International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 9 Sep. 2022, pp: 475-479 www.ijaem.net ISSN: 2395-5252

IOT Based Enhanced Air Quality Monitoring System Using MQ135 and ESP8266-12 with ThingSpeak Cloud Server

Er. NavjotKaur, Prof.(Dr.) Gurpreet Singh, Er. Kajal,
M.Tech CSE, St. Soldier Institute of Engg. & Technology, Near NIT, Jalandhar
Professor, Department of CSE, St. Soldier Institute of Engg. & Technology, Near NIT, Jalandhar
Assistant Professor, Department of Computer Sc. &Engg. St. Soldier Institute of Engg. & Technology, Near NIT, Jalandhar

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Date of Submission: 05-09-2022 Date of Acceptance: 13-09-2022

ABSTRACT: Air pollution is a critical issue faced by various countries. Health problems have been growing at drastic rate especially in urban areas of developing countries due to industrialization and growing number of vehicles. It leads to release of a 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. Premature deaths occur due to the presence of pollutants in the air. Pollutants are pumped into the atmosphere that undergoes a 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.

Keywords: IOT, MQ135, ESP866, PPM, AP, AQ.

I. INTRODUCTION:

In this research, we are going to make an IOT based Air Quality Monitoring System. This system measures the air quality in real time using MQ135 Gas Sensor with NodeMCU to send the data to ThingSpeak platform. The ThingSpeak platform is connected with Twitter, so whenever the air quality goes below a certain level, it will send the twitter notification to an authorized twitter account and thus warning people in that particular area.

II. EXISTING SYSTEM

The existing system makes use of gsm module, the prototype was equipped with basic functionalities, it enables the detection of pollutants and notifies the end user via message. Comparison of air quality for each timeslot cannot be done.

III. PROPOSED SYSTEM

The proposed system is linked to a cloud service 'thinkspeak.com'. The system enables to monitor the exact amount of pollutants at the given timeslot. The data will be stored in the database for comparing with the value obtained in future executions. For each execution, the database will be modified. The final resultant includes a line graph that depicts the amount of pollutants ranging from each time slot. If the amount of pollutants is increasing graph will be growing. If not the graph will be diminishing

The general critical benefits of proposing such a system are:

1. To study the literature of working IOT based devices, Arduino IDE, MQ135 Air Quality Sensor, NodeMCU and ESP8266 for implementation of proposed technique.
2. To communicate helpful information to the users about the concerned changes that might degrade users activities in their indoor places.
3. To collect real time database on cloud Server using ThingSpeak

IV. CIRCUIT DIAGRAM

The complete **circuit diagram for NodeMCU Air quality meter** is shown below. It is pretty simple as we only need to connect only the MQ135 sensor with our ESP NodeMCU board.

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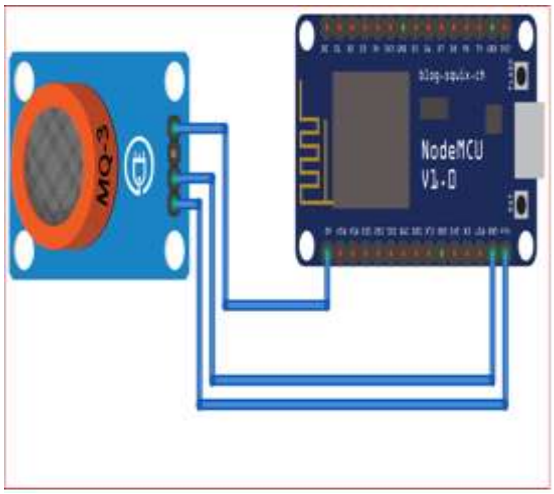

Fig. 1: Shows circuit diagram for NodeMCU Air quality meter

MQ 135 sensor is 4-pin multi-use sensor. It can be used to sense gas like benzene, alcohol, smoke. MQ135 sensor has an electrochemical sensor inside it, and this sensor is sensitive to a range of gasses are used at room temperature. You can also read about the other IoT sensors if you want to measure a particular gas.

