Smart Environment Monitoring Display Using IOT

Krishnaraj R
Assistant Professor
Electronics and Communication Engineering
Bannari Amman Institute of Technology
Erode, India

Divya Dharshini S
UG Scholar
Electronics and Communication Engineering
Bannari Amman Institute of Technology
Erode, India

Sandhya A K
UG Scholar
Electronics and Communication Engineering
Bannari Amman Institute of Technology
Erode, India

Sanjala N M
UG Scholar
Electronics and Communication Engineering
Bannari Amman Institute of Technology
Erode, India

***Abstract* — The goal of the Smart Environment Monitoring Display project is to develop a novel approach to the analysis and visual representation of environmental data in real time. This project makes use of IoT and data visual representation technologies to give users insightful information about their surroundings in an era where environmental sustainability is becoming more important. A collection of environmental sensors will be installed as part of the project to gather information on a variety of factors, including air quality, water level, temperature, and humidity. To collect thorough environmental data, these sensors are positioned strategically in public spaces, industrial zones, and urban areas. After that, the gathered data is sent to a centralised server for real-time processing and analysis. According to our needs, real-time data could be displayed on an LCD display, a mobile app, or a web page. These displays are intended to assist individuals, organisations, or communities in making informed decisions and taking action to improve their living or working conditions. In conclusion, the proposed smart environment monitoring display raises environmental awareness and empowers individuals and communities to make informed decisions to improve the quality of their surroundings, which benefits both humans and the environment. It also helps to create smarter, more sustainable environments for future generations.**

Keywords—IOT, Environment, Awareness, Smart, Humidity, Temperature, Water level, Air quality.

I. INTRODUCTION

Our modern lives are intricately connected to the environments in which we live, work, and play. These environments encompass a spectrum of factors, from the air we breathe and the temperatures we experience to the critical need for safety in the face of potential hazards like fire. Understanding, optimizing, and ensuring the quality of these environmental factors is not just a matter of convenience; it's a vital aspect of our well-being, comfort, and sustainability. In an era of rapid urbanization, advancing technology, and increasing environmental concerns, the need for comprehensive and real-time monitoring of our living and working environments has never been more pressing. A smart environment monitoring display is a cutting-edge technology that provides real-time information about various environmental parameters to ensure safety and comfort.

NodeMCU, a microcontroller that has inbuilt Wi-Fi module connected to various environmental sensors, such as temperature sensors, humidity sensors, air quality sensors, and pollution detectors. These sensors continuously collect data from the environment and transmit it to the microcontroller. This display typically integrates sensors and data visualization techniques to monitor temperature, air quality, humidity, and water level detection. The data are collected and processed from the sensors, presenting it in an easily understandable format through user- friendly interfaces such as digital screens, mobile apps, or web dashboards. Users can access real-time data, historical trends, and receive notifications or alerts to make informed decisions, promote safety, and create a comfortable living or working environment. These systems are essential for both residential and industrial applications, ensuring a healthier and safer space for everyone

Our scope extends to the development of a holistic solution that not onlymonitors various environmental factors but also presents this data in an intuitive and accessible manner. The proposed work seeks to empower individuals and organizations with the knowledge they need to make informed decisions in an ever-changing environment. This project will gain a comprehensive understanding of the significance of Smart Environment Monitoring Displays, their potential to transform the way we interact with our surroundings, and the possibilities they unlock for a greener, smarter, and more informed future. In a world that increasingly depends on data-driven decision-making, these displays represent a pivotal tool in our pursuit of healthier,

more sustainable, and more efficient living environments. By the end of this report, readers will gain a comprehensive understanding of the significance of Smart Environment Monitoring Displays, their potential to transform the way we interact with our surroundings, and the possibilities they unlock for a greener, smarter, and more informed future.

II. RELATED WORKS

From reference [1], In the paper titled "Intelligent controlling of indoor air quality based on remote monitoring platform by considering building environment", the proposed idea was to issue the Air pollution and particularly fine particulate matters that are worthy of serious concern. Fine particulate matter (PMs) exposure will harm human health and may even result in catastrophic damage, resulting in efficient monitoring techniques. For the locations where monitoring stations are difficult to install, it is necessary to bring in a monitoring platform with enough mobility. In this paper, promoted sensor board and particular communication module are combined to create a mobile and portable monitoring platform based on unmanned aerial vehicle (UAV).Additionally, the UAV platform's air quality monitoring will produce crucial data for the regulation of indoor air quality for the indoor environment in buildings.

