

AIR QUALITY METER USING WIRELESS SENSOR NETWORKS

¹C.Arul Murugan, ²N.I.Sankar Raja, ²M.ShriSakti Ramanaa,

²S.P.Saravana Prasath, ²K.Sakthivel

¹Assistant Professor, ²Bachelor of Engineering

^{1,2}Department of Electronics and Telecommunication Engineering,

Karpagam College of Engineering, Coimbatore

¹murugan.carul@gmail.com

Abstract: In this paper a system for monitoring air quality through wireless sensor network (WSN) is proposed. The central structure of the system comprises of PIC microcontroller (16F887) connected with array of sensors consisting of gas sensor, temperature sensor and humidity sensor. These sensors measure the concentrations of gases Carbon monoxide (CO), Sulphur dioxide (SO₂) and Nitrogen dioxide (NO₂) in the atmosphere. The sensed outputs from the sensor network is amplified and transmitted to the PIC microcontroller. The communication between the PIC microcontroller and the end device is achieved by Zigbee interface. The concentration of gases is displayed through an LCD interface in the system. In the proposed method the system monitors the pollutant gases in climatic conditions and thereby displays the level of different gases.

1. Introduction

Pollution can expound as a minute particle in the atmosphere and its existence muddles the natural functions. It produces vast effects on health of every habitant. Due to urbanization, the level of pollution is increasing rapidly. At adjacent there is pollution of air, pollution of water, pollution of soil throughout the world. The proposed work deals on air pollution. Air pollution has unfavorably influenced the the climatic conditions of the world thereby making difficult to process the natural functions such as cultivation of crops, human metabolism etc. The major pollutants of the air pollution are exhausted to the atmosphere from industries and vehicles. The significant pollutants of air are No₂, So₂, Co and Co₂. Emissions of VOC (Volatile Organic Compounds) is also a major pollutant. The CO₂ has not very major effects in air pollution but it has adverse effects in greenhouse effect [7].

The Examine of air pollution has two methods passive sample and online monitoring. The real time values do not provide the uses of simple equipment. The sensors are used to examine the parameters. Data transfer ways includes two system wired and wireless.

Communication technologies developing with in a way that covers a large area. Design of an air pollution examine system is in mode of wireless .GSM, GPRS deals with the mode of wireless in air pollution examine system. Those devices are high cost in both preservation and fitting.

The proposed system implements a single chip microcontroller with sensor arrays, Zigbee module and GPS module. This complex system computes the gas concentration such as Carbon monoxide, Nitrogen dioxide, and sulphur dioxide using electrochemical sensors.

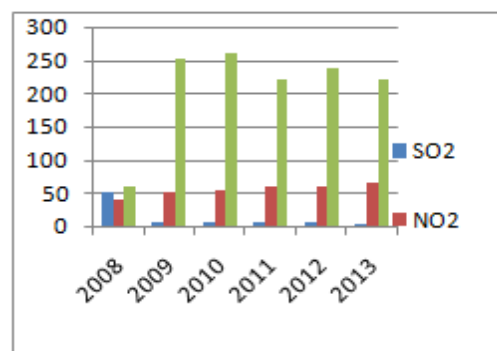


Figure 1. Pollution strategy in Delhi from the year 2009 to 2013.

2. Related Works

Godbless Swagarya et al [1] proposed the architecture of Air Pollution Monitoring system with PIC microcontroller and array of sensors. Jadhav D. et al [2] achieved the communication between the central unit and the end device with GPS module. Sandip S. Patil and Prof. Jaykaran Singh [6], in this work the PIC microcontroller communicates with end device through GSM module. Navreetinder Kaur et al [3] proposed a replacement for PIC microcontroller with ARM7. Snehal Sir sikar and Priya Karemore [5] proposed the types of sensors used in the Air Quality Monitoring

system such as Temperature sensor, Gas sensor and Humidity sensor. Luis M. L. et al [4] proposes that air quality monitoring applications can be characterized into outdoor and indoor monitoring. Indoor monitoring applications typically incorporate buildings, offices and indoor plantations monitoring. Indoor monitoring applications involve sensing temperature, light, humidity, and air quality.

3. Proposed System

In this experiment, the response of pollution of air monitoring analysis is carried out. The uses of Zigbee module, installation of low and maintenance cost of GSM and GPRS. Over non automatic pollution method computation, automatic technique has been chosen. The real time value does not provide simple gadgetry. The system of automatic uses sensor that needs to examine the boundary and the network send to control centre. The emphatic of electrochemical sensor will be low cost and efficient of energy location of sensor. The network measures that the gases concentration such as SO₂, CO, NO₂ using sensor of electrochemical. The architectural design of the air pollution monitoring system is developed on the basics WSN [9].

