SYSTEM TO MONITOR AND PREVENT THE AIR POLLUTION BY REDUCING CO EMISSION

S.SURIYA JOTHI
Student
IFET College of engineering
Department of ECE
Villupuram, INDIA

Y.JEYASINGH
Assistant professor
IFET College of engineering
Department of ECE
Villupuaram, INDIA

ABSTRACT---Air pollution is one of the major concerns which affect the human health, life of plants and animals. The pollution occurred by the major gas (carbon monoxide) due to combustion of fuel, industrial and vehicle exhaust. The polluted air causes serious effects such as ozone layer depletion and global warming. This system used to monitor and prevent air pollution through wireless sensor network. Pollutant levels in parts per million are gathered by using commercially available (MQ7) sensor and the graph is read through the pc with JAVA GUI. The software part of the project is developed under JAVA net beans IDE interfaced. The experimental results demonstrate the real time response. The proposed system aims to provide the air pollution monitoring and preventive technique for environmental awareness.

KEYWORDS— Air pollution, wireless sensor system, real time, CARBON MONOXIDE, java, GSM.

I. INTRODUCTION

Air pollution is the crucial factors which causes human health risks which may lead to death. It has significant influence on the concentration of gas in the atmosphere. The air becomes more dirty and affect the animals, plants and survival of human beings due to the occurrence of harmful gases such as carbon monoxide, carbon dioxide, CFC, HFC, and dust, and smoke enters to the atmosphere. The environmental problems such as ozone layer depletion and acid rain caused due to the atmospheric pollutants. The monitoring system is vital in both the industrial and urban areas in order to avoid the adverse in nature. In past decades, several policies are implemented by *united states (U.S.)* to regulate The ***NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)*** based on (U.S.EPA) United States environmental protection agency.

The ASIAN countries also started to adapt the National ambient air quality standards to improve the quality of air and control of causes of Pollution. In addition to those policies India, Korea, Japan, china, the air quality monitoring is implemented to further improve the air pollution and reduction policies.Metro manila is also identified as one of the most polluted city with polluted air which causes almost 18 million Filipinos people affected from leading cause of anaemia, kidney problems, infertility etc.

Those peoples are living under the *Department of Energy and Resource (DENR)* standards. In response to the Philippine government adapted (NAAQS) as aid to reduce the effects of air pollution. A recent issue where New Delhi government announced that the odd numbered vehicle should travel on particular day and even numbered vehicle should travel on another particular day in order to prevent the Carbon monoxide emission from the vehicle.

After they implemented this technique they found the scenario which clearly explains that there is a reduction of air pollution in their places. The gases such as CO_2, CO, SO_2 are the major concentration of air pollution. The urban areas as well as industrial areas are affected through air pollution. The pollution which came from different sources and lead to serious side effects. 65% of pollution came from mobile sources, 21% affected from stationary sources, 10% from Agriculture, 52% from major industries, 27% from transportation, consumer and commercial products lead to 8% of pollution, 1% from commercial and residential heating and others produces 2% of pollution. These are all the major sources which lead fresh air to Polluted air. The most important gas (carbon monoxide) caused by the gasoline-fed vehicle due to the increase of population. The leading cause of death is high poisoning of CO gas. Air pollution is a system of environmental monitoring.

The monitoring was traditionally performed by using the fixed monitoring stations which is highly sensitive and expensive. After that the conventional approach for air quality monitoring were Fourier transform infrared instruments (FTIR), chromatography, and mass spectrometry. Wired transmission mode using sensor connects with personnel computer is costly. Wired transmission is unfavourable for monitoring applications in large areas due to large size, high cost, and frequent need of maintenance. Thus we move on to the wireless sensor network (WSN) helps to monitoring and controlling the physical environment from remote locations. It produces better accuracy. WSN is equipped with various gas sensors to monitor air quality.

