Ecosense: An IoT System for Detecting Suitable and Sustainable Living Conditions

Y. Jeevan Nagendra Kumar [1], *Ragi* Chandan[1], *Sri Harsh* Somanini[1], *Suresh* Vadtya[1], *Deepika* Dangi[2]

[1] Information Technology, Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad.
[2] School of Applied and Life Sciences, Uttaranchal University, Dehradun

Abstract: The EcoSense project intends to create a sustainable IoT system to detect and track whether living circumstances are suitable for individuals. The system gathers sensor data and measures important aspects including temperature, air quality, and noise level. The degree of sustainable air pollution is determined by air pollution sensors, which monitor several dangerous chemicals including CO and CO2 in the atmosphere. The noise sensor measures the level of noise and pinpoints the source of excessive noise. Environmental temperature and humidity are measured using sensors. These sensors sustainably and continuously track all of these parameters, sending out notifications when specified thresholds are reached or exceeded. In order to assess the habitat's general compatibility, the sensor data is processed, saved in the cloud, and then examined. Following that, this information is used to give locals immediate feedback so they may decide for themselves how best to enhance their living arrangements as well as the environment and public health. their general wellbeing. This initiative helps to spread the word about living sustainably. The EcoSense initiative has the potential to have a big impact on the environmental sustainability industry. The initiative can assist people and communities in making educated decisions about their environment and taking constructive action to enhance it by offering real-time data on quality of life. The project has the potential to increase public awareness of environmental problems and inspire individuals to take action to safeguard the environment.

Keywords: IOT, Blynk, Real-time Monitoring.

1 Introduction

In recent years, the world has witnessed an alarming rise in pollution levels, posing significant threats to the well-being of human populations and the natural environment. Factors such as rapid urbanization, industrialization, and increasing vehicular emissions have led to a concerning deterioration in the quality of living conditions for individuals and communities alike.Air pollution, the contamination of the atmosphere by noxious substances, is a significant environmental hazard.

Parameters:

1.1 Temperature:

The DHT11 sensor monitors the ambient temperature inside the coal mine. This parameter is crucial for ensuring the miners' comfort and safety, as extreme temperatures can lead to heat-related illnesses or discomfort..

1.2 Humidity:

The DHT11 sensor also measures the humidity levels inside the mine. Monitoring humidity is essential to prevent condensation and maintain a comfortable working environment for the miners.

1.3 Air pollution levels:

The MQ135 sensor detects and measures the concentration of harmful gases, such as carbon monoxide and methane, in the mine atmosphere. Air pollution, the contamination of the atmosphere by noxious substances, is a significant environmental hazard. The presence of pollutants like CO and CO2 in the air can have severe consequences on human health and the environment. High levels of CO2 contribute to global warming and climate change, while elevated CO levels pose immediate threats to human health, leading to respiratory and cardiovascular issues.

1.4 Sound levels:

The LM393 sensor detects and measures the sound levels . Prolonged exposure to high levels of noise pollution has been linked to stress, anxiety, and cognitive impairments, impacting productivity and overall well-being.

Figure 1 shows the air pollution levels and the threshold in the ppm.

RATING	INDEX	CO2 PPM	MEANING
Excellent	1	0 - 400	The air inside is as fresh as the air outside.
Fine	2	400 - 1000	The air quality inside remains at harmless levels.
Moderate	3	1000 - 1500	The air quality inside has reached conspicuous levels.
Poor	4	1500 - 2000	The air quality inside has reached precarious levels.
Very Poor	5	2000 - 5000	The air quality inside has reached unacceptable levels.
Severe	6	from 5000	The air quality inside has exceeded maximum workplace concentration values.

Fig 1 : Air Pollution Levels

Figure 2 displays temperature levels, illustrating the data in degree Celsius (°C). The corresponding rating scale aids in interpreting the comfort levels associated with different temperature, ranging from optimal to uncomfortable conditions.

