Smart Grey Water Management System using Raspberry pi

Kajal Pramod Patil[1], Riddhi Abhay Tembhurnikar[2], Komal Bharat Wagh[3], Maheshkumar N. Patil[4], Prof. Hemraj V. Dhande[5], Dr. I. S. Jadhav[6]

[1,2,3] UG student, [4,5] Asso. Prof. E&TC Engg dept, *GF's Godavari College of Engineering, Jalgaon, Maharashtra, India, 425001*

Abstract *- Water scarcity is becoming a serious issue in many urban areas due to increasing population and excessive consumption of freshwater resources. Grey water, which includes wastewater generated from household activities such as washing, bathing, and cleaning, can be reused for non-potable purposes if properly monitored. This paper proposes an IoT-based smart grey water management system using Raspberry Pi 4 to monitor water quality parameters such as pH and turbidity. The system automatically decides whether the water is reusable or not. If the water quality meets predefined standards, a Solenoid Valve directs the water to a reusable storage tank; otherwise, it is diverted to a waste tank. Sensor data is transmitted to the cloud platform ThingSpeak, allowing users to monitor water quality through a mobile device or laptop. The proposed system improves water conservation and enables intelligent water management in residential environments.*

Keywords: *Grey Water, IoT, Water Quality Monitoring, Raspberry Pi, Turbidity Sensor.*

1. INTRODUCTION

Water is an essential natural resource required for human survival, agriculture, and industrial activities. However, due to population growth and rapid urbanization, freshwater availability is decreasing. A large amount of domestic wastewater, known as grey water, is generated daily from activities such as bathing, laundry, and kitchen cleaning. In many cases, this water is discharged directly into drainage systems without reuse. Grey water can be reused for nondrinking purposes such as gardening, flushing toilets, and cleaning if its quality is within acceptable limits. Manual monitoring of water quality is inefficient and time-consuming. Therefore, an automated system is required to continuously monitor water quality parameters and determine whether the water can be reused. In this project, an IoTbased grey water management system is proposed using Raspberry Pi 4. The system collects data from sensors such as pH and turbidity sensors and processes the data to determine water quality. Based on the analysis, solenoid valves automatically direct water either to a reusable tank or to a waste tank. The collected data is also uploaded to the cloud for real-time monitoring.

2. LITERATURE REVIEW

A study presented at the International Conference on Smart Technologies for Smart Nation proposed an IoT-based greywater recycling system integrated with real-time data analytics. The system utilized sensors and cloud-based analytics to monitor greywater parameters and optimize recycling processes. The results demonstrated that IoT technologies can significantly improve the efficiency of greywater reuse systems by enabling continuous monitoring and automated decision-making [1].

Similarly, another research work proposed an intelligent IoT system for continuous water quality monitoring using multiple sensors and data processing techniques. The system focused on real-time measurement of parameters such as pH, turbidity, and other water quality indicators. The study highlighted that IoT-enabled monitoring systems provide accurate data and improve water quality management by enabling remote monitoring and early detection of contamination [2].

Relay control using microcontrollers and embedded platforms has also been widely studied for automation applications. A study by Deepika Yadav et al. demonstrated the use of a relay control system using Raspberry Pi for home automation through internet connectivity. The system showed that relay modules can effectively control external electrical devices remotely, which can also be applied in automated water management systems [3].

Similarly, another study proposed a water monitoring and conservation system using Raspberry Pi for monitoring water levels and quality parameters in tanks. The system highlighted the advantages of integrating sensors and embedded systems for efficient water management [5].

In addition, the characteristics of greywater have been extensively studied to understand its suitability for reuse. Research on greywater characteristics indicates that greywater from domestic activities such as washing and bathing can be reused for non-potable purposes after proper monitoring and treatment [6].

Cloud-based IoT platforms have also been widely used for data visualization and remote monitoring. Platforms such as ThingSpeak enable real-time data collection, storage, and visualization of sensor data, making them suitable for IoT-based water quality monitoring systems [7].

