ESP Journal of Engineering & Technology Advancements (ESP-JETA)
ISSN: 2583-2646
Special Issue: International Conference on Modern Engineering and Future Technologies (ICMEFT-26)

Original Article

Real-Time Drainage Monitoring And Alert System Using Iot

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***Abstract**: Urban drainage systems play a critical role in maintaining sanitation and preventing flooding. However, blockages, overflow, and toxic gas accumulation in drainage systems pose serious risks to human health and infrastructure. This paper presents a real-time IoT-based drainage monitoring and alert system using ESP8266, ultrasonic sensor, and gas sensor. The ultrasonic sensor is used to monitor water level inside drainage systems, while the gas sensor detects harmful gases such as methane and hydrogen sulphide. The ESP8266 microcontroller processes the sensor data and provides real-time monitoring through IoT connectivity. When abnormal conditions such as overflow or gas leakage are detected, the system generates alerts to prevent hazardous situations. The proposed system is cost-effective, efficient, and suitable for smart city applications, enabling improved drainage management and public safety.*

***Keywords:** IoT, Drainage Monitoring, ESP8266, Ultrasonic Sensor, Gas Sensor, Smart City, Flood Detection*

I. INTRODUCTION

Drainage systems are essential components of urban infrastructure, designed to remove excess water and waste efficiently. However, poor maintenance, blockages, and accumulation of waste materials often lead to drainage overflow and gas build-up. These issues can result in urban flooding, environmental pollution, and serious health hazards. Traditional drainage monitoring methods rely on manual inspection, which is inefficient, unsafe, and time-consuming. Workers are often exposed to toxic gases and unhygienic conditions during inspection. With the advancement of IoT technology, smart monitoring systems can be developed to continuously observe drainage conditions in real time. These systems reduce human intervention and improve efficiency. This project proposes a real-time drainage monitoring system using IoT, which detects water level and gas concentration and provides instant alerts during abnormal conditions.

II. LITERATURE REVIEW

Kumar et al. (2019): Kumar developed an IoT-based drainage monitoring system using sensors to measure water levels and detect blockages. The system enabled real-time monitoring through cloud platforms. However, the system lacked gas detection capability, which is essential for safety.

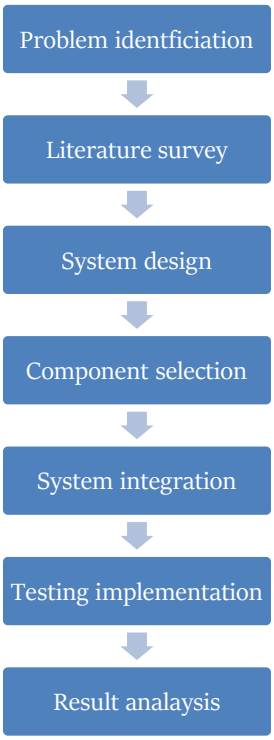
Sharma and Gupta (2020): This study focused on smart drainage monitoring using wireless sensor networks. It improved data transmission and monitoring efficiency. However, it did not include real-time alert systems for emergency situations.

Rahman et al. (2021): Rahman proposed a low-cost drainage monitoring system using microcontrollers and sensors. The system was suitable for rural applications. However, it lacked IoT connectivity and real-time alerts.

Lee et al. (2022): Lee introduced an automated drainage system that monitored water levels and controlled flow mechanisms. The system improved efficiency but increased complexity and cost.

Singh et al. (2023): Singh developed a smart drainage alert system using IoT and GSM technology. However, it did not include gas detection, which is a major limitation.

III. METHODOLOGY



IV. SYSTEM DESIGN

A. Components

- ESP8266
- Ultrasonic Sensor
- Gas Sensor (MQ series)
- Buzzer
- Power Supply

V. RESULTS AND DISCUSSION

The developed IoT-based drainage monitoring system was tested under various conditions to evaluate its performance and reliability. The system successfully monitored water levels and detected toxic gases in real time. The ultrasonic sensor effectively measured the water level inside the drainage system. When the water level exceeded the predefined threshold, the system accurately identified overflow conditions and triggered alerts. The response time was quick, and the readings were consistent with minimal error. The gas sensor (MQ series) successfully detected harmful gases such as methane and hydrogen sulphide. When gas concentration increased beyond safe limits, the system generated immediate alerts, ensuring safety for workers and surroundings. The alert mechanism, including buzzer and IoT notification, functioned efficiently under all test cases. Alerts were generated for overflow, gas leakage, and critical combined conditions without delay. Experimental results showed that the system has high accuracy, fast response, and reliable performance. Compared to traditional manual inspection methods, the proposed system reduces human effort, minimizes risk, and enables continuous monitoring.

