# Development of a Gas Leakage Detector with Temperature Control system

**A. Y. Nasir, Adoyi Boniface, A.M. Hassan**
Department of Computer and Communications Engineering,
Abubakar Tafawa balewa University,
P.M.B 0248, Bauchi, Nigeria.
aynasir@gmail.com,adoyiboniface@gmail.com,
abbas_musahassan@yahoo.com.

**N. M. Tahir**
Department of Mechatronics and Systems Engineering,
Abubakar Tafawa Balewa University,
P.M.B 0248, Bauchi, Nigeria.
nuratahir85@gmail.com.

*Abstract*—**Gas leakage in our homes, industrial sectors and gas-powered vehicle etc. is a disaster awaiting to happen if we don't take the appropriate safety precautions. One of the preventive methods to stop accidents associated with gas leakage is to install a gas leakage detection device at vulnerable places. This project presents an alternative approach to develop a device that can automatically detect and control gas leakages and also monitor temperature in vulnerable areas. The system detects the leakage of the LPG (Liquefied Petroleum Gas) using a gas sensor and then also monitors the temperature using a temperature sensor. When the LPG concentration in the air exceeds a certain level, the gas sensor senses the gas leakage and the output of the sensor goes LOW, the system then opens the exit windows, and then uses a GSM module for an alert about the gas leakage. Also, when the temperature of the environment exceeds a certain limit, it then turns ON the LED (indicator) and make an alarm through the buzzer. An LCD (16x2) displays the current temperature and gas leakage status in degree Celsius and PPM respectively.**

*Keywords—GSM (Global System for Mobile Communications); LPG (Liquefied Petroleum Gas); Gas Sensor (MQ) LCD (Liquid Crystal Display); PPM (Percentage per million).*

## I. INTRODUCTION

In modern days, especially in Africa, the use of gas cooker is rapidly replacing the use of electric cooker and kerosene stove for domestic working. Also, in industries and laboratories gas is used for diverse purposes. LPG is equally used in vehicles as fuel due to the soaring in the prices of petrol and diesel [1].

According to the reports of some researchers, the leakage of LPG has become one of the fundamental issues in recent times. There are fire disasters that were heard of in the past which could have been avoided if gas leakage was detected. Example, the Bhopal gas tragedy in India has been recorded as world's worst gas leakage accident [2]. Going by the increasing level of patronage of LPG for cooking and heating applications, coming up with an alternative safety measures and methods of checkmating the impact of fire outbreak that may result from its leakage

has attracted the attention of many researchers [3]. Before the development of house hold electronics gas detectors in the early 90s, chemically infused paper that changes its colour in response to exposure of the gas was used to detect the presence of LPG [4]. Since the introduction of electronic gas detectors, quite a number of devices have been developed.

## II. RELATED WORK

GSM-Based gas alert system has gained interest as a result of the rapid development in the communications devises and the level at which developing countries utilizes it advantages. In a design by [5], a microcontroller based low cost gas leakage detector with SMS alert, PIC16F877 was used as the main brain of the system, MQ-5 to sense gasses and SMS will be sent but the control of the environment is implemented by third party as the system only alert by alarm using buzzer. similarly, GSM based gas leakage detection system [6] uses AT89C51 and MQ-6 for microcontroller and gas sensor, this provide better accuracy than [5] but also require an external intervention to pre-control the environment. Another approach with a different microcontroller uses STC89C51RC [7] and for detection, different devices were used separately where the temperature was sense using DS18B20, the concentration of carbon dioxide adopts b-530 and humidity sensor db171. Hence, makes the design a little bit complex and not cost effective. Among other GSM based gas monitoring system our design utilizes very effective gas sensor (MQ-6), basic temperature sensor DHT 22 and an UNO Arduino Board which makes it fast, cost effective and at the same time help control the environment by allowing air into the environment to reduce the concentration of the leaked gas.

