Smart Underground Drainage Blockage Monitoring and Detection System Using IoT

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Abstract - *India has announced a project of making smart cities. For making a smart city one needs to consider many parameters such as smart home, smart television, smart transportation etc. There will be need of smart underground framework which includes underground water pipelines interaction cables, gas, pipelines, electric flow etc. In India adoption of underground Drainage system is very important. This system work in a proper manner to keep the city clean safe and healthy. If they fail to maintain the drainage system, pure water may get contaminated with drainage water and can spread infectious diseases. Also various harmful gases are spread in air and it produces air pollution so different kind of work has been done to detect, monitor and manage these underground systems. This project represent the implementation and design functions for monitoring, detecting and managing underground drainage system with different approaches*

Key Words: Drainage, Gas sensor, Arduino, Ultrasonic sensor, SMS(Short Service Message)

1. INTRODUCTION

Drainage system plays a very important role in big city where millions of people live. Drainage system in known as the base for and dryness from the excess and unused water, rain water and waste water. Monitoring of drainage manually is not possible. The irregular monitoring has contribution on the blocking of the drainage that imply to the salutation which trigger flooding in the neighborhood manual monitoring is also incompetent. It needs a lot of dedicated persons who are only able to record limited report with low accuracy.

The problem arises in such drainage lines can cause serious issues to the daily routing of the city. Problem such as blockage due to waste material, sudden increase in the water level as well as various harmful gases can be produce if the proper cleaning actions are not taken time to time. Today's Drainage system is not computerized due to which it is hard to identify if blockage has occurred in particular location.

Also sometimes due to the waste in those drainage lines can produce various gases like methane(CH_4), carbon monoxide(CO), etc which are harmful and can cause serious   problem if inhaled by humans in large amount and these faced by the drainage workers which leads to loss of life. Also we don't get early alert of the blockage of

rise in amount of those gases or the increases in the water level.

Hence detection and repairing of the blockage becomes time consuming and hectic. There are realtime examples through which we can do analysis of lack of drainage system.

In 2019 in Bangalore roads, drains and even houses in some areas were flooded, causing tremendous inconvenience to moment unprecedented growth of The unprecedented growth of Bangalore unaccompanied by the necessary infrastructure has participated problem of a large magnitude. The city drainage system comprises major drains, roads sides drains and shoulder drains all of which get overloaded during the rainy season. In order to avoid such problems smart solution are required. Smart city infrastructure could be in terms of intelligent traffic automation, military, conveying logistic, environmental and surrounding monitoring. So in order to promote smart city infrastructure in this paper we are proposing smart underground drainage blockage monitoring and detection system using various sensors. The sensors that used are ultrasonic sensors and gas sensors.

1.1 Necessity of Smart Drainage System

Urban floods are entirely manmade with poorly maintained drains, plastic bags, shrinking open spaces and climate change contributing to accumulation of water on roads after a heavy downpour.

In 2017 in Bellundur Lake(Bangalore) was back with dirt, foul-smelling froth due to heavy rainfall and lack of proper drainage system. Due to Bellandur lake tragedy 76 polluting Industries were shut.

Heavy rainfall in Delhi had flooded roads and caused huge traffic snarls.

Chennai has witnessed severe flooding in 2015 while floods in Mumbai had killed 500 people.

This tragedies are result of lack of drainage system indulged with advanced technology. Manual monitoring is time consuming and also risky for human life.

In 2019 in Agra a probe was ordered into construction of drainage and it was suppose to be constructed in 50 meter radius. However the old drainage has been been damaged upto 200 meter. This was done to benefit a certain private contractor and assign him additional work under smart city project.

After this scam was out, strict action were meant to be taken. There are many unknown scams that are hidden and the benefit is taken by corrupt people and problems are faced by the citizens.

So this gave us motivation to design a smart drainage system which will be monitored remotely and will be risk free as well.

1.2 Overview of Internet of Things

(IOT) is a sprawling set of technologies and use cases that has no clear, single definition. One workable view frames IOT as the use of network-connected devices, embedded in the physical environment, to improve some existing process or to enable a new scenario not previously possible. These devices, or things, connect to the network to provide information they gather from the environment through sensors, or to allow other systems to reach out and act on the world through actuators. They could be connected versions of common objects that might already be familiar with, or new and purpose-built devices for functions not yet realized. They could be devices that you own personally and carry with you or keep in your home, or they could be embedded in factory equipment, or part of the fabric of the city you live in. Each of them is able to convert valuable information from the real world into digital data that provides increased visibility into how your users interact with your products, services, or applications .

2. LITERATURE SURVEY

Muragesh S. K1 and SanthoshaRao [1] proposed a model that provides a system for monitoring the water level and atmospheric temperature and pressure inside a manhole and to check whether a manhole lid is open. It also monitors underground installed electric power lines. The vital considerations of this design are low cost, low maintenance, fast deployment, and a high number of sensors, long life-time and high quality of service.

