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Advanced Air Pollution Monitoring System with Real-Time Data acquisition

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Abstract— Air pollution affects our day-to-day activities and quality of life. It poses a threat to the ecosystem and the quality of life on the planet. The dire need to monitor air quality is very glaring, owing to increased industrial activities over the past years. People need to know the extent to which their activities affect air quality. This project proposes an air pollution monitoring system. The system was developed using the Arduino microcontroller. The air pollution monitoring system was designed to monitor and analyze air quality in real time and log data to a remote server, keeping the data updated over the internet. Air quality measurements were taken based on the Parts per Million (PPM) metrics and analyzed using Microsoft Excel. The air quality measurements taken by the designed system was accurate. The result was displayed on the android app and could be accessed by anyone with the use of QR code via the cloud on any smart mobile device.

Index Terms— Internet of Things, Pollution, Air, Parts per Million(ppm), Quality and real time data acquisition.

I. INTRODUCTION

Air contamination can be characterized as the nearness of moment particulars that bother the working of common procedures and furthermore create unfortunate wellbeing impacts. In another way contamination can influence the characteristic periodicity and furthermore can irritate the wellbeing of a person. As modernization and automation are becoming in all respects widely Pollution is likewise getting presented everywhere. It has been seen that in mechanically created nations human well-being is significantly influenced due to Air Pollution, where there is no framework to screen it or monitor it. In late explorations, it has been demonstrated that there is a high connection between Batten's climatic toxins and maladies like asthma and lung-related ailments. Air Pollution is currently a noteworthy worry over the globe and WHO has built up specific rules to confine the cutoff points of specific gasses like carbon monoxide, NO_2, SO_2. The Air Quality Index estimation and Pollution observation are mostly done at AQM stations that are essentially exact and precise. They show ideal unwavering quality and are viable in estimating a wide scope of air toxins. Be that as it may, even after every one of these stations slacks fundamentally in three territories:

1) Infrastructure, essential for establishment as a result of the colossal size,
2) Operational necessities are basically mind-boggling,
3) The common costs of setting up, day-by-day support, and alignment.

Components Used :

1.	ESP8266 Wifi Device
2.	Arduino Uno Controller
3.	MQ 135 Gas Sensor
4.	MQ 2 & MQ 4 Sensor
5.	Prana air PM2.5 sensor
6.	MQ 6 sensor
7.	Hook up Wires and LCD display
8.	Android app creater

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II. RELATED WORK

The Air Quality Indicator (AQI) is calculated and supported on air pollutants like CO and NO2 compounds that consume opposing possessions happening to the atmosphere and human health. The AQI may be a range that represents the very finest meditation of a specific air unused matter at a particular time. We propose an air quality as well as air pollution monitoring system that allows us to monitor & check live air quality as well as air pollution in an area through Internet of Things (IoT). It uses air sensors (Gas Sensor MQ135) to sense presence of harmful compounds in the air & constantly transmit this data. In addition, the system keeps measuring air level and reports it. This allows authorities to monitor air pollution in different areas and act against it. In addition, authorities can keep a watch on the air pollution near schools, & hospitals. Parts per million (ppm) may be similar and unremarkable units used to measure concentrations of pollutants. It determines the requirements of a new system & analyzes product and resource requirements, which is required for the successful system. The product requirement contains i/p & o/p requirements it gives the wants in terms of input to produce the required productivity. The resource requirements define in brief about the hardware that are needed to achieve the required functionality. In this project I am going to make an IoT based Air Pollution Monitoring System in which I monitor the Air Quality over a web server using ESP8266 Wi-Fi device and a trigger alarm when the air quality goes down a certain level means when there is number of harmful gasses is present in the air like CO2. It shows the air quality in PPM (Parts Per Million) on LCD and webpage so that we monitor it very easily.

Purpose of Project

The project is an implementation of IoT (Internet of Things) Based Air Pollution Monitoring System. Air pollution is a growing issue & it is necessary to monitor air quality for a better future and healthy living for all. Therefore, collection of air quality information gets easier. Analysis of monitoring data allows us to assess how bad air pollution is from day to day. After collection of the required air quality real time data it assess to the android app to the user.

