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Original Article

Drainage Monitoring and Automatically Sending Information to Municipality Corporation Using IoT

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Abstract: *Urban drainage systems are vital infrastructures that need to be regularly inspected in order to minimize potential risks to public health and safety and to prevent flooding. However, the lack of real-time data collecting and reporting capabilities in traditional monitoring approaches frequently results in inefficient maintenance and response activities. The drainage network's strategic placement of sensor nodes makes up the suggested system. Sensors on these nodes are capable of measuring things like water level, flow rate, and quality. Sensor data is gathered and wirelessly transmitted to a central gateway device via an Arduino microcontroller and Internet of Things protocols like MQTT or HTTP. In order to identify anomalies or possible problems with the drainage system, the central gateway compiles and interprets the data it receives from various sensor nodes. The system automatically initiates warnings and creates reports for prompt action in the event of abnormal conditions, such as excessive water levels or blockages. In addition, the system has a communication module that interfaces with the database or management system of the municipal corporation. This makes it possible for the drainage monitoring data to be seamlessly integrated with the current infrastructure, facilitating effective resource allocation and decision-making. This system has the advantage of early drainage problem identification, proactive maintenance scheduling, and enhanced emergency response. Municipalities can use Arduino microcontrollers and Internet of Things technologies to optimize their drainage management procedures and strengthen urban infrastructure's resistance to environmental threats.*

Keywords: *Drainage Monitoring, Automated Reporting System, Real-time Data Collection.*

INTRODUCTION

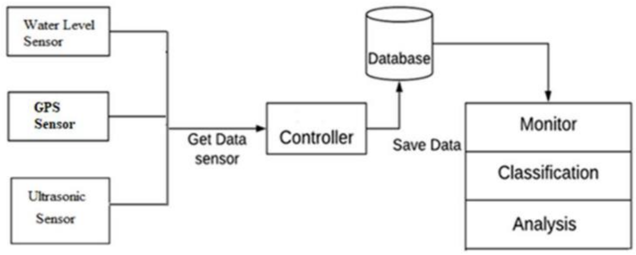
Effective drainage systems are essential for controlling rainfall runoff and reducing the risk of floods in metropolitan areas. To ensure optimal operation and eliminate blockages, real-time monitoring and prompt intervention are crucial for the effectiveness of these systems. Conventional drainage monitoring techniques frequently can't give rapid feedback, which causes solutions to be delayed and makes an area more vulnerable to flood-related tragedies.

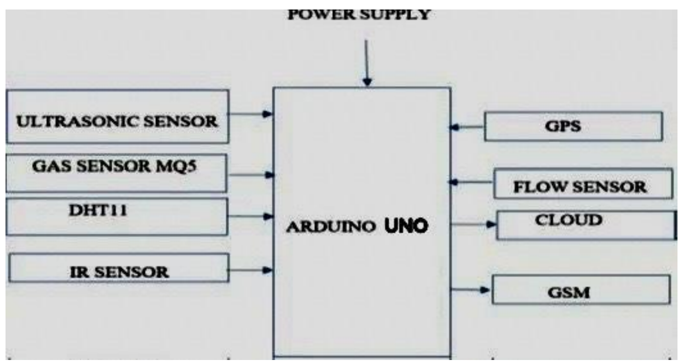
The combination of Internet of Things (IoT) technology and drainage monitoring systems provide a viable way to overcome these issues. The utilization of Internet of Things (IoT) devices, like Arduino microcontrollers with sensors, allows for the real-time collection of data on multiple factors, such as water levels, drainage system blockages, and flow rates. The goal of this project is to use Arduino-based Internet of Things devices to create a complete drainage monitoring system. The drainage performance key indicators will be continuously monitored by the system, which will then automatically forward this data to the appropriate Municipal Corporation or local authorities.