The Internet of Things (IoT) consists of real life objects, communication devices attached to sensor networks in order to provide communication and automated actions between real world and information world. IoT came into existence because, without human interaction, computers were able to access data from objects and devices, but it was aimed at, to overcome the limiting factors of human entered data, and to achieve cost, accuracy and generality factors. Sensor Network is a key enabler for IoT

paradigm. It represents the implementation and design function of an Underground Drainage and Manhole Monitoring System (UDMS) for IoT applications.

Prof.S A.Shaikh 1, Suvarna A. Sonawane [2] proposed the system for the Smart cities for the development goal to monitor the quality of resource in the city to improve good management and faster development of the city required necessity is to upgrade healthy and safe cities that delivering real time services and latest facility to implement the concept of smart city use IoT concept by which easy wireless communication is possible. Different type of data is collected from the sensors and transferred to Raspberry Pi3 Controller in the system. The acquired output from the controller is sent to the control room through the E-mail and also display on the personal computer.

Yash Narale, Apurva Jogal, Himani Chaudhari, S.P Bhosale [3] introduced the underground drainage monitoring system that will not only help in maintaining the proper health and safety of the city but additionally in reducing the work of government personnel numerous varieties of sensors (flow, level, temperature and gas sensors) are interfaced with microcontroller ARM7 so as to form the system smart. Once the various sensors reach the threshold level, the indication of that respective worth and sensor is being sent to the microcontroller. Further more, ARM7 then sends the signal and location of the manhole to the municipal corporation through GSM and GPS and the officials could easily locate which manhole is having the problem and could take appropriate step.

G. Gowthaman, K. Hari Haran proposed [4] system to simply monitoring the level, it generates alarm signals via complaints to the required departments through mail and SMS regarding prior to overflow.

MS T.Deepiga [5] introduced the Smart water monitoring system using wireless sensor network. The system consists of a sensible sensing unit that detects and controls the home electrical appliances used for daily activities by following totally different tariff rates.

Retno Tri Wahyuni1, et.al [6] proposed sensible devices once integrated into the city's infrastructure through the effective preparation of ICT, will build life during a every town lots easier. During this paper, we tend to style sensible period drain monitoring system mistreatment varied sensors like water level, blockage and gas detector.
Wirawam,et.a [7] introduced predictive flood detection system mistreatment IoT are enforced in stream like Central American nation and different rivers.

Gunasekaran, M.pavitra, S.Priyanka, R,Reeva [8] proposed a system that has underground aquifers and above-ground rivers, lakes, streams, marshes, comprising solely 65% of the water present on the world. The previous water that's

here should regularly cleanse and renew itself. Water movement is one of the associate indicator of purity and energy.

3. WHY IS NEED OF SMART DRAINAGE SYSTEM

Urban areas are most affected by floods which are man made such as shrinking open spaces, use of non recycled plastic, drains which are not monitored regularly that leads to heavy water accumulation after heavy rainfall.

In 2017 in Bellundur Lake (Bangalore) was with dirt, foul-smelling froth due to heavy rainfall and lack of proper drainage system. Due to Bellandur lake tragedy 76 polluting Industries were shut.

Delhi was flooded with water after a continuous heavy rainfall which caused traffic congestion.

Chennai has witnessed severe flooding in 2015 while floods in Mumbai had killed 500 people.

This tragedies are result of lack of drainage system indulged with advanced technology. Manual monitoring is time consuming and also risky for human life.

In 2019 in Agra a probe was ordered into construction of drainage and it was suppose to be constructed in 50 meter radius. However the old drainage has been been damaged up to 0.2 km. This was done for certain people who were involved in order to get benefit under smart city project. After this scam was out, strict action were meant to be taken. There are many unknown scams that are hidden and the benefit is taken by corrupt people and problems are faced by the civilians.

So this gave us motivation to design a smart drainage system which will be monitored remotely and will be risk free as well.

4. OVERVIEW OF TOT

Internet of Things (IoT) is one among the rising set of technologies that has no clear single definition. One feasible read frames Iot use as of network connected devices, embedded within the physical setting, to boost some existing method or to change a brand new situation not antecedently doable. These devices or things to the network to produce info they gather from setting through sensors, or permit different system to succeed in out and act on the globe through actuators. They may be connected versions of common objects which may already be aware of, or new purpose-made devices for operate not however completed.

They could be devices that you just own in person and carry with you or detain home, or they may be embedded in works instrumentation, or a part of the material of the town every of them is in a position to convert valuable info from the real world to digital information.

Internet of Things(IoT) may be a network of physical devices that area unit able to hook up with a network and exchange information.

4.1 SENSORS

Sensors can monitor the flow level, blockage in voidance likewise as quantity of dangerous gases in period scenario based mostly upon the info values given by the sensors in system the data along side location ID send to the gateway and send to the cloud (server) or concerned authority.

1) Arduino: Arduino is an one of the best open electronics platform to use hardware and software.

Arduino (Fig 1) boards are able to read inputs – light on a sensor, a finger on a button, or a twitter message –and turn it into an output - activating a motor, turning on LED, publishing something online.

