"IOT Based Air Pollution Monitoring System"
A
Mini Project Report submitted to Savitribai Phule Pune University, Pune

In partial Fulfillment for the awards of Degree of Engineering in
Computer Engineering

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Department of Computer Engineering

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Certificate

This is to certify that,

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have successfully completed the Mini project entitled**"IOT Based Air Pollution Monitoring System"**
under my guidance in partial fulfillment of the requirements for the Third Year of Engineering in
Computer Engineering under the Savitribai Phule Pune University during the academic year 2022-2023.

Date :

Place:Nashik

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Abstract

The level of pollution is increasing rapidly due to factors like industries, urbanization, increasing in population, vehicle use which can affect human health. IOT Based Air Pollution Monitoring System is used to monitor the Air Quality over a web server using Internet. It will trigger an alarm when the air quality goes down beyond a certain level, means when there are sufficient number of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3 and NOx. It will show the air quality in PPM on the LCD and as well as on webpage so that air pollution can be monitored very easily. The system uses MQ135 and MQ6 sensor for monitoring Air Quality as it detects most harmful gases and can measure their amount accurately.

Keywords: Air Pollution, Sensor, IOT, Arduino Uno

Introduction

Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma. According to a survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone. Whereas in EU number reaches to 300,000 and over 3,000,000 worldwide. IOT Based Air Pollution Monitoring System monitors the Air quality over a web server using Internet and will trigger an alarm when the air quality goes down beyond a certain threshold level, means when there are sufficient number of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, LPG and NOx. It will show the air quality in PPM on the LCD and as well as on webpage so that it can monitor it very easily. LPG sensor is added in this system which is used mostly in houses. The system will show temperature and humidity. The system can be installed anywhere but mostly in industries and houses where gases are mostly to be found and gives an alert message when the system crosses threshold limit

Literature Survey

The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities (e.g., Construction activities) and location-dependent (e.g., the traffic choke-points have much worse air quality than average). IOT Based Air Pollution Monitoring System monitors the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level, means when there are amount of harmful gases present in the air like CO_2, smoke, alcohol, benzene, NH3, NOx and LPG.The system will show the air quality in PPM on the LCD and as well as on webpage so that it can be monitored very easily. Temperature and Humidity is detected and monitored in the system. LPG gas is detected using MQ6 sensor and MQ135 sensor is used for monitoring Air Quality as it detects most harmful gases and can measure their amount accurately. In this IOT project, it can monitor the pollution level from anywhere using your computer or mobile. This system can be installed anywhere and can also trigger some device when pollution goes beyond some level, like we can send alert SMS to the user

Proposed System

The project aims at designing an air pollution monitoring system which can be installed in a specific locality and to enhance the system from the previously developed systems beating the earlier disadvantages by developing an android app available for the public. This system can be used by anyone to get in live updates about the pollution in their region. It uses Arduino integrated with individual gas sensors like carbon monoxide, ammonia along with particulate matter, humidity, and smoke which measures the concentration of each gas separately. The collected data is uploaded to the cloud using thing speak platform at regular time intervals. Ethernet shield is used for connecting Arduino and cloud. Pictorial or graphical representation of values can be shown in Thing speak the users can install an android application through which they get the recent updates and graphical content up to date. The average concentration of each gas is analyzed using MATLAB. Then certain time control is assigned based on the standard level of each gas measured and the result can be viewed in android application. The architecture of air pollution monitoring and awareness creation system. The concentration level of each gas can be viewed both as a graph and in numerical format. Based on these values the air quality index value is calculated and the nature of the air quality in that area is determined which is also displayed through the app. Along with this, the health effects for the corresponding air quality is displayed to create awareness among the public. Additionally, they could also get to know the temperature and weather in that region. The users will not get disturbed with irrelevant data as the values displayed are location specific and help them stay tuned to the current status of air pollution.

