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REAL-TIME NOISE AND AIR QUALITY MONITORING SYSTEM AT VVCE

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Abstract— One of the major problems today is rising air and sound pollution. The need for effective, affordable, operationally adaptable, and intelligent monitoring systems has been significantly driven by the fast proliferation of infrastructure and industrial facilities that are causing environmental problems like climate change, malfunctioning, and pollution. Monitoring air quality is essential for a successful future and a healthy existence for all of us. Using the Internet of Things (IoT) to track and check real-time air quality and noise pollution in each place for a smart environment, an air quality and noise pollution monitoring system is presented in this study. The system continuously transmits data to the microcontroller using air sensors to detect the presence of dangerous gases and compounds in the air.

Additionally, the system continuously measures the sound level and sends an IoT report to the online server. The sensors communicate with the microcontroller, which then analyses and sends the data via the internet. Wi-Fi is used to designate a framework for an IoT-based sound and air pollution observation, and the cloud is used to set up data access for periodic storage and access. The real-time monitoring and analysis of air quality along with the logging of data to a remote server that receives updates through the internet are all features of the air pollution monitoring system. Parts per Million (PPM) metrics were used to measure the air quality. Due to internet access, this monitored data can be obtained from a distance without going there.

The integration or cooperation of affective distributed sensing units and information systems for data synthesis forms the foundation of this monitoring system. The Internet of Things plays a part in measuring air and sound pollution since it enables data access from far-off sites.

Keywords— IoT, Wi-Fi, Parts per million (PPM).

I. INTRODUCTION

The Air and Sound Monitoring System aims to ensure that air and noise pollution is the worst-case scenario in a developing environment. In order to ensure a better future and a stable standard of living for everyone, it is crucial to monitor air quality and sound.

The fundamental goals of current technological advancements are the monitoring and control of many activities, which are increasingly merged to meet human requirements. It is also referred to as a "smart environment" when items, such as an environment, are fitted with microcontrollers, sensor devices, and different software programs.

Globally, both air pollution and noise pollution are becoming bigger issues. Controlling pollution in specific areas is crucial, as is doing so in specific industries, factories, hospitals, etc. Using our IoT-based air and sound pollution monitoring system, it is simple to monitor pollution levels, such as the amount of air pollution in parts per minute and the level of sound pollution in decibels.

The primary reason for developing an IOT-based system to monitor air and noise pollution is that this problem is worsening. In order to thrive, humans require clean air. The most vital component of human life is air.

Here, we presented an IoT-based air and noise monitoring system that tracks real-time air and noise levels. The proposed design incorporates air sensors to find hazardous polluting gases and is constantly being monitored. Additionally, it has a sound sensor that continuously calculates and reports the noise value. It is the solution for determining the amount of noise and hazardous pollutants i.e., any parameter that exceeds its threshold value triggers the alert.

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The system continuously transmits data to the microcontroller using air sensors to detect the presence of hazardous gases and compounds in the air. The technology also continuously measures sound level and transmits that information via IOT to an online server. The sensors communicate with the microcontroller, which then analyses and sends the data via the internet. This enables authorities to keep an eye on air pollution levels in various locations and take appropriate measures.

II. PROBLEM STATEMENT

These days, air and sound pollution is a major problem. For a better future and everyone's health, it is essential to monitor and manage air quality. Here, we propose an air quality and sound pollution monitoring system that enables real-time monitoring and analysis of air quality and noise pollution in specific locations.

In the case that a parameter exceeds its recommended level, an efficient natural observing framework is crucial for screening and estimating the conditions. In this problem statement, we will explore the implementation of a noise and air quality monitoring system that can effectively detect and report any issues related to air and noise pollution.

The present noise and air quality monitoring systems are vulnerable to hacking, surveillance, and tracking by unscrupulous users and other systems.

