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# Wireless Air & Sound Monitoring system using NodeMcu826

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**ABSTRACT:** The Wireless Air & Sound Monitoring system using NodeMcu8266, one of the new aspects is the utilization of ThingSpeak. ThingSpeak is an IoT platform that allows for the collection, storage, and visualization of sensor data in real-time. A low-cost and scalable method for measuring and monitoring air quality and sound levels in real time is the wireless air and sound monitoring system utilising NodeMcu8266. To identify and measure environmental factors, the system makes use of different sensors, including gas, sound, temperature, and humidity sensors. The NodeMcu8266 Wi-Fi module receives the sensor data and transmits it to a cloud-based platform for processing and analysis. Users have access to the data via a web-based user interface or a mobile application, and they can sign up to get warnings when environmental factors go over certain limits. The system is appropriate for a variety of applications, including environmental monitoring, public health, and building automation. Additionally, if the air quality or sound level exceeds a certain threshold, the system may be configured to send alarm messages to a phone. This gives consumers timely alerts so they may take the required precautions to reduce any risks or problems.

The wireless air and sound monitoring system utilizing NodeMcu8266 include a number of sensors (gas, sound, temperature, and humidity), a NodeMcu8266 Wi-Fi module, and a cloud-based platform for data processing and analysis. These components are briefly described in the abstract.

**KEYWORDS:** [ Wireless Monitoring System, Air Quality Monitoring, Sound Level Monitoring, NodeMCU8266, IOT Application, Gas Sensor, Sound Sensor, Smart City, Wireless Sensors Network, Real Time Data]

## I. INTRODUCTION

Both air pollution and noise pollution are now major environmental issues that have an impact on people's health and way of life. Numerous studies have demonstrated that exposure to high concentrations of air pollution and noise can result in a number of health issues, such as hearing loss, cardiovascular disorders, and respiratory illnesses. There is an increasing concern for public health and environmental sustainability as a result of the dangerous air quality and noise levels that have been achieved in many metropolitan areas.

The use of conventional air and sound monitoring systems is restricted in many circumstances, especially in distant or inaccessible locations, due to their high cost, complexity, and significant wiring requirements. It has become more crucial than ever to have real-time monitoring solutions that are wireless and IoT-based. Air quality and sound levels may be monitored in real time with the help of wireless monitoring devices, which can also wirelessly send data to a platform in the cloud.

In this research, we suggest a NodeMcu8266-based wireless air and sound monitoring system. NodeMcu8266 is a development kit and open-source firmware that facilitates the development of IoT applications. The suggested system comprises of several sensors that detect the amount of contaminants in the air and the amount of noise in the surrounding area, such as gas sensors and sound sensors. Wirelessly relayed to a server or cloud-based platform, the data gathered by the sensors is then processed and analysed. Through a web interface or a mobile application, consumers may access this data.

The suggested method offers a dependable, economical, and effective remedy for air and sound monitoring by addressing the shortcomings of conventional monitoring systems. To enhance public health and environmental sustainability, the system may be used in a variety of contexts, including homes, offices, schools, and outdoor areas. The remainder of the essay is structured as follows: The relevant research in the area of sound and air monitoring is covered in Section 2. The suggested system architecture and design are described in Section 3. The experimental



findings and performance assessment of the suggested system are presented in Section 4. The work is concluded and future research directions are covered in Section 5.

## II. EXISTING SYSTEM

In the literature, many air quality and sound level monitoring methods have been proposed. For the gathering, analysis, and processing of data, these systems have used cloud-based platforms and wireless sensor networks. One of these systems used a Zigbee network for data transfer, and another detected noise sources using a mix of sound sensors and video cameras. These systems' design and sensor setup, however, are constrained. NodeMcu8266, a low-cost, open-source Wi-Fi module, is used in the system that this study proposes to gather and send data wirelessly. The system has several sensors, including sound and gas sensors, which allow it to continuously check the air's quality and sound levels. The suggested system offers a more adaptable and flexible real-time air and sound monitoring solution than current systems at a lower cost.

### Motivation :

#### 2. Geographic Zone Classification:

The need for monitoring air quality and sound levels has become increasingly important due to their impact on human health and well-being. Poor air quality and high sound levels can lead to respiratory problems, hearing loss, and other health issues. Traditional monitoring systems for air quality and sound levels are often expensive and require significant maintenance, limiting their use in many applications.

