Smart Manhole Managing and Monitoring System using IoT

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Abstract. A good maintenance of the manhole is the image of an excellent town. Nowadays the manholes area unit the most downside within the sensible cities. In fact, not all areas have observance teams. It ends up in irregular observance of the manhole condition. The irregular observance ends up in the block of the hole. Manual observation in the manhole is more complicated. It needs knowledgeable, however, they will solely monitor, terrify finite and maintain in a low accuracy. Also, generally, lack of data employees might meet to an accident as they need no concepts that, however, are going to be the conditions in those manholes. During this paper, tendency to use varied sensors, like gas sensing element, temperature sensing element to sense the damages. If there's any abrupt change in any of those parameters, the system, that is connects to the municipality's office, and tells the situation by message wherever it has been placed through message. The dominant system, and therefore the maintenance are created through Internet of Things technology. This paper is going to be extremely helpful to society in maintaining the manhole.

Keywords: Internet of Things (IoT), Water Level Sensor, Temperature Sensor, Gas sensor, The Global System for Mobile communication (GSM)

1 Introduction

In recent years, developed countries have paid a lot andlots of attention to the event of manhole management, and have developed a series of encouragement and support policies. Malta is a country which places a first position for maintaining and managing the manhole system. But India is in a 107 position for maintaining and managing the manhole. An integral part of any system is that the access points into it once it involves improvement, clearing, and examination of the manhole. The workers face many problems during cleaning and examination of the manhole. The sanitation workers face many health hazards while cleaning the man- hole manually. Exposure to hazardous gases, cardiovascular degeneration, musculoskeletal diseases, infections, skin difficulties, and

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respiratory system problems are among the health risks. Sanitation staff still loses their lives, because of the inhalation of harmful gases within the manhole. This proves the inadequacy of the correct manhole watching system. In India, less sanitation workers at high risk for infections. It is critical that the manhole system be installed in a proper manner in order to keep the community clean, safe, and healthy. Therefore, completely different work has been done to find, maintain, and manage the manhole system. The target of this method is to get an efficient low- priced and checking water level and sensing the toxicity of gas and temperature in the manhole, all in real time through IOT. During this system the level of manholes is unendingly monitored. It also senses the toxicity of the gas, yet as causing automatic SMS, if the toxicity of the gas is measured. The output correct level and sends an alert message through GSM. The temperature is also continuously monitored, and if the temperature changes, an alert message is sent via IOT. If there are no changes in the manhole, it will be continuously monitored.

2 Objectives

Continuously checking water level, temperature, and gas, as well as providing automated messages. The water level sensor monitors the water level in the manhole and delivers an early warning if the level rises. Using IoT, checking the temperature and gas leaks and sending messages in real time. The major goal is to provide a low-cost, ef- fective, and adaptable system for monitoring and managing the city's infrastructure.

3 Literature Survey

In [1], the author gives detailed explanation about the problem faced by India for sewage systems. In India, they have a higher pop- ulation, so a wastewater network is required. This paper explains the design and development of smart manhole. In [2], the author discussed the significance of manhole cover management in preventing accidents. Many accidents occur as a result of manhole cover displacement, manhole loss, or manhole cracking. The paper describes an IMCS for smart cities based on edge computing. In [3], the author discussed the smart underground infrastructure and reduce the risk for the scavengers when cleaning the under ground drainage and also help for the society. In [4], the author briefly explained the damage to the manhole system because it caused many accidents and put workers lives at risk. In smart manhole system, various sensors are used to manage and monitor the manhole. In [5], the authors discussed the "Monitoring Smart City Appli- cations using Raspberry PI based on IOT", which explains how to monitor smart city applications using Raspberry PI. The system is made up of sensors that gather various sorts of data and send it to the Raspberry Pi3 controller. The controller's output is sent to the control room and displayed on a personal computer. In [6], the authors presented the Subsurface Drainage Monitoring System

