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IOT Based Air Pollution Monitoring System Using Arduino and ESP8266

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ABSTRACT

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.

Keywords : arduino, atmega328, Gas sensors, IOT, ESP8266 wi-fi module

I. INTRODUCTION

1.1 Basic Idea

Using empirical analysis, conventional air automatic monitoring system has high precision, but large bulk, high cost, and single datum class make it impossible for large-scale installation. Based on in triducing Internet of Things(IOT) into the field of environmental protection, this paper puts forward a kind of real-time air pollution monitoring and forecasting system. By using IOT, this system can reduce the hardware cost into 1/10 as before. The system can be laid out in a large number in monitoring area to form monitoring sensor network. Besides the functions of conventional air automatic monitoring system, it also exhibits the function of forecasting development trend of air pollution within a certain time range by analyzing the data obtained by front-end perception system according to neural network technology. Targeted emergency disposal measures can be taken to minimize losses in practical application.

1.2 History of Project

Present innovations in technology mainly focus on controlling and monitoring of different activities. These are increasingly emerging to reach the human needs. Most of this technology is focused on efficient monitoring and controlling different activities. An efficient environmental monitoring system is required to monitor and assess the conditions in case of exceeding the prescribed level of parameters (e.g., noise, CO and radiation levels). When the objects like environment equipped with sensor devices,

microcontroller and various software applications becomes a self - protecting and self - monitoring environment and it is also called as smart environment. In such environment when some event occurs the alarm or LED alerts automatically. The effects due to the environmental changes on animals, plants and human beings can be monitored and controlled by smart environmental monitoring system. By using embedded intelligence into the environment makes the environment interactive with other objectives, this is one of the application that smart environment targets. Human needs demands different types of monitoring systems these are depends on the type of data gathered by the sensor devices. Event Detection based and Spatial Process Estimation are the two categories to which applications are classified. Initially the sensor devices are deployed in environment to detect the parameters (e.g., noise, CO and radiation levels etc.) while the data acquisition, computation and controlling action (e.g., the variations in the noise and CO levels with respect to the specified levels). Sensor devices are placed at different locations to collect the data to predict the behavior of a particular area of interest. The main aim of the this paper is to design and implement an efficient monitoring system through which the required parameters are monitored remotely using internet and the data gathered from the sensors are stored in the cloud and to project the estimated trend on the web browser

1.3 Need of Project

Any activity involving burning things/fuels and mixing substances thatcause 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 sources is 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(CO2), Nitrogen dioxide(NO2), Sulphur dioxide(SO2) 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. This system can only be installed in key monitoring locations of some key enterprises, thus system data is unavailable to predict overall pollution situation. Using empirical analysis, conventional air automatic monitoring system has high precision, but large bulk, high cost make it impossible for large-scale installation. Nowadays, air pollution is monitored by static air quality measurement stations which are highly reliable and can measure the pollutants in air to a high level of accuracy and precision using analytical instruments, such as mass spectrometers, operated by official authorities. However, extensive cost of acquiring and operating such stations limits the number of installations. To monitor air quality, wireless sensor networks (WSNs) might be a great tool, because they can automatically collect air quality data. It will also 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 air pollution.

The proposed system will focus on the monitoring of air pollutants concentration with the help of combination of Internet of things with wireless sensor networks. The analysis of air quality can be done by

calculating air quality index. This information will be displayed on the webpage via internet in real time. By the combination of internet of things and wireless sensor networks for purpose of air pollution monitoring it becomes easy to keep the air quality data updated in real time. Also the system is cost effective which make its installation possible in various areas. 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. Also the information will be directly sent to the internet from system; no need of computer fortransmission purpose which reduces the cost further.

The air pollution occurs due to contamination of air with Carbon monoxide(CO), Carbondioxide(CO2), Nitrogen dioxide(NO2), Sulfur dioxide(SO2) and many other harmful pollutants. This pollutant causes serious damage to environment and has hazardous effects onhuman health. It becomes a need to control the air pollution. It will become easy to control it by monitoring the concentration air pollutant parameters in air. The conventional air pollution monitoring and analysis methods are quite costlier and bulky which is not suitable to install at large scale. Also it is hard to analyze the air quality at real time monitoring in previous systems.

Using laboratory analysis, conventional air automaticmonitoring system has relatively complex equipment technology, large bulk, unstable operation and high cost. This system can only be installed in key monitoring locations of some key enterprises, thus system data is unavailable to predict overall pollution situation.

The proposed system will not only detect the concentration of pollutants in the air but also gives the information about quality of air. This information will be stored on a webpage with the help of internet. The user with access key of webpage can view the information and monitor it while sitting at far distance from the system.

II. OBJECTIVE OF PROJECT

- The main objective of this system is to monitor air pollution by using internet of things application.
- Also to obtain cost effective system that will help to keep track of concentration of pollutants in air.
- Give Intimation Wirelessly to Industry .
- To achieve real time monitoring by continuously updating the data on webpage via internet.
- To find effect of concentration of pollutants on air in terms of air quality index.

III. BLOCK DIAGRAM

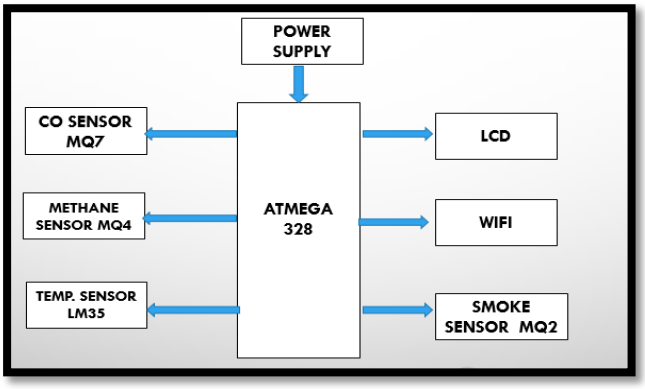

Figure 1. Block diagram.

IV. 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.

V. 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

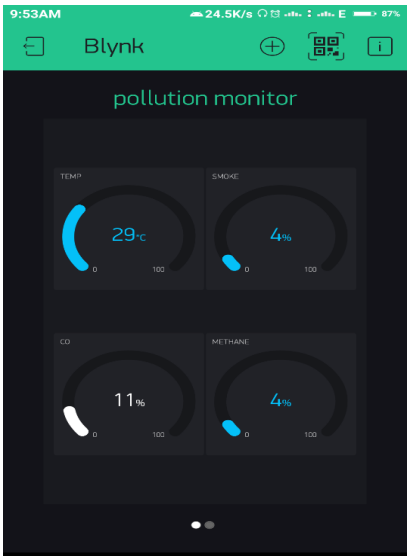

Figure 2. Parameter on blynk app

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

Figure 3. Parameter Display on LCD Screen

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

3. Air Pollution Monitoring System

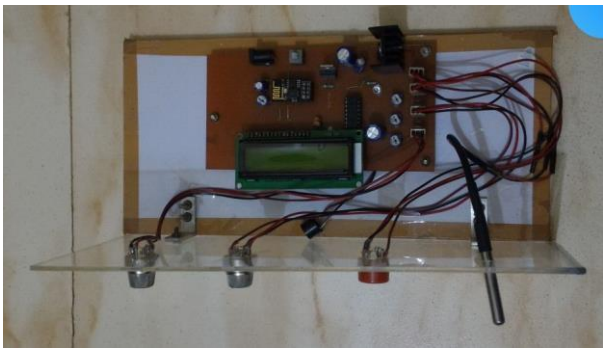

Figure 4. Design model of air pollution monitoring system

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

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 any where 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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