



ISBN	978-81-929866-6-1
Website	icsscet.org
Received	25 – February – 2016
Article ID	ICSSCCET125

VOL	02
eMail	icsscet@asdf.res.in
Accepted	10 - March – 2016
eAID	ICSSCCET.2016.125

## Development of Real Time System for Pollution Monitoring System

K P Senthil Kumar<sup>1</sup>, S Vinitha<sup>2</sup>, G R Vivin Kumar<sup>3</sup>, K Yamini<sup>4</sup>, S Syed Jamaesha<sup>5</sup>  
<sup>1,2,3,4</sup>UG Student, <sup>5</sup>Assistant Professor, Department of Electronics and Communication Engineering,  
 Karpagam Institute of Technology, Coimbatore.

**Abstract:** Air pollution monitoring is very useful concept in day-to-day life because air pollution leads to Global Warming, Acid rain and also causes many health problems. Hence, fresh air is necessary for all human beings, so that various technologies are used to monitor air quality data. This paper introduce an effective solution for real time pollution monitoring using wireless sensor networks (WSN) on real time basis. The hardware kit consists of single chip microcontroller, air pollution sensors array and a GSM module. Air pollution is mainly originating from chimney and gases such as CO<sub>2</sub>, O<sub>3</sub> and SO<sub>2</sub>. Hence Gas sensors are used to sense each gas concentration and then they are calibrated and integrated with wireless sensor nodes. Other parameters such as temperature and humidity are also measured.

**Keywords:** Air Pollution Monitoring, Wireless sensor Networks (WSN), GSM module, Gas Sensor Calibration.

### 1. INTRODUCTION

Generally, the pollution is defined as the changes in the environment that leads to harmful effects. Air pollution is present in many parts of the world because of industrial growth. The major contributor of air pollution is road transport which increases the number of vehicles which leads to road traffic. The road traffic emission emits 97% of CO and 75% of NO. Therefore air pollution monitoring is necessary to know the pollution level in the environment.

Air pollution also leads to various health problems mainly those who are working in oil and gas industries. The air pollution level is generally increased during peak hours and decreased during noon times because the number of vehicles is less at noon when compared to night time.

Resistive heating type sensors are used to measure the gases like O<sub>2</sub>, CO<sub>2</sub> and CO. Sensor networks are of small in size, low-cost sensor. These sensors are calibrated at regular intervals and integrated to Wireless nodes which have better accuracy.

The concentration of gases are sensed and they are given as data to the stations. Then the server collects data from stations and the information is send to the user through web portal or mobile via SMS using GSM module. If the concentration of gases crossed the certain level, then alert message is sent to the user through SMS. The main aim of air pollution is not only monitoring pollution but also to develop the environment.

### 2. Need for Monitoring

Pure air is very important for every human being. The air polluted causes several health diseases. In order to avoid this in large scale air

This paper is prepared exclusively for International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016 [ICSSCCET 2016] which is published by ASDF International, Registered in London, United Kingdom under the directions of the Editor-in-Chief Dr T Ramachandran and Editors Dr. Daniel James, Dr. Kokula Krishna Hari Kunasekaran and Dr. Saikishore Elangovan. Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage, and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honoured. For all other uses, contact the owner/author(s). Copyright Holder can be reached at copy@asdf.international for distribution.

2016 © Reserved by Association of Scientists, Developers and Faculties [www.ASDF.international]

**Cite this article as:** K P Senthil Kumar, S Vinitha, G R Vivin Kumar, K Yamini, S Syed Jamaesha. "Development of Real Time System for Pollution Monitoring System". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 621-624. Print.

pollution monitoring is needed. The gases that affect human health directly is CO (Carbon monoxide), H<sub>2</sub>S (hydrogen sulphide) and SO<sub>2</sub> (Sulphur dioxide). The gases that affect indirectly is O<sub>3</sub> (ozone). A high effort is needed to improve the quality of air in both inside and outside. Slowly the air pollution monitoring can be developed from manual to automatic by the technology development.

### 3. Calibration of Gas Sensors

Each gas sensors is having a unique value. Though the gas sensed are same, the sensors used are different and also they differ in terms of output characteristics. Calibration of gas sensor process is done in the laboratory by treating the sensors at different concentration of gases. The chamber can get gases and is capable of taking electrical output. The equipment called as Precise gas chromatography is used to measure Parts per million. The output level is unstable here. Signal conditioning circuits are used to amplify the measured signal. Four to five readings are taken. Finally characteristic equation of sensors are noted.

Sensors	CO	CO <sub>2</sub>
ppm	50	5000
mg/M <sup>3</sup>	55	9000

Table: Sensor Array Specifications

E.g. Calibration equation of CO<sub>2</sub> sensor is

$$x = p_1 * y + p_2$$

Where, x is measured voltage value

y is concentration of CO<sub>2</sub>

## 4. Description

### 4.1. GSM Module

A GSM module is a specialized type of module where the SIM card is accepted and operated over a subscription to a mobile operator. It is just like a mobile phone and sends messages to the concerned person regarding the pollution level and location of the vehicle.

### 4.2. CO<sub>2</sub> Sensor

A carbon dioxide sensor is an instrument used to measure carbon dioxide gas. The common principles of this sensor is infrared and chemical gas sensors. This is mainly used for indoor air quality.



Fig 1. CO<sub>2</sub> sensor

### 4.3. CO Sensor

A carbon monoxide sensor is a device that detects the presence of carbon monoxide gas to prevent CO poisoning. This is also called as CO detector. It is formed by incomplete combustion.



