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RESEARCH ARTICLE

DESIGN AND IMPLEMENTATION OF TOXIC GAS MONITORING SYSTEM

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ABSTRACT

The primary notion of gas leakage detection is the implementation of a protection framework for the detection of gas leakage in a closed environment. In the current situation, there are various criteria linked with gas leaks that have an influence on the lives and property of innocent people. This warning system, which can save people's lives, can be advantageous for businesses and homes. In this project, a SIM900 (GSM module) is utilised to complete the desired task by combining a gas sensor (MQ6), a buzzer, an Arduino UNO, a 5V stepper motor, and an LCD display. When there is a leak, the Gas sensor detects it using MQ6, and an automatic sound alert is generated, and the gas leakage is regulated. In addition, the GSM Module is used to set up an SMS-based system that sends three alerts (messages) to the chosen cell phone number. Not only is it required to identify gas leakage, but it is also vital to prevent leaking. This project is both cost-effective and dependable, as it not only detects gas leaks but also alerts people (through sound), shuts down main power and gas sources, and sends a warning message. The MQ-6 gas sensor was adopted because of its great precision, and it can be utilised in chemical and hazardous sectors where gas leaks are recorded sequentially.

INTRODUCTION

Manufacturing, electronics and semiconductors, food and beverage, and medicines are just a few of the industries that employ industrial gases. In the same way, these gases can be employed in the household. These gases, on the other hand, are dangerous because they are flammable and can produce an explosion if they build up in a confined space. A number of incidents occurred in the area. Gases like hydrogen, propane/butane, and methane that go unnoticed can be dangerous. The purpose of this study is to develop an Arduino-based hazardous gas detection and warning system that informs individuals if there is a potentially explosive gas leak. The system is designed to send out alerts in areas where sensors can detect the presence of gases in the air. The study also contains a GSM module that transmits Short Message Service (SMS) of the quantity of gases in the air to warn a person even if he or she is not in the vicinity. Poisonous compounds enter the human body through a variety of routes, including inhalation, oral ingestion, parenteral administration, and dermal contact. To confront the risks, it must be possible to identify and measure the poisonous substance in order to assess its effect on the human body. These days, with the increasingly rapid development of technological media and the rapid growth of industry, it must be possible to identify and measure the poisonous substance in order to assess its effect on the human body.

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The hundreds of cars that circulate every day in major city streets, as well as the use of pesticides and other poisonous substances for the exaggerated production of products, increased atmospheric pollution, exposing humans to small concentrations of harmful gaseous substances such as carbon monoxide and carbon dioxide, both of which have serious harmful effects on humans. The factors that can cause poisoning are physicochemical in nature. The substance's properties and the conditions of exposure to the substance or poison, such as the dosage, the route of entry into the body, and the duration of exposure Furthermore, environmental factors and weather conditions, as well as chemical agents, are major risk factors in addition to individual factors such as gender, age, bodyweight, diet, and physical fitness. In general, the rate of poisoning is higher in urban areas, particularly large ones. This is due to the conditions in those areas facilitating the development of poisoning. There are no recreation areas or sports fields where children can play freely. Furthermore, life in cities is more stressful. Suicide attempts appear to be more common in these areas. Although the number of poisoning cases does not appear to be decreasing, poisoning deaths have decreased because treatment plans are far better and more precise than ever before. gases have significant odours, such as H2S's unique "rotten eggs" odour. Parts per million (ppm) and parts per billion (ppb) are the most common measures for dangerous gas concentrations (ppb). Exposure to poisonous gases kills more people than explosions produced by flammable gas ignition. It's worth noting that a big number of gases are both combustible and toxic, thus even poisonous gas detectors may need to be approved for use in hazardous areas.

The fundamental rationale for addressing flammable and poisonous gases separately is that the hazards, laws, and sensor types required are all different. As previously stated, the key worry is the effect on employees of exposure to low concentrations of dangerous gas breathed, eaten, or absorbed through skin. It is critical to record not just the gas concentration but also the overall exposure time. There are even known occurrences of synergism, in which chemicals interact and generate a considerably worse effect when used jointly than when used separately. Concerns regarding toxic material concentrations in the workplace and at home are focused on both organic and inorganic chemicals, as well as the impacts they may have on human health and safety, as well as the disruption of regular everyday activities. The detection of flammable, poisonous, and oxygen gases has a wide range of applications. Highly dangerous chemicals, notably poisonous and combustible gases, are increasingly used and manufactured in industrial operations. Gas leaks will inevitably occur, posing a threat to the industrial plant, its personnel, and the people who live nearby. Asphyxiation, explosions, and loss of life situations occur all throughout the world, serving as a continual reminder of the problem. This is extremely essential in areas where liquefied petroleum gas (LPG) is used because no one can detect the leaking other than by smelling it, and by the time people notice it, it's usually too late. In the article, there is a case of gas leaking in the Ventura oil field in California. Three people died as a result of the disaster, two of them died during the occurrence, demonstrating the importance of utilising a gas detector. Early warning devices, such as gas detectors, are an important aspect of most businesses safety plans for reducing risks to workers and equipment. These can help provide you more time to take corrective or protective action, which will strengthen the industrial plant's safety system.

