IOT Based Air Pollution Monitoring Calibration System at Low Cost Sensor Network with Zigbee and Lorawan Connectivity

Dineshkumar B,
Assistant Professor,Department of Electronics and Communication Engineering
Velalar College of Engineering and Technology, Erode, Tamilnadu, India.

Aarthi K
Department of Electronics and Communication Engineering
Velalar College of Engineering and Technology, Erode, Tamilnadu, India.

Architha K
Department of Electronics and Communication Engineering
Velalar College of Engineering and Technology, Erode, Tamilnadu, India.

Deepani P
Department of Electronics and Communication Engineering
Velalar College of Engineering and Technology, Erode, Tamilnadu, India.

Durgalakshmi@Devika M
Department of Electronics and Communication Engineering
Velalar College of Engineering and Technology, Erode, Tamilnadu, India.

Abstract- **This paper proposes an IoT Based Air Pollution Monitoring Calibration System at low cost that uses a sensor network with Zigbee connectivity. The system is designed with an ESP32 controller, gas sensor, dust sensor, humidity sensor, sound sensor, temperature sensor, Zigbee, LCD, and IoT. The system will be used to measure the air pollution in an area and provide an alert when the levels are above acceptable limits. The system will be able to collect and store data remotely, and will provide real-time alerts to nearby users. The system will be able to calibrate the sensors for accurate readings and will be able to provide data analytics for further analysis. The proposed system will be cost-effective, energy efficient, and easy to install and maintain.**

Keywords –ESP 32 controller, Zigbee, Gas sensors, Humidity sensors, Dust sensor, Temperature sensor,Sound sensor,LCD

I. INTRODUCTION

The purpose of this project is to develop an IoT based air pollution monitoring system that can measure air pollution in areas with high air pollution levels. The system is designed to below cost and uses a Zigbee based connectivity system, ESP32 controller, gas sensor, dust sensor, humidity sensor, sound sensor, temperature sensor and LCD. In addition, used an IoT platform to store and analyze the collected data. The system will be used to monitor air quality in areas where air pollution is a major problem and to provide feedback to the public on current air quality.

II.PROPOSED ALGORITHM

The proposed system architecture for the project consist of a Zigbee based connectivity system, an ESP32 controller, gas sensor, dust sensor, humidity sensor, sound sensor, temperature sensor, LCD, and IoT. The sensors will be

connected to the ESP32 controller which will in turn be connected to a Zigbee based connectivity system. The data collected by the sensors will be sent to the IoT platform via a Zigbee connection. The data will then be analyzed and the results will be displayed on the LCD.

2.1. System Design-

The proposed system would use an ESP-32 microcontroller as a controller for the sensors. The ESP-32 is an open-source microcontroller that offers low power consumption and high performance, making it ideal for our application. The sensors used in the system would include a gas sensor, dust sensor, humidity sensor, sound sensor, and temperature sensor. These sensors would be connected to the ESP-32 via Zigbee-enabled modules. The data from the sensors would be transmitted to a remote server over a Wi-Fi or cellular connection. The collected data would be used to calculate the air quality index (AQI) and alert people when the AQI exceeds a certain level. An LCD display would be used to display the AQI and alert the user when it reaches a dangerous level. Additionally, an IoT platform would be used to store and analyze the collected data. This would allow the user to monitor air quality levels in real-time and view historical data.An IoT-based air pollution monitoring calibration system at a low cost using a network of Zigbee-enabled sensors can be implemented. The system would utilize an ESP-32 microcontroller as a controller for the sensors and transmit the data to a remote server over a Wi-Fi or cellular connection. An LCD display would be used to display the air quality index and alert the user when it exceeds a certain level. Additionally, an IoT platform would be used to store and analyze the collected data. With this system in place, people would be able to monitor air quality levels in real-time and take steps to protect their health when necessary. In today's world, air pollution is one of the most important environmental issues that need to be addressed. It has been estimated that air pollution is responsible for causing more than 7 million deaths annually. To reduce this number, it is important to monitor air pollution in real-time and take preventive actions accordingly. To do this, an IoT based air pollution monitoring system can be used. This system uses a low-cost sensor network to measure different pollutants in the air and send the data to a central server via Zigbee connectivity.

A. ESP32 Controller:

The ESP32 microcontroller is used to collect and process the data from the sensors. It is a low-cost, low-power, and highly efficient microcontroller that can be used for a wide range of applications. It is used in this system to collect and process the data from the sensors, and then send it to the server via Zigbee connectivity.

