E-ISSN No : 2581-6195 | Volume : 9 | Special Issue | May 2026

SMART DRAINAGE MANHOLE MAINTENANCE SYSTEM USING IOT

Nandini[1], Ambika[1], Ayodhyarani[1], Bhagyashree[1], Rohini D[2]

ABSTRACT

Urban drainage systems require efficient monitoring to prevent water overflow and flooding. Conventional manhole inspection and maintenance methods are manual, time-consuming, and reactive. This paper presents a **Smart Drainage Manhole Maintenance System using the Internet of Things (IoT)** for real-time monitoring and automated control. The proposed system employs **float sensors** installed inside drainage manholes to detect water level conditions. Sensor data are transmitted wirelessly to a cloud platform and monitored through the **Blynk IoT application**, enabling real-time visualization and remote supervision. When the water level exceeds predefined thresholds, alerts are generated and a **motor pump is automatically activated** to regulate water flow and prevent overflow. The system reduces human intervention, improves response time, and enhances the reliability and safety of urban drainage management.

KEYWORDS: Internet of Things (IoT), Float Sensor, Water Level Monitoring, Blynk IoT Application, Motor Pump Control, Smart City Infrastructure

[1] Students of EEE Department, Guru Nanak Dev Engineering College, Bidar, Karnataka, India
[2] Faculty, EEE Department Guru Nanak Dev Engineering College, Bidar, Karnataka, India

How to Cite: Nandini, Ambika, Ayodhyarani, Bhagyashree & Rohini D (2026), Smart Drainage Manhole Maintenance System Using Iot, International Educational Journal of Science & Engineering (IEJSE),Vol: 9, Special Issue, May 2026 279-282

1. INTRODUCTION:

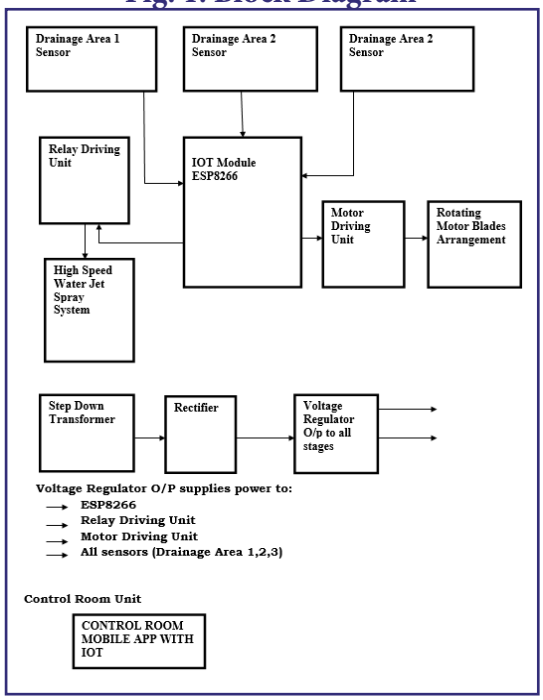
Urban areas face frequent issues with drainage systems such as blockage, overflow, and delayed maintenance. These problems can lead to waterlogging, foul odors, health hazards, and even accidents due to open or overflowing manholes. Traditional inspection methods rely on manual monitoring, which is inefficient, time-consuming, and often unsafe.

With the advancement of the Internet of Things (IoT), real-time monitoring systems can be implemented to improve infrastructure management. This project proposes a smart drainage manhole monitoring system that continuously tracks parameters such as water level.

The system aims to alert municipal authorities before critical failures occur, thereby reducing manual effort and improving public safety. By integrating sensors, microcontrollers, and communication modules, the system enables automated and intelligent decision-making.

Block Diagram:

Fig. 1: Block Diagram

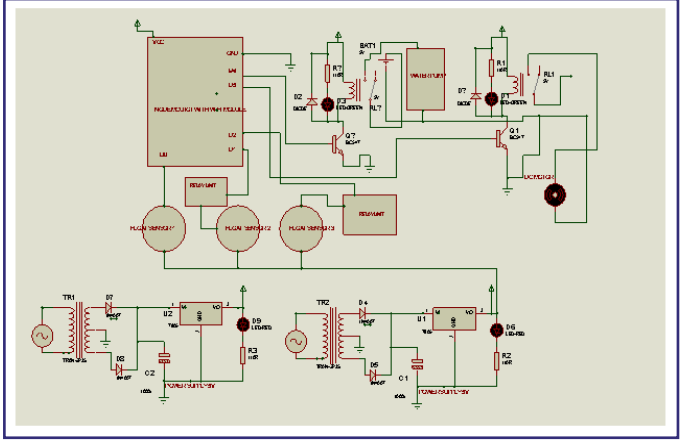


The system uses drainage sensors to detect

water level and blockages. The data is processed by the ESP8266 IoT module, which controls the relay and motor driving units. A water jet spray and rotating blades are activated to clear obstructions. A regulated power supply supports all components, and the system can be monitored remotely via a mobile application.

