

Smart System To Prevent Fire Breakouts Of Lpg Cylinder

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Abstract

The project titled “Smart System to Prevent Fire Breakouts Of LPG Cylinder” is designed with the aim of preventing major fire breakouts which may lead to loss of life and property. Nowadays LPG has become the basic necessity for our life. The proposed system is mainly focused on detecting the LPG leakage and the alarming system gets turned on once the gas leakage detected by the sensor is beyond the threshold level(70 ppm) and this system provides an additional feature by expelling the leaked gas through the window. The GSM module which is present in this system is used to send information via SMS to the registered mobile number as soon as the alarming system gets turned on to provide an information. The alarming system gets turned off when the sensor encounters the gas level present in the room is less than the threshold level(70 ppm).

Keywords: GSM, LPG, Sensor.

1.INTRODUCTION

Liquefied Petroleum Gas(LPG)plays a major role in our day to day life.20th century has become the darkest age without these LPG.LPG is one of the flammable gas which consist of a mix of propane and butane.LPG is a product obtained by the refining of petroleum and gas.LPG is a source of energy for domestic cooking, industrial ovens, electrical power generators and also it is used as a fuel for vehicles.

Indian LPG consumption in 2020 was at 27.41 million tones, 4.3percent higher than a year earlier. India’s LPG penetration reached 97.5 percent as on 1 April 2020 as compared to 94.3 percent recorded in the same month last year according to a report published by Petroleum Planning and Analysis Cell (PPAC) [1].

Rapid increase in population combined with LPG penetration in rural areas has resulted in an average growth of 8.4 percent in LPG consumption making India the second largest consumer of LPG in the world at 22.5 million tonnes.In India death caused by LPG fire breakouts for different years are 59 deaths in 2013-2014,115 deaths in 2014-2015,19 deaths in 2015-2016(April to June) [2].

The above data shows that the fire accidents caused by LPG breakout is increasing every year and there is an important need to provide solution to such accidents.The proposed model will provide

an effective solution to avoid LPG firebreakout along with the detection.

II.LITERATUREINVESTIGATION

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. “LPG Gas LeakageDetection and Alert System” done by E. Jebamalar Leavline, D. Asir Antony Gnana Singh, B. Abinaya,H. Deepika,this project detects the leakage of gases and alerts the user [3]. There is another similar project “LPG Leakage Dectector using Arduino with SMSAlert and Sound Alarm” done by Rhonnel S. Paculanan, Israel Carino which detects and alerts the user by using buzzer and sends SMS to the owner using GSM [4]. Ch. Manohar Raju and N. Sushma Rani, 2008, they introduced “An Android based Automatic Gas Detection and Indication Robot”. They proposed a model containing a mini mobile robot which is capable to detect gas leakage in hazardous places. Whenever there's an event of gas leakage during a particular place the robot immediately sends the info to android mobile through wireless communication like Bluetooth. They developed an android application for android based smart phones which may receive data from robot directly through Bluetooth. The application warns with a sign whenever there's an event of gas leakage and that we also can control the robot movements via Bluetooth [5].

A.Mahalingam,r.T. Naayagi,n.E. Mastorakis, introduced “Design and Implementation of an Economic Gas Leakage Detector”. This system gave the formulation of many problems in previous gas leakage detectors.In that system several standards have been formulated for the design of a gas leakage detection system such as IEEE, BS 5730, and IEC .For that work, the recommended UK safety standards have been adopted. The proposed alarm is especially meant to detect LPG leakage, which is most ordinarily utilized in residential and commercial premises. The system detects not only the presence of gas (gas leak), but also the quantity of leakage within the air, and accordingly raises an appropriate audio visual alarm. The objective of the system is to detect LPG gases like propane and butane. The allowed UK level for butane is 600 ppm above which it's considered to be of high level. This proposed system ensures a continuous monitoring of the gas levels. If the gas level increases above the traditional intensity of 400 ppm butane (LPG), the system starts to issue early warning alarms at 100ms interval, which suggests low level gas leakage. If the leakage level is increased to 575 ppm of butane (LPG), then the system turns on the high audio alarms at 50 ms intervals warning the occupants to run to ensure safety [6].

