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IoT Based Air Pollution Detection Monitoring System with Arduino

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Abstract - *Due to the increase in the number of cars and the duration of industrialization and urbanization, air pollution has become one of the major problems of our day. The detrimental effects of this increase in pollution have an impact on prosperity. The design and operation of an air pollution detecting system are explained in this project. This innovation is a practical application of the Internet of Things concept. This thorough study examines the potential uses of this breakthrough in a world when maintaining one's natural health is becoming a real danger. The Arduino microcontroller board is used to realize the task. In this project, I'll create an Internet of Things-based air pollution detection monitoring system. Using an ESP8266 Wi-Fi device, I'll monitor the air quality over a web server and set off an alert when the air quality drops below a certain threshold, which corresponds to a particular number of dangerous gasses, such as CO2, being present in the air.On LCDs and websites, it will display the air quality in PPM (parts per million) as "Fresh Air," "Poor Air," and "Danger Air," making it easy for me to keep an eye on.*

***Key Words*: Arduino, LCD, ESP8266, MQ Sensor, Led.**

1.INTRODUCTION

The Air Excellence Guide (AEG) might be a widely used air quality measure. The Air Quality Indicator (AQI) is based on air pollutants such as CO and NO2 molecules, which have opposing effects on both human health and the atmosphere. The Air Quality Indicator might be a range that shows the best possible meditation of a certain airborne matter at a certain moment. I suggest an Internet of Things (IoT)-based air quality and pollution monitoring system that enables real-time monitoring and assessment of both air quality and pollutants in a given location. It detects the presence of dangerous gases or compounds in the air using air sensors (Gas Sensor MQ135) and transmits this data continuously. Furthermore, the device continuously measures and reports air level. The Arduino Uno microcontroller, which processes the data and sends it via the application, communicates with the sensors. The hardware needed to accomplish the necessary functionality is briefly described in the resource requirements. In this project, I'll build an Internet of Things-based air pollution detection monitoring system that uses an ESP8266 Wi-Fi device to monitor air quality over a web server and a trigger alarm to sound when the air quality drops below a certain threshold, or when there is a detectable concentration of airborne pollutants like CO2. I can simply check the air quality thanks to the LCD and webpage that display the PPM (parts per million) reading.

1.1 Purpose of Project

This project uses an Arduino board to construct an Internet of Things (IoT)-based air pollution monitoring system. For everyone's health and well-being in the future, it is imperative to monitor air quality since air pollution is becoming a more pressing issue. IoT is growing in popularity every day, and standards will soon follow. Information on air quality is therefore easy to get. We are able to evaluate the daily level of air pollution through the analysis of monitoring data. Bangladesh's main city of Dhaka is third on the list of cities with the worst air pollution, per a recent assessment. Therefore, as the number of contaminated vehicles increases, contamination is spreading quickly and affecting the health of people and groups as well. This air pollution damages the neurological, regenerative, respiratory, and makes illness more likely. In rare circumstances, it may also result in passing. As shown by overview, air pollution was the sole source of our unanticipated losses, which ranged from 500,000 to 100,000,000. Accordingly, it is necessary to monitor and check the quality of the air. The Internet of Things (IoT) is a network of physical devices, including cars, household appliances, and other items, that are enabled to associate and exchange information by hardware, programming, sensors, and availability. Articles can be managed or noticed thanks to IoT.In this work, I'm going to propose and pilot an IoT-based air pollution screening model.

1.2 Objectives of Monitoring Air Quality

The design of the air quality monitoring program is based on the monitoring goals that are established for the management of air quality in the chosen region of interest.

defining the network's architecture, the output influence, and how to best use the resources allocated to monitoring. Additionally, it guarantees that the network is specifically built to maximize the information regarding the current issues. The creation of the environmental monitoring and surveillance system may have several goals. Online data and information transfer are typically required by the system, along with direct, automatically online quality check over the gathered data. It is possible to use a number of monitors, sensors, and data gathering devices to provide online data transfer and control.