utilizing IOT, which explains the importance of adequate underground drainage for smart city cleanliness maintenance. In [7], the author discussed the "A Smart Real-time Drainage Monitoring System Using the Internet of Things". The AT mega 328 microcontroller is used in this setup to collect data from the sensors. This approach isn't the most effective technique for keep- ing track of drainage. In [8], the author's proposal for a smart city is to provide soci- ety with cleaner and better facilities in the future. When creating a smart city, smart subterranean infrastructure is a crucial element to consider. Monitoring the drainage system is critical to keeping the city clean and healthy. Because human monitoring is ineffective, drainage problems are handled slowly and take longer to resolve. To address all of these concerns, the system uses a wireless network. A sensor network made up of sensor nodes is created. The suggested system is a low-cost, low-maintenance, IoT-based real-time system that sends a message to the management station if a man- hole's threshold values are exceeded. This system lowers the risk of death for manual scavengers who clean underground drainage, while also benefiting the general public. In [9], the author detailed the manholes in poor nations are not well checked. These unsupervised manholes can pose a danger to people in a variety of ways. This article describes an intelligent automatic manhole monitoring system that detects dangerous chemicals and poisonous gases inside the manhole, as well as the absence of the manhole's cover, and emits an alarm for passed by in such circumstance, as well as notifying the appropriate authorities. The system has the potential to improve the overall quality of the environment. As a result, the responsible authorities can take appropriate steps to maintain the manhole. The system was used in an academic setting to perform automatic monitoring of a manhole in order to assess the suggested features.

4 Existing System

INTERNET OF THINGS

The Internet of Things (IoT) is a network of physical objects—"things"

—embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems through the inter- net. Smart gadgets that gather, send, and act on data using embedded CPUs, sensors, and communication hardware are referred to as IoT devices.

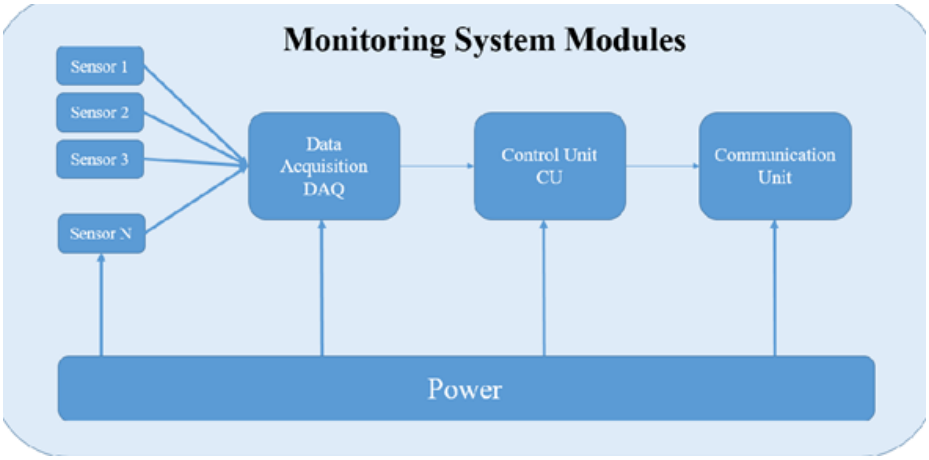

Fig. 1.IOT device based automated monitoring system

IoT devices link to an IoT gateway or other edge device to share sen- sor data, which is either routed to the cloud for analysis or analyzed locally. These gadgets may occasionally interact with one another and act on the information they receive.

5 Proposed System

In the model, it can monitor the data directly using the sensing compo- nents. It also monitors the values of the manhole system and sends the data to the system. The manhole system of today is not high-tech . So it's tough to find out what's wrong in the manhole if there's an issue. As a result, detecting and correcting faults has become time intensive. When pipe are entirely clogged, dealing with the problem becomes quite inconvenient. Workers confronted a slew of issues as a result of the manhole breakdown. The workers face many health hazards while entering into the manhole. While entering, it exposed gas which was present in the manhole caused severe death.

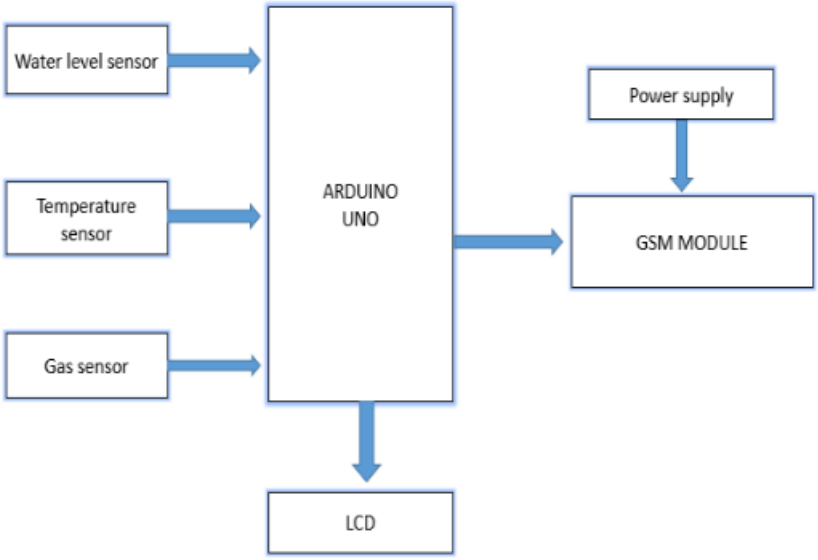

Fig.2.Block diagram of manhole system

HARDWARE REQUIREMENTS

- Arduino UNO.
- Water level sensor
- Gas sensor.
- Temperature sensor.
- GSM Module.
- LCD display.
- Resistor.
- LED.