EXISTING SYSTEM

Early drainage monitoring system initiatives concentrated on utilizing cutting-edge technologies to solve problems with urban infrastructure. These programs frequently used data logging systems and basic sensor networks to monitor water levels, flow rates, and other pertinent drainage system metrics. In an early initiative, manual data collection techniques were combined with the installation of simple water level sensors at strategic locations inside drainage networks. Periodically, engineers would visit these locations to collect water level readings, which would enable municipal authorities to keep an eye on drainage performance and spot possible problems.Another study investigated the transmission of real-time data from drainage sensors to a central monitoring station via telemetry systems. By using this method, data might be gathered more quickly and effectively, allowing for preventative maintenance and intervention in the event of drainage abnormalities.Furthermore, early initiatives frequently concentrated on creating predictive models to predict drainage system behavior using environmental and historical data. The goal of these models was to increase the resilience and dependability of urban drainage infrastructure by examining trends and patterns in drainage performance.

Block Diagram:





PROPOSED SYSTEM

The suggested approach entails creating and putting into place a thorough drainage monitoring system that makes use of Internet of Things (IoT) technology to automatically send real-time data from drainage networks to the Municipality Corporation. There will be multiple essential components in the system:

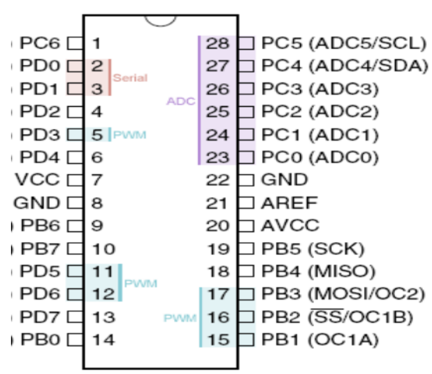
1. Sensor Deployment: Throughout the drainage system, key locations will be carefully chosen for the strategic placement of water level sensors, flow rate sensors, and other pertinent environmental sensors. These sensors will be able to track a number of variables over time, such as temperature, humidity, flow rates, and water levels.
2. IoT Connectivity: To facilitate wireless data transmission, every sensor will be outfitted with IoT communication modules, such as Wi-Fi, LoRa, or GSM. These modules will make it easier for sensor data to be seamlessly integrated into the Internet of Things, enabling remote monitoring and control.
3. Data Collection and Processing: Sensor data will be collected and processed in real-time by microcontroller units (MCUs) or single-board computers (SBCs), such as Arduino. These devices will be responsible for aggregating sensor data, performing initial data processing, and preparing the data for transmission.
4. Cloud Platform Integration: Processed sensor data will be transmitted to a cloud-based platform, such as AWS IoT or Google Cloud IoT Core, using MQTT or HTTP protocols. The cloud platform will serve as a centralized datarepository for storing, analyzing, and visualizing drainage data.
5. Automated Alerts and Notifications: Automated algorithms will be developed to analyze incoming sensor data and detect anomalies or critical events in the drainage system, such as blockages, overflows, or unusual flow patterns. When an anomaly is detected, the system will trigger automated alerts and notifications to the MunicipalityCorporation via email, SMS, or a dedicated dashboard interface.
6. Remote Monitoring and Control: Municipality officials and authorized personnel will have access to a web-based dashboard or mobile application, where they can remotely monitor the status of drainage networks in real-time. Additionally, they will have the ability to control and adjust system parameters, such as pump operations or valve settings, to optimize drainage performance.

7. Data Visualization and Reporting: The system will provide interactive data visualization tools and customizable reports to facilitate data-driven decision-making and regulatory compliance. Municipality Corporation officials will be able to generate comprehensive reports on drainage system performance, trends, and historical data analysis.

