Smart System For Drainage Worker Safety

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***Abstract*— Most of the cities adopted the underground drainage system and it's the duty of Municipal Corporation to maintain healthy and safety of cities. If the drainage system is not properly managed, then pure water get contaminate with drainage water and infectious diseases may get spread. Drainage cleaning workers are not aware of risk of sudden attack of poisonous gas. Since, the gases are odorless if exposed for long time which may causes serious health problems. Due to the lack of using proper gas leakage detection system, a number of dangerous accidents occur during the last few decades. To overcome all these problems, effective monitoring system is needed in the drainage channels. The detected system is proposed with these gas sensors like MQ4 sensor, methane sensor, hydrogen sulphide sensor. The gases could be detected with these sensors. CO, CH4, H2S gases are highly toxic to human hence the proposed system will give alert to the LCD display after reaching the threshold level of each gas sensors. Then, people get alert through the buzzer sound. Moreover, the drainage workers are supposed to provide with additional backup oxygen for their safety. The main theme of this project is to evacuate the gases in drainage and it could be performed with the help of air sucking pump.**

***Index Terms*— Sewage, Sensors, Toxic Gases, Air Sucking Pump, Alert and Safety.**

I. INTRODUCTION

Drainage worker may be exposed to hazardous gases, fumes and vapors resulting in serious poisoning. Incidents of gas poisoning in drainage work often result in multiple death. The project is used to reduce the risks on eliminate it. To track the presence of hazardous gases, the most threatening among them namely carbon monoxide, methane, and hydrogen sulfide present in drainage. To identify the safe limits of these gases and calculate the level in that situation, concentration of these toxic gases present in the air is identified accurately in PPM. To warn the workers about the potential threat that they might face on account of exposure of such gases above a safety limit. Evacuation of gases is using Air sucking pump.

II. LITERATURE SURVEY

In 2019, kumar visvam devados ambeth can be produced in this methods Hazardous gas contamination causes threat to human life. In many developing countries, the sewer is still cleaned by unskilled labours. Situation may arise where harmful gases may get emitted via sewage and can potentially endanger life. Furthermore, in coal mining, there is a possibility of hitting a source of natural gas which cannot be determined unless or until a sensor is utilized. To prevent such hazardous situations, this new gas detection system detects those types of gases, analyses them for us and provides essential details about it. [1]. W. Khalaf, explained about the Sensor array system for gases identification and quantification 2018.[2]. In 2017, Ali Gulbag, Fevzullah Temurtas

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came up with a new methods in, a study on the quantitative classification of volatile organic gas mixtures was made using parallel and cascade neural networks. A single neural network structure was also used for comparison. The quartz crystal microbalance type sensors were used to detect gas mixture. A computer controlled measurement and automation system with IEEE 448 card was used to control the gas concentration values and collect the sensor responses.[3]. In 2016, R.Kumar to produce the process in laid before a new soft computational approach using multi-scale principle component analysis for discrimination of gases. The network was found to identify the gas with high success rate. A new soft computational approach for discrimination of odours/ gases is presented. The proposed technique is applied on the raw data obtained from the responses of oxygen plasma treated thick film tin oxide sensor array exposed to four different odours/gases. The data generated from the sensor array response were subjected to wavelet transform and appropriate coefficients were selected using multi-scale principal component analysis.[4]. S. Capone, P. Siciliano, Analysis of CO and CH4 gas mixtures by using a micro machined sensor array 2016.[5]. In 2015, A. Ozmen the paper presents a system, which is made of an array of eight phthalocyanine-coated QCM sensors and an ANN to find the corresponding composition of a gas mixture. The digital data collected from the sensor responses were pre-processed by a sliding window algorithm, and then used to train a three layer ANN to determine the gas compositions. [6]. The system is tested with the following gas mixtures are 1. Ethanol-acetone, 2. Ethanol-trichloroethylene, 3. Acetone- trichloroethylene.

