Juni Khyat ISSN: 2278-4632 (UGC Care Group I Listed Journal) Vol-13, Issue-05, No.03, May : 2023 FABRICATION OF SOLAR POWERED AIR QUALITY MONITORING SYSTEM

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Abstract

Air pollution is a phenomenon that combines and rapidly spreads solid particles and gases in the air, being one of the great problems that affects the environment and health of living beings worldwide. Polluted air contains hazardous gases like carbon dioxide (CO2), nitrogen dioxide (NO2), sulphur dioxide (SO2), CO, ozone (O3), and particulate matter (PM10, PM2.5). These pollution agents must be monitored and maintained within standards. One of the solutions currently implemented is the use of fixed monitoring stations that measure the concentration of pollutants. These stations normally operate using power from the electrical distribution network, which is not feasible when measurements are taken in remote locations. Another option is to use a battery bank to power the stations, which makes the system expensive, heavy, and dependent. Therefore, the main objective in this work is to propose an air pollution monitoring system that is powered by solar energy, which is an energy source abundant in nature in most countries.

The main objective of solar powered air quality monitoring system is to develop low cost and highly efficient. It consists of different types of sensors which are used for monitoring the different gases and temperature and humidity of the surrounding environment.

Keywords: Solar panel, Arduino board, MQ2, MQ135, MQ7 Gas sensors, wi-fi module, GPS module

.INTRODUCTION

Air pollution is one of the most important factors affecting the quality of life and the health of the increasingly urban population of industrial societies. In many cities, the air is polluted by emissions from sources such as cars and trucks, power plants, and manufacturing processes. When gases and particles from those activities accumulate in the air in high enough concentrations, they can be harmful for human health, an environment. Often, terrain and meteorological conditions complicate air quality issues in the area. Although the national trend is toward better outdoor air quality, there are some urban areas in which no improvement has taken place. Concentrations of outdoor air pollutants vary from day-to-day and even during a day. For health protection, the public needs timely information about air quality and other factors (e.g., weather conditions) that affect it. An access to air quality forecasts allows residents to reduce their exposure when the pollutant concentrations are high. This is important particularly to people who are sensitive to certain pollutants' harmful effects. For example, people with asthma may be sensitive to ground level ozone and sulphur dioxide. The major motivation behind our study and the development of the system is to help the government to devise an indexing system to categories air pollution in India. The project is to build an air pollution monitoring system, so a detection system for multiple information of environment is designed in this project. This project is built for low cost, quick response, low maintenance, ability to produce continuous measurements. The main goal of this project is to monitor the air pollution, hazardous gases and increase awareness about pollution by using air pollution monitoring system. Present state of the air quality control in almost all industrial centres in our country is based on taking samples one or few times a day, which means that there is no information about time distribution of polluted materials intensity during day.

Problem statement

At first there is air pollution everywhere by means of various factors and this problem is growing like peak every year. This kind of environmental problems causes major problems in the future. Because of this kind of environmental problems, we designed a system where it can detect the harmful gases in the air, and it will show the gas percentage in ppm.it will help to take the precautions.

Existing system

In the earlier year, the contamination levels because of various ventures and urbanization have been rising significantly, making it urgent to have a trusted and innovatively propelled method for estimating and observing probably the most vital air components, including co2and temperature to have the capacity to monitor how a portion of the present progress acts. In ZigBee based air pollution monitoring system, the proposed framework comprises of a unit of mobile-DAQ, the mobile -DAQ unit that will incorporate a solitary chip microcontroller. air pollution sensor exhibit, GPS device. There is a pollution server that is on top-of-the-line individual computer application server with internet network. The mobile-DAQ unit assembles air toxins levels (CO, NO2, SO2) and packs them in a casing with the GPS physic distribution, time, and date. Thus, this the reason to send the pollution server by means of ZigBee device.

Proposed system

In proposed system the sensors are controlled through Arduino uno which contains the microcontroller, and the driven data will be processed and analysed by microcontroller. and now the data will be updated live on internet by Wi-Fi module which sends the data to cloud through internet. User can monitor the data on their smart phone or laptop. When we start the device all the sensors will start interfacing with Arduino. Now we need to send AT command in the serial port. Then the esp8266 will respond. Using hotspot, user can access internet browser on their smart phones or laptops. Web browser needs specific IP address.by providing IP address on browser, web page is displayed, web page shows the monitoring results of the respected parameters.

The gas sensor made the analogue output voltage proportional to the concentration of polluting gases in parts per million(ppm)data will first be sent to the lcd display and after it will send to Wi-Fi module.