The Vcc pin of MQ135 sensor is connected with Vin pin of NodeMCU, and GND pin is connected with NodeMCU's GND pin. While the A0 pin is connected with A0 pin of NodeMCU as shown in the circuit diagram above. The complete set-up will be powered by the micro-usb port of Node-MCU through a USB cable. I made the connections using connector wires and it looked like something below:

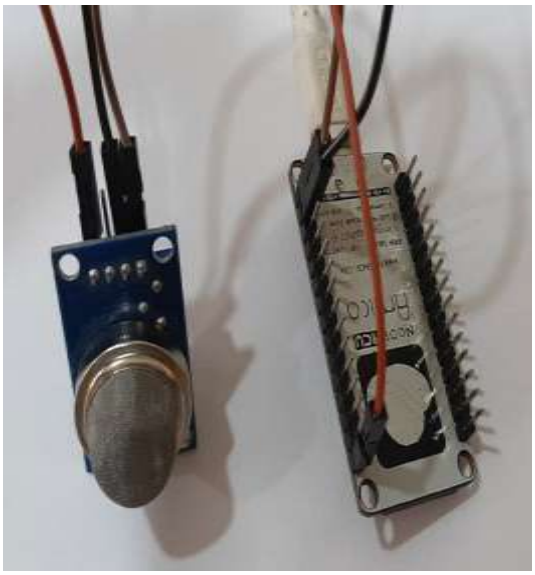

Fig. 2: Connections between MQ135 sensor and NodeMCU

V. THINGSPEAK SETUP

ThingSpeak is an open source IoT platform that allows you to aggregate, visualize, and analyze live data in the cloud. You can control your devices using ThingSpeak, can send data to ThingSpeak from your devices, and even you can create instant visualizations of live data, and send alerts using web services like Twitter and Twilio. ThingSpeak has integrated support from the numerical computing software MATLAB. MATLAB allows ThingSpeak users to write and execute MATLAB code to perform preprocessing, visualizations, and analyses. ThingSpeak takes a minimum of 15 seconds to update your readings. In this project we will be using ThingSpeak to get the value from MQ135 sensor through NodeMCU and plot a graph with the obtained value against time.

It is also possible to use ThingSpeak with Raspberry Pi and ESP32 making it suitable for a wide range of IoT Projects. Follow the below steps to set-up your ThingSpeak

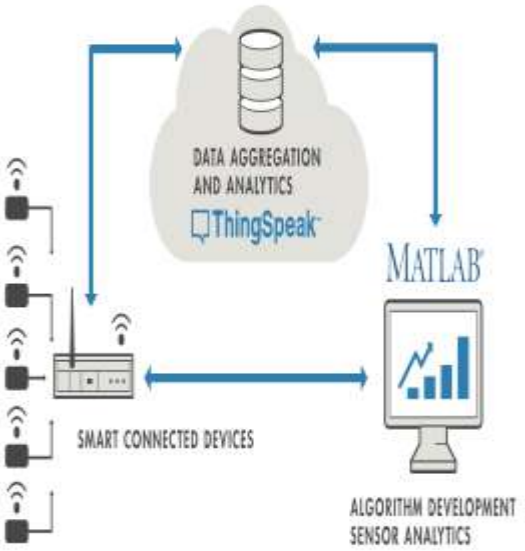

Fig. 3: Shows the implementation of real time database to store on the ThingSpeak Environment

VI. ANALOG WAY (PPM)

The MQ-135 gas sensor has an inbuilt variable resistor (sense resistor) that changes its resistance value according to the concentration of gas. If the gas concentration is high, the resistance decreases, and if the gas concentration is low, the resistance increases. The MQ-135 gas sensor basically needs only one key component as the external component – just a load resistor. The load resistor serves to adjust the sensor's sensitivity

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and accuracy. The value can range anywhere from 10KΩ to 47KΩ (the higher the resistance, the more sensitive the sensor becomes). Since sense resistance (Rs) value of MQ-135 gas sensor is different for various kinds and various concentration of gases, sensitivity adjustment becomes very necessary.

