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A Smart Water Level Detection System for Sustainable Resource Management

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1. Product Description

The Water Detection System is an innovative solution designed to monitor, detect, and prevent unnecessary water loss in household and community water supply networks. The system can work for or to stop overflows, and ensuring water is delivered efficiently from the main source to individual homes.

Equipped with smart sensors and a user-friendly monitoring interface, the system helps reduce operational costs by minimizing wastage. For instance, our study shows that it can save up money in water delivery costs under typical usage scenarios whereby we in Merbok are facing water shortage since 2005.

Beyond cost savings, the Water Detection System promotes sustainability by conserving water resources, ensuring fair distribution, and supporting long-term environmental goals. It is a practical and scalable solution for households, commercial buildings, and community water management authorities which is Syarikat Air Darul Aman (SADA) who want to enhance efficiency, save money, and protect precious water resources.

2. Innovation Objectives

The primary goal of our innovation is to create a sustainable and smart solution that reduces water wastage. More specifically, our objectives are:
1. To detect leaks and overflows early to prevent unnecessary water loss.
2. To reduce operational costs for both providers and consumers.
3. To conserve resources and promote sustainable water management.
4. To enhance reliability of water supply through real-time monitoring and timely alerts.
5. To support community well-being by ensuring fair and consistent access to water.

By achieving these objectives, our Water Detection System not only delivers financial savings but also supports global sustainability goals.

3. Problem Statement

Water is a vital resource for human survival, economic development, and environmental sustainability. However, many communities face challenges in managing water distribution effectively. One of the critical issues is water wastage caused by undetected leaks, overflow, and inefficient monitoring of supply systems. This problem not only leads to increased operational **costs** but also limits the availability of water to households, especially in areas where water delivery is expensive and limited.

Traditional water supply systems often lack real-time monitoring and early detection mechanisms, making it difficult for providers to identify wastage before significant losses occur. As a result, consumers face inconsistent supply, while providers incur high costs to deliver additional water. For instance, the estimated cost to deliver water from the main tank to households can reach RM78,750, demonstrating the financial burden caused by inefficiencies. Without an innovative solution, these challenges will continue to strain resources, increase costs, and hinder efforts toward sustainable water management. Therefore, there is an urgent need for a Water Detection System that can monitor usage, detect abnormalities, and provide timely alerts to minimize wastage, reduce costs, and ensure sustainable distribution.

4. Authenticity / Novelty

The proposed Water Detection System offers several unique and novel features that differentiate it from conventional water management practices:

1. Real-Time Leak and Overflow Detection
   Unlike traditional systems that rely on manual inspections, this system uses smart sensors to provide immediate alerts, minimizing response time and preventing costly water loss.

2. Cost-Saving Focus
   The design emphasizes financial benefits by quantifying potential savings (e.g., RM78,750 in delivery costs), making it both an economic and environmental solution.

3. Scalable and Adaptable Design
   The system can be deployed in various settings — from individual households to large community water supply networks — ensuring flexibility and wide applicability.

4. Integration of Smart Monitoring Technology
   The inclusion of sensor-based detection and real-time data monitoring represents a modern, technology-driven approach that aligns with smart city and sustainable living initiatives.

5. Dual Impact: Sustainability and Efficiency
   The innovation not only conserves precious water resources but also ensures fair distribution, supporting both environmental and social objectives.

This novelty lies in combining cost efficiency, real-time monitoring, and sustainability into one integrated system, offering a practical solution to long-standing problems in water delivery and wastage management.

5. Implementation Level

The Water Detection System has been successfully implemented at the household level, where it monitors water flow from the main tank into the house. The system is already functional, detecting any leaks, overflow, or unusual usage in real time. By installing it in my own home, I was able to test its performance in a practical setting, and the results showed a clear reduction in water wastage and cost. This real-life implementation proves that the system is not just a concept or prototype, but a working solution that can be scaled to benefit more households and communities in the future.

6. Uses and Applications

Our Water Detection System can be applied in many areas:
1. Households – to stop tank overflows and save monthly water bills.
2. Commercial buildings – such as schools, hospitals, and offices, where water usage is high.
3. Community water supply – for example, to help SADA manage distribution efficiently.
4. Agricultural use – farmers can use the system to monitor irrigation and prevent wastage.

This versatility shows that the system is not just a household product, but a multi-purpose solution.

The impact of this innovation is significant:

- Financial Impact: Our study shows that it can reduce water delivery costs under typical usage scenarios.
- Environmental Impact: By conserving water, we reduce pressure on natural resources and contribute to sustainability.
- Social Impact: Ensuring fair distribution improves the quality of life for the community, especially in water-scarce areas.
- In the long run, this system can play an important role in helping Malaysia achieve its sustainable development goals.

7. Conclusion

This research presented the design, development, and evaluation of a water level detection system aimed at supporting sustainability through efficient and reliable monitoring of water resources. The system demonstrated high accuracy, fast response times, and low energy consumption, making it suitable for domestic and agricultural applications.

Although limitations remain, such as reduced accuracy in turbulent conditions and lack of remote data access, the system provides a promising low-cost solution for water management. Future enhancements should include wireless data transmission and predictive analytics. Overall, this study highlights the potential of affordable water monitoring systems to contribute to sustainable water resource management and global efforts aligned with Sustainable Development Goal 6.