Block Diagram

Internet of Things (IoT) mainly deals with connecting smart devices to internet by joining the advantage of OSI layered Architecture. In the context of this work, we propose a cluster of Air Quality Monitoring Gas Sensor MQ135 motes, which are used to measure the concentration of Air pollutants in the air. The Gas Sensors MQ135 is interface with a tiny entrenched platform equipped with other. We have mainly used the Arduino UNO which is an open-source development boards with ESP8266-12E chips. MQ135 Gas Sensor is used to collect gas concentration measurements. This sensor data would be captured and sent to the Arduino UNO for IoT (Internet of Things) based data acquirement.
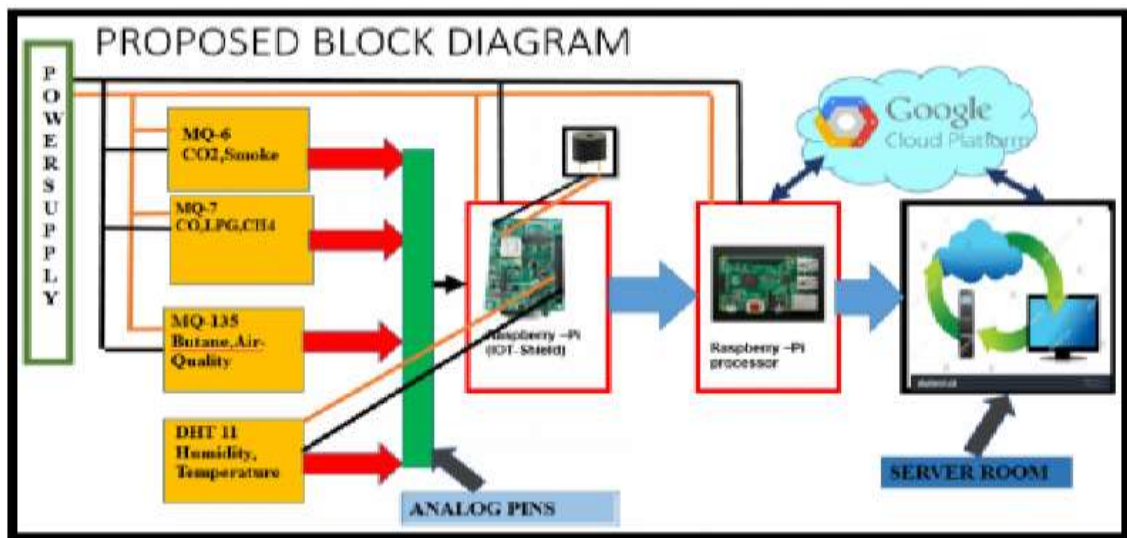
Fig1: Block Diagram

Circuit Diagram

I connect the ESP8266 with the Arduino. ESP8266 runs on 3.3V and connect the VCC and the CH_EN to the 3.3V pin of Arduino. The RX pin of ESP8266 works on 3.3V and it communicate with the Arduino when I connect it directly to the Arduino. So, I have to make a voltage divider for it which convert the 5V into 3.3V. This can be done by connecting three resistors