

# **Automated Gray Water Management System for Sustainable Water Reuse in Urban Applications**

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## **Abstract**

Rapid urbanization and increasing water scarcity have created an urgent need for sustainable water management solutions. This study presents the design and prototype development of an automated grey water management system capable of treating and reusing wastewater from household washing machines for non-potable applications such as irrigation. The system integrates Membrane Bioreactors (MBR), Electrocoagulation, and Advanced Oxidation Processes (AOPs), managed by an Arduino Uno-based control unit. Water quality parameters including turbidity, pH, and residual contaminants were monitored to evaluate treatment efficiency. Experimental results demonstrated a reduction of turbidity by over 85% and compliance with standard irrigation water quality guidelines. The automated system also optimizes treatment cycles based on sensor feedback, reducing energy consumption by 12% compared to continuous operation. The proposed solution offers a cost-effective, compact, and eco-friendly approach to urban grey water reuse, contributing to water conservation goals and supporting smart city initiatives.

## **Keywords**

Sustainability, Membrane bioreactor, Arduino-Sensors, Machine vision, Spectacular analysis.

## **Biographies**

**Pandyaraj V.**, is currently serving as an Associate Professor in the Mechanical and Automation Department. With over 16 years of dedicated teaching experience, he has contributed extensively to the academic community by training and mentoring students in various engineering disciplines. His expertise spans multiple specialized areas including Fatigue Failure Analysis (FFA), Design Work, Material Science, and Crashworthiness. Throughout his career, he has combined theoretical knowledge with practical applications, enabling students to achieve a comprehensive understanding of mechanical and automation engineering. His commitment to education and research continues to foster innovation and excellence in his department.

**Vallarasu. S, Hemanathan. S and Rajadevan. M** are undergraduate students pursuing a Bachelor of Engineering degree in Mechanical and Automation Engineering at Sri Sairam Engineering College, Chennai. Their academic journey reflects a strong interest in the intersection of mechanical design, automation technology, and sustainable innovation. As emerging engineers, they focus on applying theoretical knowledge to real-world challenges, particularly those involving environmental conservation and efficient resource management. Currently, they are collaboratively developing an Automatic Grey Water Management System, a project aimed at recycling and optimizing water usage for urban applications. This work demonstrates their commitment to promoting eco-friendly engineering practices and integrating automation for societal benefit. Through their research and technical exploration,

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they seek to contribute toward building smarter and more sustainable systems that support India's growing emphasis on water conservation and environmental responsibility.