MEMBERSHIP FUNCTIONS	RANGE (°C)
COLD	8-14
COOL	13-19
NORMAL	18-22
WARM	21-27
HOT	26-32
VERY-HOT	31-39
EXTR-HOT	38-44

Fig 2 : Temperature levels

Figure 3 describes the humidity levels in percentage(%).

Fig 3 : Humidity levels

Figure 4 describes the sound pollution levels in decibles(dB). Noise becomes hazardous above 75 dB.

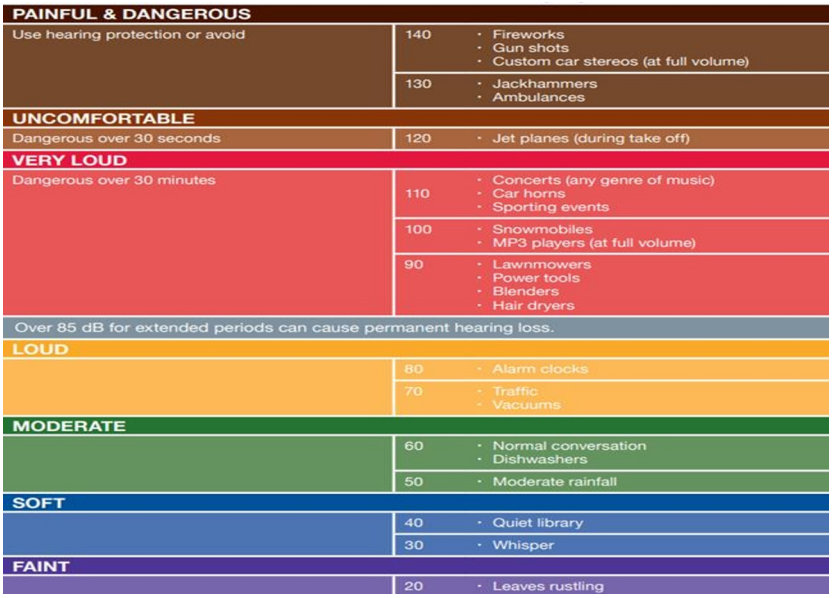

Fig 4 : Sound levels

2 Literature Survey

According to this paper they created an affordable, portable, and simple-to- use device that can be used to continuously monitor the levels of air and sound pollution using the Internet of Things. A microcontroller, Wi-Fi module, and different sensors are included in the system to measure the air quality, temperature, humidity, and sound intensity. The cloud receives the data the sensors have collected so it may be processed and displayed. When pollution levels reach predetermined standards, the technology can also be utilized to notify the appropriate authorities [1].

According to this paper they have created an IoT-based air pollution monitoring system to address this problem. They use a variety of sensors in their system to measure important air quality indicators, such as temperature, humidity, and particle matter. A microcontroller then uses the acquired data to send it to a cloud-based server. Through a web interface, the server analyzes data and produces thorough reports that are available to the public. This approach has proven to be effective in identifying pollution hotspots, monitoring air quality, and assessing pollution management strategies. Additionally, it is crucial for promoting awareness of air pollution concerns and encouraging individuals to take proactive steps in reducing their exposure [2].

According to this paper, in order to gauge the amount of noise present, the system has a noise sensor. The microcontroller, which is attached to the sensor and processes the data before sending it to a cloud server, processes the data. Users have access to the data through a web-based interface on the cloud server, which also saves the collected data. The technique makes it possible to track noise levels in real-time and makes it simpler to locate regions with significant noise pollution. The effectiveness of the noise control measure can also be assessed [3].

This paper addresses the urgent problems of air and sound pollution, which have negative consequences on both human health and the environment. It can be difficult to get real-time data across vast areas using standard methods of monitoring air and sound pollution since they frequently rely on labor-intensive manual operations. The authors suggest an IoT-based monitoring system that can gather real-time data on air quality and sound levels across large areas to get around these restrictions. A network of sensors makes up the system, which measures sound levels and air quality in various places. These sensors then transfer the data they have gathered to a cloud server, where it is processed and stored. The data from the cloud server can be accessed by users to continuously monitor the air quality and sound levels [4].

