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Air Pollution Monitoring Through Drone.

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Abstract: With the utilization of Internet of Things (IoT) technology, this project aims to establish an effective air quality monitoring system, fostering environmental and health protection. It is designed to be cost-effective, user-friendly, sensitive, and reliable. Leveraging the compatibility and efficiency of MQ 135 and MQ02 sensors in air quality measurement, the system ensures comprehensive monitoring. Featuring an intuitive interface, it enables continuous air quality control through AQI monitoring in PPM units via a browser. Emphasizing the significance of monitoring air quality at pollution sources, the project employs a drone with an attached external battery for prolonged flight time. The monitoring system dynamically adjusts the threshold based on real- time air quality readings. Real-time monitoring data is wirelessly transmitted to a ground-based smartphone, facilitating browser- based AQI monitoring. Additionally, the project integrates forecasting tools to anticipate future air quality levels at specific locations and times. The system's capability for predicting pollutants and conducting remote monitoring has been successfully validated through testing.

Keyword**Internet of Things (IoT), Air Quality Index (AQI), MQ 135 and MQ02 sensors, Pollution prediction.**

I. INTRODUCTION

When dangerous pollutants are released into the atmosphere in large enough concentrations, they can have negative impacts. This is known as air pollution. These dangerous compounds can have negative effects on property, the environment, human health, and generate foggy or discolored skies as well as unpleasant smells. Although some of these toxins come from uncontrollably occurring natural sources, human activity is the main cause of air pollution in highly populated and industrialized areas of the world. These kinds of activities are frequently connected to living standards. For a variety of pollutants, the EPA has established national air quality guidelines in order to protect public health and welfare. A useful instrument for communicating the effects of local air pollution on health is the Air pollution Index (AQI).

In order to determine pollution levels, this project addresses the requirement for real-time air quality monitoring in particular locations. Currently, there are no real-time monitoring devices in place, which makes it more difficult to collect timely data on air quality. Authorities depend on this monitoring to get real-time data on air quality, which helps forecast future changes in air quality. The project offers a novel approach to this problem that is in step with the developments of Industrial Revolution 4.0 and makes use of cloud computing and the Internet of Things (IoT). The research community has taken notice of these contemporary technologies, with IoT platforms gaining popularity due to their ability to advance scientific understanding and speed up technological adoption. The main goal of this project is to create a system for monitoring air pollution using drones that are equipped with solar power systems as a backup energy source. Standard and non-standard solar cell strings are included in this setup to increase the drone's flying time. In addition, the initiative uses real-time AQI monitoring, which is available in PPM units via a web browser, allowing for continuous and distant observation of the local air pollution levels.

II. LITERATURE REVIEW

Unmanned aerial vehicles (UAVs) present a number of opportunities for assessing air quality, but a thorough examination is required due to a number of obstacles. Air is a complicated mixture of contaminants that are hard to measure since it is made up of so many different components. In order to address this complexity, multi-pollutant approaches have been developed because the oversimplified single-pollutant models are insufficient. Moreover, determining the precise concentration of every contaminant in a combination presents a number of challenges. Aligning the sensor data with GPS information is essential for real-time monitoring because the data is gathered separately from the UAV and its sensors.

Another significant challenge is navigating UAV safety procedures, particularly in an urban setting where there are many barriers to overcome, including buildings, trees, wires, and no-fly zones. Furthermore, there are rules that must be followed when using UAVs for private, business, or research purposes. The Internet of Things (IoT)-Based Air Pollution Monitoring System uses a web server to track air quality. When air quality deteriorates above a predetermined threshold, the system sends out an alert indicating the presence of different dangerous gases, including alcohol, smoke, CO_2, benzene, NH_3, NO_x, and LPG. For easy monitoring, the air quality is shown in PPM on an LCD and a web page. The technology also keeps an eye on and regulates humidity and temperature.