Acceptable CO2 ppm values:

- 400ppm – 750ppm: Good for health
- 750 ppm – 1200 ppm: Take care
- 1200 ppm (and above): Harmful to health

VII. RESULTS AND DISCUSSION

Table 1: Collection of Database

Created_at	Entry_id	PPM
2022-05-19 07:20:34 UTC	1	218
2022-05-19 07:23:25 UTC	2	186
2022-05-19 07:27:08 UTC	3	218
2022-05-19 07:28:27 UTC	4	182
2022-05-19 07:29:18 UTC	5	233
2022-05-19 07:29:50 UTC	6	228

Fig. 4: Monitoring results CO2 PPM Values between 100 to 750 on Thingspeak Cloud

Fig. 5: Monitoring results CO2 PPM Values between 1000 to 2000 on Thingspeak Cloud

Fig. 6: Monitoring results CO2 PPM Values between 113 to 550 on Thingspeak Cloud

Fig. 5.9: Monitoring results CO2 PPM Values between 100 to 750 on Thingspeak Cloud

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Fig. 7: Monitoring results CO2 PPM Values between 90 to 650 on Thingspeak Cloud

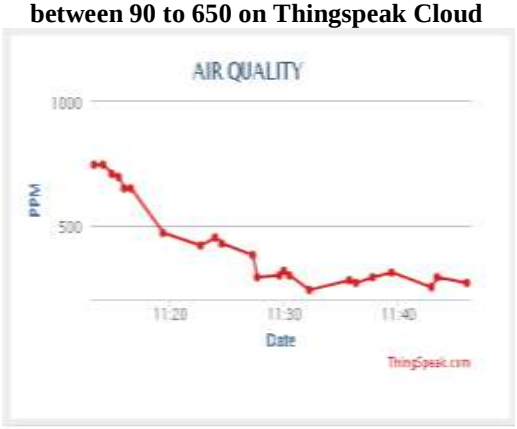

Fig. 8: Monitoring results CO2 PPM Values between 100 to 650 on Thingspeak Cloud

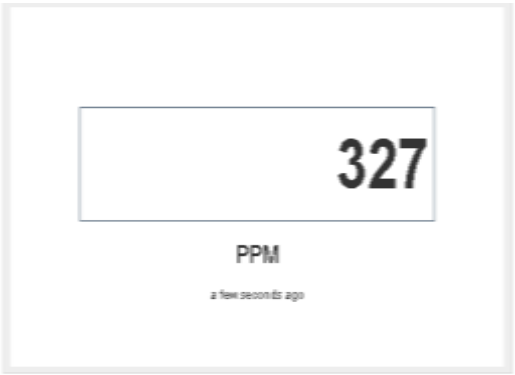

Fig. 9: Monitoring results CO2 PPM Value 327 on Thingspeak Cloud

Fig. 10: Monitoring results CO2 PPM Values between 119 to 700 on Thingspeak Cloud

Fig. 11: Monitoring results CO2 PPM Values between 119 to 650 on Thingspeak Cloud

IX. CONCLUSION

The device to monitor the toxicity in the air environment is designed using NodeMCU,IoT technology is implemented to control the air quality. By using IoT technology the process of monitoring the toxicity of air and controlling the various gases in the environment is proposed in this research. The use of MQ135 sensor senses various hazardous gases and NodeMCU is the heart of this application, which controls the whole process. Wi-Fi module controls all the process to the internet and monitor is used for displaying all the web pages over the internet.

This research tackles two issues; the first one is to develop a new cloud-based air pollution system in which IoT technology is incorporated into its infrastructure. This system introduces a low-cost sensor that allows beneficiaries to monitor the level of pollutants on air. Besides, the architecture of a new o cost sensor to collect toxic gases such as Methane, Ethanol, Toluene, CO2, CO, Alcohol, Acetone, LPG, NH4, Benzene, and

Hexaneis is introduced here. The second issue tackles to predict and forecasting environment data parameters by examining the collected air quality data as a method for improving the prediction process of the proposed system.

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