International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 4 266 - 268

Design and implementation of a gas leakage detector using wireless data acquisition system for real time applications using the concept of IoT

Akshay M.S
Student, Dept. of ECE,
Jyothy Institute of Technology,
Bangalore – 560082
ms.akshay1994@gmail.com

Chaitra B.N
Student, Dept. of ECE,
Jyothy Institute of Technology,
Bangalore – 560082
bnchaitramurthy@gmail.com

Murali G
Student, Dept. of ECE,
Jyothy Institute of Technology,
Bangalore – 560082
muraliputta3@gmail.com

Sumangala Gejje
Assistant Professor,
Dept of ECE, Jyothy Institute of Technology,
Bangalore – 560082
gejjesumangala@gmail.com

Abstract:-According to recent studies regarding environmental hazards, gas leakage has become a major concern. Various safety measures are being taken to avoid any untoward gas accidents. Here, we imbibe on a task to install gas detectors in premises' that are prone to gas accidents. The objective of this work is to design an automatic notifying and alarming system which can detect gas leakage in various premises. Many flammable gases are detected with the aid of a MQ-5 gas sensor, which is followed by a mobile notification to the user in order to take any appropriate actions to prevent excess damage.

Keywords:-Gas leakage detection, Gas sensor,Wi-Fi, ARM-7, DTMF, IoT.

*****

I. INTRODUCTION

There is an alarming need to provide security and safety precautions to homes and hazardous industries. We intend to provide security for gas leakage related issues, by notifying the person in-charge of the premises.

The application of gas detection has been of great significance, with the advent of recent technologies.

This model is designed to detect any excess gas leakage in the premises with the aid of an MQ-5 gas sensor. The LED on the sensor board glows, which is an indication for gas leak. The gas sensor output is passed on as input to the microcontroller. This is interfaced with LED/Buzzer and LCD display, which acts as an alarming system to the user within that premises. The users at a distance are intimated with a Wi-Fi module which is interfaced with the controller. In order to send a mobile notification to the user's cell phone, and in turn, the user can call the mobile which is in the premises of gas leakage, and give appropriate commands to control the Exhaust fan, and make sure the premises is safe.

Here, we propose a more advanced version, where the efficiency of data transmission to the desired location is larger. Using the concept of Internet of Things, we enable limited distance communication, in case the owner is not in proximity.

II. SYSTEM DESIGN

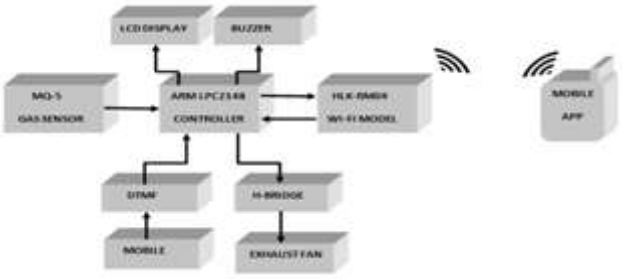

Fig-1 Block Diagram of IoT Based Gas Detection System

- **Gas sensor to ARM interface:**

An efficient and highly sensitive gas sensor, MQ-5 is used for detecting leakage of any flammable gas. The sensitive material used in it is tin/stannic oxide (SnO2), which is housed over the exoskeleton and has lower conductivity in a clean air medium.

This sensing element is subjected to current through connecting leads. This current is known as heating current. The gases coming close to the sensing element get ionized and are absorbed by the sensing element. This brings about a change in its resistance which alters the value of the current going out of it. When a gas leak is detected, the output LED on the gas sensor board glows, and a signal is sent to ARM.

- **ARM LPC2148 interface to LCD, LED and Buzzer:**

LPC2148 (Low Power Consumption) is the widely used IC from ARM-7 family. The controller is considered the heart of the system, as majority of the components are interfaced with it. The controller does not need an external program dumping hardware as it has its own ISP (In-System Program).

We use Keil uVision4 for developing the embedded C code and PHILIPS LPC200 FLASH UTILITY is the software used for dumping purpose.

The output from the sensor is perceived by the processor, which is allocated a series of tasks to be performed.

a) An intimation is sent to the LCD display. This in turn displays a message on the LCD saying 'Gas leaked'. This is done so that any person in the premises of the gas leak would be notified via text.

b) A buzzer installed on the premises will start ringing as soon as the gas leaks, and provide an audio alarm for people staying around.