III. OBJECTIVE

- To design the circuit diagram and simulate it using suitable software.
- To employ a variety of air sensors in order to identify hazardous gases.
- To integrate advanced detection technology with sophisticated capabilities to provide an air quality and noise level measurement that is both affordable and thorough.
- To use an LCD display panel to display the sensed data in a convenient format.
- To regulate and manage sources that produce and generate noise.
- To employ a variety of air sensors in order to identify hazardous gases.
- To determine the live air quality and noise level in the blocks where it is located.

IV. LITERATURE REVIEW

A) IOT-based Air and Sound Monitoring System for Smart Environment.
Author: T. Manglani, A. Srivastava, A. Kumar, and R. Sharma.

Description: The target of this proposed system was to track air pollution in various parts of the city, as well as noise pollution. It provides a smart system that can monitor live air quality and noise levels. If it finds air quality or noise level exceeding a certain threshold buzzer makes a noise to notify the user. Here system continuously monitors sound levels and activates a buzzer if the sound level exceeds the set threshold. There is no doubt that this device can greatly enhance the safety of the people.

B) An Efficient Tracking System for Air and Sound Pollution Using IoT.
Author: K. Cornelius, N. K. Kumar, S. Pradhan. P. Patel and N. Vinay.

Description: This paper presents an air quality and sound contamination monitoring system that detects harmful gases and noise levels in the surrounding environment, that permits us to check live data. The system can improve the overall quality of the surroundings. using air sensors and sound sensors for detection and the information is delivered using a microcontroller.

C) Smart Embedded Framework using Arduino and IoT for Real-Time Noise and Air Pollution Monitoring and Alert system.
Author: D. A. Janeera, H. Poovizhi, S. S. Sheik Haseena, and S. Nivetha.

Description: With the help of different air sensors and noise sensors are used to check the level of noise and air. A gas sensor is used to detect harmful gases, ESP8266, sound sensor, gas, humidity, and temperature sensor, and Wi-Fi is connected via the Internet of Things (IoT). This system includes various parameter like level of noise level and poisonous gases which is harmful to humans. The whole system is based on IoT which is monitored through Arduino via sensor and updates all the data of sensors on the cloud. This system will give us real-time updates via the IoT website. This system is used to monitor noise and air pollution levels using a wireless embedded computing system.

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V. SYSTEM DESIGN

BLOCK DIAGRAM:

Below Block diagram represents the major components of the noise and air quality monitoring system.

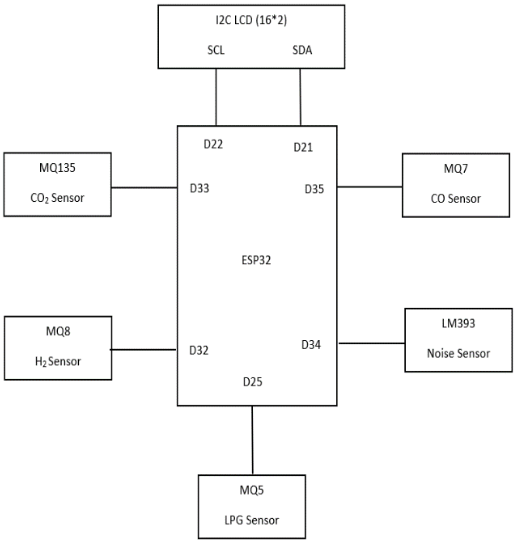

Fig 1 Block Diagram of the proposed System

WORKING:

Sensor Selection: MQ-135, MQ-5, MQ-8, MQ-7 air sensors are selected based on the gases that need to be monitored in the environment. LM393 noise sensor is selected to measure the noise levels. Sensor Calibration The sensors are calibrated to provide accurate readings. Calibration involves exposing the sensors to known concentrations of the gases and noise levels to obtain a reference value for the corresponding sensor output. Circuit Design The circuit is designed using an Arduino board and the sensors are connected to the board using appropriate interfacing circuits. The code for reading sensor data and displaying it on an LCD display or a computer screen is also written. Real-time Monitoring The system is powered up and the sensors start monitoring the air and noise levels. The readings are displayed on the LCD display or a computer screen in real time. Data Logging The sensor readings can be logged into a database for analysis and long-term monitoring. This data can be used to generate graphs and charts to visualize trends in air and noise pollution over time.

