IOT based Air Pollution Monitoring System

Devahema [1], P.V. Sai Surya Vamsi [2], Archit Garg [3], Abhinav Anand [4], Desu Rajasekhar Gupta [5]
[1] Assistant Professor, SRM Institute of Science & Technology, Chennai, Tamil Nadu, India.
[2, 3, 4, 5] Student, SRM Institute of Science & Technology, Chennai, Tamil Nadu, India.

Abstract –The level of pollution has increased with times by lot of factors like the increase in population, increased vehicle use, industrialization and urbanization which results in harmful effects on human wellbeing by directly affecting health of population exposed to it. In IOT Based Air Pollution Monitoring System the Air Quality is measured over a web server using internet and will trigger a alarm when the air quality goes down beyond a certain level, means when there are sufficient amount of harmful gases are present in the air like CO2, smoke ,alcohol, benzene and NH3.It will show the air quality in PPM on the LCD and as well as on webpage so that we can monitor it very easily.MQ135 sensor which is the best choice for monitoring Air Quality as it can detects most harmful gases and can measure their amount accurately .The pollution level can be monitored anywhere using computer or mobile. Install this system anywhere and can also trigger some device when pollution goes beyond some level, like it can switch on the Exhaust fan or can send alert.

Index Terms – Air Pollution,MQ135 Sensor,IOT,PPT

1. INTRODUCTION

Air pollution is the biggest problem of every nation,whether it is developed or developing. Health problems are 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.Various kinds of anthropogenic emissions named as primary pollutants are pumped into the atmosphere that undergoes chemical reaction and further leads to the formation of new pollutants normally called as secondary pollutants.For instance according to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change(IPCC),nearly all climate-altering pollutants either directly or indirectly(by contributing to secondary pollutants in the atmosphere) are responsible for health problems.Almost every citizen spends 90% of their time in indoor air. Outdoor air quality of the cities of developed countries improved considerably in recent decades. In contrast to this, indoor air quality degraded during this same period because of many factors like reduced ventilation, energy conservation and the introduction to new sources and new materials that cause indoor pollution.The design of buildings for lower power consumption resulted in decrease of ventilation which further decreases the quality of air inside the building. This increases the need for indoor air quality (IAQ) monitoring Due to this fact and use of new building materials, IAQ often reaches to unacceptable levels.

2. BLOCK DIAGRAM AND WORKING

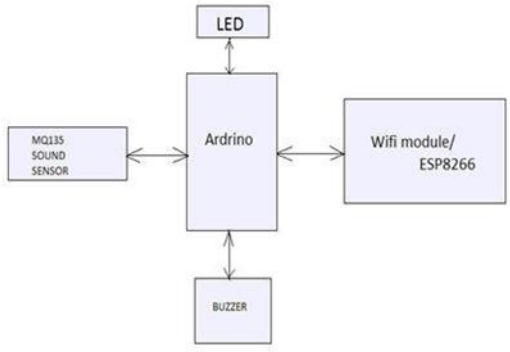

Fig:1 Block Diagram of the system

The proposed air pollution monitoring is based on the block diagram as shown in Fig.1 the data of air is recognised by MQ135 gas sensor. The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO2. So it is dynamic gas sensor for our Air pollution Monitoring system. When we will connect it to Arduino then it will sense all gases, and it will give the Pollution level in PPM (parts per million). MQ135 gas sensor will give the output in form of voltage levels and we have to convert it into PPM. So for converting the output in PPM, we have used a library for MQ135 gas sensor.Sensor was giving us value of 90 when there was no gas near it and the air quality safe level is 350 PPM and it should not exceed 1000 PPM. When it will exceeds the limit of 1000 PPM, then it will cause Headaches, sleepiness and stagnant, stuffy air and if it will exceeds beyond 2000 PPM then it will cause increased heart rate and many different diseases. When the value will be less than 1000 PPM, then the LCD and webpage will display “Fresh Air”. When the value will increase from 1000 PPM, then the buzzer will start beeping and the LCD and webpage will display “Poor Air, Open Windows”. And when it will increase 2000,the buzzer will keep beeping and the LCD and webpage will display “Danger! Move to fresh Air”.