##### 2.1. Industrial Zone:

The need for monitoring air quality and sound levels has become increasingly important due to their impact on human health and well-being. Poor air quality and high sound levels can lead to respiratory problems, hearing loss, and other health issues. Traditional monitoring systems for air quality and sound levels are often expensive and require significant maintenance, limiting their use in many applications.

##### 2.2. Residential Zone:

Due to its effects on human health and wellbeing, monitoring air quality and sound levels has become more crucial. Respiratory disorders, hearing loss, and other health concerns can result from poor air quality and loud noises. The usage of conventional air quality and sound level monitoring devices is frequently constrained by their high cost and extensive maintenance requirements.

##### 2.3 Traffic Zone:

Traffic areas may monitor air and sound pollution levels with the wireless NodeMcu8266 air and sound monitoring device. It can monitor contaminants including carbon monoxide, nitrogen dioxide, and particulate matter, which are released by moving cars and may be hazardous to the health of nearby residents and workers. To track the levels of noise and air pollution, it can be deployed in busy junctions, highways, and other high-traffic areas. The information may be used to locate areas with high levels of traffic-related pollution and to take action to lower vehicle emissions, such as encouraging the use of electric vehicles or enacting traffic control measures.

## III. IMPLEMENTATION DETAILS

There are numerous stages involved in setting up the NodeMcu8266-based wireless air and sound monitoring system:

**3.1. Hardware Configuration:** The system includes sensors to detect levels of noise and air pollution as well as a NodeMcu8266 microcontroller as the microcontroller. The sensors utilized include MQ-135 for nitrogen dioxide and particulate matter, MQ-7 for carbon monoxide, and a sound sensor for noise pollution. **Software Development:** The NodeMcu8266 microcontroller is programmed using the Arduino Integrated Development Environment (IDE). The sensor results are read out by the C++ code, which then uses Wi-Fi to send them wirelessly to a cloud server.

#### i. Arduino Integrated Development Environment(IDE):

The Arduino IDE, in general, is a user-friendly and adaptable tool that makes it easier to program microcontrollers like the NodeMcu8266. It's a great option for creating projects with the NodeMcu8266 board because of its intuitive interface, library management system, and platform compatibility.

The literature states that the Arduino Integrated Development Environment (IDE) is made up of menus, a toolbar with common function buttons, a message area, a text console, and a text editor that allows users to write code. The



IDE is open-source software that works with Windows and Mac OS X and is used to develop and upload code to Arduino Boards

**ii.Thing Speak:**

Thing Speak is an open-source Internet of Things (IoT) platform that allows users to collect, analyse, and act on sensor data from a variety of sources.

Thing Speak also allows users to create custom applications and dashboards using MATLAB scripts or third-party plugins.

**3.2. Software Development:**

The NodeMcu8266 microcontroller is programmed using the Arduino Integrated Development Environment (IDE). The sensor results are read out by the C++ code, which then uses Wi-Fi to send them wirelessly to a cloud server.

