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DECIBEL LEVEL MONITORING SYSTEM

D.JAGAN[1], R.SRIVIDYA[2], K.SNEHA[3], G.PRIYADHARSHINI[4], CH.SHIVA SHANKARA VARAPRASAD[5]

[1]Assistant Professor, Dept. of Electronics & Communication Engineering, Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India

[2,3,4,5] UG Student, Dept. of Electronics & Communication Engineering, Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India

1. ABSTRACT

In urban and industrial environments, noise pollution is a significant concern with potential health and environmental impacts. To address this issue, a Decibel Level Monitoring System (DLMS) utilizing Internet of Things (IoT) technology. This aims to continuously monitor and analyze ambient noise levels in real-time, providing valuable data for regulatory compliance, noise mitigation strategies, and public awareness.The DLMS consists of sensor nodes deployed strategically across the target area, equipped with sound level meters and IoT connectivity modules. These nodes collect ambient noise data at regular intervals and transmit it wirelessly to a central server for processing and analysis. The central server hosts a cloud-based platform capable of storing, managing, and visualizing the collected data in an intuitive manner.

Overall, the Decibel Level Monitoring System offers a proactive approach to addressing noise pollution by providing accurate, real-time data for informed decision-making and effective implementation of noise control measures.

2. INTRODUCTION

Noise pollution is a prevalent environmental issue with significant impacts on human health, well-being, and quality of life. Urbanization, industrialization, and transportation have contributed to the escalation of noise levels in various environments, ranging from residential areas to industrial zones. Excessive noise exposure can lead to adverse health effects such as hearing impairment, sleep disturbances, stress, and cognitive impairment. Additionally, it can disrupt wildlife habitats, interfere with communication, and degrade the overall living environment.

In response to these limitations, the integration of Internet of Things (IoT) technology offers promising opportunities for developing robust and scalable noise monitoring systems. By leveraging IoT-enabled sensors, wireless connectivity, and data analytics, it becomes possible to

create real-time, remote-accessible monitoring solutions capable of capturing detailed insights into noise levels across diverse environments.

3. LITERATURE REVIEW

4. **With an aim to reduce the unnecessary sound pollution and work towards it, helps present the IOT concept of Smart sensor unit for environmental sound level measurement. Arduino UNO microcontroller, Microphone, Lo-Ra click module and antenna are used for connection and cloud storage to the global TTN platform is used for implementation. The system has good performance in terms of sustainability, acquisition and representation of measured value of Sound level. The implementation of sound-level monitoring IOT based on MQTT protocol is presented where Node MCU, sound sensor, microphone and desktop is used for implementation. On subscriber side, the measured data is shown and collected in node MCU. The System constantly keeps measuring the sound level in different areas using the sound sensors and these sensors constantly transmit data which in turn is then used by the authorities to take an imposing action wherever necessary. The sensors are deployed in different areas and then they transmit the exact values (sound level) to the Node MCU. After the processing of these values is done the Node MCU transmits these values to the cloud using Thingspeak.**
5. **IoT has been implemented in many noise monitoring systems nowadays including mobile phones and vehicles. These technologies were invented and developed because of the demand from society to have systematic and efficient system for monitoring purpose. With the use of cloud server, the users can access the data at anytime and anywhere . It is an effective way to reduce the work for authorities and less time consuming when recording data.**
6. **METHODOLOGY**
7. **The methodology of a decibel level monitoring system involves several key steps and considerations to accurately measure and analyze sound levels. Here's a detailed outline of the typical methodology:**
8. **Choose appropriate sensors capable of capturing sound waves effectively. This may include microphones or specialized sound detectors designed for specific frequency ranges or environmental conditions. Proper placement of sensors is crucial for accurate monitoring. Sensors should be positioned strategically to capture sound from relevant sources while minimizing interference from background noise or other sources.Calibrate the monitoring system regularly to ensure accurate measurements. Calibration involves comparing the system's readings to a known reference standard and making adjustments as necessary. This helps maintain consistency and reliability in the measurements. Convert the analog signals from the sensors into digital signals using analog-to-digital converters (ADC). This allows for further processing and analysis of the sound data.Process the digital signals to filter out unwanted noise, enhance signal clarity, and prepare the data for decibel level calculation. Signal processing techniques may include filtering, amplification, and digital signal processing (DSP) algorithms. Calculate the decibel level based on the processed sound data. Decibels (dB) are calculated using logarithmic formulas relative to a reference level. The formula for decibel calculation is typically based on the ratio of the measured sound intensity to a reference intensity level.**
9.
10. **BLOCK DIAGRAM**

