AirGuard 360: An Innovative IoT-Based Air Quality Monitoring System

Introduction:

With increasing concerns over environmental pollution, monitoring air quality has become essential for ensuring public health and environmental sustainability. This project, named AirGuard 360, aims to provide a comprehensive IoT-based air quality monitoring system that collects and analyzes environmental data in real-time. By leveraging IoT technology, AirGuard 360 enables remote monitoring of air quality, offering critical insights into temperature, humidity, and gas concentrations. The data is visualized through the Blynk platform and ThingSpeak, facilitating easy access and real-time monitoring. It also sends notifications(email) if the air quality exceeds a defined threshold.

Objective:

The primary objective of AirGuard 360 is to design and implement an innovative IoT-based air quality monitoring system that:

- Continuously monitors environmental parameters including temperature, humidity, and gas concentrations.
- Sends real-time data to cloud platforms (Blynk and ThingSpeak) for visualization and analysis.
- Provides alerts and notifications through email when air quality deteriorates beyond a set threshold.
- Alerts users of poor air quality through notifications and visual indicators (LED and buzzer).

Methodology:

Components Used:

1. **DHT11 Temperature and Humidity Sensor**: The DHT11 is a basic, low-cost digital sensor used to measure temperature and humidity in the surrounding environment. It consists of a capacitive humidity sensor and a thermistor to measure the air temperature.MQ135 Gas Sensor: Detects various gases such as CO2, ammonia, and alcohol, indicating air quality.
2. **NodeMCU ESP8266:** The NodeMCU ESP8266 is a popular microcontroller with built-in WiFi capabilities. It is widely used in IoT projects due to its ease of use, low cost, and versatility.
3. **MQ135 Gas Sensor**: The MQ135 is a gas sensor designed to detect a wide range of gases such as ammonia, benzene, alcohol, smoke, and carbon dioxide.
4. **Buzzer and LED:** Provide auditory and visual alerts for poor air quality.
5. **LCD (Liquid Crystal Display):** Displays real-time sensor data.
6. **Blynk and ThingSpeak Platforms**: Used for data visualization and analysis.

System Design:

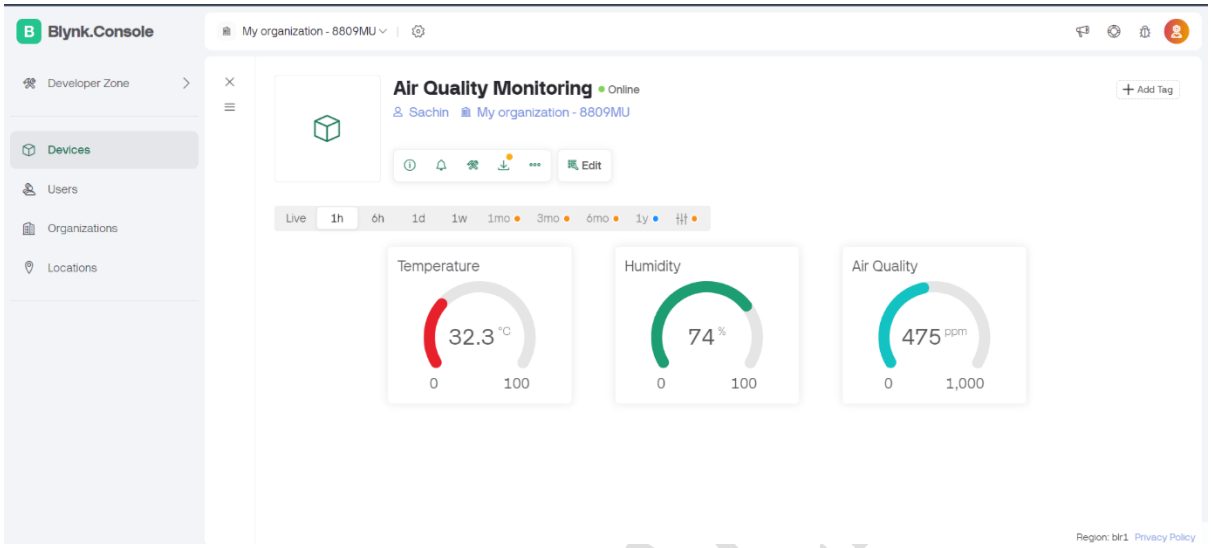
AirGuard 360 is designed to collect air quality data from sensors and transmit it to the cloud. The NodeMCU ESP8266 is programmed to interface with the sensors and send data to Blynk and ThingSpeak. The DHT11 sensor measures temperature and humidity, while the MQ135 sensor provides air quality readings based on gas concentration.

