airvoice

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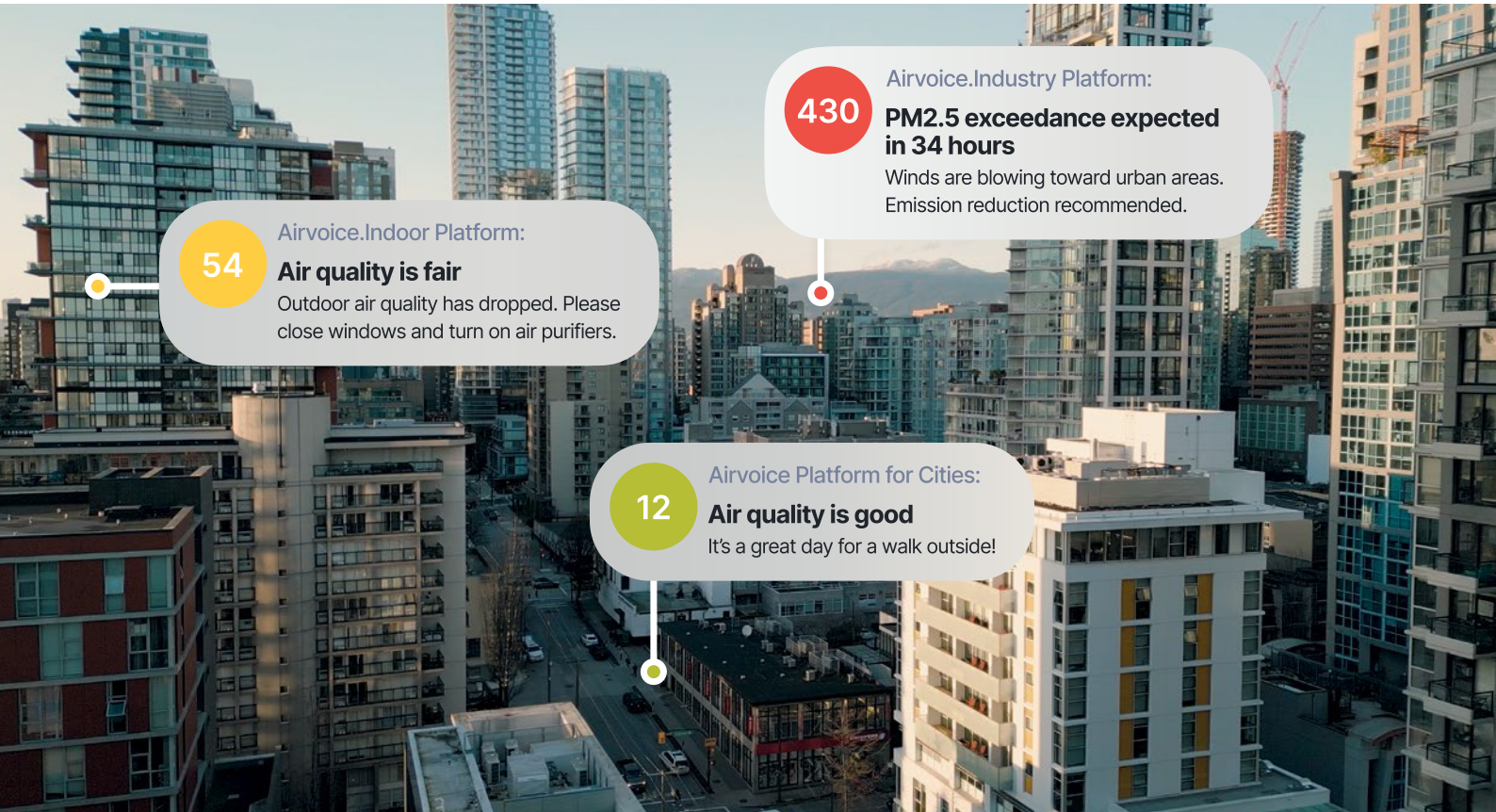
Air Quality Management Solutions & Case Studies



Breathing Innovation into India

Ashwini K. Channan

President of Airvoice.India

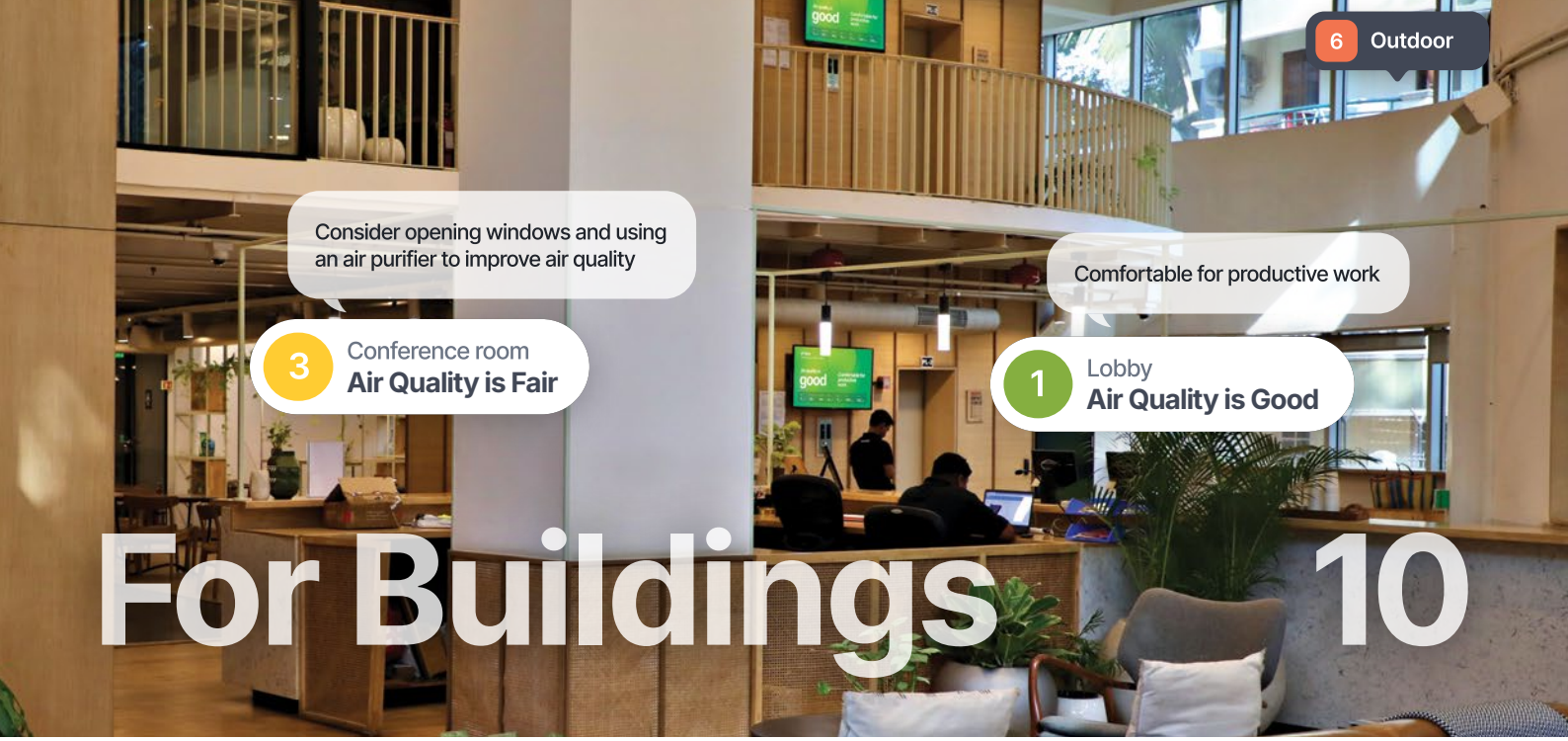
At Airvoice.India, we are proud to contribute to the growing movement for clean air across the country. We believe that air quality is one of the defining challenges and opportunities of our time, and we are honored to support India's progress with proven, data-driven solutions.

Our technology partnership with CII — and through them, with a wide network of agencies and industries — has enabled us to bring advanced air quality monitoring and management tools to one of the world's most dynamic and environmentally conscious markets. Built on nearly two decades of global experience, our technologies are helping Indian businesses, industries, and cities make informed decisions for cleaner, healthier air.

Our work spans a wide spectrum: from improving indoor air quality in offices and public spaces to managing industrial air quality impact to supporting air quality management strategies at the city level. In every case, we combine reliable hardware, intelligent software, and expert support to ensure that air quality becomes both measurable and manageable.

We also contribute to public awareness through research projects that make air quality data more visible, trusted, and actionable. In 2024, we joined global environmental leaders at the G20 Sustainability Summit to explore solutions to today's most urgent ecological challenges. We are honored to work with forward-looking, environmentally responsible organizations such as CII and NCAER. Companies like Jindal Steel & Power are leading the way by prioritizing safety and comfort in their HVAC-managed indoor environments.

Airvoice.India builds on nearly two decades of international expertise in air purification and monitoring across Asia, the USA, and Europe. Since establishing our team and Experience Centre in Gurugram in 2022, we've been actively supporting India's transition toward effective air quality management and pollution mitigation. Together with our partners and clients, we look forward to shaping a healthier, more sustainable future for India and beyond.


6 Outdoor
Consider opening windows and using an air purifier to improve air quality
Comfortable for productive work
3 Conference room
Air Quality is Fair
1 Lobby
Air Quality is Good
For Buildings
10


198 Forecast:
SO2 exceedance expected in 34 hours
12 Airvoice Monitor:
Air within normal limits
138
146
Control Point:
Air within normal limits
122
For Industries
32


86
8 Good Outdoor Air Quality
10th, No.18, Mayura Street
12
Fair Outdoor Air Quality
14th St, Clyde Hill
122
198
6
84
For Cities
46

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About Airvoice

Airvoice is a global company developing high-impact solutions for monitoring and managing air quality both indoors and outdoors. With nearly two decades of experience behind our core team, we combine scientific expertise, advanced engineering, and a strong implementation record to support healthier environments across cities, industries, and commercial spaces.

With roots dating back to 2006, Airvoice builds on a legacy of successful ventures in the air quality sector. Today, we operate across India, the USA, Europe, and Asia.

Through joint research with leading institutions, we continue to push the boundaries of what's possible in atmospheric physics, AI-based modeling, and data-driven innovation. Our scientific partners include the University of Arizona, the University of Utah, NTU Singapore, the Indian Institute of Tropical Meteorology, and others. Our mission is to bring science into everyday practice and help address one of the most pressing challenges of our time: air quality.

Our Clients and Partners

EastBanc
JINDAL STEEL & POWER
Colliers
CII Confederation of Indian Industry
EMAAR
KREA university
CSTEP
G20 भारत 2023 INDIA
B20 भारत 2023 INDIA
PUNE SMART CITY DEVELOPMENT CORPORATION LTD.
Smart City INDORE

20
years in the industry

50+
projects globally

Since 2022
operating in India

Joint research with leading universities worlwide

- New Delhi
- Belgrade
- Washington DC
- Dubai

Airvoice.India: Bringing Global Expertise in Air Quality Management Solutions to the Region

India presents a major opportunity to advance air quality technologies. Airvoice.India combines global expertise with proven, ready-to-deploy solutions tailored to tackle India's most urgent air quality challenges.

Airvoice.India was launched in 2022 as a joint venture between Airvoice Global and Col. Bhawani Singh, an independent investment management professional.

Beyond introducing advanced systems, the company co-creates solutions to address the specific needs of Indian industries and communities.

In just two years, Airvoice.India has become a recognized player in smart city and environmental initiatives, contributing to national strategies and participating in events like the G20 Sustainability Summit.

Making a Measurable Impact Across India

Airvoice does not just bring technology to India — it develops locally tailored solutions that support long-term public health and visibility of air quality data.

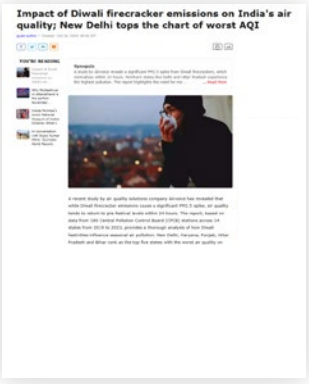
Airvoice already supports smart city programs in Indore, Pune, and Pimpri-Chinchwad and co-authored an official air quality report for Indore.

The company also leads independent research to raise public awareness — covering topics like Diwali pollution, global PM2.5 trends during New Year's Eve, and air quality in India's top tourist destinations. These reports are widely covered in national media and help make air quality data visible, trusted, and actionable.

