International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 02 | Feb - 2026 SJIF Rating: 8.659 ISSN: 2582-3930

IOT-Based Smart Drainage Monitoring and Autonomous Cleaning System Using ESP8266

Prof. Nilesh Landge[1], Deepak Adik[2], Shivraj Cholke[3], Harshad Wagh[4]

[1]*Lecturer, Department Of Mechanical Engineering, P.Dr.V.V.P. Institute of Technology & Engineering (Polytechnic), Loni Bk., Maharashtra, India*

[2]*Department of Mechanical Engineering, Pravara Polytechnic, Loni, Maharashtra, India*

[3]*Department of Mechanical Engineering, Pravara Polytechnic, Loni, Maharashtra, India*

[4]*Department of Mechanical Engineering, Pravara Polytechnic, Loni, Maharashtra, India*

Abstract - Drainage systems regularly face problems such as blockages, waste accumulation, and the presence of toxic gases, which can create unsafe conditions and affect urban hygiene. Manual inspection inside drainage lines is slow, risky, and often fails to detect early warnings of overflow or gas formation. To overcome these issues, this project develops an IoT-based Smart Drainage Monitoring and Autonomous Cleaning System using the ESP8266 microcontroller. The system continuously measures water level with an ultrasonic sensor and detects harmful gases using an MQ-135 sensor. A servo-motor-driven cleaning mechanism lifts floating solid waste to prevent blockage. All readings are processed by the ESP8266 and sent to an IoT dashboard, enabling real-time monitoring and quick alerts to the concerned authority. The prototype was tested under controlled conditions, showing accurate sensing, proper alert generation, and effective waste removal. This system reduces the need for manual scavenging, improves safety, and offers a low-cost and scalable solution for modern drainage maintenance.

Key Words: IoT, ESP8266, Smart Drainage System, Blockage Detection, Ultrasonic Sensor, Gas Monitoring, Autonomous Cleaning, Real-Time Alerts, Drainage Inspection, Hazard Detection

1.INTRODUCTION

Drainage systems are essential for maintaining cleanliness, preventing waterlogging, and ensuring smooth wastewater flow in urban areas. However, these systems often get blocked due to plastic waste, sediment, and other solid materials. Manual inspection of drainage pipelines is unsafe and inefficient, especially because workers are exposed to toxic gases like methane and ammonia inside narrow and harmful environments. Traditional methods also fail to provide continuous monitoring, resulting in delays and frequent blockages.

To address these issues, this project develops an IoT-based smart drainage monitoring and cleaning system using the ESP8266 controller. The system uses an ultrasonic sensor to measure water levels, a gas sensor to detect harmful gases, and a servo-motor mechanism to automatically remove solid waste. All readings are sent to an IoT dashboard for real-time monitoring and quick alerts. This automated approach improves safety, reduces manual effort, and provides a reliable way to keep drainage systems clean and functional..

2. Body of Paper

2.1 Problem Statement

Drainage pipelines often experience blockage due to plastic waste, sludge, and solid impurities. Manual inspection is unsafe because workers are exposed to toxic gases like methane and ammonia. Existing systems provide no real-time monitoring or early alerts. Therefore, an automated, sensor-based system is needed to detect blockages, harmful gases, and overflow conditions without human entry.

2.2 Objectives

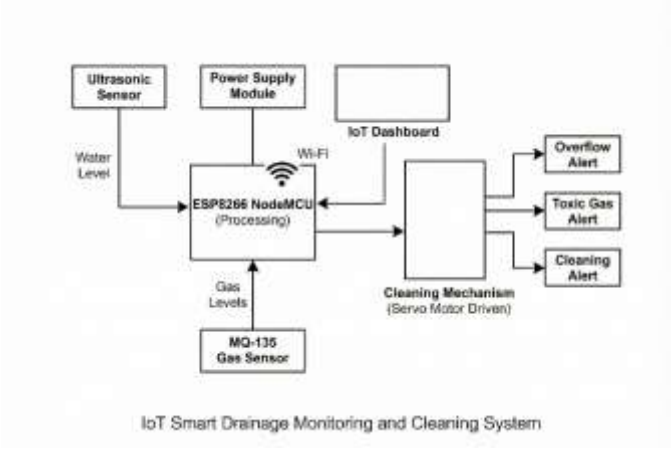
1. To monitor the water level using an ultrasonic sensor.
2. To detect hazardous gases using a gas sensor.
3. To send real-time alerts through an IoT dashboard (ESP8266).
4. To automatically remove floating waste using a cleaning mechanism.
5. To improve worker safety and reduce manual cleaning.