in series like I did in the circuit. Connect the TX pin of the ESP8266 to the pin 8 of the Arduino and the RX pin of the esp8266 to the pin 9 of Arduino. ESP8266 Wi-Fi module gives my projects access to Wi-Fi or internet. Then I connect the MQ135 sensor with the Arduino. Connect the VCC and the ground pin of the sensor to the 5V and ground of the Arduino and the Analog pin of sensor to the A0 of the Arduino. Connect a buzzer to the pin 7 of the Arduino which start to beep when the condition becomes true. In last, I connect LCD with the Arduino [8]. The connections of the LCD are as follows Connect pin VCC to the 5V of the Arduino; Connect pin GND to the GND of the Arduino; Connect pin RS to the pin 12 of the Arduino; Connect pin RW & GND (Read/Write) to used Jumper pin; Connect pin E to the pin 11 of the Arduino; The following four pins are data pins which are used to communicate with the Arduino; Connect pin D4 to pin 5 of Arduino; Connect pin D5 to pin 4 of Arduino; Connect pin D6 to pin 3 of Arduino; Connect pin D7 to pin 2 of Arduino
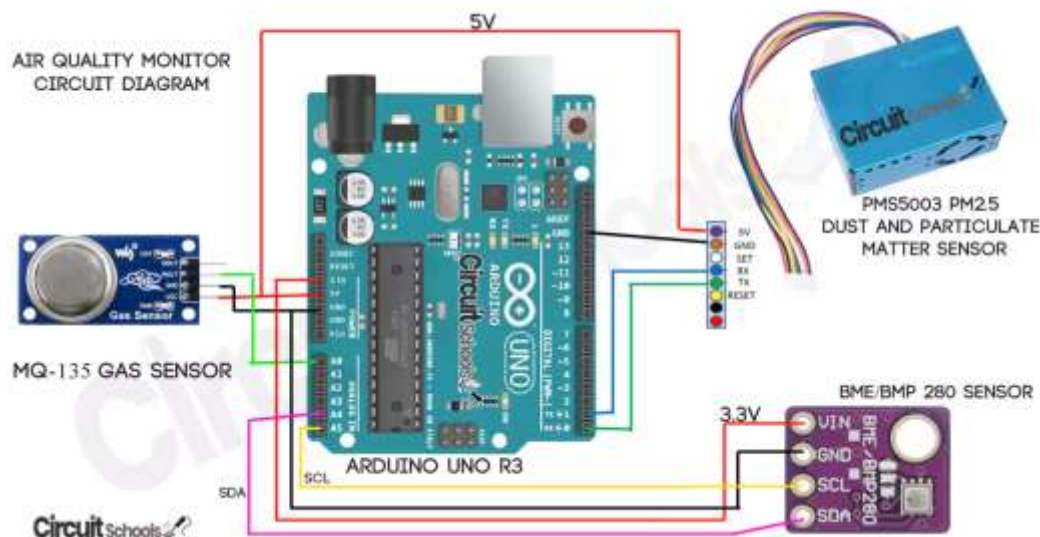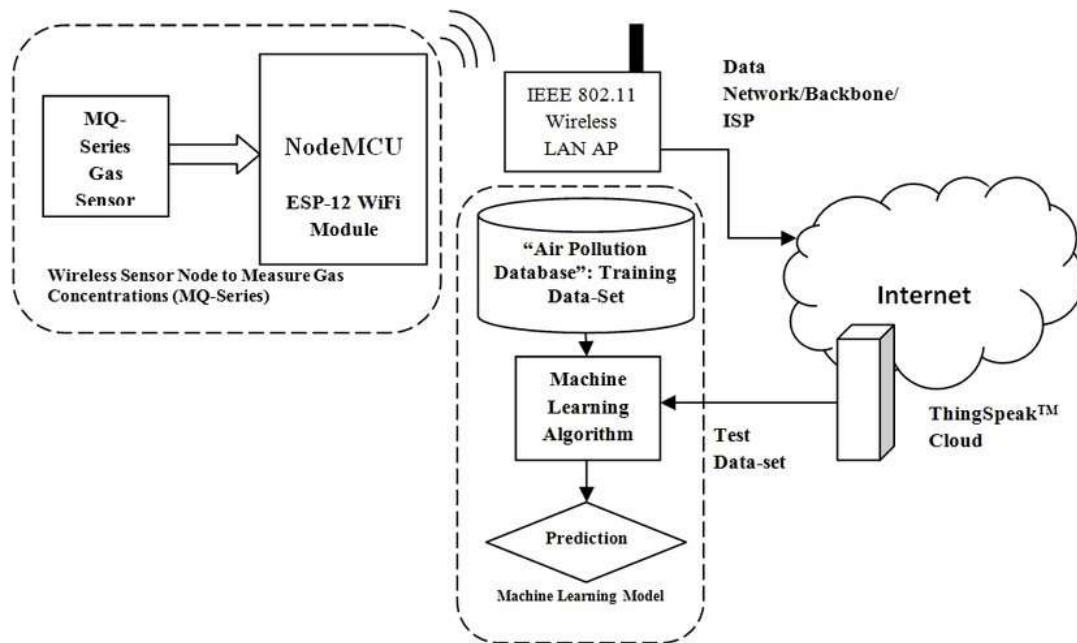

