

Effluent Gases Detection System For Sewage

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Abstract— The safety of the people shall be the highest law. As safety concerns are reasonable it is necessary to implement good safety system in places of work. Toxic effluents are more often released from sewage and sanitary areas which cannot be easily detected by human senses. Acquaintance of make them preventive and bettering sewers' safety is lacking largely. This paper focuses on designing an embedded system to track down effluents and generate alert signal through wireless network. The hazardous gases like ammonia, hydrogen sulphide, methane and carbon monoxide turns out from sewage are sensed by gas sensors every moment and updated to the client when it surpass the normal grade. The advantage of this smart system is its quick response time and accurate detection in extremity cases with the proof of safety.

Keywords— sensor nodes, gas sensors, RFID, exposure limit, alert signal

I. INTRODUCTION

Health and safety has always been top priority despite the increasing technology and human race. Though the causes and effects of sewage gases are high, there is growing demand for effective monitoring and alerting system. Without a proper sewage management system, our society can be exposed to extensive damage to our lives. Some of the areas to be concerned based on top of economical, social aspects for maintaining sustainability in the sewerage design are the requirements of energy and control of odor. The stability of such infrastructure is getting affected for many decades in India which has given the unaccountable effects on human and economic costs related for the infrastructural improvement of the projects. This sewerage system is therefore in need for the availability of cheap and less valued workers of low caste people. This system of sewerage has worsened the physical vulnerability and poor health of sewerage labors significantly. The lack of prior caring of sewage work is the witness for the deaths of thousands of sewage cleaners throughout the year from accidents and various diseases such as hepatitis and typhoid due to sudden or sustained exposure to hazardous gases like carbon monoxide, methane, hydrogen sulphide and sulphur dioxide.

A better knowledge related to hazards in the surroundings is necessary for the prevention of poisoning of gases. These gases have to be keep on track so that enormous rise in the normal level of effluents should be known and corrective measures can be taken. In contrary, the existing systems available are not much portable and are not affordable. Also it is hard to implement. Hence an embedded system is designed with Arduino UNO and various gas sensors with wireless network for the purpose of detection and altering that helps in

eliminating the lives of human which is being endangered. The system is affordable to implement at well-defined locations and monitored from single base station.

II. RELATED WORK

A paper, "Embedded system for Hazardous Gas detection and Alerting", focuses on the intelligent system for hazardous gas detection with emergency alarm when LPG and combustible gas were sensed. It is monitored by PIC microcontroller. A signal is generated and message is sent to the licensed user as an alerting system to help in faster reduction of the critical situation. Certainly this system detects only two gases. The captious level of respective gas should be known. This system is useful only in residential areas for domestic use.

A paper "Control and Monitoring system for Liquefied Petroleum Gas Detection", focuses on monitoring system. When a suspicious leak occurs, sensor in the system detects the leakage between 400-600ppm and sends the alert message to the end user and activates the alarm to provide the protection circuitry. It controls the knob of cylinder using relay DC motor. It automatically register for cylinder requirement when it reaches the lowest weight 500g. This system highly focuses only on domestic gas detection.

Isaac. O. Osunmakinde in the year 2013 released a paper, "Towards Safety from Toxic Gases in Underground Mines Using Wireless Sensor Networks and Ambient Intelligence". It examines the presence of indwelling toxic gases in critical plots, their layoff and mode in air to prevent miners from contracting diseases. It mainly focuses on devious monitoring composition of wireless sensor network. This inquiry focuses on decision making about safety improvements only in restricted areas of mines and hence it shall be unaffordable in monitoring drainage systems where the whole atmosphere differs huge. Since the modeling of WSN is based on ambient intelligence, the monitoring agent should be a skilled person to maintain the system with flexibility.

"Sewer Snort: A Drifting sensor for In-situ Sewer Gas Monitoring", a paper proposed a concept of using a drifting sensors for the purpose of monitoring sewer gas. Sewer Snort dispensers are executed at strategic areas by analyzing the sewer map and inspection demands. The dispensing schedule is framed based on the applications. Once it is deployed, there is a need to track its position. This system operates with the construction of pipe profile.