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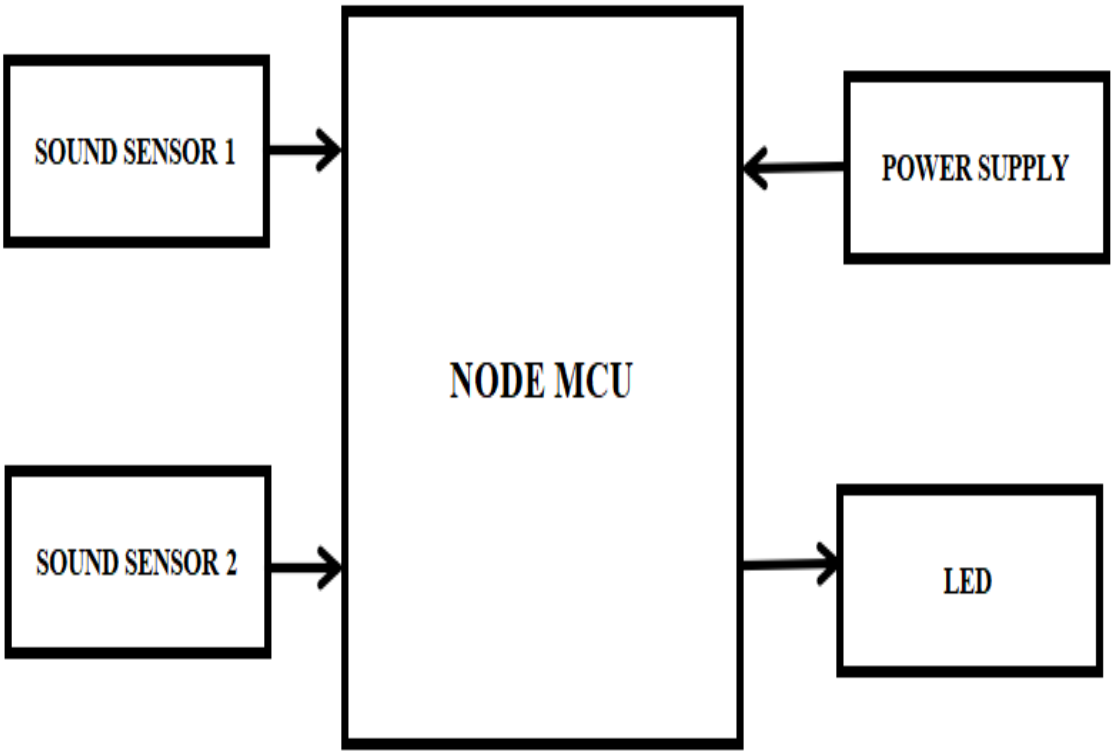

Fig1:Block Diagram

5.1 Hardware Components:

NodeMCU:

NodeMCU Development Kit/Board consists of an ESP8266 wifi chip. ESP8266 chip has GPIO pins, serial communication protocol, etc. features on it.

ESP8266 is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. For more information about ESP8266, you can refer to ESP8266 WiFi Module.

The features of ESP8266 are extracted on the NodeMCU Development board. NodeMCU (LUA based firmware) with Development board/kit that consists of ESP8266 (wifi enabled chip) chip combines NodeMCU Development board which make it a stand-alone device in IoT applications.