1.1 Circuit Diagram:

Fig. 2: Circuit Diagram



The circuit consists of an ESP8266 microcontroller interfaced with multiple float sensors to detect water levels. Based on sensor inputs, transistor-driven relay circuits control the motor and water jet system. A regulated power supply using a transformer, rectifier, and voltage regulator provides stable DC voltage. Indicator LEDs and buzzer are included for status and alert indication.

2. MATERIALS AND METHODS:

1. IoT Module - ESP8266 (3.3 V DC): The **ESP8266 IoT module** functions as the core processing and communication unit of the system. It acquires input from the float sensors, executes control logic, and transmits data to the cloud via Wi-Fi.

2. Float Sensors (5V DC): The **float sensors** are used to detect water level conditions inside the drainage manhole. They provide discrete level signals that indicate normal and overflow conditions.

3. Relay unit (5V DC): The **relay driving** enables the ESP8266 to control high-power devices safely. It provides electrical isolation between low-voltage control circuitry and high-voltage actuators.

4. Motor and Water pump (12V DC): The **motor and pump** are activated automatically when the water level crosses a predefined threshold. It helps in regulating water flow and preventing overflow in the drainage system.

5. Motor Drive unit (5V DC): The **motor driver unit** uses **5 V DC for control and 12 V DC for motor operation** to interface the ESP8266 with the motor pump. It supplies sufficient current and protects the controller from load-related damage.

6. Water jet spray (12V DC): The **high-speed water jet spray system** is used to clear blockages within the drainage channel. It assists in removing debris and improves drainage efficiency.

7. Rotating Motor blades (12V DC): The **rotating motor blades arrangement** provides mechanical cleaning of solid waste accumulated in the drainage system. It enhances the overall effectiveness of the maintenance process.

8. Power supply unit (230V AC): The **power supply unit,** consisting of a step-down transformer, rectifier, and voltage regulator, converts **230 V AC** mains input into regulated **5 V DC, 12 V DC, and 3.3 V DC** outputs. It ensures stable and continuous power delivery to all hardware components.

9. Arduino IDE: The system firmware is developed using the **Arduino Integrated Development Environment (IDE),** which is used to program the ESP8266 microcontroller. The firmware handles float sensor data acquisition, threshold-based decision logic, motor pump activation, and communication with the cloud platform.

10. Blynk mobile app: The **Blynk IoT platform** is employed for real-time monitoring and visualization of drainage system parameters. It enables remote supervision through a mobile application by displaying water level status and generating alerts during overflow conditions.

11. Wifi module: The **Wi-Fi communication protocol** is utilized by the ESP8266 to transmit sensor data to the Blynk cloud server. This ensures reliable and continuous data exchange between the

field devices and the control room interface.

12. Diode (50-1000V): Diode is used for rectification and reverses current protection in the power supply and relay circuits. It typically operates at a **forward voltage drop of 0.7 V** for silicon diodes and is rated for **50–1000 V reverse breakdown,** depending on the diode type.

13. Transistor (0.7V): The **transistor** is employed as a switching device in relay and motor driver circuits. It operates with a **base–emitter voltage of approximately 0.7 V** and is commonly rated for **30–60 V collector–emitter voltage,** enabling reliable control of high-power loads.

14. Electrolytic Capacitor (1000µF): The **electrolytic capacitor** is used for filtering and smoothing DC output in the power supply section. It is typically rated for **16 V to 50 V,** depending on the circuit voltage, and provides high capacitance for ripple reduction.

15. Ceramic Capacitor (0.1 µF (100 nF) / 50 V): The **ceramic (silicon) capacitor** is used for high-frequency noise suppression and signal stabilization. It operates at **25 V to 100 V** and offers low leakage and fast response, making it suitable for decoupling applications.

16. Voltage Regulator (7805): The 7805voltage regulator provides a constant 5V DC output regardless of variations in input voltage. It powers the Arduino, sensors, and other 5V components, ensuring stable operation of the system and protecting sensitive electronics from voltage fluctuations.

2.1 Methodology:

- The system is installed inside or near a drainage manhole. Sensors continuously collect environmental data
- Ultrasonic sensor measures water level
- Float sensor detects water levels
- Data is processed by the microcontroller
- Alert is sent via GSM/Wi-Fi
- Local alarm is triggered

3. RESULTS

The system was tested under different conditions to evaluate its performance. It demonstrated accurate detection of water level variations. Real-time data was transmitted to the cloud platform, and alerts were received instantly on the Blynk Mobile App. The system reduced response time compared to manual inspection and ensured continuous monitoring without human intervention.

Fig. 3: Prototype

4. DISCUSSION

The proposed system demonstrates how IoT can significantly improve urban drainage management. By providing real-time insights, it helps authorities take preventive actions rather than reactive measures.