In 2014, V.S. Velladurai proposed a new methodology in safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed in industries and this system can also be used in homes, villages, cities and officies. Most of the drainage and unused wells are forming toxic gases. The main objective of this work is designing, alerting system and gas purification. The hazardous gases like H2S, CO and methane will be sensed and displayed each and every second in the LCD display. If these gases exceed the normal level then an alarm.[7]. In 2013, Dhanalakshmi can to produce the new technology in the internet of things connects the entire surrounding smart device to internet. These devices use sensors and actuators to communicate with each other across the internet. IOT helps to control and sense the object remotely over the existing network, so that it has direct integration of physical world to computer based world. The traditional drainage monitoring system failed to acknowledge in the field of alerting the people about the gas explosion, increase in the water level and the opened lid.[8].

III. SMART DRAINAGE SYSTEM

The ardent passion towards contributing to the society in order to save human life was the main reason behind the origin of this project. Various articles which stated the numerous cessations of human life while attempting to treat underground sewers intrigued our team to develop the model. For those who work in atmosphere that could be hazardous to their health, selecting the right gas detectors could be the single most important decision they could ever make. Their life could hinge on that decision.

So it is critical that the users make him aware of the hazards that could be encountered and the proper sensors to protect them. Data gathered in the late 70's and early 80's indicated that 65% of all those who died in confined spaces where unaware that the space they were entering was a potential hazard over 50% of confined space depths occur to the rescuers and over one third of the fatalities occurred after the space was tested and declared space and the gas detectors was removed.

Gas detectors have been around for a long time starting with the infamous methane sniffing canary, which sadly was a one-shot device, which when subjected to methane, tended to die rather quickly with no audio and visual along capabilities other than being slightly cheap and a total lack of motion. Fortunately, technology has advanced significantly and we find ourselves at this point in time with some sophisticated electronic equipment. But even the most sophisticated technology is useless if the sensors used are to detect the gases present.

A. Underlying Problems

Broad patterns and contexts in which these incidents commonly occur emerge starkly from the PUDR study. The case studies divulge repetitive underlying problems that are overlooked by state authorities despite death after death. The report sheds crucial light on various aspects of the workers' lives and their laboring conditions, as well as the culpable fault-lines that define urban planning.

The first of these is the absence of any arrangements and provisioning for scientific sewerage and seepage systems and their regular and effective maintenance. There are swathes of entire areas and institutions in the

capital region where state-laid sewerage lines either do not exist or if they do, these are completely inadequate and ill maintained. Sewage disposal is in effect left to the devices of individuals, with no official monitoring, regulation or authorization operating on the ground.

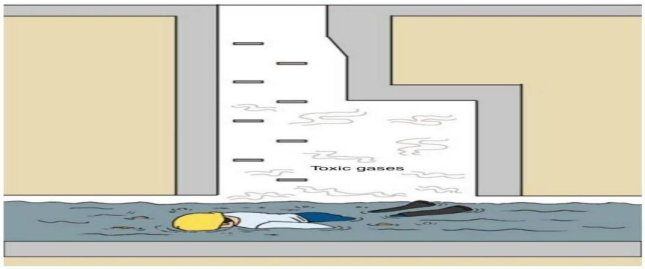

Figure 3. Death Due To The Attack Of Toxic Gase

Figure 3.1Workers In Drainage

According to the Sewerage Master Plan of National Capital Region, only about 50% of the population is covered by sewerage network, which suffers from disrepair, siltation and settling or collapse; and only about 57% of the total sewage generated by Delhi sewage is treated through 34 Waste Water Treatment Plants.
The rest of the sewage and waste water from un-sewage areas and untreated sewage either flows into drains which mostly end up in the Yamuna River. Other un-sewage areas rely on septic tanks. Waste water and faucal sludge accumulates in these tanks and regular cleaning is needed. This is what has led to a spike in the need for the services of sewage cleaning workers.

B. Working Conditions Ignored

Another aspect that policy makers and planners seem to have lost sight of in the much-touted policy push towards sanitation under the present regime is the need for continuous maintenance of sanitation systems and for safe working conditions for those involved in it. The Swatch Bharat Mission entails massive expansion of faucal sludge cleaning work which is, as mentioned, hazardous as well as brutal and stigmatizing. The workers are required to work while being often literally immersed in filth, in faucal and other domestic and industrial sludge surrounded by poisonous gases emanating there from. The deaths of workers while trying to keep sewer lines and septic tanks working, and the many ailments and diseases they suffer owing to the nature of the work are not cited once in the policy statements on sanitation.

