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An Effective Safety System for Identification and Removal of Toxic Gases in Drainage Cleaning Process

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ABSTRACT: In today's world safety plays a vital role, the underground drainage system adopted in most of the cities and it's the duty of Municipal Corporation to maintain cleanliness, health and safety of cities. If the drainage system is not cleaned properly, toxic gases are formed in the drainage which is hazardous to human health. The main objective of this work is detecting toxic gases and altering the system by designing microcontroller. The hazardous gases like H₂S, CO and Methane will be sensed and displayed each and every second in the LCD display. If this gas concentration level is increased then an alarm is generated immediately and also an alert message (SMS) is sent to authorized person and also corporation person through the GSM. The advantage of this machine controlled detection associated alerting system over the manual technique is that it offers fast reaction time and accurate detection of an emergency. The reading values of gas sensor if it will be driven out by motor driver module without any help of mankind. The ultrasonic sensor is used to detect the overall previous blockage in drainage and it will collect the database and send the alert message through GSM.

KEYWORDS: Toxic gas identification, gas sensor, ultrasonic sensor, LCD displays, Arduino and GSM.

I. INTRODUCTION

Gas run could be a major drawback with industrial sector, residential premises and gas-powered vehicles like CNG (compressed natural gas) buses, cars. One among the preventive ways to prevent accident related to the gas leakage is to install gas leakage detection kit at vulnerable places. The aim of this paper is to present such a design that can automatically detect and stop gas leakage in vulnerable premises. In particular gas sensor has been used which has high sensitivity for propane (C₃H₈) and butane (C₄H₁₀). Gas leakage system consists of GSM (Global System for mobile communications) module, which warns by sending SMS. However, the former gas leakage system cannot react in time. This paper provides the planning approach on both software and hardware. The rise within the development of technology and the humankind, we have a tendency to board failed to take care about the surroundings in which we live in. Thus, we polluted the environment and thereby reducing the quality of the place we live. Even though there are several aspects of pollution such as soil, air and water pollution, out of these air pollution acts as the serious aspect as the other can be detected visually and by taste, but the polluted air cannot be detected as it can be odorless, tasteless and colorless. Hence there is a growing demand for the environmental pollution monitoring and control systems.

In the view of the ever-increasing pollution sources with toxic chemicals, these systems should have the facilities to detect and quantify the sources rapidly. Toxic gases are one that causes serious health impacts, but are also used in industries in large quantities. These gases have to be monitored; such that increase in the normal level of them could be



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known and proper precaution measures can be taken. But the current systems available are not so portable and are costly and difficult to implement. So, an embedded system is designed using Microcontroller, for the purpose of detection of hazardous gas leakage, which in turn avoids the endangering of human lives.

The dangerous gases like Hydrogen Sulphide, Carbon monoxide and Methane were considered here. If these hazardous gases level exceeds traditional level that is $H_2S > 1000$ ppm or $Methane > 10000$ ppm then an alarm is generated immediately, and a SMS is shipped to the licensed user as an alert message, that results in quicker diffusion of emergency situation. The system is reasonable and can be easily implement in the drainage and in unused well area which is surrounded by the chemical industries or plants, to avoid endangering of human lives. The system also supports to provide real-time monitoring of concentration of the gases which presents in the air. As this methodology is automatic the data are often given in time such that the endangering of human lives are often avoided.

II. LITERATURE SURVEY

2.1. Microcontroller Based Low Cost Gas Leakage Detector with SMS Alert

LPG gas is basically a mixture of propane and butane which are highly flammable chemicals. It is odourless gas in its natural state to which Ethyl Mercaptan is added as powerful smelling agent, so that leakage can be easily detected. We can detect the LPG leakage in the cars, industrial sectors and residential areas using an Ideal Gas Sensor. We can easily implement the LPG gas leakage detector unit into a unit that can sound an alarm or give a visual suggestion of the LPG concentration in a 16x2 LCD display. The sensor used in this project has both admirable sensitivity and rapid response time. This sensor can also be used to sense other gases like isobutane, propane, LNG and even cigarette smoke. The output of the sensor goes LOW as soon as the LPG sensor senses any gas leakage. This is detected by the microcontroller and the semiconductor diode & buzzer square measure are turned ON. After a delay of few milliseconds, the exhaust fan is also turned ON for throwing the gas out and a "GAS LEAKAGE" message is sent to a predefined mobile number using GSM Module. This is used to Detect Gas Leakage (like LPG, Butane, and Methane) or any such petroleum based gaseous substance that can be detected using MQ-5 Sensor. To set up an SMS based Alert Mechanism and send 3 SMS (3 alert messages) to 2 specified mobile numbers (input inside the Arduino Program). To produce an alarm sound upon gas leak and stop the alarm once gas leak is under control. Display standing in associated LCD using a 16x2 LCD module. The sensing material in gas sensors is metal oxide, mostly when a metal oxide crystal such as 2 is heated at a certain high temperature in air, oxygen is absorbed on the crystal surface with a negative charge. Then donor electrons in the crystal surface are transferred to the absorbed oxygen, resulting in leaving positive charges in a space charge layer. Thus, electric current flows through the junction parts of 2 micro crystals. Grain boundary surface potential acts as a potential barrier against the electron flow. The electrical resistance of the sensor is imposed to this potential barrier. In the presence of a deoxidizing gas, the surface density of the charged gas decreases. Consequently, the barrier height in the grain boundary is reduced. As a result, the reduced barrier height decreases sensor resistance.