Table 1: System Decision Logic

Condition	Water Level	Gas	Alert
Normal	Low	No	OFF
Overflow	High	No	ON
Gas Leak	Normal	Yes	ON
Critical	High	Yes	ON

This table explains how the system makes decisions based on water level and gas presence. Under normal conditions, no alert is generated. When the water level increases, an overflow alert is triggered. If gas is detected, a warning alert is activated. In critical conditions where both water level and gas are high, the system generates a strong alert to indicate danger.

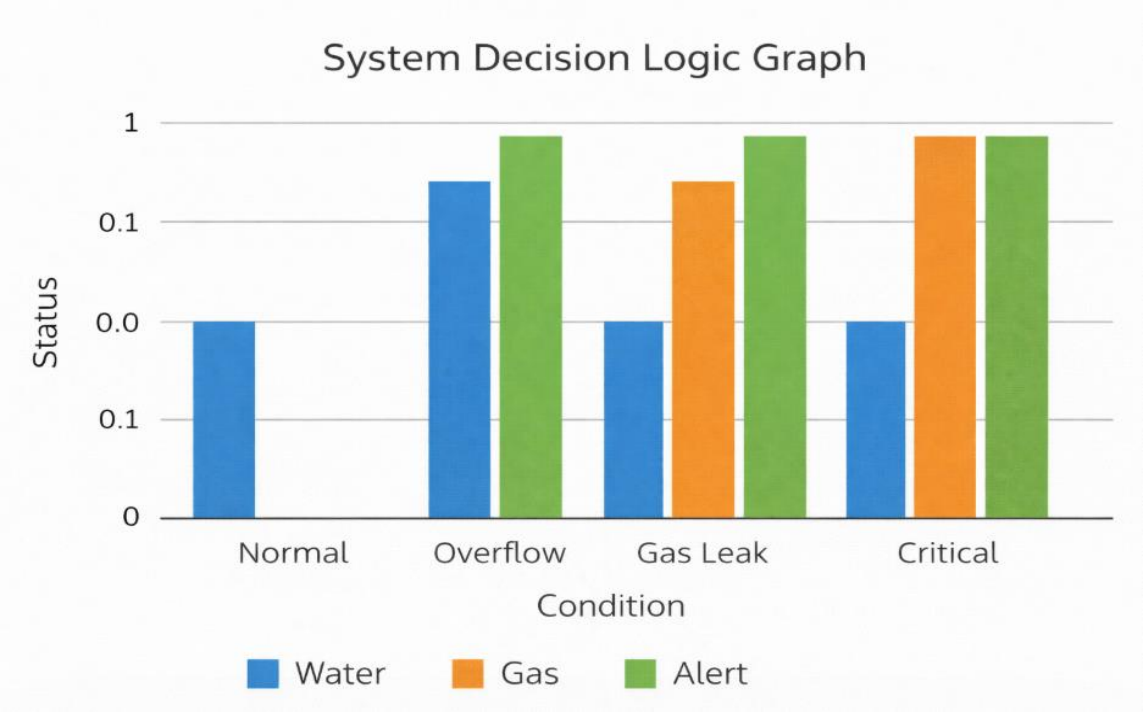
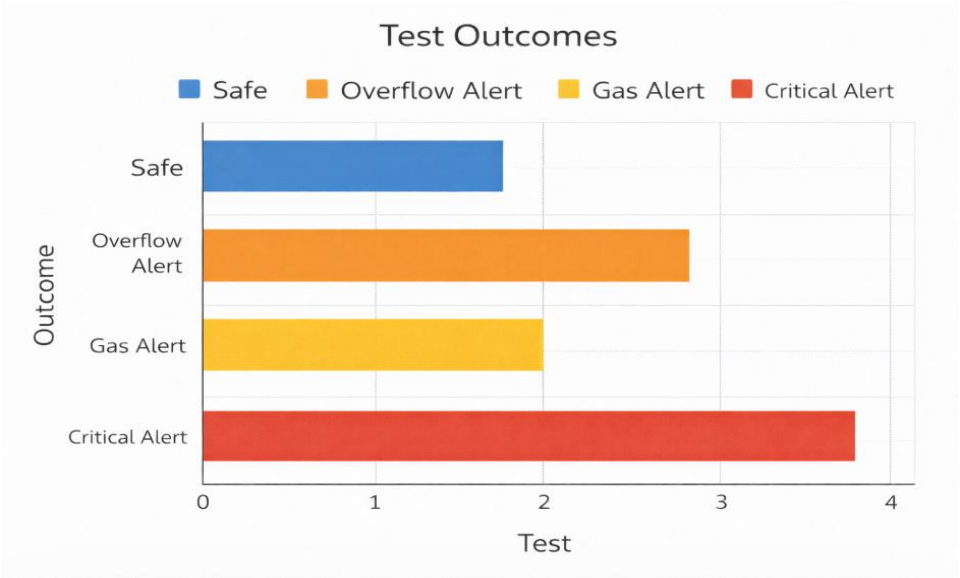


