Smart System for Monitoring Air Pollutants from Industries

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Abstract- *Air pollution is a major environmental health problem affecting the developing and the developed countries alike. The effects of air pollution on health are very complex as there are many different sources and their individual effects vary from one to the other. These chemicals cause a variety of human and environmental health problems Increase in air pollution effects on environment as well on human health. To monitor this pollution wireless sensor network (WSN) system is proposed. The proposed system consists of a single-chip microcontroller, air pollution sensors zigbee and Global System for Mobile communication(GPS module). The MobileDAQ unit gathers air pollutants levels (CO, Hydrogen, temperature) and packs them in a frame with the GPS physical location, time, and date. The frame is transmitted to the Pollution-Server via zigbee module. After two warnings the warning message with the gas quantity will be sent to the officials through GSM. We can connect database server to the Pollution- Server for storing the pollutants level for further usage by various clients such as environment protection agencies, vehicles registration authorities, and tourist and insurance companies. ZigBee module and pollution server is interfaced with GPS system to display real-time pollutants levels and there location on a 24h/7 days basis. In this system there are four transmitter are present which transmit the different levels of pollutant substance such as CO, hydrogen alcohol and temperature sensors to the receiver node in real time.*

Keywords:- ZigBee Sensor Node, Air Pollution, Environmental Pollution, CO, hydrogen, temperature.

I. INTRODUCTION

Pollution can be defined as presence of minute particles that disturbs the functioning of natural processes and also produces undesirable health effects. In other word pollution can affect the natural cycle and also can disturb the health of human being . As industrialization is growing very extensively pollution is also getting introduced at large manner. At present there is Air pollution, Water pollution, Soil pollution worldwide. This thesis only focuses on Air pollution. Air pollution is the presence of contamination or minute particles that interfere with human health and environment. These pollutants basically results from vehicles and industries. The World Health Organization states that 2.3 million people die each year due to causes directly attributed by air pollution. Based the fact above mentioned, the human should focus on air pollution monitoring. There are two methods for monitoring air pollution at present. One is passive sampling (non-automatic), and other is continuous online monitoring (automatic). The Passive sampling uses simple equipment but it does not provide the real time values. The procedure of continuous online monitoring uses sensors to monitor the parameters, and then send to control center by network. The way of data transfer includes wired and wireless systems. Even though system is reliable it is having short comings at large and dynamic range, such as complex network cabling, expensive etc. With extensively developing communication technologies, now a day's air pollution monitoring system is often designed in wireless mode. At present, the wireless mode in air pollution monitoring deals with GSM, GPRS, etc. But these modes are high cost in both installation and maintenance. But on the other hands Wireless sensor networks have been rapidly developed during recent years and used on the large scale at military, industries too. Based on these advantages, it is now being applied in environmental monitoring. In order to implement such system single chip microcontroller along with array of sensors, zigbee module and GSM-module is used. This system measures concentration of gases such as CO, hydrogen, temperature and other gases using electrochemical sensors. The hardware unit gathers air pollutants levels also pack them into the frame with GPS physical location, time and date. The frame is uploaded to the zigbee modem and transmitted to the central server via zigbee. The system is low cost and energy efficient in terms of sensors.

II. NEED OF MONITORING

Clean air is vital need for every human being. Polluted air causes many health problems and several damages.Therefore to make any step ahead of controlling the pollution rate it is necessary to monitor the air quality which may help us to make a right decision at right time.There are various causes of increasing the pollution such as smoke automobile exhaust, chemical discharge from industries, radioactive substance etc.these are main reason of decreasing

the quality of air. The main gases which directly affect the human health are carbon monoxide (CO), hydrogen sulphide, sulphur dioxide (SO2),Nitrogen dioxide(NO2) and the main contribution of these gases are traffic related pollutant emission. Huge efforts are required to improve the quality of air in both outdoor and indoor environment. Monitoring of environment has been controlled from manual to the automatic control step by step. There are various improvement in the instrument of environment monitoring but still cannot meet the harsh environment.

III. BLOCK DIAGRAM:

TRANSMITTER:

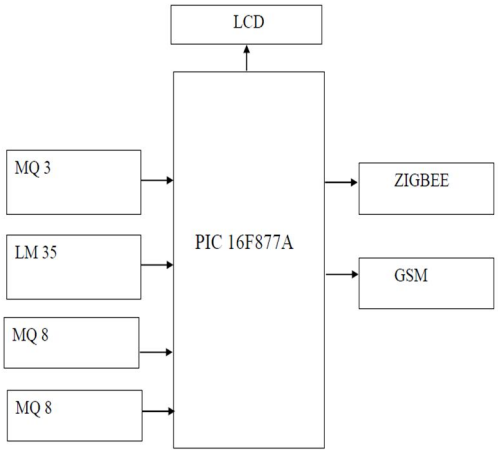

Fig 3.1: block diagram of transmitter system

RECEIVER:

