ISSN: 2454-9940

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

E-Mail :
editor.ijasem@gmail.com
editor@ijasem.org

www.ijasem.org

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN2454-9940

www.ijasem.org

Vol 18, Issue 2, 2024

IOT BASED MANHOLE MONITORING AND REPORTING SYSTEM FOR MUNICIPAL DEPARTMENT

[1]DOMAVALA TEJA SRI,[2]CHILUVERU SAI SHIVANI,[3]BEDARAKONDA DIVYA,[4]THUMOJI SOWMYA, Dr.JAVEED.MD

[1,2,3,4]Student, Department of ECE, PRINCETON INSTITUTE OF ENGINEERING AND TECHNOLOGY FOR WOMEN

[5]Assistant Professor, Department of ECE, PRINCETON INSTITUTE OF ENGINEERING AND TECHNOLOGY FOR WOMEN

ABSTRACT

The efficient management and disposal of sewage are crucial for urban development. As urban populations grow, traditional methods of monitoring sewage systems have become inadequate. To address these challenges, an IoT-based system has been designed to monitor the conditions within manholes in real-time. This system employs sensors to collect data and transmit it to a central hub, enabling quick identification and resolution of issues. By leveraging IoT technology, this system represents a significant step forward in waste management practices and is a key component in the development of Smart Cities.

Keywords: Sewage, Monitoring, Internet of Things (IoT), Real-Time, Alerts.

1. INTRODUCTION

Sewage management is a critical concern in many urban areas, often complicated by factors such as rapid urbanization and heavy rainfall. These issues can lead to malfunctions in the underground drainage systems, disrupting daily life. To mitigate these problems, a real-time monitoring and alert system for sewage management is essential. This system will allow municipal authorities to promptly address drainage issues, ensuring the efficient functioning of the sewage infrastructure in large cities. The proposed solution involves installing sensors that monitor the status of the drainage system. These sensors will detect problems such as blockages,

water overflows, and unauthorized access to manholes. The data collected by the sensors will be sent to the municipal authorities via integrated Wi-

Fi, allowing for remote monitoring. Additionally, the system will use the Blynk Server to provide the exact GPS location of the drainage system, further enhancing monitoring capabilities. The goal of this project is to ensure continuous monitoring of the drainage system, enabling quick response to any issues. By doing so, the project aims to create a cleaner and safer environment for city residents, reducing the risk of accidents and improving the overall quality of life.

2. PROBLEM STATEMENT

The sewer system faces numerous challenges, including population growth, construction waste, and heavy rainfall. To address these challenges, we have developed a monitoring system that focuses on four key parameters within a manhole:

1. **Wastewater level:** A waterproof Ultrasonic sensor will detect sudden increases in water levels.
2. **Emitted gases:** A Gas Sensor will measure the toxicity of gases emitted by wastewater.
3. **Temperature:** A Temperature Sensor will monitor spikes in temperature caused by chemical reactions between emitted gases.
4. **Alignment:** A Tilt Sensor will check if the manhole lid is properly positioned.

The system also includes a SIM module for communication and a microcontroller to integrate all sensors. Each parameter has a specific threshold, and if any parameter exceeds its threshold, the system will automatically send an alert via SMS or email to the relevant municipal department.

3. OBJECTIVES

A. Ensure the efficient operation of the sewage system through regular monitoring of manholes.

B. Enhance public safety by monitoring all manholes in the area.

C. Prevent costly repairs and accidents through consistent maintenance.

D. Optimize resource allocation by analyzing data from manholes and directing resources to areas requiring immediate attention.

4. EXISTING METHODS

Manhole monitoring is a critical aspect of municipal infrastructure management, but current methods are inadequate. For example, increases in sewage water levels often go unnoticed until an

overflow occurs, requiring manual inspection. Gas detection is sporadic, using semi-digital handheld devices that require manual observation. Tilt and temperature monitoring are often neglected entirely. These limitations highlight the need for a more advanced and dedicated monitoring system for effective manhole management.

