DETECTING ECCENTRIC GASES USING STANDARD GAS SENSOR NODES AT HAZARD TIMES

Ms.K.Anitha[1], Ms.A.Hema Malini[2] & Ms.G.Keerthiga[3]
Faculty of Electronics And Communication Engineering,Saveetha Engineering college,Chennai,India

Abstract- This paper reports on the detection of any normal and abnormal gases in case of hazards. It can even detect the percentage level of humidity as well as temperature level in surrounding environment. Obstacles can be identified through MEMS sensor. All these above actions can be performed by using the low cost gas sensor nodes. The sensors can be controlled by using Zigbee wireless protocol a map can be created between these sensor nodes to find out the required information.

Key words: Smart Sensing, Selectivity, Detection, sensitivities

1. Introduction:

At the time of any hazards, the very important scenario is, to handle the risky situation immediately. In order to take action the overview of the situation need to be found out. It is difficult to predict the hazardous situation because of its uniqueness. Now the main goal is to find out if any abnormal gases exploded in that particular area and temperature level correspondingly; so it would be easy to found out whether the people can able to sustain to that high degree or not? This information will help the rescue personnel a lot in order to assess the situation immediately.

More number of sensors is needed to deploy to collect the information in the hazardous area. As more number of sensors is needed to deploy its cost must be low. For example, let us consider an area of $500m^{2,}$ we need to deploy 12 to 15 sensors. For the working of a sensor, some external power source is needed like batteries, etc. As batteries may face some physical challenges like charge leakage, life time is not durable. To overcome this problem solar panels are used instead of batteries. The localization of sensors is very important in order to gather the information [1]. A sensor must know its own location and its nearest sensors location respectively. Deploying the sensors randomly can form a network among them. Due to this information fusion can takes place. The result can be shown through simulation whether the gas is normal or abnormal and the level of temperature and the percentage level of humidity can be detected.

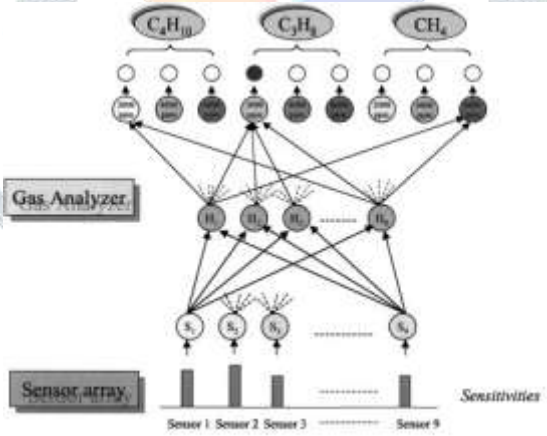

Figure 1: Sensor Network link-up

2. Architecture:

Here very low cost and energy efficient sensors are used for measuring the abnormal gases as well as the temperature and humidity. In order to find out the above information it is necessary to know about the position of the sensor nodes. Due to this reason an ultrasonic sensor is used to obtain the distance between the nodes.

The PIC microcontroller is the key component of the system. It contains an inbuilt ADC which is considered as the main advantage of the system .Only necessary circuits will be in the active state and hence some amount of energy can be saved.PIC microcontroller is a flash based 8-bit microcontroller. It can able to configure either as 3-wire SPI or 2-wire I2Cbus.Most of the pins of this microcontroller is the I/O pins.

These pins will help the PIC to control and monitor the other peripherals. Communication among the sensor network and the surrounding is done through the Zigbee module. These are the following sensors which are connected to the PIC microcontroller.

- Gas Sensor
- Humidity Sensor
- Temperature Sensor
- Ultrasonic Sensor
- MEMS Sensor

All the above sensors are connected via I2Cbus, except MEMS sensor, it is connected via SPI (Serial to Parallel Interface).The sensors which can receive the data in analog can convert in to the digital in the PIC microcontroller without using any further connections.

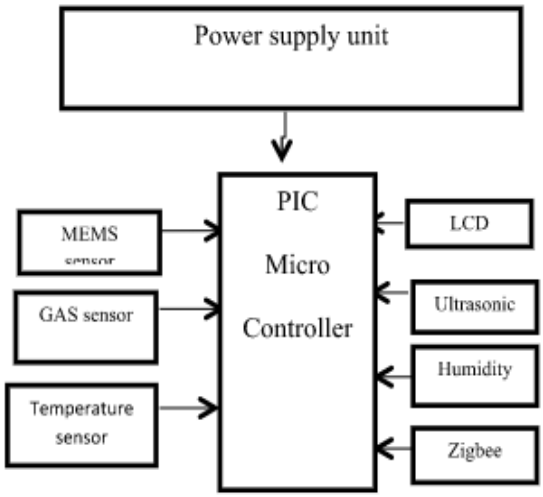

Figure 2: Block diagram of the system with gas sensor, temperature sensor, humidity sensor, ultrasonic sensor, and mems sensor of the Transmitter section.