COMPONENTS DESCRIPTION

Arduino UNO:

- Arduino UNO is an ATmega328 based microcontroller board. Its operating voltage is 5v dc and its operating frequency is 16MHz.
- It is one of the most popular prototyping boards.
- The board comes with a built-in Arduino boot loader.
- It has 14 GPIO pins, 6 PWM pins, 6 Analog inputs and on board UART, SPI and TWI interfaces, an on-board resonator, a reset button, and holes for mounting pin headers.
- While programming the board, it can be connected to the PC using USB port and the board can run on USB power.
- The Arduino UNO has 32 Kb Flash memory, 1 Kb EEPROM and 2 Kb SRAM.



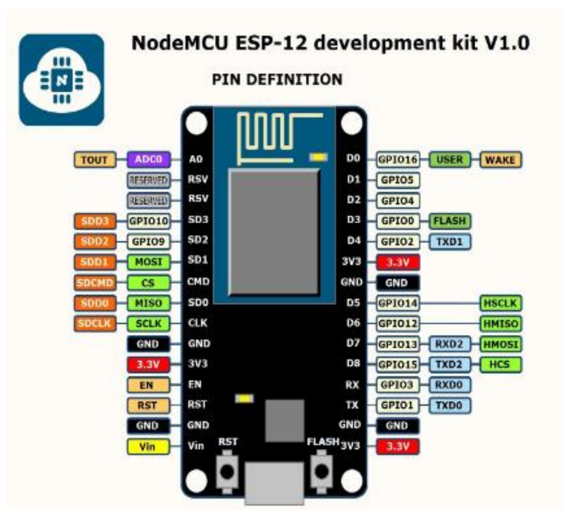
LCD display:

Liquid crystal displays (LCDs) are used in similar applications where LEDs are used. LCD is used to visualize the status of our project, which is programmed to display the Temperature and MAX30100 Sensor values, so that we can easily be able to visualize the health parameters.Its operating voltage is 5v dc supply.These applications are display of numeric and alphanumeric characters in dot matrix and segmental displays.The liquid crystal material may be one of the several components, which exhibit optical properties of a crystal though they remain in liquid form. Liquid crystal is layered between glass sheets with transparent electrodes deposited on the inside faces.

IoT:

An open source IoT platform is called Node MCU.It runs on a 5 volt direct current supply. It consists of hardware built around the ESP-12 module and firmware running on Espressif Systems' ESP8266 Wi-Fi SoC.By default, the firmware is referred to as "Node MCU" instead of the development kits. The scripting language Lua is used by the firmware.

It is based on the eLua project and built on the Espress if non-OS SDK for ESP8266. In our Project IOT is used to monitor the health parameters (Temperature, HB and SPO2) from far distance or from anywhere.All the values that should be viewed by the doctors, likewise, programmed for the NODE MCU which consists of inbuild Wi-Fi Shield, and transmitted to the Cayenne Server which works on the MQTT protocol.From the Cayenne Server all the values are updated in the Mobile App/ web page of the doctors, so that they can be able to monitor the health parameters from remote place.



MQTT PROTOCOL:

A simple publish-subscribe network protocol called MQTT is used to send messages between devices. Although TCP/IP is typically used for the protocol, MQTT can be supported by any network protocol that offers ordered, lossless, bi-directional communications.Measurements in 3G networks show that MQTT's throughput is 93 times quicker than HTTP's. Furthermore, the MQTT Protocol gives high delivery guarantees compared to HTTP.The most frequently used and well-liked protocol is HTTP. But MQTT has taken off in the last several years. When it comes to IoT development, developers have to select between them.

RESULT

By leveraging IoT sensors and data analytics, we have established a real-time monitoring system that enables early detection of potential issues, allowing for timely intervention and preventive measures. The automatic transmission of data to the municipality corporation ensures swift and informed decision-making, facilitating proactive maintenance and resource allocation.

CONCLUSION

In conclusion, the implementation of drainage monitoring and automatic information transmission to the municipality corporation using IoT technology represents a significant /advancement in urban infrastructure management. Through this project, we have demonstrated the potential to mitigate various challenges associated with traditional drainage systems, such as overflow, blockages, and inefficient maintenance practices.

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