INTERNET OF THINGS (IOT) BASED GAS LEAKAGE MONITORING AND ALERTING SYSTEM WITH MQ-6 SENSOR

Rohan Chandra Pandey[1], Manish Verma[2], Lumesh Kumar Sahu[3], Saurabh Deshmukh[4]

[1]Kalinga University, PG Student, Vlsi and Embedded System Village-Kotni ,Near Mantralaya, Naya Raipur ,Chhattisgarh
[2]Kalinga University, Assistant Professor, Department of Vlsi Design and Embedded system, Village-Kotni,Near Mantralaya, Naya Raipur, Chhattisgarh
[3]Kalinga University, Head of department,Assistant Professor, Department of Electrical Engineering Village-Kotni,Near Mantralaya Naya Raipur, Chhattisgarh

RSR Rungta College of Engineering and Technology, Senior Embeded System Trainer in project development (Projectcuriosity) Bhilai, Chhattisgarh Pin-490020

Abstract

Safety plays a major role in today's world and it is necessary that good safety systems are to be implemented in places of education and work. This work modifies the existing safety model installed in industries and this system also be used in homes and offices.

The main objective of the work is designing microcontroller based toxic gas detecting and alerting system. The hazardous gases like LPG and propane were sensed and displayed and notify each and every second in the LCD display. If these gases exceed the normal level then an alarm is generated immediately and also an alert message (Email) is sent to the authorized person through the INTERNET and used ARM development board. The advantage of this automated detection and alerting system over the manual method is that it offers quick response time and accurate detection of an emergency and in turn leading faster diffusion of the critical situation.

Keywords- Air pollution Monitoring, gas sensors, Raspberry pi or texas module, wireless networks.

A Web page is built to show the status to the user monitoring it. The web page gives a notification via mail of the Gas leakage. The LCD screen shows the status. The system puts on the buzzer when the level of gas crosses the set limit. Thus this system helps to keep by informing about gas leakages by providing danger position of the gas leakage via a web page.

1. Introduction

The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. Projections for the impact of IoT on the Internet and economy are impressive, with some anticipating as

many as 100 billion connected IoT devices and a global economic impact of more than $11 trillion by 2025.

The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles and has become headline news in both the specialty press and the popular media. This technology is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities not previously possible.

An abundance of conferences, reports, and news articles discuss and debate the prospective impact of the "IoT revolution"—from new market opportunities and business models to concerns about security, privacy, and technical interoperability.

The large-scale implementation of IoT devices promises to transform many aspects of the way we live. For consumers, new IoT products like Internet-enabled appliances, home automation components, and energy management devices are moving us toward a vision of the "smart home'', offering more security and energy efficiency.

Other personal IoT devices like wearable fitness and health monitoring devices and network enabled medical devices are transforming the way healthcare services are delivered. This technology promises to be beneficial for people with disabilities and the elderly, enabling improved levels of independence and quality of life at a reasonable cost.

IoT systems like networked vehicles, intelligent traffic systems, and sensors embedded in roads and bridges move us closer to the idea of "smart cities'', which help minimize congestion and energy consumption. IoT technology offers the possibility to transform agriculture, industry, and energy production and distribution by increasing the availability of information along the value chain of production using networked sensors.

2. Literature Review

In the year of 2008, LIU zhen-ya, WANG Zhen-dong and CHEN Rong, "Intelligent Residential Security Alarm and Remote Control System Based On Single Chip Computer", the paper focuses on, Intelligent residential burglar alarm, emergency alarm, fire alarm, toxic gas leakage remote automatic sound alarm and remote control system, which is based on 89c51 single chipcomputer. The system can perform an automatic alarm, which calls the police hotline number automatically. It can also be a voice alarm and shows alarm occurred address. This intelligent security system can be used control the electrical power remotely through telephone.

In the year of 2008, Chen Peijiang and Jiang Xuehhua, "Design and implementation of Remote Monitoring System Based on GSM", this paper focuses on the wireless monitoring system, because the wireless remote monitoring system has more applications a remote monitoring system based on SMS through GSM

In the year of 2002, K. Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi,"Investigation of gas sensors for vehicle cabin air quality monitoring", this paper focuses on, car cabin air quality monitoring can be effectively analyzed using metal oxide semiconducting (MOS) gas sensors. In this paper, commercially available gas sensors are compared with fabricated Moo3 based sensors possessed comparable gas sensing properties. The sensor has response 74% higher relative to the hest commercial sensor tested.

Internet of Things: Challenges and state-of-the art solutions in Internet-scale Sensor Information

Management and Mobile analytics by Arkady Zaslavsky, Dimitrios Georgakopoulos. This paper gave us the details about mobile analysis and sensor information management that will help in data segregation of various dustbins.

3. MATERIAL PROPERTIES AND DESIGN SPECIFICATION

1) ARM CORTEX M4

The **ARM Cortex-M** is a group of 32-bit RISC ARM processor cores licensed by ARM Holdings for microcontroller use. The cores consist of the Cortex-M0, Cortex-M0+, Cortex-M1, Cortex-M3, Cortex-M4(F), Cortex-M7(F), Cortex-M23, Cortex-M33(F).