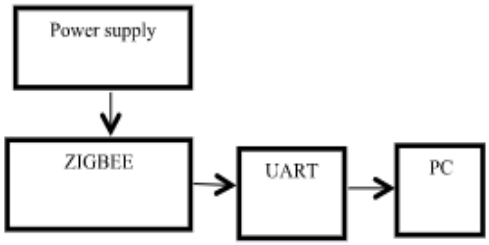

Figure 3: Block diagram of the Receiver section.

A gas sensor is a device which is used to detect the LPG gases and also any leakage of gases and the process will shut down automatically as it interfaces with a control system. This sensor (MQ-6) has high sensitivity and fast response time. It can detect the gas from 200 to 10000ppm concentration. The main advantage of this sensor is, it has very small sensitivity to alcohol and smoke [2]. MEMS sensors are used for the purpose of detecting acceleration and pressure. As the products of the MEMS sensors can provide an interface, the surrounding environment can able to sense, process and control by these sensors. These sensors are miniature in size and it can even built electrical and mechanical components on a single chip [2],[3]. It consumes very low power and gives high performance.

Temperature sensor (LM-35) is a device which uses an electrical signal for measuring the temperature [6].It also uses a sensing element known as external diode-connected transistor for measuring the temperature external to the sensor [8]. Ultrasonic sensor is used to determine the distance between the object by measuring the time difference between the source signal and the echo of the signal which is received back by the sensor. After the sensor nodes has been placed, it is necessary to find out the location of the other nodes. In this method firstly a node sends an ultrasonic signal [7], [8].After a short waiting time the signal will receive by the second active node. The propagation time of the signal depends on the temperature and the distance between the nodes. Thus the system will be calculated by the sensor.

Humidity sensor is also known as "Hygrometer", it can reports and measures both the moisture and the air temperature [10]. The ratio of the actual moisture in the air to the maximum amount of the moisture that can be held at that air temperature is known as "Relative humidity". LCDs are used for programming. The additional features of these LCDs are tricks and special stuff can be done in the system for new look. LCD with one controller will support up to 80 characters and it consists of about 14 pins. LCDs with two microcontrollers are also available which supports more than 80 characters of about 16 pins.

3. Communication Protocol:

Zigbee technology is used for controlling the sensor networks. This technology is used in the personal area networks. The information transmission is in between the switches, small packets, thermostats, and appliances etc. The main advantage of this system is low data rate, less power consumption, and low cost. Encryption is used for the security purpose. So the authenticated data cannot be trapped by the other users.

Strategy:

```
1) Private Void Main form_ Form closing(Object Sender, Form closing even targs E)
2) {
3) Spmanager.Dispose();
4) }
5) Public Static Class Regex convert
6) Public Static String Toalphanumericonly(This String Input)
7) {
8) Regex Rgx = New Regex("[^A-Za-Z0-9]");
9) Return Rgx.Replace(Input, "");
10) }
```

```
11) Public Static String Toalphaonly(This String Input)
12) {
13) Regex Rgx = New Regex("[^A-Za-Z]");
14) Return Rgx.Replace(Input, "");
15) }
16) Public Static String To Numeric Only(This String Input)
17) {
18) Regex Rgx = New Regex("[^0-9]");
19) Return Rgx. Replace(Input, "");
20) }
21) }
22) Textbox1.Text = Str. To String()
23) If (Str == "H")
24) {
25) Textbox1.Text = "Humidity Normal";
26) }
27) If (Str == "H")
28) {
29) Textbox1.Text = "Humidity Abnormal";
30) }
31) If (Str == "E")
32) {
33) Textbox2.Text = "Earthquake Occurred";
34) }
35) If (Str == "G")
36) {
37) Textbox4.Text = "Gas Normal";
38) }
39) If (Str == "G")
40) {
41) Textbox4.Text = "Gas Abnormal"
42) }
43) {
44) Webclient Client = New Webclient();
45) String To, Message;//To = Textbox1.Text;
46) Message="TemperatureHigh";   Client.Openread(Baseurl)                    //Messagebox.Show("Successfully Sent Message")
47) }
48) Private Void Textbox5_Textchanged_1(Object Sender, Eventargs E)
49) {
50) }
51) Private Void Button1_Click_1(Object Sender, Eventargs E)
52) {
53) Textbox5.Text=Textbox3.Text.Split('!')[0;
54) Textbox6.Text=Textbox3.Text.Split('!')[1;
55) }
56) Private Void Button2_Click(Object Sender, Eventargs E)
57) {
58) Textbox3.Clear();
59) }
60) End
```

This algorithm narrates the working of the protocol and providing the ways to find the shortest path among the evenly distributed sensor network for passing the information. And it can be used for measuring the temperature movements and gas levels. The updated temperature level will be compared with the standard one and identifying the cause of the source. Then the information will be forwarded to the client through wireless technology

.