Collaborative Air Quality Report for Indore with CII

Diwali Air Quality Impact Report

Media coverage:
The Times of India

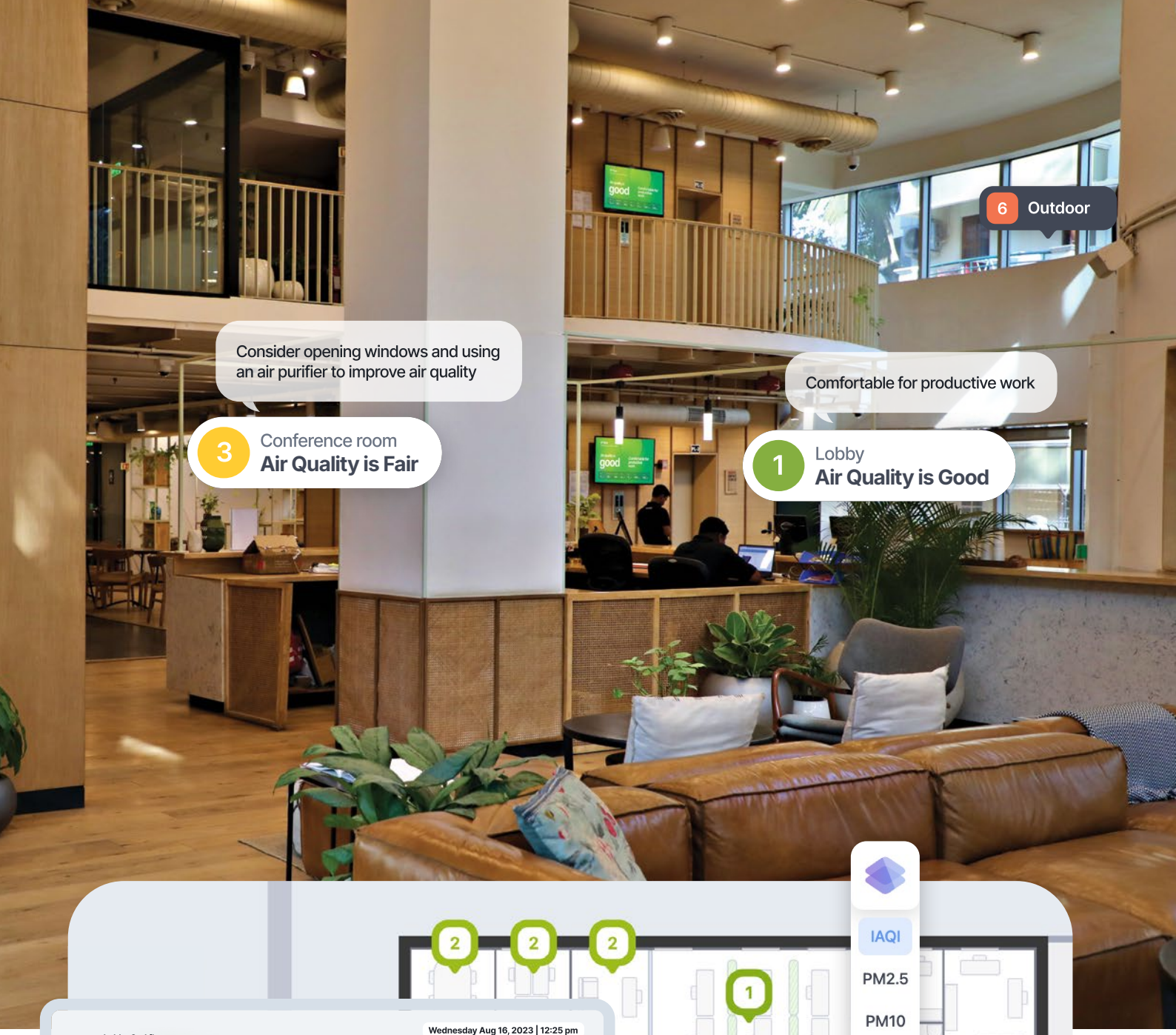


New Year's Eve PM2.5 Analysis Across Global Cities

Media coverage:
The Times of India

Air Quality in India's Popular Tourist Destinations

Media coverage:
TravelWorld.com from The Economic Times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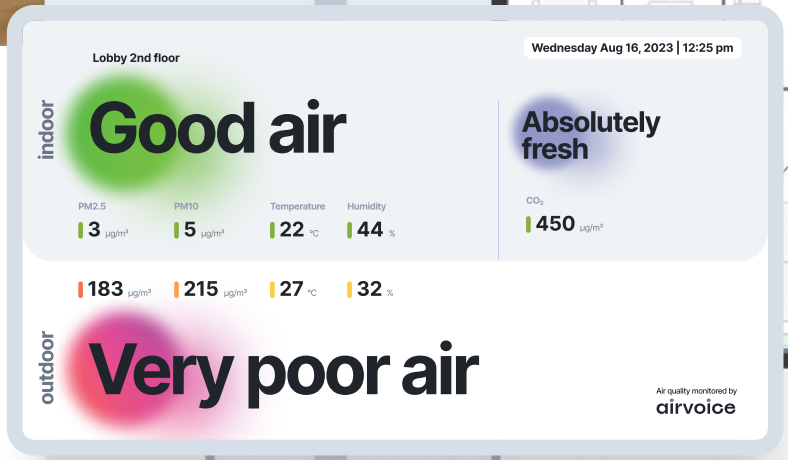
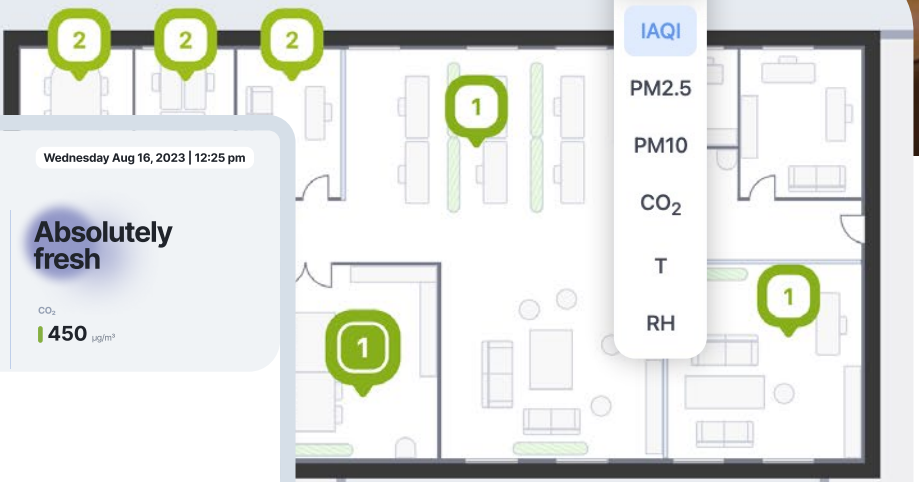

Lobby 2nd floor
Wednesday Aug 16, 2023 | 12:25 pm
indoor
Good air
PM2.5 3 µg/m³
PM10 5 µg/m³
Temperature 22 °C
Humidity 44 %
Absolutely fresh
CO₂ 450 µg/m³
183 µg/m³ 215 µg/m³ 27 °C 32 %
outdoor
Very poor air
Air quality monitored by airvoice


IAQI
PM2.5
PM10
CO₂
T
RH
2
2
2
1
1
1


IAQI 1 2 3 4 5 6 7 8 9 10 points


Air quality parameters
IAQI points
PM2.5 µg/m3
PM10 µg/m3
CO₂ ppm
T °F
RH %
Conference Room 1 3.6 3.6 425.5 76.7 25.4
Oct 13, 11:55 PM
Oct 13
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
Timezone: (GMT+04:00) Asia/Dubai

airvoice

Indoor Air Quality Solutions for Healthier Spaces

Restaurants & Cafés

Hospitals | Hotels | Shopping Malls

Homes | Gyms & Fitness Centers | Schools

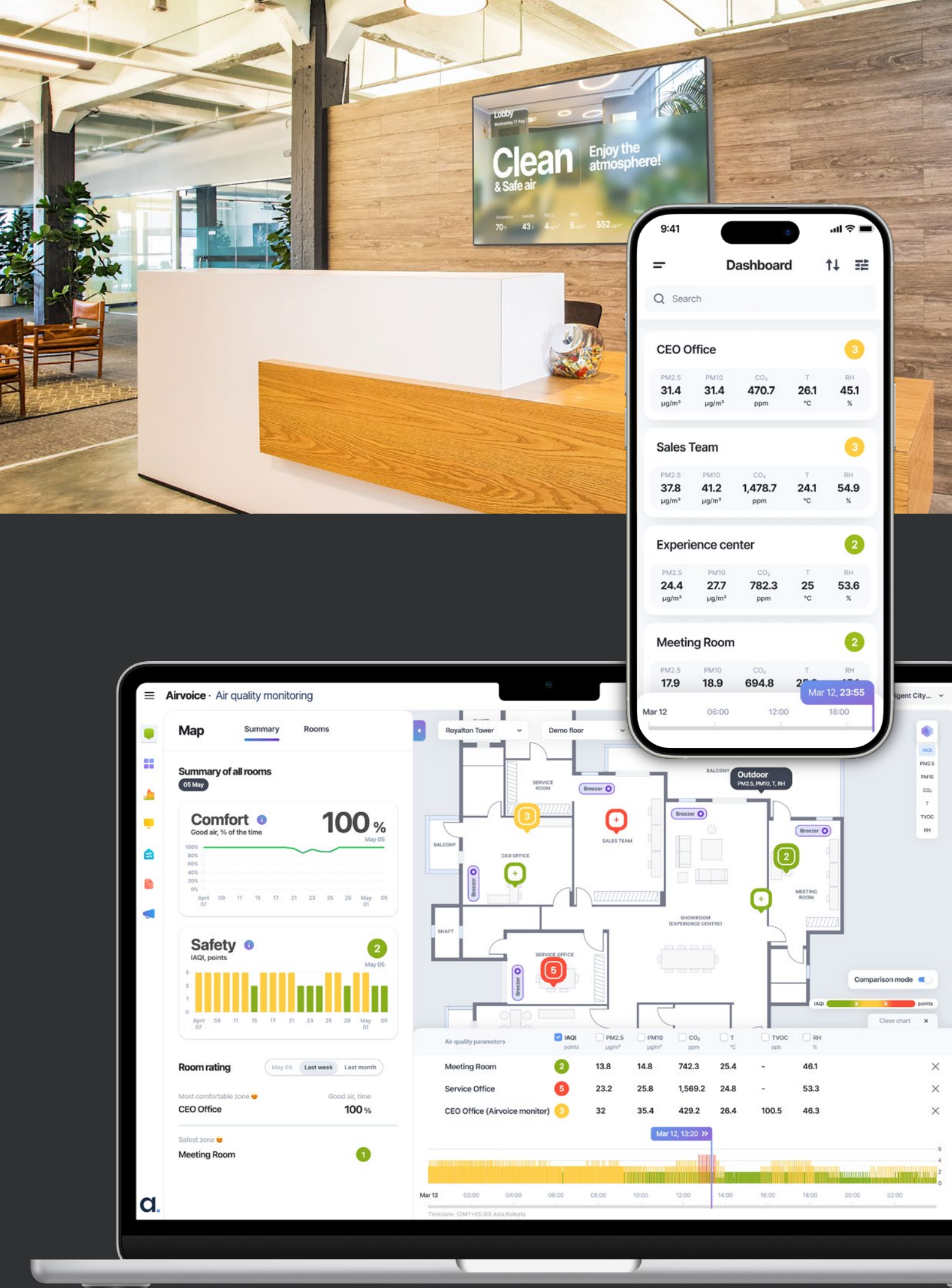
Warehouses | Coworking Spaces | Airports

Airvoice Indoor Air Quality Management Platform

Airvoice.Indoor is an integrated platform that helps you monitor, understand, and communicate indoor air quality with confidence. It can also incorporate outdoor air quality to provide a fuller picture of how ventilation and air purification systems are functioning, supporting more informed, data-driven decisions.

With smart maps, dashboards, and real-time data at your fingertips, it empowers you to maintain a healthy indoor environment, optimize HVAC performance, and demonstrate your commitment to safety and sustainability.