## III. METHODOLOGY

### A. Block Diagram

The Figure below shows the block diagram of gas leakage security system.
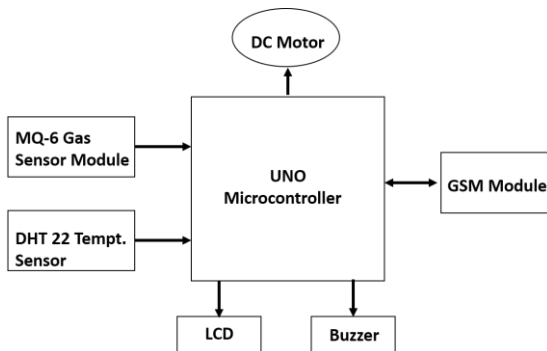


*Fig. 1: Block Diagram*

### B. MQ-6 Gas Sensor

MQ6 is a semiconductor type gas sensor which detects the gas leakage. The sensitive material of MQ-6 is tin dioxide ($SnO_2$). It has a very low conductivity in clean air. This Gas sensor not only has sensitivity to propane and butane but also to other natural gases, low sensitivity to cigarette smoke and alcohol. The MQ-6 gas sensor is shown in fig. 2. This sensor can also be used for detection of other combustible gas such as methane.



*Fig. 2: MQ-6 Gas Sensor*

The concentration range of MQ-6 gas sensor is 300-1000 ppm. This sensor is available in 6 pins package, out of which 4pins are used for fetching the signals and other 2 pins are used for providing heating current. This sensor has fast response time.
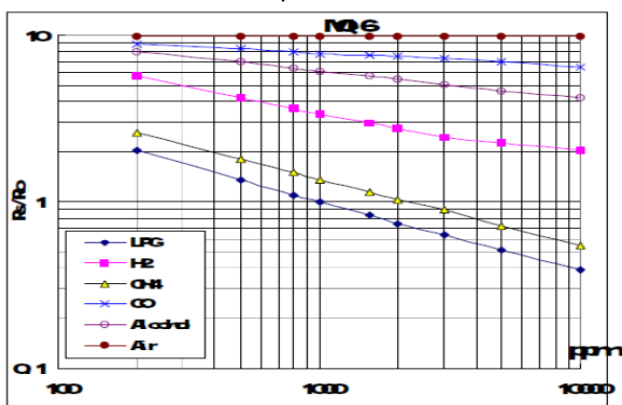


*Fig.3: shows the typical sensitivity characteristics of the MQ-6 gas sensor for several gases [hanwei sensors].*

### C. GSM Receiver

GSM module is used to send an SMS to the user cell phone. When the gas leakage is detected by the

gas sensor, microcontroller sends a signal to GSM module, in which one of the tasks is to send the text SMS. GSM module requires one SIM card. This module is capable to accept any network SIM card. Fig. 4 shows a GSM module IC (Integrated circuit). This module has a unique identity number like mobile phones have. These module works on 12V DC supply. We can send SMS and also send a voice message. These SMS or voice messages are saved in the microcontroller memory. Multiple SMSs can also be sends to user, police and fire station etc.
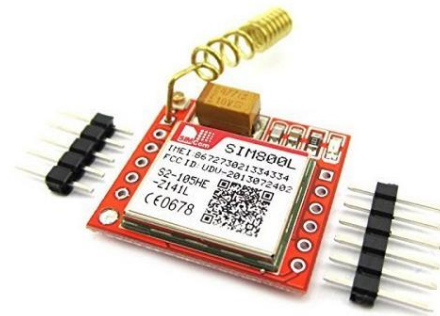


*Fig. 4: GSM Module IC*

### D. DHT 22 Temperature Sensor

The DHT22 is a basic digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin, no analog input pins needed.
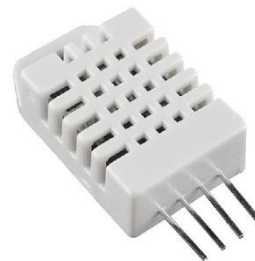


*Fig. 5: DHT 22 Temperature Sensor*

### E. DC Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. In this work it is used to drive the door of the prototype system open.
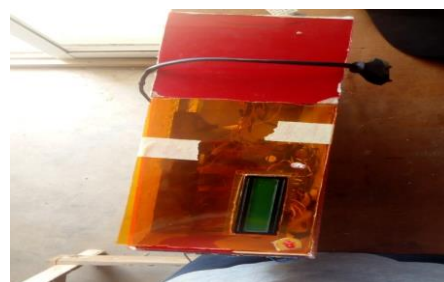


