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# A Review on Manhole Monitoring System

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***Abstract:*** ***Smart city is a concept which every country look forward to seed in their lands. To make that seed a big tree, a lot of aspects need to be addressed. Among them an important element is that, the drainage system. Even a small area with the proper drainage system will contribute a lot to the society.***
***Manholes act as the access point to a sewer system. If there are any blockages in the drainage pipelines, manholes are the way to get into the underground pipes. If the blockages are not addressed, the sewage water overflow through the manholes which rises the temper of the pedestrians as well as vehicle drivers. Even tilted manhole covers are dangerous since they lead to accidents. Also the life of the scavengers who enters the manhole is not safe because of unawareness of the toxic level of the drainage or sewage water.***
***All these problems have solutions and the respective authorities will take care of it. But the question is, who lets the authorities know that the manhole has problems. Faster the problems are communicated, quicker the actions will be taken. That's where our proposed system kicks in. With the help of sensors, the sewage water level under the manhole cover is monitored and if it rises above certain level, then the message is sent to the concerned authority. The manhole cover and the toxicity of the drainage water is also monitored continuously to inform the authority about the same. In this way the problems can be solved before it can cause any serious damages. To let common people know about the status of the manholes, an app is developed which displays the condition of the manholes.***
***Keywords: Manhole, Scavengers, Sewage, Authorities.***

## I. INTRODUCTION

Drainage management system is an important aspect of the smart city development. Manholes are the passages which leads the scavengers into the underground pipelines to remove the blockages in the drainage pipes. The main problems associated with manholes are overflow of drainage water, incorrect manhole lids and the toxic level of the drainage water which are very dangerous. These problems can be solved using a system based on IoT and sensor technology.
In most of the countries there is no proper sewage system which results in serious damages and accidents. Some of the manholes doesn't have proper lid covering. Manhole covers or lids gets tilted due to which major accidents happens and people get injured. The scavengers who enters into the manholes doesn't have any knowledge about the toxic level of the drainage water. Because of that they will lose their lives
Detecting and monitoring the manhole problems manually is a tedious job since it requires constant presence of a person in front of each and every manhole. So the main intention of this project is to design a system which monitors the level of the sewage water under the manhole cover, tilting of manhole cover and toxicity of the drainage water.
An ultrasonic sensors detect drainage water level, and if the level exceeds the threshold value, an alert message is delivered to the concerned authority. At the output of the sensor Node MCU is connected. It compares the set threshold value and sends a GSM alarm message to the person in control, which is tracked via IoT.
This device also includes a gas sensor to monitor the presence of gas in manhole so that the toxicity can be monitored, a tilt sensor to indicate whether the man hole cover is tilted. If any of these go beyond the predefined value then SMS to an authority number using SIM800l GSM module is sent.

The consequences of fault in Manhole system are:
*1)* Whenever there is a blockage, it is difficult to figure out the exact location of the blockage.
*2)* Though location is accessed, early alerts of the blockage are not received.
*3)* Due to delayed information repairing becomes time consuming.
*4)* When pipes are blocked completely, it becomes very inconvenient to handle the situation.
*5)* Today's drainage systems are not high-tech .
*6)* Failure of drainage lines creates lots of problem for the people.

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## II. MANHOLE MONITORING SYSTEM

The underground drainage pipeline monitoring system not only helps in maintaining clean and tidy environment, but minimizes the work of government. Various sensors like tilt, ultrasonic and gas sensors helps to achieve a smart system for manhole monitoring. When any of the sensors reaches the set threshold value, that value is sent to the Node MCU which is at the output end of the sensors. Then the Node MCU sends the signal and location of the manhole to the concerned authority through GSM module. Not only the municipal cooperation get to know about the problems of manholes, but also the common people through application.
Like this both common people and the person in charge gets to know about the problem.