This paper examines the improvements in IoT-based monitoring systems while addressing the important environmental concerns of air and sound pollution. The authors examine the numerous air quality and sound level sensors on the market, the communication protocols used to transport data from sensors to a central server, and the techniques utilized for data processing and presentation. They also talk about the difficulties and possibilities involved in designing and implementing IoT-based monitoring systems [5].

The authors draw the conclusion that IoT-based air and sound pollution monitoring devices have the potential to completely transform current pollution monitoring procedures. These systems provide for scalability, large-scale monitoring, and real-time data collection. This information can be used to locate areas with high pollution levels, monitor changes in those levels over time, and spread awareness of the problem [6-12].

3 Existing Systems

3.1 Traditional IoT-Based Air and Noise Pollution Monitoring System

Existing air and noise pollution monitoring systems employ Internet of Things (IoT) technology to assess air quality and noise pollution in designated regions in real-time. These sophisticated and sustainable setups utilize air sensors to detect and identify harmful gases and compounds present in the atmosphere. The gathered data is constantly transmitted to a microcontroller. Additionally, the system maintains a continuous measurement of noise levels and transmits the information to an online server through IoT connectivity.

3.2 Traditional Air Pollution Monitoring System Using IOT

Air pollution monitoring systems are designed to observe and track air pollution levels, as well as temperature and humidity in polluted regions. These systems incorporate specialized sensors for air quality, temperature, and humidity, paired with an ESP32 microcontroller equipped with an ESP32 WiFi module. The collected data is then transmitted to the cloud for storage and analysis. These monitoring systems are particularly valuable in environments where the verification of hazardous gas contamination levels is critical. The information on air pollution is utilized to provide timely warnings to workers, ensuring their safety in areas with unhealthy air quality.

4 Proposed System

In this paper, We propose of uses IoT to gather data from multiple environmental sensors and provide real-time and accurate information about the air, sound, and temperature quality in a given environment. Our project provides accurate and up-to-date information about the air, sound, and temperature quality in a given environment. The system continuously collects and updates data from the sensors, ensuring users have access to real-time information about their living conditions. This enables prompt detection of any deviations or changes, allowing for proactive action. Temperature sensors (DHT11) can be integrated into IoT systems to monitor the temperature in real time and trigger alerts or take automated actions when temperature levels exceed or fall below certain thresholds. The system utilizes a cloud server to store and process the collected sensor data. The cloud server facilitates centralized data management, analysis, and advanced insights into living conditions. By analysions data from all metrics individuals can take proactive measures to improve their health and well-being. All of this can be done with a click of a button, the app shows all the metrics details and sends alerts in necessary condition.

5 Methodology

EcoSense, utilizes a diverse range of sensors, including temperature, air quality, and noise sensors, to gather crucial data on environmental conditions. The collected data is transmitted wirelessly to the ESP32 microcontroller, which acts as a central hub for processing and transmitting it to cloud servers. The Blynk server plays a vital role in the project, efficiently storing, processing, and analyzing the sensor data. By receiving data from the ESP32

microcontroller, the Blynk server maintains a comprehensive database and performs essential calculations and analysis to derive meaningful insights. Moreover, the cloud server offers an API that enables mobile applications to access and present the collected data in a user-friendly manner.

The mobile application serves as an interface for users to access the sensor data, allowing real-time monitoring of living conditions. The application isequipped with additional features, including customizable alerts and notifications, which promptly notify users when living conditions surpass predefined thresholds. Ultimately, the EcoSense project significantly contributes to enhancing the overall quality of life and well-being of individuals through the integration of IoT technology and real-time data monitoring.