Fig. 6: Prototype model of proposed system

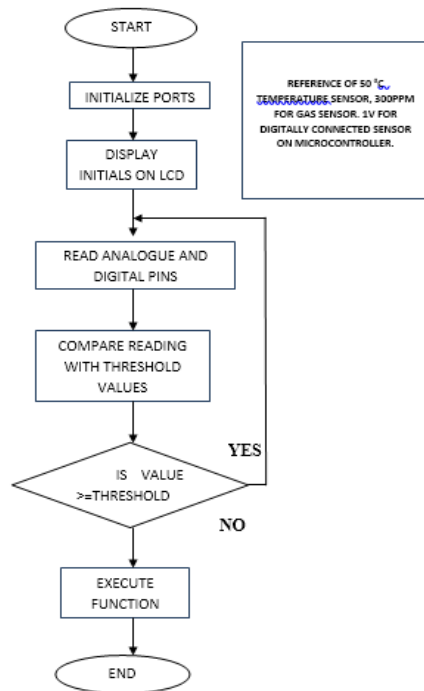The Prototype model of proposed system is dipicted below
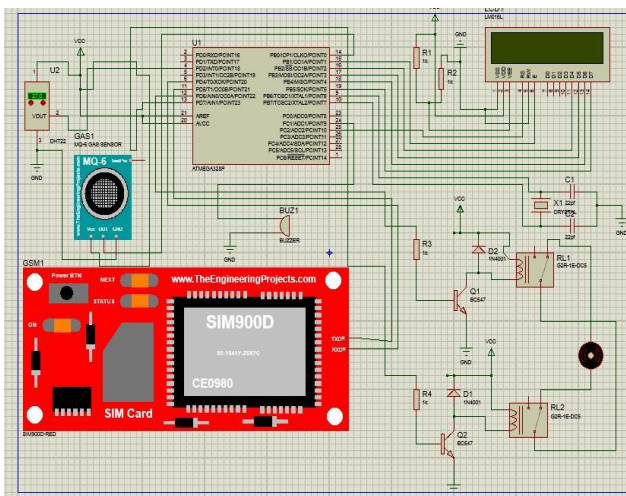


*Fig. 7: System Flow Chart*



Fig. 8: System Circuit Diagram ESystemxample of a figure caption. (figure caption)

## IV. RESULT

The prototype of the gas leakage security system has been shown in Fig.7. This system has been tested by taking some amount of LPG gas near to the sensor. MQ-6 gas sensor detects the LPG gas and sends a signal to the microcontroller. After that, the microcontroller sends an active signal to other externally connected devices also, when a high temperature is detected it sends an active signal to the microcontroller. As a result, a buzzer rings and a message is displayed on the LCD screen. Simultaneously the DC motor opens the exit windows

and the GSM module send an SMS. When the reset button is pressed, the system refreshes itself and whole system regains its initial position
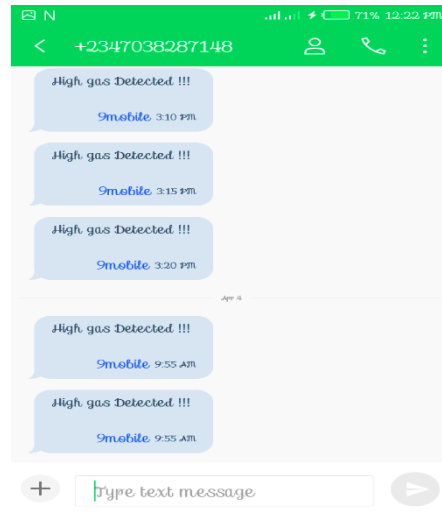


*Fig. 9: Output message received by predefined user*

## V. CONCLUSION

With the increasing rate of fire disaster in tropical countries like Nigeria, this maniacal menace could be handled by having this project implementation in homes, industries, market shops or Malls for safety reasons. In United State of America, the United States Consumer Product Safety Commission has emphasized the need for gas detectors for building security and recommends at least one for each layer of building. This proves the need for gas detection alarm systems to be 100% reliable. A backup power supply can be included in the system design to augment for power failure condition. Also, calibration of the gas sensor can be done in other for a specific gas to be sensed instead of the LPG numerous gases it senses.

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