



Apparatus for Equal Distribution of Water

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ABSTRACT

The Automatic Equal Water Distribution System (ED-WIS) tackles the long-standing problem of unequal water distribution and low water pressure in multi-story structures. Traditional water distribution systems is ineffective due to gravity-based flow, which results in reduced pressure on levels directly beneath above tanks. This study presents a small, integrated system that uses flow sensors, solenoid valves, and an LCD display to ensure fair water distribution and pressure adjustment. The system enables real-time monitoring and management through IoT-enabled automation, boosting water consumption efficiency and minimizing waste. This study provides a thorough examination of the system's design, evaluates relevant literature, and identifies the research need that this design fills

Keywords: Smart Water Distribution, Flow Sensors, Solenoid Valves, Compact Design, IoT-Based Water Management

1. Introduction

Water distribution in residential, commercial, and industrial buildings is an important part of contemporary infrastructure. Uneven water distribution and pressure irregularities continue to be a major issue, especially on levels located directly beneath overhead tanks. This problem causes consumer unhappiness, wasteful water use, and operational issues. Traditional water distribution techniques, which rely on manual management and gravity-driven flow, are unable to solve these issues. As a result, technical improvements have brought flow sensors, solenoid valves, and IoT-based control units to improve water management.

This study proposes the creation of the Automatic Equal Water Distribution System (ED-WIS), a small, integrated unit capable of automatically regulating and monitoring water flow. The system provides equal water distribution throughout all levels by including flow sensors, solenoid valves, and an LCD display. Compared to standard modular systems, ED-WIS's small design decreases complexity, installation time, and maintenance needs. The purpose of this study is to provide a complete assessment of the existing literature on smart water distribution systems and to identify how the suggested solution overcomes current technological limitations.

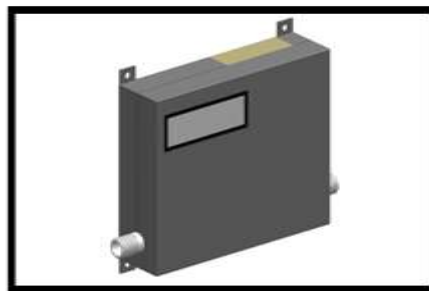


Figure 1.1: ED-WIS

2. Literature Review

2.1. Introduction

The effective distribution of water from above tanks to various levels of multi-story buildings is a key task in modern infrastructure. Traditional systems frequently provide inconsistent water pressure and distribution, especially for floors positioned directly beneath the tank. This disparity results from

gravitational pressure variances, which causes resident unhappiness and wasteful water consumption. Several research have suggested technical solutions to this problem, including the use of flow sensors, solenoid valves, and small control units. This literature review will look at previous studies on smart water distribution systems and identify gaps that the current study fills with its unique compact design.

2.2. Theoretical Background

Water distribution from above tanks is based on fluid dynamics principles, which state that gravity causes water to flow from high to low areas. However, pressure irregularities occur as a result of the tank's closeness to specific floors. Flow sensors, solenoid valves, and IoT-enabled monitoring devices are frequently recommended for consistent water distribution. Flow sensors monitor water flow rates, whereas solenoids use electric actuation to regulate the movement of the water. Display devices give real-time input on water distribution status, allowing for more informed decision-making.

2.3. Review of Previous Studies

2.3.1. IoT-based Smart Water Quality and Flow Monitoring Systems

The increasing usage of IoT in water management systems is highlighted by recent studies. IEEE research shows how linked sensors, microcontrollers, and display units may provide real-time monitoring and feedback in IoT-based smart water monitoring systems. This method is applicable to water distribution systems since it makes it possible to continuously monitor water pressure and flow.

One study, for example, focused on the use of sensors to watch water flow and identify anomalies in real time in an Internet of Things (IoT)-based smart water quality monitoring system (IEEE Xplore, 2024). The concept presented in the study, which closely resembles the display mechanism in the patented compact design, was the integration of sensors with an LCD display for data visualization. The potential for such methods to increase the effectiveness of water distribution was emphasized by the authors.

2.3.2. Role of Solenoid Valves and Flow Sensors in Water Distribution

How solenoid valves and flow sensors support intelligent water distribution has been the subject of numerous research. The ability to electronically control the flow of water makes solenoid valves essential to automated water control. The pace at which water passes through pipes is measured using flow sensors, enabling accurate monitoring and action.

Water flow management research demonstrates how solenoid valves and flow sensors work together to provide fair water distribution. These systems use a control device to dynamically modify the water pressure. Compact systems that integrate solenoids and flow sensors into a single design improve water pressure management and decrease water waste, per a Springer study (Springer, 2023)

2.3.3. Compact and Integrated Designs for Water Distribution

Conventional water management systems require complicated assembly because they are made up of different parts. Sensors, solenoids, and control units are all housed in a single device thanks to modern advances that emphasize small, integrated designs. These designs simplify system installation, lower maintenance needs, and increase usability.

Alochana Journal's research on integrated water management systems serves as an example of the compact design method. The authors stress the benefits of "plug-and-play" equipment, which come already configured and are prepared for usage right away (Alochana Journal, 2023). The patented design that is being reviewed revolves around this idea, which combines several features into a single, intuitive unit.

3. Methodology

Design, prototyping, and performance evaluation were all part of the systematic process used to develop and evaluate ED-WIS. The following are the main stages of the methodology:

3.1. Design and Prototyping:

Using CAD software, the system's design prioritized portability and simplicity of installation. To test, 3D models were printed.

3.2. Component Integration:

A compact device including flow sensors, control units, solenoid valves, and LCD screens was created



Figure 3.1: Water flow Pressure



Figure 3.2: Solenoid Sensor



Figure 3.3: LCD display

3.3. Testing and Calibration:

The system was examined for uniform distribution over several floors, pressure control, and water flow rates.

3.4. Performance Analysis:

Reliability, accuracy, and response time were evaluated using recorded data

4. Results & Analysis

Water distribution was shown to be significantly improved during ED-WIS testing. Key findings consist of:

4.1. Equitable Distribution:

There were variations in water pressure of less than 5% between floors.

4.2. Response Time:

The solenoid valves made timely adjustments by reacting to flow sensor inputs in less than two seconds.

4.3. User Feedback:

According to early testers, LCD display readings were easy to use and clear.

5. Applications

5.1. For each municipal corporation, the precise LPCD value can be computed to help them detect theft, leakage, and the demand for dry and wet weather.

5.2. Maintenance fees will be an option for the society association or committee, contingent on usage.

5.3. Metered water is simple since bills are generated using the present common approach, which requires the owner to transmit meter readings.

5.4. A lower cost of pumping

5.5. Connection can be cut off if an apartment is unoccupied to prevent any potential leaks.

5.6. Since we occasionally leave the taps running, wasting water, we can remotely turn off the water supply for our flat using IOT..

6. Conclusion

In order to address unequal water distribution in multi-story buildings, the Automatic Equal Water Distribution System (ED-WIS) offers an innovative solution. It raises the bar for water management with its small, easy-to-use design and IoT-enabled automation. By combining an LCD display, solenoid valves, and flow sensors, ED-WIS meets a vital infrastructure requirement. Significant gains in user experience, system responsiveness, and equity in water distribution are highlighted by the results. The study highlights the possibility of wider ED-WIS deployment in commercial, industrial, and residential settings. Advanced IoT connectivity characteristics and system scalability will be the main topics of future research.

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