SOFTWARE REQUIREMENTS

- Arduino IDE.
- Embedded C.

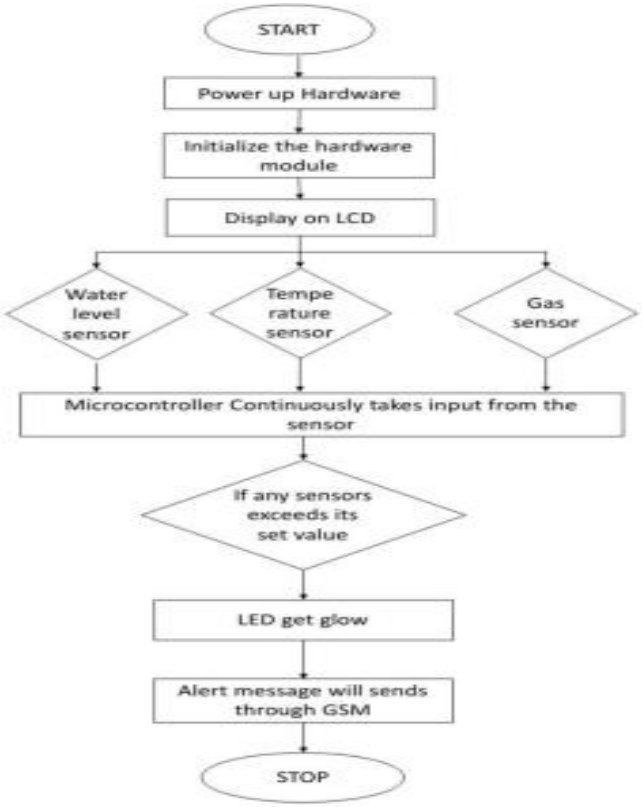

Fig.3. Flow chart of manhole system

5.1 Explanation of Flow chart

EXPLANATION OF WORKING MODEL

The readings of many sensors are taken into consideration in this research work, and the man- hole is constantly maintained and checked. The simulation method was carried out using Arduino. Then all of the values are double- checked, and the stages are as follows:

Step 1: The water level sensor determines whether or not the water level has risen. If yes, it sends a message through IoT to the corporation's headquarters; otherwise, it continues to monitor.

Step 2: The gas sensor will then check for the presence of gas within the manhole, and if there is any, it will send a notification; otherwise it will continue to monitor.

Step 3: The next sensor monitors for temperature increases, and if there is a significant rise, it alerts the authorities; otherwise, itcontin- ues to monitor.

6 Description

6.1 Water level sensor:

The water level sensor is used to determine how much water is in the manhole. If the water has increased from its original level, a notifica- tion will be sent to the authorities.

6.2 Gas Sensor

Gas sensor is used widely in various applications to sense whether the gas is present or not,so that gas sensor is used to check whether the harmful gas presence in the manhole. If it detects any harmful gas, the message will be sent to the corporation office. The MQ-6 sensor is a sensitive component and it is adjustable on the board and also it is a protection resistor. LPG, isobutene, and propane are particularly sensitive to the MQ-6 gas sensor, whereas alcohol is less sensitive.

Fig.4.Gas sensor

6.3 Temperature Sensor:

A temperature sensor is a gadget that measures how much heat energy an item produces. It also has a modest self-heating temperature. If the temperature rises above a certain threshold, an IOT message will be sent. The LM35 is an integrated circuit temperature sensor with a proportional output (in OC). Temperature is monitored more precisely with the LM35 than with a semiconductor device (thermistor).

Fig.5.Temperature sensor

6.4 GSM Module

GSM (Global System for Mobile Communication) is an open, digital cellular technology that allows mobile voice and data services to be sent. A GSM module assembles a GSM modem with communication interfaces like RS 232, USB, etc. It can easily communicate with a computer or microcontroller/microprocessor. In the adaptor is used to give power supply in the GSM module.