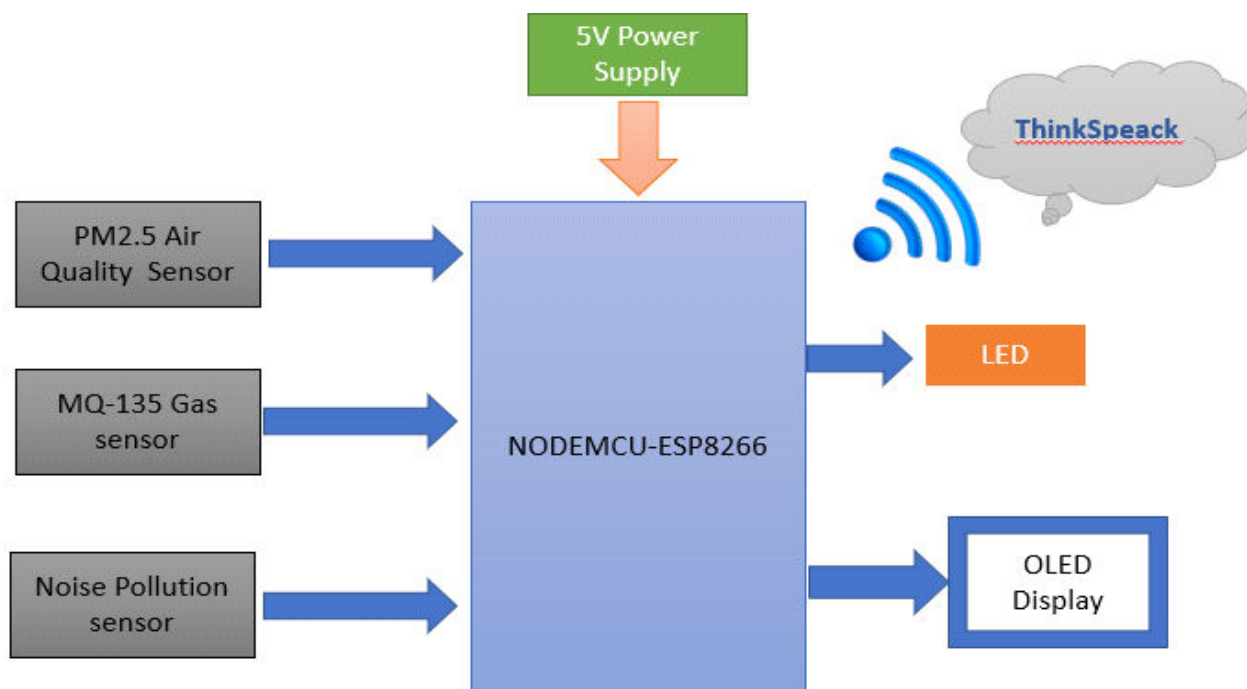
**3.3. Cloud Server Configuration:**

The NodeMcu8266 transmits data, which is received and saved in a cloud server. Since the cloud server is accessible from any location with an internet connection, it is simple to check on pollution levels from a distance.

**3.4. User Interface:**

To show the pollution levels detected by the system, a user interface is created. You can use a web application or a mobile application to access the user interface.

**3.5. Implementation of Air Quality Monitoring System using NodeMcu8266:**



**3.5.1.Assemble the necessary elements:**

A NodeMcu8266 Wi-Fi module, an air quality sensor (such the MQ-135 or MQ-7), and the required jumper wires are required.

**3.5.2.Hardware connection:**

Use jumper wires to connect the air quality sensor to the NodeMCU8266 module. Depending on the sensor and NodeMcu8266 board, the precise pin connections may change. For information on pin configurations, see the sensor's and the NodeMcu8266's documentation.

- i.MQ135
- ii.PM2.5 Air Quality Sensor
- iii. ESP8266 Wi-Fi Module
- iv. I2C OLED Display
- v. Cables and Connectors
- vi. PCB and Breadboards





**3.5.3. The development environment should be set up:**

Install the NodeMcu8266 board's required libraries and the Arduino IDE.

**3.5.4. Set up Wi-Fi connectivity:**

Set up your Wi-Fi network on the NodeMcu8266 module. To connect to Wi-Fi, enter the correct SSID and password in the code.

**3.5.5. Use the NodeMcu8266:**

Module's integrated Wi-Fi capability to send the data to a distant server or cloud computing platform. To communicate the data to a server for storage and analysis, you can use protocols like MQTT or HTTP.

**3.5.6. Analysing and displaying:**

Establish a cloud platform or server to accept the delivered data. To determine air quality indicators like particulate matter, carbon monoxide levels, or other pertinent metrics, process and analyse the data. Employ visualization

**3.6. The instructions below may be used to send alarm messages to a phone:**

**3.6.1. Configuring the hardware:**

Connect the NodeMcu8266 module to the power source and any necessary air quality sensors in accordance with their instructions.

**3.6.2. Install the necessary software:**

Install the required libraries for the NodeMcu8266 board and any extra libraries for the air quality sensor(s) after setting up the Arduino IDE.

**3.6.3. Input the code here:**

Create the software for the NodeMcu8266 that will read data from the air quality sensor(s) and create a Wi-Fi connection. Moreover, incorporate a code for a text message alert delivery to phone

**3.6.4. Set up messaging and Wi-Fi services:**

For the NodeMcu8266 to be connected to the internet, enter the Wi-Fi network credentials in the code. To send SMS or other alert messages, create an account with a messaging service provider (like Twilio) and get the necessary credentials (phone numbers, API key).

