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Storm Water Drainage Blockage Detection Technique Using Sensors

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Abstract: One major issue contributing to this problem is the blockage of storm water drainage systems, often caused by the dumping of solid waste like polythene bags. These blockages lead to overflows, sanitation problems, and health hazards. Manual clearing of these blockages is not only labor-intensive but also risky due to hazardous gases and contaminated water. To address this, a smart system utilizing sensors is proposed. This system comprises GPS, GSM, float sensors, an ESP32 board controller, LCD display, and the Blynk IoT application. The float sensor detects water levels in the drainage system, signaling potential blockages. When a blockage is detected, the system alerts authorities via text message, enabling swift action to be taken.

Index Terms - Storm Water, Storm Drainage, Blockage, Sensor, GPS System, GSM Efficiency

I. INTRODUCTION

The efficient management of urban infrastructure is of paramount importance in modern cities.Among the critical components of urban infrastructure, drainage systems play a vital role in preventing flooding, ensuring proper waste disposal, and maintaining the overall environmentalhealth of a city. However, these systems often encounter issues such as blockages, which can lead to adverse consequences such as waterlogging, property damage, and public health concerns.

Traditional methods of detecting drainage blockages involve visual inspection and manual intervention, which are not only time-consuming but also less accurate and cost-effective. To address these challenges, the integration of sensor technologies into drainage systems has emerged as a promising solution.

II. METHOD FOR DRAINAGE SYSTEM

- Clearing Debris: Remove any debris, such as leaves, branches, trash, and sediment, from drainage channels, gutters, and grates. This prevents blockages and ensures smooth water flow during heavy rain events.
- Green Infrastructure: Integrate green infrastructure elements, such as permeable pavement, rain gardens, and bios wales, into the drainage system to absorb and manage stormwater runoff naturally.
- Smart Technology: Deploy smart drainage solutions, including sensors, IoT devices, and real-time monitoring systems, to detect blockages, assess system performance, and prioritize maintenance activities.
- Emergency Response Plan: Develop an emergency response plan to address sudden drainage system failures, including procedures for flood management, temporary repairs, and communication with stakeholders.

III. NEED FOR THIS SYSTEM

Storm water is the large amount of water that collects on the ground after heavy rain or snow. When storm water is absorbed by soil and filters through, it ultimately refills the aquifer. But due to high amount of water in many of our urban cities cannot seep directly in the ground. All the water goes into storm drains, sewer systems and drainage channels, and causes soil erosion, silting, road damage, property damage, by creating waterlogging.

Smart Storm Water management:

The majority of the literature suggests that smart technology will help control storm water. However, studies show a variety of disjointed smart applications that frequently fall short of fully realising the potential of this new technology. When assessing smart storm water, future research must follow a coherent, purposeful, and consistent approach to be effective. In order to do this, we have assessed best practices and created a framework to gauge advancement and indicate areas that require improvement[11].

IV. DESIGN FOR SENSOR DETECTION TECHNIC

Following are the working steps of the module's storm water detection system.

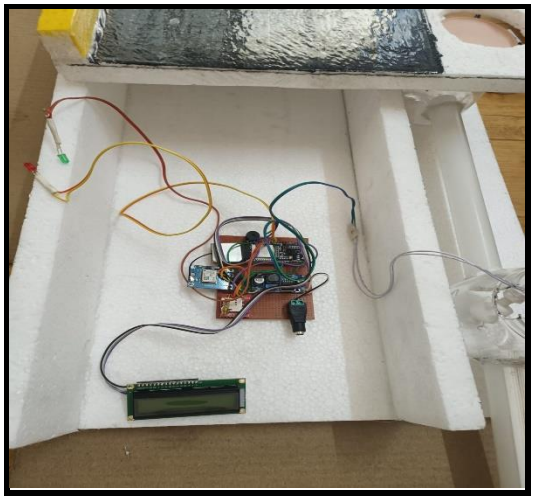
Step 1: In first step plugin the wire and keep the power supply off. Insert the SIM card in the SM Mot. Power on the supply.