III. DESIGN METHODOLOGY

In the realm of technology, drones are becoming more and more common. Most unpiloted aircraft are referred to as "drones" in this context. Drones in the field of technology are getting more and more prevalent. The majority of unmanned aircraft are called "drones" in this context. These gadgets, which are sometimes called "Unmanned Aerial Vehicles" (UAVs), are capable of carrying out a range of tasks, including military operations and package delivery. Drones range in size from the size of a palm to that of an airplane. An unmanned aerial vehicle is called a drone. Unmanned aerial vehicles (UAVs) and unmanned aircraft systems are other names for drones. Drones and other unmanned aerial vehicles (UAVs) can be commanded remotely or on their own through the use of embedded technologies and software-controlled flight plans. To enable autonomous flying, these technologies are coupled with onboard sensors and a global positioning system (GPS). Unmanned aerial vehicles (UAVs) like drones can be operated remotely or autonomously by using embedded systems with software-controlled flight plans.

A. System Architecture Design

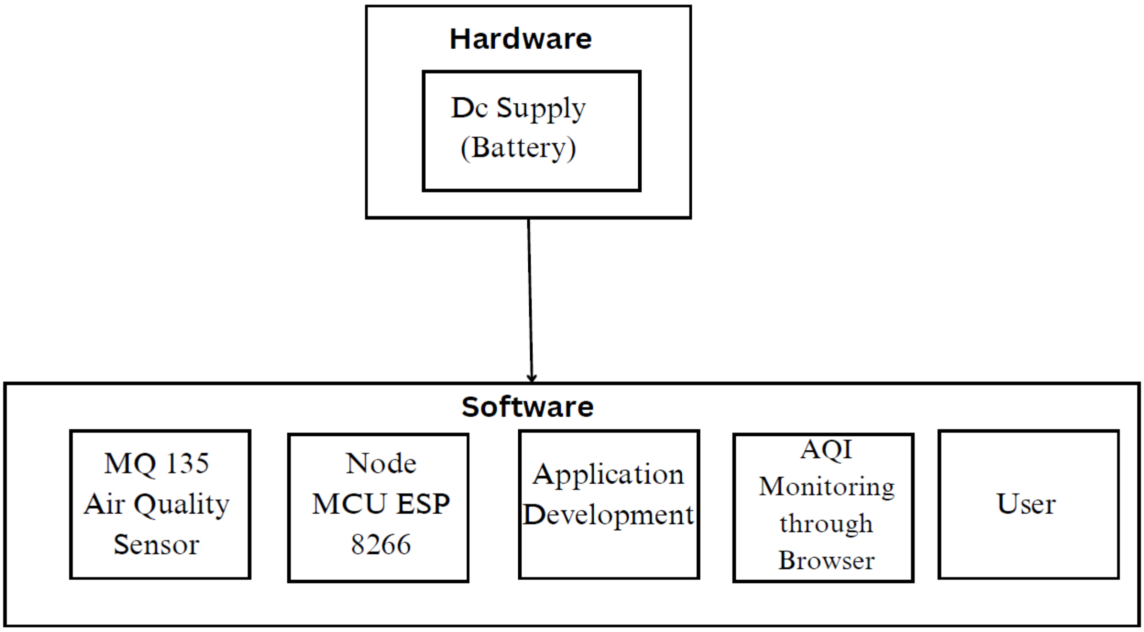


Fig. IV.a shows the block diagram of the Air Drone Pollution Monitoring System.

B. Sensor Selection And Integration

The selection of appropriate sensors is crucial for the effectiveness of Air Drone Pollution Monitoring System The MQ135 sensor is ideal for our air quality monitoring project because it can detect NH3, NOx, alcohol, benzene, smoke, CO2, and a few other chemicals. It will detect the gases when connected to an Arduino, and we will be able to obtain the pollution level in PPM (parts per million). The output from the MQ135 gas sensor is provided as voltage levels, which must be converted to PPM. Therefore, we have utilized a library for the MQ135 sensor in order to convert the output to PPM; the details are provided in the "Code Explanation" section below.When there was no gas around, the sensor gave us a number of 90, even though the safe level of air quality is 350 PPM and it shouldn't surpass 1000 PPM. Headaches, drowsiness, and stale, stuffy air are the first symptoms when it surpasses the 1000 PPM limit. If it surpasses 2000 PPM, elevated heart rate and several other illnesses may result. The LCD and webpage will display "Fresh Air" when the reading is less than 1000 PPM. The buzzer will begin beeping and the LCD and webpage will display "Poor Air, Open Windows" as soon as the value increases by 1000 PPM. The buzzer will continue buzzing and the message "Danger! Move to fresh Air" will appear on the homepage and LCD if the number rises above 2000.