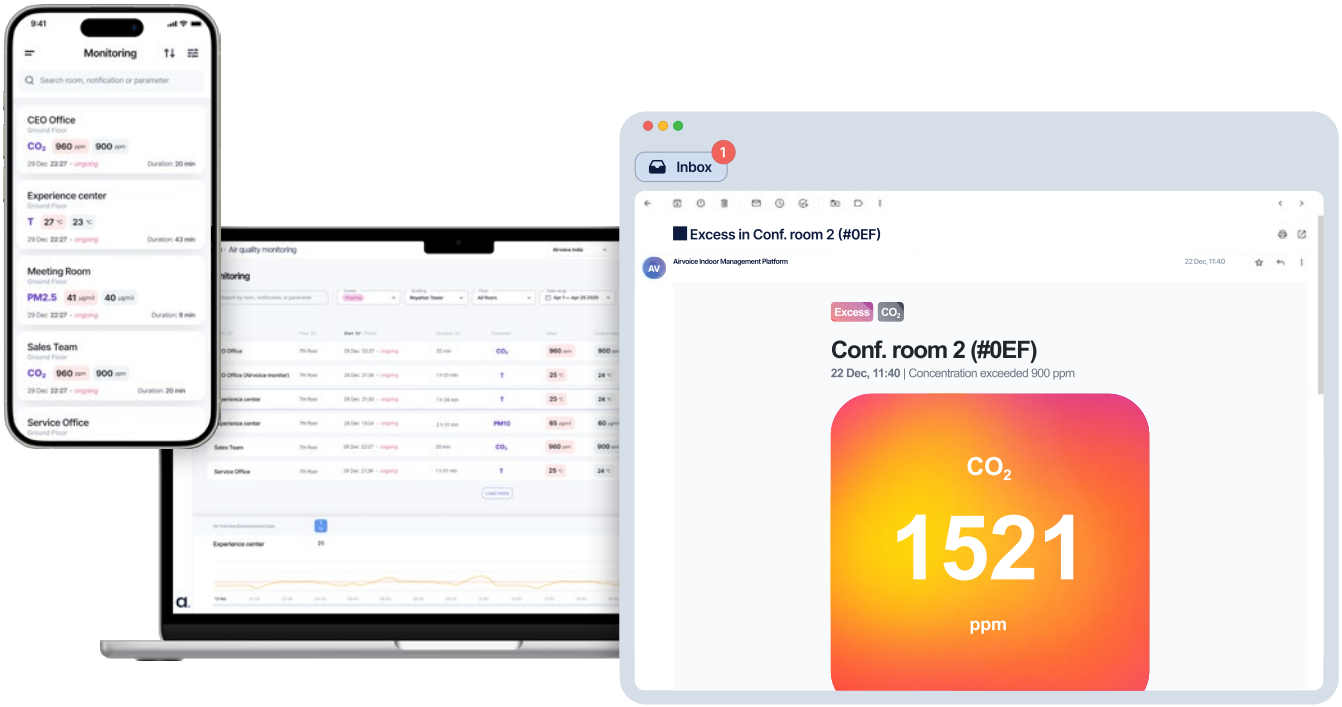
- **Live indoor air quality data** at your fingertips
- **Room-level dashboards** with intuitive visuals
- **Customizable alerts** to detect and respond to issues
- **Shareable IAQ reports** for compliance and stakeholder communication
- Data-backed justification for **HVAC upgrades**


Lobby
Clean
& Safe air
Enjoy the atmosphere!
9:41
Dashboard
Search
CEO Office
PM2.5 31.4 µg/m³
PM10 31.4 µg/m³
CO₂ 470.7 ppm
T 26.1 °C
RH 45.1 %
Sales Team
PM2.5 37.8 µg/m³
PM10 41.2 µg/m³
CO₂ 1,478.7 ppm
T 24.1 °C
RH 54.9 %
Experience center
PM2.5 24.4 µg/m³
PM10 27.7 µg/m³
CO₂ 782.3 ppm
T 25 °C
RH 53.6 %
Meeting Room
PM2.5 17.9
PM10 18.9
CO₂ 694.8
Mar 12, 23:55
Mar 12
06:00
12:00
18:00
Airvoice · Air quality monitoring
Map
Summary
Rooms
Summary of all rooms
05 May
Comfort
Good air, % of the time
100 %
Safety
IAQI, points
Room rating
Most comfortable zone
CEO Office
Good air, time
100 %
Safest zone
Meeting Room
Royalton Tower
Demo floor
Outdoor
PM2.5, PM10, T, RH
SERVICE ROOM
BALCONY
CEO OFFICE
SALES TEAM
SHAFT
SERVICE OFFICE
SHOWROOM (EXPERIENCE CENTRE)
MEETING ROOM
Breezer
Comparison mode
Air quality parameters
IAQI
PM2.5
PM10
CO₂
T
TVOC
RH
Meeting Room 2 13.8 14.8 742.3 25.4 - 46.1
Service Office 5 23.2 25.8 1,569.2 24.8 - 53.3
CEO Office (Airvoice monitor) 3 32 35.4 429.2 26.4 100.5 46.3
Mar 12, 13:20

Notifications

Stay ahead of issues with instant alerts

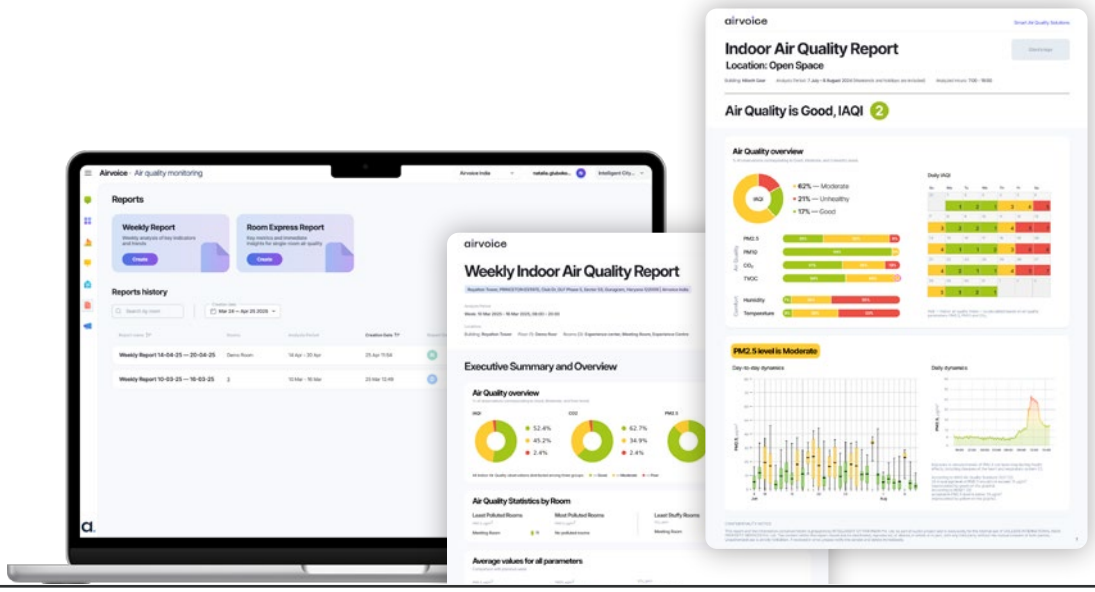
Airvoice.Indoor automatically notifies your team when air quality parameters exceed set thresholds, allowing you to respond immediately and maintain a safe, comfortable environment.



Automated Reports

Turn data into decisions

Automatically generate full-scale air quality reports tailored to match internal benchmarks, preferred standards, or stakeholder needs. Visual summaries and flexible formatting make it easy to communicate key insights, support management decisions, or justify HVAC upgrades.

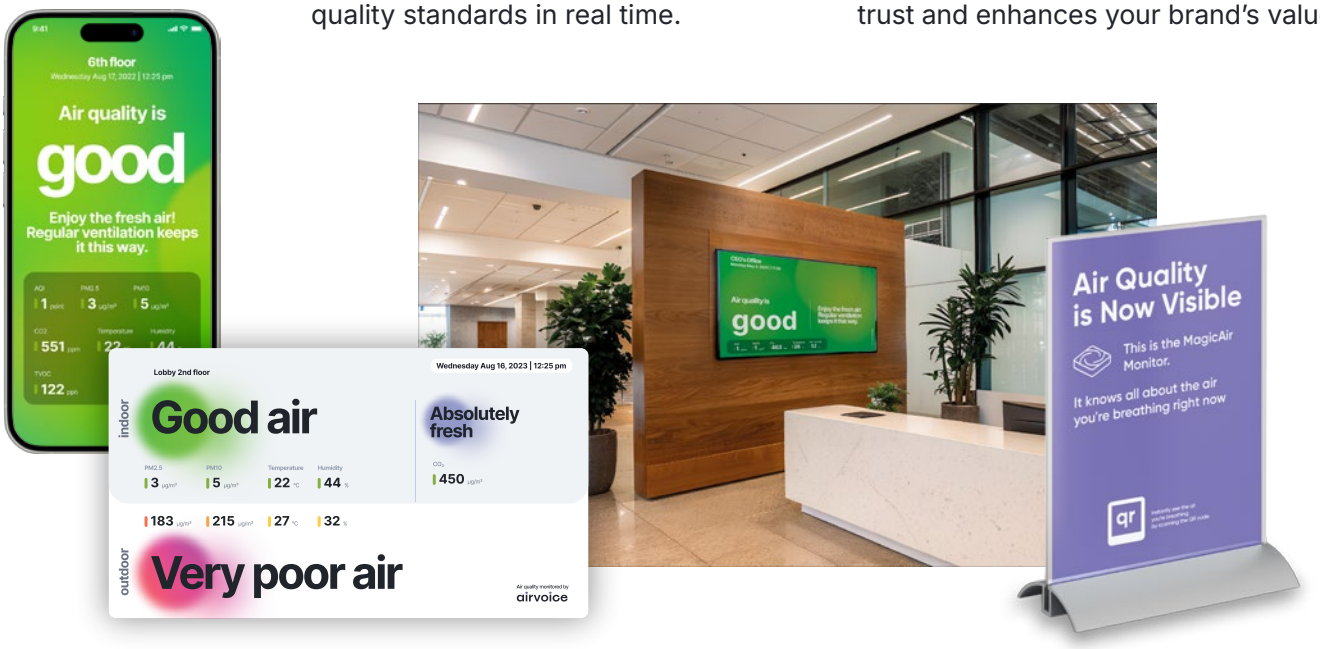


Tools to Communicate High Air Quality Standards

Showcase superior air quality and promote wellness in your space

Use digital displays, widgets, and dashboards to demonstrate your air quality standards in real time.

Whether it's for internal transparency or public confidence, visibility builds trust and enhances your brand's value.



Demand-Control Ventilation Solution for Energy-Efficient HVAC Management

Save energy while keeping indoor air clean and healthy. Airvoice.Indoor connects air quality and occupancy data to your HVAC system, enabling automated ventilation control that balances comfort and efficiency.

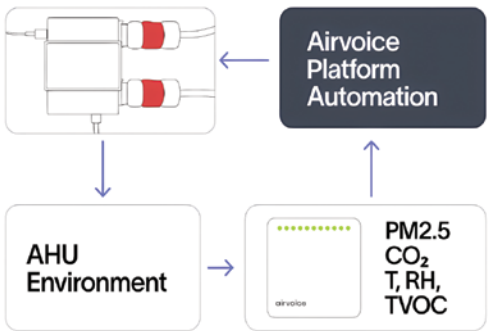
Real-Time Control
Fresh air flow adapts to IAQ and occupancy data

Cloud-Based Automation
Centralized logic with real-time visibility and control

Energy & Filter Efficiency
Reduces runtime and extends filter life

Seamless Integration
Compatible with major HVAC and BMS systems

Hands-Off Operation
Fully automated — no manual input required



Verified Indoor Air Quality Sensors

Real-time monitoring and cloud storage for analysis

Track key pollutants and comfort-related environmental factors to maintain healthier, more productive indoor spaces.

Measured parameters:

Particulate matter
PM1, PM2.5, and PM10

Environmental conditions
Temperature, humidity

Carbon dioxide
CO_2

Total organic volatile compounds
TVOC

Cost-Effective Outdoor AQ Monitor

Airvoice's compact outdoor sensor expands your view beyond the building, enriching air quality data with outdoor context. Monitor pollutant levels at building entrances or on rooftops to support more informed HVAC control, occupant communication, and exposure risk assessment.

Measured parameters:

Particulate matter
PM1, PM2.5, and PM10

Environmental conditions
Temperature, humidity

Carbon dioxide
CO_2

Total organic volatile compounds
TVOC

Want to unlock the full value of clean indoor air?

Reach out to learn how Airvoice can help improve health, performance, and energy efficiency across your spaces.

namaste@airvoice.global

Effective air quality management begins with data, enabling accountability, optimization, and tangible results

Vitalii Matiunin

CEO of Airvoice

> Indoor air quality is now widely recognized as critical to health, performance, and asset value. As a result, companies are investing heavily in HVAC and air purification systems. But many of these systems don't perform as expected — and in some cases, don't perform at all.

