Manhole Detection and Monitoring System

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***Abstract* - A smart city is the future goal to have cleaner and better amenities for the society. Smart underground infrastructure is an important feature to be considered while implementing a smart city. Drainage system monitoring plays a vital role in keeping the city clean and healthy. Since manual monitoring is incompetent, this leads to slow handling of problems in drainage and consumes more time to solve. To mitigate all these issues, the system using a wireless sensor network, consisting of sensor nodes is designed. The proposed system is low cost, low maintenance, IoT based real time which alerts the managing station through message when any manhole crosses its threshold values. This system reduces the death risk of manual scavengers who clean the underground drainage and also benefits the public.**

Keywords* - *Drainage monitoring system, IOT, Monitoring smart city.

INTRODUCTION

An integral part of any drainage system is the access points into it when it comes to cleaning, clearing, and inspection. Metropolitan cities have adopted underground drainage system and the city's municipal corporation must maintain its cleanliness. If the sewage maintenance is not proper, ground water gets contaminated causing infectious diseases. Blockages in drains during monsoon season, causes problems in the routine of the public. Hence, there should be a facility in the city's corporation, which alerts the officials about blockages in sewers, their exact location. It mainly acknowledges in the field of alerting the people about the gas explosion, increase in the water level and the temperature level. It uses IoT to make the drainage monitoring system in a highly automotive by using sensor for detecting and sending alerts through GSM and GPS module to the authorities. This project overcomes the demerits by detecting drainage water blockage by installing water flow rate sensors at the intersection of nodes. When there is a blockage in a particular node, there is variation in the flow of drainage water which when cross the set value will display the alert in the managing station. Also other demerits are solved by detecting temperature variations inside the manhole and alerting the same to the managing station. Also, flow rate sensors are used to detect the over flow of the drainage water and alerting the same to the managing station through automatic message. Maintenance of manholes manually is tedious and dangerous due to the poor environmental conditions inside so, the main focus of this project is to provide a system which monitors water level, atmospheric temperature, water flow and toxic gases. If drainage gets blocked and sewage water overflows, it is sensed by the sensors and message is sent to the municipal. It is, therefore dangerous to go inside the manholes for inspection of its current state. To solve all the problems related to underground sanitation, a remote alarm system is necessary for transmitting data collected by the sensors set inside the manhole to the managing station. This includes components such as controller, memory, transceiver and battery to supply power.

I. PROBLEM STATEMENT

Today's drainage system is not high-tech. So whenever there is blockage it is difficult to figure out the exact location of the blockage. Also, early alerts of the blockage are not received. Hence detection and repairing of the blockage become time consuming. It becomes very inconvenient to handle the situation when pipes are blocked completely. Due to such failure of drainage line people face a lot of problems

So, this system proposes:

- Detect the location
- The system governing the flow of sewage from the pipes.
- Use of flow sensors to detect the variations in the flow.
- Get the prior alerts of blockages and locate them using IOT.
- Trace location using GPS and send SMS through GSM.

II. OBJECTIVES

- Cleaner cities and intelligent management of drainage in the city.
- Detection of drainage water level and blockages in the drainage.
- Checking water flow rate continuously, as well as sending automatic mail, display on the monitor if the water level is outside of an expected normal range.
- The main objective is to obtain an effective low-cost and flexible solution for condition monitoring and infrastructure management in the city.
- Sensing the temperature and leakage of gas and updating it in real time through IoT.

A. LITERATURE REVIEW

A) The design space of wireless sensor networks, Wireless Communications
Author: Romer, K. Mattern
Description: In the recent past, wireless sensor networks have found their way into a wide variety of applications and systems with vastly varying requirements and characteristics.

As a consequence, it is becoming increasingly difficult to discuss typical requirements regarding hardware issues and software support. This is particularly problematic in a multidisciplinary research area such as wireless sensor networks, where close collaboration between users, application domain experts, hardware designers, and software developers is needed to implement efficient systems. In this paper we discuss the consequences of this fact with regard to the design space of wireless sensor networks by considering its various dimensions. We justify our view by demonstrating that specific existing applications occupy different points in the design space.