1.3 Air Quality Parameters

The following significant factors are taken into account in the suggested framework: Carbon dioxide, or CO2, is an odorless, colorless, and non-flammable gas. Additionally, it falls under the group of smother gases, which can interfere with tissues' capacity to get oxygen. Since it is one of the most important components of the developing photosynthesis process, which transforms solar energy into chemical energy, carbon dioxide is essential to life as we know it. The main cause of the increase in CO2 concentration is the massive burning of leftover fuels. This boost causes plants to develop quickly. Unwanted plants grow quickly, which increases the need for herbicides to get rid of them .Sulfur Dioxide (SO2) is a colorless gas that has a unique flavor and smell. Similar to CO2, the primary cause is the boiling and manufacturing processes of fossil fuels. Breathing issues can be brought on by inattention, particularly in sensitive populations like asthmatics. It's a factor in acid rain.

1.4. Importance of Air Pollution Monitoring System

One of the most essential and fundamental components for human survival is air. Maintaining a clean and healthy lifestyle is essential.But in today's metropolitan life, it's the most dangerous aspect. Air pollution is currently the subject that worries and affects us the most. Numerous air contaminants have negative impacts on human health and the atmosphere that are either known or suspected. These pollutants are mostly the byproducts of combustion from power production, space warming, or motor vehicle traffic flow in the majority of these places. Pollutants from these sources have the ability to travel great distances in addition to posing an immediate threat. Moderate air pollution levels are generally unlikely to have any major short-term consequences on someone who is young and in excellent health.Higher exposure levels and extended periods to air pollution, however, can result in more severe health problems and symptoms.

2. LITERATUREREVIEWS

For humans to thrive, air is one of the most essential and fundamental substances. The cornerstone to a good and healthy existence is clean and sound air.However, it is now the most dangerous aspect of metropolitan living. For us right now, air pollution is the most pressing problem. Numerous air contaminants have been shown to have negative impacts on both the atmosphere and human health. These pollutants are mostly produced by combustion in the majority of places, whether it be from power generating, space warming, or motor vehicle traffic. These sources' pollutants have the potential to travel great distances in addition to posing an immediate threat. Moderate air pollution levels are generally not expected to have any significant short-term effects on healthy, young people. On the other hand, longer periods of time and increased exposure to air pollution might result in more severe health problems.

2.1 Opportunity, Status& Capability of IoT

1. Opportunity of IoT
2. Status of IoT
3. Capability of IoT
4. Motivation and General Description
5. Open and General IoT Architecture
6. Challenge & Prospect of IoT
7. Challenge of IoT
8. Prospect of IoT

3. EXSISTING SYSTEM

The air pollution is only measured there under the current system. The data is shown on the LCD display itself, and if the limitations are exceeded, the system will use GSM to transmit the data to the appropriate parties.

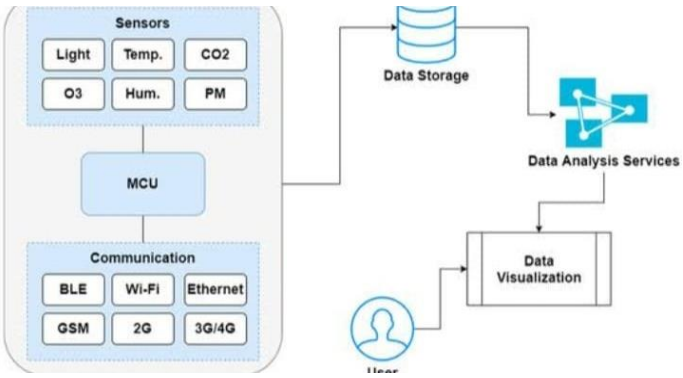

Fig -1: Existing system

4. PROPOSED SYSTEM

The goal of the article is to construct an air pollution monitoring system that can be put in a particular location

and improve upon past systems by overcoming their shortcomings and creating an Android app that the general public may use. Anyone may use this app to receive real-time information regarding the level of pollution in their area. It uses an Arduino integrated with various gas sensors to detect the concentration of each gas independently, including smoke, humidity, particulate matter, and carbon monoxide and ammonia. The thing speak platform is used to upload the gathered data to the cloud on a regular basis. An Ethernet shield is used to link the cloud and Arduino. Values can be represented graphically or pictorially in Thing Speak. Users have the option to install an Android application to receive the latest updates on material, including graphics.

