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A Review on Microcontroller based LPG Gas Leakage Detector

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Abstract

As we know, security has been major issue in today's scenario. Accidents are on increasing day by day. Here, we are talking about those accidents that are being occurred due to combustible gases, i.e., LPG, CNG. Frequently we hear, explosion in cylinder of household and vehicles. Several people have been injured and some got dead. So we are making this project for security purpose that will detect combustible gases and alert candidates. Now a day's, LPG Gas leakage detector's comes in the market with the LPG sensor that only senses any gas leakage and sends a SMS to the emergency no. provided to it and alerts the user via audio or visual indications while we are on a project in which we are using a stepper motor also in addition to the normal LPG Gas leakage detectors which helps in turning off the switch when there an emergency in our absence. In this paper, we are reviewing on the use of LPG Gas leakage detector along with the stepper motor instead of using other simple Gas leakage detector. The sensor we are using here has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke. The report consists of a background into the area of 8051 microcontroller and mobile communication, how they are interfaced to each other and AT commands set used in communication.

Keywords: *GSM, microcontroller, MODEM, SIM, LCD, mobile communication, leakage sensor, 555 timers*

INTRODUCTION

With the development of world, the technology is enhanced day by day with the realistic projects and efficient work. In this project we are using MQ-6 semiconductor sensor to detect combustible gas. This gas sensor is made of $sno_{2.}$ This sensor has lower conductivity in fresh air. When target combustible gases exist, the sensor conductivity is higher along with gas concentration rising. Basically, conductivity of this sensor depends upon concentration of the gas so it may detect not only combustible gas but also smoke, butane, isobutene, liquor. We can conjointly use it as a liquor tester. If the LPG sensing element senses any outflow from storage then the output of this sensing element goes low. This low signal is monitored by the microcontroller and it will establish the gas outflow. Currently, the microcontroller turns on LED and Buzzer. Once few milliseconds delay, it conjointly activate fan for throwing gas out and continue send messages as "GAS LEAKAGE" to your mobile no. subsequently the stepper motor turns off the switch of the cylinder. In this paper we discussed through various researches what development has been done in GAS leakage detectors and our proposed work regarding the following paper.

LITERATURE SURVEY

A number of reviews on the subject of gas leakage detection techniques were done in the past either as part of research papers/technical reports on a certain leak detection method and other gas related subjects.

Ch. Manohar Raju and N. Sushma Rani, 2008; they introduce an android based automatic gas detection and indication robot. They proposed prototype depicts a mini mobile robot which is capable to detect gas leakage in hazardous places. Whenever there is an occurrence of gas leakage in a particular place the robot immediately read and sends the data to android mobile through wireless communication like Bluetooth. We develop an android application for android based smart phones which can receive data from robot directly through Bluetooth. The application warns with an indication whenever there is an occurrence of gas leakage and we can also control the robot movements via Bluetooth

by using text commands as well as voice commands. The previous mobile robots are based on heterogeneous technologies like GSM, GPS, internet based etc., but the main disadvantage of those prototypes were the absence of communication in particular areas. So, with the rapid developments and tremendous changes in technology we have lots of techniques to eradicate previous problems. Wireless communication protocols play a vital role in present trends. Bluetooth, WI-Fi, Zigbee etc., we use one of the best feature of smart phone, i.e., the Bluetooth technology to control and monitor parameters driven by a robot.

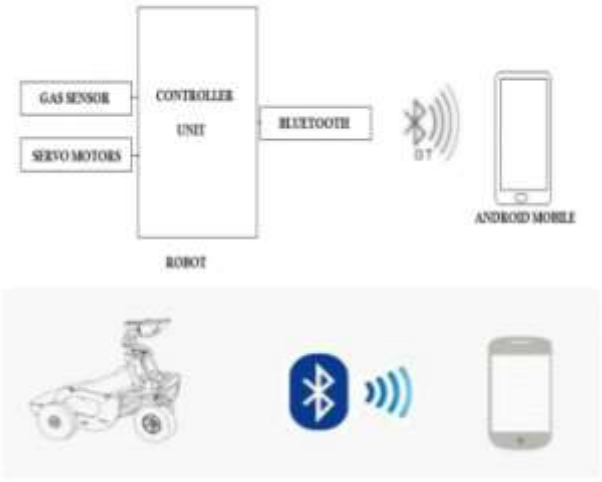

Fig. 1: *Robot Prototype [1].*

They introduce a robot and mobile application for In the meantime, the system prototype has imposingly demonstrated its use and capability in intensive series of tests. The drive unit, the navigation system and, therefore, the complementary sensor systems performed superbly throughout the tests. The robot facilitates independent gas detection and leak localization in sites that are otherwise troublesome to access. Moreover, it helps to avoid mistreatment of human inspectors in probably dangerous environments. However, before readying in industrial settings, more development is needed (e.g., in explosion protection, package development, etc.), and in fact legal problems should be processed before readying in business settings. Still, it is certain that an autonomous, mobile gas detection and leak localization robot is possible today and can significantly enhance safety [1].