Table 2: Experimental Results

Test	Water Level	Gas	Result
1	Low	No	Safe
2	High	No	Overflow Alert
3	Low	Yes	Gas Alert
4	High	Yes	Critical Alert



This table presents the results obtained during testing of the system under different conditions. It shows how the system responds to various combinations of water level and gas presence. The system correctly identifies safe, overflow, gas leakage, and critical conditions, proving its accuracy and reliability.

VI. CONCLUSION

The proposed IoT-based real-time drainage monitoring and alert system demonstrates an effective solution for managing urban drainage issues such as overflow and toxic gas accumulation. By integrating ultrasonic and gas sensors with the ESP8266 microcontroller, the system ensures continuous monitoring, accurate detection, and immediate alert generation during critical conditions. This significantly reduces the need for manual inspection, thereby minimizing human exposure to hazardous environments and improving operational safety. Furthermore, the system is cost-effective, easy to implement, and scalable for large-scale deployment. Its ability to provide timely information supports better decision-making and preventive maintenance of drainage networks. Overall, the proposed system contributes to improved public health, efficient infrastructure management, and serves as a reliable component in the development of smart and sustainable cities.

VII. REFERENCES

[1] R. Kumar, S. Verma, and A. Singh, "IoT-based drainage monitoring system," International Journal of Engineering Research & Technology, vol. 8, no. 6, pp. 112–116, 2019.
[2] S. Sharma and P. Gupta, "Smart drainage monitoring using wireless sensor networks," IEEE Access, vol. 8, pp. 102345–102353, 2020.
[3] M. Rahman, T. Islam, and K. Ahmed, "Low-cost drainage monitoring system," International Journal of Smart Technology, vol. 5, no. 2, pp. 45–50, 2021.
[4] K. Lee, J. Park, and H. Kim, "Automated drainage control system," Automation in Construction, vol. 134, pp. 104050, 2022.
[5] A. Singh, R. Patel, and M. Shah, "IoT-based drainage alert system using GSM," International Journal of Advanced Research in Electronics, vol. 10, no. 4, pp. 210–215, 2023.
[6] D. Zhang, L. Wang, and Y. Liu, "Urban flood monitoring using IoT technologies," Sensors, vol. 20, no. 18, pp. 1–15, 2020.
[7] P. S. Reddy and V. Kumar, "Smart sewer monitoring system using gas sensors," International Journal of Environmental Science and Technology, vol. 17, no. 9, pp. 4123–4130, 2020.
[8] H. Boyes, B. Hallaq, J. Cunningham, and T. Watson, "The industrial internet of things (IIoT): An analysis framework," Computers in Industry, vol. 101, pp. 1–12, 2018.
[9] A. Al-Fuqaha et al., "Internet of Things: A survey on enabling technologies," IEEE Communications Surveys & Tutorials, vol. 17, no. 4, pp. 2347–2376, 2015.
[10] J. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements," Future Generation Computer Systems, vol. 29, no. 7, pp. 1645–1660, 2013.
[11] S. Madakam, R. Ramaswamy, and S. Tripathi, "Internet of Things (IoT): A literature review," Journal of Computer and Communications, vol. 3, no. 5, pp. 164–173, 2015.
[12] N. Ahmed and M. Hossain, "Real-time water level monitoring system using ultrasonic sensor," International Journal of Scientific Research, vol. 9, no. 3, pp. 78–82, 2020.
[13] R. Kumar and P. Singh, "Gas leakage detection system using MQ sensors," International Journal of Engineering Trends, vol. 68, no. 2, pp. 56–60, 2020.
[14] T. Nguyen and M. Kim, "Smart city applications using IoT-based monitoring systems," Sustainable Cities and Society, vol. 49, pp. 101–110, 2019.
[15] B. Patel and K. Desai, "Real-time alert systems using embedded IoT," International Journal of Embedded Systems, vol. 12, no. 1, pp. 25–32, 2021.