AUTOMATION OF LPG BASED HEATING SYSTEM

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Abstract

The system is designed to detect the LPG gas leakage and prevention of the same for home safety. The detection of gas leakage is done by using gas sensor and prevention is done by turning off of the main power supply on detecting the leakage. The additional feature of the system includes the automation of the gas stove which involves implementation of the timer based system of induction stove to the LPG stove. The design also includes displaying a message on LCD display when the weight of the gas cylinder goes below a certain threshold in order to replace the cylinder. The system is implemented using ARDUINOMEGA which uses ATmega2560 microcontroller.

Keywords: LPG Automation,Smart LPG Regulator,GAS Automation

1. Introduction:

The main focus to develop our system was to make it a real time system which involves both detection of gas leakage and prevention. The increase in the development of technology has led to use LPG gas for cooking at home and also hotels. LPG primarily consists of propane and butane which are highly flammable chemical compounds. In the natural state, LPG and natural gas are all odourless. The distinctive smell that people associate with these gases is actually added to them as safety measure .LPG smells because of an odorant, Ethyl Mercaptan is added to the gas to make it easier to detect a leak .Since the sense of smell in a person varies, it is not reliable. Therefore, we use a gas sensor which detects the leakage.

The paper refers [1] to the detection of the leakage and alerting the customer about the same and switches on the exhaust fan. In [2], with the help of microcontroller they display the amount toxic gases being leaked along with detection and alerting system. [3] Refers to locating the area of leakage. In [5] the leakage is detected and alerted by sending SMS to the owner using GSM interface.

All these existing research papers involve in detection of leakage and alerting system. The system which we have proposed aims on not only detection and alerting, but also includes prevention of any electrical interferences or accidents due to the leakage. This prevention is implemented by switching off the main power supply when the leakage is detected. The leakage detection is done by using a MQ6 gas sensor. Along with leakage detection and prevention, there lies an idea of weighing the gas cylinder with the help of load cell. Sometimes we return the cylinder to the gas agent assuming it to be empty, which may not be the case. This problem is overcome by using weighing mechanism which weighs the cylinder and displays a message to replace the cylinder when the weight is below the threshold value. We also implement timer concept in the proposed device for cooking the food for required amount of time.

2. Literature Survey

The system detects the leakage of the LPG and alerts the consumer about the leak and as an emergency measure the system will switch on the exhaust fan and also checks the leakage. Sunithaa.J, Sushmitha.D, "Embedded control system for LPG leakage detection and prevention" International Conference on Computing and Control Engineering (ICCCE 2012), 12 & 13 April, 2012.

The main objective of the work is design in microcontroller based toxic gas detecting and alerting system. The hazardous gases like LPG and propane were sensed and displayed each

and every second in the LCD display and alerts with the help of an alert message. V.Ramya, B. Palaniappan, "Embedded system for hazardous gas detection and alerting" International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.3, May 2012.

This system gives real time detective of potential risk area, collect the data of leak accident and locate leakage point. This system having protection circuitry consists of exhaust fan and a Liquefied Petroleum Gas Safe Solenoid Valve. In this system MQ-6 gas sensor used to sense poisonous gas. Mr.SagarShinde, Mr.S.B.Patil, Dr.A.J.Patil, "Development of movable gas tanker leakage detection using wireless sensor network based on embedded system", International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2, Issue 6, November- December 2012, pp.1180-1183.

The objective of this work is to present the design of a cost effective automatic alarming system, which can detect liquefied petroleum gas leakage in various premises. In particular, the alarming system designed has a high sensitivity for primarily butane, which is also individually sold bottled as a fuel for cooking and camping. A. Mahalingam, R. T. Naayagi, N. E. Mastorakis, "Design and Implementation of an Economic Gas Leakage Detector", Recent Researches in Applications of Electrical and Computer Engineering.