Pal-Stefan Murvaya, Ioan Sileaa, 2008; they told in their survey on gas leak detection and localization techniques various ways to detect the gas leakage. They introduce some old or new technique to detect the gas. The proposed techniques in this paper are non-technical methods, hardware based methods

which include acoustic methods, optical methods and active methods.

In their survey they told a wide variety of leak detecting techniques is available for gas pipelines. Some techniques have been improved since their first proposal and some new ones were designed as a result of advances in sensor manufacturing and computing power. However, each detection method comes with its advantages and disadvantages. Leak detection techniques in each category share some advantages and disadvantages. For example, all external techniques which involve detection done from outside the pipeline by visual observation or portable detectors are able to detect very small leaks and the leak location, but the detection time is very long. Methods based on the mathematical model of the pipe have good results at high flow rates while at low flow rates a mass balance based detection system would be more suitable. This disadvantage is prone to disappear for some of these techniques due to forthcoming technological advancements.

In proposed paper, they work on the classification of leak detection technologies. Most detection techniques rely on the measurement of a certain physical quantity or the manifestation of a certain physical phenomenon. This can be used as a rule for classification as we have several common used physical parameters and phenomena: acoustics, flow rate, pressure, gas sampling, optics and sometimes a mix of these. An example is available in relation to the optical detection methods. Because of the great variety of these detection solutions, leak finding technologies are sometimes classified into optical and non-optical methods. The block diagram of the classification is shown in Figure 2 [2].

Fig. 2: *Classification of Gas Leak Detection Techniques based on their Technical Nature [2].*

Zhao Yang, Mingliang Liu, Min Shao, and Yingjie Ji, 2011; in this paper they told about their research on leakage detection and analysis of leakage point in the gas

pipeline system. In this paper they gave various model which used SCADA I/F Model: The SCADA system has the function of transferring the acquired data from a pipeline system to Transient Simulation Model every 30 seconds. This module communicates with SCADA. Dynamic parameters are collected every 30 seconds, such as pressure, flow and temperature. Transient Simulation Model: Transient flow is simulated utilizing perfect numerical methods based on actual data. Pressure and temperature served as independent variables are provided in order to get average pressure and average temperature. Then all the parameters of the gas in the pipeline system can be acquired. Leakage Detection: The leakage detection is carried out by comparing the data acquired through the SCADA system with that by the Transient Simulation Model. This model could provide leakage point judgment and prompt warning based on transient simulation and volume balance.

The basic block diagram of this gas leakage detection system which is given by Zhao Yang is shown in Figure:

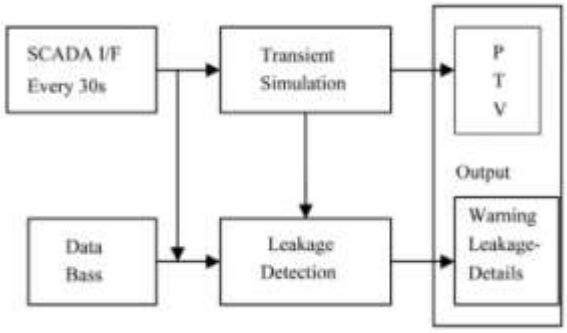

Fig. 3: *Leakage Detection System [3].*

Leakage detection model is set up based on continuity equation, momentum equation, energy equation, state equation and volume-mass balance. THE leakage detection model includes five modules: SCADA I/F, Dada Bass, Transient Simulation, Leakage Detection, Output. Leaks as small as 0.3% of the nominal gas flow are readily detected. When leakage point is much closer to inlet, the pressure is even higher, so differential pressure between gas and atmosphere is still bigger, and leakage is even more. The pipeline outlet pressure and leakage position almost reveal the linear relation. The results show that leakage and outlet pressure are more important parameters compared to the coefficient of frictional resistance and pipeline diameter. A computer program to run on-line has been developed to obtain leakage location and performs well when

leakage percentage ranges from 0.3% to 93% of the nominal gas flow. So the developed program software turns out to be a very useful tool in automatic supervision of pipelines as well as instantaneous leakage detection [3].