Data Collection and Transmission:

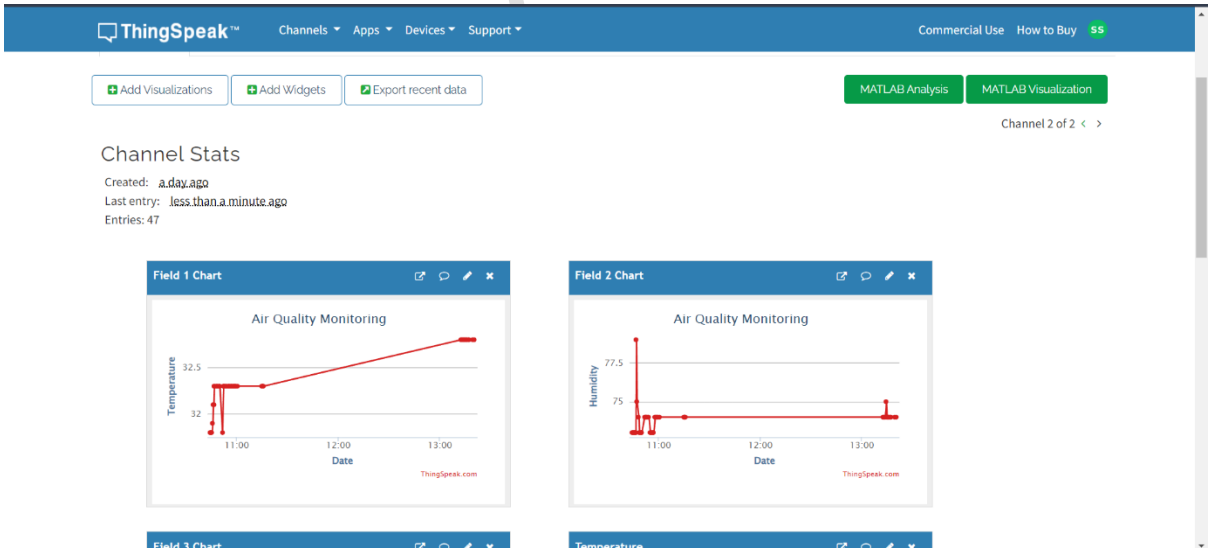
The NodeMCU reads data from the sensors at regular intervals. The data is then sent to the Blynk platform, which provides real-time monitoring through a mobile app and web interface. Additionally, the data is uploaded to ThingSpeak for further analysis and visualization. An LED and a buzzer are used to alert users if the air quality exceeds predefined thresholds, indicating potential air pollution.

Data Visualization:

- **Blynk Platform**: Provides a real-time dashboard accessible via mobile app and web interface. Users can monitor temperature, humidity, and air quality in real-time.



- **ThingSpeak:** Offers advanced data visualization tools, enabling users to analyse historical data and detect trends in air quality over time.

