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Smart Safety Monitoring System for Sewage Workers

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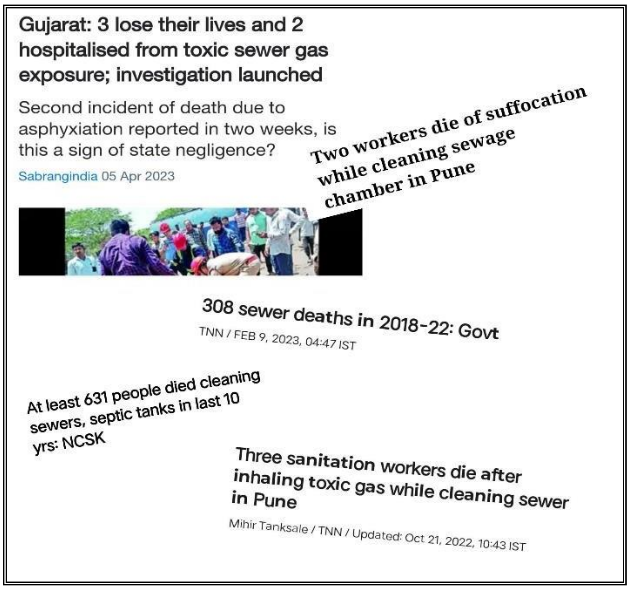
Abstract— This paper primarily focuses on the safety of sewage workers because a significant number of sewage employees pass away every year as a result of inadequate facilities and dangerous poisonous gases emitted during sewage cleaning. Our papers's primary goal is to prevent the sewage worker from dying and to ensure that there is a low risk to their health. This system for real-time gas monitoring is highly helpful and serves as safety gear. The instrument will gather data for the cloud application while continuously monitoring the sewage. Whenever a hazardous gas is discovered and it exceeds a certain danger level, an application will send a message to the appropriate authorities with specific information about the gas.

Keywords— Internet of Things, sewage gas monitoring system, GLOBAL SYSTEM FOR MOBILE (GSM) Subscriber Identity Module (SIM) etc.

I. INTRODUCTION

Gases with high toxicity level include carbon monoxide, methane, and hydrogen sulphide. In 2018, toxic sewer gas kills 5 people in Delhi. When fixing a sewage treatment system, five guys had to be sent to the hospital after losing consciousness. Thus, sewage gases are hazardous to human health.

Environmental sewage the use of an Internet of Things (IoT) device and platform to monitor hazardous gas has been suggested as a way to assist sewer workers who put their lives in danger and to assure minimal health risk. [4] The death rate among sewage employees has risen recently asa result of these toxic pollutants. The failure to cleanse sewage when it reaches a harmful level causes hundreds of sewage cleaners to pass away every year in accidents and from a variety of illnesses including hepatitis and typhoid that are brought on by sudden or prolonged exposure to hazardous gases. The formation of toxic wastes that produce hazardous gases from the natural decomposition of sewage and its mixes in slurries is the main source of sewage gases. The formation of toxic wastes that produce hazardous gases from the natural decomposition of sewage and its mixes in slurries is the main source of sewage gases. The created system is adaptable to different sewage facilities, both urban and rural. By making minor design changes, the system may be made to function properly in both home and industrial settings.



The ThingSpeak IoT platform allows remote access to concentration or ppm levels from any location in the world. The main components of this paper were the creation of an IoT platform and hardware for monitoring the setup. This system offers us a solution to the dynamically changing sewer environment as compared to earlier systems, which lacked real-time monitoring and online updating of the status of gas concentrations in the air.

I. RELATED WORK

By using a sewage monitoring system, a helpful method of warning people or facilities that employ these workers to leave certain locations when ppm levels of Unrecommended levels of certain gases are reached. This protects workers' lives and keeps them safe from dangers when they are in hazardous surroundings. Prior to sending in manual employees, organizations frequently use septic tanks and chemical sewage treatment at industrial locations, but there is no system in place to monitor harmful levels.

A cyberphysical system or embedded system that can process sensor data and ensure wireless communication to the server is referred to as a smart system. Scientists looking at the dangers of industrial effluent on the environment and the air have already proposed a variety of systems. IoT could be utilised, for instance, to deal with the issue of air pollution, as suggested in pollunio, by reducing ground-level ozone and particulate matter that causes respiratory illnesses, such as Sulphur dioxide, nitrogen oxides, or airborne particles created by the emission of harmful gases from cars that worsen air quality.