S Shyamaladevi, V G Rajaramya, P Rajasekar and P Sebastin Ashok, 2014; In this research paper they told about their project ARM7 based automated high performance system for LPG refill booking and leakage detection and methodology to make their project. The paper is designed based on modular approach which is easy to analyze as LPG cylinder booking unit, gas leakage monitoring unit at the consumer end and server system unit at the distributor side. MQ6 placed in the vicinity of the gas cylinder. In the advent of leakage, the resistance of the sensor decreases increasing its conductivity. Corresponding pulse is fed to microcontroller and simultaneously switches on the buzzer and exhaust fan. Microcontroller sends a message "EMERGENCY ALERT: LPG gas leakage found in your home" to required cell numbers via GSM module and the same will be displayed on LCD.

In automatic Gas booking system, LCD continuously monitors the weight of the gas in cylinder and displays it on seven segment display. When the weight of the gas is less than or equal to 2 Kg, a logic high pulse is fed to a port pin of microcontroller. As this pin goes high, microcontroller will send a booking message to distributor of format, "AA01-RAJA-05-B". At the same time, the message will be displayed on LCD as "Cylinder Booking". Hardware and Software Requirements are Load cell, Instrumentation amplifier, 2*16 LCD, LPG sensor, GSM modem, PC, Keil uvision4, Visual studio2008, Pro-load software.

The gas leakage detection system was proposed, designed and successfully implemented in this paper for home safety and industrial applications. This system detects the leakage of the LPG and alerts the consumer about the leak by SMS and as an emergency measure the system will turn off the power supply, while activating the alarm. Along with gas leakage detection, this system gives a fully automated approach towards the gas booking. Real time weight measurement of the gas and its display on LCD makes it an efficient home security

system and also can be used in industries and other places to detect gas leaks. This project is implemented using the ARM 7 processor and simulated using the Keil software. The cost involved in developing the system is significantly low and is much less than the cost of gas detectors commercially available in the market [4].

Falohun A.S., Oke A.O., and Abolaji B.M. 2016; in this paper they proposed their dangerous gas detection using an integrated circuit and MQ-9. In this basically, they used an embedded design which includes typical input and output devices include switches, relays, solenoids, LEDs, small or custom LCD displays, radio frequency devices, and sensors for data such as temperature, humidity, light level etc. Embedded systems usually have no keyboard, screen, disks, printers, or other recognizable I/O devices of a personal computer, and may lack human interaction device. The amount and type of detectors and the type of fire alarm system that one chooses for property protection will depend on the owner's property protection goals, the value of the property and the requirements of the owner's insurance company. Generally, heat detection will be used in all areas that are not considered high value. Here again, one of the most common mistakes in fire alarm system application is to provide partial protection of a building and expect high performance from the installed systems of any kind.

The principle of operation which is proposed in this paper is the gas detector alarm system is designed with the intention to ensure that the event of gas is intelligently detected, promptly notified and interactively managed. It is built around a timer to accept input from the gas sensor, MQ-9, and activate a buzzer and set of led that alerts in the event of gas. The sensor used is the MQ-9 and from the datasheet, it specializes in gas detection equipment for carbon monoxide and CH4, LPG family and any other relevant industry or car assemblage.

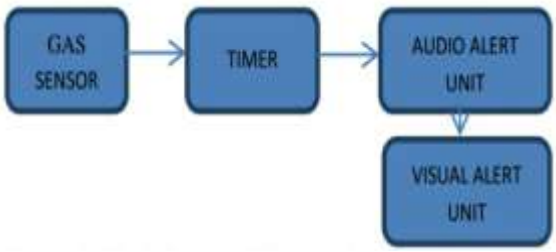

Fig. 4: *Block Diagram of the User-Interactive Gas Leakage and Fire Alarm System [4].*

The sensor which was proposed in this paper is MQ 9. It advantage is that it has; good sensitivity to CO/Combustible gas, high sensitivity to methane, propane and CO, long life and low cost, Simple drive circuit. The enveloped MQ-9 has 6 pins, 4 of which are used to fetch signals, and other 2 for providing heating current. The sensor works with voltages between 5V and 12V AC or DC. A 5V supply voltage was used for this design. Once powered, the output of the sensor is normally HIGH but goes LOW when gas is sensed [5].