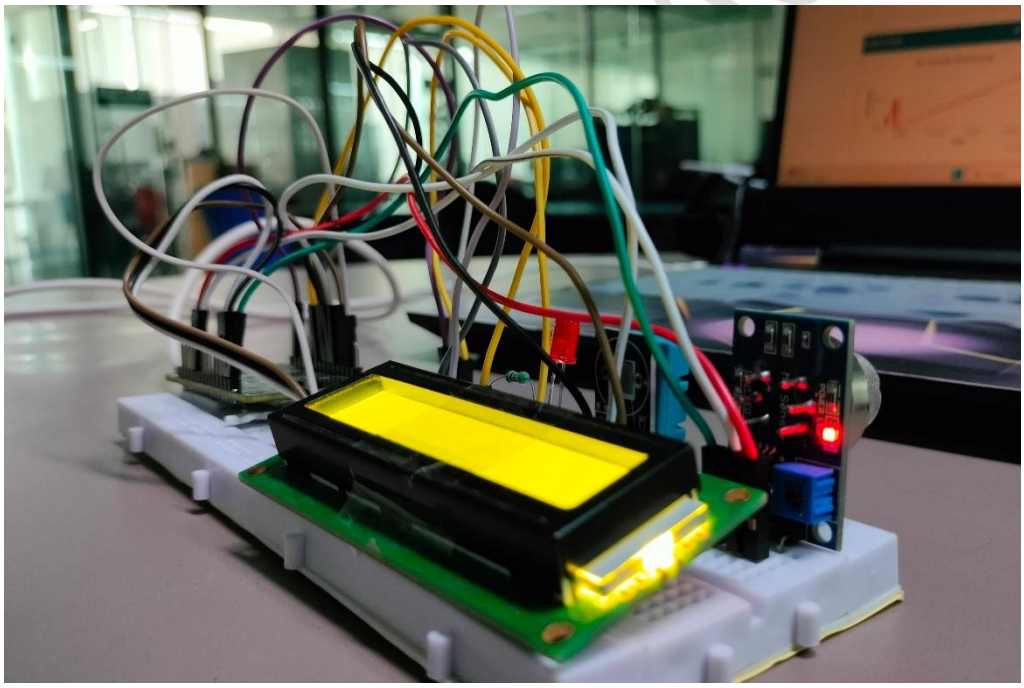


Results:

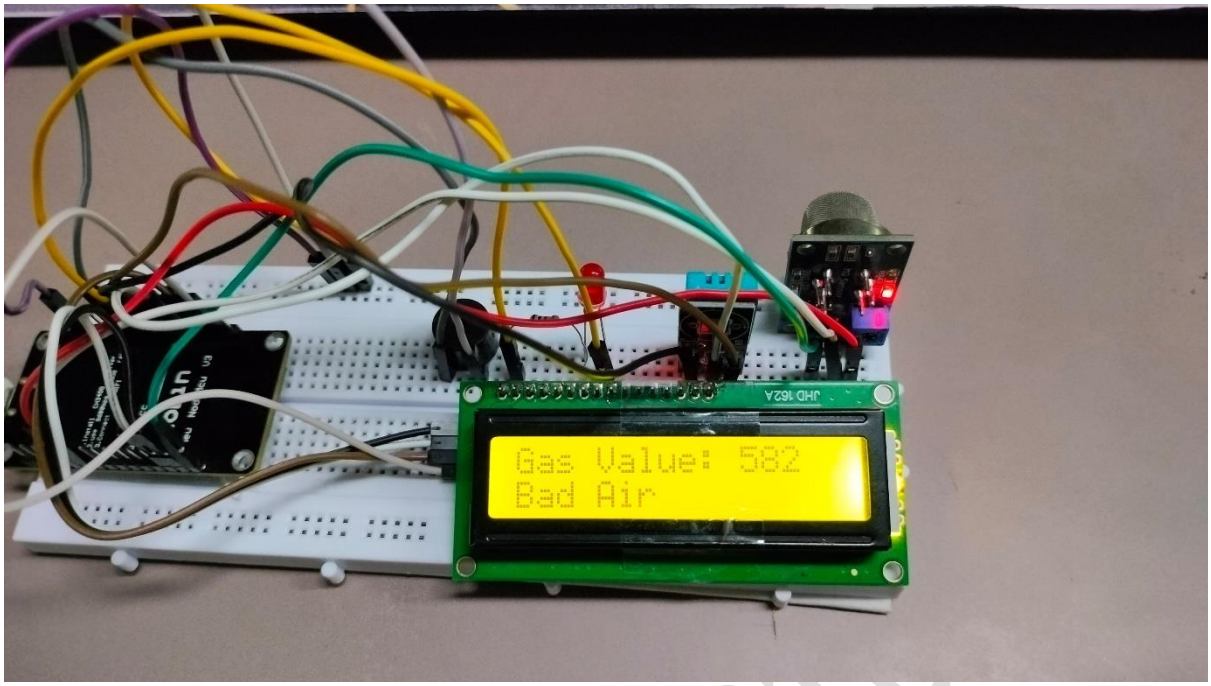
AirGuard 360 effectively monitored and reported air quality parameters, with results visualized on both Blynk and ThingSpeak platforms. The system successfully:

