Mathematical Statistician and Engineering Applications
ISSN: 2094-0343
2326-9865

Air Quality Monitoring System using IoT

[1]J. SriramPavan, [2]Dr. CH. Himabindu, [3]Dr.K.C.K.Naik, [4]K.G.S.Venkatesan

[1,2,3]Department of ECE, [4]Department of IT
[1,2,3,4]QIS COLLEGE OF ENGINEERING AND TECHNOLOGY

Article Info
Page Number: 108 - 116
Publication Issue:
Vol 68 No. 1 (2019)

Article History
Article Received:
09 September 2019
Revised: 16 October 2019
Accepted: 21 November 2019
Publication: 28 December 2019

Abstract
The main agenda of our project Air Quality Monitoring System, is to measure the quality of air using MQ135, MQ2 and MQ7 sensors. By monitoring air quality, the general population becomes more conscious of the value of leading healthier lives for future generations. The Indian government has previously taken steps to outlaw the use of motorbikes with single and two-stroke engines since they contribute significantly to air pollution. We are working to design a plan for putting the air quality monitoring system in place. Due to the increase of automobiles on the road today, as well as the effects of industry and urbanization, air pollution has become one of the major problems. There are negative effects on prosperity from this rise in pollution levels. This project illustrates how an Air Quality Monitoring system is represented and carried out. The innovation understood here is a practical application of the Internet of Things concept. The job is completed using an Arduino microcontroller board. In this project, we're going to build an IOT-based air quality monitoring system. To do this, we'll use an ESP8266 Wi-Fi device to monitor the air quality over a web server, and we'll show the Amount of dangerous gases like CO2, CO, and ammonia in PPM (Parts Per Million)

Keywords: ESP8266 WFI Module, Arduino UNO, MQ2 Sensor, MQ7 Sensor, MQ135 Sensor, DHT11 Sensor

1.INTRODUCTION

As the name suggests, embedded describes something that is connected to another item. An embedded system is a piece of computer hardware that also contains software. A stand-alone unit or a component of a bigger system can both be an embedded system. An embedded system with a microcontroller or microprocessor is designed to carry out a certain purpose. For instance, a fire alarm is an integrated device that only detects smoke. An embedded system is similar to a computer system in that it is primarily designed to accomplish specific functions such as controlling data in various electronics-based systems, accessing data, processing, and storing data. Embedded systems are hardware and software combinations that are designed to perform a certain set of functions. The embedded system's most essential feature is that it regenerates the output in a very short amount of time. Many embedded systems will be encountered in our daily lives.

2.LITERATURE REVIEW

By introducing a new dimension of "Things" for communication and integration, the Internet of Things (IoT) is defined as an expansion of current interactions between people and applications. The Internet of Things (IoT) was developed through a significant and complex process of technological innovation. The Internet of Things' applications are moving away

from being vertical and toward being polymeric. Driving domain-specific requests is the core development strategy in the early phases of IoT deployment. An industrial control system with special characteristics for the industry is an example of a domain-specific application. When used in conjunction with commercial and industrial manufacturing processes, the programme can provide a variety of enterprise management services. Polymeric applications are those that span industries and are based on stages of public information services.

3.EXISTING METHOD

The Internet of Things (IoT) connects intelligent objects to the internet via the OSI layered architecture. For this inquiry, we recommend using a cluster of Air Quality Monitoring Gas Sensors motes to measure the concentration of air contaminants. The concentrations of the gases are measured via sensors. The data from the sensors would be acquired and delivered to the Arduino UNO in order to collect IoT (Internet of Things) data[5].