Using Matlab, the average concentration of ethylene is examined. The standard level of each gas measured is used to assign a specific time control, and the outcome can be seen in an Android application.

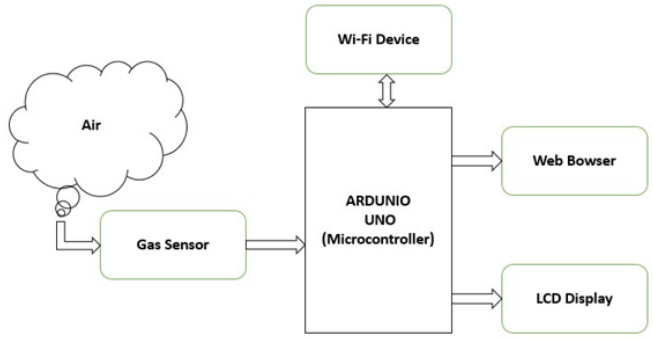

Fig -2: Proposed Design

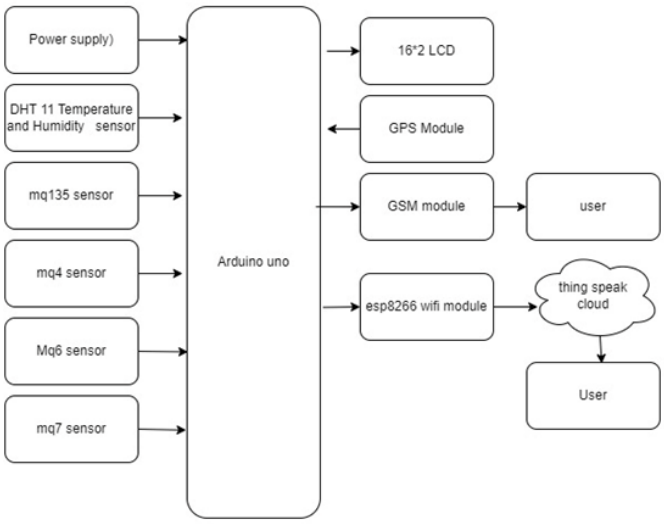

Fig -3: Proposed Architecture

The main elements of my project have been covered in the section above. I describe the architecture here. The Arduino board is linked to a gas sensor and a Wi-Fi device. Additionally, an LCD attached to the Arduino board is used to show data. I use a gas sensor and an alarm to monitor the air quality over a serial monitor and LCD. When the air quality falls below a specific threshold, it indicates that there are enough dangerous gases, such as CO2, smoking, alcohol, benzene, and NH3, in the atmosphere. The LCD as well as serial monitors display the air quality in PPM so that I can monitor it with ease. The MQ135 sensor is the ideal option for monitoring air quality since it can correctly measure the amount of dangerous gases and distinguish which ones are present. I can use a computer to monitor the pollution level from anywhere using this Internet of Things (IoT) project.

5. COMPONENTS REQUIRED

i. ArduinoUno
ii. GassensorMQ135
iii. ESP8266Wi-FiDevice
iv. 16x2LCD
v. Buzzer
vi. 0.5mArduino A-BCable
vii. Jumperwire

6. Setup the Hardware of this Project

The Arduino and ESP8266 Wi-Fi device are linked; VCC and CH_EN are linked to the Arduino 3.3V pin; The Arduino pin 8 is linked to the TX pin; GND is linked to the pin GND of the Arduino, while the RX pin is connected to pin 9 of the Arduino. VCC pin is linked to pin 5v of the Arduino; MQ135 sensor and speaker are connected to the Arduino; The Arduino's GND is linked to the GND pin; AO is linked to the Arduino's A0; The speaker pin is linked to both pin 7 of the Arduino and GND; Arduino is linked to LCD; The Arduino's 5 V and GND are wired to the VCC and GND pin;D4, D5, D6, and D7 pins are linked to the Arduino pins 05, 04, 03, and 02; RSpin is attached to the Arduino pin 12; Epin is connected to the Arduino pin 11;

