IOT Based Air Pollution Monitoring and Forecasting System Using ESP8266

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ABSTRACT

Any activity involving burning things/fuels and mixing substances that cause chemical reactions may release toxic gases in the process and some activities like construction, mining, transportation, etc. produce large amounts of dust which has the potential to cause air pollution. As generation of toxic gases from industries, vehicles and other sourcesis tremendously increasing day by day, it becomes difficult to control the hazardous gases from polluting the pure air. Air pollution not only brings serious damage to human health but also causes negative effects to natural environments. The air pollution occurs due to contamination of air with Carbon monoxide (CO), Carbon dioxide (CO_2), Nitrogen dioxide (NO_2), Sulfur dioxide (SO_2) and many other harmful pollutants. This pollutant causes serious damage to environment. It also has hazardous effects on human health. Carbon monoxide reduces oxygen carrying capacity of the body's organs and tissues which may lead to cardiovascular disease. Carbon monoxide causes visual impairment, reduced manual dexterity, reduced work capacity, poor learning ability. So it becomes more and more important to monitor and control air pollution. It will become easy to control it by monitoring the concentration air pollutant parameters in air. Using laboratory analysis, conventional air automatic monitoring system has relatively complex equipment technology, large bulk, unstable operation and high cost.

Keywords : Arduino, Atmega328, DS18B20 Temperature Sensor, MQ2, MQ7, Online Monitoring

I. INTRODUCTION

1.1 Overview

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, 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 [4].In order to implement such system single chip microcontroller along with array of sensors, IOT module and Global positioning system module (GPS-module) is used. This system measures concentration of gases such as CO, NO2 andSO2 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 IOT modem and transmitted to the central server via IOT. Central server is interfaced to Google maps to display location of hardware unit. The system is low cost and energy efficient in terms of sensors.

1.2 Problem Identities

Although the urbanization brings a higher economic development, the excessive population concentration will cause environmental damage and pollution like air pollution, noise pollution, water pollution etc. Due to leakage of gas in the real time applications like cooking (LPG) gas in our homes, leakage in oil & gas industries, leakage in pipelines of transfer of LPG gas & exposures to pollutants etc need to be detected & may results in the harm to human systems like nervous, cardiovascular systems.

1.3 Objectives of the work

The purpose of this planning is to establish the scope of the project in terms of the major functions, performance issues and technical constraints. The plan will provide an estimate of the size of the product, the effort required and the duration. This plan will also consider the risk encountered during the project and the strategies for dealing with them. The plan will also discuss the detailed schedule of various subtasks within the project and also the resources needed to accomplish them.

II. LITERATURE REVIEW

1. Zigbee Based Wireless Air Pollution Monitoring System Using Low Costand Energy Efficient Sensors.

Mr.Vasim K. Ustad, Prof.A.S.Mali , Mr.SuhasS.Kibile, *PG Student, Department of Electronics Engineering, Tatyasaheb Kore Institute of Engineering &Technology,Warananagar, Maharashtra, India.*

Air pollution is a major environmental health problem affecting the developing and the developed countries a like. 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, so this paper contain brief introduction about air pollution. To monitor this pollution wireless sensor network (WSN) system is proposed. The proposed system consists of a Mobile Data-Acquisition Unit (Mobile-DAQ) and a fixed Internet-Enabled Pollution Monitoring Server. The Mobile-DAQ unit integrates a single-chip microcontroller, air pollution sensors array, and Global Positioning System Module (GPS Module).The Pollution-Server is a high-end personal computerapplication server with Internet connectivity. The Mobile-DAQ unit gathers air pollutants levels (CO, NO2, andSO2), and packs them in a frame with the GPS physic allocation, time, and date. The frame is transmitted to the Pollution-Server via xigbee module. The Central-Server is interfaced to Google Maps to display the location of hardware unit. 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.

2 Pollution Monitoring System using Wireless SensorNetwork in Visakhapatnam

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As the technology increase, the degree of automation (minimizing the man power) in the almost all sectors are also increases. Wireless Sensor Networks (WSN) are gaining the ground in all sectors of life; from homes to factories, from traffic control to environmental monitoring. The air pollution monitoring system contains sensors to monitor the interested pollution parameter in environment. We simulated the three air pollutants gases including carbon monoxide, carbon dioxide & sulphur dioxide in air because these gases decides the degree of pollution level. We can also apply the approach in various applications like leaking cooking gas in our homes, to alert the workers in oil & gas industry to detect the leakage etc. This simulation creates the awareness in people in cities.

III. WEB BASED AIR POLLUTION MONITORING SYSTEM USINGSAMRT PHONE.

ShilpaR. Khodve, A .N. kulkarni, dept. Of electronics and telecommunication, zeal college of engineering and research, pune, india.