This is often caused by invisible gaps between how systems are designed, installed, and operated. In buildings around the world, systems that look good on paper fail in practice, delivering only a fraction of the air quality they were meant to provide.

Why does this happen? Because without real-time data, there's no feedback loop, and without feedback, no one takes ownership of air quality as a business asset.

Effective air quality management starts with monitoring. That's where Airvoice comes in. We do not just provide data but also turn it into actionable insights, helping you uncover hidden losses, diagnose root causes, optimize HVAC performance, and deliver real impact.

Healthy Air. Efficient Control. Visible Results.

Clean indoor air isn't just a matter of comfort — it's a strategic business asset

Research by Dr. Joseph Allen and his team at Harvard shows that doubling office ventilation rates can improve cognitive performance by up to 8%, at a cost of just $40 per person annually. The economic return? An estimated $6,500 per employee in productivity gains.[1]

When air quality is overlooked, occupants — whether employees or tenants — experience health issues and discomfort, motivation declines, and buildings and businesses lose value. But when it's managed effectively, it becomes a driver of well-being, efficiency, and long-term value.

Airvoice helps building owners and employers turn indoor air into a visible, optimized, and valuable resource, supporting ESG goals and attracting top talent.

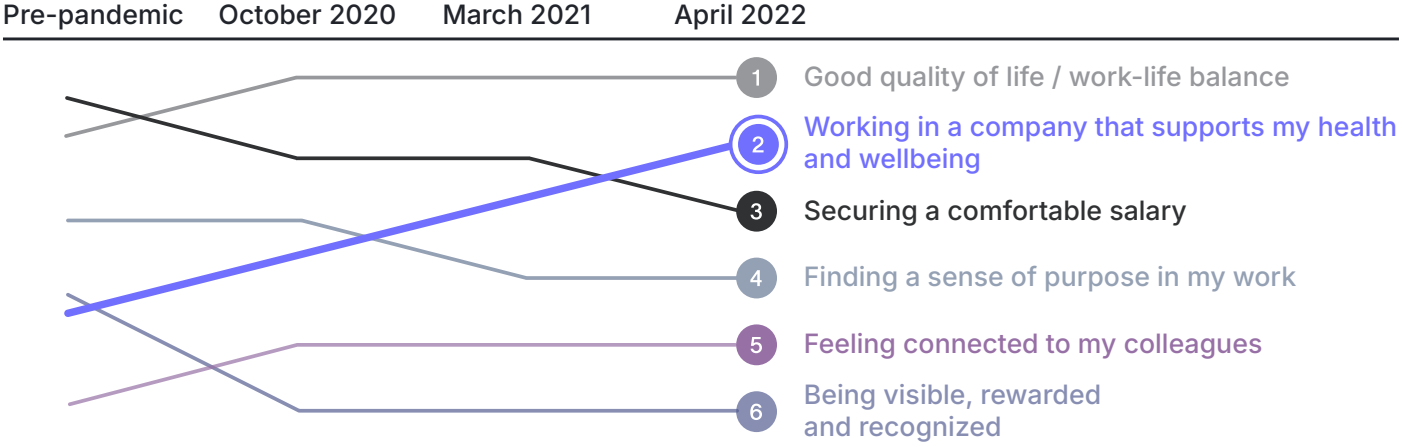
[1] MacNaughton P, Pegues J, Satish U, Santanam S, Spengler J, Allen J. 2015. Economic, environmental and health implications of enhanced ventilation in office buildings.

Up to 8%
less is the value of buildings with no air monitoring

Up to 7%
decreased value of "non-ESG" enterprises

"Working in a company that supports my health" — now a top priority for employees, according to JLL.

Top Work Priorities According to a JLL Survey



Source: JLL Workforce Preferences Barometer, 2022.

Enhancing Air Quality at Jindal Corporate Office

Airvoice has been a long-term technology partner to Jindal Steel & Power Ltd., delivering indoor air quality improvements across multiple sites, including the Corporate Office in Gurugram, NTH Building in New Delhi, and Bhikaji Cama Place. This case highlights results from one representative site, where a data-driven upgrade to the air system significantly improved indoor air quality (IAQ), energy use, and workplace health.

Problem

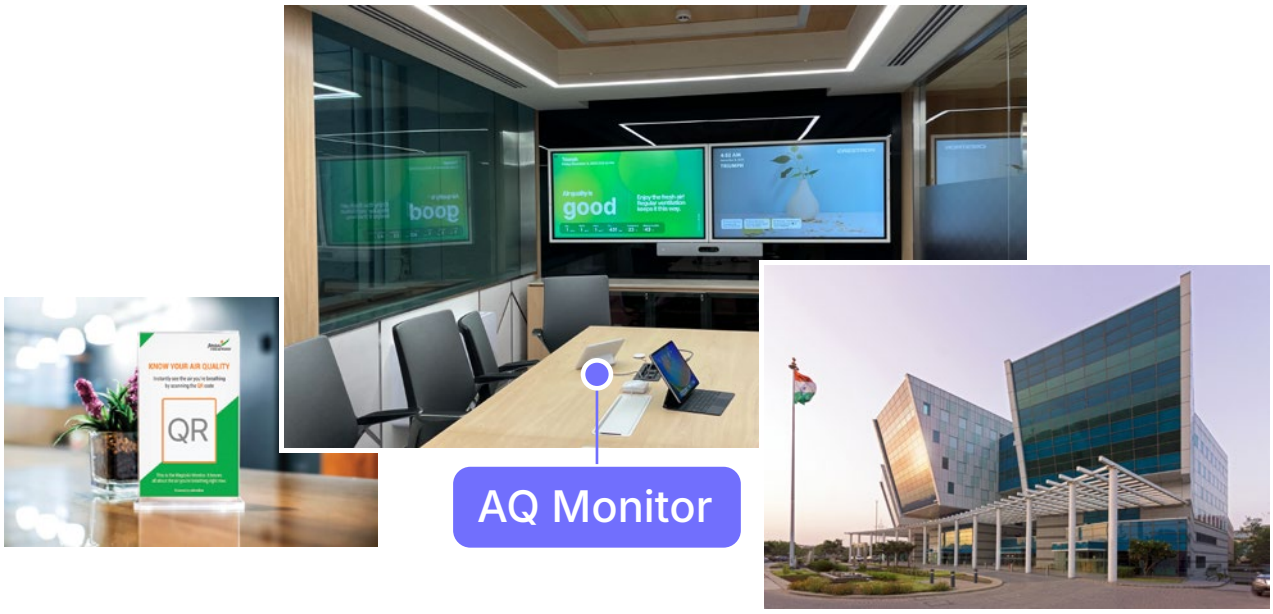
- Persistent PM2.5 levels throughout the building, often approaching outdoor pollution concentrations
- Inefficient manual operation of the ERV (Energy Recovery Ventilator), running at fixed times regardless of actual need

Solution

- Real-Time Monitoring: Installed sensors to track pollution levels and HVAC effectiveness
- Filtration Upgrade: Replaced and optimized AHU filters for better air purification and durability
- Demand-Controlled Ventilation (DCV): Enabled automated ERV activation based on live CO_2 and PM2.5 levels
- Integration with Airvoice Platform: Connected ERV system to enable cloud-based control, reporting, and analytics

Results

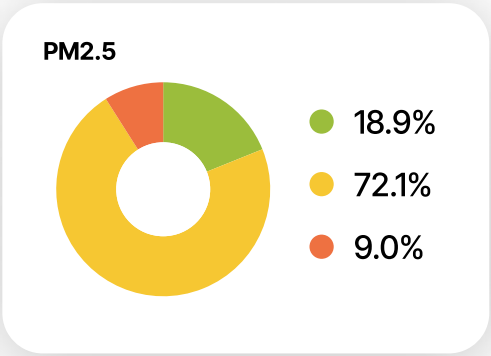
- Safer Air Across the Site: Indoor PM2.5 levels drastically reduced, achieving healthy IAQ standards
- Faster Response Time: Noticeable improvements within one hour of system activation, even at reduced AHU power
- Significant Energy Savings: Ventilation runtime reduced by 10×, from 85 hours to just 9 hours per week — without compromising air quality
- Smart Automation in Action: AHU and ERV systems now dynamically adjust to real conditions, improving operational efficiency

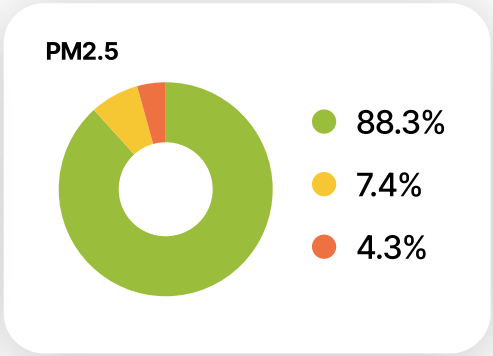


Airvoice indoor air quality solutions installed at JSP's sites in Gurugram and Bhikaji Cama Place, New Delhi.

JINDAL STEEL & POWER

Summary for week from September 2 to September 6





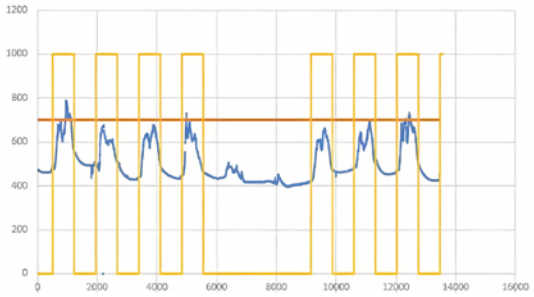
Solution not implemented

Solution implemented

Dramatic improvement in indoor PM2.5 levels after Airvoice solution implementation: Share of healthy air quality readings increased from 19% to 88% in less than one week.

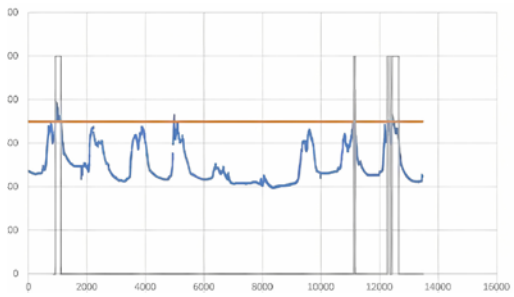
Implementation of DCV in Jindal Steel & Power Corporate Office, India (Gurugram)

Manual ERV Control



Total – 85 hours
in Powered-On state

CO_2-Based Demand Control



Total – 9 hours
in Powered-On state

Results

Ventilation operating time was reduced by 10x,

from 85 hours to 9 hours during the control week.

Maximizing Comfort in CII Conference Rooms

Airvoice partnered with the Confederation of Indian Industry to improve air quality and comfort in conference rooms at its Delhi headquarters, achieving healthier CO_2 levels and positive employee feedback through targeted ventilation upgrades.