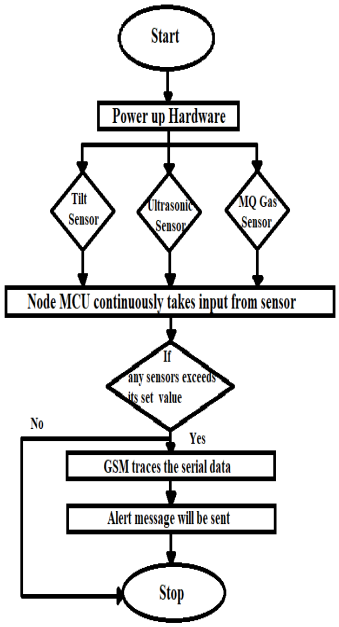



Figure 1: Block diagram of Proposed System

## III. LITERATURE REVIEW

Z. Mohd Hussin et.al [1] proposed the first step by automated waste drain water system. It includes sensors like gas sensors, ultrasonic sensors and Arduino microcontroller for the requirements of framing up the raw signals. They concentrated on the success and actual time track of drainage system using internet of thing (IoT) applications. Global System for Mobile Communication (GSM) is also employed in the system to dispatch alert messages to the authority officials or control. The details from the sensors will be transported and posted to ThingSpeak in the face of graph where the content will also be copied in the web server and cloud by ESP 8266.

N Nataraja et.al [2] which started a particular process in manhole tracking or monitoring system. They implemented a secured system by incorporating sensors and GSM technology. It contains of Arduino Uno, BMP 280, Ultrasonic Sensor, SW-420 Vibration Sensor, HC-SR04 Ultrasonic Sensor, GSM SIM 300. Special sensors are used in the system so that the access can be taken about the surrounding habitat and calculate the result obtained near stations, at the place where effective actions are carried out by looking through positioning, and follow the required protocol on time. This system helps to know the conditions of tilted lid which causes to accidents and also leads to the circumstances of person may fall into it. Thereby it alerts the concerned personnel about the problems and situation of the drainage system and required measures are taken.The system helps this problem to overcome by providing the preventive measures to close the manhole regard of human safety. The safety of human is very important to avoid diseases caused due to drainage system. The alert messages will be sent to the registered authority.

Habib Shahorier Tasin et.al [3] developed a methodology and proposed a system of uncapped manhole detection system for waterlogged road. The target of this development system was to secure people from involving into these accidents. Nearby municipality will be triggered with the messages if their is any dispensaries . If it finds any problematic condition it shows the message on an LED display and with help of a buzzer the user will be notified. There is no second opinion that, this system can strongly enhance the securedness of the people. It is also cheapest and user-friendly option.

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Sharma Pankaj Kumar Ramadhin et.al [4] started a elegant drainage and health observe system of manual scavenger using IoT. Sensors like ultrasonic sensors for checking the level of wastage, gas sensor to detect harmful gases, pulse sensor, heartbeat sensor, buzzer and also fan and Arduino. If threshold is reach by the drainage water , the buzzer will be alerted and its content will be exihibited on the IoT webpage. This system is new from other systems, which help to overcome the drainage problems . This system will provide us content and sends SMS, Email and on the IoT website before the overflow of drainage, because it helps the workers as well as people who are living in their respective places with a drainage problems .

Saadnoor Salehin et.al [5] developed an IoT based proposed system for monitoring manhole in context of Bangladesh. This paper introduces an intelligent automatic manhole monitoring system which determine poisonous chemicals and gases inside the manhole and absence of the lid of the manhole. In this situation, an alarm generates to the passersby and alerts the respective officials about the system state. The system can enhance overall status of the surroundings. Hence, the concerned officials can take proper actions to maintain the manhole. The system has been executed in an academic environment to implement the automated monitoring of a manhole and to estimate the proposed features.

Vidhya Sree. A et.al [6] proposed a development of manhole cover detection and continuous monitoring of hazardous gases using WSN and IoT. This document provides an vital manhole monitoring and detecting system, where the continuous examination of toxic gases, condition of manhole lid is detected using various sensors. The continuous monitoring of the lid open condition and gas levels are traped by the sensing device and the data are transfered to Atmega 328p microcontroller device. The processed data will be saved in the cloud for additional processing and using the long-distance communication LoRa module it sends to the host station. By means of received data an alert will be sent to the public with regard to data. The design objective of the proposed system is inexpensive, low maintenance, feasible, also swarming of the gully pot system, contamination of water, and outflow of poisonous gases and blockage of manholes are determined and the information is provided to the concerned officials by Wireless Sensor Networks (WSNs) and Internet of Things.