C. Software Design

C is a general-purpose programming language created by Dennis Ritchie at the Bell Laboratories in 1972 in Bell Laboratories in 1972. Despite its age, this language is still highly popular. The primary explanation of its widespread use is that it is an essential language in computer science. Since C was created to write the UNIX operating system, the two are closely related. The programming itself is done using sketches, which are Arduino programs written in a syntax similar to C/C++. A basic Arduino sketch includes two main functions: setup () and loop (). The setup () function runs once when the board is powered up or reset and is used for initializing variables and pin modes. The loop () function runs continuously after setup () and is where you write the code for your desired functionality. For example, a common beginner's sketch blinks an LED connected to pin 13 on the Arduino board. You can write the code for this functionality within the setup () and loop () functions. Once the sketch is written, you upload it to the Arduino board by clicking the upload button in the IDE.

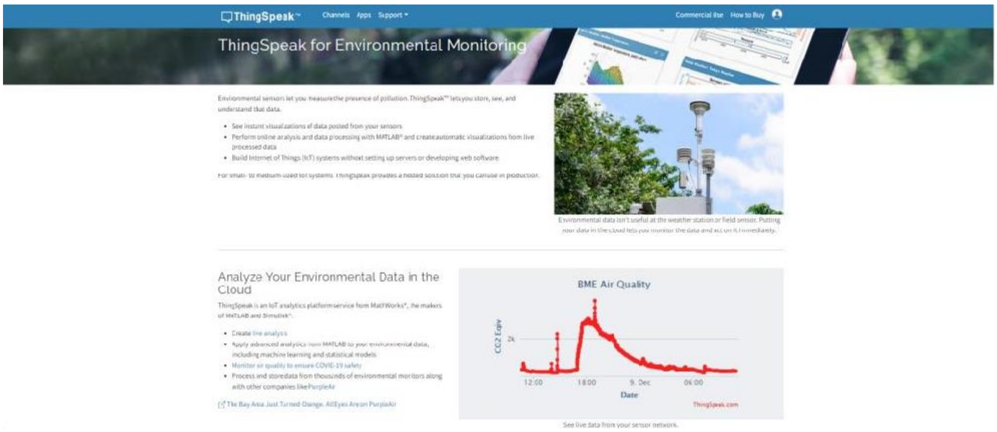


Fig IV.b shows "ThinkSpeak" website for environmental monitoring

D. Hardware Design

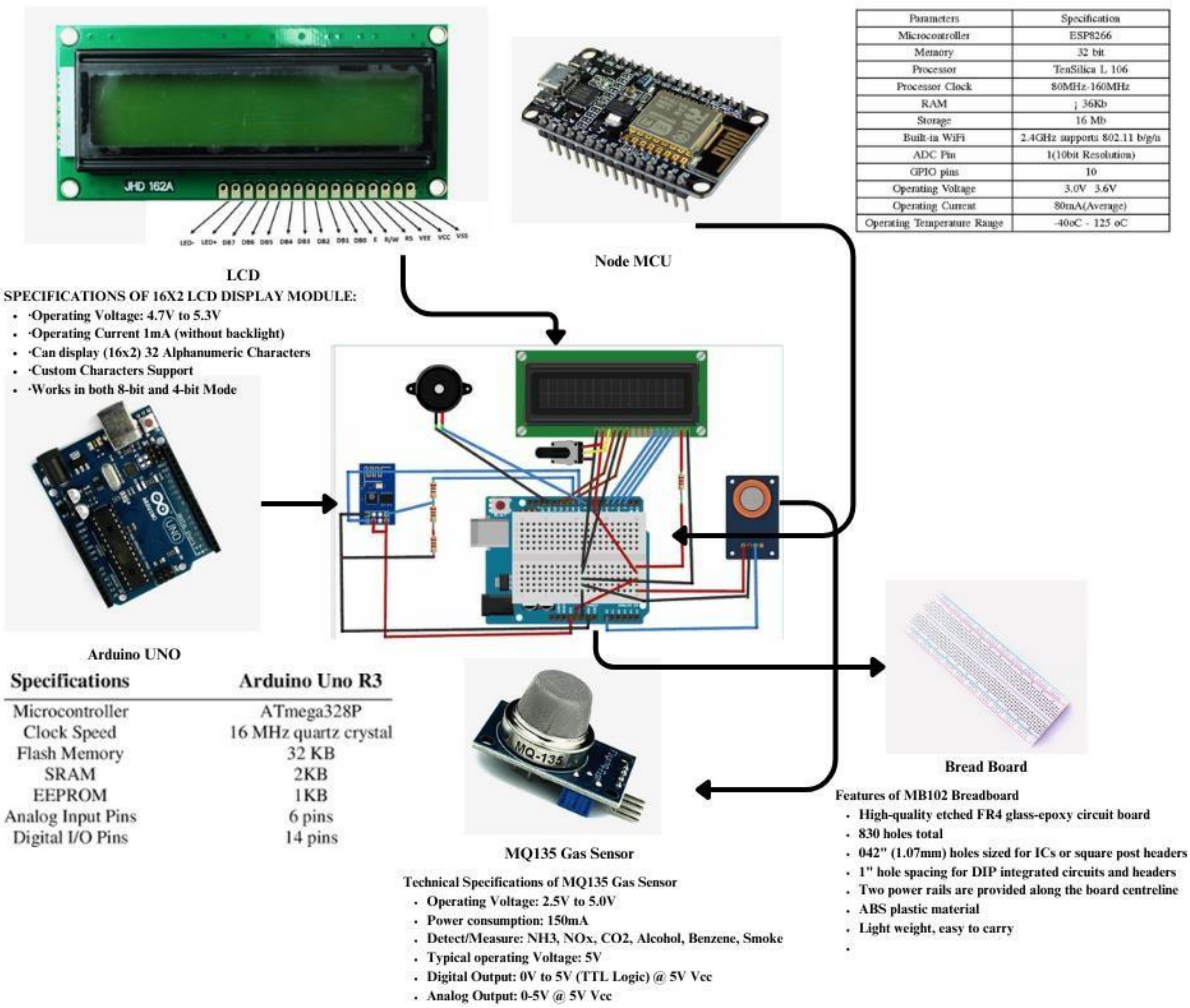


Fig IV.c shows circuit diagram of the Air Drone Pollution Monitoring System.

E. Testing And Validation

Thorough testing is conducted on the Air Drone Pollution Monitoring System to verify its functionality in a range of operational scenarios and environmental circumstances. Make sure you are linked to your ESP8266 device's Wi-Fi before uploading the code. When you launch the serial monitor after uploading, the IP address will appear as indicatedbelow.

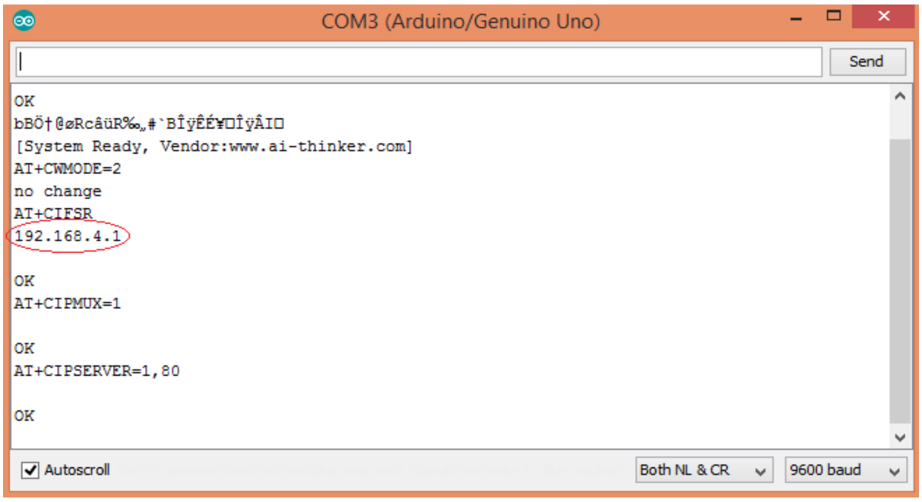


Fig IV.d shows a snippet of code testing.