From reference [2], In the paper titled "Integrated pollution monitoring system for smart city", the proposed idea was to continuously monitor the level of pollution in urban areas. The air's dust particle density, humidity, light intensity, and sound level are just a few of the parameters that change when there is pollution. Wireless sensor networks (WSN) utilising wasp mote smart cities devices, connected with several sensors, such as dust sensor PM-10 (GPY21010AU0F), humidity sensor (808H5V5), luminosity sensor (LDR), and microphone (dBA), are a technology that can be developed for an integrated pollution monitoring system. We used 3G connectivity as a communication protocol to store the data in a cloud system. The developed system performed as anticipated after being tested on a prototype in a controlled laboratory setting. Government officials and decision-makers can use the system's findings as the foundation for further actions aimed at lowering pollution levels.

From reference [3], In the paper titled "IoT Based Smart Indoor Environment Monitoring and Controlling System", the proposed idea introduced an indoor monitoring and controlling device powered by Internet of Things (IoT) technology, which significantly improves people's lives and productivity. The newest or most innovative technology, known as IoT, connects devices to the internet without human intervention. It enables machines to communicate, work together, and gain knowledge from one another's experiences just like people do. In the current situation, the majority of people spend more than 90% of their time in artificial environments, and if there are any changes in the environmental conditions, it can lead to the spread of numerous illnesses that affect the human body, such as cancer, asthma, paralysis, etc. It is necessary to continuously monitor indoor air quality, which can be done with IOT-based devices, in order to get rid of all these conditions. The current study presents the implementation of an Internet of Things (IoT)-based indoor ambience monitoring and controlling platform to achieve good indoor quality. It also has benefits such as being less expensive, taking less time, being more effective, and achieving paperless workflow in a busy environment without involving human-to-human interaction.

From reference [4], In the paper titled "Assessment of Indoor Air Quality of Educational Facilities using an IoT Solution for a Healthy Learning Environment", the proposed idea was an inexpensive, Internet of Things-based environmental monitoring solution that is specifically designed for educational facilities. The system is built around inexpensive Bluetooth Low Energy wireless sensor boards and a single-board computer board-based BLE-WIFI gateway. Because the software components are open source, the system can be further customised to meet regional needs. To gather and display data, the system makes use of SNMP and the free, WEB-based CACTI monitoring framework. In addition to enabling real-time monitoring of these environmental parameters, the system also enables the facility's occupants to receive feedback via LEDs on sensor boards. Numerous studies have shown a link between the air quality in educational buildings and occupants' levels of comfort and concentration. With the system we described in this paper, distributed sensor networks can be used to monitor lecture halls on educational properties.

From reference [5], In the paper titled "The development of evaluation system for ocean environment monitoring data analysis", the proposed idea was to procure, investigate and assessment of the marine climate checking information, to comprehend the current circumstance and dynamic change pattern of marine biological climate and early admonition and guaging of the marine crisis, is the establishment and reason of the security of marine natural climate. Ocean environment monitoring data analysis evaluation system with Visual Studio 2005 as software development environment, new development tool and pick. Oracle database is used as the data access solution in a network-oriented data access mode. The integrity, spatial indexing, and spatial database engine of ArcGIS SDE are in charge of maintaining the geographic database. In order to obtain the hydrological, meteorological, chemical, biological, and other marine environmental monitoring data for time series trend analysis, spatial distribution and change trend analysis, and evaluation of the marine environment analysis, methods of human-computer interaction are used. These methods are combined with the technology of GIS dynamic display, displayed by a user- friendly graphical interface.