IV. EXISTING SYSTEM

The existing methodology is based on the IoT, which helps to save the life of the drainage workers while working by getting into the manholes. The mixture of poisonous gas will attack them when they try to get into the manhole to clean the drainage. This smart safety system will help to save the workers live and to keep the society clean. This may also monitor the society when the drainage is filled and automatically send the notification to the department so that they will send the concerned worker to clear and solve the blockage of the drainage system.

Figure 3.2 Lack Of Awareness

The sensor is placed under the drainage manhole and it is connected with the WSN so that the sensor sends the notification to the communication department so that they can send the concern team workers to find solutions to the problem. The second part is the major part ensures the safety of the workers and the save the workers life. The existing process in the form of smart safety IoT device that is made up of raspberry pi which will control the gas sensor and display the gas level on the LED display.

The green light will glow that may confirm the gas level is normal if it is not in the normal level of gas the red light will glow so that workers can enter into the manholes with safety precautions. The device also contains an emergency button that will help to give the emergency notification to the communication department and emergency department via the WSN. That supposes the worker is attacked dangerous gas the man will press the emergency button that will send emergency notification to their department and emergency departments. Hence without delay they can be saved.

V. BLOCK DIAGRAM

Figure 3.3 Block Diagram

C. Arduino Nano Microcontroller

Arduino Nano is a microcontroller board designed by Arduino.cc. The microcontroller used in the Arduino Nano is Atmega328, the same one as used in Arduino UNO. It has a wide range of applications and is a major microcontroller board because of its small size and flexibility. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors and other actuators. Arduino Nano is a surface amount breadboard embedded version with integrated USB. The Nano is automatically sense and switch to the higher potential source of power, there is no need for the power select jumper. This new version 3.0 comes with ATMEGA328 which offer more data space.

Figure 5.1 Arduino Nano Microcontroller

D. Carbon Monoxide Sensor

Sensitive Material of MQ-7 gas sensor is SnO2, 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.
Carbon Monoxide Sensor is used to sense the Carbon Monoxide gas and it has a digital input signals low and high. If the input signal is low, there is no gas affected then if the input signal is high, gas is affected the worker.

Figure.5.2 Carbon Monoxide Sensor

E. Hydrogen Sulphide Sensor

In an electrochemical sensor the cells combine enclosed electrodes and electrolyte. H2S diffuses through a permeable membrane, the volume of H2S increases in the air, an oxidation or reduction reaction occurs at one of the electrodes, and as a result, a linear current change occurs. A gas monitor helps keep workers safe in hazardous environments. Our single gas H2S monitor is designed to alert workers when the level of Hydrogen Sulphide reaches the high or low level set point.

Figure 5.3 Hydrogen Sulphide Sensor

A H2S gas Sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of gas the Sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor which can be measured as output voltage. H2S sensor is used to sense the H2S gas and it has a digital input signal low and high.

F. Methane Gas Sensor

Methane gas sensor detects the concentration of methane gas in the air and outputs its reading as an analog voltage. Methane gas is flammable and combustible with oxygen. Methane one of the primary components of natural gas, so it is readily found in the environment and used in the diverse range of application. Methane has a lower explosion limit of 5.0%.

Figure 5.4 Methane Gas Sensor

A Methane gas sensor is a device used as an integral part of fixed gas detection. For methane gas it has digital inputs signals such as low on the high. If the inputs signals low, there is no gas affected then, if the input signals is high the gas is affected then the LCD display shows methane gas is detected.

G. Air Sucking Pump

A Suction pump works by atmospheric pressure; when the piston is raised, creating a partial vacuum, atmospheric pressure outside forces water into the cylinder, whence it is permitted to escape by an outlet valve. Atmospheric pressure alone can force water to a maximum height of about. Materials flow from one location to another when a pressure difference is created between two locations. This phenomenon is the basic working principle of an ideal vacuum cleaner. When a centrifugal fan rotates it makes the air to flow by adding it external kinetic energy. Fill an enclosed pressure capable tank with water. Have the water outlet at the bottom and air pressure inlet at the top. Pump air in and water goes out. Not so much a pump but an effective way to move water from one place to another.