2.2. MICROCONTROLLER BASED LPG GAS DETECTOR USING GSM MODULE

Ideal gas sensing element is employed to discover the presence of a dangerous LPG leak in your car or in a service station, storage tank environment. This unit are often simply incorporated into associated degree, to sound an alarm or give a visual indication of the LPG concentration. The sensing element has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke. If the LPG sensor senses any gas leakage from storage the output of this sensor goes low. This low signal is monitored by the microcontroller and it will identify the gas leakage. Now the microcontroller is turn on LED and Buzzer. After few milliseconds delay, it also turns on exhaust fan for throwing gas out and continue send messages as "GAS LEAKAGE" to a mobile no., written in c-code. MQ-5 Semiconductor Sensor for Combustible Gas Sensitive material of MQ-5 gas sensor is SnO_2 , which with lower conductivity in clean air. When the target combustible gas exists, the sensors conductivity is higher along with the gas concentration rising. We use simple electrocircuit, convert change of conductivity to correspond output signal of gas concentration. MQ-5 gas sensing element has high sensitivity to Methane, Propane and Butane and could be



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used to detect both Methane and Propane. The sensor could be used to detect different combustible gas especially Methane, it is with low cost and suitable for different application

2.3. FPGA-GSM BASED GAS LEAKAGE DETECTION SYSTEM

Toxic and ignitable gases square measure wide employed in business, heating systems, home appliances and vehicles. This includes combustible gases like propane, ethane, butane, methane, ethylene etc. Liquefied Petroleum Gas (LPG) also referred to as propane or butane is normally stored in pressurized cylinders in liquid form and vaporizes at normal temperatures. A leakage can ignite and cause explosion. Therefore, the leak detection of gases has gained more interest in recent years especially in fields of safety, industry, environment, and emission control. A conventional gas leakage system uses on-site alarms as a warning to indicate the leakage. The drawback of the conventional leakage system is that it becomes ineffective in the absence of first response team on-site. This may delay the preventive actions causing damage to life and environment. Therefore, there is a need for a system to detect the leakage and send the information to the first response team through wireless media. A leak detection system that initiates a take heed call or SMS will be more effective in the absence of people on-site. Moreover, the leakage warning call can be sent to fire station as well. Gas leak discoverers built with microcontrollers to detect and send information through wireless media is presented. Alternatively, an FPGA can be used in the detection system to detect many toxic and combustible gases making them ideal for use in a variety of environments. FPGAs clearly have many advantages as far as the high-performance systems are concerned where smoothing filters are required to clean the sensor data. In this paper, we propose a leakage detection system that uses FPGA to detect the leakage with a warning call initiating feature to the first response team. LPG is used to test the system. The paper is organized as follows. An overview of the gas leak detection system is explained in section II. The leakage detection and call initiation in FPGA is explained in section III and section IV explains the experimental setup and the conclusion is given in section V.

2.4. HUMAN SAFETY SYSTEM IN DRAINAGE, UNUSED WELL AND GARBAGE ALERTING SYSTEM FOR SMART CITY

Safety plays a serious role in today's world and it is necessary that sensible safety systems are to be enforced 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 offices. Most of the emptying and unused wells are forming toxic gases. The main objective of this work is designing microcontroller based toxic gas detecting, 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 traditional level then an alarm is generated immediately and also an alert message (SMS) is sent to the licensed person through the GSM. The advantage of this machine driven detection and alerting system over the manual method is that it offers quick response time and accurate detection of an emergency and in turn leading faster diffusion of the critical situation using gas purification process convert a toxic gas into pure air. The garbage alerting system is used to control the air pollution. All the gas sensor values are continuously monitoring through the mobile application using wifi module. This system is very much useful to make a city smart as well as reduce the human death'