This system have ARM7 LPC2138 is heart of the system. Sensors like temperature, smoke, co, no are interfaced with microcontroller which is use for the environmental monitoring air pollution and relay for load like fan and LED. The relay operates on 12v power supply so we are providing this 12volt to relay from secondary side of transformer. The system designed 5v supply for the module LCD, MAX232, sensors which require 5v. But controller LPC2138 and

Bluetooth module needs +3.3v that we are providing by using LM1117 IC that is in SMD(surface mount device) package. The controller continuously reads the value of sensors and displays it on LCD, and by using Bluetooth module these values of sensors are sent to android mobile. At the mobile side android web server is designed to show the parameters worldwide. These values are displayed on the mobile window as well as worldwide mobile or PC. Data will be viewed by the any engineer from any end of the world by this system. If at any time value of temperature sensor will increase by threshold that we have set 40, FAN will on that is connected as a load to relay. It means if temperature increases relay will on and it will on the fan. Similarly if value of smoke sensor will cross the threshold value that is 45, relay will on the LED that is visual indication. And again this increased value will also send to mobile using Bluetooth module. Different sensors are connected to ARM7 via inbuilt ADC. The output of sensor is containing the information about different parameter values.ARM7 is connected Bluetooth module through Max232.The Bluetooth module is used to send the data to the Android phone from Hardware. Android based server &PC are synchronized through same network via same Wi-Fi or keeping hotspot on of smart phone. The same screen as desktop computer is displayed on the smart phone so that the person from Remote locationalso see the current status of various parameters .We will first connect the Android phone &PC. Once the connection isestablished the administrator will be able to monitor wireless sensor parameter using the Android phone. Also theadministrator can send report via his smart phone directly to PC.

IV. Air Pollution Monitoring System in Solapur City using Wireless Sensor Network.

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Due to advances in technology there is trend in miniaturization of devices which demands to develop low cost sensor, low power and rugged devices .In

view of this Wireless Sensor Networks (WSN) have gained importance in various applications: Business, Agricultural, Domestic, Industries, Traffic control, and environmental monitoring. The paper presents Wireless sensor network system used to monitor and control the air quality in Solapur city. Environmental air pollution monitoring system that measures, SPM (Suspended Particulate Matter), NOx, and SO2 are proposed. The traditional air quality monitoring system, controlled by the Pollution Control Department, is extremely expensive. Analytical measuring equipment is costly, time and power consuming, and can seldom be used for air quality reporting in real time. Attempt has been made to develop monitoring system using commercially available standard pollutant gas sensors and CC2530ZDK board that uses 2.4 GHz IEEE 802.15.4 standard, high performance low power 8051 core, which will serve as a node in a Wireless Sensor Network. A specific program made with LabVIEW is created to configure and supervise the operation and the sensing measurements on the network used.

V. Web Based Air Pollution Monitoring System (Air Pollution Monitoring Using Smart Phone).

Shilpa R. Khodve, A. N. Kulkarni, Department of Electronics and Telecommunication, Zeal College of Engineering and Research, Pune, India.

This system will have ARM7 LPC2138, which is heart of the system. Sensors like temperature, smoke, CO, NO are interfaced with microcontroller for the environmental monitoring air pollution. All the parameters of the sensors are displayed on the LCD. All the values are sent to the nearby mobile using Bluetooth. At the mobile android web page is designed to show the All parameters worldwide .these values are display on the mobile window as well as worldwide mobile so that PC Data will be viewed by the any engineer from any end of the world by this system. this system will have one more facility as all the values are sent by microcontroller to the Mobile.

Mobile application will note down the coordinates of the area with sensor values stored in the form of database and Person will be able to view the sensor vise air pollution area wise due to the GPS facility. One more system feature is that it will show the all the values of the sensor on the monitor window as well as these values are compared with threshold value of the air pollution If any of the value goes above the threshold then the system will send the message to the administrative part or the engineer.

VI. Industrial Air Pollution Monitoring and Analysis System.

JadhavAditya S., PawarVishwajeet P., JorwekarSagar R, JadhavVidya P. Computer Engineering, SPPU, Maharashtra.

Safety plays a vital role in today's life; the main aura of safety also comes in under education and work system. As use of toxic gases is tremendously increasing day by day, it becomes difficult to control the hazardous gases. The system existing before was based on microcontroller based toxic gas detecting and alerting system and the developing system will have a complete monitoring system which is IOT based. As monitoring is done continuously, we can release and share monitoring news at real time too. The positioning, analyzing and synchronous display can be done with the help of WebGIS. The controller makes out a decision plan with the database of inquiry rules, and traces the implementation of the program. This system could make real time remote monitor dynamically and accurately toward the monitor scope. It will help us to keep a working staff away from danger and a high security can be achieve and it will also help the Government authorities to monitor the harmful gases emission as "Global Warming" perspective too.

