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Aquasense: Sensing And Reporting Water Flow

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***Abstract*—Water distribution networks are critical infrastructure for modern cities, yet leaks, bursts, and undetected pipeline faults lead to significant water loss and increased maintenance costs. Early detection of such issues remains challenging due to fluctuating demand patterns and environmental disturbances. AquaSense presents an IoT-based intelligent water pipeline monitoring system designed to provide real-time leak detection and infrastructure monitoring. The proposed system integrates multiple sensors including a YF-S201 flow sensor, a 0-150 PSI pressure transducer, and an ADXL335 vibration sensor connected to an ESP32 microcontroller for continuous data acquisition. The ESP32 performs edge-level processing to calculate flow rate, pressure variations, and vibration patterns, enabling threshold-based anomaly detection. When abnormal conditions such as sustained high flow or unusual vibration patterns are detected, the system automatically generates alerts. Sensor data is transmitted to the Blynk IoT cloud platform where it is visualized through a real-time dashboard and integrated with a web-based monitoring interface. By enabling real-time monitoring, reducing water loss, and improving maintenance response, AquaSense contributes to sustainable water management and supports the development of smarter and more resilient water distribution systems.**

***Index Terms*—IoT, Water Pipeline Monitoring, Leak Detection, ESP32, Edge Processing, Blynk Cloud, YF-S201, ADXL335.**

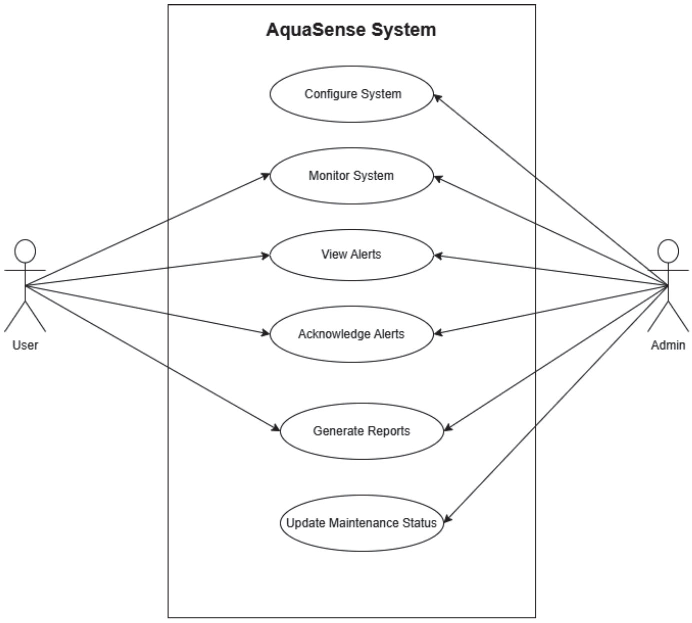

Fig. 1. use case diagram

I. Introduction

Water distribution networks are essential infrastructure for supplying water to households, campuses, and urban areas. However, leaks, bursts, and unauthorized usage in pipelines lead to significant water loss, increased operational costs, and infrastructure damage. Traditional monitoring methods often rely on manual inspection or centralized systems that are unable to provide continuous real-time monitoring, making early detection of small leaks difficult.

AquaSense introduces an IoT-based intelligent monitoring system designed to detect abnormalities in water pipelines using multiple sensors. The system integrates a YF-S201 flow sensor, a 0–150 PSI pressure transducer, and an ADXL335 vibration sensor connected to an ESP32 microcontroller for real-time data acquisition. These sensors continuously monitor flow rate, pressure variations, and vibration patterns within the pipeline.

A. Objectives

The main objective of the project is to design and implement a real-time IoT-based water pipeline monitoring system capable of detecting leaks, bursts, and abnormal flow conditions while providing real-time alerts and monitoring capabilities. The specific objectives include:

- To design an IoT-based monitoring system that continuously measures water flow, pressure, and pipeline vibrations.
- To implement edge-level processing for analyzing sensor data and detecting anomalies in pipeline conditions.
- To transmit sensor data to the Blynk IoT cloud platform using wireless communication for remote monitoring.
- To generate notifications when abnormal flow, pressure drops, or unusual vibrations are detected.

II. Literature Review

Several research studies have explored the use of IoT technologies, wireless sensor networks, and intelligent monitoring systems to improve water pipeline leak detection. Liu et al. (2019) proposed a wireless sensor network-based system for detecting leaks in water pipelines. The system uses distributed sensor nodes to monitor pipeline conditions and transmit data

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for analysis. Basha and Ramesh (2020) developed an IoT-based monitoring system that collects sensor data and sends it to cloud platforms for real-time analysis.

III. System Analysis

A. Existing System Drawbacks

The current pipeline monitoring systems exhibit several limitations:

- **Limited Detection Capability:** Small leaks are difficult to detect in the early stage.
- **High Implementation Cost:** Advanced monitoring systems such as fiber optic sensing require expensive equipment.
- **False Alarms:** Acoustic monitoring systems are affected by environmental noise.
- **Centralized Monitoring Issues:** SCADA-based systems rely on centralized architecture.