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III. BLOCK DIAGRAM

BLOCK DIAGRAM

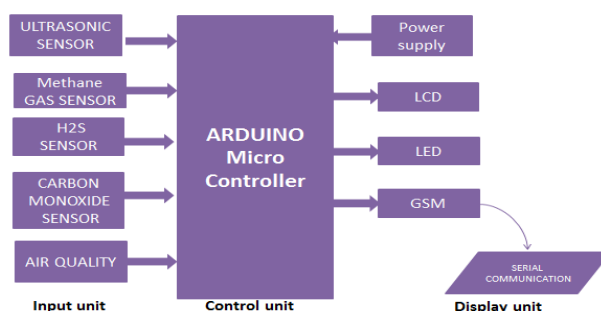


Chart-1 Block diagram

IV. COMPONENTS

4.1. Arduino UNO

Arduino may be a single-board microcontroller to make using electronics in multidisciplinary projects more accessible. The hardware consists of an associate ASCII text file hardware board designed around an 8-bit AtmelAVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller. The Arduino Uno is hoped up via the USB connection or with an external power supply. The power source is selected automatically. External (non USB) power can come either from an AC to- DC adapter (wall -wart) or battery. The adapter can be connected by plugging a 2.1mm center -positive plug into the board's power jack. Leads from battery is inserted within the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If furnished with but 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If exploitation over 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The ATmega328 has 32 KB (with 0.5 KB used for the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM. Each of the 14 digital pins on the Uno is used as associate input or output, exploitation pin Mode, digitalWrite, and digital browse functions.

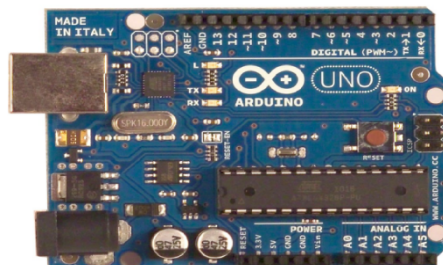


Chart-2 Arduino UNO

4.2. LCD

A Liquid Crystal Display commonly abbreviated as LCD is basically a display unit built using Liquid crystal technology. When we build real life/real world electronics based projects, we need a medium/device to display output values and messages. The most basic form of electronic 7 segment display which has its own limitations. The next best available option is Liquid Crystal Display which comes in different size specifications. Out of all available LCD modules in market, the most commonly used one is 16×2 LCD Module which can display 32 ASCII characters in 2



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lines (16 characters in 1 line). Other commonly used LCD displays are 20×4 Character LCD, Nokia 5110 LCD module, 128x64 Graphical LCD Display and 2.4 inch TFT Touch screen LCD display.

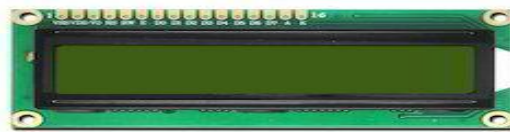


Chart-3Liquid Crystal Display

4.3. Arduino GSM shield

The Arduino GSM defend permits associate Arduino board to attach to the web, send and receive SMS, and make voice calls using the GSM library. The Arduino GSM Shield allows an Arduino board to connect to the internet, make and receive voice calls and send and receive SMS messages. The shield uses a radio modem M10 by Quectel. It is potential to speak with the board using AT commands. The GSM library includes a large number of methods for communication with the shield. The shield uses digital pins 2 and 3 for software serial communication with the M10. Pin 2 is connected to the M10's TX pin and pin 3 to its RX pin. The M10 is a Quad-band GSM/GPRS modem that works at frequencies GSM850MHz, GSM900MHz, DCS1800MHz and PCS1900MHz. It supports TCP/UDP and HTTP protocols through a GPRS connection. GPRS data downlink and uplink transfer speed maximum is 85.6 kbps. To interface with the cellular network, the board requires a SIM card provided by a network operator.



Chart-4 Arduino GSM Shield

4.4. GSM

This is a world normal for mobile communication that fully is world System for Mobile communications. It also referred to as 2G, which is second generation cellular network. GSM supports outgoing and incoming voice calls, Simple Message System, and data communication via GPRS among others. The Arduino GSM defend is really a GSM electronic equipment. In the eyes of a mobile operator, the Arduino GSM shield looks just like a mobile phone while from Arduino perspective, the Arduino GSM shield looks just like a modem. GSM is a second-generation (2G) standard employing time-division multiple-Access (TDMA) spectrum-sharing, issued by the European Telecommunications Standards Institute (ETSI). The GSM standard does not include the 3G Universal Mobile Telecommunications System (UMTS) code division multiple access (CDMA) technology nor the 4G LTE orthogonal frequency-division multiple access (OFDMA) technology standards issued by the 3GPP. GSM, for the first time, set a common standard for Europe for wireless networks. It was also adopted by many countries outside Europe. This allowed subscribers to use alternative GSM networks that have roaming agreements with one other. The common



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normal reduced research and development costs, since hardware and software could be sold with only minor adaptations for the local market.