Fig 2:Circuit Diagram

Flowchart

Fig 3:Flowchart For Air Polution Monitoring System

Requirements

Hardware Requirement:

1) MQ135 Gas sensor

2) Arduino Uno

3) Wi-Fi module ESP8266

4) 16x2 LCD

5) Breadboard

6) 10K potentiometer

7) 1K ohm resistors

8) 220-ohm resistor

9) Buzzer

10) MQ 6 LPG gas sensor

11) Temperature sensor LM35

12) Humidity sensor SY-H5220

Software Requirement:

1) Arduino 1.6.13 Software

2) Embedded C Language

Applications:

1) Industrial perimeter monitoring

2) Indoor air quality monitoring

3) Site selection for reference monitoring stations

4) Making data available to users.

Advantages:

1) Easy to Install

2) Updates On mobile phone directly

3) Accurate Pollution monitoring

4) Remote location monitoring

5) High Collection Efficiency

Disadvantages:

1) High initial cost

2) Require high voltage

3) Collection efficiency reduce with time

4) Space requirement is more

5) Possible of explosion during collection of combustible gases or particulates

RESULT
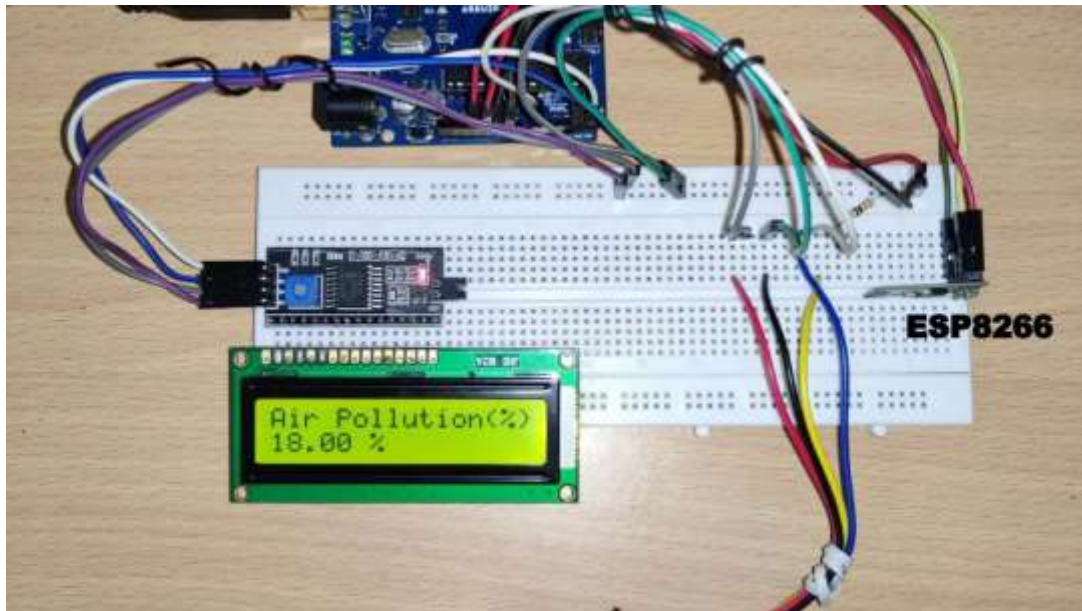
Fig 4: Implementation of Project

The MQ135 sensor can sense CO2 and some other gases, so it is perfect gas sensor for my Air Quality Monitoring Detection System Project. When I connect it to Arduino then it senses the gases, and I get the Pollution level in PPM (parts per million). MQ135 gas sensor gives the output in form of voltage levels and I need to convert it into PPM. So, for converting the output in PPM. Sensor is giving me value of 0.1 when there was no gas near it and the safe level of air quality is 0.5 PPM and it is not exceeding 0.5 PPM. When it exceeds the limit of 0.5 PPM, then it starts cause Headaches, sleepiness and stagnant, stale, stuffy air and if exceeds beyond PPM then it can cause increased heart rate and many other diseases. When the value less than 0.5 PPM, then the LCD and webpage will display "Fresh Air". Whenever the value increase 0.5 PPM, then the LCD and webpage will display "Poor Air, Open Windows". If it increases 1 PPM, then the buzzer keeps beeping and the LCD and webpage will display "Danger! Move to fresh Air".

Conclusion

The system 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 and MQ6 gas sensor gives the sense of different type of dangerous gas and Arduino is the heart of this project. Which control the entire process. Wi-Fi module connects the whole process to internet and LCD is used for the visual Output.

Future Scope

The future scope is that device which we are having can be done in a compact way by reducing the size of the device for further implementation or the modifications which can be is that detecting the vehicles amount of pollution which can be determined. In future the range can be made increased according to the bandwidth for the high range frequencies. Further research can be made by making the people in the right direction for their welfare. Therefore, there is another beneficiary by using this device in an app so the all can be used in an GSM mobile phones for their daily updates by increasing their range

References

1. https://securedstatic.greenpeace.org/india/Global/i ndia/Airpoclypse--Not-just-Delhi--Air-in-mostIndian-cities-hazardous--Greenpeace-report.pdf

2. content/uploads/2008/04/5v-regulator-using7805.JPG

3.]https://store.arduino.cc/arduino-uno-rev3

4. https://www.arduino.cc/

5. https://www.aliexpress.com/item/1PCS-LOTSolution-PH-valuo-Temperature detector-sensormodule-for-arduino Freeshipping/32620995019.html?spm=2114.4001

6. Ch.V.Saikumar, M.Reji, P.C.Kishoreraja, "IOT Based Air Quality Monitoring System", International Journal on Information Theory (IJIT), Vol-117, No.-9, 2017;

7. Riteeka Nayak, Malaya Ranjan Panigrahy , Vivek Kumar Rai and T Appa Rao "IOT based air pollution monitoring system", International Journal on Information Theory (IJIT) Vol-3, Issue-4, 2017;

8. Poonam Pal, Ritik Gupta, Sanjana Tiwari, Ashutosh Sharma, "Air Pollution System Using Arduino", International Journal on Information Theory (IJIT), Vol-04, Issue-10, 2017;

9. D.Arunkumar, K.Ajaykanth, M.Ajithkannan, M.Sivasubramanian, "Smart Air Pollution Detection And Monitoring Using IoT", International Journal on Information Theory (IJIT) Vol-119, No.-15, 2018;

10. Shanzhi Chen, Hui Xu, Dake Liu, Bo Hu, and Hucheng Wang, "A Vision of IoT: Applications, Challenges, and Opportunities with China Perspective", IEEE INTERNET OF THINGS JOURNAL, VOL.-1, NO.-4, August 2014;

11. S. Chen, H. Xu, D. Liu, B. Hu and H. Wang, "A Vision of IoT: Applications, Challenges, and Opportunities with China Perspective," in IEEE Internet of Things Journal, Vol-1, No.-4, 2014;