

A Survey of VOC –Monitoring System

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Abstract— Air pollution is one of the major issue that raises many problems in indoors and outdoors. Here is the survey about Volatile Organic Compound (VOC) monitoring systems which are used to detect the concentration of harmful organic compounds. In the monitoring systems it uses wireless sensor networks and other modules which makes easy to detect and alert the people. This system is useful to control VOCs in the environment. In this paper, it focuses the previous monitoring systems, their components, features and their comparison.

Keywords— VOC, Zigbee, wireless sensor networks, gas detectors.

I. INTRODUCTION

Many air pollution systems in various areas were reported in different surveys. Now-a-days people spend most of their time indoors either at their residence or at their office. There are various methods in practice to measure air pollutants like Gas Chromatography (GC), Mass Spectroscopy (MS) and Fourier Transform Infrared Instruments (FTIRs). These methods provide accurate and selective gas reading. But there are limitations such as high cost, large size and time consumption. At indoors, volatile organic compounds [7] such as Acetone, Benzene, Ethylene glycol, Formaldehyde, Methylenechloride, Toluene are emitted from paints, Carpets and adhesives, Composite wood products, sealing caulks, Solvents, Varnishes. These VOCs when inhaled causes several short term and long term illness. Hence a continuous monitoring is necessary. In this report it gives a study about the systems to monitor the levels of VOCs in the surroundings. The module which is designed will sense for VOCs using a network of Harmful Gas Detectors. These sensors will sense the availability of VOCs and transmit data wirelessly to the computer using Zigbee module. When the levels of VOCs are above the acceptable level, the monitoring System will give an alert message to the people.

II. RELATED WORKS

In the literature review, following papers are referred for the project. It gives us the brief study of the VOC monitoring systems. The paper mentioned below are the work which up till now done on the voc monitoring systems, sensors, energy.

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A. Air pollution monitoring system using Zigbee and GPS

This [1] presents various sensors to measure the common air pollutants. The measured data is displayed on the monitor using the Graphical User Interface (GUI). The data based server is attached to the pollution server for storing the pollutants level and it interfaced to Google maps to display real time pollutants, pollutants level and locations in large areas. At present GPS, GPRS are used in wireless monitoring systems and are costly to installation and maintain. So that here introduces Zigbee. The WSN is an efficient method of measuring and monitoring air pollutants. The WSN is of low cost, multifunctional. The Zigbee is the new Short range, low power, low data rate wireless network topology. Network layers supports star, tree and mesh topology with each node having capability of transmitting and receiving data over communication links. The Zigbee co-coordinator is responsible for initiating and maintain the device on the network.

Advantages:

- WSN is low cost.
- Multifunctional.

Limitations:

- GPS costly to installation and maintain.
- Bad in selectivity and sensitivity.

B. Design and Development of Zigbee based WSN for Monitoring Air Pollutants

The [2], gives the design of a low power wireless sensor network and control of inter-node data reception for use in the real time acquisition and communication of air pollutants. The network consists of end devices with sensors, routers that propagate the network over long distances, and a coordinator that communicates with the computer. The design is based on ARM 7 based LPC2378 microcontroller and EZ430RF 2480 Zigbee module to process communicate the data effectively. Also, to reduce data packets loss and Priority is given to power consumption and sensing efficiency, which is achieved by incorporating various smart tasking and power management protocols.

Advantages:

- The ARM processor LPC2378 is a high performance
- low power device.

Disadvantages:

- Less user friendly
- Lowest power consumption is not possible.

C. An Efficient Interface for Monitoring Air Pollution by Using Micro Controller Based Sensors.

In this [3], consider design of protocol using sensors connected to a micro-controller based system. It presents a

prototype for measuring the levels of the main air pollutants NO₂, NO_x, CO, and CO₂ in cities. So a protocol is designed using PIC 16F877 Microcontroller, for the purpose of measuring the levels of air pollution and provide real-time monitoring of concentration of the gases in the air. The gas levels are sensed through the respective gas sensors used for sensing and sent to the PIC. The sensed analog signals are converted to digital through ADC. The sensed gas levels are displayed in the LCD.

Advantages:

- The Micro controller has attractive features and they are suitable for a wide range of application.

Disadvantages:

- PIC is usually used in industrial level
- It is more costlier.

D. Monitoring the Room Environment using WSN

This also gives a design using WSN[4]. Here, system monitor the indoor air quality like temperature, humidity and gas leakage. The input is the sensor value and output is displayed on LCD. Also when there is dangerous situation, the alarm will be on and the data will be stored on PC for reference. To improve people's comfort, health and safety it is very useful to monitor Indoor Air Quality (IAQ).

Advantages:

- The system is less cost.
- Convenient to use.

Disadvantages:

- PIC is bit complicated.
- Renewable energy is not in use.

