

Sensor Based Smart Drainage System

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Abstract: India is constantly moving towards automation and aiming to build every city a smart city. For making a smart city we need to consider many parameters such as smart water management, smart electricity management, smart transportation etc. There will be a need of smart underground infrastructure which includes underground water pipelines, communication cables, gas pipelines, electric flow, etc. As most of the cities in India have adopted underground drainage system, it is very important that this system should work in a proper manner to keep the city clean, safe and healthy. If they fail to maintain the drainage system, the pure water may get contaminated with drainage water and can spread infectious diseases. So different kind of work has been done to detect, maintain and manage these underground systems. This project represents the implementation and design functions for monitoring and managing underground/road-sided drainage system with different approaches.

Keyword: Blynk, IoT, GSM, GPS, Arduino, Node MCU Wi-Fi Module, Alarm, Sensors, LED

I. INTRODUCTION:

The underground drainage system is an important component of urban infrastructure. It is considered to

be city's lifeline. Most management on underground drainage is manual therefore it is not efficient to have clean and working underground system also in such big cities, it is difficult for the government personnel to locate the exact manhole which is facing the problem. Therefore, it is essential to develop a system which can handle underground drainage without human intervention. Underground Drainage involves sewerage system, gas pipeline network, water pipeline, and manholes. This project describes various functions

used for maintenance and monitoring of underground and road-sided drainage system. It provides a system which is able to monitor the water level, atmospheric temperature, water flow and toxic gasses. [1] If drainage system gets blocked and water overflows it can be identified by the sensor system. And machine starts moving in the forward direction and clean all the blocking part of the drainage. [2] Smart City is aimed to manage different resources of a city electronically in an efficient manner and establish a significant connection between the urban community and urban infrastructure. An essential part of a sustainable environment of a city is a healthy drainage system where the excess surface water is being removed from an area naturally or artificially to provide a hygienic environment. A healthy drainage system is strongly associated with an effective waste management system.

[3] we have reported an effective implementation for Internet of Things used for monitoring regular domestic conditions by means of low cost ubiquitous sensing system. [4] Today's drainage system is not high-tech. So, whenever there is blockage, it is difficult to figure out the exact location of the blockage. Also, early alerts of the blockage are not received. Hence detection and repairing of the blockage become time consuming. It becomes very inconvenient to handle the situation when pipes are blocked completely. Due to such failure of drainage line

people face a lot of problems. [6] irregular monitoring contributes to clogging of drainage systems, which leads to localized flooding. Manual monitoring methods also prove ineffective and insufficient. An inefficient and improper sewage system poses significant risks in terms of water and soil contamination and the spread of disease, especially in relation to climate change. [7] A new intelligent approach for recognizing multi-featured objects using optical sensor-based technology for processing solid wastes.

II. LITERATURE REVIEW

2.1 Automated Internet of Things for Underground Drainage and Manhole Monitoring System for Metropolitan Cities

Author : Muragesh SK and Santhosha Rao

Most of the cities adopted the underground drainage system to maintain the cleanliness of cities. If the drainage maintenance is not proper the pure water gets contaminate with drainage water and infectious diseases may get spread. The drainage gets blocked during rainy season, it will create problem for routine life. The traffic may get jammed, the environment becomes dirty, and totally it upsets the public. If the manhole lid is not closed properly there is a chance of occurrence of accidents and also people or animals may get fall into the drainage. This problem is solved, suppose imagine if we should have a remote monitoring system to monitor the internal states of the manhole, and then we can solve this problem efficiently. These problems occur due to environmental changes like rainy season etc.

2.2 Towards the Implementation of IoT for Environmental Condition Monitoring in Homes

Author: Kelly S.D.T, Suryadevara, N.K, Mukhopadhyay S.C

Description: In this paper, we have reported an effective implementation for Internet of Things used for monitoring regular domestic conditions by means of low-cost ubiquitous sensing system. The description about the integrated network architecture and the interconnecting mechanisms for reliable measurement of parameters by smart sensors and transmission of

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data via internet is being presented. The longitudinal learning system was able to provide self-control mechanism for better operations of the devices in monitoring stage. The framework of the monitoring system is based on combination of pervasive distributed sensing units, information system for data aggregation, reasoning and context awareness. Results are encouraging as the reliability of sensing information transmission through the proposed integrated network architecture is 97%. The prototype was tested to generate real-time graphical information rather than a test bed scenario.

2.3 Monitoring Smart City Applications using Raspberry PI Based on IOT

Authors: Prof. S A. Shaikh¹, Suvarna A. Sonawane.

Description: The Smart city is the development goal to monitor the quality of resource in the city to improve good management and faster development of the city required necessity is to upgrade healthy and safe cities that delivering real time services and latest facility to implement the concept of smart city use IoT concept by which easy wireless communication is possible. The system consists of sensors, collect different types of data from sensors and transfer to the Raspberry Pi3 controller. The acquired output from the controller is sent to the control room through the E- mail and also display on the personal computer