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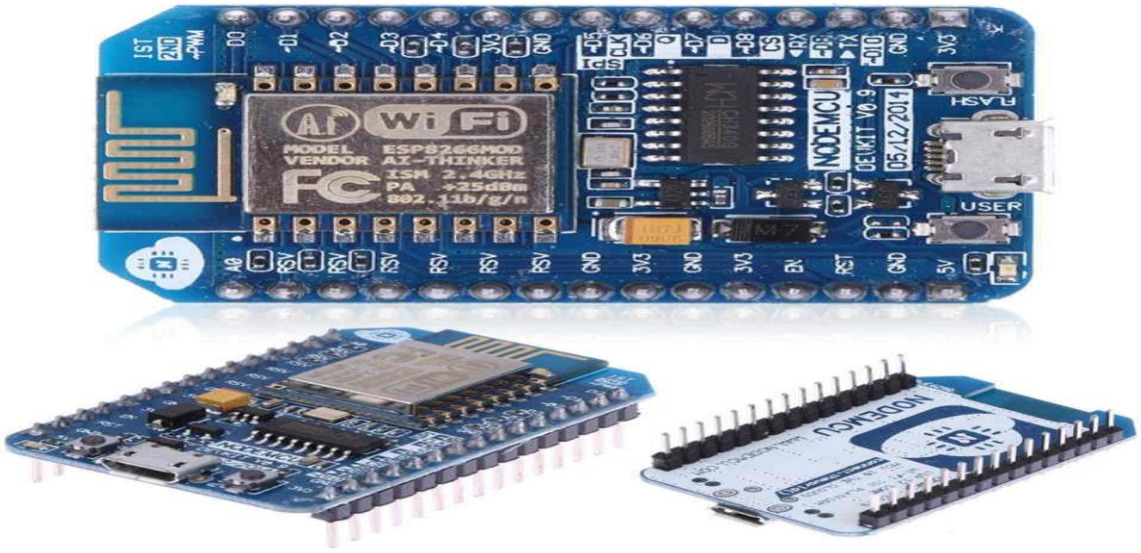

19.
20. Fig2:NodeMCU
21.
22. Sound Sensor:

The sound sensor is one type of module used to notice the sound. Generally, this module is used to detect the intensity of sound. The applications of this module mainly include switch, security, as well as monitoring. The accuracy of this sensor can be changed for the ease of usage.

This sensor employs a microphone to provide input to buffer, peak detector and an amplifier. This sensor notices a sound, & processes an o/p voltage signal to a microcontroller. After that, it executes required processing.This sensor is capable to determine noise levels within DB's or decibels at 3 kHz 6 kHz frequencies approximately wherever the human ear is sensitive. In smartphones, there is an android application namely decibel meter used to measure the sound level.

23.
24. Fig3:Soundsensor
25.
26. 5.2 Software Required:
27. Aurdino IDE:

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller)

and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

The key features are

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

  After learning about the main parts of the Arduino UNO board, we are ready to learn howto set up the Arduino IDE. Once we learn this, we will be ready to upload our program onthe Arduino board.

Thing speak

Thing speak is an IoT analytics platform service that allows you to aggregate, visualize and analyse live data streams in the cloud. Thing Speak provides instant visualizations of data posted by your devices to Thing Speak. With the ability to execute MATLAB® code in Thing Speak you can perform online analysis and processing of the data as it comes in. Thing Speak is often used for prototyping and proof of concept IoT systems that require analytics. Thing Speak allowsyou to aggregate, visualize and analyze live data streams in the cloud.

Thing Speak Key Features

This is a basics and setup tutorial of latitudes and longitudes.