E. Air Pollution Monitoring System based on Wireless Networks -Simulation

This [5] proposes an industrial air pollution monitoring system based on WSNs by using Proteus software to provide live monitoring and measure harmful air pollutants. This system is integrated with the GSM and its communication protocol used is Zigbee. The system consists of sensor nodes, a control center and database through which sensing data can be stored. The simulations have been performed using the Proteus software and MicroC Pro. for PIC. The designed sensor array consist of CO, SO₂, and dust sensors. These sensors are connected to the PIC16F887 microcontroller. The sensor output voltages representing the level of each pollutant were converted to a mg/m³ value and simultaneously these data are sent to the database to be displayed.

Advantages:

- Sensor output voltages representing the level of each these data are sent to the database to be displayed.

Disadvantages:

- Alert system are not present.
- Only gives simulation.

F. Air quality monitoring for Urban areas based on WSN

This [6] aims an automatic micro-scaled air quality monitoring system for areas with a high density of population

and vehicles, based on WSN and also integrates with GSM. The monitoring system consists of a gateway and sensor nodes with the air quality detection sensors. The gateway collects the data received from the sensor nodes and transmits the data to the control center managed by the Lab VIEW program through which sensing data can be stored in a database. This system is deployed to the main roads in the Taipei city to monitor the CO concentration caused by vehicle emissions. The high -resolution meteorological data and concentrations of air pollutants can be provided in a real-time manner, including rainfall, wind speed, wind direction, temperature, humidity and the concentration of carbon monoxide.

Advantages:

- Stores a large amount of data into the database via the MySQL reveals high-resolution pollution conditions.

Disadvantages:

- Power consumption is high.
- Only some pollutants can monitor.

G. Design and Application of a VOC-Monitoring System Based on a Zigbee WSN

Basic aim of this [7] is to design a low-power Zigbee sensor network and communication of data concerning air pollutant levels from VOCs. The network consists of end device sensors with photoionization detectors, routers that propagate the network over long distances, and a coordinator that communicates with a computer. The design is based on the ATmega16 microcontroller and the Atmel RF230 Zigbee module, which are used to effectively process communication data with low power consumption. WSN system can monitor VOC concentrations with a high level of accuracy and thus can be used for automatic environmental monitoring. The measurement nodes are small and easy to deploy in buildings. Thus, the monitoring of both IAQ and building energy conservation can be achieved. When comparing [4],[5],[7], this method is more relevant, user friendly and also can apply in many fields

Advantages:

- Energy conservation can be achieved.

Disadvantages:

- Renewable energy cant make use.

III. COMPARISON

Title	Components	Advantages	Disadvantages	Applications
Air pollution monitoring system using Zigbee and GPS	WSN GPS GSM Zigbee	WSN is low cost, multifunctional.	GPS costly to installation and maintain. Bad in selectivity and sensitivity. It required high temp.	This whole unit can mounted on vehicle to gather information from various parts of city.
Design and Development of Zigbee based WSN for Monitoring Air Pollutants	ARM microcontroller MSP430 CC2480 Zigbee	The ARM processor LPC2378 is a high performance, low power device.	Less user friendly. Lowest power consumption is not possible.	Used in environmental monitoring systems and bio-medical applications.

An Efficient Interface for Monitoring Air Pollution by Using Micro Controller Based Sensors.	PIC16F877A microcontroller. Gas sensors.	The Micro controller has attractive features and they are suitable for a wide range of application.	PIC is usually used in industrial level. It is more costlier.	Applicable in industrial level monitoring
Monitoring the Room Environment using WSN	WSN PIC Microcontroller Sensors GSM	The system is less cost and convenient to use	PIC is not most advanced. Renewable energy is not in use.	It gives a wide applications in our day today life such as hospitals, college, office to improve the health
Air Pollution Monitoring System based on Wireless Networks - Simulation	WSN PIC Microcontroller Sensors GSM Proteus software	Sensor output voltages representing the level of each these data are sent to the database to be displayed.	Alert system are not present. Only gives simulation	An industrial air pollution monitoring system
Air quality monitoring for Urban areas based on WSN	Sensor nodes Gateway Lab VIEW program GSM	Stores a large amount of data into the database via the MySQL reveals high-resolution pollution conditions	Power consumption is high. Only some pollutants can monitor	Applicable in EPA monitoring stations.
Design and Application of a VOC-Monitoring System Based on a Zigbee WSN	WSN Zigbee Photoionization detector	Energy conservation can be achieved.	Renewable energy cant make use	Many buildings contain synthetic materials and furnishings to save energy, the airtightness of buildings has been increased

IV. CONCLUSION

In this survey, various papers are referred and compared related to Air pollution (VOC) monitoring system. Volatile organic compounds are emitted as gases from certain solids and liquids. VOCs include a variety of chemicals, some of which can cause short- and long-term health effects. Many VOCs are found at consistently higher concentrations in indoors. This helps to analyze about air pollutants, VOC monitoring systems, their components and merits and demerits of the VOC monitoring system.

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