ARM Cortex-M0 and Cortex-M3 IC

The ARM Cortex-M family are ARM microprocessor cores which are designed for use in microcontrollers, ASICs, ASSPs, and SoC. Cortex-M cores are commonly used as dedicated chips, but also are "hidden" inside SoC chips as power management controllers, I/O controllers, system controllers, touch screen controllers, smart battery controllers, and sensors controllers.

Cortex-M4

Conceptually the Cortex-M4 is a Cortex-M3 plus DSP Instructions, and optional floating-point unit (FPU). If a core contains an FPU, it is known as a Cortex-M4F, otherwise it is a Cortex-M4.

GAS SENSORS

The Figure below of the MQ-6 gas sensor unit may commonly illustrate us more.

LPG sensor

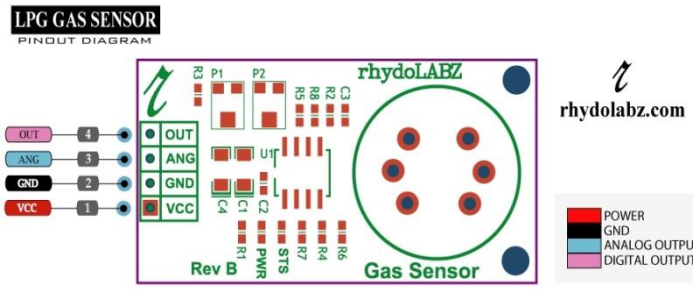
It is an ideal sensor to detect the presence of a dangerous LPG leak in our home or in a service station, storage tank environment and even in vehicle which uses LPG gas as its fuel. This unit can be easily incorporated into an alarm circuit/unit, to sound an alarm or provide a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising.

MQ-6 gas sensor shown in figure is used to sense the poisonous gas and has high sensitivity to LPG, and also response to Natural gas. It is a portable gas detector which has long life with low cost. When the target combustible gases exist, the sensor's conductivity is higher along the gas concentration.MQ-6 gas sensor, which has sensitivity to Isobutane, butane and also to natural gas.The MQ-6 LPG sensor detects the concentration of gas in the air and outputs its reading as an analog voltage. The concentration sensing range of 300 ppm to 1000 ppm is suitable for leak detection. The sensor can operate at temperatures from -10 to 50°C and consumes less than 150 mA at 5V.

Features:

- MQ-6 LPG Gas Sensor
- Easy SIP interface
- Compatible with most microcontrollers

- Analog Sensor voltage is available at ANG pin.
- Onboard Status and Power LED
- Onboard Pot for threshold setting
- Onboard Pot for Sensitivity setting
- On board microcontroller



Pin details of LPG Gas Sensor Module -V2 is as given below.

NOTE: 1. A high on OUT pin indicates LPG presence. This pin can be connected to the Digital I/O pin of the microcontroller.

2. ANG pin outputs a voltage (0-5V) corresponding to the level of LPG detected. This pin can be connected to the ADC pin of the microcontroller.

Components

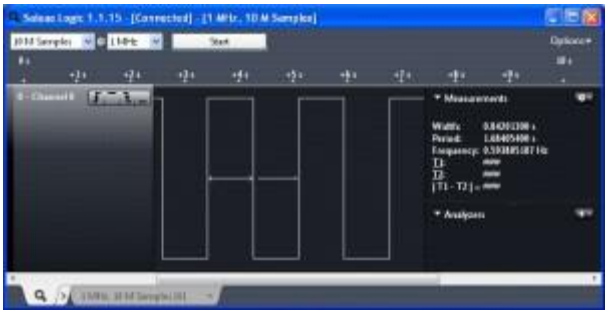
- There are two potentiometers used in Gas Sensor Module . they are as follows:
  - ***POT P1***: The on-board POT P1 is used to set tolerance voltage for detecting the LPG presence. When LPG is detected, the OUT pin will be high. This will occurs when the output voltage is greater than the tolerance level set, using the POT P1.
  - ***POT P2***: The on-board POT P2 is used to set the sensitivity of the Gas sensor. We recommend you to calibrate the detector for 1000ppm of LPG concentration in air and use value of POT P2 about 20KΩ.
- There are two leds in Gas Sensor Module . They are:
  - ***D1***: PWR Led. This Green Led indicates the Power input.
  - ***D2:*** STS Led.The red status Led (STS) indicates the various status of LPG Sensor module eg. Power on, initialization & LPG detection. When the sensor is powered up, the STS led will blink twice to indicate the module is functional. There after STS Led will blinks every second till the module is getting ready (Heating Zone) . After the sensor is initialized, the module will enter in to the ARM mode and ready to detect the gas concentration. When LPG is detected, the STS led will blink fast.