Health effects of pollution
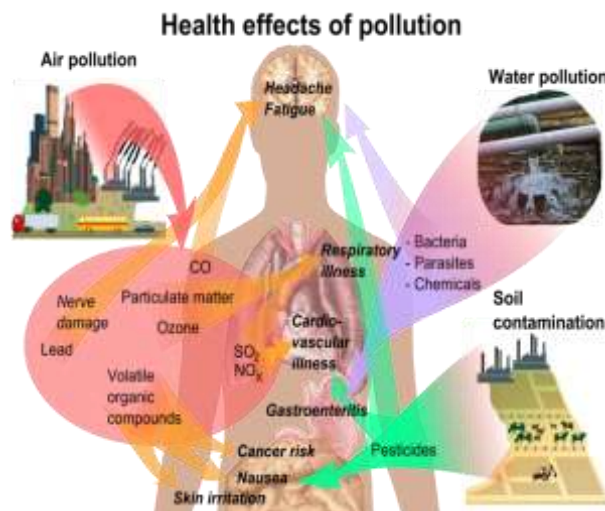
The constituent source of air pollution is carbon monoxide. The carbon monoxide is a colourless, odourless, poisonous gas. This is generally referred as *silent killer* because of its ability to take the lives quickly an quietly when the victims never even knew they were at risk. This gas is produced when fossil fuel burns incompletely because of insufficient oxygen. During the incomplete combustion of carbon and oxygen combine to form carbon monoxide etc. The symptoms like flu, nausea. Shortness of breath, headache etc.

The severity of symptoms depends on the concentration of gas. The combustion-furnaces, stovetops, water heater, candles, kerosene etc. produce less than 30ppm. The 100ppm cause permanent brain or heart damage. 400ppm cause headache in 1 to 2 hours an same concentration for certain period cause the unconsciousness an death in 3 to 5 hours. The safety limit is 50ppm.WSN have variety of applications used in the field of environmental monitoring, flood detection, indoor climate control, fire detection, surveillance, medical diagnostics, emergency response, ambient air quality monitoring, bio complexity monitoring, precision agriculture, disaster relief management bio diversity mapping, facility management, intelligent buildings, medical and health care etc. Thus the WSN which plays a major role in the field of monitoring the physical characteristics from our

environment. The WSN allowed the low cost air pollution monitoring with easy configuration, quick, reduced installation and deployed in real time environment. This project by using wireless sensor network going to monitor air pollution as well as to prevent.

II. METHODOLOGY

The system is divided into two methods were
➤ Monitoring stage
➤ Prevention stage

The embedded system is used in this model. Embedded system is any device that includes a programmable computer but it is not itself intended to be a general purpose computer. The types of embedded system are such as *small scale embedded system, medium scale, sophisticated embedded system.* The real time embedded system should meet with the real time deadlines; consume little power, cost- competitive. The applications of embedded systems are automotive, smart buildings, office automation, aircraft and telecommunication.

III. HARDWARE DESCRIPTION

I) MQ7 SENSOR CONFIGURATION:

The sensor used in this system detects the concentration of gas in the air. (MQ7) sensor which is highly sensitive to the CARBON MONOXIDE gas. This sensor easily implemented in the environment due to stable and long life. The output readings are obtained as an analog voltage. Almost this sensor is used in car, industries, and home.

The temperature ranges of the sensor is -20% to -50% it consumes less than 150 Ma AT 5V. The heating resistance of the sensor is $33\Omega \pm 5\%$. The heating time of the sensor is 60 ± 1 second.The sensitivity characteristics are depends on the ratio of (RS/Ro) where RS is the sensor resistance during exposure to the carbon monoxide and Ro is the original or initial sensor resistance. The sensor which consists of 9 pins the most

important are pin 1 gas sensing layer and pin 4 is heating coil. Structure and configuration of gas sensor is composed by micro Al2O3 ceramic tube. Consists of tin dioxide (sno2) sensitive layer.