2.3 Proposed System

The system uses ESP8266 as the controller, connected to ultrasonic and gas sensors for monitoring drainage conditions. A servo-motor-powered cleaning arm removes floating waste. Sensor data is uploaded to a cloud

platform, allowing authorities to track conditions in real time and receive alerts when abnormal values are detected.

2.4 Block Diagram



IoT Smart Drainage Monitoring and Cleaning System

Explanation:
Sensors → ESP8266 → Processing → IoT Dashboard → Alert → Cleaning Mechanism

2.5 Working Principle

The ultrasonic sensor measures water level continuously. Gas sensors monitor drainage air quality. ESP8266 processes this data and uploads it via Wi-Fi. When blockage or toxic gas is detected, the system triggers alerts. The servo motor cleaning mechanism removes solid waste to prevent overflow.

2.6 Components Used

- ESP8266 Microcontroller
- Ultrasonic Sensor (HC-SR04)
- MQ-Series Gas Sensor
- Servo Motor Cleaning Mechanism
- Motor Driver
- 16×2 LCD Display
- Power Supply Module

3. CONCLUSIONS

The IoT-based smart drainage monitoring and cleaning system successfully provides a safer and more efficient approach to managing drainage pipelines. The ultrasonic sensor measures water level accurately, while the MQ-series gas sensor detects harmful gases that commonly form inside drainage lines. The ESP8266 controller processes this information and sends real-time alerts to the IoT dashboard, allowing quick action during overflow or gas buildup. The servo-based cleaning mechanism helps remove floating solid waste, reducing the chances of blockage. Overall, the developed system reduces manual inspection, improves worker safety, and offers a practical, low-cost solution for modern drainage maintenance and smart-city applications.

Block Diagram of IoT-Based Smart Drainage Monitoring and Cleaning System

ACKNOWLEDGEMENT

The authors express their sincere gratitude to **Prof. Nilesh Baburao Landge** for his continuous guidance, valuable suggestions, and strong academic support throughout the development of this project. His expertise in mechanical engineering and consistent encouragement greatly contributed to improving the design, implementation, and overall quality of the system. The authors also thank the institute for providing the necessary resources and laboratory facilities to complete this work successfully..

REFERENCES

[1] R. Muthukumar, S. Praveen and K. Ramesh, "IoT-Based Sewage Gas Monitoring and Alert System," *International Journal of Innovative Research in Engineering*, vol. 12, no. 3, pp. 145–150, 2024.

[2] Z. Hussin and S. Saaddin, "Design and Development of an Automated Drainage Monitoring System," *International Journal of Engineering Research Applications*, vol. 10, no. 2, pp. 87–92, 2022.

[3] V. Gerlin and A. Joseph, "Smart Drainage Inspection System Using Ultrasonic and Gas Sensors," *International Journal of Emerging Technologies and Advanced Engineering*, vol. 13, no. 1, pp. 55–60, 2023.

[4] N. Yadav, P. Shinde and R. Jagtap, "Real-Time IoT-Enabled Automatic Drainage Cleaning Mechanism," *International Journal of Science and Research*, vol. 11, no. 5, pp. 101–106, 2023.

[5] S. Vispute and A. Kulkarni, "IoT-Assisted Drainage Overflow Detection and Hazard Alert System," *International Journal of Scientific Research in Engineering and Management*, vol. 7, no. 5, pp. 214–220, 2025.

BIOGRAPHIES

Deepak Shankar Adik is a final-year Diploma student in Mechanical Engineering with strong practical skills in AutoCAD, SolidWorks, and Creo for 2D drafting, 3D modelling, and assembly design. He has completed certified training in major CAD tools, Python programming, advanced Microsoft Excel, and cybersecurity. Deepak has internship experience in mechanical design at Infinite Graphix Technologies Pvt. Ltd., where he worked on modelling, drafting, and design documentation. His academic and technical background reflects a deep interest in engineering design, IoT systems, and innovative problem-solving for real-world applications.