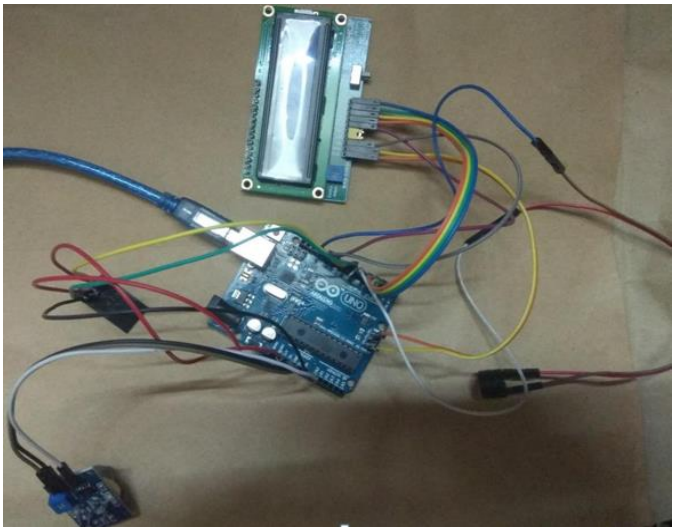

Fig -4: Hardware connections of this project

7. RESULTS

The MQ135 sensor is an ideal gas sensor for an air quality monitoring and detection system project since it can sense CO2 and several other gases. It detects the gasses when I attach it to an Arduino, and I receive the pollution level in PPM (parts per million). The output from the MQ135 gas sensor is provided in voltage levels, which I must convert to PPM . In order to convert the output to PPM. In situations where there is no gas around and the air quality is between 0.5 and 0.5 parts per million, the sensor is reporting a value of 0.1.Headaches, drowsiness, and stagnant, stale, stuffy air are the first symptoms to appear when it surpasses the 0.5 PPM limit. If it goes over PPM, elevated heart rate and several other illnesses may result. The website and LCD will show "Fresh Air" when the reading is less than 0.5 PPM."Poor Air, Open Windows" will appear on the LCD and webpage whenever the value increases by 0.5 PPM.

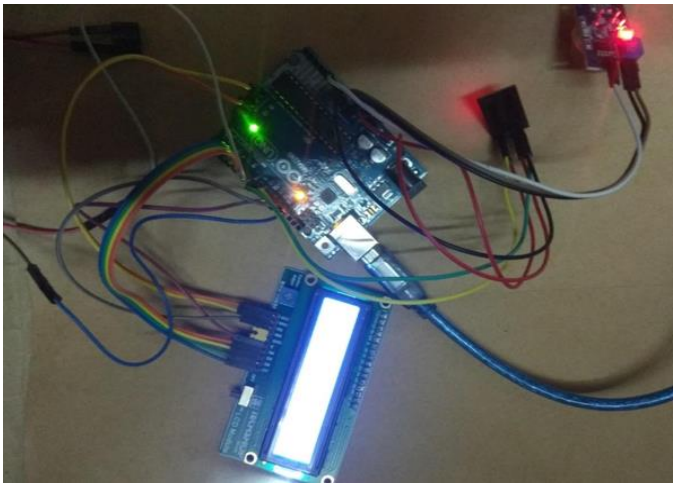

Fig -5: Hardware Result of this project

Fig -6: Web Result of this project

3. CONCLUSIONS

An IoT-based system for monitoring ambient air quality using an Arduino microcontroller is suggested as a way to enhance air quality. The process of monitoring different environmental characteristics, like the air quality monitoring issue discussed in this paper, is improved by the usage of IoT technology. Here, the MQ135 is used to convey the idea of several hazardous gas types, and Arduino is the project's central component. An Arduino module, which controls the entire process, links it to an LCD, and a serial monitor is utilized for the visual output.

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