III. PROPOSED WORK

In this project, a gas sensor - MQ2, DHT11 sensor, Ultrasonic sensor and IR sensor are integrated with NodeMCU - ESP8266. The Gas sensor (MQ2) senses the leaking gas in the environment. DHT11 Sensor senses the temperature and humidity of the surrounding environment. IR sensor detects the heat of an object and as well as it detects the motion of object with the help of infrared radiation emitted by the object due to their temperature and gives an alarm to the user. Ultrasonic sensor detects the distance of the object (water level) and displays the distance of the water level from ground level. All these collected data are transmitted to the microcontroller which is dumped with the technical coding for the upcoming process. The technical coding has been implemented in Arduino IDE software and dumped into the microcontroller. To establish communication link between microcontroller and output devices Wi-Fi modules are present which is in-built in the microcontroller. The collected data transferred into the microcontroller check for threshold values that has been given in the code. The threshold values of DHT sensor are for temperature 0 to 50 degree Celcius and humidity 30% to 50%, for gas sensor the threshold value is 300 - 10000 ppm. Whenever the collected data exceeds these threshold values then alarm will give an alert on the detection of gas, temperature, humidity and on unknown object's entry into home or indoor places. The values would be displayed continuously in the LCD display whether the value exceeds the threshold or not. These all would help the people to be precautious on any kind of accidents and from unhealthy environment.

IV. BLOCK DIAGRAM

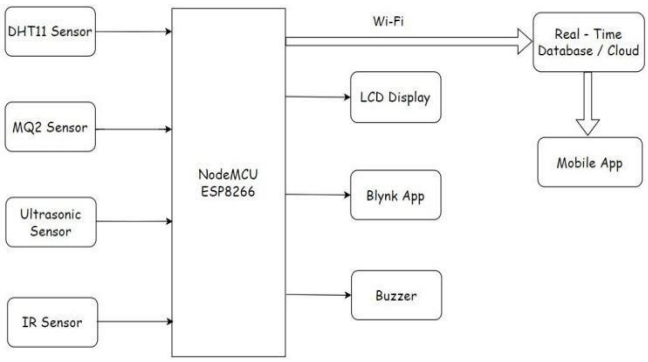

Figure 1: Block Diagram

i. NODEMCU - ESP32

ESP8266 is a cost-efficient and highly integrated Wi-Fi microcontroller for IoT application. With the help of NodeMCU, ESP8266 can be programmed to control various hardware components and sensors. It is capable of functioning consistently in industrial environment due to its wide operating temperature range. It can be programmed using the Arduino IDE making it a popular choice for IoT projects. The microcontroller unit can be used to collect the data form the sensors and transmit the data over Wi-Fi module. The module can also be programmed to send alerts when the collected data exceeds the threshold values. The ESP8266 has low power consumption and compact size making it ideal for IoT application and its built in Wi-Fi capabilities allow for easy data transmission without need for additional hardware. Additionally, the availability of open source libraries and the ease of programming with the Arduino IDE make it an accessible option for developers.

Figure 2: NodeMCU - ESP8266

ii. GAS SENSOR

The Grove-Gas sensor(MQ2) module is useful for gas leakage detecting in home and industry. It can detect H2, LPG, CH4, CO, Alcohol, Smoke and Propane. Based on its fast response time measurements can be taken as soon as possible. Also the sensitivity can be adjusted by the potentiometer. The MQ2 measures gas concentration from 100-10000ppm and its ideal for detecting gas leak, as a gas alarm or for other robotics and other microcontroller projects. The MQ series sensors use a small heating element with an electronic chemical sensor.

Figure 3: Gas Sensor

iii. DHT11 SENSOR

The DHT11 is a commonly used Temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers. The DHT11 sensor is available in a compact, single-package design with three pins for power (VCC), ground (GND), and data (signal). The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%. The sensor usually operates on 3.3V or 5V DC power and

consumes very little power, making it suitable for battery- powered applications.

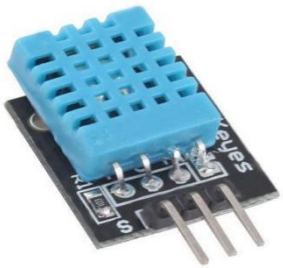

Figure 4: Temperature and Humidity sensor

iv. IR SENSOR

An IR sensor is a type of detector that detects heat of an object and as well as detects the motion of object with the help of infrared radiation emitted by the object due to their temperature. The Infrared radiations are naked to human eyes, that could only be sensed with the help of Infrared sensor. IR sensor is a radiation sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780nm - 50µm. These sensors are frequently employed in different applications, including closeness detecting, movement location and temperature estimation. They are generally utilized in gadgets, security framework, mechanical technology and other fields.

