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# RAIN OPERATED MANHOLES IN SMART CITIES USING IOT

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## Abstract:

The ideal of the future is a "smart city" with improved infrastructure and living conditions for all residents. When designing a "smart city," it's crucial to take into account the subsurface infrastructure. Keeping an eye on the city's drainage systems is crucial for public health. Due to the inefficiency of human monitoring, this causes delays in the processing ofdrainage issues that take longer to fix. Wireless sensor nodes form the basis of the system meant to address these concerns. The suggested system is inexpensive, requires little upkeep, is Internet of Things (IoT) based in real time, and sends an email to the management station if the level in any manhole rises beyond a certain threshold. Manual scavengers who clean the subterranean drainage system are less likely to die because to this method, which also helps the general public.

Key Words- Smart underground, Drainage system monitoring, wireless sensor network, low cost

## Introduction

The places at which maintenance personnel may enter to clean, clarify, and examine a drainage system are crucial.The municipal corporation of a metropolis is responsible for the upkeep of its subsurface drainage system. Poor sewage system upkeep may pollute ground water, which in turn can spread illness.When drains get clogged during the monsoon, it disrupts people's daily lives. Therefore, the municipal corporation should have a system that notifies authorities of sewage obstructions, their precise position, and whether or not the manhole cover is open automatically. Sewers, gas pipes, water lines, and manholes all make up the underground drainage system. Underground electric power cables are monitored by temperature sensors. To prevent chemical leak and electrical energy-related manhole explosions, pressure sensors are installed.

Managing urban infrastructure, especially in the context of precipitation and drainage, has become more difficult in recent years due to the rapid rate of urbanization.Flooding, clogged drains, and other problems may result from excessive precipitation. resulting harm to vital facilities, transportation systems, and population security. Smart towns are adopting IoT and rain-operated manholes to deal with these problems.

Rain-operated manholes, which use Internet of Things (IoT) capabilities to improve urban water management, are one such idea gaining favor. This article is to investigate the relevance, advantages, and prospective uses of rain-operated manholes in the context of smart cities. We will explore the technical issues, integration with existing infrastructure, and far-reaching consequences for sustainable urban development of IoTenabled systems.

The innovative idea of Rain-Operated Manholes involves retrofitting existing manholes with sensors and actuators that allow them to react in real time to precipitation. Water flow and drainage capacity in these manholes may be adjusted in real time depending on environmental data. They improve the efficacy of stormwater management systems and lessen the dangers connected with flooding by intelligently adjusting to changing weather conditions.

Internet of Things integration is critical to the performance and usefulness of rain-operated manholes. These manholes use an array of sensors, such as rain gauges, water level sensors, and flow meters, to measure and record the volume and velocity of precipitation, water, and flow, respectively. A centralized control system receives this information in real time and uses it to take action, such as repositioning manhole covers or redirecting water to other drainage routes.

## Literature survey

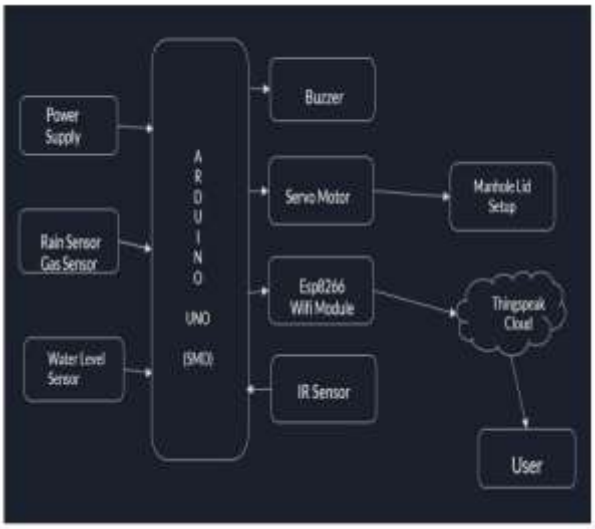
depicts the transmitter and reception components of an Underground Drainage and Manhole Monitoring System (UDMS), which are used to develop and design the UDMS. This design prioritizes frugality, ease of upkeep, speed of deployment, a large number of sensors, durability, and service quality. Paper [2] mainlyhas been recognized for their work in warning the public of a gas explosion, rising water levels, and an opening lid. The IoT-based drainage monitoring system uses sensors to detect issues, notifies authorities with blaring alarms, flashing LED lights, and text messages sent over a Wi-Fi module, all while saving data in the cloud and making it viewable via a web browser.