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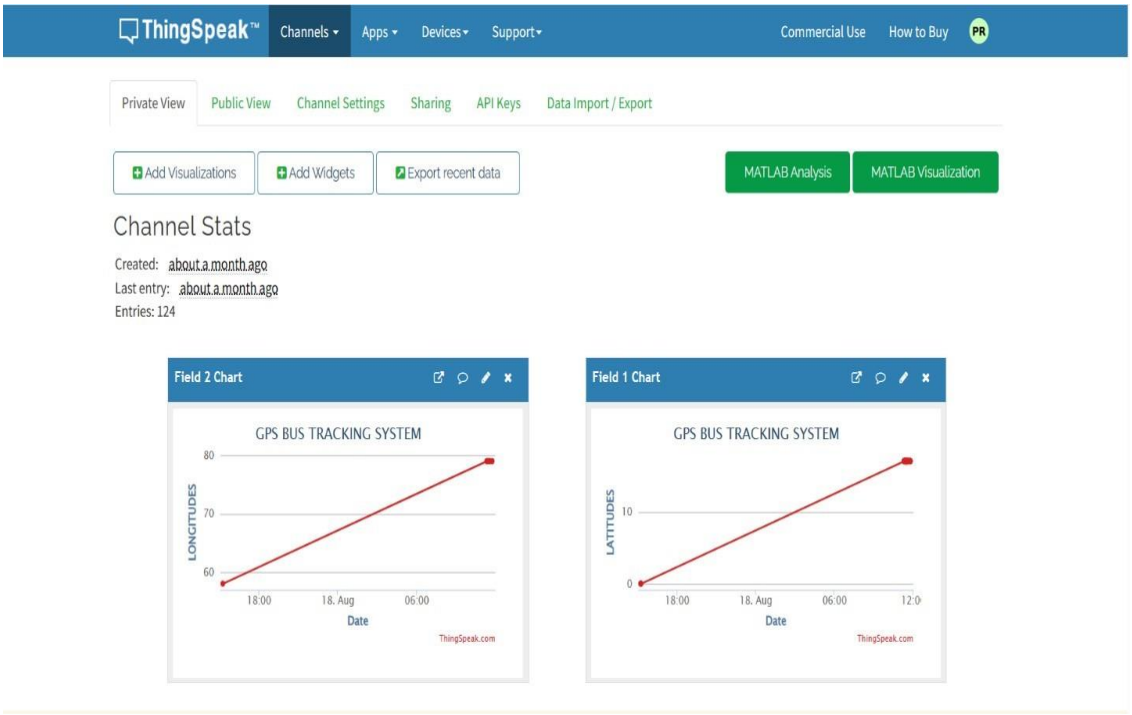
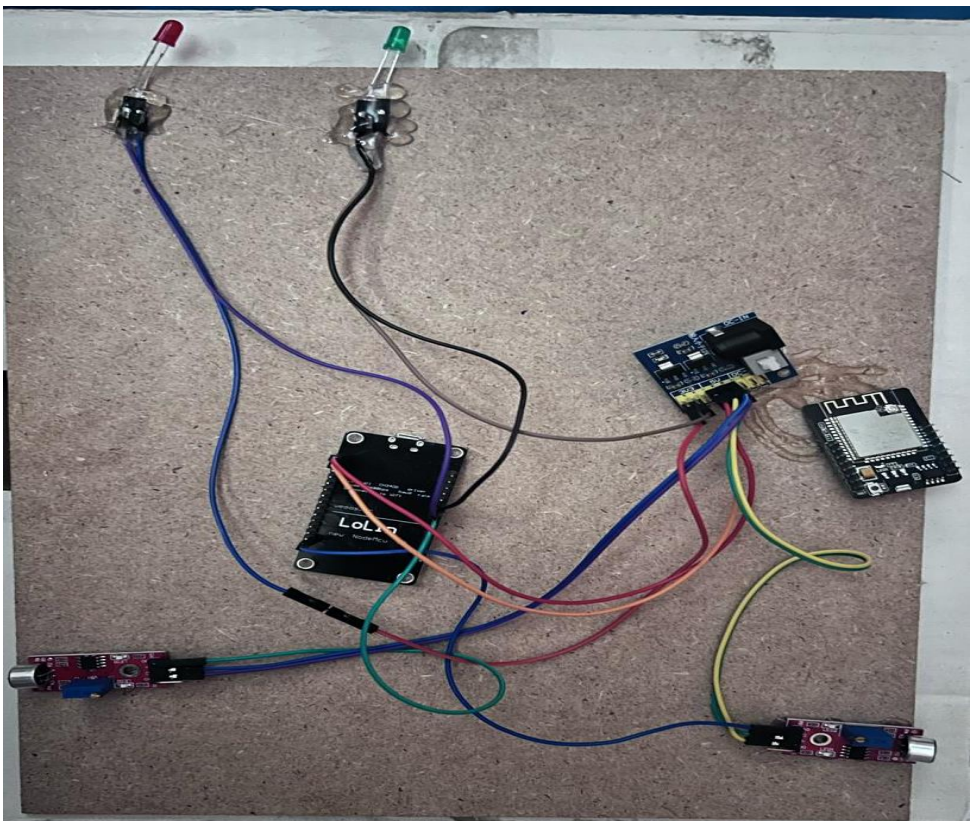