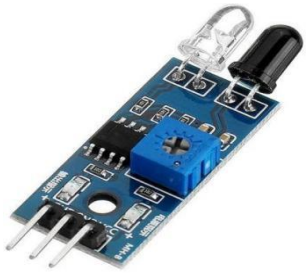

Figure 5: IR Sensor

V. ULTRASONIC SENSOR

A ultrasonic sensor is a instrument that measures the distance of an object utilizing ultrasonic sound waves. A ultrasonic sensor utilize a transducer to send and get ultrasonic pulses that hand-off back data about an object's nearness. It sends the sound pulse to measure the distance or presence of target object, measures the range over the scope of human hearing, around the objective and after estimating the time it takes the sound echo to return. They are typically made of piezo-electric material and they transmit the ultrasonic wave that travels through the air till it encounters the person or object. They are also used to detect, monitor and regulate liquid level in a closed containers. They are also used as level sensors. The distance can be calculated by the formula L = 1/2 * T * C Where L is the distance, T is the time between emission and reception, C is the sonic speed.

Figure 6: Ultrasonic Sensor

V. FLOW DIAGRAM

The flow diagram in the Figure 2 here offers an idea of displaying the data of environmental parameters and also alerts using alarms when exceeding the threshold values which would be helpful for creating an awareness among individuals to be precautious from environmental impacts and take necessary steps to be healthy. The sensors are primary input device that gather data from the environment. The sensors continuously collect data about the surrounding environment. Here temperature, humidity, gas and distance parameters are monitored. The collected data is sent to a microcontroller, which act as a central processing unit of the system. It processes the incoming data and prepares it for display. It checks for threshold values and if the data exceeds the threshold value then it alerts with alarm sound. If doesn't exceed the threshold value then displays the values in the output displays such as LCD display, Web dashboard, Mobile app.

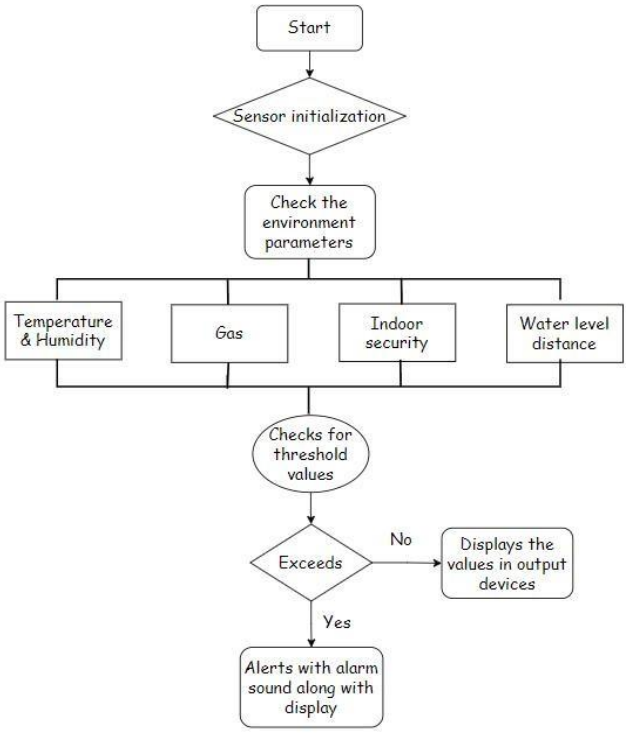

Figure 7:Flow diagram

VI. RESULT

Here the results are displayed in the LCD Display, Blynk App and also in a web dashboard. In LCD Display the temperature, humidity, gas leakage and flammability values will be displayed as values. According to the highness of the values the colour in the LCD display would change.