PROPOSED WORK

We have concluded from these existing and above discussed technology. We shall use a new technology IOT (Internet of Things) to get fastest notification of gas leakage. We shall use a stepper motor to OFF the knob of cylinder regulator to avoid the accidental cases due to gas leakage. We will also use a website or application under the IOT technology to get fastest response from the module. The other module and things which are used in this project is GSM module, microcontroller, exhaust fan, LED for indication, a buzzer to notify local peoples and MQ 5 or MQ 6 gas sensor module to sense the gas leakage [6].

In this proposed model we want to achieve five aspects:

To Design an Embedded System

In this we use the AVR microcontroller that control all the module and things.

Accident Avoiding Feature

In this we use the exhaust fan to reduce the gas from the place, a stepper motor that OFF the cylinder knob and for notify the local people automatically weeping the buzzer.

GSM Module

GSM module is used to send the message of gas leakage.

IOT Module

This module is use for app notification.

Sensor Module

This module is use to sense the gas leakage. In this module we use a sensor MQ 5 or MQ 6 to perform the leakage detection operation.

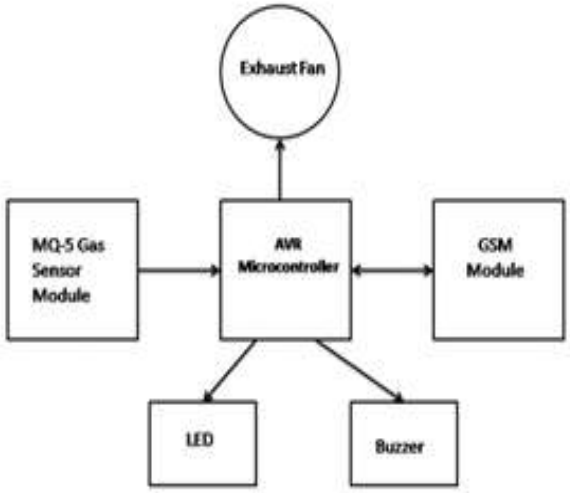

Fig. 5: *Block Diagram of Proposed Model.*

CONCLUSION

Finally, we conclude in recent households, the use of LPG is taking a big troll. From the use of cylinder up to the use of petroleum pipelines. The biggest threat in using this technology is security. And our project will prove to be boom for households and industries.

A wide variety of leak detecting techniques is available for gas pipelines. Some techniques have been improved since their first proposal and some new ones were designed as a result of advances in sensor manufacturing and computing power. However, each detection method comes with its advantages and disadvantages. Leak detection techniques in each category share some advantages and disadvantages. For example, all external techniques which involve detection done from outside the pipeline by visual observation or portable detectors are able to detect very small leaks and the leak location, but the detection time is very long. Methods based on the mathematical model of the pipe have good results at high flow rates while at low flow rates a mass balance based detection system would be more suitable. Hybrid systems benefiting from the real-time detection capability of a software based method and the high localization accuracy of a hardware based technique, along with other specific advantages of both approaches, seem to be the future trend in gas leak detection. Selecting from the wide variety of commercial solutions available is ultimately an action that has to be taken after assessing the needs of the system in which gas leak detection is needed.

EXPECT RESULT

Overall this project will be a cost effective and multi operation project.

REFERENCES

1. Ch. Manohar Raju, N. Sushma Rani. An android based automatic gas detection and indication robot. *In International Journal of Computer Engineering and Applications*. 2014; 8(1).
2. Zhao Yang, Mingliang Liu, Min Shao, Yingjie Ji Research on leakage detection and analysis of leakage point in the gas pipeline system. *In Open Journal of Safety Science and Technology*; 2011.
3. S Shyamaladevi, V G Rajaramya, P Rajasekar, P Sebastin Ashok. ARM7 based automated high performance system for lpg refill booking & leakage detection. 2014; 3(2).
4. Pal-Stefan Murvaya, Ioan Sileaa. A survey on gas leak detection and localization techniques.
5. Falohun A.S., Oke A.O., Abolaji B.M. Dangerous gas detection using an integrated circuit and MQ-9. *In International Journal of Computer Applications*. 2016; 135(7).
6. Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar, Rahul Verma. GSM based gas leakage detection system. *In International Journal of Technical Research and Applications*. 2013; 1(2).