4. Experimental Setup:

This project was carried out in two phases .The first phase is building the hardware with the help of sensors, microcontroller, solar panel with PC. The second phase was software development, based on Embedded C and Visual studio and compiling program with hardware. The experiments were conducted multiple times to analyze the performance of the system.

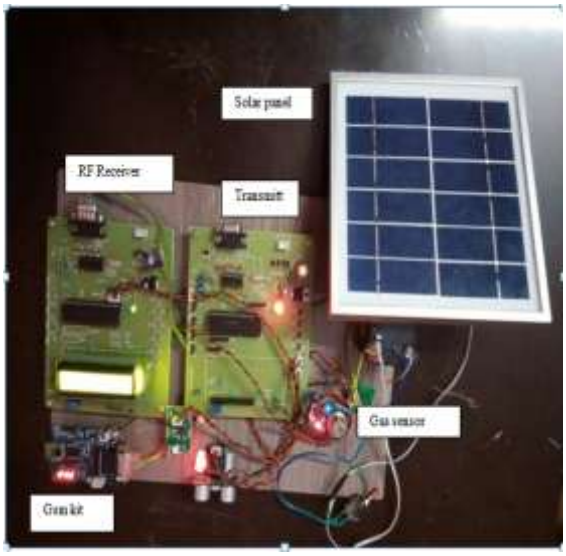

Figure 4: Hardware Kit

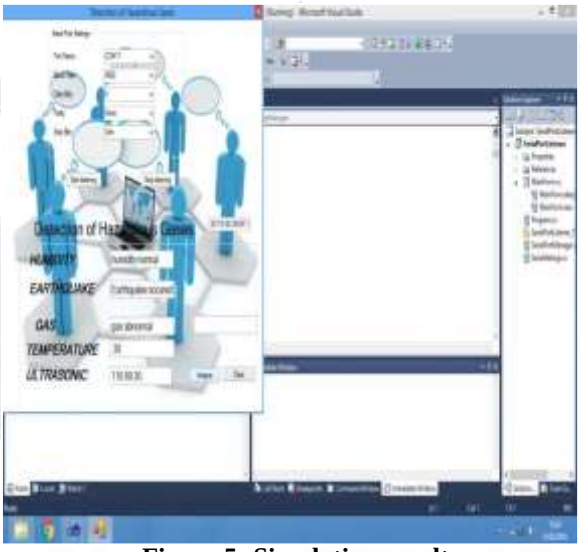

Figure 5: Simulation result

5. Conclusion:

We designed the low cost and energy efficient sensor system for the accurate measurement of the abnormal gases in case of hazards. Both humidity levels and temperature levels can also be identified. All environmental changes can be found in the simulation. Generally, batteries are used for power source. But, in this case solar panels are used to overcome the defects like charge leakage, durability etc. Continuous power supply can be provided for the sensors. Replacement of batteries will not be required with the usage of solar panels.

6. References:

[1] H.B.Kuntze, C.W.Frey, I.Tchouchenkov, .B.Staehle, E.Rome, K.Pfeiffer, & J.Wollenstein."SENEKA-sensor network with mobile robots for disaster management," in Homeland Security (HST), 2012 IEEE Conference

[2] S.Bicelli, "Low-power carbon monoxide MOX sensors for wireless distributed sensor networks," in Instrumentation and Measurement Technology Conference Proceedings 2007 IEEE.

[3] Amro Qandour, Daryoush Habibi,& Iftekhar Ahmad"Wireless sensor networks for fire emergency and gas detection", In Networking, Sensing and Control (ICNSC), 2012 9th IEEE International Conference

[4] Andrey Somov, Alexander Baranov, Denis Spirjakin. "A wireless sensor–actuator system for hazardous gases detection and control." Sensors and Actuators A: Physical.Volume 210, Issue null, Pages 157-164.

[5] Matthew Barnes, Hugh Leather, D.K.Arvind. "Emergency Evacuation using Wireless Sensor Networks". Local Computer Networks, 2007. 32nd IEEE conference.

[6] Andrey Somov, Alexander Baranov, Denis Spirjakin. "Development of wireless sensor network for combustible gas monitoring". Sensors and Actuators A: PhysicalVolume 171, Issue 2, November 2011, Pages 398-405.

[7] 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.

[8] HarutaM.Tsubota S.Kobayashi T.Kageyama H.Genet ,M.J.DelmonB. "Low-Temperature Oxidation of CO over Gold Supported on TiO", volume 144,Issue 1,November 1993.

[9] P.Krummenacher, H.Oguey, Smart Temperature Sensor In CMOS Technology. Volume22, Issues1-3, June 1990, Pages 636-638.

[10] Srivastava, Richa, "Humidity Sensor: An Overview". Pages 302-309 | received 01 Feb 2012, Accepted 01 May 2012, Published online: 19 Feb 2013.