B. Zigbee:

Zigbee is a wireless communication protocol used to connect different types of devices. It is used in this system to connect the sensors to the central server. The data from the sensors is sent to the server via Zigbee, where it can be monitored and analyzed. This allows for real-time monitoring of air pollution levels.

C. Low Cost Sensor Networks:

The low cost sensor network used in this system consists of different types of sensors that measure different pollutants in the air. These sensors include Gas Sensors, Dust Sensors, Humidity Sensors, Sound Sensors, and Temperature Sensors. These sensors are connected to an ESP 32 microcontroller, which is responsible for collecting and processing the data from the sensors. The data is then sent to a central server via Zigbee connectivity.

III. Experiment and Result

2.2 Sensor Networks:

The sensor network will be composed of the ESP32 controller, gas sensor, dust sensor, humidity sensor, sound sensor, temperature sensor, and Zigbee. The ESP32 controller will be used to receive data from the sensors and transmit it to the Zigbee transceiver. The Zigbee transceiver will be used to send data to the IoT platform.The LCD will be used to display the air quality index of the area where the sensor network is installed. The web dashboard will be used to monitor the air quality index of different locations in real time. This can be used to compare the air quality index of different locations. The mobile application will be used to provide users with notifications regarding changes in the air quality index of their area.

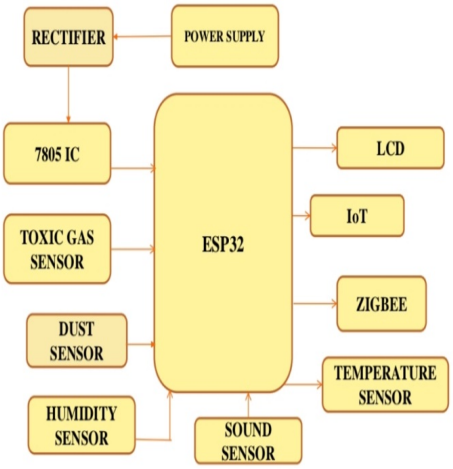

Fig:1Block Diagram of the Air Quality Monitoring System

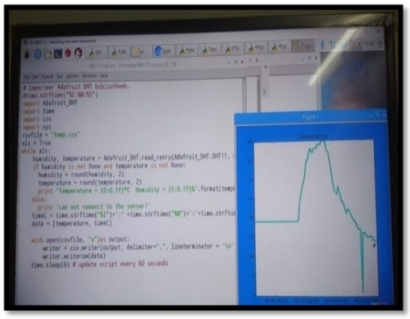

Fig.2: Plot showing the variation of pollutant in the Morning

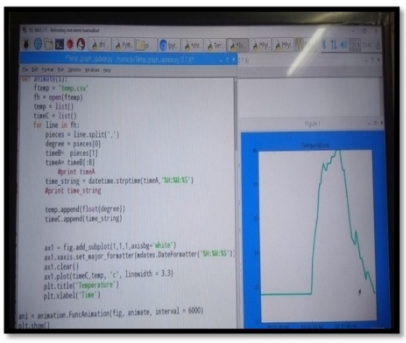

Fig. 3: Plot showing the variation of pollutants in the Evening

The Internet of Things (IoT) has revolutionized the way we collect and analyze data. By connecting physical objects to the internet, we can create a distributed network of sensors that can measure and monitor various environmental variables. One of the most pressing issues facing the world today is air pollution. With the increased usage of industrial and automotive machinery, the level of air pollution has been steadily increasing. As such, it is important to have a system in place to monitor the quality of air and alert people when it reaches dangerous levels. This paper proposes an IoT-based air pollution monitoring calibration system at a low cost using a network of Zigbee-enabled sensors.

IV.CONCLUSION

In this system, the IoT based Air Pollution Monitoring Calibration System proposed in this paper is a low-cost, efficient and reliable solution to monitor air pollution. It is capable of measuring and storing air quality parameters such as humidity, dust, temperature, sound, and gas levels. The system uses Zigbee connectivity to transfer data from sensors to the ESP32 controller and then to the cloud. The LCD display allows for easy visualization of the data. The system is also equipped with an alert system which can be used to notify authorities in case of any potential hazard. A perfect collaboration between sensors and the mini-computer has been established by using a compact analog-to-digital converter, which by using eases the process of data collection. Using this system, we have collected data from crowded and non-crowded environment, for example, public area and open space and each time the accuracy of data which was collected are satisfactory. Through this system, we are able to measure and collect almost all the common air pollutants in our environmental surrounding. Thus, it is one of the compact air-pollution monitoring model.

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