College Research Affiliate Program (IoT) Batch - 4

IIIT Hyderabad

IoT-Based Air Quality Monitoring Project

Team No. :14 – VCloud

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1. Introduction

This project focused on developing and deploying an **IoT-based Air Quality Monitoring Node** to measure and analyse key environmental parameters such as **PM2.5, PM10, temperature, and humidity**. The system was designed using an **ESP32 microcontroller**, **SDS011 particulate sensor**, and **AHT10 temperature & humidity sensor**. The monitoring node was deployed at a strategic campus location, where it collected real-time data over a period of **3 days**. The collected data was processed and analysed to identify **trends, variations, and environmental influences on air quality**. The project aimed to enhance awareness of air pollution and demonstrate the practical application of IoT in environmental monitoring.

2. Node Development

The air quality node was developed using the following components:

- **ESP32 Microcontroller**: Used for processing and transmitting data.
- **SDS011 Sensor**: Measures PM2.5 and PM10 levels using laser scattering technology.
- **AHT10 Sensor**: Measures temperature and humidity.
- **IP65 Box**: Provides protection against environmental factors. (We haven't used due to unavailability)
- **PCB Board & Connectors**: For wiring and integration.

Steps Followed:

1. Installed and configured Arduino IDE with ESP32 board support.

2. Interfaced SDS011 and AHT10 sensors with the ESP32 microcontroller.
3. Wrote the firmware to read data from sensors and transmit it via Wi-Fi.
4. Tested the setup on a local system before deployment.

3. Deployment Details

- **Location**: The node was deployed at a secure, open-air location on campus to ensure proper exposure to ambient air.
- **Setup Challenges**: Faced initial issues with Wi-Fi connectivity and sensor calibration, which were resolved through debugging and recalibration.

4. Data Collection

- **Duration**: Data was collected continuously for 3 days.
- **Frequency**: Readings were taken every 10 seconds and logged.
- **Parameters Monitored**: PM2.5, PM10, temperature, and humidity.

