

IoT Based Underground Drainage Monitoring System



G Chandhini, B Chithra, P Kiruthikadevi, Bhagya Sasi, V. Kamal Kumar

Abstract: Underground drainage monitoring system plays an important role in keeping the cities clean and healthy. Compared to other countries, India consists of highest number of sewage workers. Exposure of sewage workers to poisonous gases like hydrogen sulphide, sulphur dioxide, carbon monoxide, methane, ammonia, nitrogen oxide increases the death of the sewage workers. The main aim of this project is to design a network system which helps in monitoring poisonous gases present in sewage. Whenever the gas level crosses the threshold value, the information with different gas ppm values is displayed in the smart phone through the app. It also indicates whether it is safe for the manual scavengers to work in the environment or not.

Keywords: Smart phone, IOT, Alarm, Threshold value, Sensors, Application, LED, Sewage system.

I. INTRODUCTION

The underground drainage system monitoring plays a very important role in making the cities clean. In India, the process of monitoring and maintaining the drainage system is done manually. The drainage consists of solid and liquid waste generated by hospitals, industries, factories and from homes. Hazardous gases are released from this waste which affects the human health. Exposure of sewage workers to poisonous gases increases the chances of sewage workers affected by diseases like paratyphoid fever, hepatitis and even death. Manual monitoring & cleaning the drainage is necessary but it leads to huge accidental deaths of human due to over gas in manholes. According to the recent survey atleast one worker had died while cleaning sewage tank for every five days since the beginning of 2017. The death of sewage workers has been increasing day by day.

II. PROPOSED SYSTEM

In order to protect the sewage worker from death we have come up with the solution called IOT based underground drainage monitoring system which helps in monitoring hazardous gases present in sewage & helps to alert the sewage workers whenever the gas level crosses the specified limit. It also displays the value of gas level in the smart phone through the app. It also helps to decide whether it is safe for the worker to work in the environment or not..

The proposed methodology is based on IoT, which helps in monitoring the hazardous gases present in sewage. Whenever the gas level crosses the threshold value, the sewage workers are alerted through a buzzer indicating whether it is safe for the worker to work or not through an app in the smartphone. This system helps in saving the life of sewage workers.

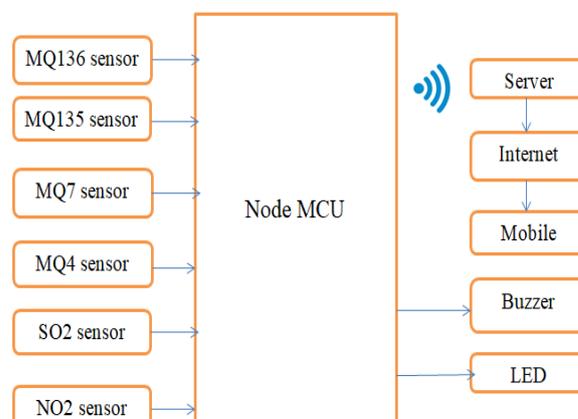


Figure 1. Block Diagram

Here six gas sensors such as MQ136, MQ135, MQ4, MQ7,SO2, N02 are used for monitoring hazardous gases such as hydrogen sulphide, ammonia, methane, carbon monoxide, sulphur dioxide, nitrogen oxide. These six sensors are connected to Node MCU and the output is connected to digital dashboard through server and to buzzer and LED. The six sensors used over here are used to sense the gas and sends the output to the Node MCU. The output of the Node MCU is connected to smart phone that is ionic application. In Node MCU the output value of the sensors are compared with threshold values and when the level goes above the specified limit it displays as danger in the smart phone. When the result is displayed in the smart phone the alarm is triggered using buzzer where by LED also glows. So that sewage worker working in the sewage are alerted and the deaths of manual scavengers can be avoided.

Revised Manuscript Received on May 15, 2020.

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III. SYSTEM SPECIFICATIONS:

1. Mq136 Sensor

MQ136 gas sensor is a message queue sensor which is used to detect hydrogen sulphide gas. This gas is produced as a result of microbial breakdown of organic material in the absence of oxygen. Hydrogen sulphide is a colourless gas with a odour of rotten eggs.