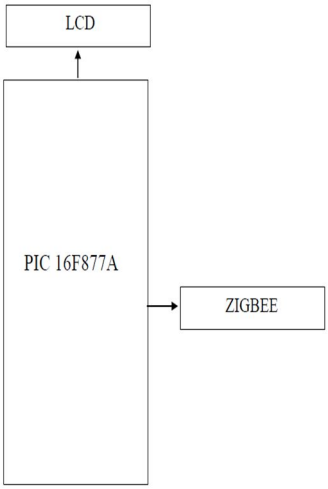

Fig 3.2: block diagram of receiver system

IV. PIC MICROCONTROLLER

A single chip microcontroller is obtained by integrating all the components of a microcontroller in one IC package. Hence apart from CPU such a single chip microcontroller will therefore contains its own clock generator and some amount of ROM or EPROM, RAM and I/O ports on the same chip. It may also have other features like timer/counter, USART, PWM, A/D etc., on the chip. The term PIC, Peripheral Interface controller, has been coined by microchip Technology to identify its single chip microcontroller. These devices have been phenomenally successful in market place. For many years this market was dominated by 4-bit controllers i.e. by controllers that dealt with data 4-bit at a time. More recently, 8-bit controllers have come to dominate in the market i.e. fragmented among dozens of manufactures. PIC controllers possess an array of features that make them attractive for a wide range of applications. These microcontroller are a available with a range of capabilities, packaged in both dual- in-line (DIP) packages and surface mount packages. The 40-pin parts posses virtually the same array of features as the 40/44-pin parts but are housed in a smaller package and are supported by eleven fewer input/output (I/O) lines. This could be called microcomputer, as all the major parts are in the IC. Most frequently they are called microcontroller because they are used they are used to perform control functions. The microcontroller contains full implementation of a standard MICROPROCESSOR, ROM, RAM, I/0, CLOCK, TIMERS, and also SERIAL PORTS. Microcontroller also called "system on a chip" or "single chip microprocessor system" or "computer on a chip".

V. SENSORS FOR MONITORING POLLUTION

5.1 MQ 3 SENSOR:

This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0-3.3V ADC.

Features:

- 5V DC or AC circuit
- Requires heater voltage
- Operation Temperature: -10 to 70 degrees C
- Heater consumption: less than 750mW

Dimensions:

- 16.8mm diameter
- 9.3 mm height without the pins

5.2 MQ 9 SENSOR:

This semiconductor gas sensor detects the presence of Carbon Monoxide at concentrations from 10 to 1,000 ppm and combustible gas from 100 to 10,000 ppm. The sensor's simple analog voltage interface requires only one analog input pin from your microcontroller.

5.3 MQ 8 SENSOR:

This is a simple-to-use, suitable for sensing hydrogen concentrations in the air. The MQ-8 can detect hydrogen gas concentrations anywhere from 100-10000ppm.This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.This sensor comes in a package similar to our MQ-3 alcohol sensor, and can be used with the breakout board below.

5.4 LM 35:

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in **o**C).

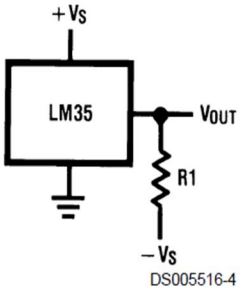

Fig 5.4: LM35 temperature sensor

5.4.1 PIN DESCRIPTION

It has an output voltage that is proportional to the Celsius temperature.

The scale factor is .01V/**o**C

The LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4 **o**C at room temperature and +/- 0.8 **o**C over a range of 0 **o**C to +100 **o**C. Another important characteristic of the LM35DZ is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The sensor self-heating causes less than 0.1 oC temperature rise in still air.The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air.

The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C is rated for a -40° to +110°C range (-10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package. These devices are sometimes soldered to a small light-weight heat fin, to decrease the thermal time constant and speed up the response in slowly-moving air. On the other hand, a small thermal mass may be added to the sensor, to give the steadiest reading despite small deviations in the air temperature.

VI. ZIGBEE BASED WIRELESS AIR POLLUTION MONITORING SYSTEM:

The chemical composition that adversely affects the functionality of natural. The result in undesirable environmental, health effect of living and Non-living crates may be tensed or pollution one of the pollution. Air pollution and is the result of vehicle emissions and other volatile organic compounds. The IEEE so 2.15.4 standard define three function band of operation of zigbee.868MHz, 916MHz and 2.4GHz bands out of which 2.4GHz bands is mostly available wireless communication pollutants the world and this band also offers the highest data rate of 250 kbps and 16 channel between 2.4GHz and 2.4835GHz as physical layer. zigbee module empty dipole type antenna to increase gain of antenna.

Frequency band =2.4GHz
Data rate =250 kbps and 16 channel
Transmission Distance Environment =30m in indoor non loss = 100 m in loss Environment

In the air pollution monitoring system is developed by using zigbee. We get easily data on display continuously and we analysis the data by observing generation of air pollutant. The main advantages of zigbee are the particular area monitoring is possible.In this method the concentration of the major air pollution are defined. And the SO2, NO2,CO and CO2 are the major air pollutions. Which has harmful effects to the environment? In Hyderabad city, they are measured the air pollutions concentration and declare the result. Air pollution is caused by which sources like rood transport. In this they are used the Fourier transform infrared instruments. There instrument provide accurate readings at concentration of pollution.

VII. CONCLUSION

The zigbee is the new Short range, low power ,low data rate wireless network topology The zigbee network layers supports star, tree and mesh topology with each node having capability of transmitting and receiving data over communication links. To monitor the air pollution with the wireless sensor network has several benefits over the traditional environment. Wireless sensor network has its own advantage such as low cost, easy to setup and provide a real time pollutant data. monitoring stations which are used to analyze and collect the real time pollutant data from the road traffic emission. To monitor the pollution level from different area of glance is a difficult task and it requires a large infrastructure setup and proper management but if system can segment the pollution level as per the area so it can be better monitored and better solution can be provided.

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