X. Guo. et.al [7] proposed various methods for monitoring and managing underground drainage system.The absence of manhole cover causes trouble such as pedestrians or vehicles falling into the well and so on, and it often happens to open the manhole cover without admittance of authorized units and also leads to cable damage, which seriously influence the safe operation of the network. This system investigate and develops the intelligent monitoring system of manhole well, and realizes the monitoring of manhole well status based on the IoT technology. The system mainly comprises of alarm terminal, lock well cover, centralized monitoring server and centralized monitoring client. The lock well cover and the alarm terminal recognize the change of the well cover state, convey information to the application layer by means of network and apprise the user, and accordingly the user will process it.

Y. Xie, et.al [8] developed an system which mainly consists lock well cover, alarm terminal, centralized monitoring server and centralized monitoring client. The lock well cover and the alarm terminal recognize the change of the well cover state, provide information to the application layer by means of network and inform the user, and the user will take action accordingly. Among them, the application layer is constitutes centralized monitoring server and centralized monitoring client. The system is used for three major telecom operators to protect the ground cable. On the one hand, it guard the resources and market of the operators; on the other hand, it decreases the inadequacy of manhole covers on the road, and prevents several accidents.

J. Zhang, et.al [9] developed a secured manhole monitoring system. The construction of smart cities has been given new implication and requirements. As a central part of the infrastructure, urban manhole covers have a large audience and wide distribution, but due to the lack of an efficient and intelligent unified control system, various accidents have occurred frequently in this area in recent years. According to the current situation and development needs of manhole cover management in smart cities, this thesis designs an intelligent manhole cover management and control system based on Narrow Band Internet of Things (NB-IoT). In the part of terminal data accession, by optimizing the structure of sensor circuit, the type of manhole cover information accession is added. The gathered node information data is transmitted to the server through NB-IoT in a low-power long-distance working mode. The server side completes the visualization of the obtained data and provides rich control functions on the user's operation interface.

S. Salehin et.al [10] developed a IoT based manhole detection and monitoring system. Manholes are not monitored properly. The unsupervised manholes can act as a threat to lives in various ways. The paper gives an intelligent automatic manhole monitoring system which detects harmful toxic gases and chemicals inside the manhole, absence of the cover of the manhole and generates an alarm to the passersby in that situation, sends message to the authority about the system state.

This system improves overall quality of the surroundings. Therefore, the concerned authorities can take proper measures to maintain the manhole. This system has been implemented in an academic environment to conduct the automated monitoring of a manhole to evaluate the proposed features.

N. N. Kasat, et.al [11] proposed a Smart City Solutions on Drainage, Unused Well and Garbage Alerting System For Human Safety Pollution has increased a lot from last decade. The drainage, sewage and manholes always results floods with wastes and slurry. This results in creating various flammable and harmful sewer gases. The consequences of this harmful gases deal with explosion risk as well as life threatening risks for the concerned cleaners. Besides this, the safety of the people living nearby the affected area may get retard as well. The concerned authority does not have the prior knowledge about the presence of such harmful gases in the underground environment. The cleaning action may get take time which can give rise to certain diseases. Sometimes the lid of manhole is left open which causes threats. A system is required which can continuously monitor the harmful sewer gases as well as lid and slurry levels inside the manhole and provide alarming or alerting facility on emergency conditions. The proposed system is an IoT based system with on-spot buzzer and message alerting facility.

G. Ramesh, et.al [12] The Sewage system which consists of many harmful gases can leads to many diseases. It is very important to know that the process of what and how the workers are carrying out. The design is helpful in checking the different gas levels because the person who is going to work in the drainage systems can get a clear clarity that where he had to start the work. The health conditions and the worker levels are found out in the LCD display in aspect. The health conditions of the workers is recognized with the help of LCD screen. When the worker enters the manhole system, one can identify the gas threshold limit values to check his health condition. To avoid this the oxygen is supplied to the person with the help of the pump motor. The signal is sent to a municipal office in the format of a message.