When the concentration of Hydrogen sulphide gas goes above 50 ppm it leads to irritation of eyes, nausea, headache & exposure to high level leads to rapid unconsciousness, coma & death.

2. MQ135 SENSOR

MQ135 gas sensor is used to detect gases like NH₃, NO_x, Alcohol, Benzene, Smoke and CO₂. Its detection range is 10 to 50 ppm for NH₃ 10 to 50 ppm for benzene, 10 to 50 for alcohol. It is mainly used for air quality monitoring application and is also used in domestic & Industrial purpose. Its operating voltage is +5V. Exposure to MQ135 sensor causes irritation in respiratory system, eyes , nose & throat. It also causes lung damage and can result in blindness.

3. MQ7 SENSOR

MQ7 gas sensor is used to detect carbon monoxide gas. The detection range of carbon monoxide gas ranges from 20-2000 ppm. If carbon monoxide levels are high the person may become unconscious or die. Exposure to moderate level of this gas also increases the risk of heart disease.

4. MQ4 SENSOR

MQ4 gas sensor is used to detect methane gas. The detection range of methane gas ranges from 300-10,000 ppm. This sensor is highly sensitive to methane and natural gas. Exposure to high levels of methane can result in nausea, memory loss and loss of consciousness.

5. SO2 SENSOR

SO₂ sensor is used to detect the concentration of sulphur dioxide gas. It is toxic gas which leads to many health problems. It's detection range is 0-2000ppm. It is a toxic gas which affects the respiratory system, particularly lung function. It causes coughing and leads to asthma and chronic bronchitis.

6. NO2 SENSOR

NO₂ gas sensor is used to detect nitrogen dioxide gas. It's detection range is 5-10 ppm. This is one of the most dangerous gas which can seriously damage the respiratory system with a very low concentration. It can also lead to nausea, irritation in eyes.

7. NODE MCU

The Node MCU (node microcontroller) is an open source hardware and software. The software is build around a system on a chip (SOC) called the ESP8266 and hardware which is based on ESP12 module, scripting languages Lua is used. The ESP8266 node MCU has total 17 General Purpose I/O Pins. Node MCU has inbuild wifi, more GPIOs and supports Bluetooth 4.2. It is very cheap when compare to

Arduino UNO. Node MCU is the heart of the proposed system which controls the entire process.

IV. RESULTS

An ionic app is developed to display the amount of gas levels individually to the sewage workers. When the gas level crosses the threshold value, the buzzer makes a sound alerating the sewage worker. This system prevents the death of sewage workers. Below two cases are mentyioned for the clear understanding of the working of ionic application.

CASE 1

In case 1 all the gas levels are below the threshold values so buzzer will not make sound & led does not glow. 1

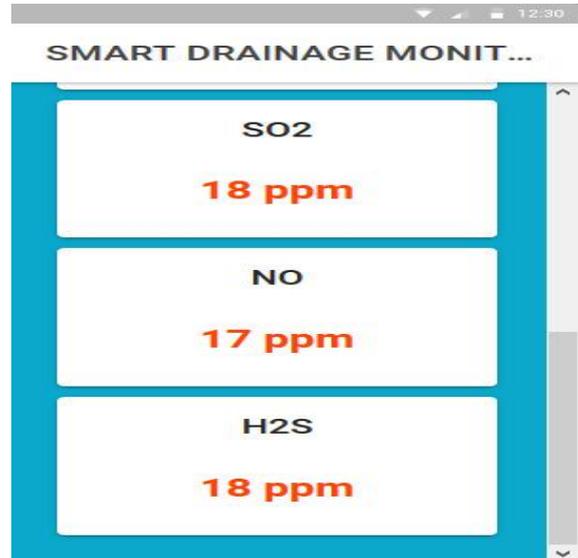


Figure 2. Software Output(Case 1)