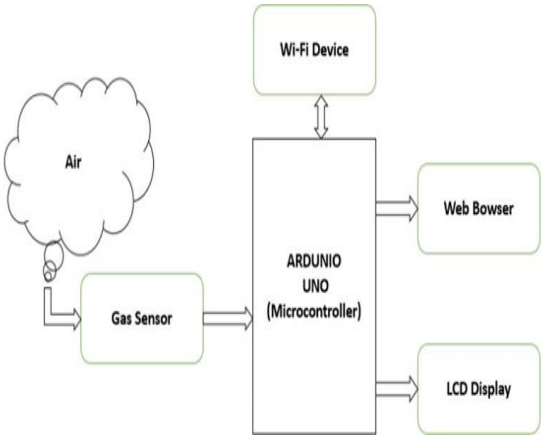


Figure: Existing method

IOT USED:

ZigBee is a wireless technology standard for controlling and locating networks. To assess the concentration of air pollutants in the air, we propose a cluster of Air Quality Monitoring Gas Sensor MQ135 motes in the context of this work[6]. The Gas Sensors MQ135 is attached to a small, well-known platform together with other components. Using the MQ135 Gas Sensor, gas concentrations are.

DISADVANTAGES OF EXISTING SYSTEM

- Zigbee uses low-bit-rate technology since it is intended for transmissions of small amounts of data.
- Depending on the network's size and range, Zigbee technology can be expensive to use.
- If a Zigbee-compliant appliance develops a flaw, the cost of appliance replacement will be high.

4. PROPOSED METHOD

4.1COMPONENTS

1.Arduino uno:

The Arduino Uno microcontroller board is built around the ATmega328P, an 8-bit microprocessor with 32KB of Flash memory and 2KB of RAM. The microcontroller comes with everything you need to get started; all you need to do is power it by connecting it to a computer via a USB cable, a battery, or an AC-to-DC adapter. The Arduino stage is oriented around the Uno panel, the first in a series of USB boards. After forking the project, they gave it a new name. Arduino will continue to work

Fig: Arduino UNO

2.MQ2 Sensor:

Gases including LPG, alcohol, propane, hydrogen, carbon monoxide, and even methane can be detected or measured using the MQ-2 Gas Sensor. The Digital Pin of this sensor's module version makes it possible for it to operate without a microcontroller when you only need to detect one gas. Gas measurements in ppm must be taken using the analogue pin.

Fig- Mq2 sensor

3.MQ7 Sensor:

The MQ7 is a sensor that measures carbon monoxide (CO) concentrations in the air (PPM). With the MQ7 Gas sensor, CO concentrations between 20 and 2000 ppm may be monitored. This sensor has good sensitivity and a short reaction time.

Fig- Mq7 sensor

4.MQ135 Sensor:

The MQ-135 Gas Sensors are used in air quality management systems and are good for detecting or measuring NH3, NOx, Alcohol, Benzene, Smoke, and CO2. When all you need to do is detect gas, the MQ-135 sensor module's digital pin makes it possible for it to function without a microcontroller. Use the analogue pin if you need to monitor events in PPM.

Fig- Mq135 sensor

5.DHT11 Sensor:

A cheap digital temperature and humidity sensor is the DHT11. To measure humidity and temperature in real time, this sensor may easily be linked to any microcontroller (such as an Arduino, Raspberry Pi, etc.). There are two variations of the DHT11 humidity and temperature

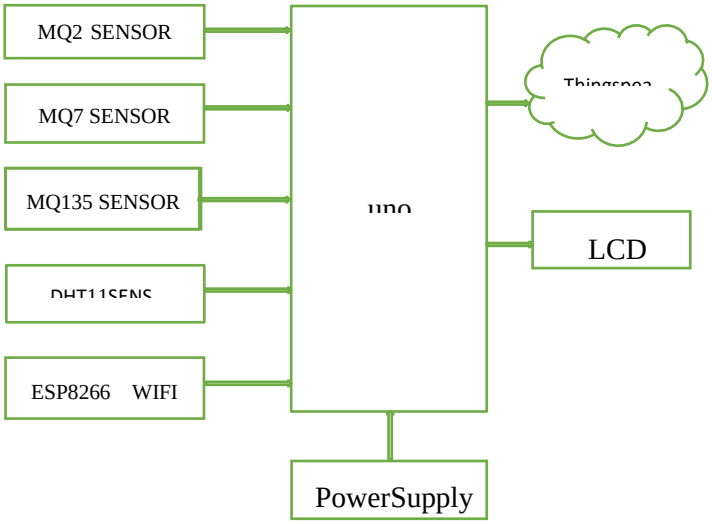
Fig-Dht11 sensor

6.ESP8266 WIFI Module:

The ESP8266 is a low-cost Wi-Fi microchip that has a microprocessor and a complete TCP/IP stack. In August 2014, the ESP-01 module, developed by a third-party manufacturer named Ai-Thinker, introduced the chip to Western manufacturers for the first time. This tiny module enables microcontrollers to connect to a WiFi network and create basic TCP/IP conversations

Fig-Esp8266 wifi module

4.2 BLOCK DIAGRAM



.Fig: Block diagram of proposed system

In addition to a gas sensor, the Arduino board is connected to a Wi-Fi device. For information display, an LCD is also linked to the Arduino board. We monitor the air quality using a serial monitor and LCD, which show the quantity of dangerous airborne gases such CO2, CO, and NH3. The air quality is displayed in PPM on the LCD and serial monitor so that we can easily keep an eye on it. Because they can recognise the majority of harmful gases, MQ135, MQ2, and MQ7 sensors are the best option for air quality monitoring [9].

4.3 CIRCUIT DIAGRAM

Connect the RX and TX pins of the ESP8266 to pins 9 and 8 of the Arduino, respectively. With the help of an ESP8266 Wi-Fi module, my creations may connect to Wi-Fi or the internet. Next, we connect the MQ135, MQ2, MQ7, and DHT11 sensors to the Arduino. The A0, A1, A2, and A4 pins of the Arduino should be connected to the sensor's analogue inputs, together with the 5V and ground pins of the Arduino. Finally, we connect the Arduino and LCD. The connectors for the LCD are as follows. Connect the Arduino's VCC pin to the 5V power source.

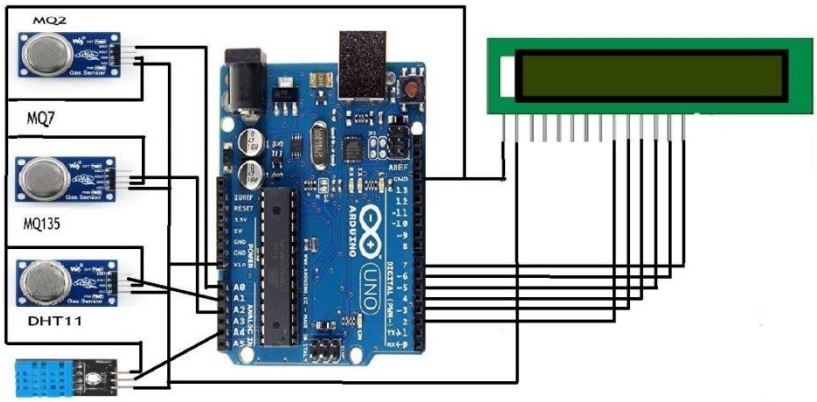


Fig- Circuit Diagram

4.4 ALGORITHM

STEP1: Collect all the components as per requirements.

STEP2: Arrange and connect all the components as per block diagram.

STEP3:The following connections should be made: Connect pin E to pin 11, Connect pins 2 and 3 to pins D2 and D3 of the Arduino, pins 4 and 5 to pins D5 and D6 of the Arduino, and pins 7 and D7 of the Arduino.

STEP4: Initialize the power supply.

STEP5: Gas Sensors start sensing the concentrations.

STEP6: Arduino starts simulates by the drawn output.

STEP7: LCD Shows the visualisation of gasesConcentration.

STEP8:Arduino gives the information to the cloud.

STEP9: IOT stores and gives the graphical representation.