Step 2: Switch on the mobile hotspot. Change the name of the hotspot to IOT. Reset the password to 12345678 or as per safety requirements. Connect the device to the mobile. Login to the app "Blynk IoT."

Step 3: Place the sensor in the chamber. Allow water to enter in chambers for continued flow. When the drain system is working properly, the display will show "Chamber Normal," the alarm will remain silent, and the light on the street pole will blink in a green colour. This is a sign that the system is healthy. Now Plug the end cap or close the valve to stop water flow and keep water in the drainage line.

Step 4: As water stops, the intake water level will increase, and due to this, the water level will touch the sensor. As the sensor comes into contact with water, it gives a message to the system that the line is chocking due to foreign matters because this system is in trouble. As per the message received from the sensor, the display shows the notification" Chamber full," the alarm starts to ring, and the light fixed on the street pole blows red. The system will send a message to the authorities, to which the local authorities have to act based on location. After removing the blockage (foreign matter), the line will automatically be in healthy condition.

Step 5: As per the received message form system, received details are to be added to the system for the history record. Identification of the root cause due to which the system came into contact with foreign matters



Circuit Model

Water level Sensor

Model Component:

- **GPS6M:**
- Type: GPS Module
- Parameters: Provides location data through GPS signals.
- Requirements: Typically operates on a voltage range of 3.3V to 5V.
- **GSM 800L:**
- Type: GSM Module
- Parameters: Enables communication over GSM networks for tasks like sending/receiving SMS, making calls, etc.
- Requirements: Operates on a voltage range of around 3.4V to 4.4V.
- **ESP32BOARD:**
- Type: Microcontroller Development Board (e.g., ESP32-based)

- Parameters: Offers processing power and various connectivity options (Wi-Fi, Bluetooth) for IoT projects.
- Requirements: Usually powered by a 3.3V source.

➢ **16x2 Display:**

- Type: LCD Display
- Parameters: Typically, a 16 characters x 2 lines alphanumeric display used to show text information.
- Requirements: Usually powered by 5V.

➢ **I2C Module:**

- Type: Communication Module
- Parameters: Facilitates I2C (Inter-Integrated Circuit) communication between microcontrollers and peripherals.
- Requirements: Typically operates on a voltage range of 3.3V to 5V, depending on the specific module.

➢ **Float Sensor:**

- Type: Sensor
- Parameters: Detects liquid level by floating on the surface.
- Requirements: Usually operates on a voltage range of 3.3V to 5V.

➢ **For power supply:**

- Most of these components can be powered by a common voltage source between 3.3V to 5V.
- It's crucial to check the datasheets of individual components for precise voltage and current requirements to ensure proper functioning and avoid damage.
- You may need a stable power supply or battery source depending on your application's requirements.

V. APPLICATION

- Early Blockage Detection: The system can detect blockages in storm water drainage systems at an early stage, allowing for prompt intervention and maintenance.
- Flood Prevention: By identifying and addressing potential blockages, the system helps prevent localized flooding during heavy rainfall, reducing the risk of property damage and infrastructure disruption.
- Infrastructure Protection: Protects the integrity of drainage infrastructure by minimizing the chances of damage caused by blockages, erosion, or overflow.
- Real-Time Monitoring: Provides real-time monitoring capabilities, enabling authorities to respond quickly to changing conditions and mitigate the impact of extreme weather events.
- Data Analysis for Planning: The collected data can be analysed to identify patterns and trends, helping urban planners make informed decisions about future infrastructure developments and improvements.

VI. CONCLUSION

Storm water drainage systems and its maintenance, if neglected, could pose a threat in community and healthcare causing infections as well as emergence of multi-resistant bacteria that could cause unpredictable clinical issues. In this study, an attempt is made to design Storm water Drainage System for the road using different types of alert systems; The main objective of this study is to safely discharge the flood or regular used water without causing flooding situation of low-lying areas and colonies near outlet which is caused due to (stumbling of unwanted materials in chambers) overflow of chambers.

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