3. PROPOSED AIR POLLUTION MONITORING SYSTEM DESIGN

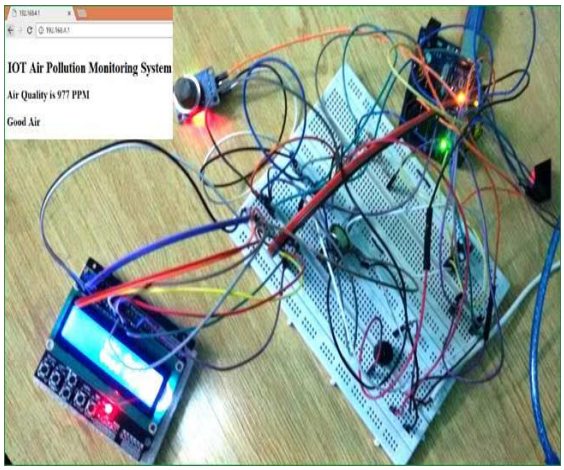

Fig 2:Proposed Air Quality Monitoring System

3.1. Air Pollution Monitoring Equipment

The different components of the equipment along with their intended purpose are discussed below.

3.2. Arduino Uno R3 microcontroller

It is the most flexible hardware platform used based on ATmega328P which can be programmed according to the function where it is to be used. It has 6 analog inputs, 14 digital input/output pins(6 pins of these can be used as PWM outputs) , a USB connection, a 16 MHz quartz crystal, SPI, serial interface, a reset button, a power jack and an ICSP header as shown in Fig.3.The Arduino microcontroller is not only for technical audience but is intended for designers and artists as well because of its focus to usability based on its design which helps to achieve the intended goal [6].It is the primary component of the framework. In addition, it is an open source microcontroller device with easily accessible software/hardware platform and is compatible with many sensors available. Everything needed for its working is present on the board; we only require a USB cable to directly connect it to the computer or give power using battery source or AC to DC adapter to get started. Also, it is not expensive and can be assessed with free authoringsoftware i.e. IDE (integrated development environment). With the availability of a large no. of source codes over the internet, the programming of Arduino becomes easy. The online growing community backing Arduino consists of programmers like us that share their examples for others to make it a more reliable platform. It is mainly used in RF and IR circuits. These decoders are mainly used for remote control applications like burglar alarm, car door alarm, security system etc. The chosen pair of encoder and decoder for communication should have same number of address and data bits.

3.3. MQ135 Gas Sensor

The Sensitive material used in MQ135 gas sensor is SnO2. The conductivity of this material is lower in clean air. The sensor conductivity increases with the increasing concentration of target pollution gas. MQ135 can monitor different kinds of toxic gases such as sulphide, ammonia gas, benzene series steam and CO2. The detection range is 10-10,000 ppm with the voltage rate of about 5.0V±0.1V AC or DC The important features are long life span, low cost, simple driver circuit and good sensitivity to toxic gases. MQ 135 gas sensor is widely used in industrial gas alarm, portable gas detector and domestic gas alarm as shown in Fig.6. MQ-135 is used in this framework for monitoring CO2 in air. The amount of CO2 present in the atmosphere is 400.7 ppm according to which the sensor is calibrated.

3.4. ESP8266 Wifi Module

The ESP8266 WiFi Module is a self contained SOC with integrated IP protocol stack that can give any microcontroller access to your WiFi network.Wifi module is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Every ESP8266 module comes pre-programmed with an AT command set firmware, meaning, we can simply connect to the Arduino device.The ESP8266 module is an extremely cost effective board.

Fig 4:ESP8266 Wifi Module

3.5. LCD

LCD (Liquid Crystal Display) Shown in fig. is an electronic display module. A 16x2 LCD display is very basic module and is very commonly used in different types of devices and circuits.These modules are preferred over seven segment and other multi segment LEDs.

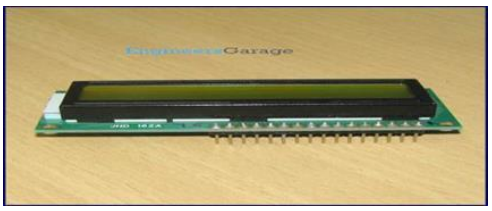

Fig 5: Liquid Crystal Display

A 16x2 LCD means it display 16 characters per line and there are 2 lines. By this LCD each character is displayed in 5x7 pixel matrix. This LCD contain two registers, thats are Command and Data. The command register stores the command instructions which is given to the LCD. A command is an instruction which is given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is in the form of ASCII value of the character to be displayed on the LCD. Pin diagram of LCD shown in fig.

4. CIRCUIT DIAGRAM AND EXPLANATION

At First we will connect the wifi module with the Arduino. ESP8266 runs on 3.3V and if we will supply 5V from the Arduino then it wo**n't work** properly and it will damage. Then we will Connect the VCC and the CH_PD to the 3.3V pin of Arduino. The RX pin of ESP8266 works on 3.3V and it will not communicate with the Arduino when we will connect it directly to the Arduino. So, we have to make a voltage divider for it which convert the 5V into 3.3V. This will happen when we connect three resistors in series like we did in the circuit. then we will Connect the TX pin of the ESP8266 to the pin 10 of the Arduino and the RX pin of the esp8266 to the pin 9 of Arduino through the resistors.

