



Design & Implementation of LPG Gas Detector using GSM Module

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ABSTRACT: Gas leakages resulting into fatal inferno has become a serious problem in household and other areas where household gas is handled and used. Gas leakage leads to various accidents resulting in financial loss as well as human injuries and loss. The work aims at designing a system that detects gas leakage and alerts these describer through alarm and status display besides turning off the gas supply valve as a primary safety measure. The shutting off of the supply valve stops further gas flow to the cooker to prevent. The system more like a first Aid, automatically uses a normally closed solenoid valve for the shutting off of the gas valve before calling for help via visual display and audible alarm to those within the environment. The system is an intelligent system, as it does not create nuisance by continuously sounding alarm but the alarm stops beeping once the concentration of the gas in the atmosphere after leakage goes below the set point and opens the valve again for operations. This work will minimize losses occasioned by explosions due to gas leakages and improve safety of life. Gas leakage is a major problem with industrial sector, gas powered vehicles like CNG, LPG cars. One of the preventive methods to stop accident associated with 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 (C_{3H8}) and butane (C_{4H10}). 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 design approach on both software and hardware.

Keywords: MQ-5 Gas sensor, Gas leakage detection, Buzzer, Microcontroller, Solenoid valve.

I. INTRODUCTION

The use of liquefied petroleum gas (LPG) is rapidly increasing in developing countries like Nigeria, India, Bangladesh, Nepal, South Africa as It produces low smoke and less soot. The LPG is a flammable mixture of hydrocarbon gases like propane and but Gas pipelines are safe but they are prone to gas leakage due to mishandling, accidents and over filling of the gas cylinder. Explosions resulting from domestic cooking gas leakage can be fatal causing loss of property and injuries or even deaths. A number of research papers have been published on gas to leakage security system in which gas sensors are used to detect gas leakage and a response circuit is caused to initiate an alert procedure and/or take action to avert an incident. One such method detects gas leakage and sends SMS to the householder. This does not make provision for halting further gas leakage. Another method not only detects gas leakage but also beep and turns off main power and gas supplies, and send an SMS. GSM module is used which alert the user by sending an SMS. This has broader focus beyond kitchen gas leakages. Another approach uses a smart security phone attached gas leakage

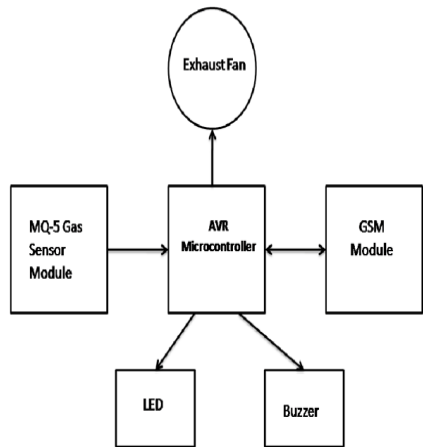
sensor that senses leakage and sounds an alert alarm as well as sending a SMS to the home owner and emergency services. The design of a wireless LPG leakage monitoring system is proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by a SMS and as an emergency measure, the system will turn off the power supply, while activating the alarm. The additional advantage of the system is that it continuously monitors the level of the LPG present in the cylinder using load sensor and if the gas level reaches below the threshold limit of gas around 200 Grams so that the user can replace the old cylinder with in time and automatically books the cylinder using a GSM module .The device ensures safety and prevents suffocation and explosion due to gas leakage. This project is implemented using PIC microcontroller and simulated using keil software. This approach does not make provision for kitchen gas that uses gas cylinders not supplied by power utility supply, which the commonest is found in developing countries like Nigeria and many other developing countries who have not developed such infrastructure. In yet another approach, leak detection module consists of MQ-6 gas sensor to detect amount of combustible gas present in the surrounding.

As the leakage detects the ARM 7 controller sends the message to LCD which displays “Gas Leakage Detected”. work develops a gas detection and response system that detects gas leakage and automatically shuts off supply through the gas solenoid valve and sounds an alarm. It is focused on managing cylinder gas supply used in domestic household cooking in the kitchen to minimize accidents due to gas leakages.

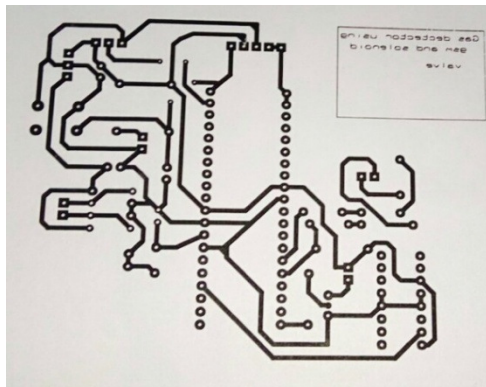
II DESIGN METHODOLOGY

In this work a sensor capable of detecting the presence of gas in the air .To avoid increasing the gas concentration which will hasten fire incidents, supply of gas to the burner must be proper, if it is not then it should alert the owner of the status of the gas cooking system, an alarm must beep, display were added and message should be send.