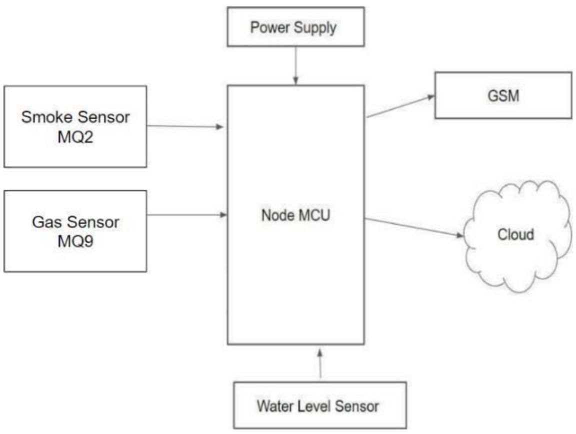
The Internet of Things (IoT) is widely regarded by experts as one of the most cutting-edge developments with the potential to materially alter wellness, security, and safety as well as address practical repercussions inside the general public. This technological advancement can work with sensors, and a smart system is created for application in the industrial sector.

II. OBJECTIVES

The main motto of this paper is to provide following objectives:

To alert the worker if any parameter goes beyond its specific range. As soon as the parameter exceeds then the authorized person's registered mobile device should get a warning message if the level of dangerous gas exceeds the threshold.

Fig. 1 Block Diagram



A. A. NodeMCU:

The NodeMCU (Node MicroController Unit) is an open source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains all crucial elements of the modern computer: CPU, RAM, networking (wifi), and even a modern operating system and SDK.

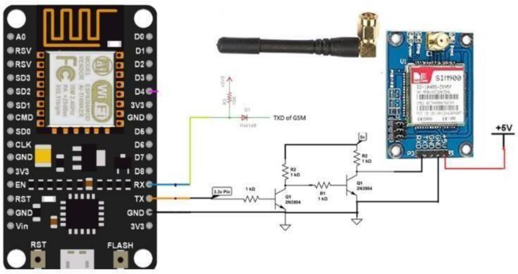


Fig.2. Interfacing of NodeMCU with GSM 900A

B. B. GLOBAL SYSTEM FOR MOBILE:

GSM modems are special sorts of modems that function over wireless networks subscription-based, similar to a mobile phone. Essentially a GSM modem functions as a mobile phone for a computer by accepting a Subscriber Identity Module (SIM) card. GSM is an open, digital cellular technology that uses the 850MHz, 900MHz, 1800MHz, and 1900MHz frequency bands to provide mobile voice and data services.

The SIM900A is an easily available GSM/GPRS module, used in many mobile phones and PDA. The Internet of Things (IoT) and embedded applications can both be developed using the module. The SIM900A is a dual-band GSM/GPRS engine that operates on the EGSM 900MHz and DCS 1800MHz frequencies. The GPRS multi-slot class 10/class 8 (optional) and CS-1, CS-2, CS-3, and CS-4 coding methods are supported by the SIM900A.

C. C. Gas Sensor (MQ9):

Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion. This type of device is used widely in industry and can be found in locations, such as on the oil rigs, to monitor manufacturing processes and emerging to technologies such as that the photovoltaic. They may be used as in firefighting. Gas sensor is a device that detects the presence of hazardous gases in that area often as part of safety system.

Fig. 3. Gas sensor (MQ9)

The Grove - Gas Sensor (MQ9) module is useful for gas leakage detection (in home and industry). It is suitable for detecting LPG, CO, and CH4. Due to its high sensitivity and fast response time, measurements can be taken as soon as possible.

Sensitive material of MQ-9 gas sensor is SnO_2, which with lower conductivity in clean air. It make detection by method of cycle high and low temperature, and detect CO when low temperature (heated by 1.5V). The sensor's conductivity is higher along with the gas concentration rising. When high Temperature (heated by 5.0V), it detects Methane, Propane etc. combustible gas and cleans the other gases adsorbed under low temperature. Please use simple electronic circuit, convert change of conductivity to correspond output signal of gas concentration.

D. D. Smoke Sensor (MQ2):

The MQ2 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemiresistors because sensing is based on the change in resistance of the sensing material when exposed to gasses.

Fig 4. Smoke Sensor (MQ2)

The MQ2 gas sensor operates on 5V DC and consumes approximately 800mW. It can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations ranging from 200 to 10000 ppm.

E. E. Water Level Sensor:

Level sensors are used to detect the level of substances that can flow. Such substances include liquids, slurries, granular material and powders. Level measurements can be done inside containers or it can be the level of a river or lake.

Fig. 5. Water Level Sensor

The water level indicator circuits are used in factories, chemical plants, and electrical substations and in other liquid storage systems. There are many possible uses for this simple system, examples include monitoring a sump pit (to control pump activation), rainfall detection, and leakage detection.