## IV. CONCLUSION

It explains various applications like underground drainage and manhole problems identification in real time. Various parameters like tilting of manhole cover, toxic gases inside the manhole, flow and level of sewage water under manhole cover are being monitored and updated on the internet using the Internet of Things. This enables the concerned person to take the necessary actions regarding the same. In this way the unnecessary trips on the manholes are avoided and can only be conducted as and when required. Also, the real time update on the internet helps in maintaining the consistency in drainage check thus avoiding the hazards. The information regarding the faults of manhole are not only conveyed to the concerned authority to take action, but also communicated to the people out there via application. This helps the people who travel by that particular road, to know about the problem and can change the route if they want. This feature is what makes our project unique from others.

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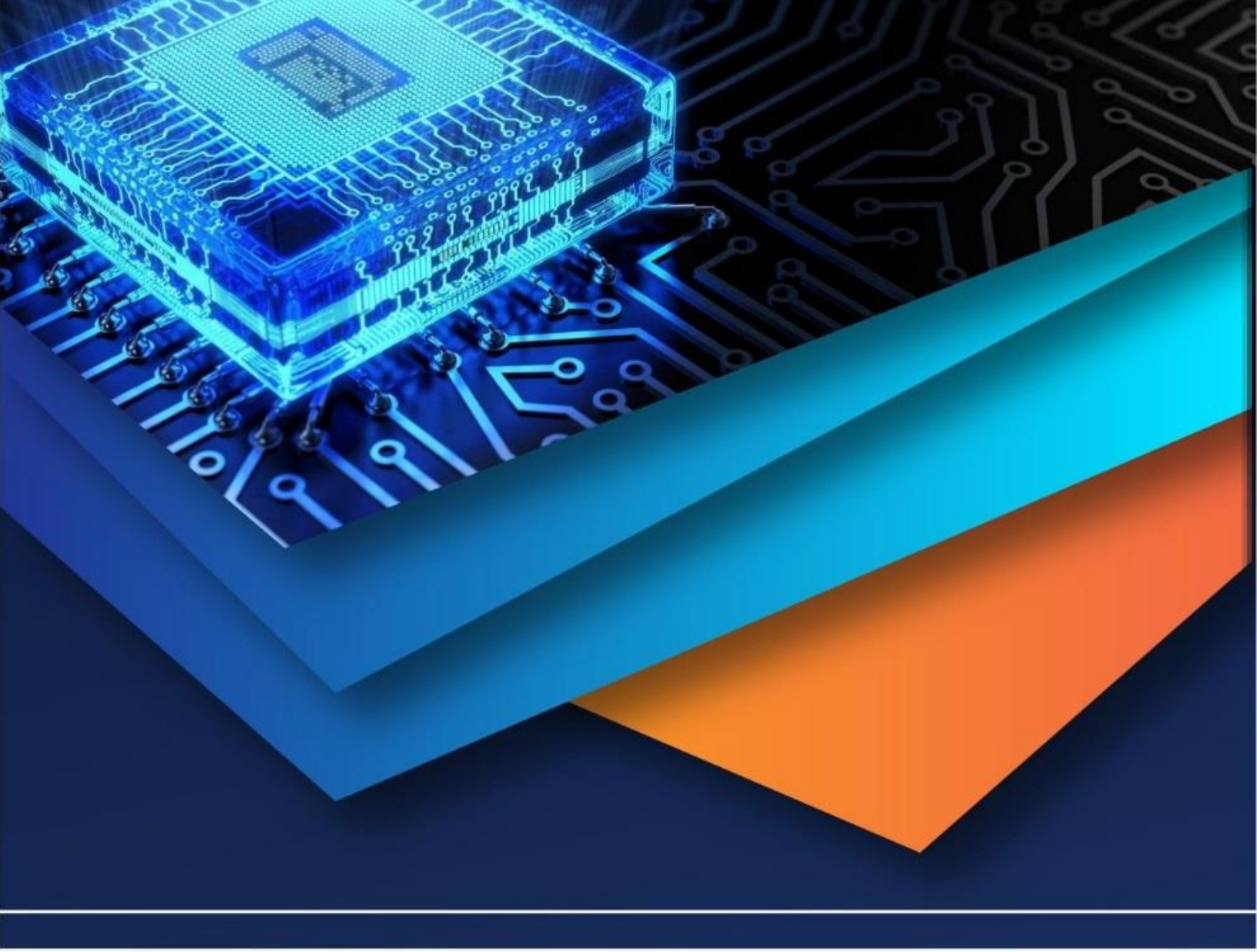
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