Fig.7. GSM MODULE

6.5 Arduino

Arduino is an open-source platform that may be used to create elec- trical creations. It is capable of running both hardware and software. Arduino is used to programme the physical board and upload com- puter code.

Fig.8.Arduino

6.6 LCD Display

Liquid Crystal Displays (LCDs) have materials which combination of both liquids. If any problem occurs in the manhole, the alerts will be displayed on the LCD.

Fig.9.LCD Dispaly

6.7 LED(Light Emitting Diode)

It stands for Light Emitting Diode. These are mainly used for making indicators. By emitting the light, it shows any problem that occurs in the manhole.

WORKING

The GSM module is given electricity in this document, and it immediately begins to detect any dangerous gases, temperature, and water level in the manhole. When any of the parameters change, thesystem notifies the authorities. The water level sensor monitors the level of water in the manhole and sends an early warning if it rises. The is followed by checking if the water level within the manhole is within control, and then a temperature sensor is used to determine the temper- ature. If the temperature in the manhole is above 32 degrees Celsius, the information is sent. Once the gas sensor determines that there is gas above the manhole, an urgent alert will be sent to the corporate office's authorities. If all of the variables are within control, monitor the gas level automatically.

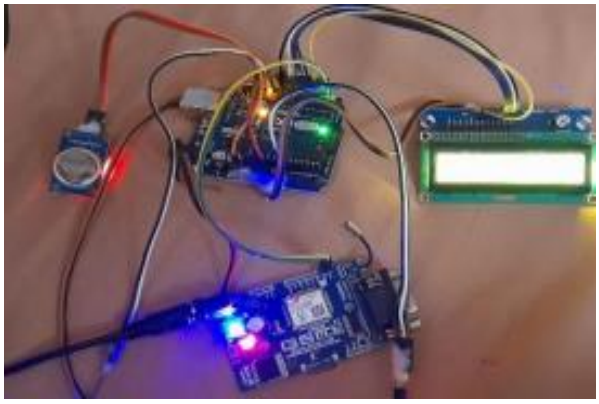

Fig.10. working Model(1) for smart Manhole And Monitoring System Using Iot

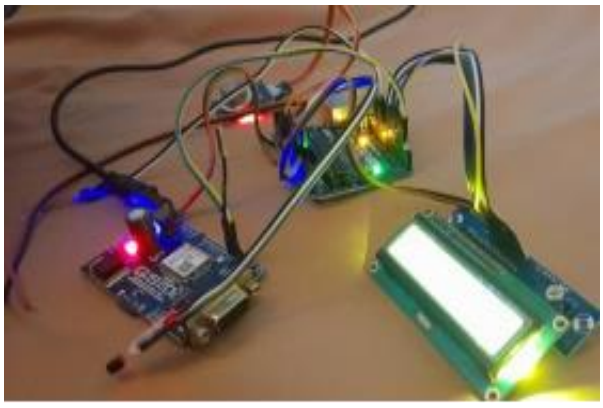

Fig.11.working Model(2) for smart Manhole And Monitoring System Using Iot

7 Result and Discussion

This paper proposes totally different ways of watching and maintain- ing the manhole system. It explains manhole identification in real time. It monitors various parameters like toxic gases, temperature, and water levels in the manhole using the technology of Internet of Things. These parameters are monitored continuously and updated through GSM. By receiving alerts from sensors, government officials can take necessary actions. In this way, unnecessary trips to monitor the status of manholes can be avoided, and only done as needed.

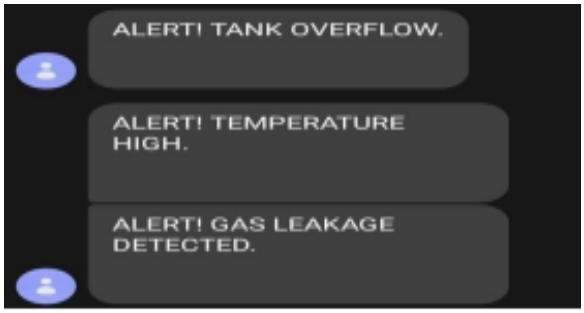

Fig.11. Output For Smart Manhole And Monitoring Using Iot

8 Future Work

Different sensors were added in the future to monitor the manholes and send the location using GPS. These sensors include an ultrasonic sensor that is used to determine whether the manhole cover is present. Nowadays, many accidents occur due to the absence of manhole cov- ers. The crack sensors detect any cracks in the manhole cover. The tilt sensor measures the angle of inclination of the manhole cover. GPS pinpoints the exact location of the manhole cover.

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