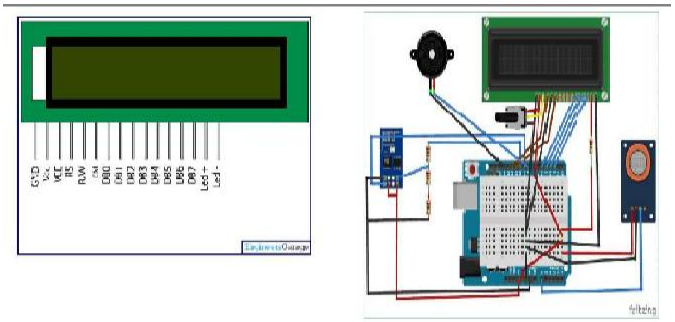

Fig 6: CIRCUIT DIAGRAM AND EXPLANATION

ESP8266 Wi-Fi module will give our projects access to Wi-Fi or internet. It is a very cost effective device and it will make your system very powerful. It can communicate with any microcontroller and it is the most leading devices in the IOT platform. Then we will connect the MQ135 sensor with the Arduino. After that we will 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. then Connect a buzzer to the pin 8 of the Arduino which will start to beep when the condition becomes true. In last, we will connect LCD with the Arduino.

5. RESULTS AND DISCUSSONS

We have to connect the Wi-Fi of your ESP8266 device first Before uploading the code. After uploading, we will open the serial monitor and it will dispilay the IP address which is shown.

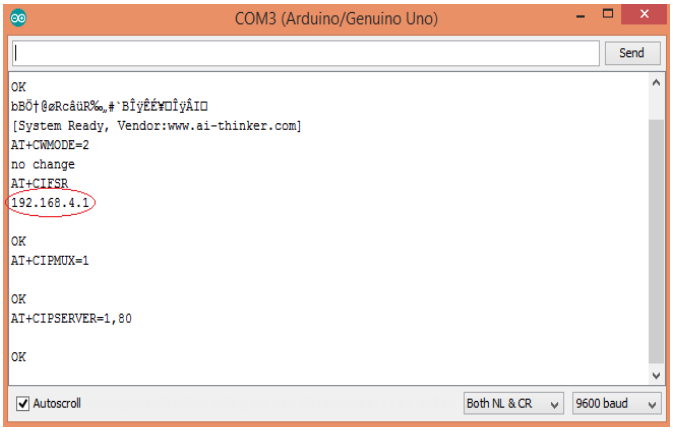

Fig 7:IP ADDRESS

Type this IP address in your browser, it will show you the output as shown below. You will have to refresh the page again if you want to see the current Air Quality Value in PPM

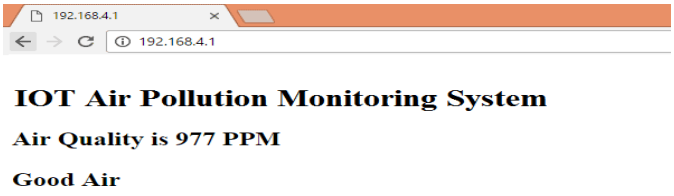

Fig 8:AIR QUALITY STATUS

We have setup a local server to demonstrate its working, But to monitor the air quality from anywhere in the world, we need to forward the port 80 (used for HTTP or internet) to our local or private IP address (192.168*) of our device. After port forwarding all the incoming connections will be forwarded to this local address and you can open above shown webpage by just entering the public IP address of your internet from anywhere. We can forward the port by logging into your router (192.168.1.1) and we can find the option to setup the port forwarding

6. 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.MQ135 gas sensor gives the sense of different type of dangerous gas and arduino is the heart of this project.Which control the entire process. wifi module connects the whole process to internet and LCD is used for the visual Output.

REFERENCES

[1] Riteeka Nayak, Malaya Ranjan Panigrahy,Vivek Kumar Rai and T Appa Rao:IOT based air pollution monitoring system Vol-3, Issue-4, 2017
[2] Navreetinder Kaur,Rita Mahajan and Deepak Bagai: Air Quality Monitoring System based on Arduino Microcontroller Vol. 5, Issue 6, June 2016
[3] Palaghat Yaswanth Sai: An IoT Based Automated Noise and Air Pollution Monitoring System Vol. 6, Issue 3, March 2017
[4] 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 Vol. 3 Issue 2 (2017) Pages 1781 – 1785
[5] Exploring Arduino:Tools and Techniques for Engineering Wizardry by Jeremy Blum 1st edition
[6] Ms. Sarika Deshmukh, Mr.Saurabh surendran and Prof.M.P. Sardey:Air and Sound Pollution Monitoring System using IoT Volume: 5 Issue: 6