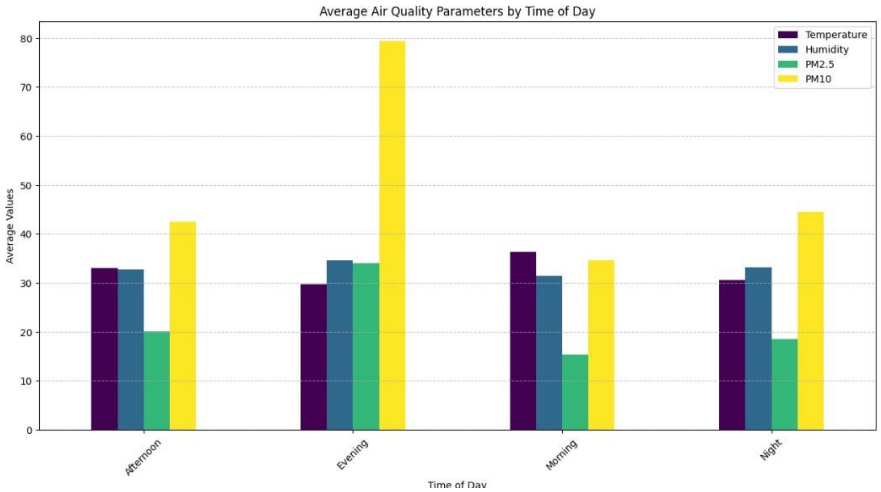
5. Data Processing and Analysis

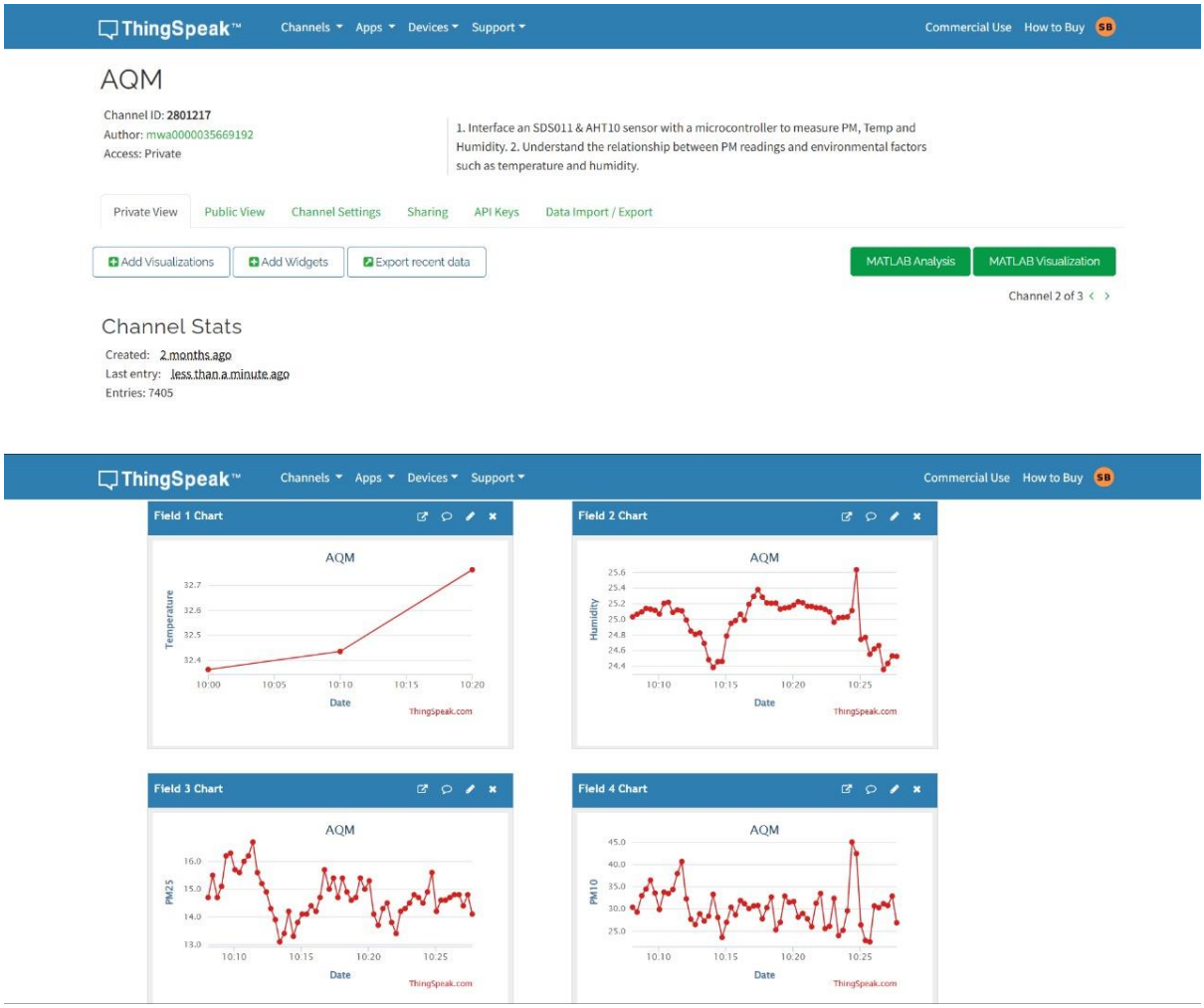
- **Tools Used**: Python for data cleaning, visualization, and statistical analysis.
- **Findings**:
    - PM2.5 and PM10 levels showed variations based on environmental conditions.
    - High humidity correlated with lower particulate matter concentrations.
    - Temperature changes affected sensor readings, requiring compensation.

6. Results and Conclusions

- The collected data provided insights into air quality variations on campus of Vasavi College of Engineering.
- Data trends indicated specific times of the day with higher pollution levels.
- The project successfully demonstrated IoT-based air quality monitoring.

7. Images and Visuals





8. Video Demonstration

https://drive.google.com/drive/folders/1Ig1oByO_5xCSPjI3fTkp9MzzZpJvvozD?usp=sharing

9. Challenges and Learnings

- **Challenges**:
  - Data transmission errors
  - Environmental interference and
  - Internet unavailability
- **Learnings**: Improved understanding of IoT sensor integration and real-time data analysis.