A. Block Diagram



B. Circuit Diagram

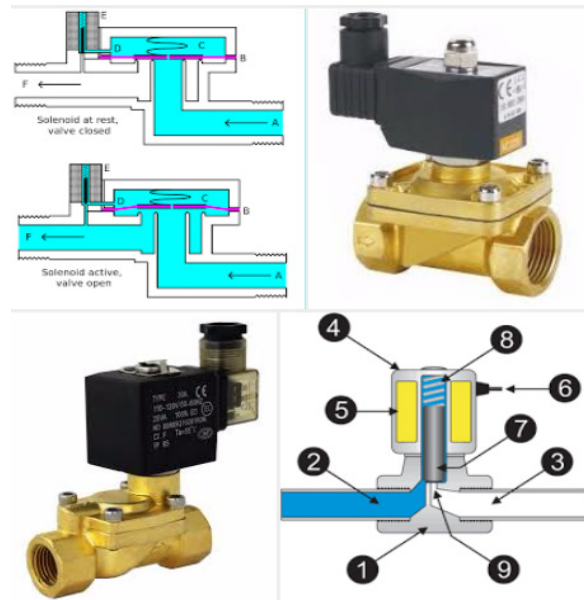


C. The Design of the Control Unit

The control unit receives signal from the gas detector sensor and then sends signal to the solenoid valve drive unit and then activate an alarm. It should also

display in LCD .From the circuit diagram, the control circuit is implemented with a PIC16F876A microcontroller. The PIC16F877A features 256 bytes of EEPROM data memory, self-programming, Comparators, the Synchronous serial port can be configured as either 3-wire Serial Peripheral Interface and the 2-wire Inter-Integrated Circuit bus and a Universal Asynchronous Receiver Transmitter(USART). The PIC16F876A microcontroller has three input/output ports. The signals from the MQ-6gas sensors is used as signal input at Port A, Port A is configured as an input port. Receives signal from the gas sensor. Port B is configured as an output port. Port B is used to drive the 16x2 LCD. Port C is configured as an output port. Port C is used to drive the buzzer alarm and the solenoid valve drive control signal. The microcontroller unit is operated with4MHz crystal oscillator. The LCD is operated in 4-bits mode. The analog to digital converter of the PIC16F876A microcontroller is implemented at Port A of the microcontroller. The analog signal from the MQ-5 gas detector is converted to 10-bits digital signal. When the concentration of gas rises above that of set point in the microcontroller, the micro controller sends a signal to the solenoid valve drive unit to close the solenoid valve so as to shut off gas supply and also activate an alarm to alert the there is gas leakage.

D. Solenoid Valve Drive Unit



The solenoid valve drive unit controls the opening and closing of the solenoid valve which controls the flow gas from the supply to the point where the gas is being used. The solenoid valve drive receives signal from

the control unit and the carries out the appropriate action. There parts are defined:

1. Valve body: This is the body of valve to which the solenoid valve is connected. The valve is usually connected in the process flow pipeline to control the flow of certain fluid like liquid or air.
2. Inlet port: This is the port through which the fluid enters inside the automatic valve .
3. Outlet port:- The fluid that is allowed to pass through the automatic valve leaves the outlet port.
4. Coil:- This is body of the solenoid coli. the body of the solenoid coil is cylindrical in shape, and it hollow from inside.
5. Coli Winding:- The solenoid consists of several turns of the enameled wire wound around the ferromagnetic material like steel or iron.
6. Lead wires:- These are external connection of the solenoid valve that are connected to the electrical supply.
7. Plunger or Piston:- This is the solenoid round metallic part cylindrical in shape and place in the hollow portion the solenoid valve.
8. Spring:- The plunger moves inside the hollow space due to the action of the magnetic field against the action of the spring.

III. RESULTS & DISCUSSION

Testing was carried out by releasing LPG into the atmosphere around the sensor. The gas detector and response unit are there to detect it.

The results of test carried out on the device at different times and days for concentration of gas in the air around the sensor. The last four values is the case of an endless loop due to high gas concentration. The device was tested placing the LPG device at different distances from the gas source.

It was observed that when the LPG device was test by placing it at different distances from the gas source, the response time of the LPG system decreased as the distance from the gas source increased. Also it was observed that the sensitivity of the gas sensor was very high in clean air. The gas sensor sensitivity varied with temperature while the reference voltage remained constant over time.

At constant gas concentration, the sensed voltage will always be constant. The gas sensor has a very fast response to gas since the time difference between test results with same concentration is very small while the difference between the sensed voltages is very high.

IV. CONCLUSION

A device that can detect such leakages and shuts off the gas supply to the burner from the cylinder was designed and developed. It was observed that when the LPG device was tested by placing it at different distances from the gas source, the response time of the LPG system decreased as the distance from the gas source increased and vice versa. The gas sensor's sensitivity varied with temperature while the reference voltage remained constant over time. This device can be deployed anywhere cooking place or in kitchen .This system will ensure that explosions resulting from leakages of cooking gas from the cylinders are averted.

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