Working of monitoring & controlling system

We have connected the MQ135 gas sensor and ESP8266 Wi-Fi device. Connected the VCC and the ground pin of the sensor to the 5V and ground of the the Analog pin of sensor to the A0 of the Controller. Connected a buzzer to the pin 7 of the Arduino which is start to beep when the condition becomes true. The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO2 and some other gasses, so it is a faultless gas sensor for our Air Quality Observing Detection Project. When I connect it to the
Arduino, 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. Sensor is giving us value of 0.1 when there is 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 1 PPM then it can cause increased heart rate and many other diseases. When the value is being less than 0.5 PPM, then the LCD and serial monitor is displayed “Fresh Air”. Whenever the value is increased
0.5 23 PPM, then serial monitor is displayed “Poor Air, Open Windows”. If it is increased 1 PPM, then the buzzer is kept beeping and the LCD is displayed “Danger! Move to fresh Air”. After uploading the code, I am connected to the Wi-Fi of my ESP8266 device, the serial monitor has opened and it is showing the IP address like shown below (192.168.43.57). If I have typed mentioned IP address in my browser, it is shown the output as below. I have to refresh the page again if I want to see the current Air Quality Value in PPM. After uploading code, the value is being less than 0.5 PPM, then the LCD and Web Browser is displayed “Fresh Air”. After uploading code, the value is increased 0.5 PPM, then the LCD and web browser are displayed “Poor Air, Open Windows”. After uploading code, When the value is increased 1.00 PPM then the buzzer is kept beeping and the LCD and Web Browser are displayed “Danger! Move to fresh Air”.

Controlling system works by using connected devices & sensors to monitor air quality in realtime and then taking automated actions to reduce the levels of pollutants. Here is an overview of how such a system may work:

1. **Sensors:** A network of sensors is installed in different locations to measure various pollutants in the air, such as particulate matter, carbon monoxide, sulfur dioxide, nitrogen dioxide, etc.
2. **Data Collection:** The sensors collect data and send it to a central platform where it is analyzed and processed to get an overall picture of air quality.
3. **Analysis:** The collected data is analyzed to determine the levels of pollutants and identify areas with high pollution.

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4. **Automated Actions:** Based on the analysis, the system can trigger automated actions to reduce the levels of pollutants. For example, it could turn on air purifiers, activate pollution control devices, or send alerts to authorities to take corrective measures. and Mainly we use cyclonic method to control air pollution levels, This type of technology is a part of the group of air pollution controls collectively referred to as "precleaners," because they are oftentimes used to **reduce the inlet loading of particulate matter (PM) to downstream collection devices by removing larger, abrasive particles.**

III. CIRCUIT DIAGRAM OF MONITORING SYSTEM

A Circuit Diagram of an IoT-based air pollution monitoring system typically consists of a microcontroller unit connected to a gas sensor (for detecting pollutants like CO2), a temperature sensor, and an air pressure sensor. The sensors gather data which is then processed by the microcontroller and sent to a cloud server via Wi-Fi. The cloud server stores the data and displays it in a user-friendly format, allowing real-time monitoring of air quality. An OLED display is used to display the readings locally.

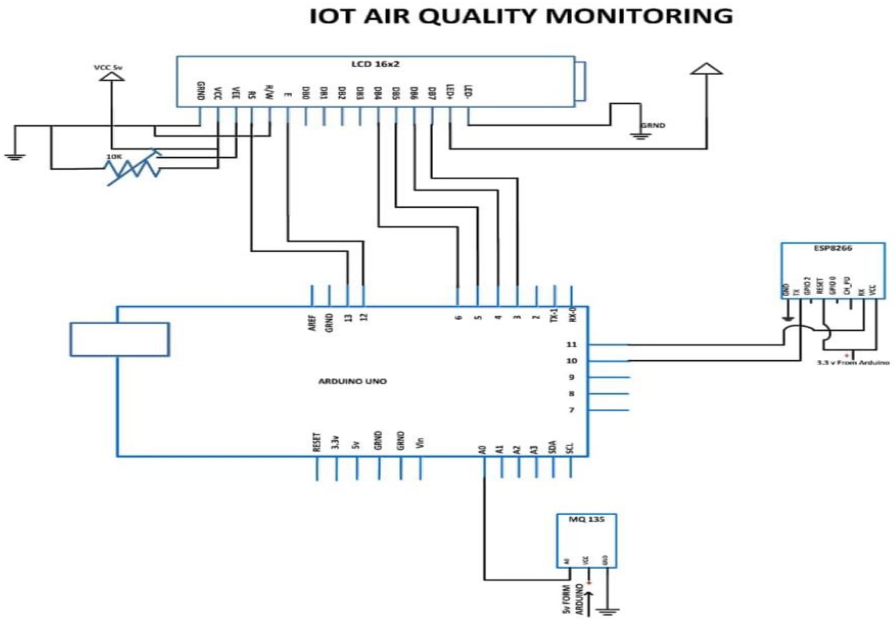

Figure 1.