Literature Review

- Karthika S, Vanitha U, Rejina Parvin J, Supraja Arasu T, Sampritha R V, Srinithi K.: This system provides a range of safety benefits which are important for early detection of gas leakage. Lastly, our proposal would be a huge source of gas leaks in homes. This can be applied anywhere to detect gas leakage, because it is a low-cost device. Simple components such as Arduino, stepper motor, sensor (MQ6), and GSM module are used in this system. Implementation of this warning system may be useful for businesses, houses, hat can save people's lives. SIM900 (GSM module) is used in this work to perform the chosen task by interfacing display Gas Sensor (MQ6), Buzzer, Arduino UNO, Stepper Motor(5V), and LCD. They are used to detect only gas from CH4. Our concept can be used to detect the LPG gas which is the butane and propane mixture. It is more important to detect LPG, since it is an alternative fuel commonly used. LPG-gas detection can avoid accidents at home.
- D. Kissinger, N. Rothbart, K. Schmalz, J. Borngräber, and H.-W. Hübers: This paper discusses the findings of our recent work and updates them on Integrated Gas Spectroscopy Systems Transmitter (TX) and receiver (RX) mounted with IHP 0.13µm SiGeBiCMOS, fT / fmax 300/500 technology GHz GHz. Its present a millimeter / terahertz wave (MmW / THz) SiGe-based gas-spectroscopy sensor BiCMOS technology. There is a display spatial combination of two transmitters allowing a complete spectral coverage up to 50GHz. This is achievable with high sensitivity and compactness Setup using fractional n-PLLs built into the chip Transporter frames. They have demonstrated parallel operation recently of two TXchips and one RX.
- Lei Shuyz, YuanfangCheny_, ZhihongSuny, Fei Tongx, Mithun Mukherjeey: This survey offers a detailed overview of the current and emerging work on the identification of sources of gas leakage and continuous object monitoring using WSN. Similar wellknown gases diffusion models used in algorithms for localization and monitoring the gas source with the advent of sensing technologies, techniques of localization are explored in terms of precision, robustness and energy consumption issues. Provides a thorough analysis on at present usable gas spreading models for gas leakage localization sources. Since continuous objects are widely diffused a area of non uniform diffusion velocity and surrounding acceleration, continuous tracking groups are difficult to track than a single object. Wireless sensor networks (WSNs) are random multi hop systems sensor nodes deployed in monitoring area. The gas concentration, the direction of diffusion, the speed and other physical conditions parameters are calculated with different nodes of the senor.
- L. Engel, K. R. Tarantik, I. Benito-Altamirano, C. Pannek, J. D. Prades, J. Wöllenstein: This describes a quick and easy method for monitoring toxic gases in ambient air, based on apparent change in color of the printed paper Sensor which can be measured with a sensor (e.g. Smartphone) Or just naked eye. The development of gas sensitive pastes for the colorimetric processing by screen sensation. Ammonia identification measures (NH3), Hydrogen sulphide (H2S) and formaldehyde (CH2O) have been identified as closer review. A poly coated white paper (p-phenylene oxide) (PPE) acted as a base for the manufacture of sensors and it has the layer of an acidic pH benefit and suitable for assessment by camera for the distinct matt surface. Similar printing aids investigated as to their gas sensitive effect Colorimetric-layer behavior. The change of color was featuring UV / Vis spectroscopy. Its shows the Printable assets disponible measures for controlling harmful gases in ambient air changes to clear color. As for their inexpensive these sensors can be useful for many preparations and evaluations applications of chemistry, climate and manufacturing.
- NiladriSarma, Arpita Mittal, Deeksha Choudhary, Aishwarya Chowdhury, T.Ramya: In this the fabricated bots move through a predefined area and track the gas leakage and the warning is sent via alert to the final recipient. The gaseous sensor the system can detect the gas leaks and the warning message is sent to the user on and the other hand. All the robots with directed vision follow the alpha robot and travel along the path desired. The nonstop RF transmission ensures master-slave intelligence in a very effective manner in simple way. The architecture of control is preserved by the alpha robot and all other guided bots follows the alpha. Using this device will prove a shift to economic growth.
- Abubakar I. Adamu, Manoj K. Dasa, Ole Bang and Christos Markos: In the outcomes shown here indicate the chance of targeting gases such as NH3 and CH4, which are high importance in the agricultural and agricultural sector. The device proposed is highly reliable for continuous monitoring, selective, low-cost and