When you enter this IP address in your browser, the output as seen below will be displayed. If you like to view thecurrent Air Quality Value in PPM, we must reload the website once more.

IV. WORKING

The Air Drone Pollution Monitoring System with Self Power Generation is a cost-effective, user-friendly, sensitive, and reliable air quality monitoring solution that uses MQ 135 and MQ02 sensors on a drone with an external battery for extended flight time. The sensors continuously monitor pollutants like CO, NO2, SO2, and PM, and real-time data is wirelessly transmitted to a ground-based smartphone or control center. The system adjusts threshold values based on readings and generates alerts if pollution levels exceed predefined thresholds. The system also integrates forecasting tools to predict future air quality levels at specific locations and times. The system's capability for predicting pollutants and conducting remote monitoring is confirmed

through rigorous validation and testing. The intuitive user interface allows easy access to real-time air quality data and forecasting information. Overall, the Air Drone Pollution Monitoring System with Self Power Generation offers a comprehensive solution for monitoring air quality, contributing to environmental sustainability and public health.

Fig III.a shows a figure of a drone with battery of 12v.

V. HARDWARE COMPONENTS

The drone's structure is a skeleton that consists of various components, including propellers, which work together to create a uniform center of gravity. Different drone designs use different frame constructions, with a minimum of three propeller fitting gaps. These structures ensure safe landings, but can be adjusted by a skilled operator. Landing gear comes in two types: retractable and fixed. Propellers are essential components of drones, creating air pressure differences. They come in various shapes, sizes, and numbers, each with its advantages and disadvantages. Propeller rotation is determined by the motor's rotation, usually clockwise. Some drones rotate propellers in a counterclockwise direction, or "reverse" rotation. The direction of rotation depends on the drone's design and application requirements. For multirotor drones, all propellers must spin in the same direction for proper function.

Fig. V.a displays a snippet featuring all the hardware components.

A. Motors

The propeller's ability to rotate requires motors, such as the A2212/10T 1400kv DC brushless motor. This motor increases the drone's push force for propulsion. However, there should be an equal number of motors and propellers. Additionally, the drone motors are positioned so that the controller can easily spin them. Their rotation enhances the drone's ability to control its direction. Choosing the appropriate motor is essential for the drone's efficiency. It is necessary to carefully check a number of characteristics, including voltage and current, thrust and the thrust-to-weight ratio, power, efficiency, and speed.

B. Flight Controller Board

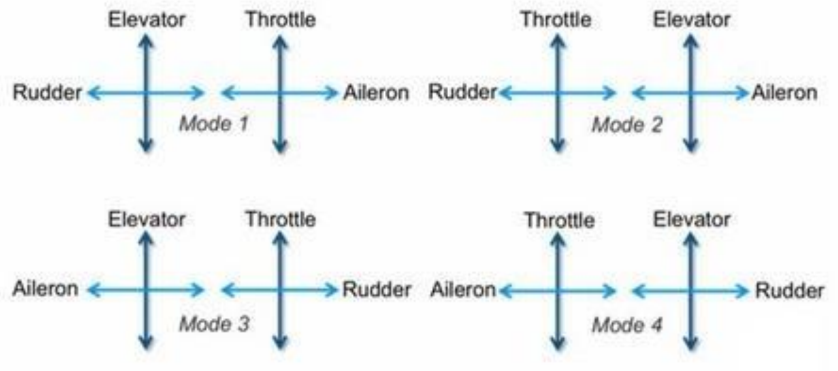
In case it is necessary for the drone to return to its takeoff position without guidance, the takeoff location is noted on the flight board. The return to home' function is what is meant by this. The drone's altitude and power consumption are also calculated by it. Drone intelligence is derived by the flight controller. The drone is stabilized in the air by it, and it manages the motors. On the market, there is a wide variety of flight controllers in different sizes and forms. CC3D, APM, and Naze32 are a few of the well-liked flight controllers.

