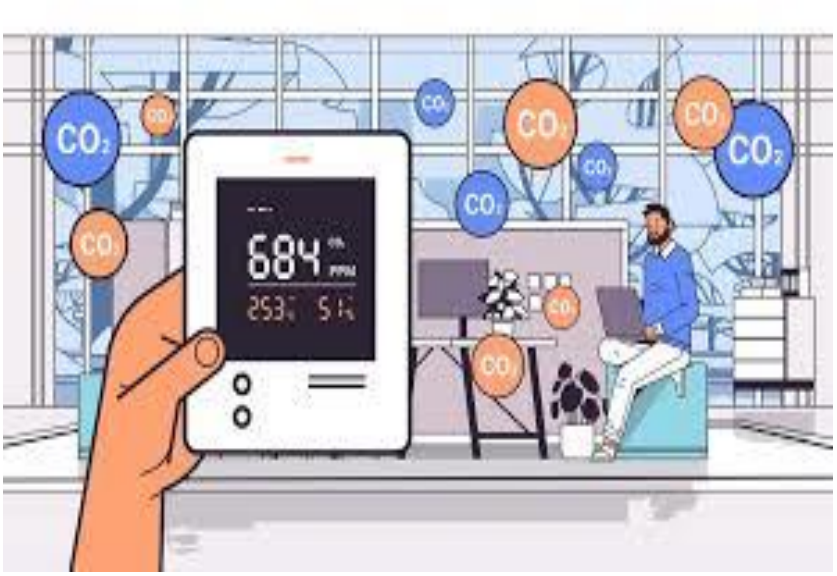

SMART INDOOR AIR QUALITY MONITORING & ANALYTICS DASHBOARD

ABSTRACT

Submitted in partial fulfilment of the requirements
for professional practice in **Data Analytics & Business Intelligence.**

Naveen Ponde

ACKNOWLEDGEMENT

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I would like to express my sincere gratitude to everyone who supported me during the completion of this project.

I am thankful to my mentors, peers, and learning resources for their guidance in understanding **Power BI, DAX, cloud data pipelines, and analytics best practices**. I also acknowledge the availability of modern cloud platforms and analytics tools that enabled the successful implementation of this project.

This project has significantly enhanced my practical knowledge in **data modeling, visualization, and cloud-based analytics**.

Naveen Ponde

TABLE OF CONTENTS (INDEX)

ARCHITECTURE INDEX

1. INTRODUCTION

Indoor air quality (IAQ) plays a critical role in occupant health, comfort, and productivity, especially in corporate offices, commercial buildings, and public spaces. Poor air quality can lead to discomfort, health risks, reduced efficiency, and long-term safety concerns.

This project focuses on designing and implementing a **Smart Indoor Air Quality Monitoring & Analytics Dashboard** using **IoT sensor data** and modern **cloud analytics tools**. The dashboard enables stakeholders to monitor real-time and historical air quality conditions, identify problem areas, and make data-driven decisions to improve indoor environments.

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2. BUSINESS PROBLEM STATEMENT

Organizations deploy indoor air quality sensors, but raw sensor data alone does not provide actionable insights. The key challenges are:

Lack of **centralized visibility** across buildings and locations

Difficulty in identifying **air quality risks in real time**

No easy way to analyse **patterns, trends, and correlations**

Limited support for **executive-level decision-making**

There is a need for a **scalable, interactive analytics solution** that converts raw sensor readings into meaningful insights

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3. PROJECT OBJECTIVES

The main objectives of this project are:

- To monitor key indoor air quality parameters in real time
- To analyse historical trends and patterns
- To compare air quality across buildings, floors, zones, and spaces
- To identify correlations between environmental parameters
- To provide executives and facility teams with actionable insights

4. SCOPE OF THE PROJECT

In Scope

- Indoor air quality analysis using sensor data
- Multi-level filtering (Building, Floor, Zone, Space, Time)
- KPI-based monitoring and threshold evaluation
- Correlation and trend analysis
- Cloud-based data storage and analytics