Client: Confederation of Indian Industries (CII)

Location: Corporate office, Delhi, India

Scope: Air quality monitoring across five floors (12,000 sf in total) focusing on conference rooms

Objectives

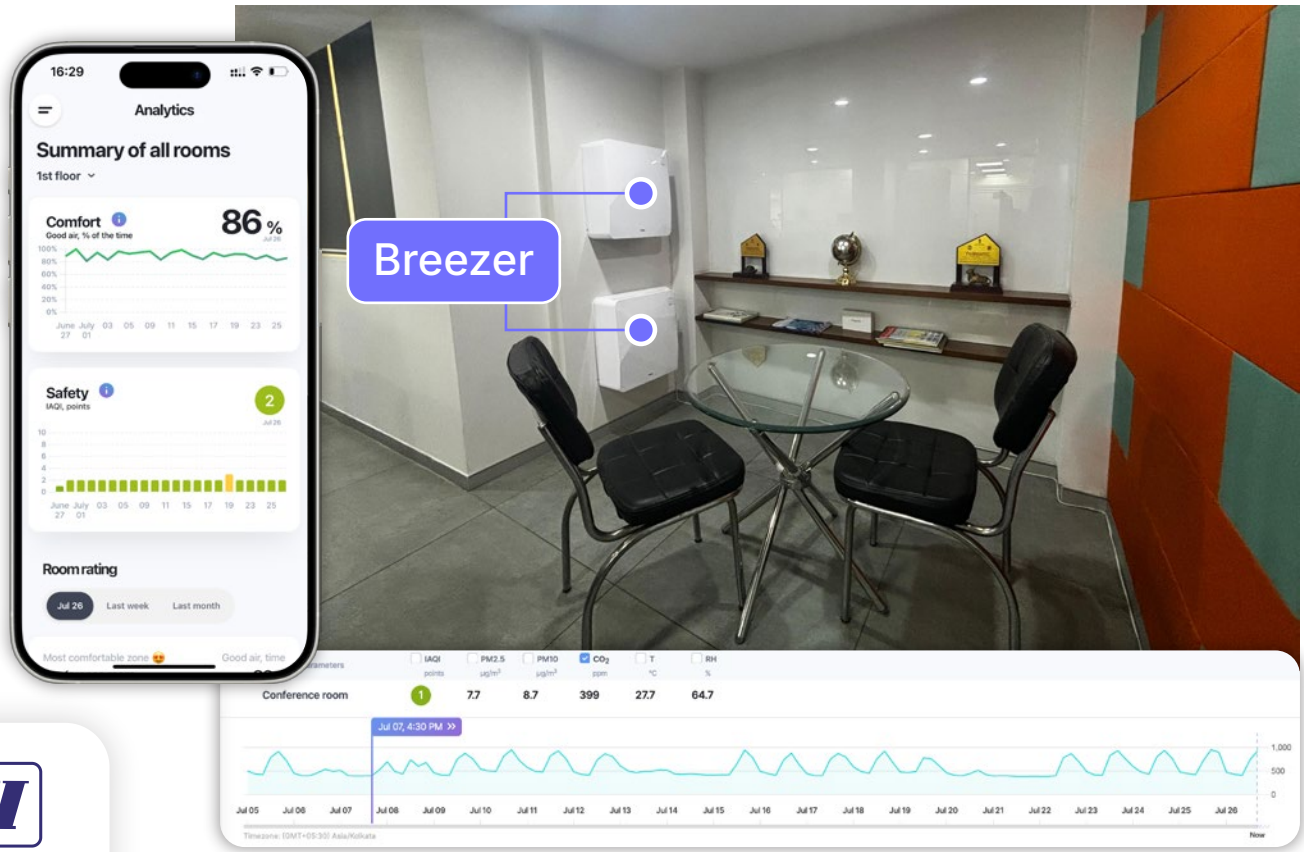
- Address poor air quality, particularly high CO_2 levels in conference rooms
- Improve ventilation in areas lacking proper air exchange systems

Solution

- Conducted detailed air quality assessments in conference rooms, identifying high CO_2 levels due to inadequate ventilation
- Installed two Breezers in a high-traffic conference room to manage CO_2 levels
- Implemented a demand control ventilation system based on real-time data

Results

- Achieved consistent CO_2 levels below 1,000 ppm, enhancing air quality during meetings
- Recorded excellent PM2.5 values, ensuring clean and fresh air in the workspace
- Positive employee feedback on improved air quality and comfort during long meetings, contributing to better focus and well-being



Revitalizing Air Quality at NCAER Corporate Space

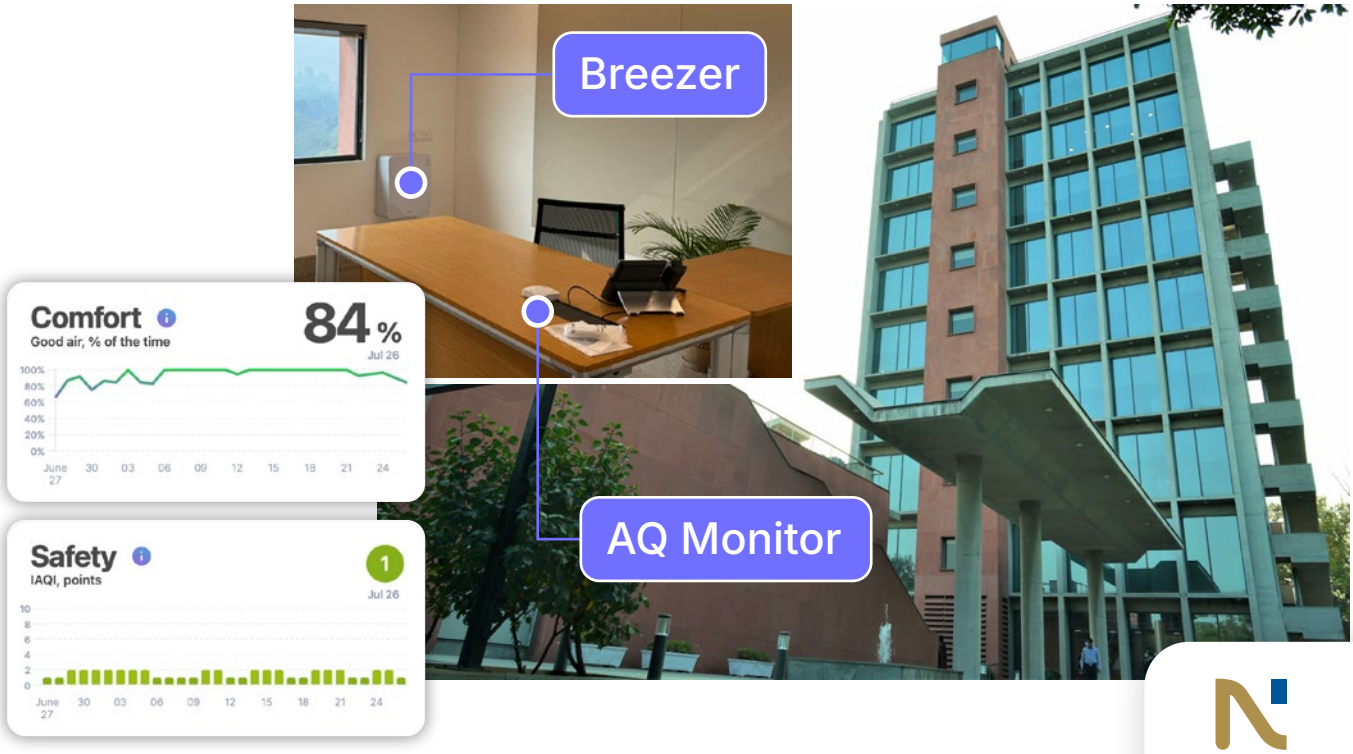
Airvoice assessed indoor air quality across the New Delhi headquarters of the National Council of Applied Economic Research, providing targeted ventilation upgrades and HVAC recommendations that improved comfort and resolved elevated CO_2 and PM2.5 levels.

Client: National Council of Applied Economic Research (NCAER)

Location: Main corporate office, New Delhi, India

Scope: AQ Monitoring across over 100,000-sf office space since December 2023

Objectives	• Identify and address air quality issues, specifically elevated levels of CO_2 and PM2.5 • Provide actionable recommendations for ventilation and filtration improvements
Solution	• Installed IAQ monitors and conducted a detailed assessment of indoor air quality to identify problem areas • Deployed immediate improvements with Breezers in key zones and proposed comprehensive HVAC upgrades
Results	• Provided air quality solutions, including recommendations for enhanced ventilation and filtration • Installed an initial Breezer to immediately address air quality in a critical area, with further installations underway to improve conditions in other essential zones • Advised on further HVAC adjustments to address identified issues



NCAER

Strategic Air Quality Optimization at Colliers Bengaluru

At Colliers' Bengaluru office, Airvoice implemented an extensive air quality monitoring system with 24 air quality sensors to identify pollution sources and recommend HVAC upgrades that enhance workplace comfort and wellbeing.

Client: Colliers

Location: Embassy Golf Links Business Park, Bengaluru, India

Scope: AQ monitoring across 21,000-sq space since July 2023

Objectives

- Assess the current HVAC system for potential improvements
- Provide data-driven ventilation strategies to optimize indoor air quality, particularly addressing high levels of CO_2 and PM2.5

Solution

- Implemented a comprehensive monitoring network of 23 indoor and 1 outdoor sensors to analyze seasonal air quality variations
- Advised on HVAC upgrades and room usage to improve PM2.5 levels

Results

- Identified plant-based air purifiers as internal PM pollution sources, which guided operational adjustments
- Provided actionable insights that led to discussions with building management for system improvements

Promoting Healthy Air at Open Advanced Technologies

Airvoice implemented a monitoring system across Open Advanced Technologies' office to evaluate CO_2, PM, and TVOC levels, uncovering ventilation gaps in executive offices and guiding upgrades for better indoor conditions.

Client: Open Advanced Technologies LLP

Location: Main corporate office, New Delhi, India

Scope: Installed a network of IAQ monitors across the 5,100 sq space in March 2024

Objectives

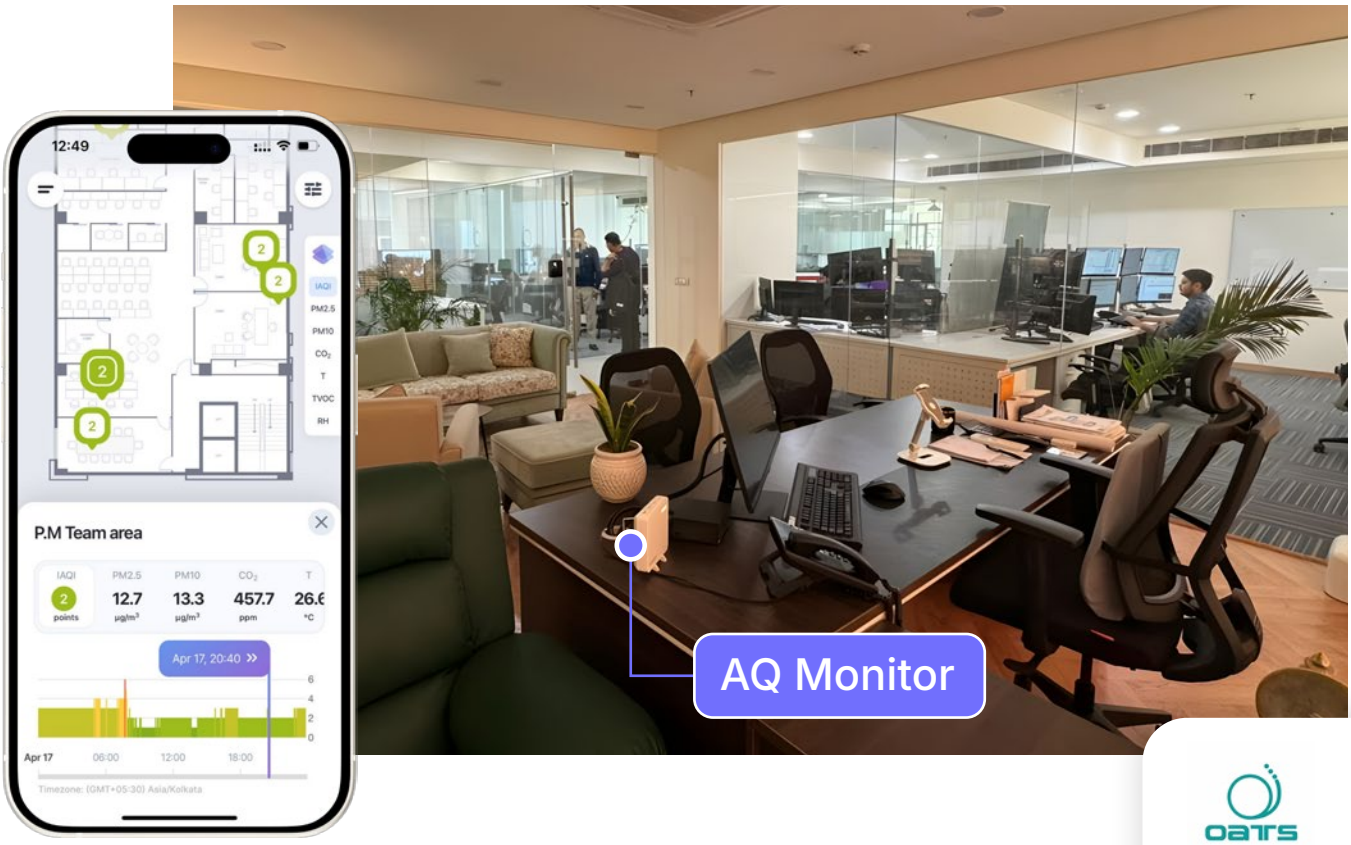
- Assess and improve indoor air quality focusing on CO_2, PM, and TVOC levels
- Enhance air circulation specifically in leadership offices

Solution

- Conducted air quality monitoring to evaluate CO_2, PM, and TVOC across the office
- Identified well-ventilated areas and zones lacking effective air exchange, particularly top-management offices
- Recommended enhancements to the overall ventilation system

Results

- Confirmed effective ventilation in general office areas but identified poor air exchange in leadership offices
- The improvements are intended to ensure a healthier office environment, reducing sick leave days and enhancing employee productivity



Elevating Air Standards in DC Commercial Real Estate

To improve tenant experience and rebuild post-COVID confidence, EastBanc partnered with Airvoice to implement full-building air quality monitoring and real-time displays — supporting proactive air management and contributing to higher occupancy.