The system detects the leakage of the LPG using gas sensor and alerts the consumer about the gas leakage by sending SMS. The proposed system uses the GSM to alert the person about the gas leakage via SMS and alert the people at home by activating the alarm which includes the LED, Buzzer simultaneously and display the message on LCD display to take the necessary action and switch on the exhaust fan. M. B. Fish, R.T. Wainer, "Standoff Gas Leakage detectors based on tunable diodes laser absorption spectroscopy".

3. Hardware Description:

This prototype consists of leakage detection and prevention module, weighing mechanism and timer circuitry. It uses Arduino Mega 2560 which is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; it can be simply connected to a computer with a USB cable or power it with an AC to DC adapter or battery to get started. The leakage detection module consists of the MQ-6 gas sensor which is highly sensitive to LPG. MQ-6 gives fast response time at the output and has a stable and longer life. The sensitivity of the gas sensor can be adjusted using external circuitry. The sensor is insensitive to air. The sensor output is analog resistance. The output of sensor module is connected to ADC of the microcontroller. The microcontroller digitizes the voltage and checks if the concentration of LPG is within safe levels. If the concentration of LPG which is a combustible gas and is beyond safe levels (the safety level is programmable) the microcontroller immediately activates the LCD and turns off the main power supply and further it is interfaced with the load cell to implement additional functionality of displaying the weight of the cylinder approximation of the percentage of total weight is displayed using an LCD. The load cell can translate 10kg of pressure into an electrical signal. The load cell is capable of measuring the electrical resistance that changes in response to, and proportional of the strain applied to the load cell. Further a timer is installed in order to help the user to cook for certain amount of time.

The important function of gas detection module is to detect the change in composition of LPG gas when there is a leakage and turn off the main power supply. To detect the leakage MQ6 gas sensor is used. The sensitive material in MQ6 is SnO_2 with lower conductivity in low clean air. When the target combustible gas is present, the sensor's conductivity is higher along with rise in gas concentration and the resistance of sensor changes with the concentration of combustible gases. Figure 2 shows the gas leakage sensing circuitry. A simple electronic circuit can be used to convert the change in resistance to change in terms of concentration of combustible gases.MQ6 gas sensor has high sensitivity to Propane, LPG and Butane. Low cost and long life are the first

advantages of using this sensor. Secondly it has simple drive circuit. For the sensor to function properly the sensor needs to be heated for specific amount of time called the preheat time. The sensor works with 5volt power supply.