**3.6.5. Implement an alarm system:**

In the code, specify the air quality parameter thresholds. Trigger the warning mechanism when the sensor readings go over the set thresholds. Send alert messages to the specified phone number(s) using the messaging service API

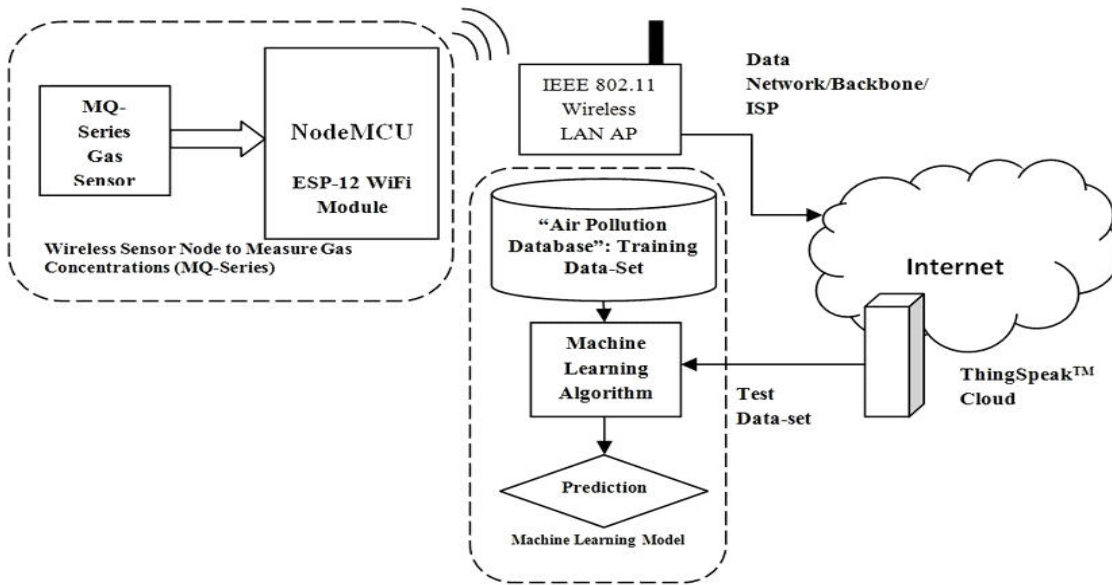
**Working on the proposed System**

We are seeking to advance agricultural practise from conventional to precision agriculture with the suggested technology. By utilizing real-time data from soil sensors, farming practices may be made much more accurate and efficient. The NPK sensors keep track of the soil's levels of nitrogen, phosphorus, and potassium. Along with the DHT11 sensor, soil moisture, and PH sensor, one of these sensors is used. The system's objective is to help farmers make wise crop selections. In addition to historical temperature and humidity data from the website, realtime data is also gathered and stored to increase accuracy. The project analyses temperature and humidity levels in the field using live data from the DHT11 sensor, previous data gleaned from the website and/or Google, the type of soil the farmer uses, and past rainfall data in order to be definite and precise in crop forecast. Learning networks were used to train the dataset. The dataset utilized for training comprises crop PH values that match these parameters as well as temperature and humidity.

Based on the parameters, the relevant historical and real-time data are obtained. To get the most precise outcome, the accuracy offered by several machine learning techniques is compared before being delivered to the customer.

In addition to the best crop, moreover, the system suggests the best crop fertilizer. Choosing the proper algorithm is the important step in machine learning, Random forest gives more accuracy but SVM is faster and more accurate than random forest, If the data is Multidimensional and having a large number of features in that case SVM has better