Client: EastBanc

Location: Washington DC

Scope: 156,000-sf 8-floor building, ongoing since June 2022

Objectives

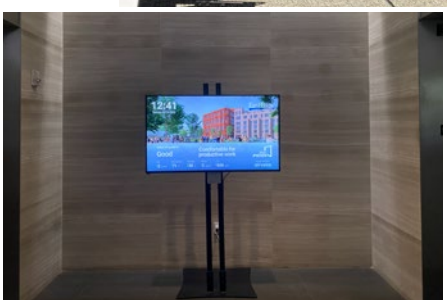
- Demonstrate controlled and safe indoor air quality post-COVID to reassure tenants
- Address tenant complaints regarding uncomfortable air conditions, including overheating and stuffiness

Solution

- Implemented an IAQ monitoring system across all floors to provide real-time data, making air quality information publicly accessible to build tenant trust
- Installed an outdoor AQ monitor to validate the superior indoor air quality
- Set up a public display in the lobby to provide visible and continuous air quality updates

Results

- Provided building engineers and administrators with immediate alerts on air quality issues, enabling proactive management and resolution before tenant discomfort arises
- Significantly reduced tenant complaints about air quality
- Improved tenant retention rates and increased building occupancy



EastBanc

Showcasing Indoor Air Quality Excellence at Airvoice's India Office

At its own Experience Center in Gurugram, Airvoice implemented advanced air monitoring and smart ventilation to maintain clean indoor air despite high outdoor pollution, thus showcasing system capabilities while ensuring a safe, productive workplace.

Location: Airvoice Experience Center in Gurugram, Delhi NCR

Scope: Monitoring with indoor AQ sensors across the 2,940-sf office area

Objectives

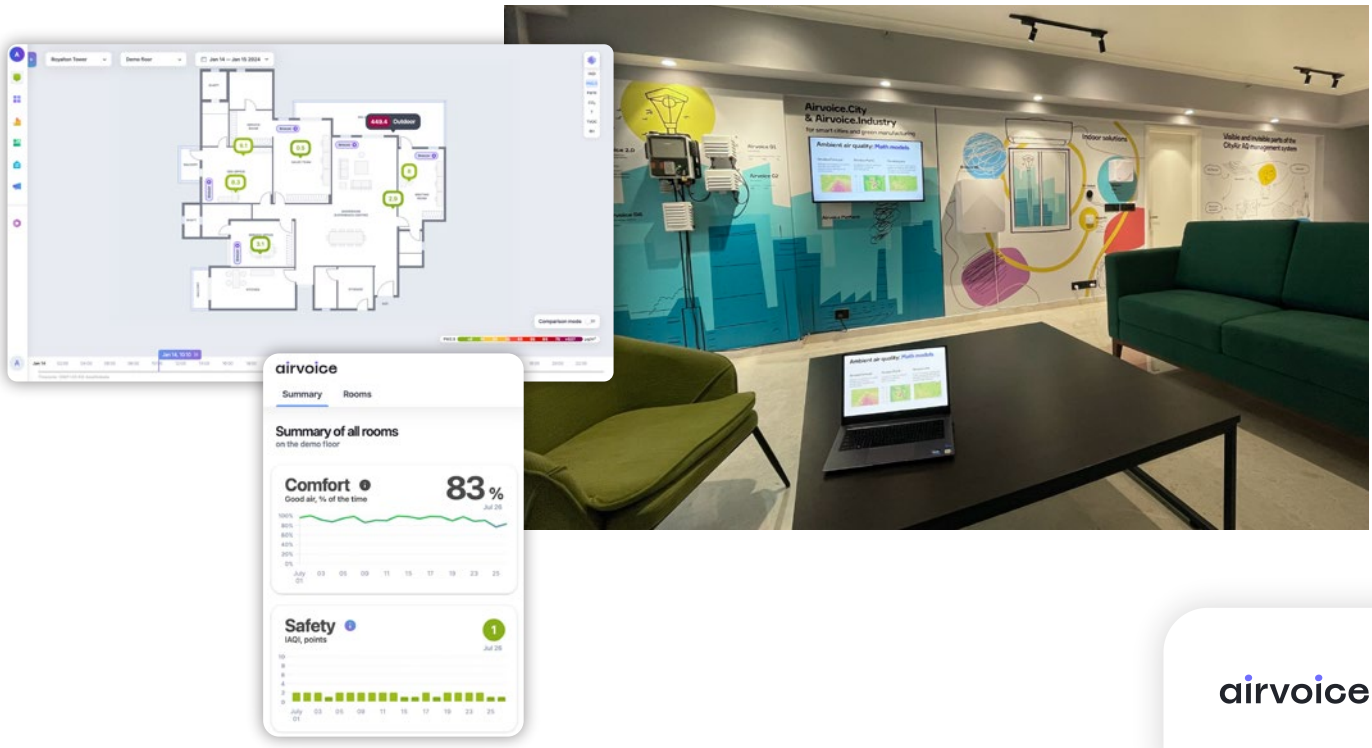
- Monitor and manage IAQ despite high outdoor pollution levels, particularly PM2.5
- Implement solutions to maintain healthy and productive workplace environments
- Demonstrate the effectiveness of advanced air purification systems in maintaining safe indoor conditions

Solution

- Installed air monitoring devices to continuously assess indoor pollutants
- Utilized Breezers and the Airvoice platform for dynamic air quality control based on real-time data, optimizing air purity and energy use
- Created a healthier workplace environment significantly contrasting with the high outdoor pollution levels

Results

- Significantly IAQ, maintaining PM2.5 levels far below the hazardous outdoor levels
- Enhanced system efficiency through predictive models of room occupancy and air quality
- Generated valuable data, leading to innovations in air quality management



airvoice

Optimizing Indoor Air Quality for LETA Architecture

In a compact Manhattan office, LETA Architecture used Airvoice monitoring to track indoor pollutants and CO_2 levels, adopting targeted ventilation solutions that improved air quality and supported employee focus and wellness.

Client: LETA Architecture PLLC

Location: New York, NY, USA

Scope: Indoor & outdoor air quality monitoring across 500-sq space since December 2023

Objectives

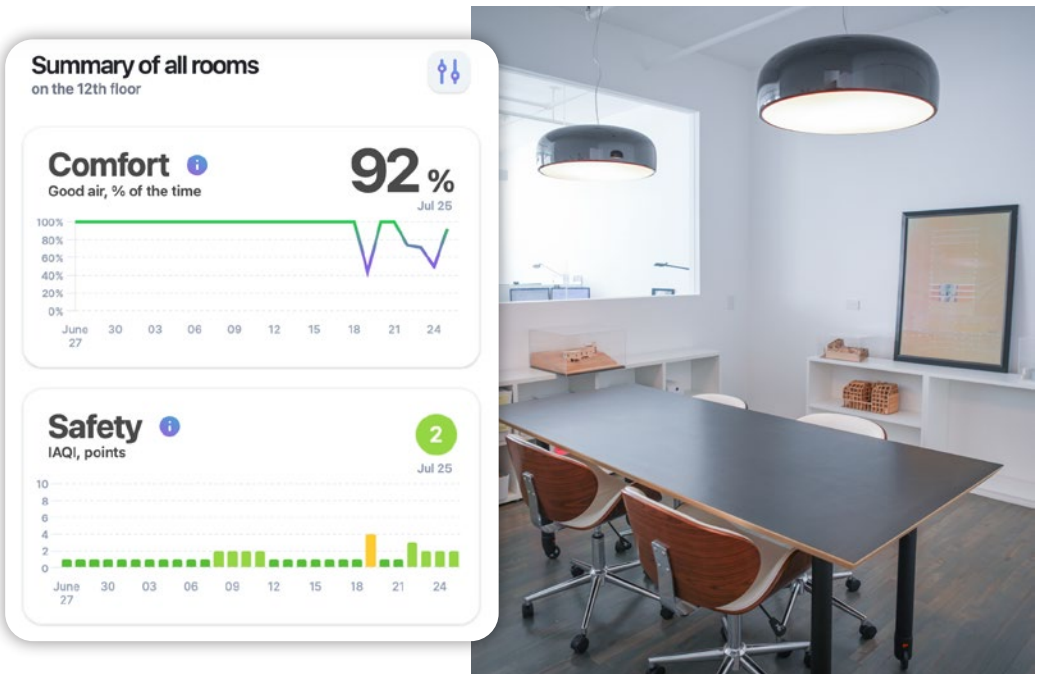
- Evaluate indoor air quality (IAQ) to identify problem areas and potential improvements
- Enhance air quality and employee wellness in office environments

Solution

- Implemented continuous monitoring on particulate matter (PM2.5, PM10), CO_2, TVOC, temperature, and humidity
- Identified CO_2 as the primary pollutant affecting air quality due to insufficient ventilation
- Recommended installation of smart ventilation systems to manage CO_2 levels effectively and enhance overall air quality

Results

- Achieved an overall "Good" IAQ rating, with occasional moderate ratings during peak office hours
- Significantly improved CO_2 levels, reducing potential impacts on productivity and cognitive function
- Enhanced HVAC system effectiveness by integrating real-time monitoring data to optimize air exchanges and reduce particulate levels



Healthy Workplace Air Monitoring at ICH BV

Dutch manufacturer ICH BV partnered with Airvoice to evaluate natural ventilation strategies across two office buildings — proving their effectiveness and providing a real-time data backbone for employee health initiatives.

Client: ICH BV

Location: Hollandscheveld, Netherlands

Scope: Real-time air quality monitoring across 2 office buildings

Objectives

- Establish continuous air quality monitoring to ensure a healthy work environment, reflecting the company's commitment to employee wellness
- Evaluate natural ventilation efficacy, particularly in absence of mechanical HVAC systems

Solution

- Deployed indoor air quality monitors in three main areas: open space with a canteen, sports hall, and a combined office and assembly area, plus one movable unit for dynamic room assessment
- Integrated data into the AirVoice.Indoor Platform, allowing real-time monitoring and management of CO_2 levels, particulate matter (PM2.5, PM10), temperature, and humidity

Results

- Achieved optimal air quality with no critical levels of CO_2, enhancing mental efficiency and productivity
- Confirmed the effectiveness of natural ventilation strategies, with low indoor PM levels indicative of good outdoor air quality
- Provided a data-driven foundation for continuous environmental quality improvement and employee health initiatives

Enhancing Air Quality in Healthcare Settings for Apollo

Airvoice helped Apollo Hospitals assess indoor air quality across two facilities, identifying elevated PM2.5 and CO_2 levels and delivering targeted HVAC and filtration recommendations to support safer conditions for patients and staff.

Client: Apollo Hospitals

Location: Delhi and Bengaluru, India

Scope: Air quality monitoring across two hospitals of 75,000-sf total floor area during December 2023

Objectives

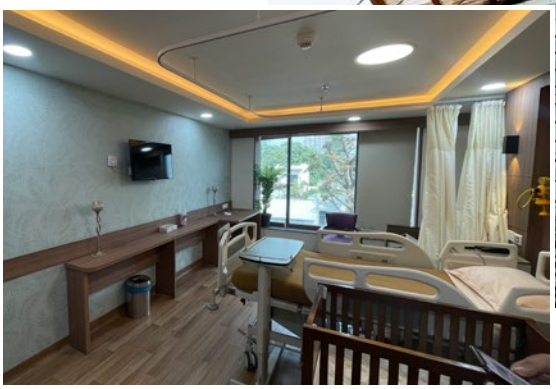
- Assess and improve indoor air quality across multiple hospital zones, especially in patient care areas
- Implement solutions to address high CO_2 and PM2.5 levels identified during the monitoring period

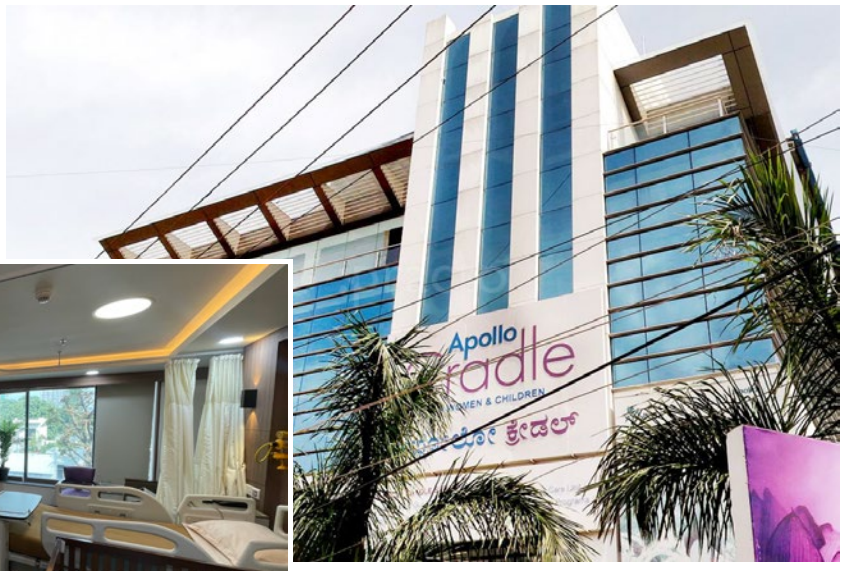
Solution

- Installed IAQ monitors (10 per facility) to measure indoor conditions, focusing on patient rooms, administrative areas, and public spaces
- Conducted a comprehensive air quality assessment over a month, providing detailed data on PM2.5 and CO_2 levels
- Recommended HVAC enhancements and local air purification solutions based on the data-driven analysis

Results

- Achieved optimal air quality in OT rooms, complying with health standards for PM2.5 and CO_2
- Identified and addressed high CO_2 and PM2.5 levels in administrative areas and lobbies, significantly improving air safety
- Proposed strategic ventilation improvements to enhance air quality and ensure patient and staff well-being





Monitoring Indoor Air Quality for Amber Enterprises

Amber Enterprises partnered with Airvoice to deploy indoor and outdoor air quality monitoring at their Gurugram office, enhancing ESG reporting, optimizing HVAC operations, and raising employee awareness through real-time data access.