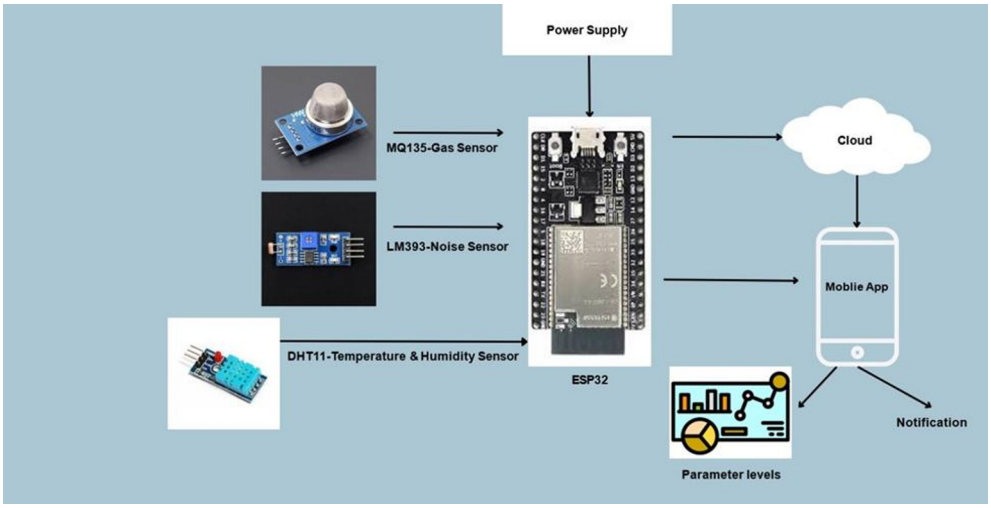

Fig 5: Proposed Architecture

Figure 5 shows the system architecture. The initial phase involves establishing a connection between the ESP32 microcontroller and a variety of environmental sensors, including those for temperature, humidity, and air quality. Subsequently, the project focuses on gathering sensor data from these sources. The collected data then undergoes processing, wherein the system analyzes it to identify any instances where predefined thresholds for temperature, humidity, or air quality are exceeded. In such cases, an alert is triggered, immediately notifying the user. The user is presented with the option to respond accordingly based on the alert received. The system proceeds to present the readings in a comprehensive dashboard, providing users with an intuitive display of the environmental conditions.

6 Results

The EcoSense project utilizes the Blynk IoT platform to display real-time parameter levels of air quality, sound, temperature, and humidity. Through the Blynk app, users can conveniently monitor these environmental metrics on their mobile devices. the system is equipped with customizable alert notifications, ensuring users promptly receive important updates on parameter fluctuations via email or mobile notifications. users have the flexibility to adjust threshold values for various parameters through

the app. The application offers an interactive and user-friendly graphical interface, allowing effortless customization of settings to meet individual preferences and monitoring needs.