VI. SYSTEM SPECIFICATION

SOFTWARE	HARDWARE
Arduino IDE	MQ5 Gas sensor
Blynk App	MQ7 Gas sensor
	MQ8 Gas sensor
	MQ135 Gas sensor
	LM393
	ESP32
	LCD display

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1. MQ5 Gas sensor

Fig 2 MQ5 EGas sensor

The MQ-5 gas sensor is a popular type of gas sensor that is widely used to detect the presence of combustible gases, such as LPG, propane, methane, and hydrogen, in the air. It is commonly used in gas leakage alarms, gas detectors, and other safety devices. The MQ-5 sensor works on the principle of the heating of a sensing material, usually, a metal oxide, which changes its resistance when it comes in contact with a target gas.

2. MQ7 Gas sensor

Fig 3 MQ7 Gas sensor

The MQ-7 gas sensor is another popular type of gas sensor that is commonly used to detect the presence of carbon monoxide (CO) gas in the air. The MQ-7 sensor works on the principle of the heating of a sensing material, typically a tin dioxide (SnO2) semiconductor, which changes its resistance when it comes in contact with carbon monoxide. The MQ-7 sensor module typically consists of a small circuit board with a sensing element, a heater element, and a comparator circuit. The sensor needs to be powered by a stable voltage of 5V DC, and it outputs an analog voltage signal that is proportional to the concentration of carbon monoxide gas being detected. The output voltage can be read and processed by a microcontroller or other digital circuitry to trigger an alarm or other actions.

3. MQ8 Gas sensor

Fig 4 MQ8 Gas sensor

The MQ-8 gas sensor is a type of gas sensor that is commonly used to detect the presence of hydrogen gas (H2) in the air. The MQ-8 sensor works on the principle of the heating of a sensing material, typically a metal oxide semiconductor, which changes its resistance when it comes in contact with hydrogen gas. The MQ-8 sensor module typically consists of a small circuit board with a sensing element, a heater element, and a comparator circuit. The sensor needs to be powered by a stable voltage of 5V DC, and it outputs an analog voltage signal that is proportional to the concentration of hydrogen gas being detected. The output voltage can be read and processed by a microcontroller or other digital circuitry to trigger an alarm or other actions.

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4. MQ135 Gas sensor

Fig 5 MQ135 Gas sensor

The MQ-135 gas sensor is a popular type of gas sensor that is widely used to detect the presence of various air pollutants, including harmful gases like ammonia, nitrogen oxides, and sulfur dioxide, as well as smoke and other volatile organic compounds (VOCs). The MQ-135 sensor works on the principle of the heating of a sensing material, typically a tin dioxide (SnO2) semiconductor, which changes its resistance when it comes in contact with the target gas.

5. LM393

Fig 6 LM393

LM393 is a low-power, dual voltage comparator IC (integrated circuit) designed for use in a wide range of analog and digital applications. It is commonly used in circuits that require signal level detection or switching, such as in motor control, battery charging circuits, and LED lighting. The LM393 contains two independent comparators that can be used in a variety of different configurations, such as voltage level detection, window comparators, and precision voltage-to-current converters. The output of each comparator is an open collector output, which means that it can sink current but cannot source current. The output can be connected to a transistor or a relay to control other components in a circuit.