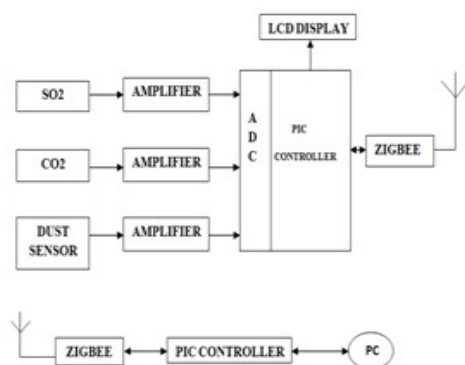


Figure 2. Block Diagram of Air Quality Meter using Zigbee.

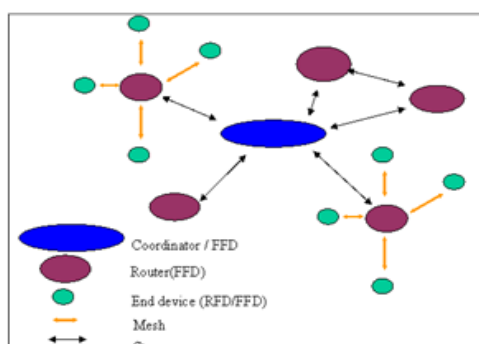


Figure 3. Zigbee Interface Network

4. Hardware Description

Collection of data, storage and offline retrieval data supported by sensor platform. Cascading is used for live sensor reading. System can be retrieve across a USB cable. This wired application program interface contributes power to board. A particular relative amount substance and solution contained within. 16F887 microcontroller ascendancy every system strand from battery impose to information represented by a continuously variable quantity of physical to expressed as digital series, physical quantity transfiguration usually represented by values. The reservoir of PIC built-in digital input/output port, SPI communication port, RS232-serial communication port, 16 channels, 8 input/output interrupt driven timer, 8/10 bit that convert analog to digital, memory of RAM, memory of EEPROM, memory of FEEPROM. The RS-232 standard of communication via Zigbee-modem is to contact so that a real or notional link is established for pollution server. Hardware module of a proposed system is delineate by integrating.

A. PIC 16F887 Micro Controller

The main component of the system is a PIC microcontroller (16F887) and it acts as a central processing unit. The chip correlate the particular kind of matter with uniform properties computation process runs inside on the system of operating. Intersecting between the RS232 serial communication and Zigbee modem provided in microcontroller with a connection of parallel to the dust sensor and gas sensor. PIC 16F887 microcontroller and sensors has an amplifier in between, because the sensor presuming very small output voltage (mV).

B. Sensor Arrays

Air pollution is monitored simultaneously using various sensors. Using comparison it is easy to find out how much the air is polluted and control measures are taken to avoid such environment. Alarm based technology is used to make alert of the polluted environment [10]. The array of sensors detects the pollutants in air, which are dust, Carbon monoxide (CO) and sulphur di-oxide (SO₂). The linear current output has range between 4-20 mA in the above sensors. Zero level output consistent to the 4 mA and maximum level consistent to the 20mA. the simple circuit of simple signal is delineate to transform the 4-20mA range into 0-5 V to be reconcilable with the voltage range of the built-in convertor of analog-to-digital in PIC microcontroller.

C. Zigbee Module

Wireless device is hardware platform of Zigbee module. MAC layers and the basic physical function

realize to the module, such as power control and channel, transmitter and receiver, and modulation and demodulation. The module has two type of organized network, such as ZCM and ZED. Zigbee coordinator modem organize for gathering information from Zigbee end device and coordinating and the network of maintaining and the data sending collected from sensor oversee to Zigbee end device, directly to Zigbee coordinator modem. Direct of digital sequence spread base band of spectrum modem incorporates the module with an efficient data rate of 250kbps. The proposed work is created by utilizing zigbee. The data is easily displayed continuously the analysis of the data is done by observing generation of air pollutant. One of the important benefits of Zigbee is observing a particular area [8].

D. Central Server

Personal computer is a central server with convenient to the internet. The microcontroller is affix to the pollution server with coordinator of Zigbee via RS232 communication standard. Each ZED is collected to ZCM from knowledge of air pollution. The data base saves the data to central server.

5. Simulation Result

The Proteus software is used for simulation purposes. CO, SO₂ and dust sensor are consists of array in designed system. PIC 16F887 microcontroller has tether with these sensors. The values of each sensor have been manifest and data are sent to the database. The output of concentrations of gases is displayed in the LCD display as shown in Fig 4.