Out of Scope

- Predictive modelling and forecasting
- Automated HVAC control actions
- Outdoor air quality integration

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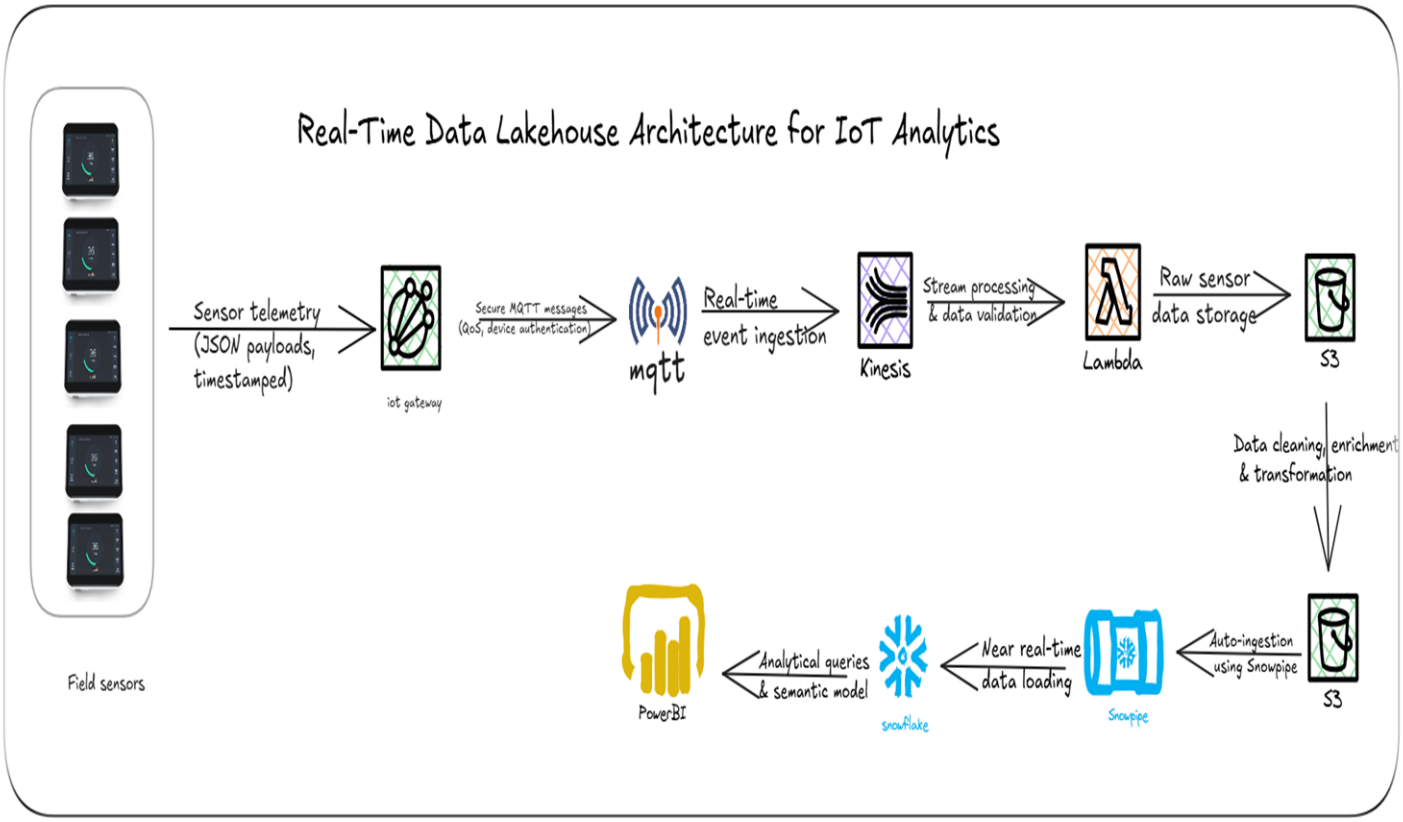
5. AIR QUALITY PARAMETERS