III. PROPOSED SYSTEM

A. Hardware Design

In this proposed system we used the various gas sensors for analyzing the presence of hazardous gases in the sewage. The setup at different nodes is controlled by single receiver end. The sensor produces range of values which is being emitted from the sewage to the controlling kit. Depending on the predefined condition, the output will be sent through RFID

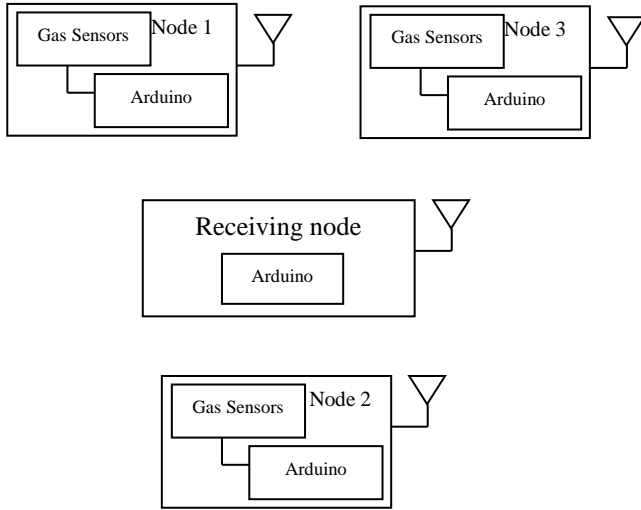


Fig. 1 Block Diagram

B. Carbon Di-Oxide Sensors

A carbon dioxide sensor is a device used for the measurement of carbon dioxide gas. The most common conventions for CO₂ sensors are infrared gas sensors (NDIR) and chemical gas sensors. CO₂ measurement is very much important in monitoring indoor air quality, the functioning of the lungs in the form of a capnographic device.



Fig. 2. Carbon di-oxide Sensor

CO₂ in a gaseous environment is observed by its absorption characteristics. The key components are infrared source, a light tube, wavelength filter, and an infrared detector. The most often used for measuring carbon dioxide are NDIR. They have characteristic with good sensitivities of 20–50ppm. Chemical CO₂ gas sensors are based on polymer or hetero polysiloxane have the major merit of consuming very less energy. It can be reduced in size to fit into microelectronic-based systems. Most of CO₂ sensors are fully calibrated prior to shipping. Over time, the null point of the sensor needs calibration to maintain the long term stability of the

sensor.CO₂ sensors can be used to monitor the quality of air and the adaptable need for fresh air.

C. H₂S Sensor

This sensor is under constant development because of the hazardous and corrosive nature of H₂S.It is used to identify hydrogen sulphide in the hydrogen feed stream of fuel cells for the prevention of catalyst. It is used in personal protective equipments to alert the presence of hydrogen sulphide gas to the user. It can sense the gas to the maximum of 1000ppm.

D. Methane Sensor

This sensor is highly sensitive to CH₄ and natural gas. It gives quick response with long life with stability. It is highly used in gas leakage detection system. Resistance value of this sensor is different to various concentration gases. So, sensitivity adjustment is very necessary.

IV. WORKING MODEL

A. Characteristics Of Toxic Gases Analysis

More number of toxic gases like carbon monoxide is colorless and odorless. Mean while, some hazardous gases like H₂S have an unpleasant smell at lower concentrations yet such smell vanishes at higher concentrations due to olfactory factors. It will be very harmful if drainage workers think that they can easily recognize the presence of toxic gases by smell. H₂S, CO and CH₄ are the most common hazardous gases found in drainage worksites. In addition, oxygen deficiency is another major cause of illness and fatalities.

TABLE I. CHARACTERISTICS OF EFFLUENTS

Hazardous gas	OEL (ppm)	IDLH (ppm)	Relative density (Air=1.0)	LEL/UEL
H ₂ S	10	100	1.2	4.3%/45.5%
CO	25	1200	1.0	12.5%/75%
CH ₄	---	---	0.6	5.3%/15%

B. Hydrogen sulphide (H₂S)

Hydrogen sulphide is a deadly dangerous gas with unique “rotten egg” odor that can be detected even at very low concentrations.H₂S has a paralyzing effect on the sense of smell at concentration of 100ppm and certainly workers cannot detect changes in concentrations. It is very dangerous to stick on the smell to detect the presence of hydrogen sulphide. Such harmful gas can be detected by more reliable method of using gas sensor. The concentration of hydrogen sulphide above 100 ppm is immediately dangerous to life or health and concentrations over 1000 ppm could cause immediate discomfort. As effluents are very often that present in a drainage system, workers get affected because of hydrogen sulphide leads to death.