2.4 Smart Drainage Monitoring and Controlling System Using IOT

Tushar Pathak¹, Sanyogita Deshmukh², Pooja Reddy³, Prof H. P. Rewatkar

The network consists of GPS sensors nodes, network coordinator, and Cloud storage. A remote graphical user interface is further developed to examine the information and analysis results. Based on the proposed system architecture, sensor nodes response to sample the physical parameter to measurable voltage level through corresponding sensors; The Blynk server is then used to transfer these acquired data to the organizer via a wireless connection. Coordinator is focusing to constellation maintenance, collect data and transfer the reassemble information to the cloud storage using the Wi-Fi through mobile internet. Open WSN Cloud data storage platform Blynk custom-made in this work. The Blynk platform offers versatile data assortment and visual image; therefore, ease the support of enormous number of sensor data and GPS locations are streams and viewed. An underground drainage monitoring system will not only help in maintaining the proper health and safety of the city but also in reducing the work of government personnel. Various types of sensors (Ultrasonic, temperature and gas sensors) are interfaced with Arduino uno in order to make the system smart. When the respective sensors reach the threshold level, the indication of that respective value and sensor is being sent to the controller. Furthermore, Arduino uno then sends the signal and location of the manhole to the municipal corporation through GSM and GPS and the officials could easily locate which manhole is having the problem and could take appropriate steps. Also, Arduino Uno updates the live

values of all the sensors in the manholes falling under the respective area using IoT. message will also be displayed on the LCD.

2.5 Smart Drainage System Using IOT

Kamal Sahoo¹, Janhvi Tambe², Shravani Patil³, Abhishek Mathpati⁴, Mrs. Prachi Kalpande⁵

In this system, sensors are placed inside the well, which detect and transmit the necessary information about the water level, openings and other factors to the treatment plant (Oma irtyam) using a Wi-Fi module. This allows them to take precautions to address the problem with public safety in mind.

Advance drainage system –

The current drainage system is not computerized. Therefore, when a blockage occurs, it is always difficult to find out the exact location of the blockage.

Also, no early warnings about blocking are sent. Because of this, it takes time to identify and correct blockages. It is very difficult to deal with the situation when the pipes are completely blocked. People face many problems due to this type of sewage failure. The Internet of Things (IoT) is a revolutionary concept that combines the physical and digital dimensions. It connects everyday objects with sensors and communication devices, allowing them to collect and exchange data and operate autonomously corrects the limits of human contribution and strives for cost-effectiveness, precision and versatility. Sensor networks are the cornerstone of the IoT paradigm, driving its transformation. The Internet of Things enables objects to intelligently interact with both the real and digital worlds, providing unprecedented automation and connectivity.

Summary of Literature & Identified Gaps

The literature review discusses the application of Internet of Things (IoT) technology for monitoring and managing urban infrastructure, particularly drainage systems. Studies highlight the benefits of IoT-based systems, including real-time monitoring, automated maintenance, improved public health, and cost-effectiveness. Key components of these systems include wireless sensor networks, cloud storage, and GPS/location-based services. The review emphasizes the potential of IoT to transform urban infrastructure management.

Gaps:

1. Security Concerns: The literature review does not adequately address the security concerns associated with IoT-based systems, such as data breaches and cyber-attacks.

2. Scalability and Interoperability: There is limited discussion on the scalability and interoperability of IoT-based drainage systems, particularly in the context of integrating with existing infrastructure.

3. Data Analytics and Insights: While the review mentions data analysis, it does not delve into the specifics of how data analytics can be leveraged to gain valuable insights for urban planning and infrastructure management.

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4. Cost-Benefit Analysis: A comprehensive cost-benefit analysis of IoT-based drainage systems compared to traditional methods is lacking.

5. Implementation Challenges: The review does not thoroughly discuss the challenges associated with implementing IoT-based systems in real-world settings, including infrastructure requirements, maintenance, and user adoption.

6. Standardization and Regulation: There is limited discussion on the need for standardization and regulatory frameworks to support the adoption of IoT-based systems in urban infrastructure management.

III.CONCLUSION

The implementation of a smart drainage system using IoT technology offers a transformative approach to urban drainage management. By integrating sensors, IoT connectivity, and data analytics, cities can create more resilient, sustainable, and liveable urban environments, better equipped to handle the challenges of urbanization and climate change. Sensors can significantly improve the management and maintenance of urban drainage infrastructure, By leveraging sensor technology.

IV.FUTURE SCOPE

Future Scope of Smart Drainage Systems Using Sensors

1. Real-time Monitoring and Early Warning Systems

In the future, smart drainage systems will be widely used for real-time monitoring of water levels, flow rates, and blockages. Using IoT-enabled sensors, authorities can receive instant alerts about potential overflows or flooding, allowing faster emergency response.

2. Integration with Smart City Infrastructure

As smart cities grow, drainage systems will be integrated with centralized city management platforms, connecting with weather data, traffic systems, and urban planning tools. This will help in predicting and managing waterlogging and flood-prone areas.

3. Data-driven Decision Making

Continuous sensor data will enable predictive analytics using Artificial Intelligence (AI) and Machine Learning (ML). These systems can forecast drainage issues before they occur, improving planning for maintenance and design of urban infrastructure.

4. Automation and Self-Cleaning Mechanisms

Future smart drainage networks may include automated gates or valves that control water flow based on sensor input, and even self-cleaning technologies to remove debris without human intervention.

5. Environmental Benefits

Sensors can help detect water pollution levels, toxic chemicals, or sewage leaks early. This contributes to better environmental management and cleaner urban water systems.

6. Cost and Maintenance Efficiency

With predictive maintenance based on sensor alerts, municipalities can reduce manual inspections and repair costs, leading to more efficient and sustainable operations.

7. Rural and Agricultural Applications

Beyond urban areas, smart drainage systems can be adapted for agricultural fields to monitor irrigation and prevent soil erosion or waterlogging, improving crop yield and soil health.

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