6. ESP32

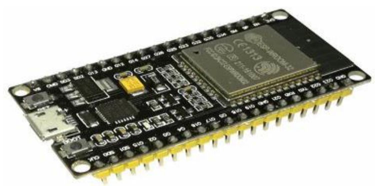

Fig 7 ESP32

ESP32 is a powerful and versatile Wi-Fi and Bluetooth-enabled microcontroller that is widely used in the development of IoT (Internet of Things) applications. It is a successor to the popular ESP8266 microcontroller and is designed to offer more processing power, more memory, and more connectivity options. The ESP32 microcontroller features dual-core processors that can operate up to 240 MHz, up to 520 KB of SRAM, and up to 16 MB of flash memory. It also has built-in Wi-Fi and Bluetooth capabilities, which can be used to connect to wireless networks and devices. Additionally, the ESP32 has a variety of other features, including analog-to-digital converters, digital-to-analog converters, pulse-width modulation, and timers.

7. LCD display

Fig 8 LCD display

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An LCD (Liquid Crystal Display) is a type of flat-panel display that uses the properties of liquid crystals to display images. It is commonly used in various electronic devices such as digital watches, calculators, smartphones, and computer monitors. The LCD display works by sandwiching a thin layer of liquid crystal material between two sheets of polarizing material. When an electric current is applied, the liquid crystal molecules align themselves to allow light to pass through or to block it, depending on the orientation of the polarizing filters. This allows the display to create images by controlling the amount of light that passes through each pixel. LCD displays come in various sizes and resolutions, ranging from small screens for handheld devices to large displays for televisions and computer monitors. They can also be found in a range of colours, including monochrome displays and full-colour displays.

8. Arduino IDE

Fig 9 Arduino IDE

The Arduino IDE (Integrated Development Environment) is a software tool that is used to write and upload code to Arduino microcontroller boards. It provides an easy-to-use interface for programming and testing Arduino projects, making it a popular choice for hobbyists, students, and professionals alike. The Arduino IDE is free and open-source software that can be downloaded from the official Arduino website. It supports a variety of programming languages, including C and C++, and comes with a library of pre-written code that can be used to quickly prototype new projects. The IDE also includes a serial monitor for debugging and testing, as well as a built-in code editor with syntax highlighting and autocomplete features. One of the advantages of the Arduino IDE is its compatibility with a wide range of Arduino boards, including the popular Arduino Uno, Nano, and Mega boards. The IDE also supports many third-party Arduino-compatible boards, as well as various shields and modules that can be used to add additional functionality to the boards.

9. Blynk App

Fig 10 Blynk App

Blynk is a mobile app that allows users to control and monitor their Internet of Things (IoT) devices from their smartphone or tablet. The app can be used to create custom interfaces and control panels for IoT devices, and it provides an easy-to-use interface for connecting to and controlling these devices remotely. With Blynk, users can create custom dashboards that display real-time data from their IoT devices, such as temperature, humidity, and other sensor readings. They can also create custom controls, such as buttons and sliders, that can be used to control the devices remotely.

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VII. METHODOLOGY

Selecting the models: Choose three appropriate models for the air and noise monitoring system. The models could include a gas sensor model (such as MQ135, MQ5, MQ7, MQ8), aand a noise sensor model (such as the LM393), and a microcontroller model (such as the ESP32). Building the hardware: Build the hardware for the air and noise monitoring system using the selected models. This could involve connecting the gas sensor and noise sensor to the microcontroller and adding other components such as an LCD display for displaying the sensor readings. Programming the microcontroller: Write the code for the microcontroller to collect data from the gas and noise sensors and transmit it in real-time to a cloud-based platform or local database. This code could also include any additional functionality such as alerts or notifications if certain thresholds are exceeded. Testing and calibration: Test and calibrate the air and noise monitoring system to ensure accurate and reliable measurements. This could involve testing the system in various environments and making adjustments to the sensors or code as necessary. Deployment and data analysis: Deploy the air and noise monitoring system in the desired location and begin collecting data. This data can then be analyzed to identify patterns or trends in air quality and noise pollution, and used to inform decision-making around environmental management and public health