Chart-5 GSM

4.5. MQ6

A gas detector could be a device that detects the presence of gases in an section, often as part of a safety system. This type of kit is employed to detect a gas leak or other emissions and can interface with a bearing system so a process can be automatically shut down. A gas detector will sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals. Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion. This type of device is employed widely in industry and can be found in locations, such as on oil rigs, to monitor manufacture processes and emerging technologies such as photovoltaic. They may be used in firefighting. Gas leak detection is the process of identifying potentially hazardous gas leaks by sensors. These sensors sometimes use associate loud alarm to alert people when a dangerous gas has been detected. Exposure to toxic gases can also occur in operations such as painting, fumigation, fuel filling, construction, excavation of contaminated soils, landfill operations, entering confined spaces, etc. Common sensors include combustible gas sensors, photoionization detectors, infrared point sensors, ultrasonic sensors, electrochemical gas sensors, and semiconductor sensors. More recently, infrared imaging sensors have come into use. All of these sensors are used for a wide range of applications and can be found in industrial plants, refineries, pharmaceutical manufacturing, fumigation facilities, paper pulp mills, aircraft and shipbuilding facilities, hazmat operations, waste-water treatment facilities, vehicles, indoor air quality testing and homes.



ePro
Labs

Chart-6 MQ6

4.6. Adapter

An AC adapter is a power supply built into an AC mains power plug. AC adapters are also known by various other names such as "plug pack" or "plug-in adapter", or by slang terms such as "wall wart". AC adapters generally have a single AC or DC output that is conveyed over a hardwired cable to a connector, but some adapters have multiple outputs that may be conveyed over one or more cables. "Universal" AC adapters have interchangeable input connectors to accommodate completely different AC mains voltages.



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Chart-7 Adaptor

Adaptors with AC outputs may consist only of a passive transformer (plus a few diodes in DC-output adaptors), or they may employ switch-mode circuitry. AC adaptors consume power (and produce electric and magnetic fields) even when not connected to a load; for this reason they are sometimes known as "electricity vampires", and may be plugged into power strips to allow them to be conveniently turned on and off.

V. RESULT

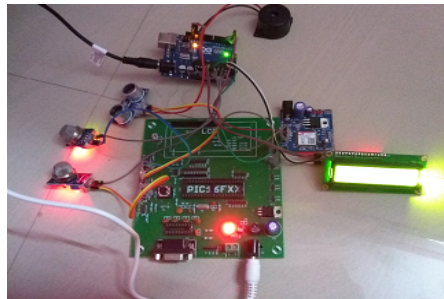


Chart-8 Hardware output

VI. CONCLUSION

An embedded system for hazardous gas detection has been implemented; here only one gas (CO) has been detected for demo purpose. 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 drainage, unused wells, 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 method.

REFERENCES

1. R. Al-Ali, Member, IEEE, Imran Zulkernain, and Fadi Aloul, Senior Member, IEEE, "A Mobile GPRS-sensors array for Air Pollution Monitoring" vol.6, pp.410-422, Oct.2010.
2. NihalKularatna, Senior Member, IEEE, and B. H. Sudantha, Member, IEEE "An Environment Air Pollution Monitoring System Based on the IEEE 1451 Standard for Low Cost Requirements" IEEE Sensors J., Vol. 8, pp.415-422, Apr. 2008.
3. M. Abu Jayyab, S. Al Ahdab, M. Taji, Z. Al Hamdani, F. Aloul, "Pollumap: Air Pollution mapper for cities", in Proc. IEEE Innovations in Information Technology Conf., Dubai, UAE, Nov.2006, pp.1-5.
4. Y. J. Jung, Y. K. Lee, D. G. Lee, K. H. Ryu, and S. Nittel, "Air pollution monitoring system based on geosensor network", in Proc. IEEE Int. Geoscience Remote Sensing Symp., 2008, vol. 3, pp. 1370-1373.
5. M. Gao, F. Zhang, and J. Tian, "Environmental monitoring system with wireless mesh network based on Embedded System", in proc. 5th IEEE Int. Symp. Embedded Computing, 2008, pp. 174-179.
6. J. W. Kwon, Y. M. Park, S. J. Koo, and H. Kim, "Design of Air Pollution Monitoring system Using ZigBee Networks for ubiquitous-city ", in proceedings of In. Conf. Convergence Information Technology, 2007, pp.1024-1031.
7. H. Huang, H. Bainand S. Zhu, "A Greenhouse Remote Monitoring System Based on GSM," in Proc. of IEEE International Conference on information management, pp. 357-360, 2011.
8. H. G. Rodney Tan, C. H. Lee and V. H. Mok, "Automatic Power Meter Reading System Using GSM Network," in Proc. of the 8th International Conference (IPEC 2007), pp. 465-469, 2007.
9. J. L. Solis, Y. Li and L. B. Kishs, "Fluctuation-Enhanced Multiple Gas sensing by Commercial Taguchi Sensor,"IEEE Sensor Journal, vol. 5, no. 6, Dec 2005.