The primary goal of this project is, therefore, to implement a system for measuring and reporting changes in water level, air temperature, water velocity, and harmful gas concentrations. When a manhole cover opens or there is a blockage in the drainage system, the sensors detect this and report it to the nearby monitoring station. Repairs of manhole coversowing to the hazardous and time-consuming circumstances within. Therefore, it is risky to enter the manholes to check on their condition. All the issues with subterranean sanitation may be resolved with the help of a remote alarm system that relays information from sensors installed within the manhole to the controlling center.In order to create this setup, this project makes advantage of Wireless Sensor Networks (WSN). Control unit, data storage, radio, and power source all make up a node.

## Methodology

Using an Internet of Things (IoT) block diagram, rain-operated manholes in smart cities may be built using components including an Arduino UNO, rain sensor, gas sensor, water level sensors, buzzer, servo motor, Wi-Fi Module, and infrared (IR) sensor. The A238P micro controller is used here to link the various parts together.

carry out the duties, etc. The Things view app, which we developed for this project and made available on both the Play Store and the App Store, receives data from the IoT cloud depicted in the previous block diagram and displays it on the user's device when the user is online.




Block diagram

After establishing a connection, we had access to the project's comprehensive information and readings, which are shown graphically across a number of tabs (for example, a rain sensor graph, a level graph, and a gas graph). Which we can adjust and manage through app or manual controls. Which means the Internet of Things is a crucial part of this endeavor.

## Working

Using Internet of Things principles, rain-activated manholes may be installed in a smart city.

Here's a high-level description of how this system may function:

To monitor precipitation, rain sensors are placed at strategic areas. Such detectorsmay be engineered to precisely record rain's volume and duration. When precipitation is observed, the sensor notifies the control hub.

The signals from the rain sensors are sent to the central control system, which is in charge of coordinating the use of the manholes. The IoT network and its communication with the manholes may be managed by a cloud-based platform or a local server.

Third, a communication network uses the Internet of Things to link the rain gauges, the control center, and the manholes. Wi-Fi, Lora WAN, and cellular networks are all viable options for wireless data and command transmission in this network.

The actuation mechanism in each manhole responds to signals from the control system and opens or closes the manhole accordingly. The manhole cover may be automatically raised or lowered by this system, which can be powered mechanically or operated hydraulically.

Fifth, the data collected by the rain sensors is processed by the central control system, which then takes choices based on established criteria.It may, for instance, figure out how much rain must fall before the manholes should be opened to avoid flooding.

IoT-powered rain-activated manholes for smart citiesSixthly, the system is able to give real-time monitoring of the manholes' status, showing whether or not they are open, as well as alerts should this change. In the event of failure or problem detection, it may also send warnings or notifications to appropriate authorities or maintenance teams.

When it comes to coordinated operations and effective water management during rainstorm events, the IoT-based rain-operated manhole system may be combined with existing municipal infrastructure like drainage systems or flood control systems.

Using Internet of Things (IoT) mechanisms built into rain-operated manholes, cities may better manage urban infrastructure, lower the danger of flooding, and increase resistance to severe rains. In addition to optimizing maintenance efforts and assuring the manholes' safety and operation, the technology also provides automatic and rapid reaction to changing weather conditions.

## Arduino UNO

The ATmega328P from microchip is the basis for the Arduino Uno, an open-source microcontroller board.The board has both digital and analog I/O ports.pins for connecting to shields and other add-on boards, often known as input/output pins.It's USB-rechargeable.It operates on voltages between 7 and 20 volts and may be powered by wire or an external 9-volt battery.

Arduino uno

## Gas Sensor

The fourth gas detector is an easy-to-operate CO (Carbon Monoxide) sensor that can measure ambient CO levels. The MQ-2can detect COgas levels between 20 and 2000 ppm. This sensor is very sensitive and quick to respond. The analog resistance is the sensor's output. Longevity, cheap cost, and a simple driving circuit are just a few of its many benefits. It also has excellent carbon monoxide sensitivity over a broad range.

## Water level sensor

Fluidized solids, such as slurries, granular materials, and powder, all have an upper free surface that may be detected by a level sensor. Unlike most bulk solids, which pile at an angle of repose to a peak, fluids become almost horizontal in their containers (or other physical limits) when subjected to gravity.