Parameter	Unit	Description
Temperature	°C	Thermal comfort
Humidity	%	Moisture level
CO	ppm	Toxic gas indicator
TVOC	ppb	Volatile compounds
PM10	µg/m³	Particulate matter
Odor	Index	Air freshness
AQI	Index	Overall air quality

6. DATA ARCHITECTURE

Architecture Flow (Fig 6.1)



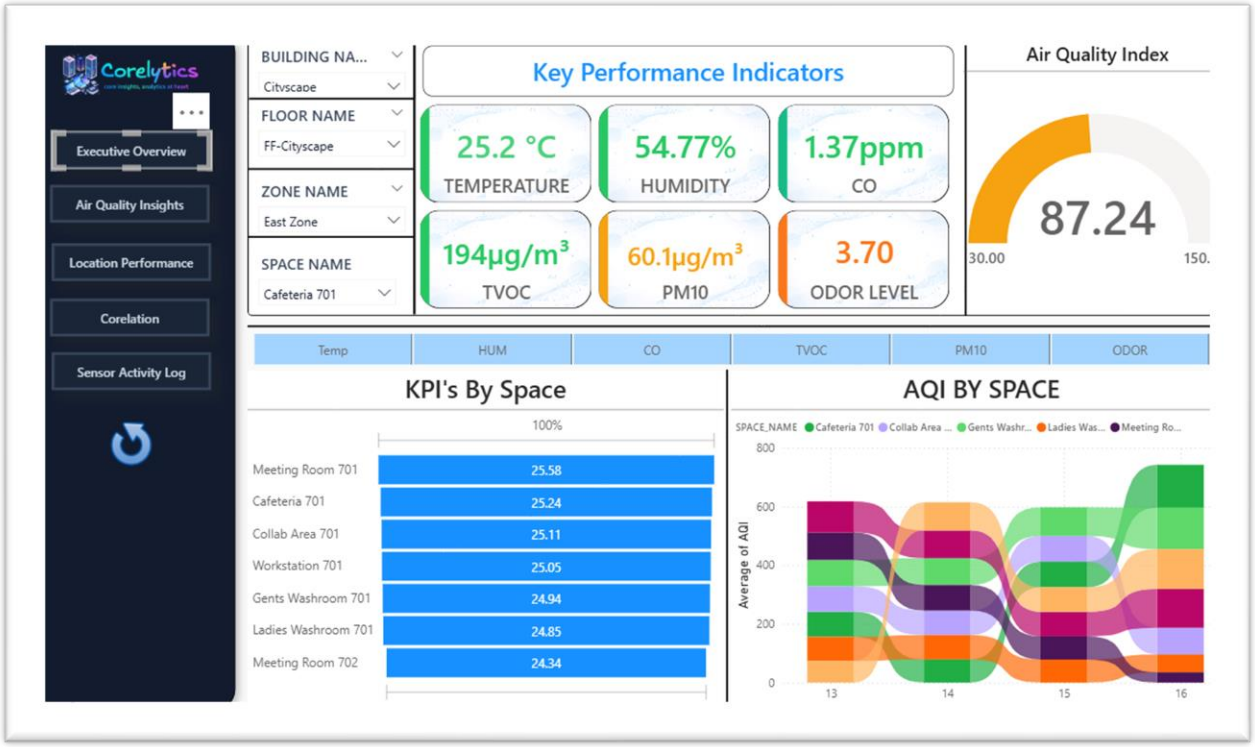
1. IoT Sensors capture indoor air data
2. Data stored in **AWS S3**
3. **AWS Lambda** performs data transformation
4. Clean data loaded into **Snowflake**
5. **Power BI** consumes data for analytics

This architecture ensures **scalability, reliability, and real-time analytics**.