concentration-sensitive as low as 4 ppm when calculated using Allan-werle analysis. SUPERCONTUNUUM (SC) lasers are spatially compatible so-called white light lasers with a large bandwidth covering a few octaves and severe spectral visibility, which is orders of magnitude higher than synchrotrons. Gas sensors, means of optical methods, are remarkable their durability, high sensitivity, selectivity, and immunity Catalysator poisoning and environmental change. In addition, their very short answer time makes it possible on-line. detection of real-time gas. One of the methods for optical sensing is spectroscopy, such research mainly includes techniques.

METHODOLOGY

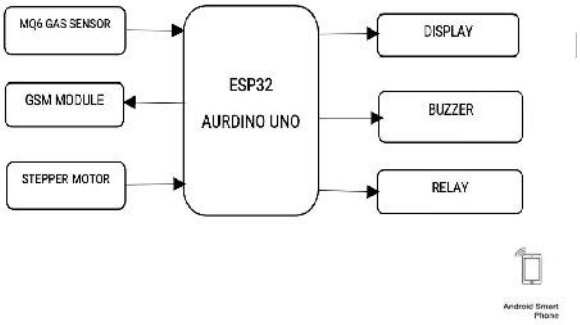

Fig 1. Block Diagram

MQ6 gas sensor is used to detect LPG, Methane and Propane. This sensor is placed near the gas source and detect concentration of gases. The information is then passed to the Arduino. The Arduino serves as the controller of the system. It is in charge for triggering the Global System Mobile (GSM) module, Liquid Crystal Display (LCD) monitor, Led's, buzzer and Servo motor based on the received signal from the sensors. The Arduino recognizes the highest level of concentration of gas regardless of how many gases are present in the area. It analyses the level of gas marking it with "safe level", the condition where the gas being detected is considered tolerable that starts at 0 parts per million (PPM) up to 299 PPM; "medium level", the condition where the gas being detected is less concentrated with a set point of not less than 300 PPM and not more than 350 PPM; and "danger level", the condition where the gas being detected has too much concentration with a set point of not less than 351 PPM. The system also includes a GSM module that sends Short Message Service (SMS) in every level of detected gas. However, only mobile devices with text messaging functions can receive the notifications. The system has a 6x12 characters LCD monitor screen that shows the concentration of gas through text. The system has a 12V buzzer that only functions when "danger level" is reached to alert people nearby of the high concentration of hazardous gas. The system also includes a servo motor that functions when "medium level" is reached and would still function even on "danger level" to reduce the concentration of gas. On the contrary, the fan will turn off when "safe level" is again acquired.

Conclusion and Future Scope

Based on the findings and result of the study, the system can successfully detect and monitor the concentration of methane, propane, and LPG gases in a certain room.

The GSM module successfully sends SMS to the authorized person in an area where the hazardous gas is being detected. The LCD monitor can display the level of gas detected. The gas sensors and the critical level of the respective gas should be known, and then this system can be implemented for detecting various gases either in domestic area such as places of educational institutions, residential and industrial areas which avoids endangering of human lives. This system provides quick response rate and the diffusion of the critical situation can be made faster than the manual methods. The buzzer successfully warns and informs the people that there is a leakage of hazardous gas and the exhaust fan turns on when there is a build-up of hazardous gas to reduce the concentration. Also, real data is stored in fire base.

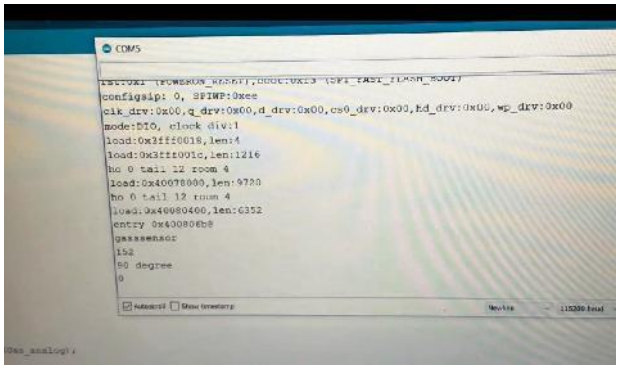

Fig. 2. Simulation Results

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