Figure 4. LCD output

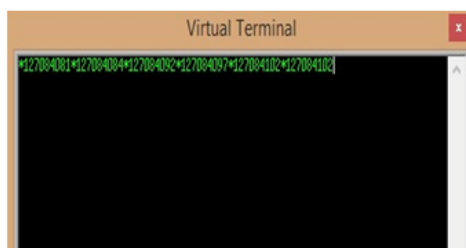


Figure 5. Output Terminal

6. Conclusion & Future Scope

The proposed work of air quality monitoring system is simulated using Proteus software. The system is to measure the harmful pollutants of gas and live monitoring. The system has been delineate in a way peculiarly for those countries where there is technologies lack in relating to the natural world and impact of human activity. The future scope of the proposed system is the inclusion of a unit that controls the level of gases in the air.

Fig 6 Graph showing values for different levels of gases.

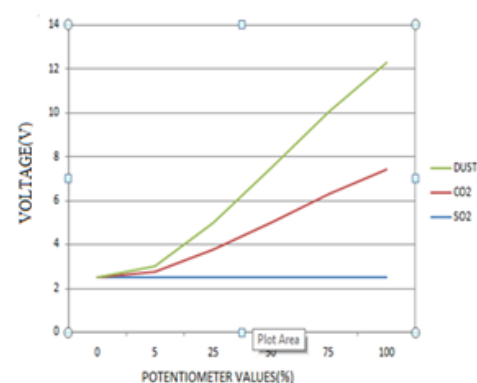


Fig.5 shows the terminal output of the system which simultaneously displays the result of gas levels based on different potentiometer values. Fig 6 shows the graphical representation of the intensities of gases. The graph represents the change in voltage with respect to potentiometer values.

References

- [1] Godbless Swagarya, ShubiKaijage, Ramadhani S. Sinde, "Air Pollution Monitoring System based on Wireless Network - Simulation", IISTE, ISSN 2222-1727, Vol.5, No.8, 2014
- [2] Jadhav D. A. , Patane S. A. , Nandarge S.S. , Shimage V.V. , Vanjari A.A. , "Air Pollution Monitoring System Using Zigbee and GPS Module", IJETAE, ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 9, September 2013.
- [3] NavreetinderKaur , Rita Mahajan , Deepak Bagai , " Air Quality Monitoring System based on Arduino Microcontroller ", IJIRSET, ISO 3297: 2007 Certified Organization, Vol. 5, Issue 6, June 2016.
- [4] Luís M. L. Oliveira, Joel J. P. C. Rodrigues, "Wireless Sensor Networks: a Survey on Environmental

Monitoring", Journal of Communications, Vol. 6, No. 2, APRIL 2011.

[5] Snehal Sir sikar, PriyaKaremore, "Review Paper on Air Pollution Monitoring System", IJARCCCE, Vol.4, Issue 1, January 2015.

[6] Sandip S. Patil, Prof. JaykaranSingh , "Monitoring and Controlling of Hazardous Gases inside Vehicle and Alerting Using GSM Technology" , IJARCSSE , Volume 5, Issue 1, January 2015.

[7] Y.Narasimha Murthy, V.Sukanya, C.Saritha, "Zigbee based Wireless Sensor Network for Monitoring Air Pollutants", International Journal of Scientific & Engineering Research Volume 4, Issue3, March-2013

[8] Nikheel A. Chourasia, Surekha P. Washimkar, "Implementation Of Zigbee Based Wireless Air Pollution Monitoring System", Vol. 2, Issue 4, June-July 2012, pp.761-766.

[9] RajaVara Prasad Y, Mirza Sami Baig, Rahul K. Mishra, P. Rajalakshmi, U. B. Desai and S.N. Merchant," Real time wireless air pollution monitoring system", ICTACT.

[10] D.Rishikesh & Nithin.K.Kurian, "Air Pollution Diagnostics using variety of Sensors", Vol. 1 Issue4.

[11] T. Padmapriya and V.Saminadan, "Improving Performance of Downlink LTE-Advanced Networks Using Advanced Networks Using Advanced feedback Mechanisms and SINR Model", International Conference on Emerging Technology (ICET), vol.7, no.1, pp: 93, March 2014.

[12] S.V.Manikanthan and T.Padmapriya "Recent Trends In M2m Communications In 4g Networks And Evolution Towards 5g", International Journal of Pure and Applied Mathematics, ISSN NO:1314-3395, Vol-115, Issue -8, Sep 2017.

[13] K. Ramash Kumar,"Implementation of Sliding Mode Controller plus Proportional Integral Controller for Negative Output Elementary Boost Converter," Alexandria Engineering Journal (Elsevier), 2016, Vol. 55, No. 2, pp. 1429-1445.

[14] S.Shakeela, "Agribot: An Agriculture Robot", International Innovative Research Journal of Engineering and Technology, Vol 02, No 04, pp.129-131, 2017.