B) Towards the Implementation of IoT for Environmental Condition Monitoring in Homes
Author: Kelly S.D.T, Suryadevara, N.K, Mukhopadhyay S.C
Description: In this paper, we have reported an effective implementation for Internet of Things used for monitoring regular domestic conditions by means of low cost ubiquitous sensing system. The description about the integrated network architecture and the interconnecting mechanisms for reliable measurement of parameters by smart sensors and transmission of data via internet is being presented. The longitudinal learning system was able to provide self-control mechanism for better operations of the devices in monitoring stage. The framework of the monitoring system is based on combination of pervasive distributed sensing units, information system for data aggregation, reasoning and context awareness. Results are encouraging as the reliability of sensing information transmission through the proposed integrated network architecture is 97%. The prototype was tested to generate realtime graphical information rather than a test bed scenario.

C) Monitoring Smart City Applications using Raspberry PI Based on IOT
Authors: Prof. S A.Shaikh 1, Suvarna A. Sonawane.
Description: the Smart city is 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. The system consist of sensors, collect different types of data from sensors and transfer to the Raspberry Pi3 controller. The acquired output from the controller is sent to the control room through the E- mail and also display on the personal computer.

B. SYSTEM DESIGN

BLOCK DIAGRAM:
Below diagram represents the major components of the underground drainage monitoring system.

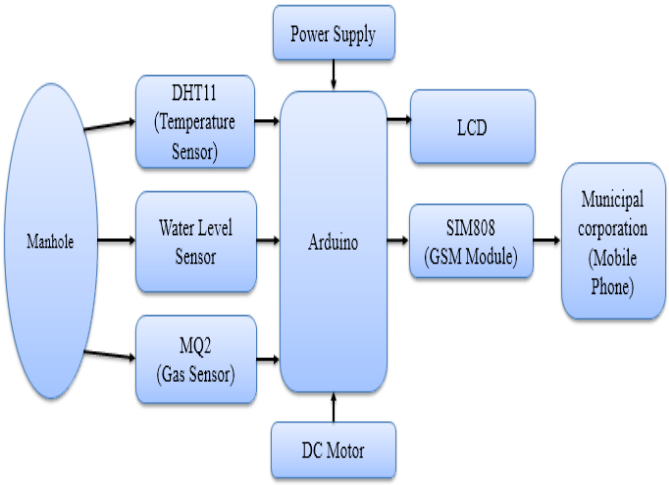

Figure 1: Block Diagram of Underground Drainage Monitoring System

WORKING:

An underground drainage monitoring system will not only help in maintaining the proper health and safety of the city but also in reducing the work of government personnel. Various types of sensors (flow, level, temperature and gas sensors) are interfaced with microcontroller Arduino Uno in order to make the system smart. When the respective sensors reach the threshold level, the indication of that respective value and sensor is being sent to the microcontroller. Furthermore, Arduino Uno 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 steps. Also, Arduino Uno updates the live values of all the sensors in the manholes falling under the respective area using IoT. A message will also be displayed on the LCD.

C. SYSTEM SPECIFICATIONS

Software	Hardware
Simulation Proteus 8 Professional	Arduino Uno
Arduino	Humidity & Temperature Sensor (DHT 11)
	Water Level Sensor
	Gas Sensor (MQ2)
	LCD
	DC Motor
	Adaptor
	12V Relay Module
	GSM Module (SIM 808)

1. Arduino Uno:

The Arduino Uno is an open-source microcontroller board based on the microchip ATmega328P microcontroller .the board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits .it can be powered by the USB

cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

Figure 2: Arduino Uno

2. DHT 11 (temperature & humidity sensor):

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data.

3. LCD (liquid crystal display):

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.