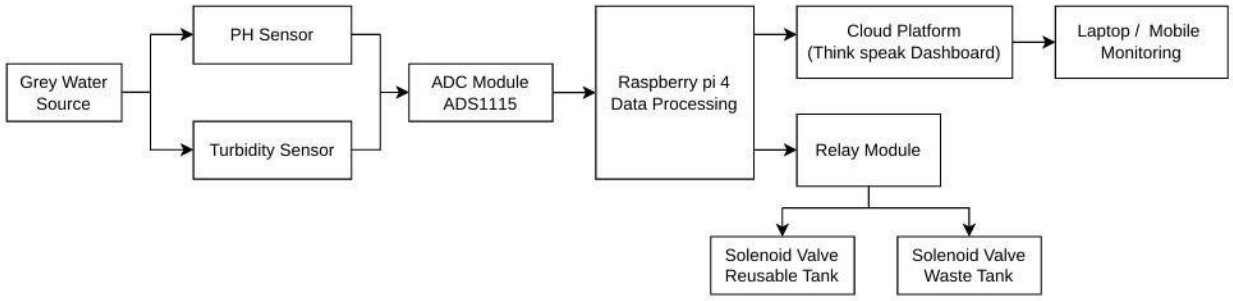
3. PROBLEM STATEMENT

A significant amount of grey water generated in households is wasted without reuse due to the absence of an efficient monitoring and management system. Without proper monitoring, it becomes difficult to determine whether grey water is safe for reuse. Manual methods of water testing are time-consuming and impractical for continuous monitoring. Therefore, there is a need for an automated system that can monitor water quality parameters in real time and make intelligent decisions about water reuse. The proposed system addresses this problem by developing an IoT-based grey water management system that monitors water quality and automatically diverts water based on its usability.

4. PROPOSED SYSTEM

The proposed system consists of sensors, a processing unit, control devices, and a cloud monitoring platform. pH and turbidity sensors are used to measure water quality parameters. The sensor outputs are sent to the processing unit for analysis. The Raspberry Pi 4 acts as the central controller that processes the sensor data and determines whether the water is reusable or not. If the measured values fall within predefined limits, a Solenoid Valve is activated to direct water to the reusable tank. If the values exceed the safe limits, another valve directs the water to a waste tank. The system also sends the collected data to the cloud platform ThingSpeak, where users can view real-time data through graphs and dashboards.

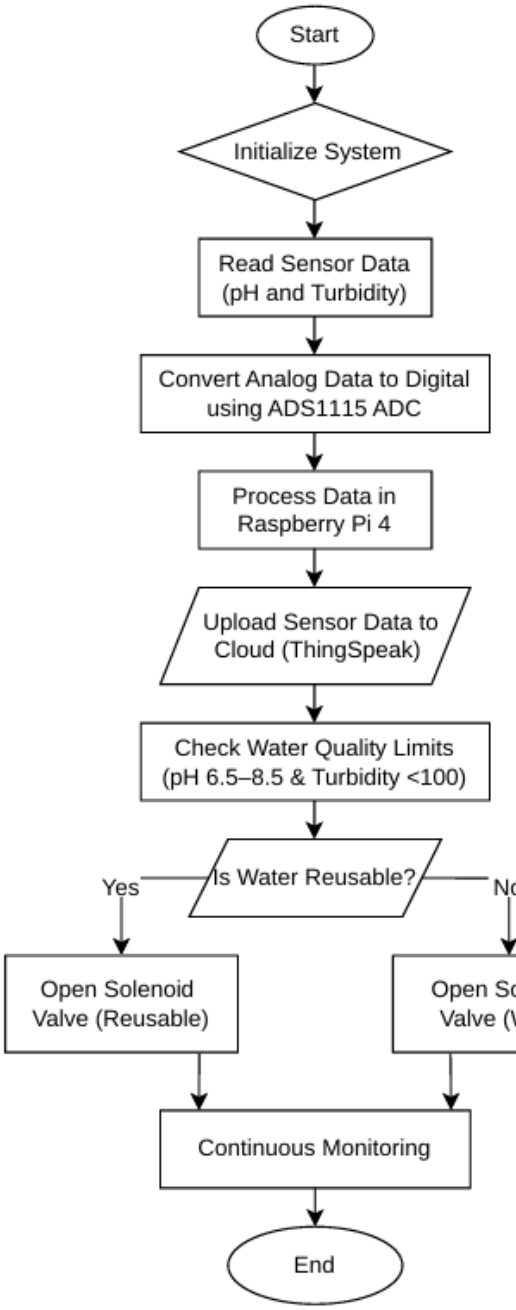
Block diagram



5. METHODOLOGY

The methodology of the proposed system involves several steps. First, grey water from household sources is collected in a primary storage tank. Sensors installed in the tank measure water quality parameters such as pH and turbidity. The sensor signals are processed by Raspberry Pi 4, which evaluates the values against predefined thresholds. Based on this evaluation, the system decides whether the water can be reused. If the water quality is acceptable, the controller activates a Solenoid Valve that directs water to the reusable storage tank. If the water quality is not acceptable, the system opens another valve that sends the water to a waste tank. At the same time, the sensor readings are uploaded to the cloud platform ThingSpeak for remote monitoring.