- **ARM interface with Wi-Fi module and DTMF:**

A 'HLK-RM04' Wi-Fi module is interfaced with the ARM controller. The user's mobile is connected to the IP address of Wi-Fi to intimate about the gas leak. Another mobile placed in the premises is connected to the DTMF through a 3.3mm jack. The system is initialized by making a call to the mobile at the premises by pressing 2 on the keypad of user's mobile. DTMF decoder board decodes DTMF audio signal from mobile to 4 bit binary TTL level output with LED indication.

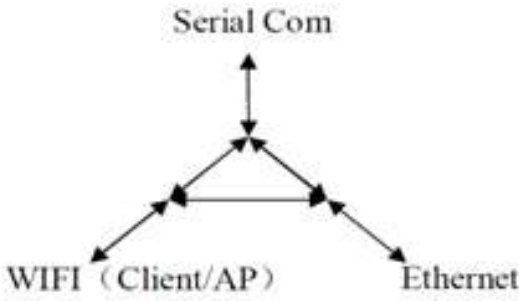

Fig- 2 Full transparent two-way data transmission

The above figure represents embedded module based on the universal serial interface network standard, built-in TCP / IP protocol stack, enabling the user serial port, Ethernet, wireless network (Wi-Fi) interface between the conversions.

The user is notified of the gas leak through an android app – TCP/IP Client. This is used for transmitting and receiving data after connecting to a specific server using TCP/IP communication.

On receiving the notification, he can make a call to the mobile in the gas leak premises. By pressing 5, the Exhaust fan at the premises is turned ON and the gas is allowed to be extinguished. When the gas concentration decreases to a safe level after some period of time, we can turn OFF the Exhaust fan by pressing 8, assuming that all the gas is pushed out of the place.

This operation of the Exhaust Fan is performed by the H-Bridge. A H bridge is an electronic circuit that enables a voltage to be applied across a load in either direction.

III. RESULTS

The overall system was designed and tested under controlled environments, by inducing LPG, Alcohol and CO.

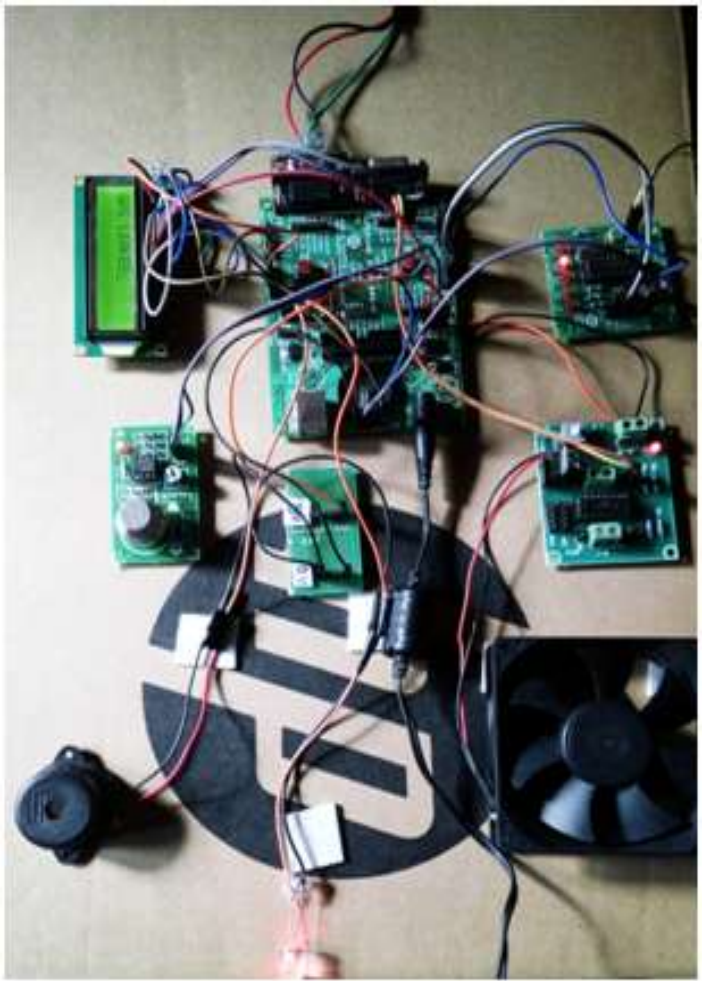

Fig-3 Overall System

The output voltage level of the gas sensor can be adjusted through potentiometer arrangement. When the gas concentration exceeds a certain limit, an alarm is raised with a LCD, LED and a buzzer in the gas leakage area.