BLOCK DIAGRAM
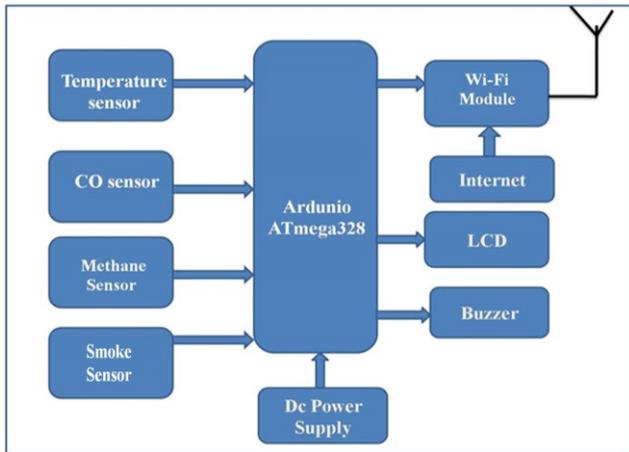
Figure 1. Block diagram.

WORKING

The MQ4 sensor can sense CH4, MQ7 sensor can sense CO, MQ2 sensor can sense smoke, LM35 sensor can sense temperature and some other gases, so it is perfect gas sensor for our Air Monitoring System Project. When we will connect it to Arduino AVR ATMEGA328 microcontroller then it will sense the gases, and we will get the Pollution level in PPM (parts per million). MQ4 (CH4) gas sensor gives the output in form of percentage we need to convert it into PPM. So for converting the output in PPM. Same for others gases also detect the pollution in the air in percentage and we know that the value should be in PPM . Then our project is based on wireless that is operating parameter used is the android phone . For that we have to required some programming concepts to run the project that's why we have to create a code using Aurdino1.6.10. Software. In this software the code should be written in simple C language with all descriptions of sensors , and other operating system in which the code explains how sensor, Wi-Fi module, LCD display, and so on should be connected . Whole program is dumped into the microcontroller ATMEGA328. With this WiFi module 8266 is used for trans receiving the data from hotspot from other device . And it useful for detecting the quantity of polluted gases in the air with that the values are display on Android Blynk App in the percentage level and if you want to check manually then it is display on LCD display. By determining the all the percentage value into LCD display and android phone it clear that project should be run successfully and it will be used further in industrial area, where the pollution must be large.

VII. RESULTS

The behaviour of three sensors observed in various conditionsand heating plates in MQ-7 sensor produces the more heateven for small change of the gas concentration and two sensorget effected during simulation. We also observed that materialused in construction of sensor, place a vital role in accuracyand performance of the pollution system. MQ-7 sensor composed by micro AL2O3 ceramic tube, TinDioxide (SnO2) sensitive layer, measuring electrode andheater are fixed into a crust made by plastic and stainless steelnet. The heater provides necessary work conditions forsensitive components. MQ-7 is able to detect from 20 ppm to2000 ppm of concentration in environment.

1. Online tracking on mobile App
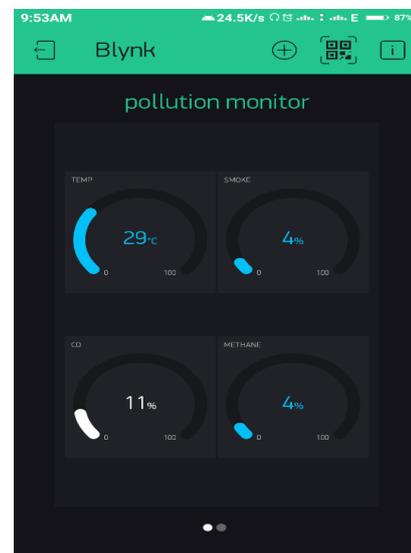
Figure 2. Parameter on blynk app

Figure shows the Air pollution monitoring system on online application in which it displays the temperature, methane, Co, smoke.

2. Parameter Display on LCD Screen

Fig. Parameter Display on LCD Screen

- Temperature= 29C
- CO=16%
- Smoke
- Methane

Figure shows the total Air Pollution Monitoring model in which all the assembly is the combination of IOT and Embedded System.

VIII. CONCLUSION

The system utilizes city buses, industrial areas to collect pollutant gases such as CO, CH4 , smoke and temperature. The data shows the pollution quantity; how much quantity present in air it shows in percentage. Here we have successfully design such a system which can monitor with the help of our android phone which shows the real time air pollution percentage present in air which can be accessible from anywhere in world so, here we have designed circuit which make takes corrective action on the increase of air pollution on the particular threshold value. The proposed Wireless Air Pollution Monitoring System provides real-time information about the level of air pollution in these regions, as well as provides alerts in cases of drastic change in quality of air. This information can then be used by the authorities to take prompt actions such as evacuating people or sending emergency response team. The system utilizes city buses to collect pollutant gases such as CO, NO2, and SO2. The pollution data from various mobile sensor arrays is transmitted to a central several that make this data available on the Internet through a Google Maps interface. The data shows the pollutant levels and their conformance to local air quality standards.

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