Figure 5.5 Air Sucking Pump

Any high point in the suction line can become filled with air and interference with proper operation of the pump. This is particularly true when the liquid being pumped contains an appreciable amount of air in the solution or of entrained air and the pump is handling a suction lift. Air suction pump is a device which increases the velocity of air or gas when it is passed through equipped impellers. They are mainly used for flow of gas required for exhausting, aspirating, cooling, ventilating, conveying etc. Suction pressure range 400-650mmhg. Speed in rpm = 2880. The voltage level of Air suction pump 415v, frequency range 50 HZ, suction capacity (cube m per hr) = .1000.

H. LCD Display

An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16*2 LCD display is a very basic module commonly used in DIYs and circuits. The 16*2 translates a display 16 character per line in 2 such lines. In the LCD each character is displayed in a 5*7 pixel matrix. Methane sensor, Carbon monoxide sensor, Hydrogen sulphide sensor performances are displayed in LCD.

Figure 5.6 LCD Display

I. Relay Circuit

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contact in another one. When a relay contact is normally closed, there is a closed contact when the relay is not energized. Its basic function is to allow a low power control voltage operate a high power switch. The control and the switch are electrically isolated from each other and they have their own voltage and current ratings. Operating voltage is 5v and max current is 20mA.

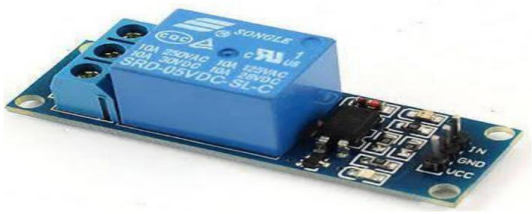

Figure 5.7 Relay Circuit

J. Buzzer

Buzzer is used to give alert sound based on the performance. If it is reaches to abnormal state buzzer sound will produced. The buzzer consists of an outside case with two pins to attach it to power and ground. When current is applied to the buzzer it causes the ceramic disk to contract or expand. This causes the surrounding disc to vibrate the sound that you hear.

Figure 5.8 Buzzer

VI. Hardware Requirement

- PIC 16F72
- MQ4 Sensor
- MQ136 Sensor
- MQ7 Sensor
- LCD Display
- Buzzer
- LED Indication

VII. Software Requirement

- CCS C Compiler

VIII. Circuit Diagram

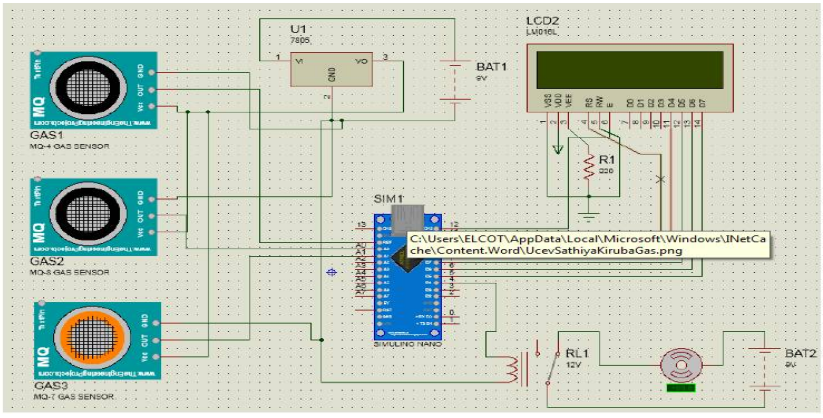

Figure 5.9 Circuit Diagram

IX. Proposed System

- The proposed system consists of gas sensors like MQ4,MQ7 and MQ136 which is used to detect toxic gases like H2S,CO and methane
- The microcontroller which is used to measure the toxic gases level in term of PPM
- If any of the toxic content value is reached above the threshold level then the system, automatically alerts the buzzer and LED indication
- The whole system implemented in stick.

X. Conclusion

The accuracy of our sensor system owes to the calibration procedure. This system was able to detect carbon monoxide and methane at the same time adding to its efficiency. The system provides the user with potential health hazards on continuous exposure to a certain concentration of the gas in addition to its existence amount. Thus, the workers using the detector not only get the concentration of the toxic gases present in air but also the health hazards it could bring. The concept of providing the user with the effect it could cause eliminates the effect of illiteracy and carelessness. The system can be enhanced by increasing the number of gases which can be detected by the detector. Thus system can be extended to multiple purposes and can be modified according to the environment by adding or removing the sensors in the system. Thus the detector would have the same goal of defecting toxic gases but would find its applications in many fields.

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