VIII. RESULTS AND DISCUSSION

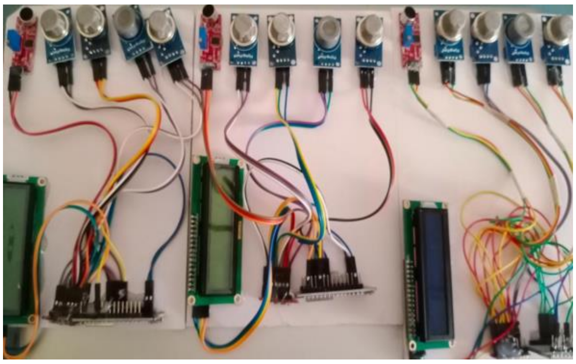

Fig 11 HARDWARE SYSTEM OF THE PROPOSED WORK

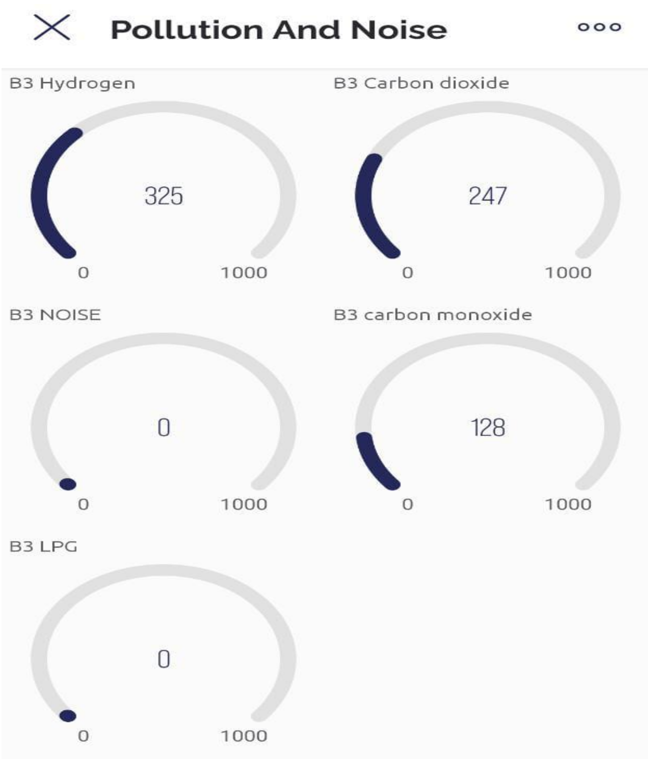

Fig 12 Figure showing the data updated on Blynk App

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Fig 13 Display of LCD showing the air and noise values

In the results section, the focus would be on the data collected in real-time from the air and noise monitoring system. This could include information such as the levels of pollutants detected by the gas sensor, the decibel levels measured by the noise sensor, and any trends or patterns identified in the data over time. The data collected in real-time would be compared to established standards and guidelines to determine if air and noise pollution levels are within safe levels.

IX. CONCLUSION

The real-time air and noise monitoring systems have the potential to provide valuable information about air and noise pollution levels in a given area. By continuously measuring and transmitting data in real-time, these systems can help identify sources of pollution, monitor the effectiveness of pollution reduction strategies, and provide data for policy decisions around environmental management and public health. The development and deployment of a real-time air and noise monitoring system require careful consideration of the models, hardware, and software used. The selection of appropriate sensors, microcontrollers, and communication technologies is crucial to ensure accurate and reliable measurements. Additionally, the system needs to be calibrated and tested to ensure that it functions correctly and provides accurate data. Despite the potential benefits, real-time air and noise monitoring systems also face challenges and limitations. The cost of implementation and maintenance can be high, and the accuracy of the sensors may be affected by environmental factors such as temperature and humidity. Ongoing calibration is necessary to ensure that the system provides reliable data.

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