a. WORK CARRIED IN COMPONENTS

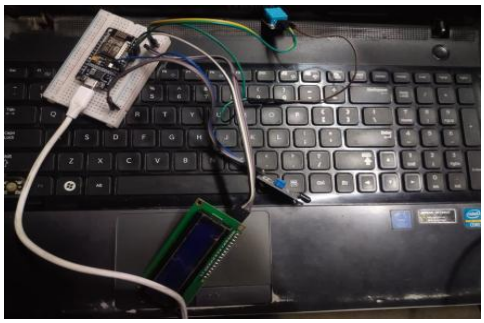

Figure 8: Connection of components

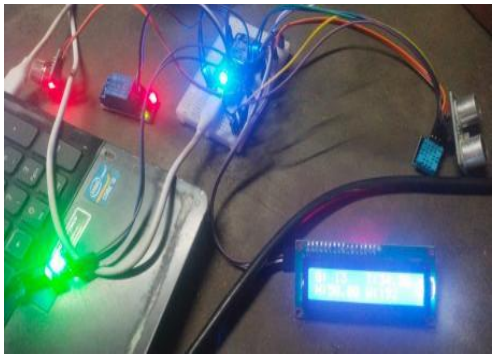

Figure 9: Working model

b. OUTPUT DISPLAYED IN VARIOUS DEVICES

Figure 10: Output displayed in LCD

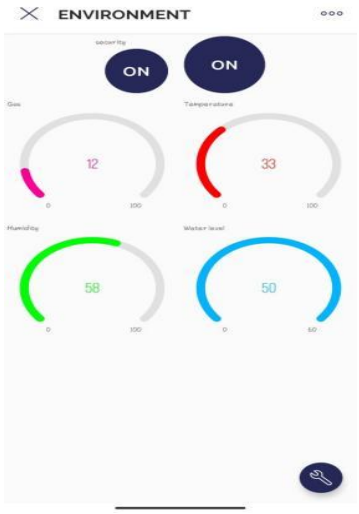

Figure 11: Output displayed in Mobile App

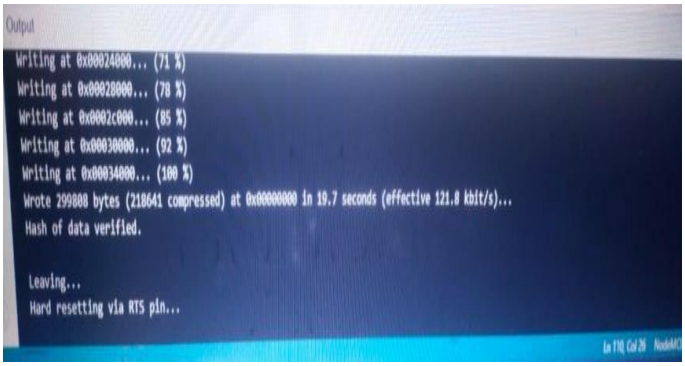

Figure 12. Output displayed in Dashboard

VII. CONCLUSION

The implementation of a smart environment monitoring display offers substantial benefits across various sectors, including homes, industries, and public spaces. Such systems provide real-time insights into critical environmental parameters, facilitating informed decision-making and fostering healthier, more sustainable environments. Smart displays empower users with a heightened awareness of their surroundings by offering real-time data on temperature, humidity, air quality, and more. Users can make informed choices regarding their environment, ensuring comfort and safety. The incorporation of threshold-based alerts ensures that users receive timely notifications when environmental parameters deviate from desired levels. This capability is especially crucial for safety and health in both residential and industrial settings.

VIII. FUTURE SCOPE

In the future, this project could be expanded to show the concentration of each harmful gas present in the atmosphere. We can also display the reason for the pollution in public places by analysing the concentration levels, so that people are aware of the pollution. The activities that promote

pollution can be reduced by understanding the source of the pollution. This also aids asthma patients in avoiding places with high pollution levels.

IX. REFERENCES

[1] D. Pujara, P. Kukreja and S. Gajjar, "Design and Development of E-Sense: IoT based Environment Monitoring System," 2020 IEEE Students Conference on Engineering & Systems (SCES), Prayagraj, India, 2020, pp. 1-5, doi: 10.1109/SCES50439.2020.9236768.

[2] A. Hammami, "Smart Environment Data Monitoring," 2019 International Conference on Computer and Information Sciences (ICCIS), Sakaka, Saudi Arabia, 2019, pp. 1-6, doi: 10.1109/ICCISci.2019.8716469.