4.5 METHODOLOGY

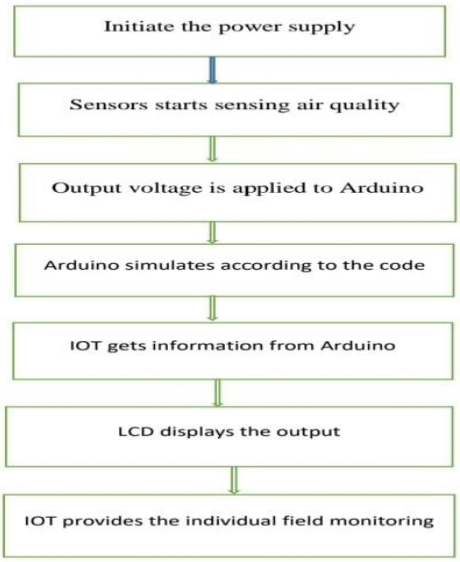


Fig- flow chart

4.6 THINGSPEAK

You may collect, visualise, and analyse real-time data streams with the cloud-based IoT analytics platform ThingSpeak[10]. Data transmitted to ThingSpeak by your devices is visualised in real time by ThingSpeak. You have the option to run MATLAB® code in ThingSpeak to perform online analysis and analyse data as it is received. For the creation of IoT systems and proof-of-concept analytics, ThingSpeak is commonly utilised. You can send data straight to ThingSpeak from any internet-connected devicevia a Rest API or MQTT. The Things Network, Senet, the LibeliumMeshlium gateway, and Particle.io cloud-to-cloud integrations allow for the transmission of sensor data to ThingSpeak through LORAWAN and 4G/3G cellular networks as well[11].

5.RESULT

Step1: Connecttheall sensors totheArduino.

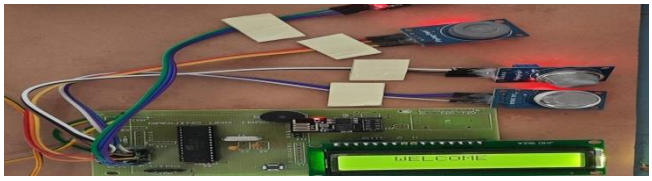


Fig-circuit

Casei- Concentrationofgasesat room temperature.

Case ii- Concentrationofgasesare at heavy Traffic.

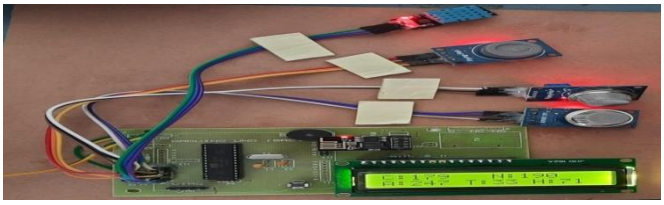


Fig-visual concentration

Step2: GraphicalVisualizationofindividualfields

Case i- GraphicalVisualizationofgasesat Room Temperature.

Case ii- Graphical Representation of gases at Heavy Traffic.

Fig- Graphical representation

6.CONCLUSION

The heart of this project, Arduino, uses the MQ2, MQ135, MQ7, and DHT11 to detect several types of harmful gas. Arduino module controls the entire process, and it is connected

to an LCD and a serial monitor for visual output. If the circuit get connected to the Arduino in different places like at Room Temperature, Less Traffic, Heavy Traffic the concentration of gases will be different according to the location and it will be stored in the cloud through IOT.At Room Temperature, the concentration of gases is very low,At Low Traffic, the concentration of gases is high, At Heavy Traffic, the concentration of gases is very high which is harm to breath and graphical Representation shows according to the concentration. At this places people should aware of taking maximum precautions like wearing masks.

7 .REFERENCE

[1] 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;

[2] 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;

[3] Poonam Pal, Ritik Gupta, Sanjana Tiwari, Ashutosh Sharma, “Air Pollution System Using Arduino”, International Journal on Information Theory (IJIT), Vol-04, Issue-10, 2017;

[4] D.Arunkumar, K.Ajaykanth, M.Ajithkannan, M.Sivasubramanian, “Smart Air Pollution Detection And Monitoring Using IoT”, International Journal onInformation Theory (IJIT) Vol-119, No.-15, 2018;

[5] Shanzhi Chen, Hui Xu, Dake Liu, Bo Hu, andHucheng Wang, “AVision of IoT: Applications, Challenges, andOpportunities with China Perspective”, IEEE INTERNET OF THINGS JOURNAL, VOL.-1, NO.-4, August 2014