5. LITERATURE REVIEW

Reference [1] discusses using IoT to develop a smart, real-time drainage and manhole monitoring system. Reference [2] presents an accident-avoidance system for large cities that detects and alerts authorities about open manholes using an ultrasonic sensor. Reference [3] describes a cost-effective, low-maintenance IoT system that notifies management when manholes exceed certain thresholds, reducing risks for manual scavengers and the public. Reference [4] outlines a system that monitors blockages, dangerous gas levels, and depths, providing alerts as needed. Reference [5] proposes a sensor-based system for detecting garbage overflow and harmful gas emissions in manholes, sending alerts to relevant authorities. Reference [6] introduces a low-cost, robust IoT-based manhole monitoring system aimed at creating a safe and clean environment in Smart Cities. Reference [7] explores methods to reduce power consumption in IoT-based manhole monitoring systems, proposing low-power analog chaotic oscillators as an alternative to inefficient technologies. Reference [8] describes an IoT system for manhole monitoring that alerts sewage department officials and residents about overflowing drains via a mobile app.

6. METHODOLOGY

The system utilizes four types of sensors: Gas Sensor, Ultrasonic Sensor, Tilt Sensor, and Temperature Sensor. The circuit is powered by a battery connected through a booster module, which powers the sensors, NodeMCU, and other components. Once activated, the sensors begin collecting data on temperature, gas levels, sewage water levels, and the tilt of the manhole cover. The Gas Sensor detects common and toxic gases in the manhole, while the Ultrasonic Sensor measures the sewage water level. The Tilt Sensor monitors the proper closure of the manhole cover. The GPS module provides location data, which is shared with the microcontroller. The Temperature Sensor tracks the internal temperature of the manhole. The microcontroller records and processes

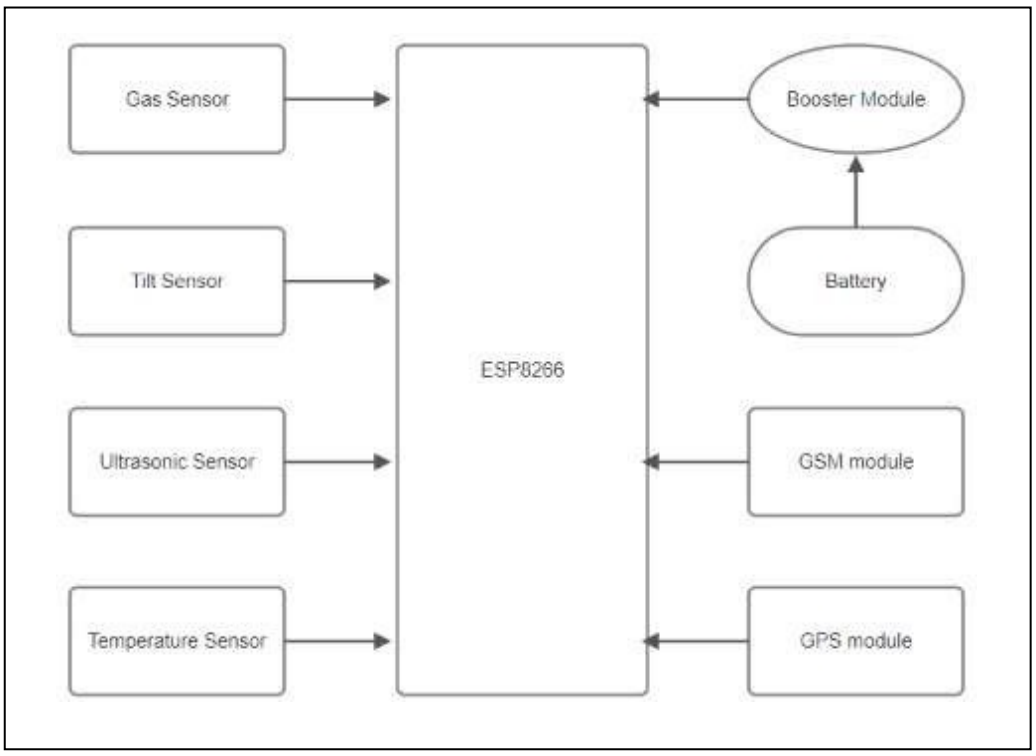
ISSN2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024

this data for transmission. If any sensor detects a value outside the set thresholds, an alert is generated and sent via the GSM Module to a designated contact, typically a municipal authority. The system continuously tracks and updates data in real-time using IoT technology, accessible via a connected device.