- Measured and displayed temperature and humidity with high accuracy.
- Detected gas concentration levels and differentiated between fresh and polluted air.
- Alerted users through visual (LED) and auditory (buzzer) signals when air quality thresholds were exceeded.
- Provided real-time data on mobile and web interfaces, ensuring continuous monitoring and quick response to changes in air quality.

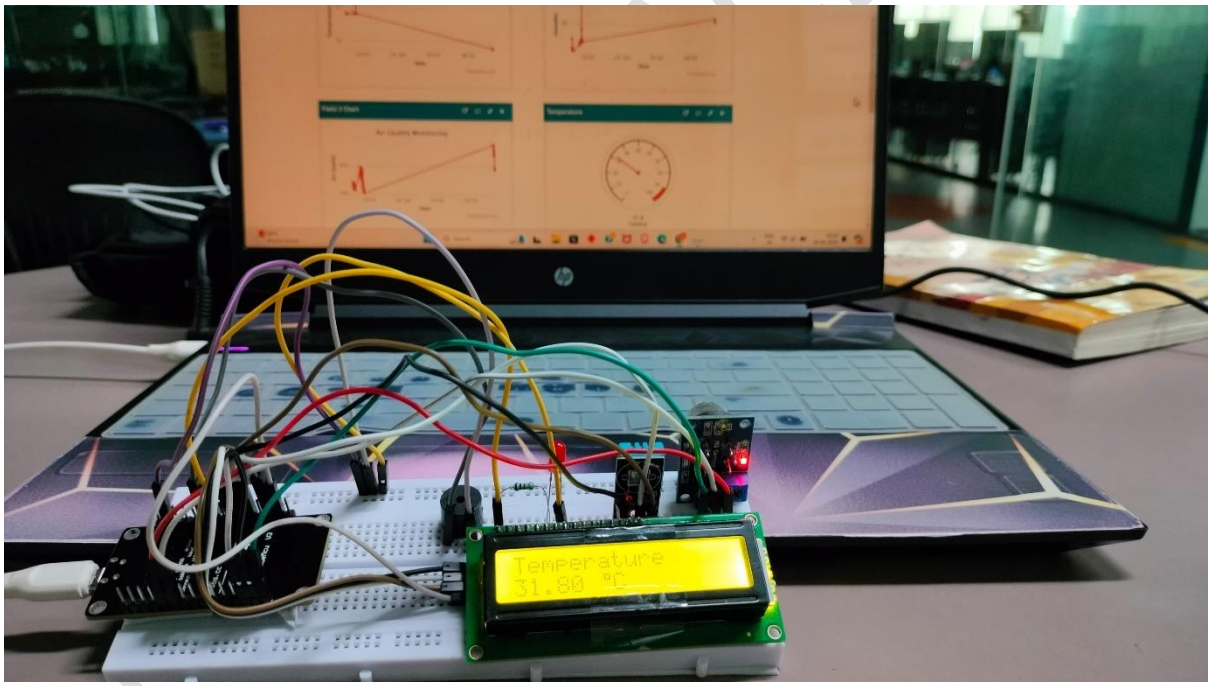
Hardware Representation:



