

SENSOR BASED LPG GAS DETECTION AND CONTROL

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Abstract: In our country India about 62 people die every day due to fire related accidents out of which LPG based accidents account for one sixth of the total. Our work has taken this problem due to the alarming statistics .A solution to this problem has been considered. The solution is a sensor based system which provides gas detection through the use of sensors. Control also is initiated to prevent disasters due to gas leakage blasts. There are existing market solutions for the same, but our work has integrated many practical features like electricity turnoff, exhaust fan-on, alert display ,buzzer alarm and alert messages which will ensure safety during gas leakage. Our system can also provide accountability for deaths due to LPG blasts as a message will be sent to a remote user and this can help in detecting the exact time line of events in scenarios like dowry related deaths where foul play is suspected. Such a system can thus act as a deterrent to people who use the pretext of LPG gas blasts for killing innocent women in India. Hence this system can provide better security to human life either in the case of accidental deaths or preplanned murders.

IndexTerms–LPG leakage, sensors, alert, electricity, control

I. INTRODUCTION

People consider their homes as a safe haven. But various statistics show that our homes may not be as safe as we think. Figures from NCRB (National Crime Records Bureau) tell us that fire accidents cause an average of 62 deaths per day [1].This statistics was for the period from 2010 till 2014, out of which 17% of deaths were caused due to LPG leakage [1].According to NCRB the state wise [2] statistics is shown in Figure.1.

The statistics are alarming and this has to be looked at from different perspectives. There can be various causes for these deaths and statistics show that some of these are caused due to dowry related problems, some others are suicide and others are because of inadequate safety checks on LPG cylinders.

Our work aims at providing a cost effective solution which will be able to detect LPG leakage. This system will immediately cut off the gas supply by turning off the LPG regulator if LPG gas leakage is detected. The work has also considered additional features like sending an SMS to a registered mobile number about the leakage at home.

Not only that the system is integrated with the electricity supply which will be immediately shut-off if gas leakage is detected. This system also has integrated an exhaust fan which will be turned on if gas leakage is detected. Thus this system can help to overcome accidental LPG gas leakage. Not only this ,the work also provides a solution to dowry related deaths .This can be done if all LPG subscribers are required to mandatorily include this system along with their cylinder.

This can be helpful in investigations to find out if the people who killed the girl have turned off the Sensor based LPG gas detection and control system when they killed the girl. Thus this system provides more accountability during deaths of people due to LPG leakage.

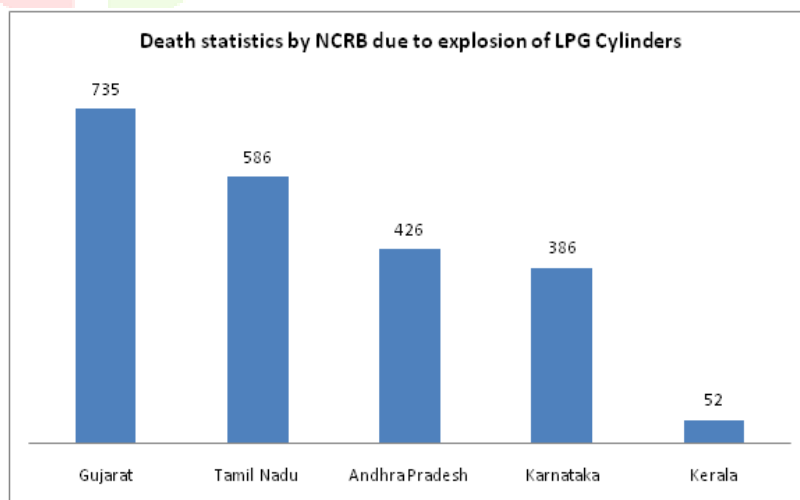


Fig.1. Statistics of deaths caused due to LPG explosion

II. PROPOSED SYSTEM

2.1Block Diagram

The block diagram of the proposed system is shown in Figure.2.The system is based on various sensors which detect gas leakage .The inputs acquired from the sensors are input to the control unit which is the micro controller. The microcontroller has an algorithm which compares the acquired input signals with a predefined database. If the input sensor value crosses a threshold level, control actions are taken. First the LPG

regulator knob is turned off, then the electricity is cutoff after which exhaust fan is turned on and finally a text message is sent to a registered mobile number from the GSM.