7. DASHBOARD DESIGN & ANALYSIS

7.1 Executive Overview

Purpose:
Provides a high-level snapshot of overall indoor air quality.



Features:

- KPI cards for Temperature, Humidity, CO, TVOC, PM10, Odor, AQI
- Color-coded thresholds for quick interpretation
- Global slicers for time and location

Insights:

- Identifies whether air quality is within safe and comfortable limits
- Highlights KPIs that require immediate attention

Purpose:
Analyze trends and behavior of air quality parameters over time.

Features:

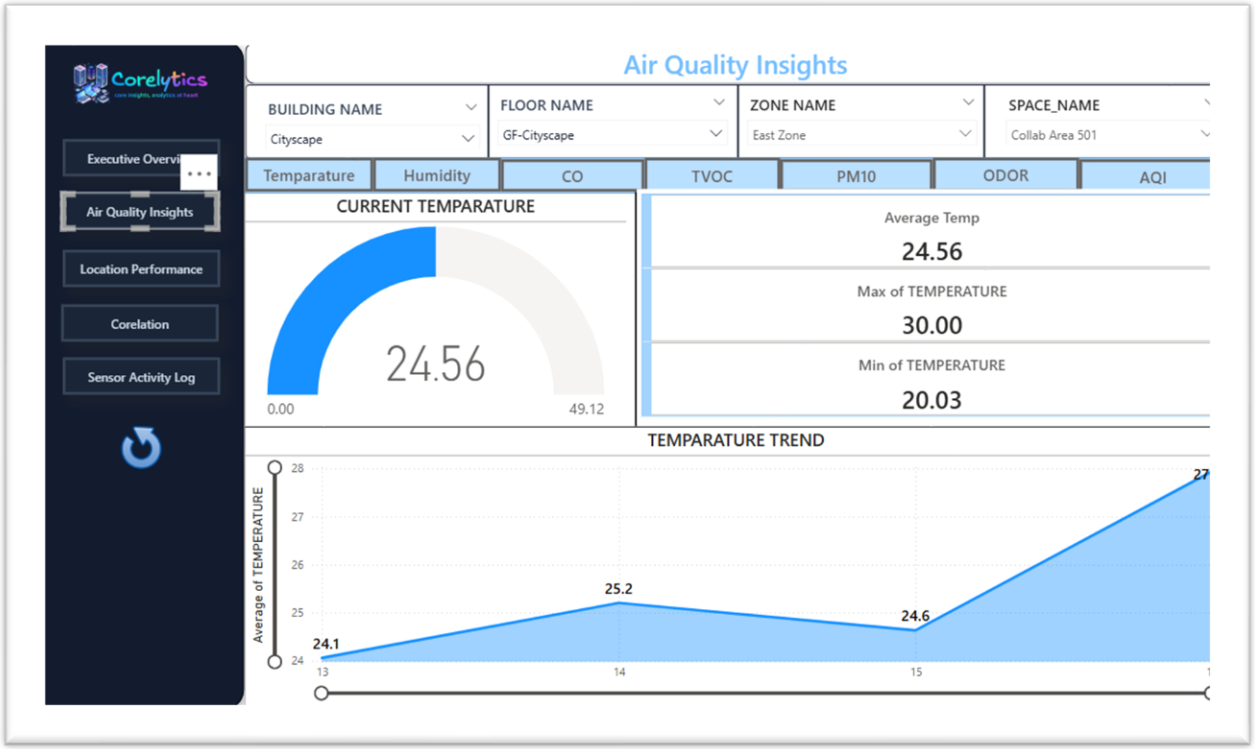
- Time-series charts
- Daily, monthly, and quarterly aggregation
- Average, minimum, and maximum values

Insights:

- Temperature and humidity follow daily usage patterns
- PM10 and TVOC show spikes during peak occupancy
- Helps evaluate HVAC and ventilation efficiency

7.2 Air Quality Insights

Purpose:
Analyze trends and behavior of air quality parameters over time.