Fig 6: Blynk Dashboard

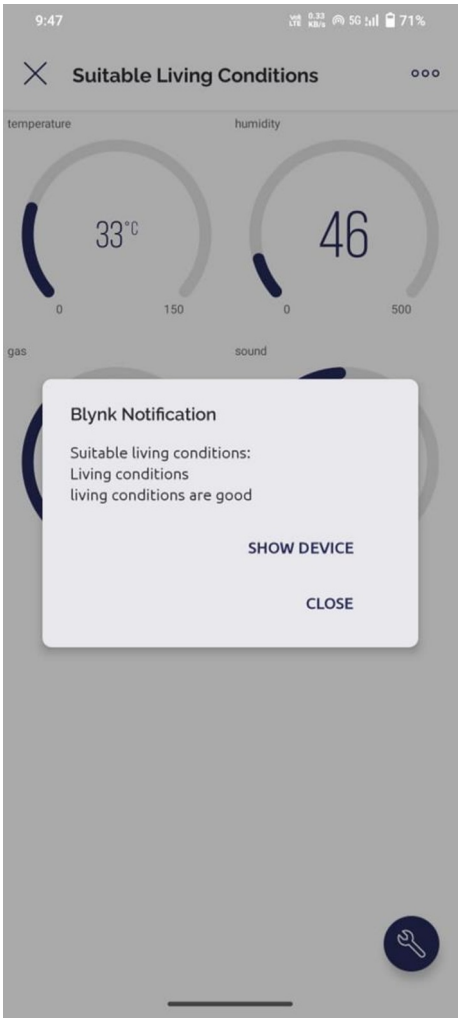

Fig 7: Alerts

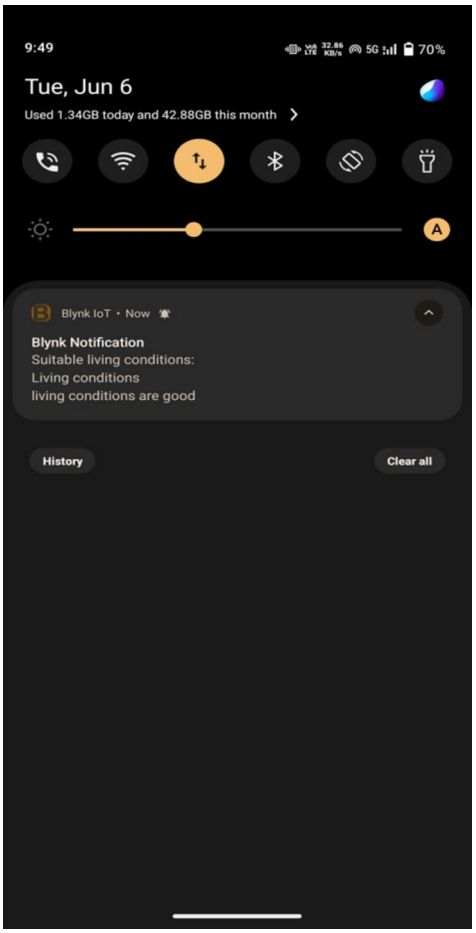

Fig 8: mail Notification

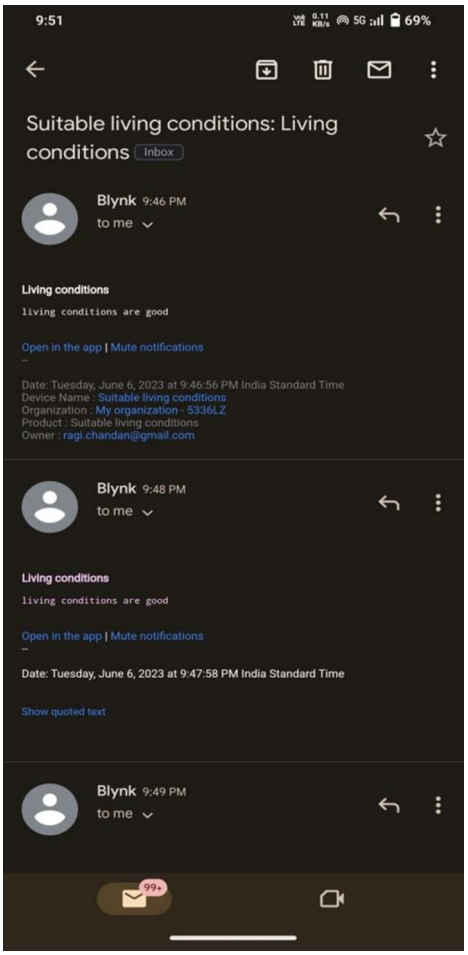

Fig 9: Email Message

7 Conclusion

The Ecosense project is highly beneficial as it empowers individuals to make informed decisions about their living conditions. It enables users to identify and address problems related to air pollution, noise levels, temperature fluctuations, and humidity variations. By having access to accurate and timely data, individuals can take proactive measures to maintain a healthy and comfortable living environment for themselves and their families. This project highlights the importance of leveraging IoT technologies to improve living conditions and promotes sustainable and intelligent living environments. This project has laid the foundation for a scalable and customizable IoT system that can contribute to improving living conditions.

8 Future Enhancements

In terms of future enhancements, there are several areas of improvement. Firstly, expanding the range of sensors to include additional parameters such as light intensity and humidity could provide a more comprehensive understanding of the living conditions. Secondly, incorporating machine learning

algorithms to analyze the collected data could enable the system to provide personalized recommendations for improving the living environment. Additionally, integrating the system with smart home devices would allow for automated adjustments based on sensor readings.Furthermore, enhancing the user interface and user experience of the Blynk app could make it more intuitive and user-friendly. This could include adding additional features, such as historical data visualization and trend analysis.