P.Meenakshi Vidya, S.Abinaya, G.Geetha Rajeshwari, N.Guna,“Automatic LPG detection and hazard controlling” proposed the real time gas monitoring and leakage detection system. In this system, the gas leakage is detected and controlled by exhaust fan [7].

Srinivasan, Leela, Jeyabharathi, Krithika, Rajashree, “Gas Leakage Detection and Control”.This sytem detects the gas leakage and alert SMS to the user switch off the power supply [8].

Hina Ruqsar, Chandana R , Nandini R , Dr. T P Surekha,“Internet of Things(IOT) Based Real Time Gas Leakage Monitoring and Controlling”,proposed the system which is used to detect monitoring gas leakage and send SMS through GSM[9].

Falohun A.S., Oke A.O., and Abolaji B.M. 2016, “Gas Detection Using an Integrated Circuit and MQ-9”. This system mainly detects the leakage and creates an alert so that occupants in the building can maintain the optimal ventilation and turn off the all electrical appliance [10].

K.Padmapriya, Surekha, Preethi, “Smart Gas Cylinder Using Embedded System”. This system detects the leakage of LPG and sends the SMS to turn off power supply. Load sensor is used to monitor the value below the threshold value and automatically booking the cylinder using GSM module is done [11].

Selvapriya, S.Sathyaprabha, M.Abdul rahim, “LPG Leakage Monitoring and Multilevel Alerting System”. The aim of leakage detection system is that it can automatically detects and alert and control gas leakage. Moreover the fire accident are also prevented by switching off the power supply [12].

L.K.Hema, Dr.D.Murugan, M.Chitra, “WSN Based Smart System for Detection of LPG and Combustible Gases”, This system is proposed with the smart sensor technology. This system is used to detect leakage of LPG gas which is flexible and reliable. This system has four units a sensor node, a relay node, network coordinator, and a wireless actuator [13].

B. D. Jolhe, P. A. Potdukhe, N. S. Gawai, “Automatic LPG Booking, Leakage Detection And Real Time Gas Measurement Monitoring System”. They proposed the system in which two sensors are used for detecting the gas leakage and an SMS is sent to the user using GSM [14].

Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar and Rahul Verma, “GSM Based Gas Leakage Detection System”, proposed the system in which two types of gases namely LPG and CNG are detected and sends a SMS to the user, produces a buzzer alert to the user in the house and display alert in LCD [15].

R.Padmapriya, E.Kamini, “Automatic LPG Booking, Leakage Detection and a Real Time LPG Measurement Monitoring System”. They proposed the system in which ARM7 processor using keil software and send a SMS to the User as an alert [16].

V.Ramya, B.Palaniappan, “Embedded System for Hazardous Gas Detection and Alerting”, proposed the system which is used to detect the leakage of gas and alert the user by sending a SMS through GSM [17].

M.B.Frishi, R.T.Wainner, B.D.Green, M.C.Laderer, M.G.Allen, “Standoff Gas Leak Detectors Based on Tunable Diode Laser Spectroscopy”, proposed the system which used trace sensing technology and it is used to detect the leakage [18].

T.Soundarya, J.V. Anchitalagammai, G. Deepa Priya, S.S. Karthick kumar, “C-Leakage: Cylinder LPG Gas Leakage Detection for Home Safety,” proposed a system which is used to detect the LPG gas leakage and produces an alert [19].

From referring above all the existing models we provide a solution to enhance the project by

combining all the solutions as a single unit.

III.IMPLEMENTATION

3.1. System Design

The block diagram of the proposed model of Smart System to Prevent Fire Breakouts of LPG Cylinder is shown above in figure 1. The gas sensor senses the level of the gas and its result is given to the arduino. The arduino processes the input which is sent by the gas sensor and based on the result produced the output devices get turned on and SMS is sent to the registered mobile number via GSM module.