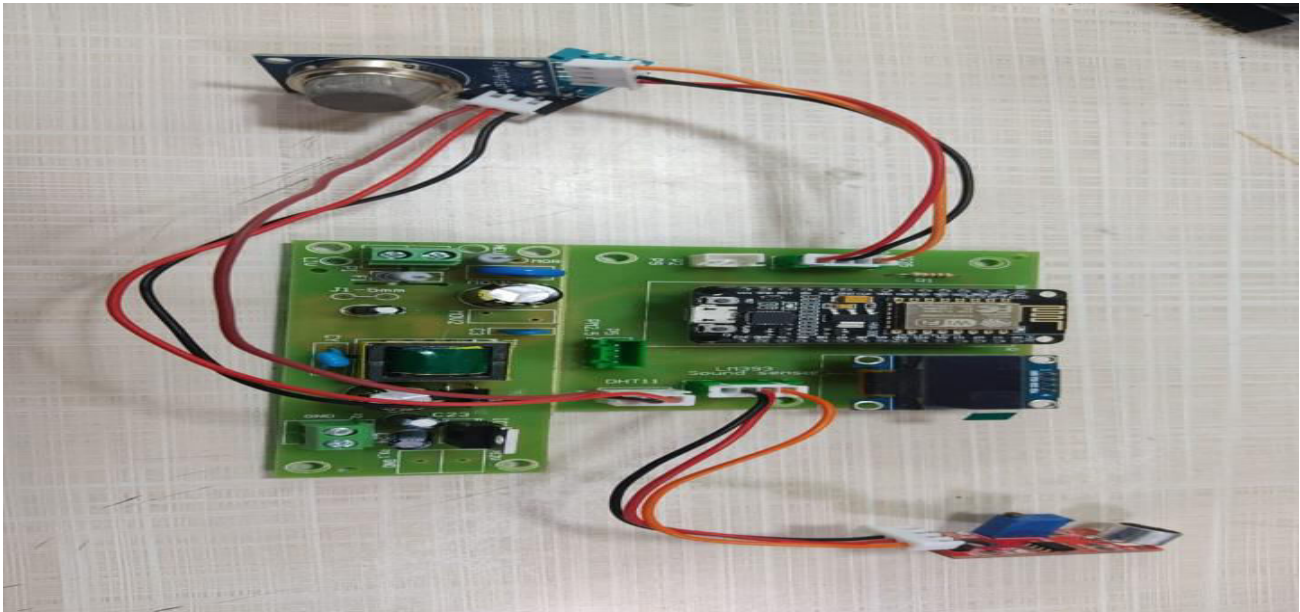
accuracy than Naïve Bayes, that’s why we choose SVM (Support Vector Machine) algorithm for the crop prediction, and support vector machine gives more accuracy and efficiently works on large amount of data.



**IV. RESULT**

**4.1. Hardware:**

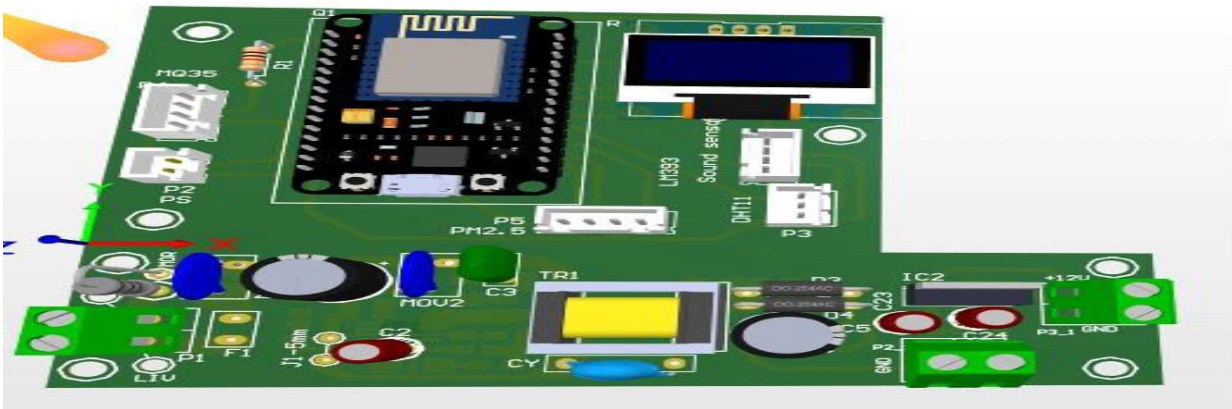
1. NodeMcu8266 Module: It is a Wi-Fi enabled microcontroller board based on the ESP8266 chip. It provides the main processing unit for the system and enables wireless communication with the internet.
2. Air Quality Sensor: This sensor is used to measure various parameters related to air quality, such as particulate matter PM2.5, carbon monoxide (CO), carbon dioxide (CO2), temperature, and humidity. Examples of air quality sensors that can be used include the SDS011, BME280, or the MQ series gas sensors.
3. Sound Sensor: This sensor is used to measure sound levels in the environment. It captures acoustic signals and converts them into electrical signals for analysis.
4. Display (Optional): A display unit such as an LCD screen or OLED display can be used to provide real-time visualization of the monitored data.
5. Breadboard and Jumper Wires: These components are used for prototyping and connecting the various sensors and modules together.