Client: Amber Enterprises India Ltd

Location: Universal Trade Tower, Gurugram, Haryana, India

Scope: 4th floor indoor + outdoor monitoring, Dec 2024 – Jan 2025

Objectives

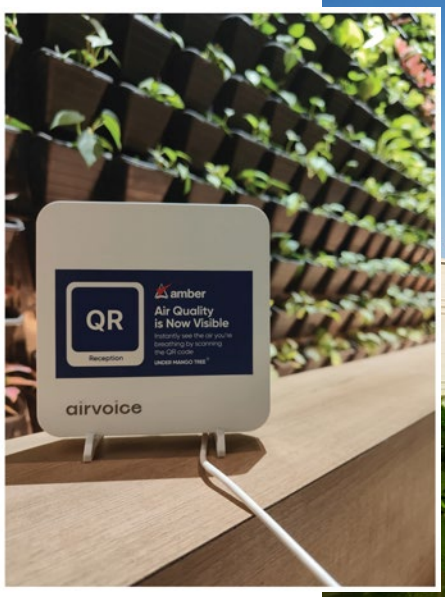
- Monitor key air quality metrics to support ESG goals
- Enable data-driven HVAC control for healthier workspaces
- Raise employee awareness through real-time air quality feedback

Solution

- Installed indoor AQ sensors and a cost-effective outdoor monitor
- Deployed display widget and 10 QR-coded tabletents for local IAQ access
- Provided access and training for the Airvoice.Indoor platform

Results

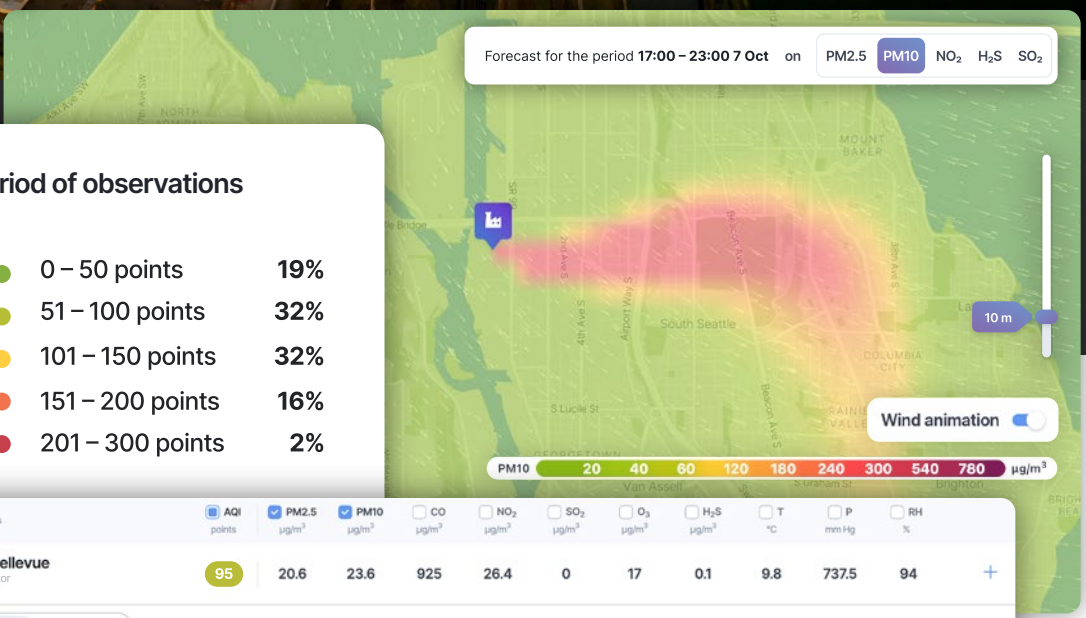
- 89.8% data completeness; 5 rooms reached 100%
- Elevated CO_2 and PM2.5 levels in several areas indicated need for improved ventilation
- Actionable insights enabled targeted HVAC adjustments and informed future improvements

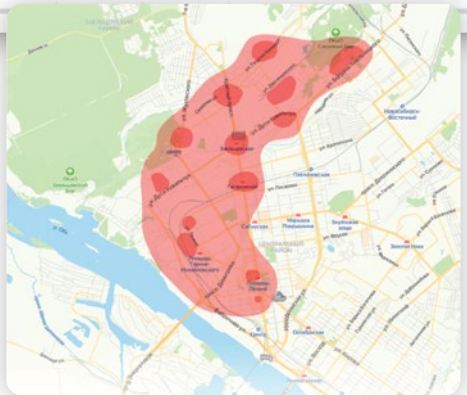


amber

AQI statistics for the entire period of observations

0 – 50 points	19%
51 – 100 points	32%
101 – 150 points	32%
151 – 200 points	16%
201 – 300 points	2%





airvoice

Air Quality Management for Industries

- Construction Sites
- Manufacturing
- Oil & Gas
- Chemical Industry
- Energy & Utilities
- Warehousing & Logistics
- Metals & Mining
- Ports, Terminals & Airports
- Waste Management
- Agriculture & Livestock

Airvoice.Industry

A Set of Advanced Technologies Empowering Enterprises to Control their Air Environmental Footprint

The air quality impact of industrial operations can be measured, mitigated, and transformed into a driver of trust — with the right tools. Airvoice.Industry offers a comprehensive solution that helps enterprises proactively manage their footprint by adjusting operations in response to changing conditions and demonstrating care for public health and sustainability.

Built on nearly two decades of international experience, the Airvoice solution combines modular software, cost-effective near-reference monitoring systems, and advanced modeling tools to address specific industrial needs. From tracking and forecasting how emissions affect surrounding areas to communicating air quality standards, Airvoice.Industry helps businesses prevent incidents, stay compliant, and foster strong, transparent relationships with local authorities and communities.

Understand Your Impact

Track air quality on and around your industrial site using a reliable monitoring network. Analyze your environmental footprint with expert input from Airvoice research team.

Predict Emissions in Advance

Use Airvoice.Plume to model and forecast emission dispersion up to 24 hours ahead. Anticipate exceedances, prevent exposure, and go beyond compliance.

Prioritize Safety & Health

Continuously monitor air conditions across your site and fenceline. Respond quickly to protect employees and nearby communities.

Communicate with Confidence

Share accurate, real-time data with authorities and the public. Strengthen your ESG position through transparency and evidence-based reporting.

Custom Air Quality Solutions for Industry

Dmitri Chubarov

Chief Scientific Officer

> At Airvoice, we work hand-in-hand with industrial partners to address their specific air quality challenges. Our approach is always collaborative: rather than offering one-size-fits-all solutions, we begin by closely studying on-site conditions. This initial research phase helps us define clear system requirements and understand the client's unique operational context.

In some cases, an existing Airvoice system can be deployed with minimal adaptation. More often, however, we integrate data from the company's monitoring setup into our platform or develop entirely new solutions, particularly in the field of air quality modeling.

In fact, many of our most advanced modeling tools have been developed through close collaboration with environmental teams at some of the world's largest industrial companies. These partnerships have allowed us to create solutions that are both scientifically rigorous and practical for everyday operations.

Throughout the implementation process, we support our partners with ongoing data interpretation and analysis, enabling timely decision-making and strategic, long-term management of air quality and environmental impact.

Airvoice.Industry: A Modular System for Measuring, Understanding, and Managing Air Pollution Impact

Airvoice.Industry combines advanced software, hardware, algorithms, and expert consulting, ensuring flexibility to meet your objectives. The Airvoice's modular system combines:

Hardware

Airvoice Ambient Air Quality Monitoring Systems (AAQMS) and Gas Modules track key pollutants and weather conditions with high accuracy. All sensors undergo rigorous calibration to ensure reliable field performance.

Software

Airvoice Platform for air quality data integration, analysis, and reporting.

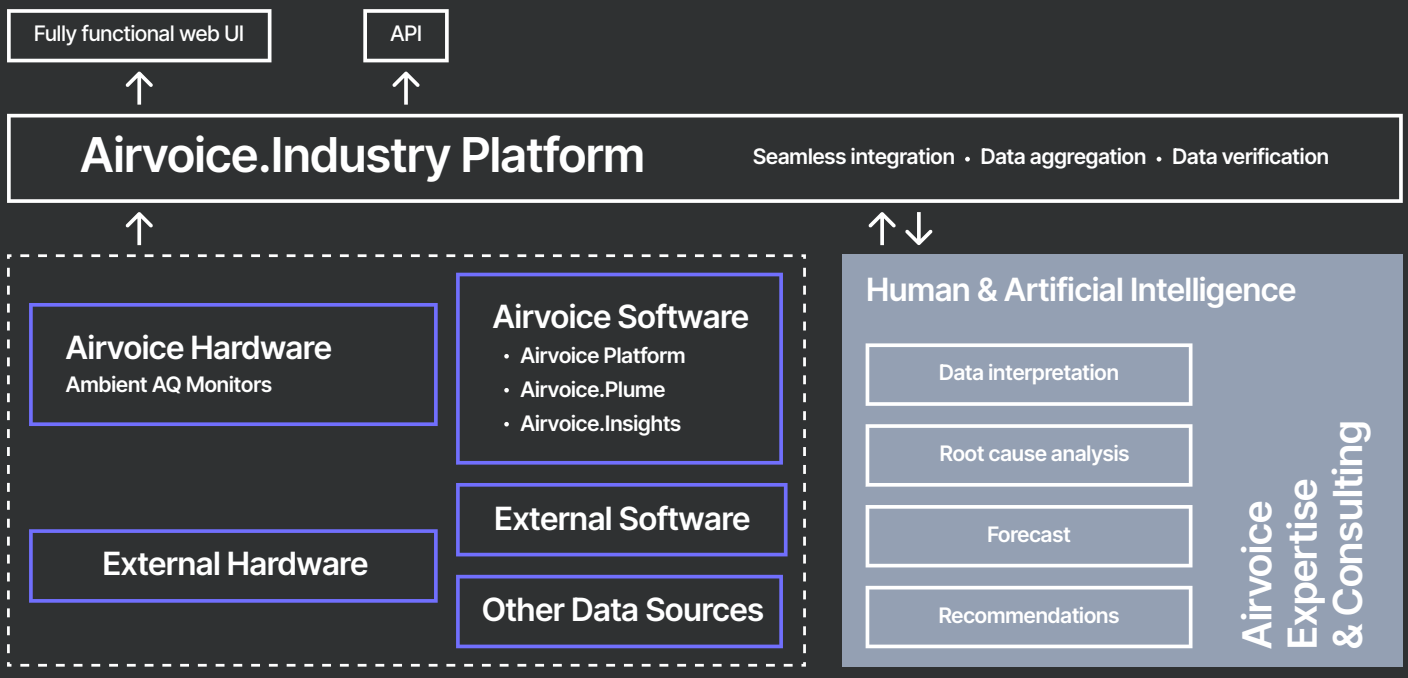
Airvoice.Plume for emission dispersion modelling.

Airvoice.Insights for analyzing multiple pollution sources and generating dynamic impact forecasts.