Fig:1 MQ7 SENSOR

The heater provides necessary work conditions for work of sensitive components. The standard measuring circuit of MQ7 sensitive components consists of two parts they were

1. Heating circuit
2. Signal output circuit it accurately respond changes of surface resistance of sensor.

The sensitive layer of the sensor is sensitive components made of sn02 with stability, so it has excellent long term stability. The service life can reach 5 years under working condition. When the sensor shifted from clean air to carbon monoxide, output signal measurement is made within one or two complete heating period. Ro which measure 1000ppm carbon monoxide in clean air.
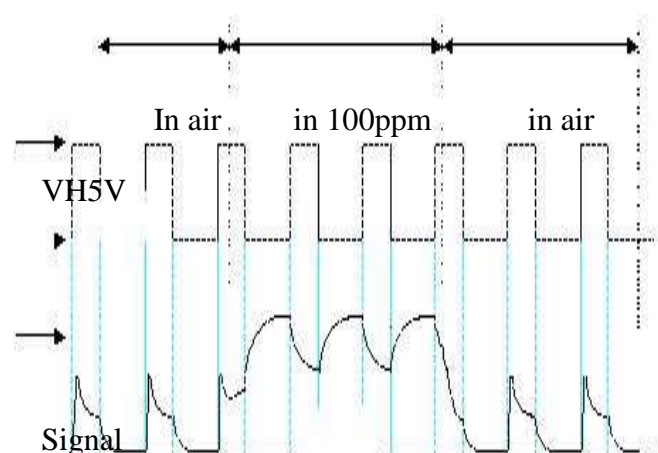

Fig: RL signal output measured by using circuit output.

II) ARDUINO

The Arduino Uno is a low power AVR microcontroller board consists of 8-bit based on ATmega328 with the flash memory. It consists of 6 analog inputs, (14 digital input/output pins), 16 MHz ceramic resistor, a power jack, a USB connection, In-circuit serial programming (ICSP) header and a reset button. It is a type of hardware Board designed to around 8-bit Atmel AVR microcontroller or 32-bit Atmel ARM. Arduino is the open source hardware. The coding is accessible and transferable (C++, processing, java). The terminology of Arduino is i/o board- main microcontroller and sensors- components. The applications widely were low cost CRO, LED cubes. The operating voltage of arduino is 5V. the input voltage is about 7-12V. arduino has a resettable polyfuse that protects our system USB from shorts and over current.
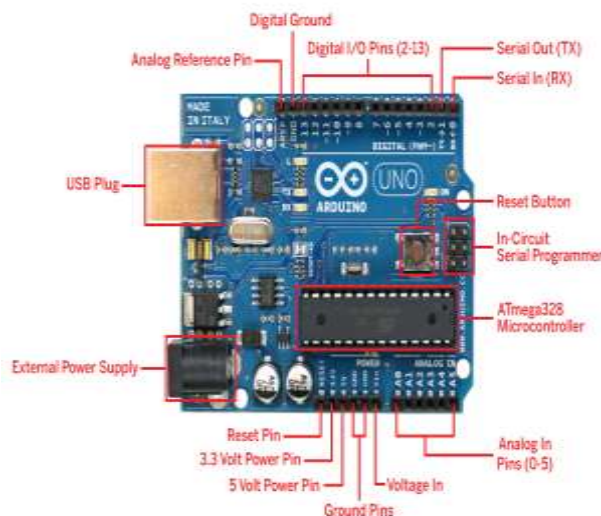

Fig: Arduino Uno

III) TRANSCEIVER

NRF 24LO1 transceiver is a single chip suitable for low power wireless application. Can operate and configure through (SPI). The transceiver operates at 2.4 GHz (standard frequency) ISM band operation. SPI serial port communication is used a interface between the microcontroller and wireless transceiver. Acts as a bidirectional (full duplex communication).

The NRF transceiver is ultra-low power consumption device and used many applications such as game controller, toys, tracking system. The NRF 24L01 is the very cheapest transceiver available in the market. This used to transmit the information from source to receiver.The transceiver operates with peak RX/TX currents lower than 14Ma, and 1.9 to 3.6V supply range. The nRF 24L01 enabling years of battery life time. This transceiver almost used in gaming, sports, toys etc. The features of the transceiver is ultra-low frequency , auto acknowledgement, auto re-transmit etc. this is the cheapest sensor available in market.