#### 4.2. 3D Module:

The 3D module design should consider the appropriate placement and integration of these components, ensuring proper ventilation for the air quality sensor and accurate sound level detection for the sound sensor. Additionally, the design should provide access to the NodeMcu8266 module for programming and connectivity purposes.

It is recommended to consult with a 3D designer or engineer to create a detailed and customized 3D module design based on the specific dimensions and requirements of your Wireless Air & Sound Monitoring system.



#### 4.3. Thingspeak:

- i. Data Transmission: The NodeMcu8266 module can be programmed to send the monitored air quality and sound level data to the ThingSpeak platform. This can be achieved using the ThingSpeak API, which allows for easy communication between the NodeMcu8266 and the ThingSpeak server
- ii. Data Analysis: ThingSpeak also supports the integration of MATLAB® Analytics, which allows for advanced data analysis and processing. This feature enables users to apply algorithms and perform complex computations on the collected data, enabling deeper insights and potential correlations between air quality, sound levels, and other factors.



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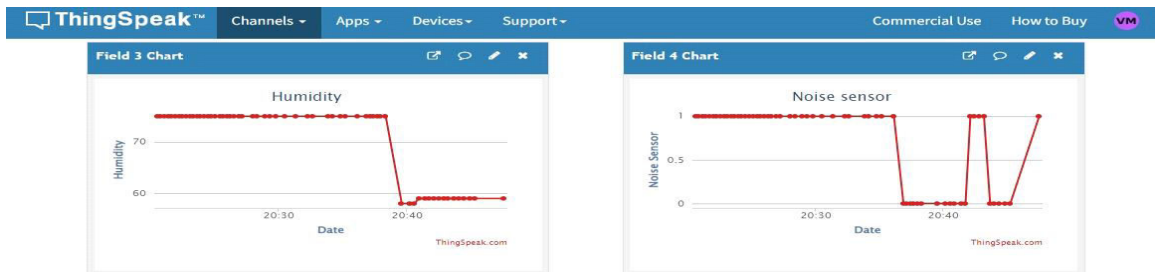
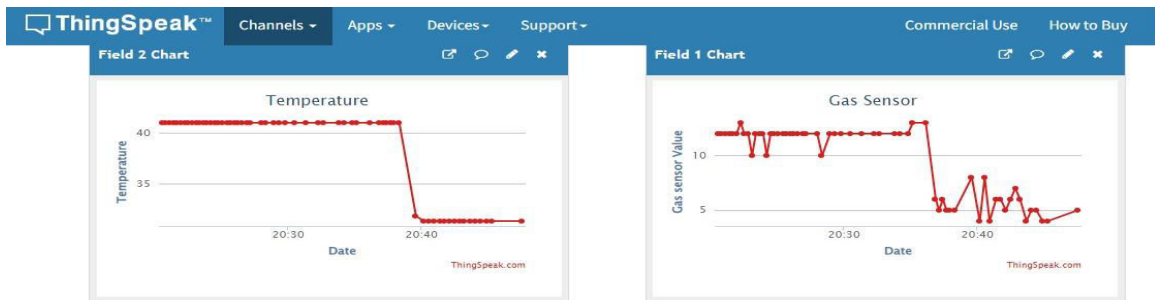
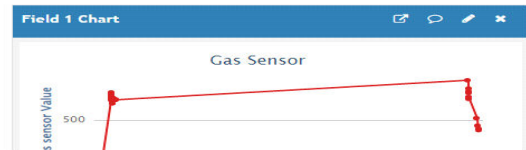
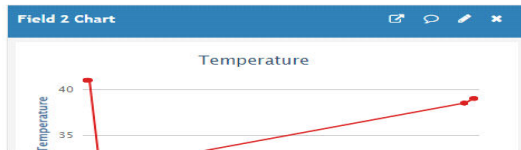
Private View Public View Channel Settings Sharing API Keys Data Import / Export