Addition feature is to indicate about the approximate weight of the cylinder is given as full, medium or empty. This measurement is done by interfacing a load cell with microcontroller. The load cell will produce an analog voltage corresponding to the change in weight this is in terms of millivolts a suitable circuitry is used to amplify and filter this analog voltage . This will be displayed in a Liquid Crystal Display interfaced with the microcontroller. If found empty a message is displayed on LCD to replace the cylinder. The Arduino Mega 2560 forms the heart of the entire system controlling all processes that take place. A timer is interfaced to for the users to set a particular amount of time depending on their need of time for cooking is displayed on the LCD display.
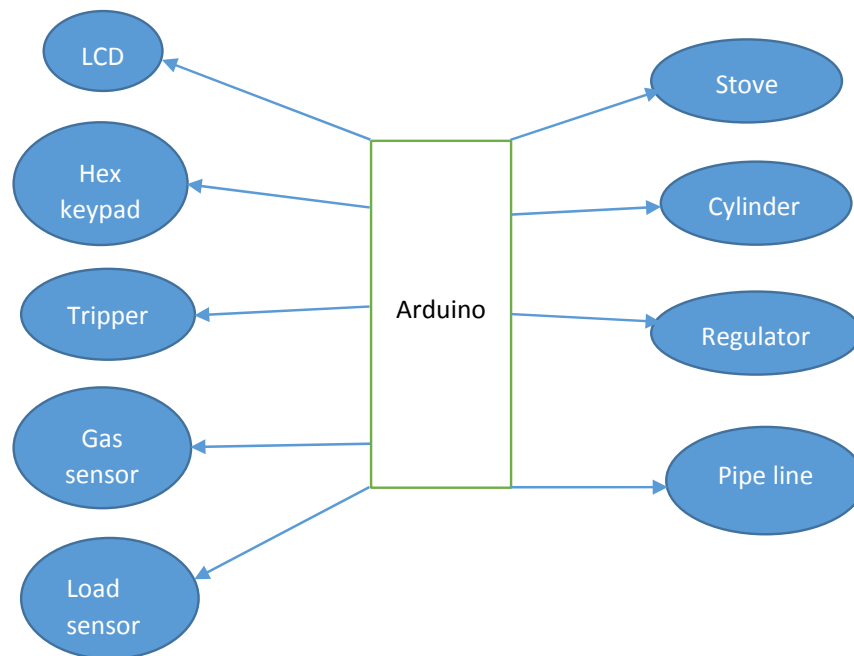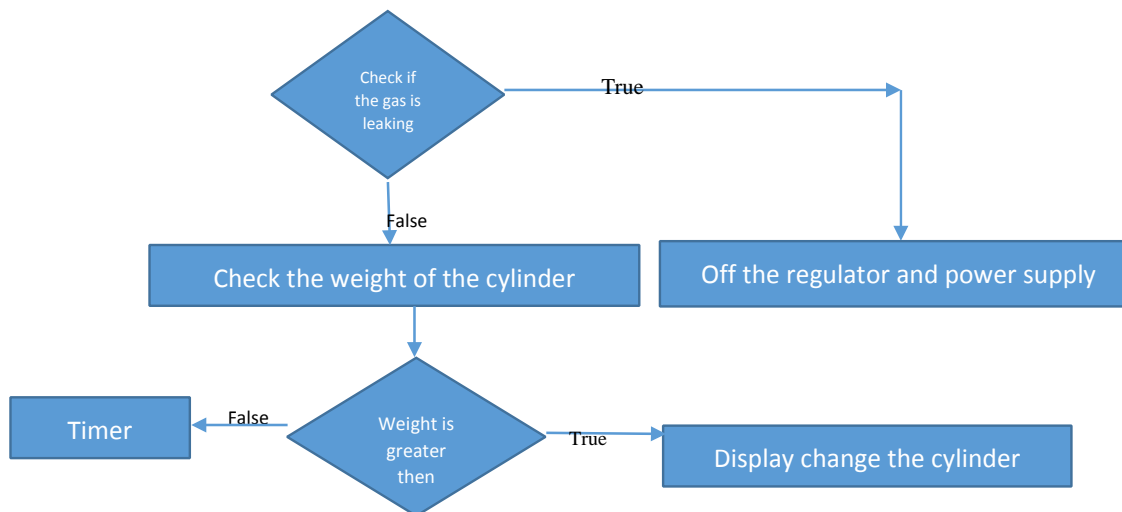

4. System Operation:

In this prototype, gas leakage detection is performed using MQ6 gas sensor, which is placed in the vicinity of the gas cylinder. At the occurrence of leakage, the resistance of the sensor decreases increasing its conductivity. Corresponding pulse is fed to microcontroller and simultaneously the main power supply is turned off in order to prevent accidents. The load cell continuously monitors the weight of the gas in cylinder and displays the weight on LCD. When the weight of the gas is less than or equal to a threshold value, a logic high pulse is fed to a port pin of microcontroller. As this pin goes high, microcontroller will display the message to replace the cylinder on LCD. Along with the above facility inbuilt timer is also provided to turn off the stove after certain duration of time. The timing pulse is fed into microcontroller when a key in hex keypad is pressed and accordingly the digital output is displayed on LCD.

5.   Future Scope

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1. By making this product to operate for many cylinders together we can use it in the flats.
2. Can detecting the location and amount of leakage we can use the device for industrial purpose.

7. Conclusion

This system detects the leakage of the LPG and alerts the consumer about the leak and as an emergency measure the system will turn off the power supply, while activating the alarm. 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 Arduino mega processor. 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.

8.   Reference

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