Fig: NRF 24L01 Transceiver

IV) GSM

The GSM modem can accept any GSM network operator SIM card. And it operates with own unique phone number like mobile phone. It requires the connectivity to GSM network and SIM card.it is a type of the wireless MODEM which used to send and receive the information or data through the GSM network.
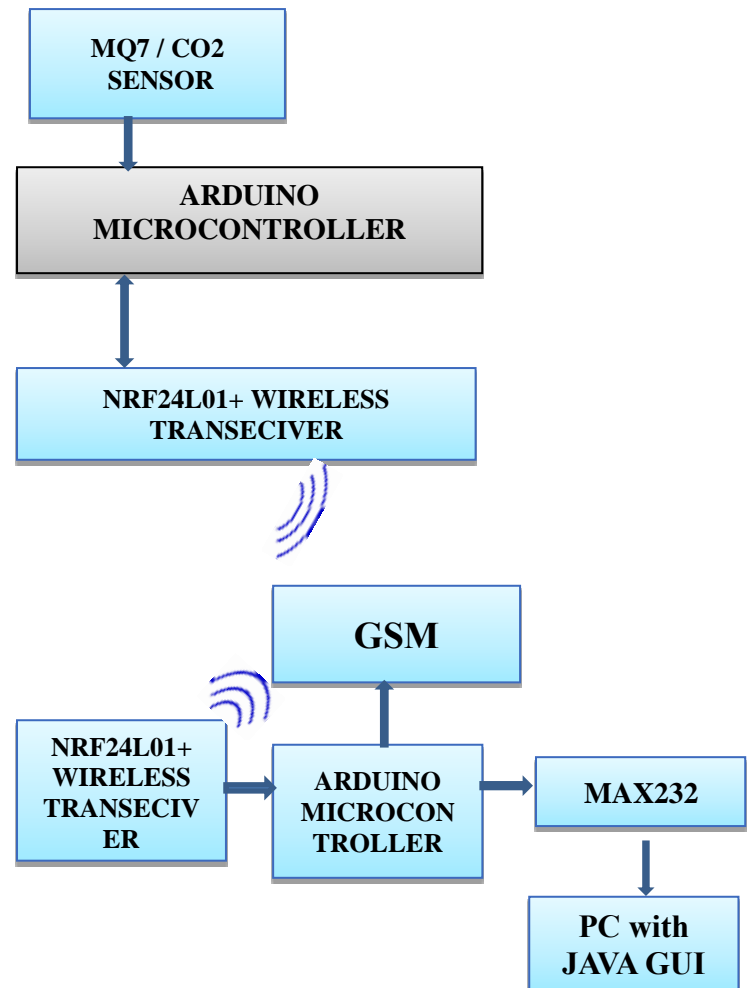

Fig: GSM Module

GSM MODEM also used in GPRS mode to connect with the internet.

DESIGN OF AIR POLLUTION MONITORING AND PREVENTIVE SYSTEM

The functions used for the air pollution applications are explained in detail

- The MQ7 sensor used to sense the concentration of carbon monoxide gas level. The output readings are obtained as an analog voltage. This sensor is almost used in vehicle, industries, and home.
- The Arduino Uno is a low power AVR microcontroller board consists of 8-bit based on ATmega328 with the flash memory. The program coded in the microcontroller which measures the amount of carbon monoxide presence. The arduino is open source library which is easily interfaced. The coding is accessible and transferable.
- The transceiver used to both transmit and receive the information. The transceiver used is a NRF 24L01 which ultra-low power applications. Operates at 2.4 GHz ISM BAND. This type of transceiver is cheapest transceiver available in the market. This used to transmit the information from source to receiver.
- By using these components the air pollution (carbon monoxide) level is monitored and viewed through PC. The pc uses JAVA GUI which predict the high amount of the pollution.
- After the monitoring stage prevention takes place by using GSM. The GSM is a cellular network which is widely used in different cell sizes like *macro ,micro, pico and femto etc.* the key feature of GSM is the *subscriber identity module* commonly (SIM).the GSM uses AT commands to convert into message format.

These are the functions which is followed in the air pollution monitoring and preventing technique.