SYSTEM IMPLEMENTATION BLOCK DIAGRAM:







Fig 2: Solar powered air quality monitoring system

COMPONENTS REQUIRED:

In this project hardware and software components are used as follows

- 1. Hardware components:
 - 1) Arduino uno
 - 2) Rechargeable battery
 - 3) MQ2 Gas sensor
 - 4) MQ135 Gas sensor
 - 5) MQ7 Gas sensor
 - 6) Temperature and humidity sensor
 - 7) Wi-fi module(Node mcu)
 - 8) GPS module
- 2. Software requirement:
 - 1) Arduino IDE
 - 2) Adafruit io

Table No 1: sensors range and units

S.NO	Name of the sensor	Units	Detection ranges
1	MQ2(LPG)Gas sensor	Ppm	0-5000ppm
2	MQ7(CO)Gas sensor	Ppm	20ppm-2000ppm
3	MQ135(Air quality) Gas sensor	Ppm	0-500 ppm
4	DHT11(Temperature and humidity) sensor	°C and %	-20-60°C and 5-95%

WORKING PROCUDERE:

In this proposed system is powered by solar panel of 12v with battery backup by using the battery for store electrical energy which gets energy from solar panel in day light. With the goal that can likewise utilize this technique using battery around evening time.

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There are different types of sensors like MQ2, MQ135, MQ7 Gas sensors are used to detect the different gases. These gas sensors supply power of 5v through solar panel. the MQ series gas sensors are analogue sensors so they are implemented with any micro controller.MQ series sensors are electrochemical and change their resistance when exposed to specific gases, internally it has a heater responsible for increasing the internal temperature and with this the sensor can react with the gases pushing a change in the resistance value. Depending on the system heater may need a voltage between 5v and 2v, the sensor behaves like a resistor and needs a load resistor to close the circuit and within this make a voltage divider and be able to read it from a microcontroller. Arduino microcontroller is an open-source platform to work with the sensor we need to power the sensor first, for that we are using the 5v and ground pin of the Arduino uno board and we are connecting the output pin of the sensor to A0 pin of the Arduino, and ground pin is common in between the led and the sensor.

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MODELING AND ANALYSIS

The environmental parameters which are to be measured are introduced in layer 1. In layer 2 the Study of the featured sensor devices. Layer three includes decision making on measured sensor data with the timing and space. Layer 4 is collecting the data and the layer 5 is sensing surrounding data. Then the data will be uploaded to cloud via internet. The proposed model of the system is shown in the figure 3 at first the environmental parameters are measured and then studying characteristic features of sensor device, decision making on sensor device and threshold value, then data is collected in the server which is sent by Wi-Fi module which works at 3.3 volt. The data can be seen by user in the Smartphone or laptop (By entering IP address of the server in the browser or web address of the server) or in the lcd display.

Now the flow chart of the proposed system is shown in the figure 4. At first, we must load the libraries which are related to the sensor and defining the pins. In the next step collecting the data from sensor (MQ 135, MQ2, MQ7), processing the data and displaying data on LCD display. And now we must send the data to server through internet which is done by ESP 8266 chip. When we need to send the data to server, we need to know the entered network credential is are correct or not if they are correct then the data will be sent to server if not, we need to enter the correct values then the data will be sent to the server. In the last step the measured will be visualized online. And now the entire process repeats.



Fig 4: Flow chart of proposed system

Results and discussions:

This proposed system gives a smart air quality monitoring system that constantly keep track of air pollution in a surrounding area and displays the different types of gas sensors data on an LCD screen. The system helps to create awareness of the quality of air that one breathes daily.



Fig 5: Results for indoor air quality to represent a digital form







Fig5: Graphical representation of different sensors data





Applications of air quality monitoring system

- 1) Indoor and outdoor air quality monitoring system
- 2) Gas leakage detection system

CONCLUSION

This system is used to monitor the air of environment using Arduino microcontroller, IoT Technology is proposed to improve quality of air. With the use of IoT technology enhances the process of monitoring various aspects of environment such as air quality monitoring issue proposed in this paper. Here, using the MQ135, MQ2, MQ7 gives the sense of different type of dangerous gas and Arduino is the heart of this project. Which control the entire process, Arduino module connects the whole process to LCD and serial monitor is used for the visual Output.

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FUTURE SCOPE

This project can also be implemented using a Wi-Fi module that displays the AOI on a web server continuously. The server can be accessed by everyone, anytime and it can keep them informed about the air quality of a particular location. It can also connect multiple Arduino's and display the AQI of multiple areas and compare them to find which area is more polluted and which one is cleaner. It can also use the GSM module to send messages to users when the air quality goes above a particular limit i.e., the citizens can be alerted if the AQI goes above 300 and the air quality turns bad. This can keep them well prepared. Additional SD card is place to the Arduino board to store the monitoring values in time to time.

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