Fig 1 Arduino UNO

2) Ultrasonic: Ultrasonic sensor(Fig 2) has high frequency, sensitivity, and power create simple to detect the object. They have greater accuracy than different ways at measuring thickness and depth of a parallel surface. The Transmitter and Receiver will play an important role (Fig 3). Ultrasonic are easy to use and not dangerous during operation.
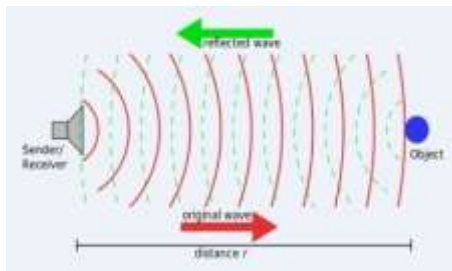

Fig 2 Ultrasonic Sensor

Fig 3 Working principle of Transmitter and Receiver

3) Gas Sensor: Gas Sensor(Fig 4) detects the presence of harmful gases which might be present at fuel station, industries etc. This unit can be easily incorporated into an alarm circuit/unit, to sound an alarm or provide a visual indication of the H_2S concentration. The sensor has excellent sensitivity combined with quick response.

It is flexible and reliable that combine technology. The drainage channel are covered with manholes to operate and to clear the blocking present inside the channel.

Fig 4 Gas Sensor

5. PROPOSED SYSTEM

The Underground Drainage System are maintained by Cleaning offices in India to make clean healthy surroundings and hence environment.

But often due to poor maintenance of the underground drainage system, the water in the drainage system gets mixed up with the pure water and consumption of this polluted water leads to water borne diseases.

The sudden changes in the atmosphere and variations in the climate during different seasons the drainage gets blocked or water logged, making environment unhealthy and disturbs the healthy routine of common people.

To overcome all these issues in the underground drainage system we have designed the smart drainage system that will have:

1. Sensors to detect blockage, flood and gases.

2. The intelligence of sensors and system can clogging the impeding within the system and will offer the details of the location and different data for further actions.

3. System will also sense hazardous gases like methane (CH_4), Sulphur Di-oxide(SO_2) carbon monoxide (CO) etc.

As the level of such gases pass value worth thee system will generate the alert using alarm system by which the Health department can take correct action on it.

4. These entire data packet will be jointly sent by the gateway node and stored at the cloud all the system, we are able to simply monitor, modify and rectify the issues in real time.

From the block diagram (Fig 5) we can observe the working methodology of Smart Drainage System.
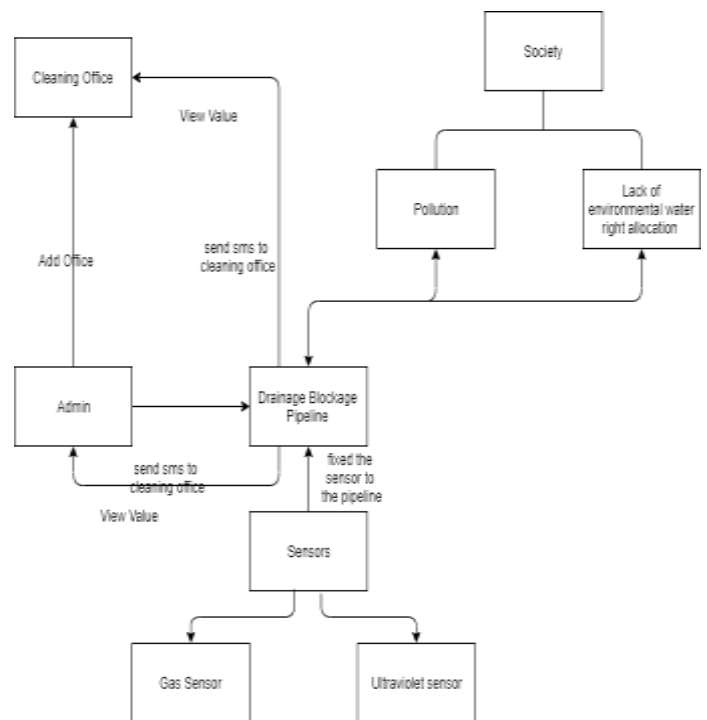

Fig 5 Block Diagram

6. RESOURCES

HARDWARE

System	Windows 7 and Upgrade version/Linux
RAM	4 GB
Hard Disk	500 GB
CPU Speed	2 GHz

SOFTWARE

Operating System	Windows/Linux/CenterOS.
Programming Language	Java
Front End	HTML, CSS, Bootstrap
IDE	Eclipse

7. PERFORMANCE ANALYSIS

Phases	Time
Analysis	20 H
Design	30H
Coding	20H
Testing	30H
Documentation	20H
Maintenance	40H
Total Time	160H

CONCLUSION

Thus our project aims to create a safe and healthy environment by creating a smart drainage monitoring system. This paper addresses all about smart and real-time drainage monitoring and detecting system through IoT applications for metropolitan cities. By using various sensors such as gas detection, ultrasonic blockage detection we can monitor the real-time scenario of the drainage system by detecting the problems in the drainage system. By doing this we can able to take a particular action on the problems as we will receive the early alerts of blockage as well as increase. This paper can be used to design the smart and real-time drainage blockage Monitoring detection System as well as troubleshooting the problem.

ACKNOWLEDGMENT

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