Procedure For Calibration:

- Place the gas sensor module in a clean environment.
- Before powering up the module , first you need to set the sensitivity. According to the manufacture specification it is recommended to set the sensitivity to approximately 20k (by varying potentiometer P2) . In order to view the value ,place the multimeter probe to the ANG pin and the other end to the GND .
- Once the sensitivity adjustment has been done, power up the module with 5v. At the first stage you can observe the STS(STATUS) led blinking in order to indicate the module is functioning. Below shows the STS led waveform
- LPG gas sensor module enters into 3 zones
  - Heating zone
  - Armed zone
  - Trigger or sensing zone

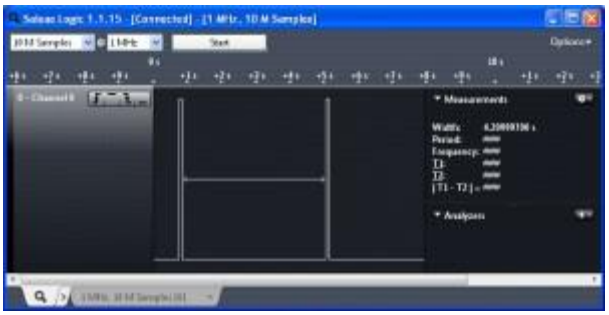
1.Heating Zone

Module enters to heating zone after the power up. Once the module enters the heating zone STS led blinks once in a second and wave form is shown below:



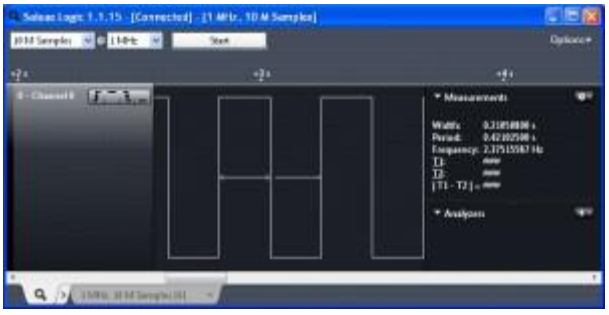
2.Armed zone

Module once after the heating zone, enters into the armed zone. This is the stage before the gas sensing.



3.Trigger or sensing Zone

Here the module enters to the gas sensing zone. If the module detects the GAS ,ie when the GAS concentration increases STS led will start blinking rapidly.



Interfacing the LPG Sensor with The Raspberry pi 3 model

Raspberry pi 3 has been used as a single-board computer with wireless LAN and Bluetooth .It is a powerfull processor which can run full range of ARM GNU/Linux distributions as well as windows 10 IOT edition.The raspberry pi 3 is installed in our project model which supports linux operating system and python language coding commands which helps us to control and monitor the detected gas level through this attached sensor unit and is interfaced with a Iot based free web page linked via raspberry pi 3. Interfacing this computer board detects and tells us about real time value of gas level.

Interfacing with the sensor module is done through a 4-pin breadboard compatible SIP header and requires One I/O pin from the host microcontroller. The onboard microcontroller provide initial heating interval after power-up and then starts to measure LPG .If it found the LPG concentration above preset value , it will inform the Host controller by pulling the Output Pin to High and Starts to blink a onboard status LED. The sensor module is mainly intended to provide a means of comparing LPG sources and being able to set an alarm limit when the source becomes excessive.

Conclusion

A discussion on how the aims and objectives are met is presented. An overall conclusion IOT based toxic gas detector is it has become more efficient, more applicable to today's applications and smarter. The

work presented in this project was directed towards pushing IOT technology to the next level.

The principle of operation of Operation of IOT based gas leakeage and monitoring system was shown by operating the Raspbery pi 3 model attached with embedded system with required input and output gas level with the help of gas sensors was achieved. This results in a more efficient in operation because it is connected to a common free IOT based web page specially built to notify or email the responsible authority automatically so reduces the stress of constant monitoring. The choice of using a real time gas leakage monitoring and sensing the output levels of gas has been clearly observed by the help of this system

.

REFERENCES

[1] Lianos, M. and Douglas, M. (2000) Dangerization and the End of Deviance: The Institutional Environment. British Journal of Criminology, 40, 261-278. http://dx.doi.org/10.1093/bjc/40.2.261

[2] Ferguson, T. (2002) Have Your Objects Call My Object. Harvard Business Review, June.

[3] Nunberg, G. (2012) The Advent of the Internet: 12th April, Courses.

[4] Kosmatos, E.A., Tselikas, N.D. and Boucouvalas, A.C. (2011) Integrating RFIDs and Smart Objects into a Unified Internet of Things Architecture. Advances in Internet of Things: Scientific Research, 1,

[5]. http://dx.doi.org/10.4236/ait.2011.11002 [5] Aggarwal, R. and Lal Das, M. (2012) RFID Security in the Context of “Internet of Things”. First International Conference on Security of Internet of Things, Kerala, 17-19 August 2012. http://dx.doi.org/10.1145/2490428.2490435

[6] Biddlecombe, E. (2009) UN Predicts “Internet of Things”. Retrieved July 6.

[7] Gershenfeld, N., Krikorian, R. and Cohen, D. (2004) The Internet of Things. Scientific American,

[8] Lombreglia, R. (2010) The Internet of Things, Boston Globe. Retrieved October