B. Proposed System Architecture

The proposed system, AquaSense, uses multiple sensors including a YF-S201 flow sensor, a pressure transducer, and an ADXL335 vibration sensor connected to an ESP32 microcontroller. The ESP32 performs edge-level processing to analyze sensor data locally.

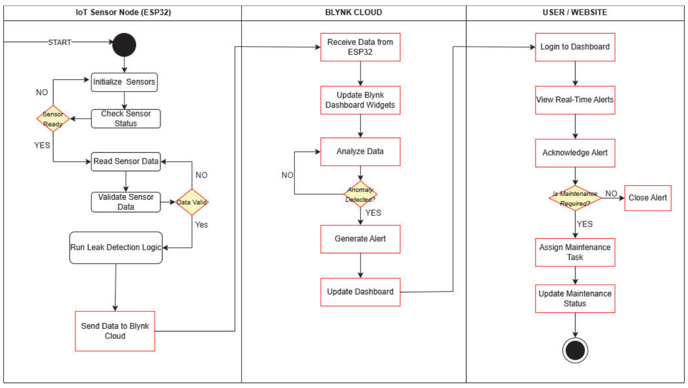

Fig. 2. System Architecture

IV. System Specifications

A. Hardware Specifications

- **YF-S201 Flow Sensor:** Measures flow rate.
- **Pressure Transducer (0–150 PSI):** Monitors pressure variations.
- **ADXL335 Vibration Sensor:** Detects structural faults.
- **ESP32 Microcontroller:** Central processing unit with Wi-Fi.

V. Implementation and Hardware Description

A. Hardware Mechanics

The YF-S201 flow sensor consists of a rotor and a Hall effect sensor. The sensor generates electrical pulses proportional to the flow rate. The ESP32 counts these pulses to calculate liters per minute. The ADXL335 measures acceleration along X, Y, and Z axes to detect physical disturbances.

VI. Results and Discussion

The system was tested under various flow and pressure conditions to evaluate its accuracy and response time. The results demonstrate that the AquaSense system is highly effective in identifying leaks.

A. Data Visualization

Sensor data was successfully logged into the Blynk Cloud. The dashboard provided real-time graphs showing the correlation between pressure drops and increased flow rates, which are classic indicators of a pipeline burst.

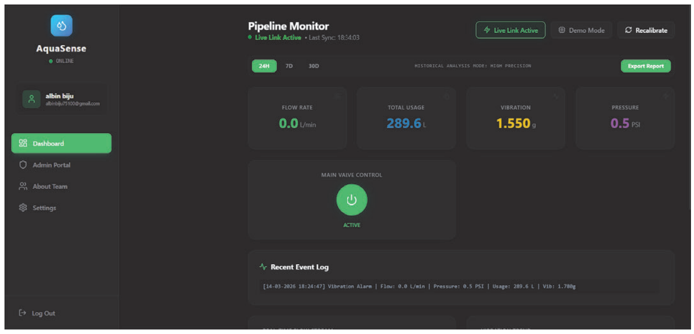

Fig. 3. The interactive dashboard .

B. Performance Metrics

The system successfully detected simulated leaks within 5 seconds of the flow exceeding the 0.3 L/min threshold. The vibration sensor effectively filtered out ambient environmental noise, only triggering alerts when physical impacts or high-pressure vibrations were detected.

TABLE I
Functional Test Results

TC ID	Test Scenario	Observed Output	Status
TC 01	Normal Flow	Steady readings (0.1 L/min)	Pass
TC 02	Simulated Leak	Alert triggered after 5 sec	Pass
TC 03	Sudden Pressure Drop	Graph reflects immediate drop	Pass
TC 04	Connectivity	99% uptime via Wi-Fi	Pass

VII. Conclusion and Future Enhancements

AquaSense provides an efficient and intelligent approach for monitoring pipeline conditions. Through continuous monitoring and alert generation, it helps in early detection of pipeline faults and reduces water wastage. Future enhancements include machine learning based leak detection and smart city integration.

References

[1] Y. Liu, et al., ”Water Pipeline Leakage Detection Based on Wireless Sensor Networks,” Sensors, 2019.
[2] S. M. Basha and R. Ramesh, ”Real-Time Water Pipeline Monitoring Using IoT Sensors and Cloud Platforms,” International Journal of Smart Infrastructure, 2020.

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[3] H. M. H. Al-Kafrawi, et al., ”IoT-Based Smart Water Leakage Detection System,” IEEE Internet of Things Journal, 2021.
[4] H. Zhang, Y. Li, and X. Wang, ”IoT-Based Pipeline Monitoring and Leak Detection Using Smart Sensors,” IEEE Sensors Journal, 2022.
[5] D. Mahesh Kumar and T. Jagadeep, ”Water Pipeline Leakage Detection and Monitoring System Using Smart Sensors with IoT,” IJRIEEE, 2023.