Figure 2. **Actual Image of our IOT Based Air Pollution Monitoring System**

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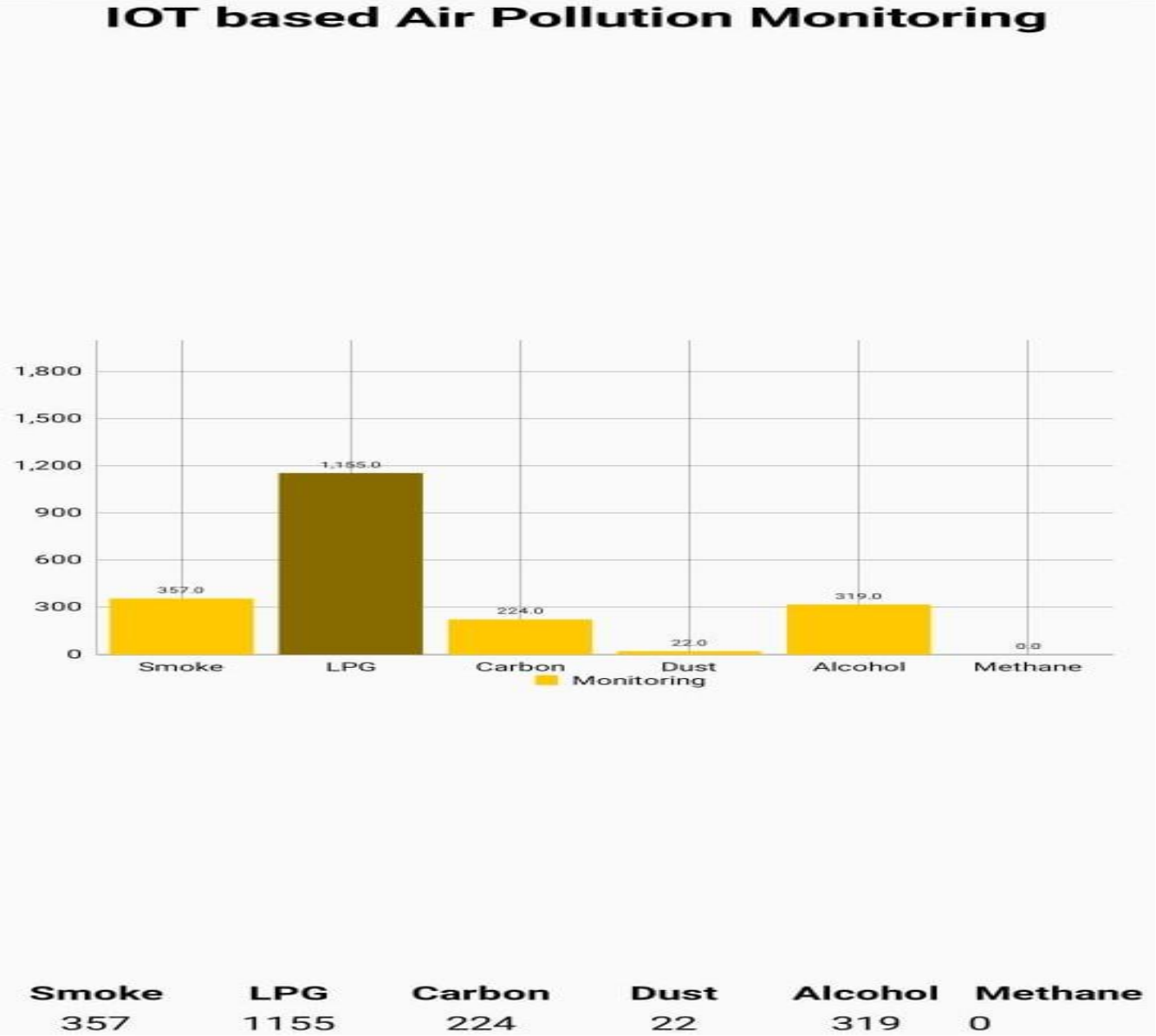

Figure 3. **Real-Time Data access in Android APP**

IV. CONCUSSION

IoT Technology is proposed to improve the quality of air. With the use of IoT technology enhances the process of monitoring various aspects of the environment such as the air quality monitoring issue proposed in this paper. Here, using the MQ135 gives the sense of the different types of dangerous gas. And through ESP8266 we can easily access data of the pollution level of that particular area in our PC as well as in our handset, which makes it reliable & easy and also provide the real time data in android app.

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