4.1 Advantages

- Reduces manual inspection
- Improves safety for workers
- Prevents overflow and flooding
- Real-time monitoring

5. CONCLUSIONS

This project successfully demonstrates a smart drainage manhole monitoring system using IoT technology. The system enhances efficiency, safety, and reliability in drainage management. It provides a scalable solution that can be implemented in smart cities to prevent urban flooding and improve sanitation systems.

6. ACKNOWLEDGMENTS

We express our sincere gratitude to our faculty, institution, and peers for their guidance and support throughout this project. Their valuable suggestions helped in successfully completing this work and also express our gratitude to KSCST for sponsoring this project.

REFERENCES AND FOOTNOTES:

1. Varun Krishna Nallamothu; Saahith Medidi; Swetha Priyanka Jannu, 2022 - IOT based Manhole Detection and Monitoring System.
2. A. Roshan; S. Thirdeep; B. Koushik; A. Prabhu Chakkaravarthy, 2024 - IoT Based Manhole and Drainage Monitoring System.
3. Tushar Pathak; Sanyogita Deshmukh; Pooja Reddy; Professor H.P. Rewatkar, 2021 - Smart Drainage Monitoring and Controlling System using IOT.
4. Manjula K; Sneha Latha, 2024 - A IOT Based Drainage Monitoring and Cleaning System.
5. S Sultana, A Rahaman, AM Jhara, AC Paul, 2020 - An IOT Based Smart Drain Monitoring System with Alert.
6. A Pendharkar, J Chillapalli, K Dhakate, 2020 - IoT Based Sewage Monitoring System.
7. U Andrijašević, J Kocić, V Nešić, "Lid Opening Detection in Manholes,". 2020 - ieeexplore.ieee.org.
8. P Bhosale, ``Iot Based System for Detection of Sewage Blockages" 2021, it-in-industry.org.
9. Timofte, R.; Van Gool, L.,"Multi-view manhole detection,recognitionand 3D localisation," Computer Vision Workshops (ICCV Workshops),2011 IEEE International Conference on, vol., no., pp.188,195, 6-13 Nov. 2011 doi: 10.1109 /ICCVW.2011.61302
10. Prof Muragesh SK1, Santhosha Rao2, "Automated Internet of Things For Underground Drainage and Manhole Monitoring Systems For Metropolitan Cities." International Journal of Innovative Science, Engineering Technology, Vol. 2 Issue 4, June 2015.
11. Dhanalakshmi.G, Akhil.S, Francisca Little Flower.M,Haribalambika.R, "Explosion detection and drainage monitoring system by Automation System" International Journal of Innovative research in computer and communication engineering, vol. 6, issue 2, February 2018.
12. M Aarthi, A Bhuvaneshwaran, "Iot Based Drainage and Waste Management Monitoring and Alert System for Smart City" Annals of the Romanian Society, 2021 - annalsofrscb. ro.
13. Pushpakumar R, Rajiv S, "IOT based smart drainage worker safety system" International Journal of Innovative Technology and Exploring Engineering (IJITEE), 2019.
14. Prof S. A. Shaikh1, Suvarna A. Sonawane2, "Monitoring Smart City Application Using Raspberry PI based on IoT". International Journal of Innovative Science, Engineering Technology, Vol 5 Issue VIL, July 2017.
15. S Sultana, A Rahaman, AM Jhara, AC Paul,"An IOT Based Smart Drain Monitoring System with Alert Messages" Conference on Intelligent,, 2020 Springer..
16. Gangyong Jia, Member, IEEE, Guangjie Han, Member, IEEE, Huanle Rao, Lei Shu, "Edge Computing-Based Intelligent Manhole Cover Management System for Smart Cities" Journal Of Latex Class Files, 2017.
17. S. Salehinetal., "An IoT Based Proposed System for Monitoring Manhole in Context of Bangladesh Department of CSE". Department of CSE, Military Institute of Science and Technology, Dhaka, Bangladesh", 2018.
18. P. Srivastava, M. Bajaj and A. S. Rana,"Overview of ESP8266 Wi-Fi module based Smart Irrigation System using IOT. 2018 Fourth International Conference on Advances in Electrical, Electronics, Information,Communication and Bio-Informatics (AEEICB), Chennai, 2018, pp. 1-5, doi:10.1109/AEEICB.2018.8480949.
19. V.Vani, M.Mohana, D.Vanishree, K.S.Subiksha, M.Sushanthika,"Smart Drainage System using Zig Bee and IoT". International Journal of Recent Technology and Engineering (IJRTE), 2019.
20. Y. Liu, M. Du, C. Jing and Y. Bai," Design of supervision and managemet system for ownerless manhole covers based on RFID". 2013 21st International Conference on Geoinformatics, Kaifeng, 2013.
21. A Pendharkar, J Chillapalli, K Dhakate, "IoT Based Sewage Monitoring System". Available at SSRN, 2020, researchgate. net