## Rain Sensor:

A rain sensor, often known as a rain switch, is a kind of weather-activated switch. Rain sensors are often used for one of two purposes. The first is a rain-detection device for autonomous irrigation systems, which prevents water waste by turning off the system when rain is detected. The second is an item that keeps the rain out of a car's cabin.

Reflected infrared light from a clear section of the windshield is detected by a sensor located inside the vehicle. Light scatters off the wet glass and onto the surrounding environment, reducing the quantity of light reflected back to the sensor during a rainstorm.

## Wi-Fi Module:

We considered the ESP32, Node MCU, and Particle Photon, but ultimately settled on the ESP8266 Wi-Fi Module. The data from the sensors is uploaded to the cloud through the ESP8266. In addition, it may act as a command receiver for cloud-based systems like manage the system's peripherals.

Wi-Fi Module

## Buzzer:

Electric-acoustic buzzers were chosen because they are more effective than other kinds of buzzers at warning walkers and motorists of potential danger.

Buzzer

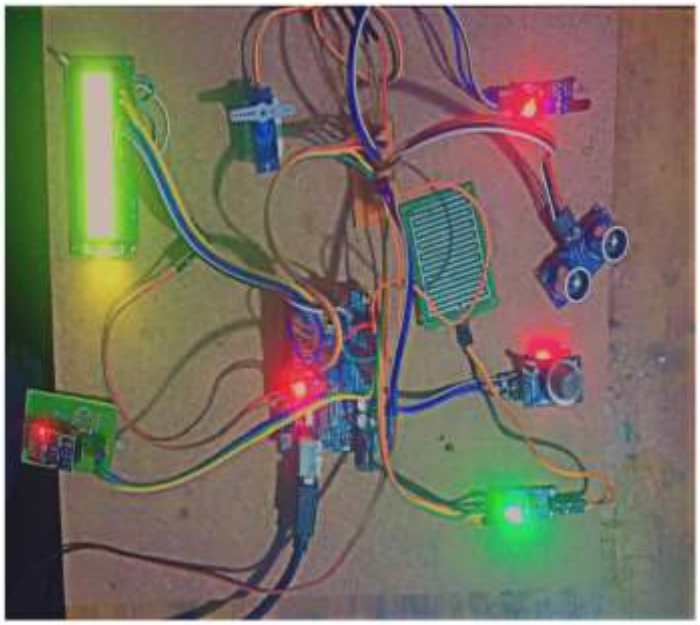
## Servo Motors:

Most hobby servo motors have ratings of 3 kg/cm, 6 kg/cm, or 12 kg/cm (kilograms per centimeter). Find out how much of a load your servo motor can carry at a certain distance with this kg/cm. A Servo motor with a 6kg/cm torque rating, for instance, Raise 6 kilograms If the load is hanging 1 cm from the motor's shaft, the weight it can support decreases as the distance increases. A servo motor's position is controlled by an electrical pulse, and the motor's electronics is located next to the motor itself.

Servo motor

## Results:

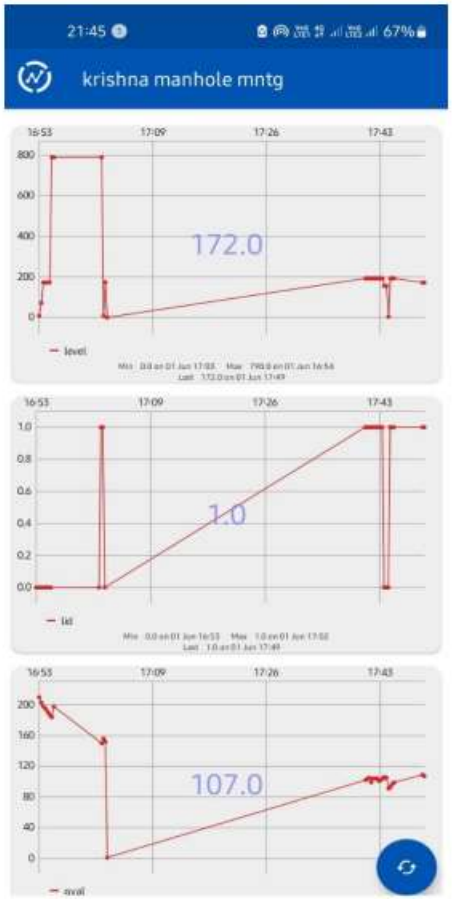
Our project's ultimate deliverable is an app that will be used to control the preceding steps.



