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Smart Sewage Management System

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Abstract: The Smart Sewage Management System introduces an innovative way to manage sewage flow on rural roads using IoT technology. It aims to detect excessive sewage discharge, which can harm the environment and public health. By focusing on monitoring drainage water levels in real-time, it addresses the common problem of drainage overflow in developing areas, where manual checks are slow and unreliable. The system uses a network of sensors that monitor water levels and send alerts to local authorities when levels get too high, allowing for quick action. Overall, this sewage management system not only helps protect the environment but also improves living conditions in rural communities.
Keywords: ESP8266 (NodeMCU), MQ2 sensor, DHT11

I. INTRODUCTION

Water is main and essential resource that is necessary and used for various Purposes such as agriculture, industry and all the life on the earth, including humans. Many People are not aware of the significance of adequate water each day. More water is being wasted in numerous unchecked ways. This issue is related to inadequate water management Practices, waste water uses and disjointed water allocation. As a result, effective use and water monitoring could be a problem for house or industry water adequate management. In this project we mainly focus on the sewage water management which flows in the road due to inappropriate maintenance we provide a solution through an application which focuses in the particular segment where the message will be send to the municipal authority while using GSM module. The Internet of Things (IoT) gives us ability to create a system for the human less monitoring. In other words. The internet of things (IoT) is a setting which enables data transmission over a network without the need of human-human interaction. The IoT Creates several chances for integration between real world and computer systems. This improves efficiency and Accuracy and also brings financial gain this enables things which can be detected and controlled remotely through existing network infrastructure. This prevents overflowing and low water level in the pipes.in this water level monitoring is used and implemented as sewage water control system which can also use for industrial and domestic purpose.

II. METHODOLOGY

When the water level sensor detects that the water has reached the two electrodes of the sensor, it registers this as normal water flow. In response, the first LED indicator (LED 1) lights up, signaling that the water level is functioning within the normal range. However, when the water level rises further and touches all three electrodes of the sensor, it is interpreted as an overflow condition. In this case, both LED indicators (LED 1 and LED 2) light up to visually alert that the system has detected an overflow. This process is mirrored at a second sensor point, ensuring that the water flow is monitored at multiple levels within the system for redundancy and accuracy. Apart from water level monitoring, the system also tracks environmental conditions using DHT11 and MQ2 sensors. The DHT11 sensor measures temperature and humidity in the surrounding area, while the MQ2 sensor detects gas concentrations, including smoke and other potentially harmful gases. Both sensors are connected to a NodeMCU, which serves as the central processing unit. The NodeMCU collects data from these sensors and processes it in real time. The water flow detection system has been programmed with specific conditions to identify different scenarios. If both monitoring points detect an overflow (i.e., the water reaches all three electrodes at both locations), the system categorizes the event as a full overflow. However, if an overflow is detected at the first point but not at the second, this indicates a blockage in the water flow between the two points. These conditions help the system distinguish between normal, overflow, and blockage scenarios. All sensor data — water level, temperature, humidity, and gas levels are continuously transmitted to a ThingSpeak dashboard for monitoring. ThingSpeak provides a cloud-based platform that allows remote access to the system’s data, making it easy to track environmental and water flow conditions from any location. The data visualization on the dashboard helps in assessing the current state of the system and identifying any potential issues in real time. In addition to real-time monitoring, the system incorporates a deep learning algorithm to enhance its predictive capabilities. This algorithm uses historical sensor data to forecast overflow events. By analyzing patterns in the water levels and environmental data, the deep learning model predicts when the next overflow is likely to occur, allowing for proactive management.

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This feature is crucial in preventing damage or disruptions caused by unexpected overflows. The system's predictive model not only estimates the likelihood of future overflows but also provides a time window for when these events are expected, making it an advanced solution for water flow management. This combination of real-time monitoring, intelligent overflow detection, and predictive analytics makes the system robust and efficient, capable of providing both immediate alerts and long-term insights into water flow behavior.

A. DHT11(temperature & humidity sensor)
A simple, incredibly affordable digital temperature and humidity sensor is the DHT11. It measures the ambient air using a thermistor and a capacitive humidity sensor before emitting a digital signal on the data pin (no analog input pins are required). Although it's easy to use, grabbing data requires precise timing.