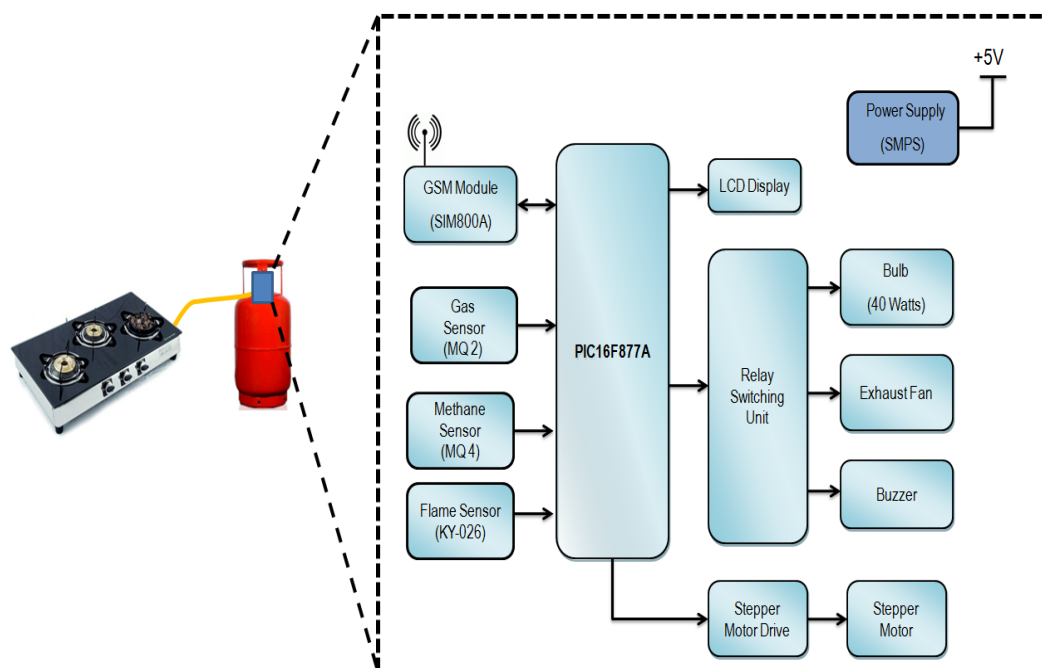


Fig.2. Block Diagram of Proposed system

2.2 Experimental Setup

The proposed system was prototyped and tested. The sensors used for the prototype detected parameters like smoke, LPG and flame. The analog inputs from the sensors were provided to an ADC (Analog to Digital converter) which converted them to digital. The digital outputs are then fed into the control unit which consists of the PIC16F877A. The PIC16F877A is programmed such that it acquires the sensor inputs and compares them with a predefined data set. If the input sensor values cross a particular threshold the regulator valve of the LPG cylinder is immediately turned off by means of a stepper motor circuit.

The system is also integrated with a character LCD which will display the status of gas leakage if a person is in the kitchen so that they can take precautionary measures. The buzzer also is sounded for the benefit of the person, in case the person is inside the house. At the same time the electricity for the household is turned off and the exhaust fan is turned on.

The controller also triggers the GSM module which transmits a message alerting about the gas leakage to a registered mobile number. The same information can also be conveyed to a nearby fire station. The experimental setup of the proposed system is shown in Figure.3. The various components used for building the prototype are PIC16F877A-Microcontroller, MQ-2 –smoke sensor, MQ-4 Methane sensor, KY026-Flame sensor, SIM800A-GSM Module.

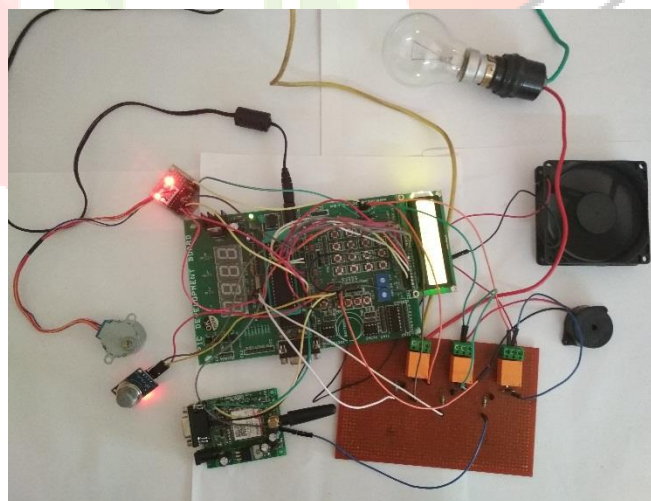


Fig.3. Experimental setup of proposed system

III. RESULTS AND DISCUSSION

The prototype for the sensor based LPG gas detection and control system was tested and validated. The system was tested for the following test cases.

- 1) Test case 1: Acquiring Inputs from sensors
- 2) Test case 2: Processing analog signals using ADC
- 3) Test case 3: Testing of GSM message
- 4) Test case 4: Turning of electricity
- 5) Test case 5: Turning on exhaust fan
- 6) Test case 6: Testing of stepper motor