C. Carbon monoxide (CO)

The unfragrant and colorless gas is given out when the burning of charcoal is done in badly open areas. This is similar in the case when gasoline/diesel generators or other fuel-driven tools are used in adequately ventilated workplaces. Unmasking to carbon monoxide at concentrations over 400ppm can cause blurring, fainting on exertion and collapse. An aerial concentration of carbon monoxide more than 1200ppm is very hazardous to human health and lives.

D. Methane (CH₄)

Methane is commonly produced when nuclear matter is crumbled by a variety of bacterial processes. It is a colorless, extremely convulses and ignitable gas that can cause fire and explosion. The accumulation of methane in a poorly ventilated area will lead to displacement of normal air. This results in the deficiency of oxygen in the environment.

V. EXECUTION FLOW

The proposed system will works depending on the flow chart. Figure 3 shows the flow diagram of our proposed system with various modules and their working. After connecting the sensor and RFID with the Arduino start to execute the program. It will first enter the set up loop and get the input by sensor.

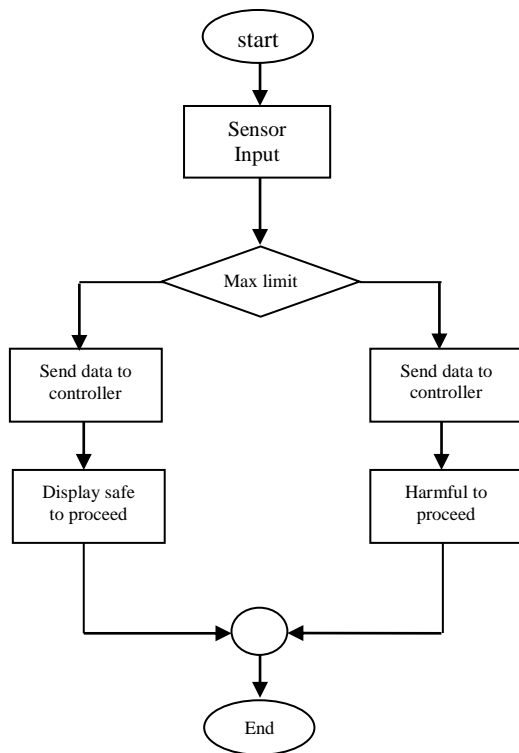


Fig. 3. Flow diagram of proposed system

The sensor get the input from the environment gives as analog outputs to the Arduino. After getting the input it enters the main loop and compares the input to the data limit. The value is compared and if the value is higher than the predefined value denoting that exposable limit is high, it displays “harmful to proceed” in the serial monitor. If the value is not greater than the predefined value the exposable limit is normal and it displays “safe to proceed” in the serial monitor. Mean while it sends the data to the controller. And again the setup will be reset automatically.

VI. EASE OF USE

The proposed system is cost effective. It is stable and reliable. It is helpful in rescue of sewers from harmful exposure of gases. This system doesn't need any external support since it provide prior intimation. The transmission and reception process is faster and result will be accurate.

VII. RESULT

The successful outcome of the monitoring system is shown in figure 4. The end result is generated based on the predefined ppm levels of toxic gases from the sensor. Such result is transmitted through wireless network.

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Hydrogen sulphide present not harmful
Safe to proceed
Hazardous hydrogen sulphide present

HArmful to proceed
Hazardous carbon present

HArmful to proceed
Hydrogen sulphide present not harmful
Safe to proceed
Hazardous hydrogen sulphide present

HArmful to proceed
Hazardous carbon present

HArmful to proceed
Hydrogen sulphide present not harmful
Safe to proceed
  
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VIII. CONCLUSION

This paper has introduced an innovational approach for trench gas detection and supervision based on ppm levels of hazardous gases. The toxic gases like methane, hydrogen sulphide and carbon monoxide are monitored by the hardware designed. That is, when the normal ppm levels of gases exceeds the data is send to the receiver through RFID. This system is highly reliable with accuracy and it is cost effective.

IX. FUTURE WORK

Internet of Things plays a leading role in the digital world. To make our society fulfilled with faster communication at affordable cost, this project aims to upgrade the means of transmission through Wi-Fi. By using this wireless networking technique data can be accessed over maximum coverage area. This system with such advanced technology will bring the drastic change in the lives of sewers. This system hopefully will be the helping hands for the department of health and sanitation.

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