B. Gas detector (MQ2 Sensor)
This is an easy-to-use carbon monoxide (CO) sensor that may be used to measure airborne CO concentrations. CO gas concentrations can range from 20 to 2000 ppm, as detected by the MQ2 sensor. This sensor responds quickly and has a high sensitivity. The output of the sensor is an analog resistance. Its benefits include a long lifespan, inexpensive cost, a simple motor circuit, and good sensitivity to carbon monoxide across a wide range.

C. Water level sensor
This module uses copper electrodes as water level sensors for drainage pipelines. It has two main electrodes: one at 10% capacity to indicate low water levels and another at 90% capacity to indicate high levels. There’s also a common electrode connected to the power supply below the low-level indicator. When water fills the pipeline, the electrodes conduct electricity, keeping the connected transistors turned on, which sends a high signal to the microcontroller. If the water level drops, the electrodes lose contact, turning the transistors off and sending a low signal to the controller. When the controller detects a high signal from the 90% electrode, it sends a notification via Wi-Fi to relevant authorities, updating them on the drainage water level. This allows them to take action before an overflow occurs.

D. Software Requirements: Arduino Programming Platform (IDE)
Open-source ideals underpin the hardware and software platform known as Arduino. Arduino boards are capable of reading many different types of inputs, such as light detection from sensors, button clicks, and even messages from Twitter. These inputs can then be used to create the appropriate outputs, like turning on a motor, an LED, or posting content online. Giving instructions to the Arduino board's microcontroller is known as programming; this is accomplished with the Processing-based Arduino Software (IDE) and the Wiring-based Arduino programming language.

III. RESULTS AND DISCUSSION
This project describes different applications, including subsurface drainage and real-time hatch identification, and suggests several techniques for maintaining and keeping an eye on these systems. By working on this project, we can prevent risks and cut down on the labour and time needed to check for blockages in underground drainage systems and sewers. In this project, not only has the water level been regularly monitored, but sewage overflow and obstruction have been located before they have caused additional harm. The gas sensor module was used to identify the methane gas leak, and in addition to monitoring the temperature and humidity levels, spontaneous gas removal was carried out. This would be put into practice to control drainage in an intelligent manner, making cities cleaner.

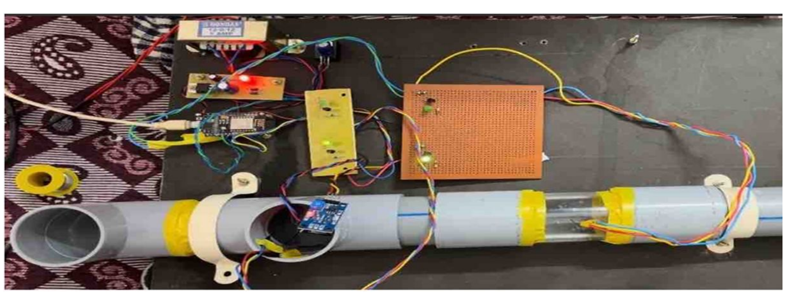

Fig 3.1: Prototype Model of Smart Sewage Management system

A. Applications

1) Flood Prevention
2) Automated Wastewater Treatment
3) Environmental Protection
4) Smart Maintenance
5) Public Health Monitoring

B. Limitations

The project faces limitations related to data availability and quality from Node MCU devices, potential inaccuracies due to sensor placement, challenges in balancing model complexity and generalization, the inability to account for human interventions, uncertainties in environmental systems, regulatory constraints, and resource limitations. Despite these challenges, addressing sewage overflow prediction remains vital for mitigating pollution and safeguarding public health. Continued research and innovation are needed to develop robust predictive systems that can support effective decision-making in sewer management.

IV. CONCLUSION AND FUTURE SCOPE

A. Conclusion

The Smart Sewage Management System successfully integrates IoT and deep learning technologies to monitor and manage sewage levels. Using the MQ2 sensor and DHT11, the system efficiently collects real-time data such as gas levels and environmental conditions, while the NodeMCU transmits this data to a cloud platform (ThingSpeak). By leveraging deep learning algorithms, the system predicts sewage overflow with high accuracy, providing early warnings to prevent potential flooding.

This project demonstrates the practical application of IoT in environmental monitoring, showcasing how real-time data and machine learning can work together to optimize infrastructure management. The predictive capabilities ensure timely intervention, offering a scalable and automated solution for urban waste management. With further refinement and deployment, the system can contribute to smarter city management and improved public safety.