4. Gas Sensor:
This is a simple-to-use Carbon Monoxide (CO) sensor, suitable for sensing CO concentrations in the air. The MQ-2 can detect COgas concentrations anywhere from 20 to 2000ppm. This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. It has good sensitivity to carbon monoxide in a wide range and has advantages such as long lifespan, low cost, and simple drive circuit &etc.

5. Level Sensor:
Level sensors detect the level of liquids and other fluids and fluidized solids, including slurries, granular materials, and powder that exhibit an upper free surface. Substances that flow become essentially horizontal in their containers (or other physical boundaries) because of gravity whereas most bulk solids pile at an angle of repose to a peak.

6. GPS:
The Global Positioning System (GPS) is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

7. GSM:

Fig 3: GSM

SIM900 GSM Module is the module that supports communication in 900MHz band. We are from India and most of the mobile network providers in this country operate in the 900 MHz band. If you are from another country, you have to check the mobile network band in your area. A majority of United States mobile networks operate in 850 MHz bands (the band is either 850 MHz or 1900 MHz). Canada operates primarily in 1900 MHz band.

8. DC Motor:
The direct current fans, or DC fans, are powered with a potential of fixed value such as the voltage of a battery. Typical voltage values for DC fans are, 5V, 12V, 24V and 48V. In contrast, the alternating current fans, or AC fans, are powered with a changing voltage of positive and of equal negative value.

9. Adaptor:
The 12 Volt Adapter Power Supply is probably the most widely used power adapter. The 12 Volt Power Supply Adapter is a throwback to the early days of electronics when 12V was a common battery output voltage.

10. Relay Module:
12V Relay Module is a relay board that you can control its contacts with 12V via Arduino or another microcontroller board. The relays on the board are relayed by 12V and the board's supply voltage is 12V. It draws 20mA of current from microcontroller when triggering.

Figure 4: Relay Module

D. METHODOLOGY

FLOW CHART:

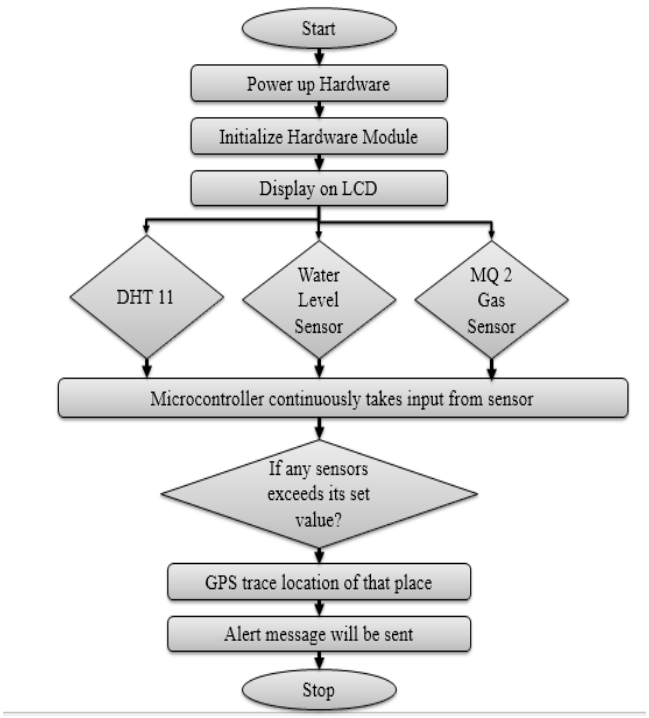

Figure 5: Flow chart of proposed model

E. CONCLUSION

Underground monitoring is challenging problem. This project proposes different methods for monitoring and managing underground drainage system. It explains various applications like underground drainage and manhole identification in real time. Various parameters like temperature, toxic gases, flow and level of water are being monitored and updated on the internet using the Internet of Things. This enables the person in-charge to take the necessary actions regarding the same. In this way the unnecessary trips on the manholes are saved and can only be conducted as and when required. Also, real time update on the internet helps in maintaining the regularity in drainage check thus avoid the hazards.

D. REFERENCES

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