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┌─────────────────┐
│   MQ7 / CO2     │
│    SENSOR       │
└─────────────────┘
         │
┌─────────────────┐
│    ARDUINO      │
│ MICROCONTROLLER │
└─────────────────┘
         ↕
┌─────────────────┐
│ NRF24L01+ WIRELESS │
│    TRANSECIVER     │
└─────────────────┘

┌──────────┐   ┌──────────┐
│   GSM    │   │          │
└──────────┘   └──────────┘

┌───────────┐  ┌──────────┐  ┌──────────┐
│ NRF24L01+ │  │ ARDUINO  │  │ MAX232   │
│ WIRELESS  │→ │ MICROCON │→ │          │
│ TRANSECIV │  │ TROLLER  │  └──────────┘
│ ER        │  └──────────┘       │
└───────────┘                ┌──────────┐
                             │ PC with  │
                             │ JAVA GUI │
                             └──────────┘
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APPLICATIONS

The air pollution monitoring and preventing technique is widely used in many applications such as to monitor through

- ➢ *Testing with industrial exhaust*
- ➢ *Testing with vehicle exhaust*
- ➢ *Testing by imbuileded in smart building*
- ➢ *Testing in environment*

This system is used to monitor carbon monoxide level from industries, building, and tested in environment etc. many people expose their life by working in industries they are easily get affected by the CO emission and they lost their healthy life. Then most of the people spend more than one-third of their lifetime inside the buildings the indoor air pollution which affect their health. By using this method the people are get awareness to provide them from polluted air the carbon monoxide

which is highly emitted through the vehicles. So in this case especially we used to monitor the CO in the vehicle. The sensor i.e. the transmitter side, is placed in the vehicle and the receiver side is placed in the toll gate, so that vehicle exhaust is continuously monitored when it pass through any toll gate.

Fig: vehicle in tollgate

If the level of carbon monoxide emission is high then the message is alert to the user as well as the RTO by using GSM. The message is sent through GSM as the CO emission in your vehicle is high so you should go to the FC within one week or else your vehicle should be ceased. If they not obey the warning message then the message is sent to the RTO only in order to cease the vehicle after that necessary steps are taken by the RTO. By using this technique some amount of pollution is reduced from vehicle emission. This paper aims to provide the necessary function to monitor as well as to control the certain amount of pollution in environment.
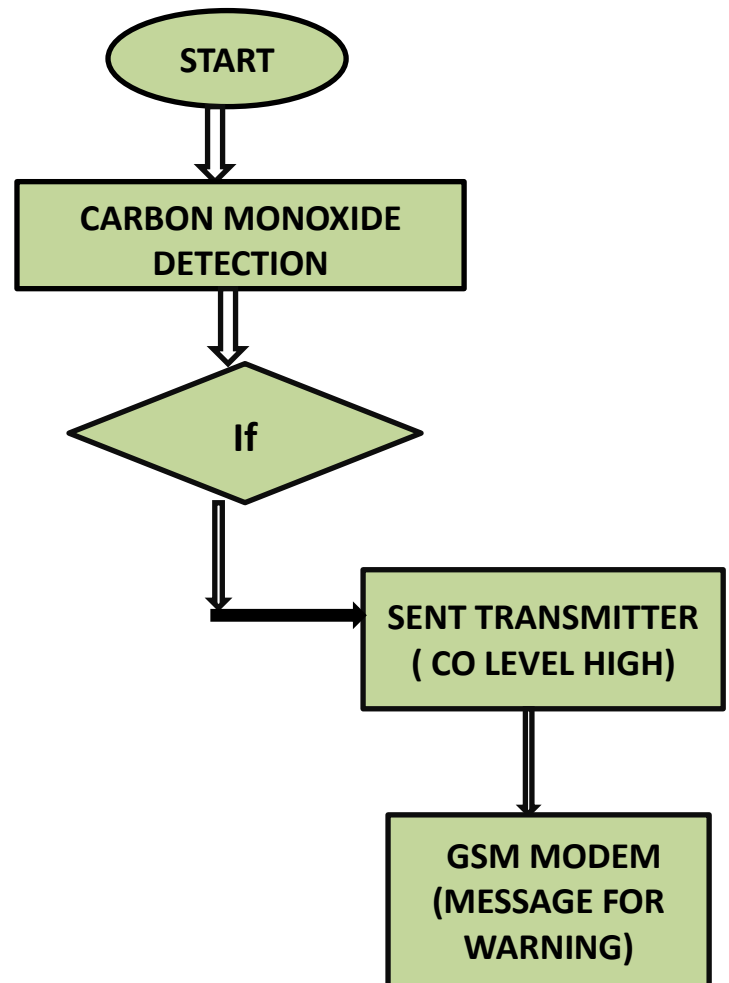

Fig: LCD Module

The below figure experimentally demonstrate the carbon monoxide level monitored and shown as a prototype output.