[3] A. M. Manoharan and V. Rathinasabapathy, "Smart Water Quality Monitoring and Metering Using Lora for Smart Villages," 2018 2nd International Conference on Smart Grid and Smart Cities (ICSGSC), Kuala Lumpur, Malaysia, 2018, pp. 57-61, doi: 10.1109/ICSGSC.2018.8541336.

[4] A. K. Kanál and K. Tamás, "Assessment of Indoor Air Quality of Educational Facilities using an IoT Solution for a Healthy Learning Environment," 2020 IEEE International Instrumentation and Measurement Technology Conference (I2MTC), Dubrovnik, Croatia, 2020, pp. 1-6, doi: 10.1109/I2MTC43012.2020.9129231.

[5] D. Ram Nivas, M. Kathirvelu, M. Ishwarya Niranjana, R. Krishnaraj and J. Dhanasekar, "Wireless Electronic Notice Board and Attendance Monitoring System," 2022 3rd International Conference on Communication, Computing and Industry 4.0 (C2I4), Bangalore, India, 2022, pp. 1-6, doi: 10.1109/C2I456876.2022.10051245.

[6] H. Zhang, X. Zuo, W. Jiang, Q. Jiang and G. Yin, "Design of Smart Home Environment Monitoring System Based on STM32," 2023 3rd International Symposium on Computer Technology and Information Science (ISCTIS), Chengdu, China, 2023, pp. 823-827, doi: 10.1109/ISCTIS58954.2023.10213174.

[7] B. Soundarya, R. Krishnaraj, S. Mythili, Visual speech recognition using convolutional neural network, in: IOP Conference Series: Materials Science and Engineering, vol. 1084, IOP Publishing, 2021, p. 012020.

[8] G. M. E. Rahman, K. A. Wahid and A. Dinh, "IoT enabled Low power and Wide range WSN platform for environment monitoring application," 2020 IEEE Region 10 Symposium (TENSYMP), Dhaka, Bangladesh, 2020, pp. 908-911, doi: 10.1109/TENSYMP50017.2020.9230959.

[9] R Krishnaraj, B Soundarya, S Mythili and N Vikram, "Design of Memory Array Using Tail Transistor and Sleep Transistor Based 7T SRAM with Low Short Circuit and Standby Power", IOP Conf. Series: Materials Science and Engineering, pp. 1084, MAR 2021.

[10] M. -Ş. Nicolae, I. -D. Nicolae, R. -C. Presură Nicolae and P. -M. Nicolae, "Remote Monitoring of Environment Radiation with Arduino Wemos and Geiger Counter Sensors," 2023 Power Quality and Electromagnetic Compatibility at Low Frequency (PQEMC-LF), Craiova, Romania, 2023, pp. 77-80, doi: 10.1109/PQEMC-LF58184.2023.10211935.

[11] B. Yuan et al., "Intelligent Monitoring System for Substation Environment Based on UAV Inspection Mode," 2023 Panda Forum on Power and Energy (PandaFPE), Chengdu, China, 2023, pp. 1823-1828, doi: 10.1109/PandaFPE57779.2023.10141068.

[12] T. H. Nasution, A. Hizriadi, K. Tanjung and F. Nurmayadi, "Design of Indoor Air Quality Monitoring Systems," 2020 4rd International Conference on Electrical, Telecommunication and Computer Engineering (ELTICOM), Medan, Indonesia, 2020, pp. 238-241,doi: 10.1109/ELTICOM50775.2020.9230511.

[13] K. R, S. T, V. N, S. B and S. A, "Design of a Sleep Transistor and Read, Write Separation based 6T SRAM Memory Array for Low Power IOT Applications," 2021 Smart Technologies, Communication and Robotics (STCR), Sathyamangalam, India, 2021, pp. 1-5, doi: 10.1109/STCR51658.2021.9588951.

[14] Y. Cheng, X. Xu, Y. Du, P. Guan, S. Liu and L. Zhao, "Design of Air Quality Monitoring System Based on NB-IoT," 2019 IEEE International Conference on Power, Intelligent Computing and Systems (ICPICS), Shenyang, China, 2019, pp. 385-388, doi: 10.1109/ICPICS47731.2019.8942533.