Flowchart



6. HARDWARE AND SOFTWARE REQUIREMENT

Hardware component

- Raspberry Pi 4
- pH Sensor
- Turbidity Sensor
- Solenoid Valve
- Relay Module
- Power Supply
- Water Tanks

Software component

- Python programming language
- Cloud platform ThingSpeak
- Raspberry Pi OS

7. EXPECTED RESULT

The Experimental result demonstrate that the proposed system can effectively monitor grey water quality and automatically classify it as reusable or non-reusable based on pH and Turbidity values. The system successfully directs water to the appropriate storage tank using automated valve control while simultaneously uploading sensor data to the IOT cloud platform.

Test No.	pH Value	Turbidity (NTU)	Water Quality Status	System Decision	Valve Activated
1	7.1	45	Good	Reusable	Reusable Tank Valve
2	6.8	52	Acceptable	Reusable	Reusable Tank Valve
3	8.9	130	Poor	Not Reusable	Waste Tank Valve
4	7.5	60	Acceptable	Reusable	Reusable Tank Valve

Threshold Values Used

Parameter	Acceptable Range
pH	6.5 – 8.5
Turbidity	< 100 NTU

8. CONCLUSION & FUTURE SCOPE

8.1. Conclusion

This paper presents an IoT-based smart grey water management system designed to monitor water quality and enable efficient water reuse. The system uses Raspberry Pi 4 to process sensor data and control Solenoid Valve mechanisms for automatic water diversion. By integrating sensors, cloud connectivity, and automation, the proposed system helps conserve water resources and promotes sustainable water management practices. The system is suitable for residential buildings and small communities where grey water reuse can significantly reduce freshwater consumption.

8.2. Future scope

The proposed system can be further improved by integrating additional sensors such as temperature, dissolved oxygen, and total dissolved solids (TDS) sensors for more accurate water quality analysis.

Machine learning algorithms can also be implemented to predict water quality trends and optimize water reuse decisions. In addition, mobile applications can be developed to provide real-time alerts and notifications to users.

The system can also be scaled for large residential complexes and smart city applications.

9 REFERENCES

[1] *C. S. Ranganathan, V. Singh Thakur, R. Raman, S. Sujatha and S. Parikh, "IoT and Real-time Data Analytics Optimize Greywater Recycling," 2023 Second International Conference On Smart Technologies For Smart Nation*

(SmartTechCon), Singapore, Singapore, 2023, pp. 1049-1053, doi: 10.1109/SmartTechCon57526.2023.10391788.

[2] *P. Mandal, A. Roy, H. Nath and M. Dhar, "Intelligent IoT System for Continuous Water Quality Monitoring," 2024 IEEE Silchar Subsection Conference (SILCON 2024), Agartala, India, 2024, pp. 1-5, doi:*
10.1109/SILCON63976.2024.10910322.

[3] *Deepika Yadav, Yogendra Singh and Harshit Gupta, Controlling Relay using Raspberry Pi Via Internet for Home Automation. International Journal of Advanced Research in Engineering and Technology, 9(1), 2018, pp 1–11.*

[4] *Shashidhar, Dr & Phanisahithi, G. & Aniketh, M. & Rahul, B. & Kumar, N.. (2025). SMART IRRIGATION USING RASPBERRY PI. International Journal of Data Science and IoT Management System. 4. 366-370. 10.64751/ijdim.2025.v4.n4.pp366-370.*

[5] *Sahaana, Sahaana & Thanusha, Bathala & Roshanara, Shaik & Kaviya, M.. (2022). Water monitoring and conservation in tanks by effective methodology using raspberry PI. International journal of health sciences. 75807587. 10.53730/ijhs.v6nS3.7733.*

[6] *E. Eriksson, K. Auffarth, M. Henze, and A. Ledin, "Characteristics of Grey Wastewater," Urban Water Journal, vol. 1, no. 1, pp. 85-104, 2002.*

[7] *MathWorks, "ThingSpeak IoT Analytics Platform," Available: https://thingspeak.com.*