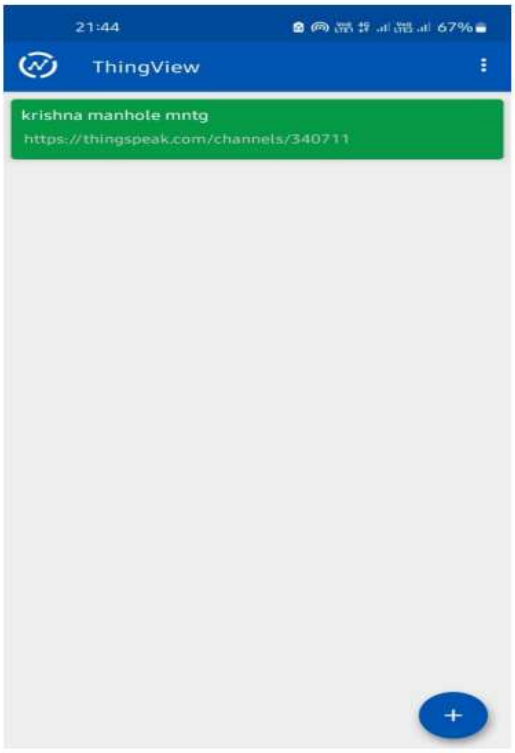
Out put

## Thinks View IoT app output:

Here we need to download Thinks View app from Play Store or App Store. After we need to add channel by entering special channel ID and connect Wi-Fi Module with given Hotspot Details and the data will be shown in graphs as below.



Graphs




# Conclusion

Rainfall amounts, water levels, and flow rates are all tracked in real time so that maintenance and efficiency may be improved. Saving money by reducing the amount of road and infrastructure damage caused by flooding. Improved protection for pedestrians and drivers by rapidly dispersing floodwater. The capacity for remote monitoring and control enables prompt action to be taken. compatibility with existing smart city networks and technologies. Useful information for city planning and disaster preparation. IoT-enabled rain-operated manholes provide efficient stormwater management, save costs, increase safety, and help create more sustainable and resilient urban settings; hence, they are an essential component of the smart city concept.

## Future scope:

IoT-enabled, rain-operated manholes may report on rainfall amounts, water flow rates, and drainage system performance in real time, allowing for more precise monitoring and more accurate predictive maintenance. Cities may use this information for predictive maintenance after processing it.techniques, anticipating possible drainage system problems and implementing solutions before they escalate. Saving money, enhancing infrastructure management, and decreasing downtime are all possible results of taking a preventative stance.

## REFERENCES:

***[1]. Dr. Gunasekaran M1, Pavithra S2, Priyanka R2, Reeva M2, Volume: 06 Issue: 03, "IOT enabled undergroud Drainage monitoring System", Mar 2019 .***

***[2]. 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.***

*[3]. 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.*

*[4]. 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.*

*[5]. Lazarescu, M.T., "Design of a WSN Platform for Long-Term Environmental Monitoring for IoT Applications," Emerging and Selected Topics in Circuits And Systems, IEEE Journal on, vol.3, no.1, pp.45, 54, March 2013.*

*[6]. IoT Based Underground Drainage Monitoring System - G Chandhini, B Chithra, P Kiruthikadevi, Bhagya Sasi, V. Kamal Kumar -International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-9 Issue-3, September 2020*

*[7]. Smart Real-Time Drainage Monitoring System Using Internet of Things - GAURANG SONAWANE 1 , CHETAN MAHAJAN 2 , ANUJA NIKALE 3 , YOGITA DALVI 4 1,2,3,4 Dept. of Computer Engineering, Late G. N. Sapkal College of Engineering, Nashik - © MAY 2018*

*[8]. | IRE Journals | Volume 1 Issue 11 | ISSN: 2456-8880 7. Basha, D. and Rus, D. "Design of Early Warning Flood Detection System for developing countries. Proceeding of the conference on ICTD, Bonsalove, India. Pp 1- 10, 2007.*

*[9]. ✓8. Yuwat, C. and Kilaso, S. " A Wireless Sensor Network for Weather and Disaster Alarm System" , IPCSIT Vol. 6, Singapore. Pp 1 – 5, 2011 9. Morias, R., Valente, A., Serodo, C.*

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