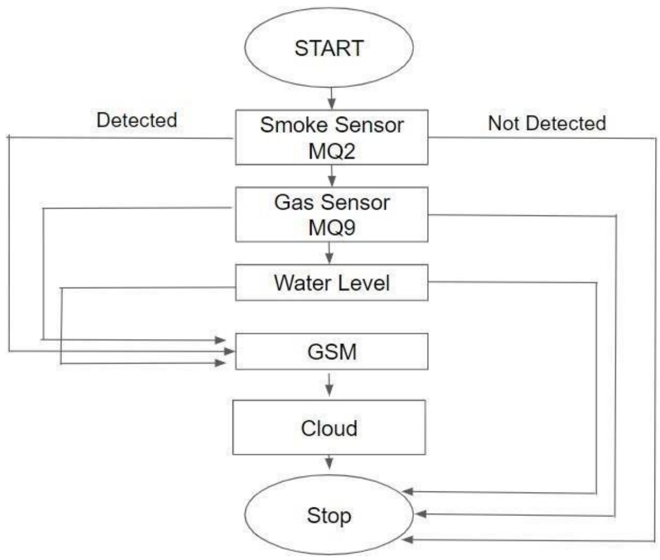


Fig.6. Flowchart of system

RESULTS AND ANALYSIS

The proposed methodology helps to prevent the sudden accident of workers and also helps to keep the society clean. The smart safety device cost wise less and fast in accessing the WSN and transfer the information both the concerned department and emergency department. The proposed device helps the worker at a basic level of knowledge to understand the gas level and indication light. The smart device can be implemented and used across the world and also helps to monitor the overflow of the sewage water. This implementation is done with good result.

V. CONCLUSION AND FUTURE SCOPE

The suggested practice aids in keeping society clean as well as preventing unexpected workplace accidents. The smart safety gadget has a lower cost and accesses the WSN quickly, sending information to the concerned department and the emergency room. The suggested equipment aids the administration in gathering precise information about the number of harmful gases present in the sewage, if any. At some point, the system will notify him/her of any threat to the employees. The smart device can be put into operation anywhere in the world and aids in monitoring sewage water overflows.

The future work might be implemented as an Android application that connects to a smart safety device and notifies the user of any of the aforementioned dangers. The worker's location might also be included in the message. With the use of AI/ML, the data that is continuously preserved in the cloud can also be utilized to create datasets that can be used to predict mishaps of this nature.

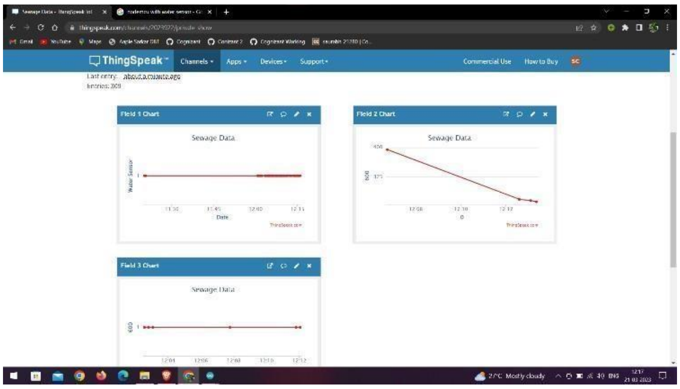


Fig.7. Sensor Readings (Data)

Field 1 Chart – Water Sensor

Since, no water is detected. Therefore, Analog reading of the sensor is 1 and a Straight Line.

Field 2 Chart – MQ9 Sensor

Since, some gas is detected. Therefore, the digital reading of sensor is fluctuating.

Field 3 Chart – MQ2 Sensor

Since, some gas is not detected. Therefore, Analog reading of the sensor is 1 and a Straight Line.

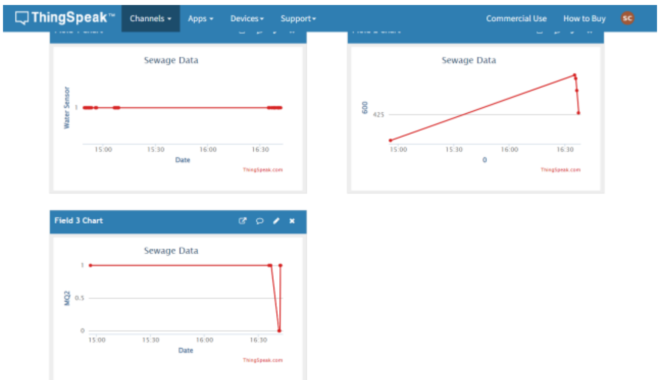


Fig.8. Sensor Readings (Data)

Field 1 Chart – Water Sensor

Since, no water is detected. Therefore, Analog reading of the sensor is 1 and a Straight Line.

Field 2 Chart – MQ9 Sensor

Since, some gas is detected. Therefore, the digital reading of sensor is fluctuating.

Field 3 Chart – MQ2 Sensor

Since, some gas was detected. Therefore, Analog reading of the sensor is fluctuated from 1 to 0.

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