Fig 4. Output of channel fields

28.RESULT



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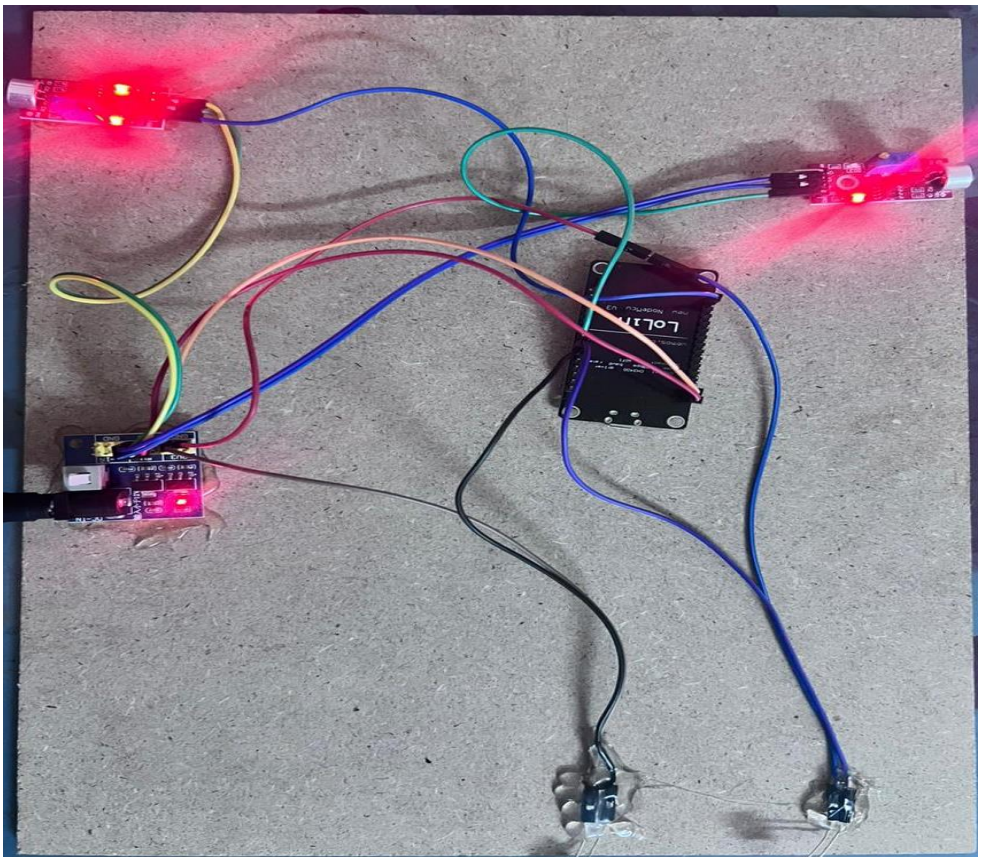

29.CONCLUSION

The conclusion of a decibel level management system would typically involve summarizing the findings and outcomes of the system's implementation and providing recommendations or insights based on those findings. Evaluate how well the system met its objectives. This could involve discussing metrics like the reduction in noise levels achieved, compliance with regulations, or improvements in overall noise management. Discuss any challenges or limitations encountered during the implementation of the system. This could include technical difficulties, resistance from stakeholders, or unforeseen environmental factors.Highlight the benefits of the system, both tangible and intangible. This might include improved health and safety outcomes, enhanced quality of life for individuals affected by noise, or increased productivity in noise-sensitive environments. Provide recommendations for future improvements or adjustments to the system. This could involve suggestions for optimizing the technology used, refining monitoring processes, or enhancing stakeholder engagement. Discuss potential future developments or expansions of the decibel level management system. Consider how advances in technology or changes in regulations might impact the system's effectiveness and relevance.Summarize the key points discussed in the conclusion and reiterate the significance of the decibel level management system in addressing noise-related issues.

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