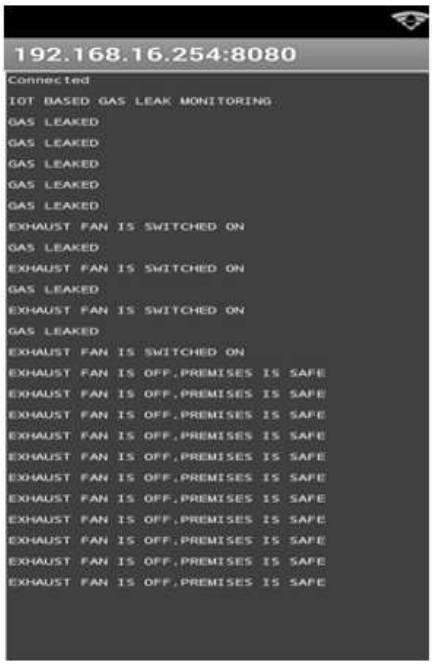

Fig-4 Notifications on User's Mobile via TCP/IP Client

A notification is sent to the person in-charge using TCP/IP Client app as shown in the figure 4, by using a Wi-Fi module and he can take necessary action by controlling the Exhaust Fan, and prevent any gas accidents.

Name of Test	Gas leakage test
Feature being tested	Gas leakage
Sample Input	Flammable and non-flammable gases
Expected Output	Flammable gas: Output LED turns ON, LCD displays a message "Gas leaked" and Buzzer starts beeping. A notification stating "Gas leaked" is sent to the user's mobile via TCP/IP Client app. Non-flammable gas: No output is obtained from the gas sensor.

Table-1 Result of gas leakage test

Name of Test	Exhaust Fan control Test
Feature being tested	Switching ON/OFF of Exhaust Fan
Sample Input	Press of a keypad number from user's mobile
Expected Output	5: Exhaust Fan is turned ON 8: Exhaust Fan is turned OFF

Table-2 Result of Exhaust fan control

This reliable system can be used in places with high risks of gas leakage. As shown in table 1 and table 2, the system was successfully tested, and the results obtained were as per the expectations.

IV. CONCLUSION

The working model was designed and tested in appropriate conditions and the results were positive. The practical testing was done with the help of LPG gas, Alcohol and CO.

This system has wide applications in the field of home automation and safety. It can be installed in areas prone to gas accidents such as residential and commercial areas.

V. REFERENCES

[1] Mahalingam, R. T. Naayagi, N. E. Mastorakis, "Design and Implementation of an Economic Gas Leakage Detector", IEEE 2012.

[2] Nivedhitha S , Padmavathy A P , Susaritha U S, "Development of Multipurpose Gas Leakage and Fire Detector with Alarm System", 2013 Texas Instruments India Educators' Conference, Vol.10 No. 41, IEEE 2013.

[3] Luay Fraiwan, Khaldon Lweesy, Aya Bani-Salma, Nour Mani, "A Wireless Home Safety Gas Leakage Detection System", IEEE 2011.

[4] Rasika S. Ransing, Manita Rajput, "Smart Home for Elderly Care, based on Wireless Sensor Network", 2015 International Conference on Nascent Technologies in the Engineering Field, Vol. 12, Page 16, IEEE 2015

AUTHORS

Akshay M.S
Student, Dept. of ECE, Jyothy Institute of Technology, Bangalore – 560082
ms.akshay1994@gmail.com

Chaitra B.N
Student, Dept. of ECE, Jyothy Institute of Technology, Bangalore – 560082
bnchaitramurthy@gmail.com

Murali G
Student, Dept. of ECE, Jyothy Institute of Technology, Bangalore – 560082
muraliputta3@gmail.com

Sumangala Gejje
Assistant Professor, Dept of ECE, Jyothy Institute of Technology, Bangalore – 560082
gejjesumangala@gmail.com