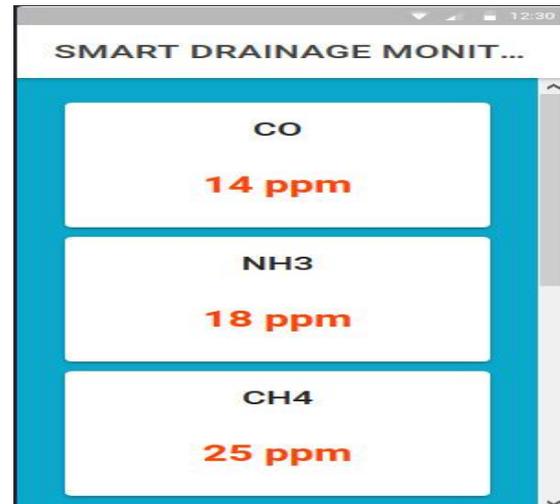


Figure 3. Software Output (Case 1)

CASE 2

In case 2, the Carbonmonoxide gas is above the threshold value so buzzer makes a sound & led glows indicating it is not safe for the sewage worker to work over there. By following this method the death of sewage workers can be avoided.

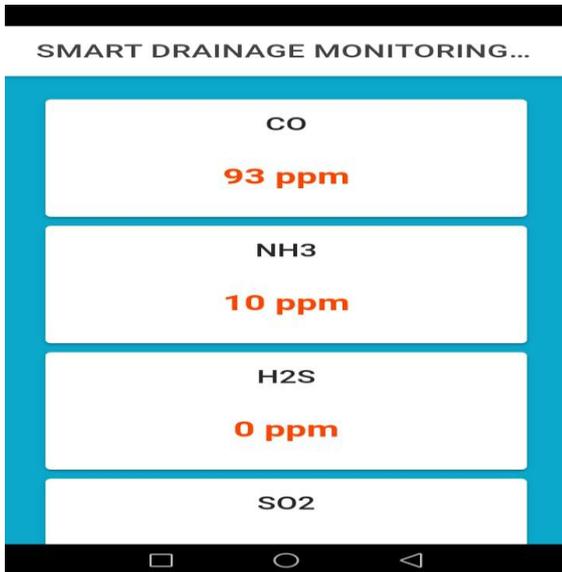


Figure 4. Software Output(Case 2)

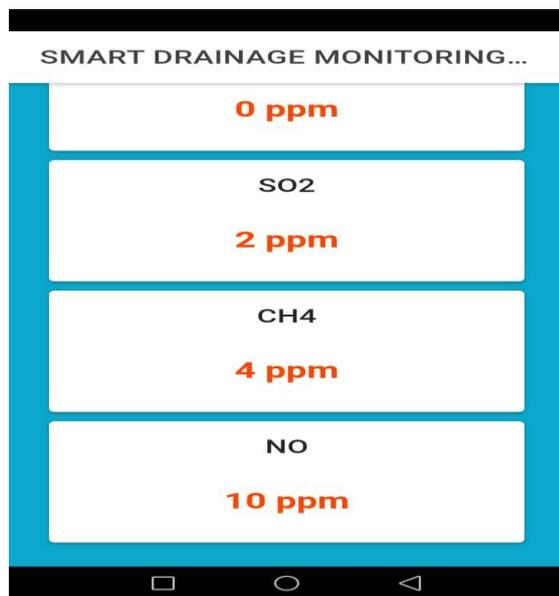


Figure 5. Software Output(Case 2)

V. CONCLUSION

This project provides a smart solution to monitor the toxic gases present in sewage and alert the manual scavengers when the level goes above the specified limit. Here six sensors are used to detect the gases and node MCU is the heart of the system which controls the entire system. Node MCU consists of a inbuilt Wi-Fi which connects the whole process to internet and the output is displayed in the smart phone through the app. The smart drainage monitoring system helps the people to move to safer areas when the gas level is above the specified limit. This system helps to reduce the death of sewage workers and it also has an advantage to monitor the amount of pollution on their mobile phones using the application.

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