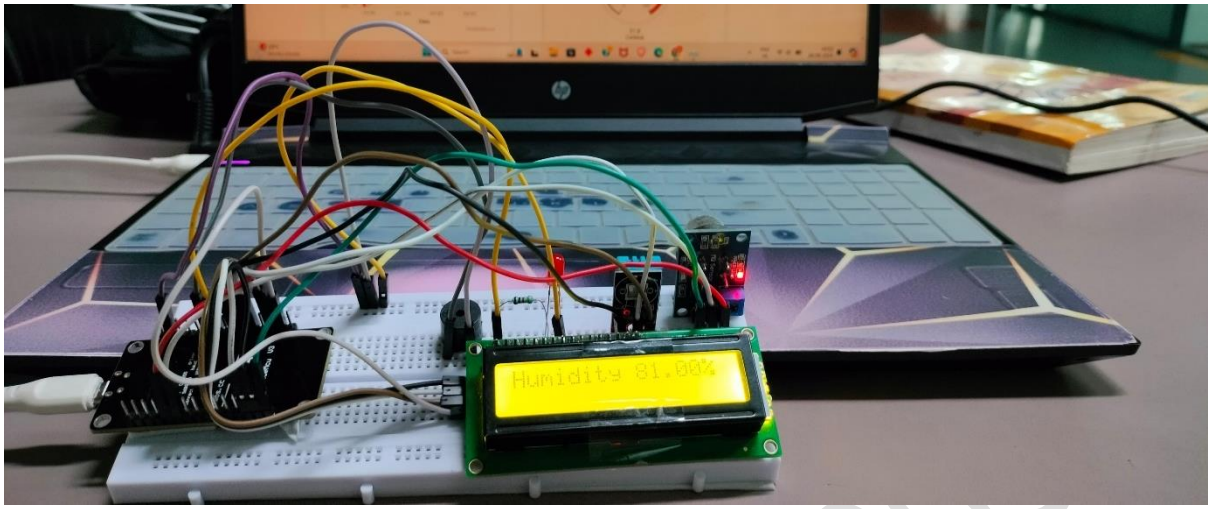
Gas value display:



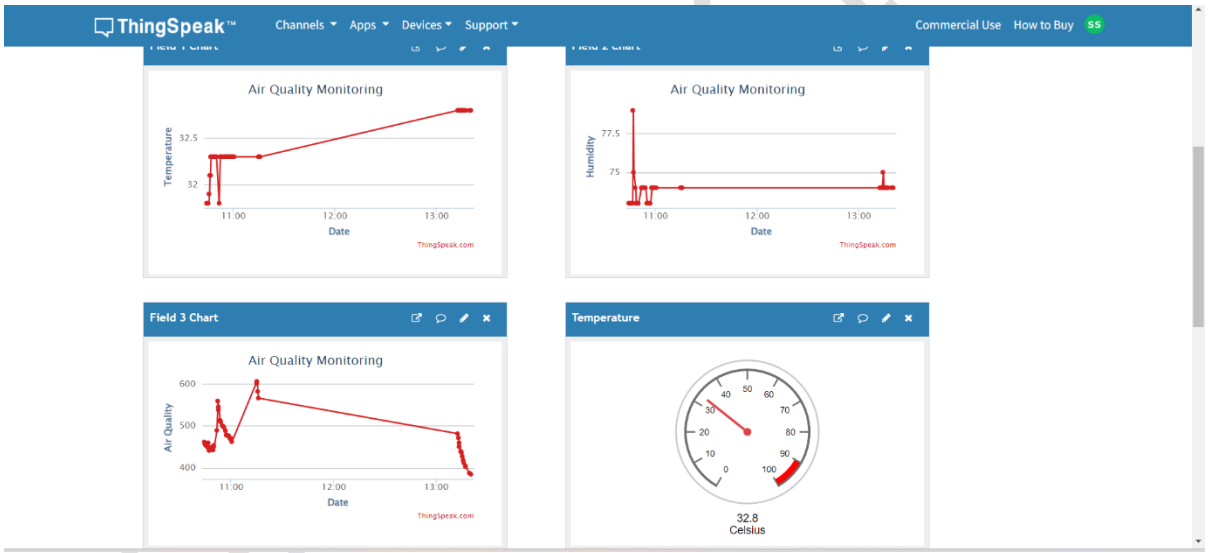
Temperature value representation:

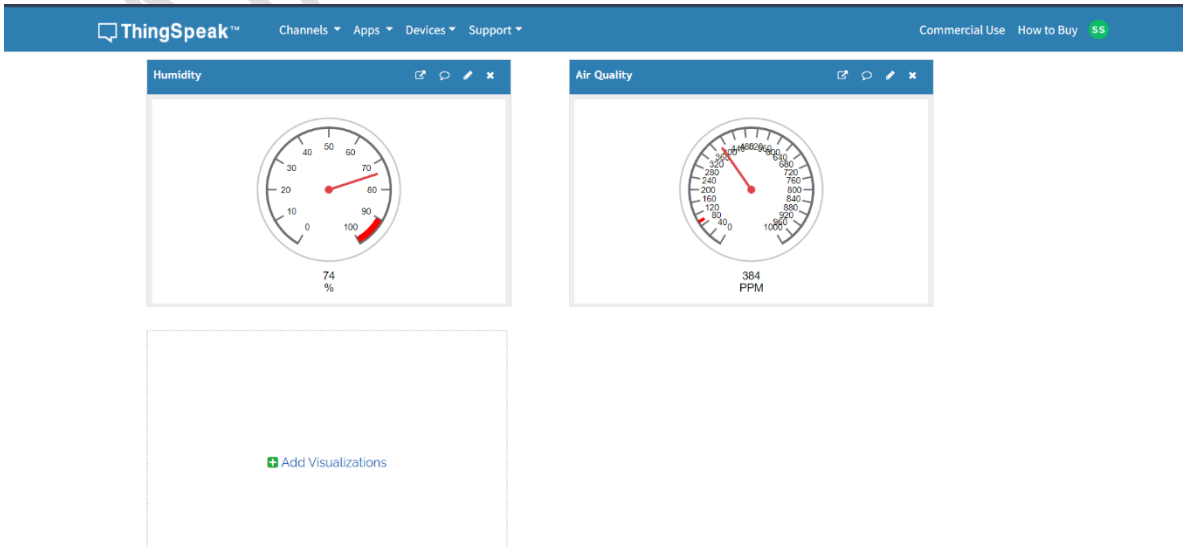


Humidity value representation:

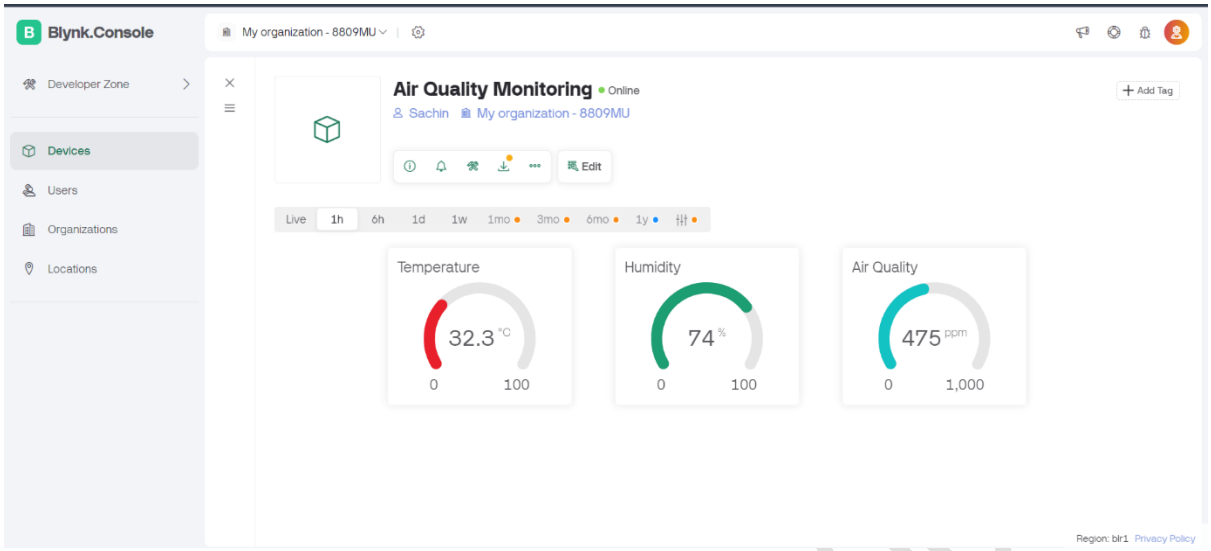


ThingSpeak data representation :

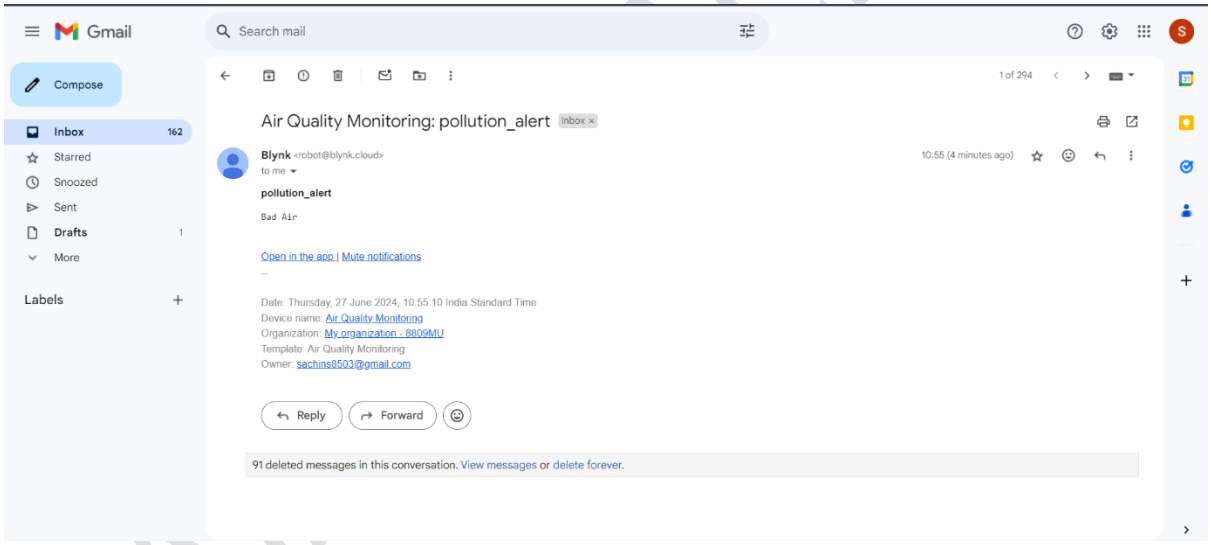




Blynk data visualization:



Notification:



Conclusion:

AirGuard 360 showcases an innovative approach to air quality monitoring using IoT technology. It highlights the importance of real-time environmental monitoring and data-driven decision-making in maintaining public health and safety. The project demonstrates the potential of IoT in creating effective solutions for environmental challenges and sets the stage for future developments in this field.

By continually refining and expanding the capabilities of AirGuard 360, we can enhance its effectiveness and applicability, ultimately contributing to a healthier and more sustainable environment.