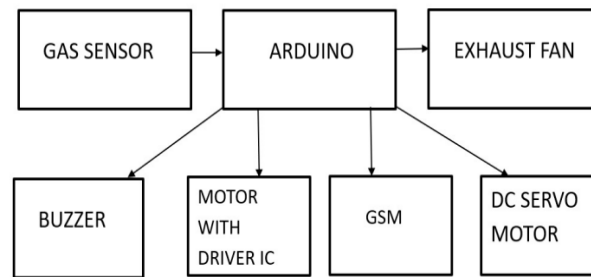
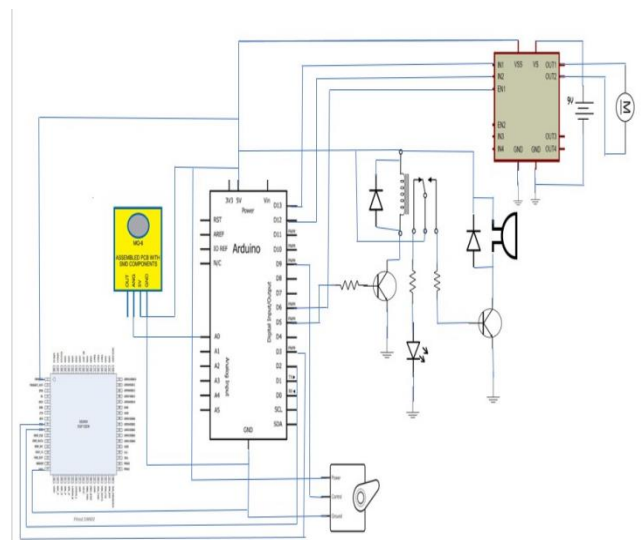


Fig 1. Block Diagram of Smart System to Prevent Fire Breakouts of LPG Cylinder

3.2. Circuit Diagram

The circuit diagram of the proposed model of Smart System to Prevent Fire Breakouts of LPG Cylinder is shown below in figure 2. The MQ-6 gas sensor which is connected to the arduino is an input device which senses amount of gas. The arduino gives signal to the output devices. The output devices connected to the arduino are servomotor, exhaust fan, GSM and buzzer. Based on the signal sent by arduino these output devices work accordingly.



MQ-6 Gas Sensor is used to detect gases like LPG and Butane. It has both analog and digital pin where analog pin gives output depends on the intensity of gas which is measured in units of parts per million(ppm). It has operating voltage of 5V. It works with and without a microcontroller. The MQ-6 gas sensor measures gas more accurately in the range of 200-10000ppm.

Arduino UNO

Arduino Uno is a open source microcontroller board based on Microchip ATmega328P(high performance, low power controller from Microchip) microcontroller. Arduino Uno has both digital and analog pins which are used to interface with external device. There are 14 digital input/output pins which has capable of 6 Pulse Width Modulation(PWM) output pins and it has 6 analog pins. Arduino is programmable by the Arduino IDE(Integrated Development Environment) using a USB cable of type B. The operating voltage of Arduino is 5V.

Buzzer:

Buzzer is an electronic device used as an alarm/indicator. It has an operating voltage of 4-8V. It has two terminals which is positive and negative.

Relay:

Relay is an electrical component used to open and close a circuit. It act as an electrical switch. It has three main pins NC(Normally Closed), NO(Normally open) and COM(Common) .It operates on 5v.

Servomotor:

Servomotor SG 90 is used as an actuator. It can be used in two ways linear actuator and rotary actuator. A servomotor can make rotations upto 180 degree. Servomotor has three wires they are positive, negative and PWM(Pulse Width Modulation) signal wire. It has an operating voltage of 5v and operating speed is 0.1s/60degree.

GSM:

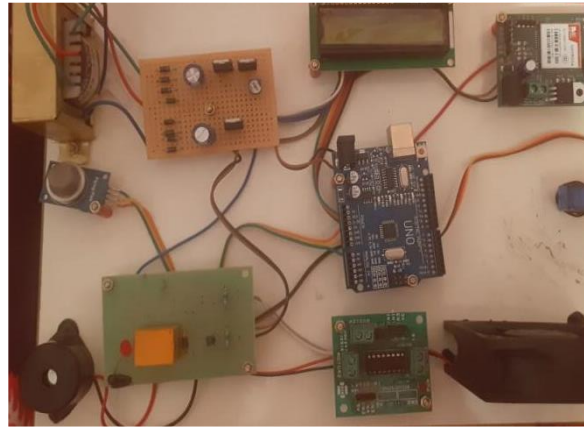
GSM SIM900A(Global System for Mobile communication) is used to send and receive messages and phone calls. It is used to alert a user by sending message or phone calls. It has operating voltage of 4-4.5V. It has 68pins. In GSM there are two main pins ,they are TXD(Transmit Data) and RXD(Receive Data) which are used to transmit and receive data.