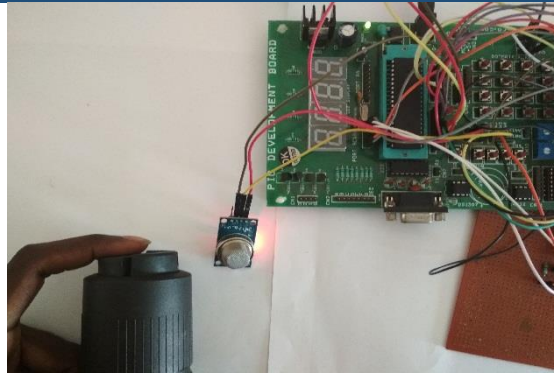


Fig.4.Test case 1-Acquiring Inputs from sensors

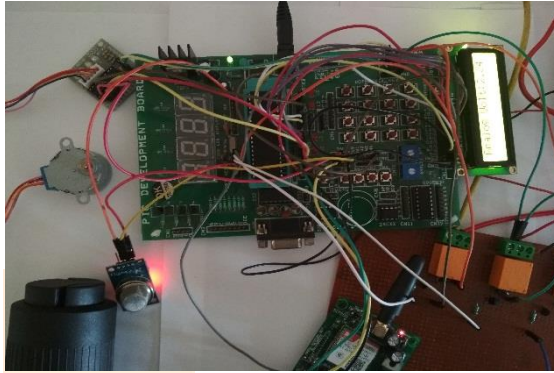


Fig.5.Test case 2- Processing analog signals using ADC

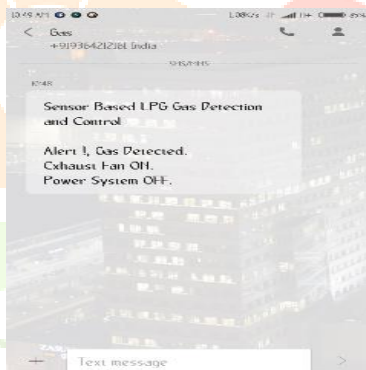


Fig.6.Test case 3- Testing of GSM message

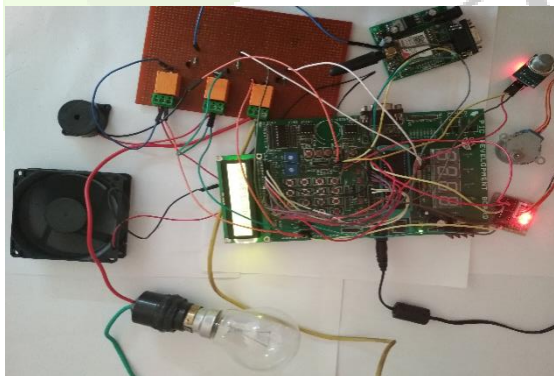


Fig.7.Test case 4-Turning of electricity



Fig.8.Test case 5-Turning of exhaust fan

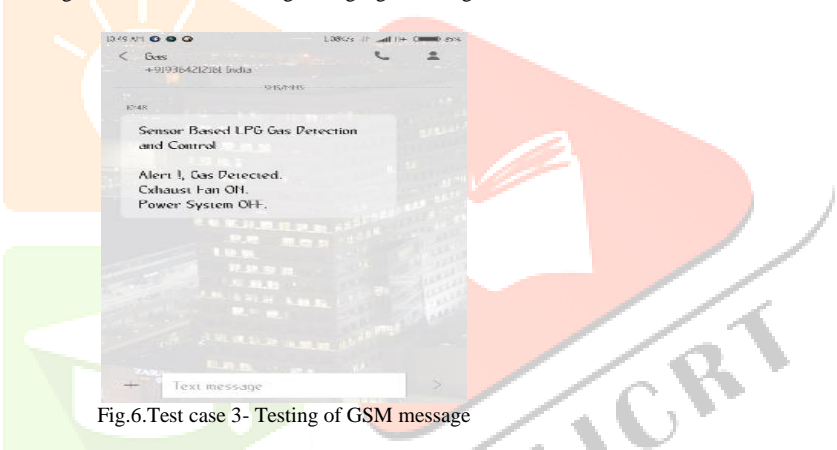
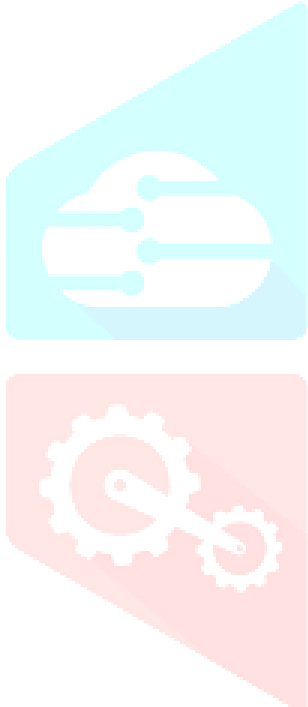




Fig.9.Test case 6-Testing of Stepper Motor

IV. CONCLUSION

The sensor based for automatic Gas detection and shutoff was designed and tested. The same was integrated with additional features to bring in more accountability considering the alarming rate of LPG gas based deaths across the country. It was found that the system provided an effective solution by turning off the LPG regulator and also considered bringing out all precautionary measures. Existing solutions in the market have considered only automatic shut-off. But our system has brought in additional features without much addition in cost like turning on the exhaust fan, turning of electricity, display of the gas status in the CLCD and alert using a buzzer. The system also was able to inform the status in case of emergency to a remote user using GSM.

V. FUTURE WORK

The work has not considered integrating this information into the network. This work can be further enhanced to provide more accountability by sending information in case of gas leakage to a centralized server which can be used in investigations for dowry related deaths. This can work as a deterrent to those who kill people in the name of money.

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