C. Battery

LiPo batteries are among the most often used battery kinds for drones because they have a greater voltage per cell than other rechargeable battery types, which allows them to operate the drone's onboard systems with less cells while still offering a high energy density relative to their size and weight. An essential component for controlling and operating the drone is its electrical and electronic component. Other parts, however, can be added or removed depending on the drone's intended use. Although it's recommended to add these for multitasking, the drone can still operate without these pieces.

D. Radio Transmitter

A drone transmitter is a channeled transmitter and communicator that uses specific frequencies to steer the drone inspecific motions. For effective operation, drones require at least four channels.



The transmitter reads stick inputs and sends them to a receiver in real time, which then passes the information to the flight controller.It is a channeled transmitter and a communicator to the drone. Drones require at least four channels for effective operation. The transmitter reads stick inputs and sends them to a receiver in real time. The receiver then passes this information to the flight controller, enabling the drone to move accordingly. Each channel has a specific frequency for steering. Hence it is important to pick the right transmitter.

E. Electronic Speed Controllers (ESC)

Electronic Speed Controllers (ESC) are crucial components in drones that control the speed and power consumption of motors. They help ground pilots estimate the drone's height during flight by calculating the total power consumed by all motors. The ESC connects the flight controller and motor, and quadcopters require four ESCs for each brushless motor. The ESC spins the brushless motor using the flight controller's signal and battery power.

Brushless motors, which lack brushes, use a different way to convert direct current (DC) into alternating current (AC) through the use of an ESC. The ESC is a brushless DC motor speed controller that requires a PWM signal to vary the speed of a BLDC motor. It is available in different variants and power ratings and is fed with a voltage of 11.1 V DC from a LiPo battery. The flight controller board measures drone parameters like pitch, yaw, and roll, and generates a 3-phase alternating current to drive high current BLDC motors.

VI. RESULT

The integration of drone technology for air pollution monitoring and AQI monitoring through a browser interface has significantly improved remote monitoring and forecasting capabilities. This project has enabled real-time monitoring, accurate forecasting predictions, and improved accessibility and flexibility in data analysis. The data collected is converted into Parts Per Million (PPM) units and integrated into contemporary app systems, transforming air quality monitoring into a wireless communication mode. The drone's design, equipped with a 12V battery for optimized operation time without reliance on solar panels, ensures reliability and sustainability in monitoring operations. This autonomy and effectiveness in collecting air quality data contribute to the project's autonomy and effectiveness. The integration of drone technology with AQI monitoring and modifications to the existing IoT platform has resulted in a more autonomous and efficient air quality tracking system, promising to address air pollution challenges and improve environmental monitoring practices in the future.

VII. CONCLUSION

Leveraging current technology, this project enhances remote operations, real-time monitoring, and forecasting predictions through the extensive data collection it facilitates. The utilization of AQI monitoring via a browser in PPM units as one of the contemporary app systems has empowered authors to control and observe air quality. This method has transformed the system into a wireless communication mode, enabling the monitoring of data acquired wirelessly at any moment needed.

The adoption of AQI monitoring through a browser has simplified the investigation of data collected from the sensors. The data obtained is up-to-date and accurate, utilized for forecasting future air quality at specific locations. The drone, equipped with a 12V battery, has been designed to optimize operation time without relying on solar panels for energy. The results, derived from integrating the existing IoT platform available on the internet with modifications to the air quality monitoring system, have led to the development of a more autonomous air quality tracker.

VIII. REFRENCES

[1] https://iopscience.iop.org/article/10.1088/1742-6596/1529/2/022103/pdfwww.google.com

[2] www.youtube.com

[3] https://robocraze.com/blogs/post/drone-part-list

[4] https://makerbazar.in/blogs/news-15/how-to-make-your-own-quadcopter-drone

[5] https://circuitdigest.com/microcontroller-projects/iot-air-pollution-monitoring-using-arduino