B. Future Scope

The future scope of the sewage management project can be significantly enhanced by integrating it with weather forecasting systems. By linking sewage management with real-time weather data, the system can predict and prepare for heavy rainfall or storms, which often lead to increased sewage flow and potential overflows. This proactive approach allows for better management of sewage systems, reducing the risk of flooding and contamination. Additionally, predictive models can optimize the operation of sewage treatment plants, ensuring they function efficiently under varying weather conditions.

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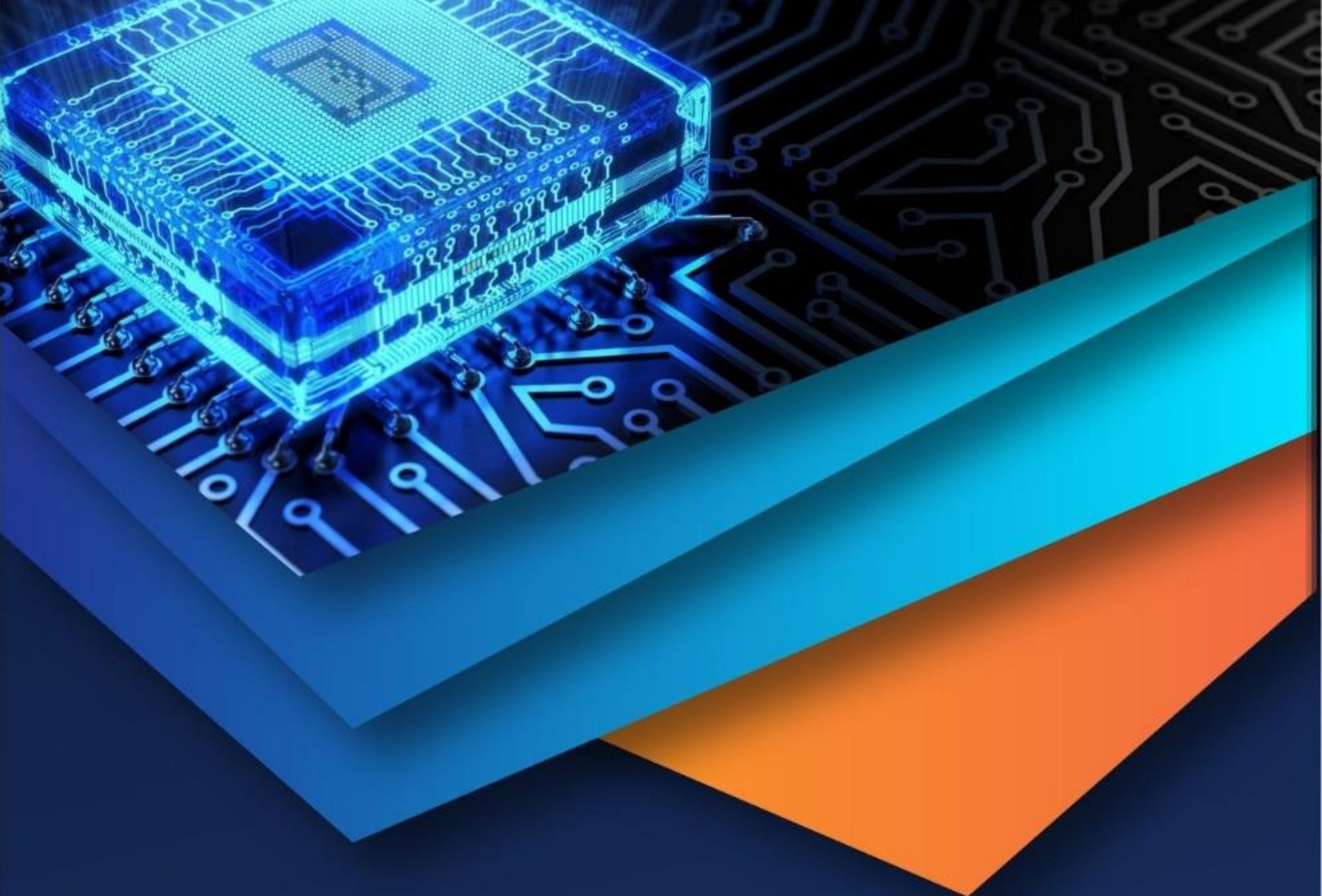

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