Overall, the "Ecosense" project has laid the foundation for a scalable and customizable IoT system that can contribute to improving living conditions. With further enhancements and advancements, this system has the potential to revolutionize how individuals monitor and enhance their living environments. By implementing these future enhancements, the Ecosense project can continue to evolve and provide users with even more comprehensive insights into their living conditions. These advancements can contribute to healthier, more comfortable, and sustainable living environments for individuals and communities.

9 References

[1] Pooja; Shraddha; Priyanka and A. D. Sonawane. IoT-Based Air and Noise Pollution Monitoring System. International Journal for Modern Trends in Science and Technology 2021, 7, 0706228, pp. 12-16.

[2] Afidatul Nadia Mok Hat, Syahidah Abd Kadir, Farraniza Mohd Yusof, S. Khadijah Hussin. (2022). IoT Based on Air and Sound Pollution Monitoring Systems. Journal of Physics: Conference Series, 2319(1), 012013.

[3] Agiru Hima Vasanth, Ayush Agrawal, Aditya Bohara, Jagjeet Bebarta, Dr. Muzamel Ahmed, Dr. Suma V. (2023). Air Pollution Monitoring System Using IoT. International Journal of Creative Research Thoughts, 11(1), 179-186.

[4] Ashwini. S. Patila, N.S. Joshi, Jyoti Sabar, Uttam Harale, S. R. Kumbhara. (2022). EL-05. IoT-Based Noise Pollution Monitoring System in Industrial Area. In Proceedings of the 2022 International Conference on Inventive Systems and Control (ICISC), 1-6.

[5] Vidyashree S, Shalini S V, Shilpa M U, Shreyas K R. IoT-based air and sound pollution monitoring system. International Journal of Advanced Research in Innovative Ideas and Trends in Technology (IJARIT), 6(3), 1556-1561. (2022).

[6] Tanuja Borate, Meghalata Lipane, Madhuri Kale, Vaishnavi Pardeshi, and Prof. Prashant Jawalkar. "IoT Based Air and Sound Pollution Monitoring System." International Journal of Creative Research Thoughts, 11(1), 179-186. (2023).

[7] Kaushik Vipul R., Tanaji Dabade, and Vijay N. Patil. "IoT Based Air and Sound Pollution Monitoring System: A Review." Journal of Emerging Technologies and Innovative Research, 8(1), 11-18. (2021).

[8] D. Srinivasa Rao, Ch. Ramesh Babu, Y. J. Nagendra Kumar, N. Rajasekhar, T. Ravi, “Medical Image Fusion Using Transform Based Fusion Techniques”, International Journal of Recent Technology and Engineering, Volume-8 Issue-2 ISSN: 2277-3878

[9] Prasanna Lakshmi, K., Reddy, C.R.K. A survey on different trends in Data Streams (2010) ICNIT 2010 - 2010 International Conference on Networking and Information Technology, art. no. 5508473, pp. 451-455.

[10] Jeevan Nagendra Kumar, Y., Spandana, V., Vaishnavi, V.S., Neha, K., Devi, V.G.R.R. Supervised machine learning Approach for crop yield prediction in agriculture sector (2020) Proceedings of the 5th International Conference on Communication and Electronics Systems, ICCES 2020, art. no. 09137868, pp. 736-741.

[11] Sankara Babu, B., Suneetha, A., Charles Babu, G., Jeevan Nagendra Kumar, Y., Karuna, G. Medical disease prediction using grey wolf optimization and auto encoder based recurrent neural network (2018) Periodicals of Engineering and Natural Sciences, 6 (1), pp. 229-240.

[12] Nagaraja, A., Boregowda, U., Khatatneh, K., Vangipuram, R., Nuvvusetty, R., Sravan Kiran, V. Similarity Based Feature Transformation for Network Anomaly Detection (2020) IEEE Access, 8, art. no. 9006824, pp. 39184-39196