IV.WORKING

The gas sensor used here is the MQ-6 gas sensor which is used for continuously monitoring the gas level. Once the gas level sensed is greater than the specified level(70 ppm) it means that there is an gas leakage and it should be immediately sorted out to avoid the fire accidents. When the gas level sensed is beyond the specified range then automatically the buzzer gets switched on and the relay which is connected with the main supply of the house will turn off the main supply so that there will be no power supply which may lead to fire accidents. Simultaneously, the program written in embedded C is present in the arduino. This program is written in such a way that it turns on the servo motor when there is a gas leakage which is fixed near the window. This servo motor opens the window through which the exhaust fan expells the gas out of the room. The aim of this

work is to reduce the chances of fire breakouts and providing this system at an convenient manner as much as possible.

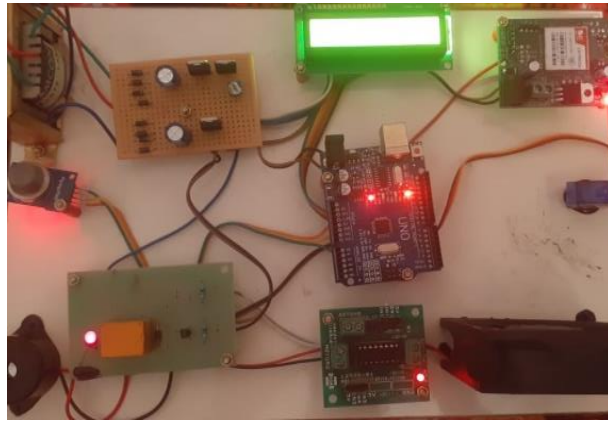
Fig 3.Hardware implementation of Smart System To Prevent Fire Breakouts Of LPG Cylinder



V.RESULTS AND DISCUSSIONS

After completing the design and the hardware setup the project was tested under various condition. At first the model is tested where there is no leakage and as a result when the system energizes the LED glows. Then the model is tested where there is gas leakage but below the threshold level (70 ppm). As a result the level of the gas and the condition (normal) is displayed in Liquid Crystal Display (LCD).

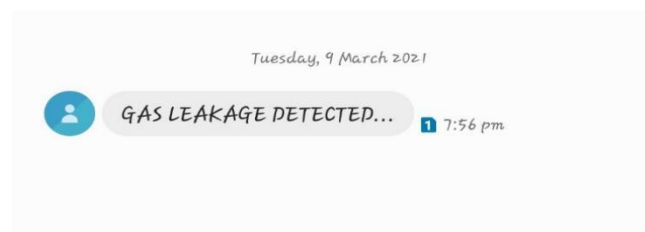




Then the model is tested where there is a gas leakage and above the threshold level(70 ppm).As a result the level of the gas and the condition(danger) is displayed in Liquid Crystal Display(LCD).



The GSM module sends an SMS to the registered mobile number when the gas leakage is beyond the threshold level.



VI.CONCLUSION

Thus the Smart System to Prevent Fire Break Outs of LPG Cylinder is designed and tested under various conditions and the output with gas leakage and without gas leakage is achieved successfully. The proposed system is designed in such a way that it senses the gas. When the gas leakage level is above 70ppm the power supply is turned off and the servo motor opens the window through which the leaked gas is expelled out by the exhaust fan and also SMS is sent to the registered mobile number. When the gas leakage level is below 70ppm the LED alone gets turned on indicating that the gas leakage level is below the threshold value(70 ppm).This is practically verified. Hence by using the proposed system the fire accidents caused by the gas leakage can be prevented and we can save the human life and property.

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