Add Visualizations Add Widgets Export recent data

MATLAB Analysis MATLAB Visualization

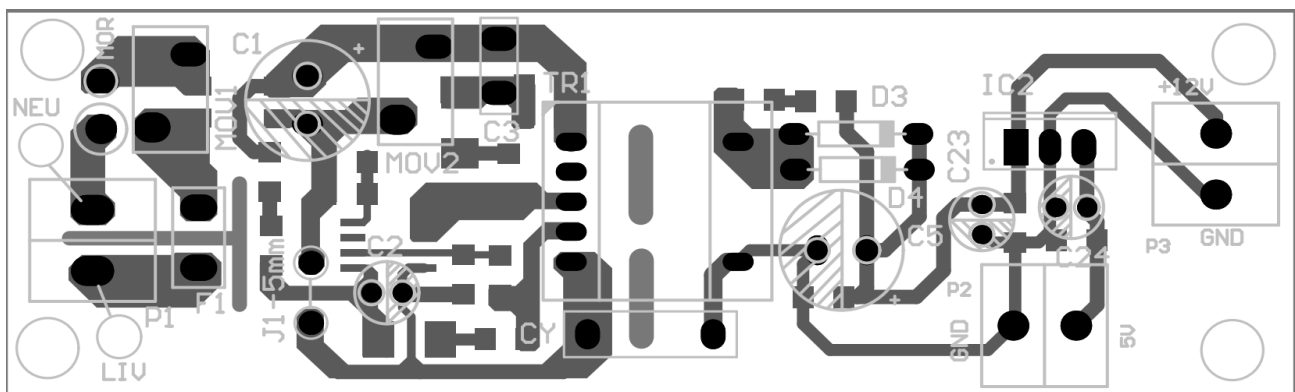
Channel Stats

Created: 26 days ago  
 Last entry: 7 days ago  
 Entries: 1425



4.4. Power supply:

- 1.The Mcu8266 module typically requires a power supply of 3.3V.
- 2.The power source can be connected to the VIN or VCC pin of the NodeMcu8266 module.
- 3.It is important to pay attention to the polarity while connecting the power supply to the module, ensuring that the positive and negative terminals are correctly aligned.
- 4.Once the power supply is connected, the NodeMcu8266 module should power on and start functioning.







## V. CONCLUSION

In conclusion, this paper proposes a wireless air and sound monitoring system that utilizes NodeMcu8266, a low-cost and open-source Wi-Fi module, to collect and transmit data wirelessly. The system is equipped with multiple sensors, including gas sensors and sound sensors, and utilizes a cloud-based platform for data processing and analysis. Compared to existing systems, the proposed system provides a cost-effective and efficient solution for real-time air and sound monitoring, and it is more versatile and flexible. The proposed system has the potential to be used in various applications, such as environmental monitoring, public health, and building automation. Future work can focus on expanding the sensor network, improving the accuracy of data analysis, and integrating the system with other smart devices.

## REFERENCES

The approach suggested in this study is based on earlier work on wireless sensor networks for tracking sound levels and air quality. Relevant references include Wu et al. (2019), who presented a wireless sensor network for monitoring urban sound levels utilising sound sensors and video cameras, and Hamedi et al. (2019), who offered a Zigbee-based wireless sensor network for interior air quality monitoring. Garg et al. (2019), who suggested an Arduino-based IoT air pollution monitoring system, is another pertinent source. These references offer information on various sensor setups and data transmission methods that may be used for monitoring air and sound. Here are some additional references for the proposed system:

1. Mahmood, M. A., Ali, M., and Khan, M. A. (2020). Air quality monitoring system powered by Arduino and the Internet of Things (IoT). *Dimension*, 153, 107391.
2. Chandrasekaran, K., P. Dasgupta, and T. K. Mandal (2019). Air pollution monitoring system powered by the Internet of Things (IoT). (pg. 165–184) in *Internet of Things (IoT) in Biomedical Engineering*. University Press.
3. J. Singh, M. K. Rana, & D. Singh (2021). machine learning and the internet of things are used in a real-time air quality monitoring system. *Dimensions*: 181, 109575.
4. A. Nadeem, M. Waqas, A. Sajjad, & R. Nawaz (2019). a smart air quality monitoring device with integrated IoT. *2019 Journal of Sensors*.

These references include information on a range of topics related to IoT-based sound and air quality monitoring, such as sensor selection, data processing, and machine learning methods.



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