7. COMPONENTS USED

1. **NodeMCU:** A versatile platform for software and hardware development based on the ESP8266 System-on-a-Chip (SoC) by Espressif Systems, ideal for IoT projects.
2. **SIM800L GSM Module:** Operates in the 900MHz band (common in India), but can be used in other regions depending on the local network bands.
3. **XL6009 Booster Module:** A step-up boost converter that adjusts output voltage with high efficiency, converting 5-32V DC input to 4-38V DC output.
4. **MQ Gas Sensor:** A sensor designed to detect Carbon Monoxide (CO) levels in the air, offering a wide detection range, quick response, and high sensitivity.
5. **KY-017 Tilt Switch Module:** Used for measuring levels of various flowing materials, ensuring accurate level detection in different applications.
6. **Waterproof Ultrasonic Sensor:** The JSN-SR04T sensor detects objects and measures distance using ultrasonic waves, with applications in both indoor and outdoor environments.
7. **GPS Module:** The NEO-6M GPS module provides precise location data and is commonly used in GPS tracking and navigation systems.
8. **18650 Cell & Cell Holder:** A rechargeable lithium battery with 3.7V output, known for its lightweight and reusability.
9. **IDE Software:** The Arduino IDE is an open-source platform for writing and uploading code to Arduino boards, supporting languages like C and C++.

ISSN2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024



8. CONCLUSION

The proposed IoT-based manhole monitoring system offers a significant improvement in urban infrastructure safety. By providing real-time updates on the status of manhole covers, the system enables city authorities to respond quickly to potential hazards. Future research should focus on enhancing the system's accuracy, integrating it with other smart city technologies, and addressing cybersecurity concerns associated with IoT-based infrastructure monitoring.

9. FUTURE SCOPE

There are several opportunities to enhance the current system for better performance, sensitivity, and efficiency. Future upgrades could include adding sensors with improved detection capabilities or additional sensors to monitor a broader range of parameters. Power consumption optimization could also extend the battery life of sensors and microcontrollers. Integrating machine learning algorithms could improve anomaly detection and reduce false alarms. Deploying multiple units in all manholes within a networked area could create a comprehensive monitoring system for an entire city.

Although this would require significant resources and maintenance, the benefits of efficient sewage system monitoring and improved maintenance schedules align with the vision of Smart Cities.

10.REFERENCES

1. 'Smart Real-Time Drainage Monitoring System Using Internet of Things' by Gaurang Sonawane, Chetan Mahajan, Anuja Nikale, Yogita Dalvi/ IRE Journals Volume 1 Issue 11.'
2. 'Manhole monitoring system implemented in the smart city' by D.Sakthipriya, V. Logeswari, K. Nishanth, B.Reethika/ International Conference on Emerging Trends in IOT & Machine Learning, 2018.'
3. 'Smart Manhole Detection' by Memane Abhishek Ganpat, Aher Omkar Ganpat, Bansode Sumit Shivaji/ IJEAST Volume 6 Issue 11.'
4. 'IOT Based Drainage and Waste Management Monitoring Alert System For Smart City' by M Aarthi, A Bhuvaneshwar/ Annals of the Romanian Society March 2021.'
5. 'An IoT-Based Proposed System for Monitoring Manhole in Context of Bangladesh' by Saadnoor Salehin, Syeda Sabrina Akter, Anika Ibnat, Tasmiah Tamzid Anannya, Nurun Nahar Liya, Manisha Paramita, Md Mahboob Karim/ ICEEICT.'
6. 'Manhole Monitoring System' by Dr. V. M. Karthikeyan, M.E., Ph.D, Balaganesh. R, Jayaseelan. S/ IJERT.'
7. 'IOT-based Manhole Detection and Monitoring System' by Prof Swati Khawate, Prof Sharan Inamdar, Nitin Battula, Naveen Cheerala, Laxmimanasa Chirivella/ IJRASET.'
8. 'MANHOLE MONITORING SYSTEM' by Sai Teja, B Premsingh, A Ranjith Kumar, N. Anupama Rani/ IJCRT Volume 11 Issue 5.'
9. 'Manhole Detection and Monitoring System Using IOT' by Mr Mane Harshavardhan Vijay, Mr Nimbaler Swapnil Sanjay, Chougule Pushpraj Babaso, Mr Ghatage Abhishek Dundappa, Ms Saundatti MG/ IJRPR.'

ISSN2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024

10. 'An IoT Based Manhole Monitoring System' by Komal Mahalunge, Sanjana Chauhan, Mansi Parsekar, Kiran Dange/ IJSRD.'

11. 'Manhole Detection and Monitoring System' by Ruheena M. A, Rukhayia Sheereen, Sheeba Kulsum,
T. Komala/ IJERT.'