FLOWCHART

The flowchart is simple way to realize the concepts of any techniques. Here the flow chart simply represents the air pollution monitoring and preventive system.

CONCLUSION

The proposed Wireless Air Pollution Monitoring System provides real-time information about the level of air pollution. This project is attempted to minimize the pollution problem in environment. The systems detect the carbon monoxide emission by using MQ7 sensor and transceiver used which is locally available in the market makes it more convenient compared to pre-ordered methods. The

Atmega 328 microcontroller which effectively process and communicate data with low power consumption. This system will be helpful to monitor the air pollution level with less hardware components, less power consumption &very low cost transceiver are able to use which is capable of detecting several kinds of gas compounds. More individuals expose themselves to a less healthy environment by inhaling polluted air. This paper which made environmental awareness and to take necessary measures to provide a healthy life.

REFERENCES

[1] Alave, K. DENR Issues New Limits on Vehicular Emissions to Cut Air Pollution. *Philippine Daily Inquirer.* (2010)

[2] Ageitos, M., Guerrero, P., Baldasano, J. Effects of Introducing Hybrid Cars in Madrid and Barcelona Metropolitan Areas. *HARMO12-Conference (Air Quality Management Strategies in Urban Area)* pages 1-16. (2008)

[3] Australian Bureau of Statistics. (2010).. *Australian Social Trends. 4102.0,* Environmental awareness and Action, pages 1-5

[4] Bagula, A., Inggs, G., Scott, S., Zenarro, M. (2010).:An Application to Pollution Maps. Community Sensor Network *Wireless Communications and Information Conference, (2010).*

[5] Burgonio, T. (2007). *Philippine Daily Inquirer,*Air pollution kills nearly 5,000 Metro residents yearly. pages 5 - 6Retrieved from http://newsinfo.inquirer.net

[6] Choi, S., Cha, H., Ha, R., Kim, N., (2009). Micro Sensor Node for Air Pollutant Monitoring: *Sensors. ISSN 1424-82,* pages 7970 - 7987

[7] Clean Air Initiative for Asian Cities (CAI-ASIA) Center. Air Quality Monitoring and Reporting.Air Quality in Asia.2010 edition, page13

[8] Environmental Management Bureau Department for Environment and Natural Resources 2009. *National Air Quality Status Report, 2005-2007,* pages 11 - 41. Retrieved from http://emb.gov.ph

[9] Clagett.M, Houk, J , (2009). Air Quality Management: Successes and Emerging Challenges. *THE ENVIRONMENT AND TRANSPORTATION. TR NEWS 262,* pages 8-12.

[10] Dr Invernizzi, G. (2004). Particulate Matter from Tobacco versus Diesel Car Exhaust. *National Cancer Institute Tobacco Control Unit,.* Retrieved from:http://www.medicalnewstoday.com/releases/12481.php

[11] Jaichandran, R., Irudhayarj, A., 2011. Prototype System to Monitoring and Computing Greenhouse gases. *(WCSIT) World of Computer Science and Information Technology Journal Vol. 1, No. 5,* pages 177-183.

[12] , K., Perseedoss, Khedo, R., Mungur, A. A Wireless Sensor Network Air Pollution Monitoring System.(2010) *International Journal of Wireless & Mobile Network, Vol. 2, No. 2,* pages 1 - 15

[13] Richards, M., Ghanem, M., Ma, Y., Guo, Y., Hassard, J. (2008). Air Pollution Monitoring & Mining Based on Sensor Grid in London. *Sensors 2008, ISSN 1424-8220.*