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- Time-series charts
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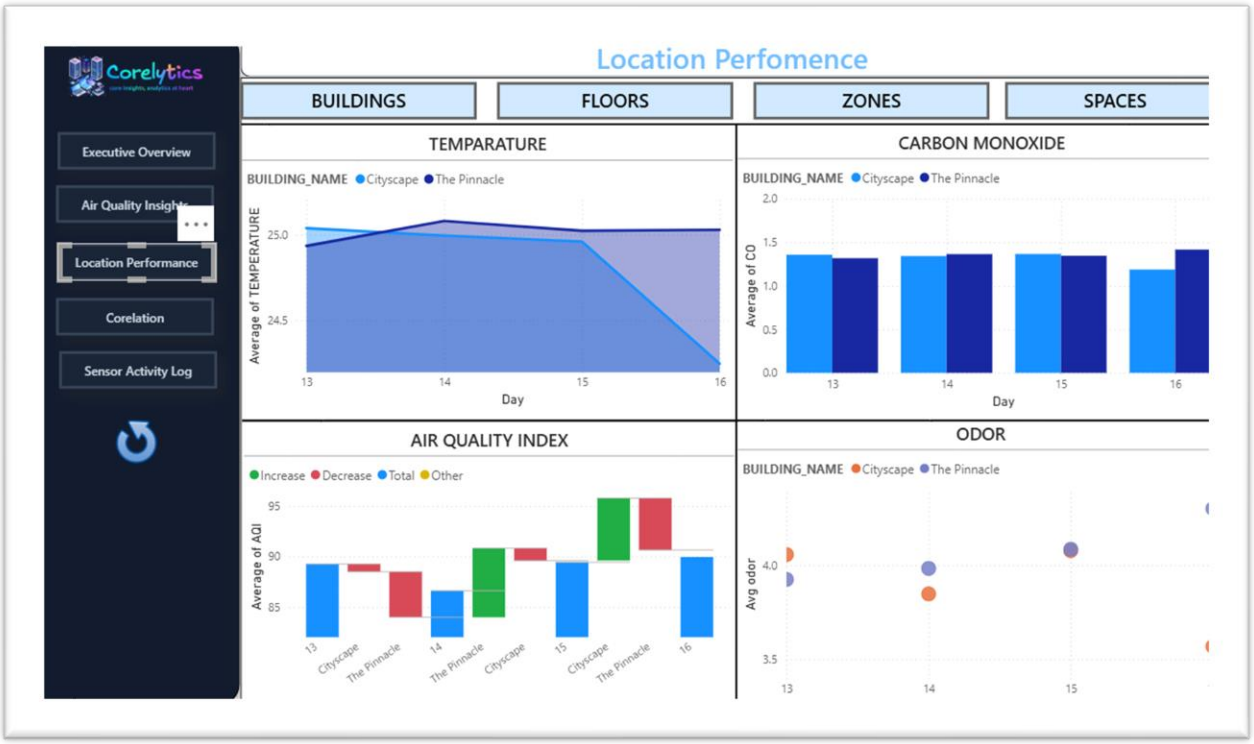
- Average, minimum, and maximum values

Insights:

- Temperature and humidity follow daily usage patterns
- PM10 and TVOC show spikes during peak occupancy
- Helps evaluate HVAC and ventilation efficiency

7.3 Location Performance

Purpose:
Compare air quality across different locations.



Features:

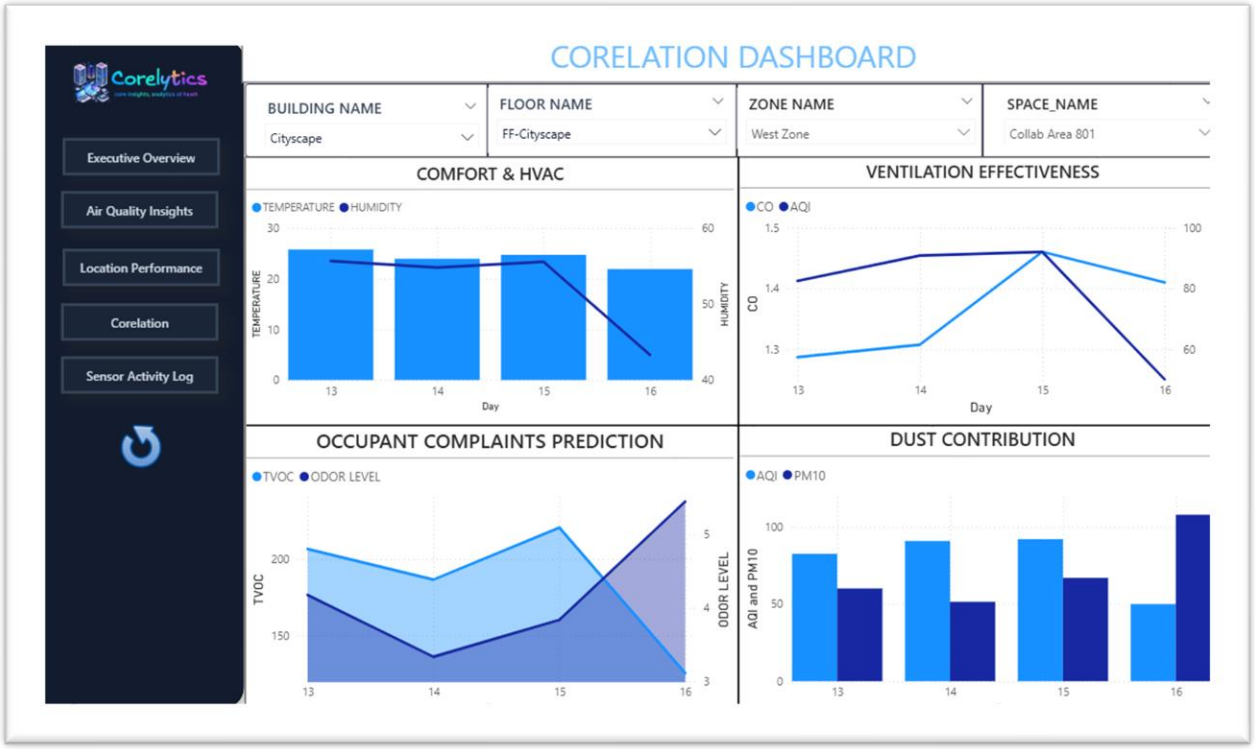
- Building, floor, zone, and space-level analysis
- Comparative bar and table visuals

Insights:

- Cafeterias and high-traffic areas show higher PM10 and odor
- Certain floors consistently perform better due to airflow design

7.4 Correlation Analysis

Purpose:
Understand relationships between different air quality parameters.



Features:

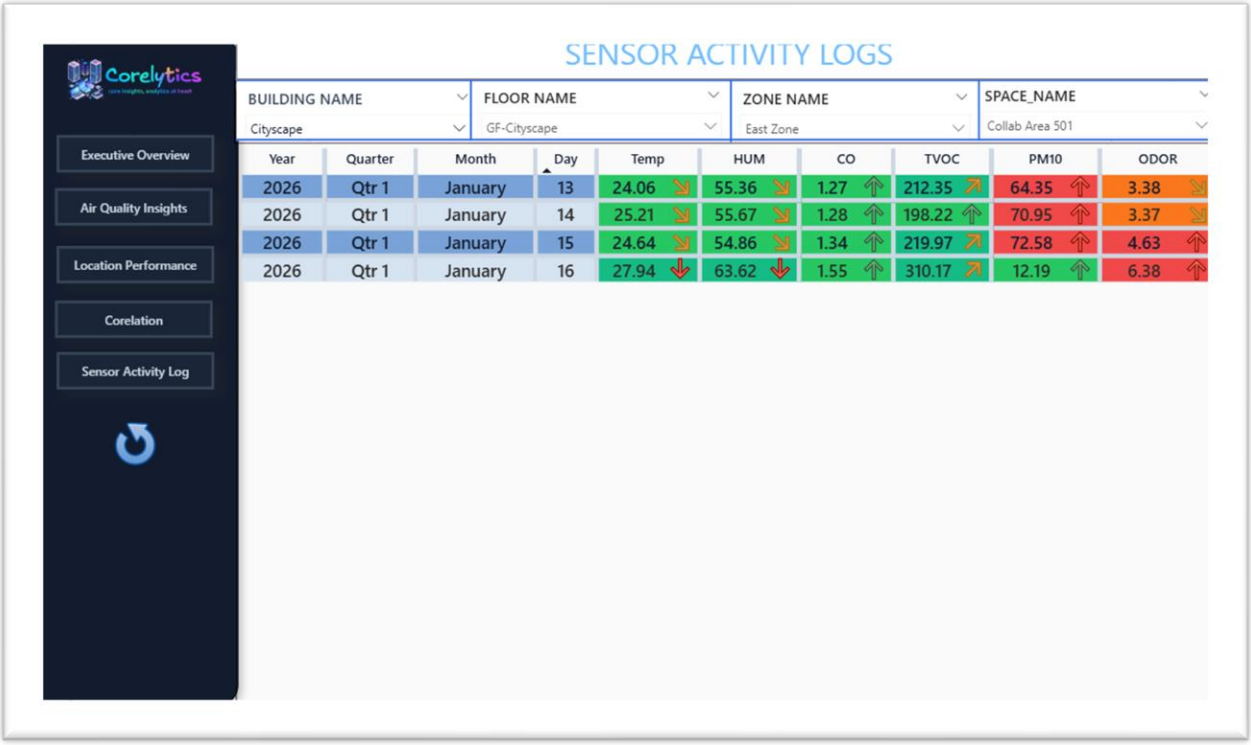
- Correlation matrix and scatter visuals
- Dynamic filtering

Insights:

- Strong correlation between TVOC and odor
- CO increase aligns with AQI degradation
- Helps identify root causes rather than symptoms

7.5 Sensor Activity Log

Purpose:
Provide granular, audit-level sensor data.



Features:

- Tabular view with conditional formatting
- Trend indicators (up/down arrows)
- Date-wise sensor readings

Insights:

- Identifies abnormal days or sensor anomalies
- Ensures data reliability and transparency

8.KPI Thresholds & Color Coding

Each KPI is classified using standardized thresholds:

- **Green:** Safe / Optimal
- **Amber:** Moderate / Needs Monitoring
- **Red:** Poor / Requires Action

This approach enables quick visual interpretation for both technical and non-technical users.

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9. TOOLS & TECHNOLOGIES USED

- **Power BI** – Dashboard development and reporting
- **DAX** – Measures, KPIs, thresholds, time intelligence
- **Data Modeling** – Relationship design and optimization
- **Data Visualization** – Executive-friendly visual storytelling
- **Snowflake** – Cloud data warehouse
- **AWS S3** – Raw data storage
- **AWS Lambda** – Serverless data ingestion and transformation

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10. BUSINESS IMPACT

- Improves **occupant comfort and safety**
- Enables **early detection** of air quality risks
- Supports **data-driven facility management**
- Reduces manual monitoring effort
- Provides leadership with **real-time visibility**

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11. CONCLUSION

The Smart Indoor Air Quality Monitoring & Analytics Dashboard successfully transforms raw IoT sensor data into meaningful insights. By integrating cloud technologies with advanced Power BI analytics, the solution empowers organizations to proactively manage indoor environments, enhance occupant well-being, and support informed decision-making.

This project demonstrates strong capabilities in data analytics, cloud integration, dashboard design, and business storytelling.

12. FUTURE ENHANCEMENTS

- Predictive analytics for air quality forecasting
- Automated alerts and notifications
- Integration with HVAC control systems
- Machine learning-based anomaly detection