[6] 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;

[7] Ms. Sarika Deshmukh, Mr.Saurabh surendran and Prof.M.P. Sardey, “Air and Sound Pollution Monitoring System using IoT” International Journal on Information Theory (IJIT), Vol-5, Issue-6, 2017;

[8] Navreetinder Kaur,Rita Mahajan and Deepak Bagai, “Air Quality Monitoring System based on Arduino Microcontroller”, International Journal on Information Theory (IJIT), Vol.-5, Issue-6, June 2016;

[9].Palaghat Yaswanth Sai, “An IoT Based Automated Noise and Air Pollution Monitoring System”, International Journal on Information Theory (IJIT), Vol.-6, Issue-3, March 2017;

[10] L.Ezhilarasi, 2 K.Sripriya, 3 A .Suganya , 4 K.Vinodhini, “A System for Monitoring Air and Sound Pollution using Arduino Controller with IOT Technology”, International Journal on Information Theory (IJIT), Vol.-3 Issue-2, 2017;

[11] Devahema, P.V. Sai Surya Vamsi, Archit Garg, Abhinav Anand, Desu Rajasekhar Gupta, “IOT based Air Pollution Monitoring System”, Journal of Network Communications and Emerging Technologies (JNCET), Vol-8, Issue-4, 2018;

[12] P Ramprakash, M Sakthivadivel, N Krishnaraj, J Ramprasath. ”Host-based Intrusion Detection System using Sequence of System Calls” International Journal of Engineering and Management Research, Vandana Publications, Volume 4, Issue 2, 241-247, 2014

[13] N Krishnaraj, S Smys.”A multihoming ACO-MDV routing for maximum power efficiency in an IoT environment” Wireless Personal Communications 109 (1), 243-256, 2019.

[14] N Krishnaraj, R Bhuvanesh Kumar, D Rajeshwar, T Sanjay Kumar, Implementation of energy aware modified distance vector routing protocol for energy efficiency in wireless sensor networks, 2020 International Conference on Inventive Computation Technologies (ICICT),201-204

[15] Ibrahim, S. Jafar Ali, and M. Thangamani. "Enhanced singular value decomposition for prediction of drugs and diseases with hepatocellular carcinoma based on multi-source bat algorithm based random walk." Measurement 141 (2019): 176-183. https://doi.org/10.1016/j.measurement.2019.02.056

[16] Ibrahim, Jafar Ali S., S. Rajasekar, Varsha, M. Karunakaran, K. Kasirajan, Kalyan NS Chakravarthy, V. Kumar, and K. J. Kaur. "Recent advances in performance and effect of Zr doping with ZnO thin film sensor in ammonia vapour sensing." GLOBAL NEST JOURNAL 23, no. 4 (2021): 526-531. https://doi.org/10.30955/gnj.004020 , https://journal.gnest.org/publication/gnest_04020

[17] N.S. Kalyan Chakravarthy, B. Karthikeyan, K. Alhaf Malik, D.Bujji Babbu,. K. Nithya S.Jafar Ali Ibrahim , Survey of Cooperative Routing Algorithms in Wireless Sensor Networks, Journal of Annals of the Romanian Society for Cell Biology ,5316-5320, 2021

[18] Rajmohan, G, Chinnappan, CV, John William, AD, Chandrakrishan Balakrishnan, S, Anand Muthu, B, Manogaran, G. Revamping land coverage analysis using aerial satellite image mapping. Trans Emerging Tel Tech. 2021; 32:e3927. https://doi.org/10.1002/ett.3927

[19] Vignesh, C.C., Sivaparthipan, C.B., Daniel, J.A. et al. Adjacent Node based Energetic Association Factor Routing Protocol in Wireless Sensor Networks. Wireless Pers Commun 119, 3255–3270 (2021). https://doi.org/10.1007/s11277-021-08397-0.

[19] C Chandru Vignesh, S Karthik, Predicting the position of adjacent nodes with QoS in mobile ad hoc networks, Journal of Multimedia Tools and Applications, Springer US,Vol 79, 8445-8457,2020