Fig 2. CO sensor

**Cite this article as:** K P Senthil Kumar, S Vinitha, G R Vivin Kumar, K Yamini, S Syed Jamaesha. "Development of Real Time System for Pollution Monitoring System". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 621-624. Print.

#### 4.4. Temperature Sensor

A temperature sensor is the sensor used to measure temperature using electrical signal. It also includes thermocouples.

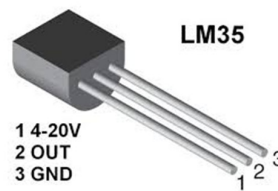


Fig 3. Temperature sensor

#### 4.5. Humidity Sensor

A humidity sensor is the sensor which is used to measure the relative humidity of the air. It measures both moisture and air temperature,

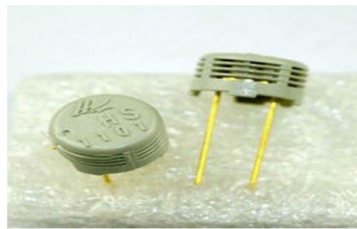
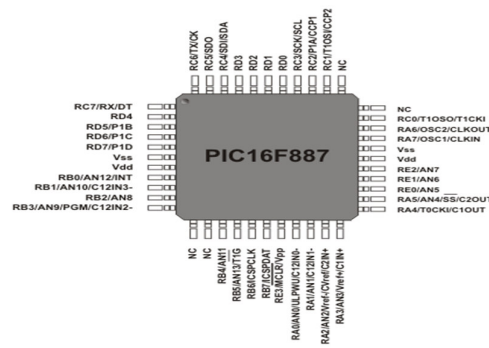


Fig 4. Humidity sensor

#### 4.6. Microcontroller

All operations in this circuit is carried out by a microcontroller called PIC microcontroller which are the family of specialized microcontroller. PIC defines “Peripheral Interface Controller”.



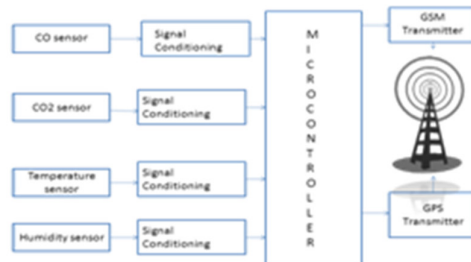
#### 5. Related Works

Previously air pollution monitoring is done by computerised technology which defines a two dimensional map of pollution content. EOFs which means Environment Observation and Forecasting System is another large scale sensor network used for monitoring and forecasting. The environmental application along with sensor consisting of sensor, communications and computer technology. Another way of monitoring is based on online GPRS sensor array with single chip microcontroller. It has an internet connectivity where the mobile has connected to the internet and the pollution level is connected and converted into frame with GPS and then it is uploaded to GPRS modem. The generally used gas sensors for monitoring have diffusion tubes and infrared sensors. They provide accurate and data but they are expensive.

**Cite this article as:** K P Senthil Kumar, S Vinitha, G R Vivin Kumar, K Yamini, S Syed Jamaesha. “Development of Real Time System for Pollution Monitoring System”. *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 621-624. Print.

## 6. Methodology

The main aim is to develop the environmental pollution monitoring system. Then the major air pollutants are monitored and their polluted level of each gases are sensed, measured and the data are sent to the web portal through GSM module. If the pollution level crosses the threshold level, then alert message is given from the server to mobile. The main process used here is signal conditioning. After this process, they are integrated into microcontroller.



Block Diagram of GSM Transmitter

## 7. Conclusion

Thus the air pollution monitoring system using wireless sensor networks has been used for monitoring the air quality data. It also gives the real time information about the level of air pollution. It provides alerts in case of extreme changes in the quality of air. The data collected from the server gives the pollutant levels. The monitoring stations communicate with M2M type with a backend server. The advantages of using semiconductor sensors are low cost, quick response, low maintenance and accurate results.

## 8. Reference

1. D. D. Lee and D. S. Lee, —Environmental gas sensors, || IEEE Sensors J., Vol. 1, No. 3, pp. 214–215, 2001.
2. J. C. St. John and W. L. Chameides, —Environ. Science Techno 31||, pp. 2797-2804, 1997.
3. Nihal Kularatna, and B. H. Sudantha, —An Environmental Air Pollution Monitoring System Based on the IEEE 1451 Standard for Low Cost Requirements || IEEE Sensors Journal, Vol. 8, No. 4, 2008.
4. Gas board technical guide – Libelium system, <http://www.libelium.com/support>
5. Wen Wang, Taehyun Kim, Keekeun Lee, Haekwan Oh, and Sangsik Yang, —Development of a New Wireless Chemical Sensor for CO2 detection|| IEEE SENSORS Conference, 2007.
6. Muna Acosta, Designing with Electro-Chemical Sensors, National Instrument Application Note AN-1798.
7. IST, Chapter 1—Introduction —International Sensor Technology||, pp.1–4.
8. Young Jin Jung, Yang Koo Lee, Dong Gyu Lee, Keun Ho Ryu, Silvia Nittel —Air pollution monitoring system based on geosensor network||, IEEE International Geoscience and Remote Sensing Symposium, pp.III-1370–III-1373, 2008.
9. Gongbo Zhou, Zhencai Zhu, Guangzhu Chen, Ningning Hu, —Energy-Efficient Chain-type Wireless Sensor Network for Gas Monitoring || Second International Conference on Information and Computing Science, 2009.