Expertise & Consulting

The Airvoice research and consulting team ensures your data is analyzed, interpreted, and translated into actionable recommendations, from diagnostics and forecasting to stakeholder reporting.

Airvoice Air Value Management System



Airvoice Platform Enables Industrial Enterprises to Monitor Emissions, Assess Risks, and Ensure Compliance

The Airvoice platform integrates data from sensors, models, and other sources into clear maps, graphs, and visuals. It empowers environmental managers to track pollutant dispersion, assess risks, and ensure regulatory compliance.

- View all data from sensors and models as intuitive maps, graphs, and visuals
- Analyze air quality statistics over selected time periods
- Pinpoint sources and hotspots
- Set personalized exceedance alerts
- Generate tailored reports with flexible timeframes and formats
- Predict emission dispersion in the surrounding area using **Airvoice.Plume**
- Assess the contribution of multiple sources with **Airvoice.Insights**
- Configure role-based access for different stakeholder groups


AQI statistics for the entire observation period
0 – 50 points 19%
51 – 100 points 32%
101 – 150 points 32%
151 – 200 points 16%
201 – 300 points 2%
Forecast for the period 17:00 – 23:00 7 Oct on
PM2.5
PM10
NO2
H2S
SO2
10 m
Wind animation
PM10 20 40 60 120 180 240 300 540 780 µg/m3
Air parameters
AQI
PM2.5
PM10
CO
NO2
SO2
O3
H2S
T
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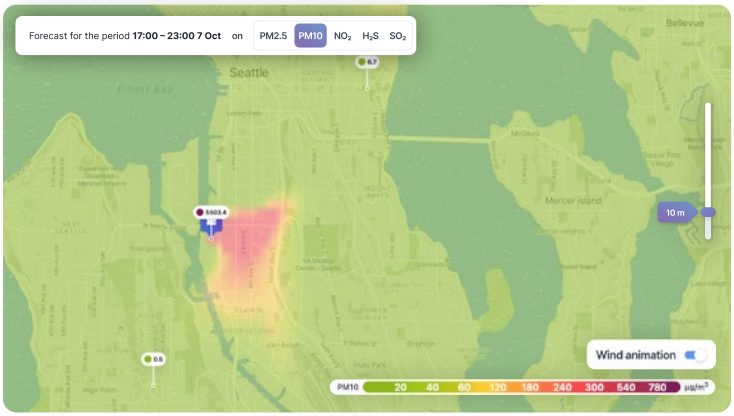
RH
45th St, Bellevue
Airvoice monitor
95
20.6
23.6
925
26.4
0
17
0.1
9.8
737.5
94
5 min
20 min
1 hour
1 day
Download Data
6 Oct, 18:20
4 Oct
5 Oct
6 Oct
Data quality
Now

Airvoice.Plume Helps Industrial Enterprises Predict, Visualize, and Mitigate Air Pollution Risks

Airvoice.Plume is a dynamic modeling tool that simulates pollutant dispersion from multiple sources under real-world atmospheric conditions. By combining topography, land cover, and weather data with emission source profiles, it helps industrial enterprises anticipate air quality risks, visualize pollution movement up to 24 hours in advance, and adjust operations to minimize impact on surrounding communities.



- Considers **weather, topography, land cover, and emission source data**
- **Visualizes plume trajectory dynamics** for up to 24 hours in advance
- Supports **multiple sources, pollutants, and heights** above the ground

Airvoice.Plume Helps Industrial Enterprises to

Predict the spread of pollutant concentrations from multiple sources. 24 hours ahead

Visualize the dynamics of a source's impact on nearby areas as atmospheric conditions change

Differentiate the contributions of different sources into air quality

Receive alerts of upcoming exceedances to proactively manage air pollution episodes

Adjust operational activities to mitigate the community's exposure

Maintain strong and transparent relations with stakeholders

Airvoice Monitors Deliver High-Accuracy Ambient Air Data for Smarter Decision-Making

Airvoice compact and cost-effective Ambient Air Quality Monitoring Systems (AAQMS) undergo rigorous calibration in third-party laboratories. Their enhanced measurement accuracy has been proven through global co-location tests.

- Measure key pollutants (PM2.5, PM10, CO, NO_2, O_3, SO_2, H_2S) and weather parameters
- Integrate any number of gas or meteorological sensors through a modular hub

Establishing an Advanced Dust Management System at a Coal Loading Terminal

A leading stevedore company implemented a comprehensive air quality monitoring system alongside Airvoice's emission dispersion modeling tools. This enhanced dust management, ensured compliance, and addressed public concerns about air quality.

Stevedore

Objectives

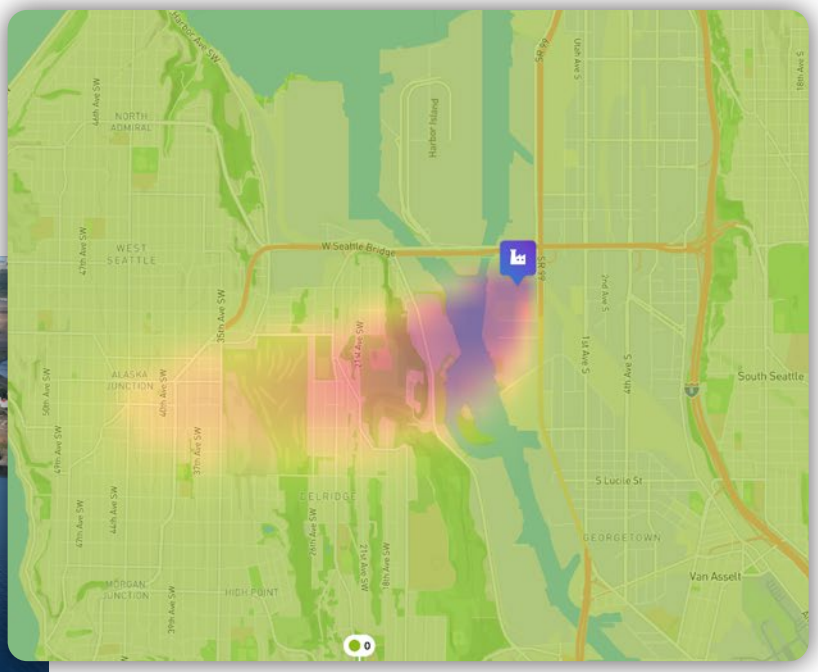
- Overcome dust suppression challenges during extreme cold to ensure the effectiveness of measures
- Meet environmental regulations and provide data to demonstrate compliance
- Maintain transparent communication with the local community about air quality and dust management efforts

Solution

- Deployed a network of Airvoice monitoring systems for continuous dust level monitoring within and around the terminal
- Utilized Airvoice.Plume software to forecast dust dispersion and adjust suppression strategies based on real-time data
- Developed communication tools to share air quality data with the community

Results

- Successfully managed dust dispersion, maintaining operations during adverse weather
- Ensured regulatory compliance through accurate, real-time environmental data
- Transparent communication enhanced public trust and the company's reputation



Airvoice.Plume dust dispersion forecast and visualization

* Due to confidentiality agreements, specific project details are not disclosed. All photos and screenshots are for illustrative purposes only and do not depict the actual site or data.

Air Quality Management Initiative at a Mining and Smelting Company

A global leader in metals and mining implemented air quality monitoring to effectively control air pollution, reduce emissions, and ensure compliance with environmental regulations.

Metals & Mining

Objectives	• Reduce emissions while maintaining some of the industry's lowest emission levels • Enhance air quality in the region through advanced monitoring tools • Commit to global disclosure standards to improve public and government relations
Solution	• Installed a dense network of compact Airvoice monitors along the perimeter and in the nearby city • Integrated Airvoice software suite to forecast pollutant dispersion • Developed a unique air quality index tailored to the enterprise's operational specifics
Results	• Real-time air quality monitoring and analytics enabled informed decisions for effective pollution mitigation • The system aided in assessing improvement initiatives, ensuring ongoing optimization • Transparent data communication boosted public trust and enhanced the company's reputation

* Due to confidentiality agreements, specific project details are not disclosed. All photos and screenshots are for illustrative purposes only and do not depict the actual site or data.

Implementing an Odor Monitoring System for a Livestock Enterprise

A livestock enterprise, the largest pork producer in the region, implemented an odour monitoring system to determine its impact on air quality and address community concerns about unpleasant smells in the city.

Agriculture

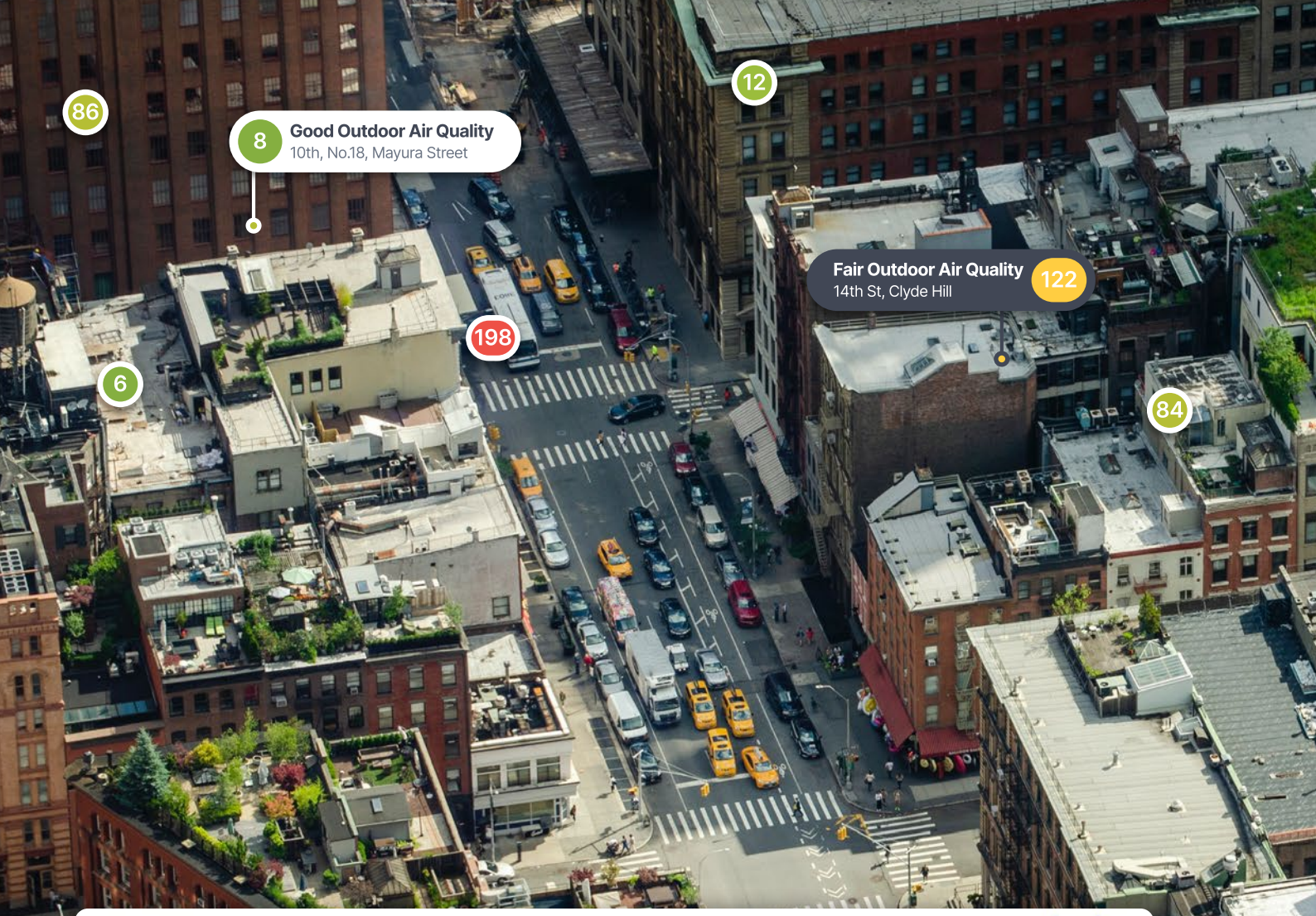
Objectives	• Determine the extent of odour impact from the livestock operations on the surrounding community • Implement forecasting tools to predict and tackle potential odour issues by • Enhance transparency with local residents and bodies
Solution	• Installed a network of Airvoice monitors to continuously track odour-related pollutants like hydrogen sulfide and ammonia • Integrated Airvoice.Plume software to predict odour dispersion based on real-time data • Implemented air quality data communication through a city web portal, with clear air quality indices
Results	• Accurate monitoring and predictive tools allowed the farm to proactively manage odour emissions • Addressed community and authorities' concerns regarding smells • Enhanced public trust through transparent communication

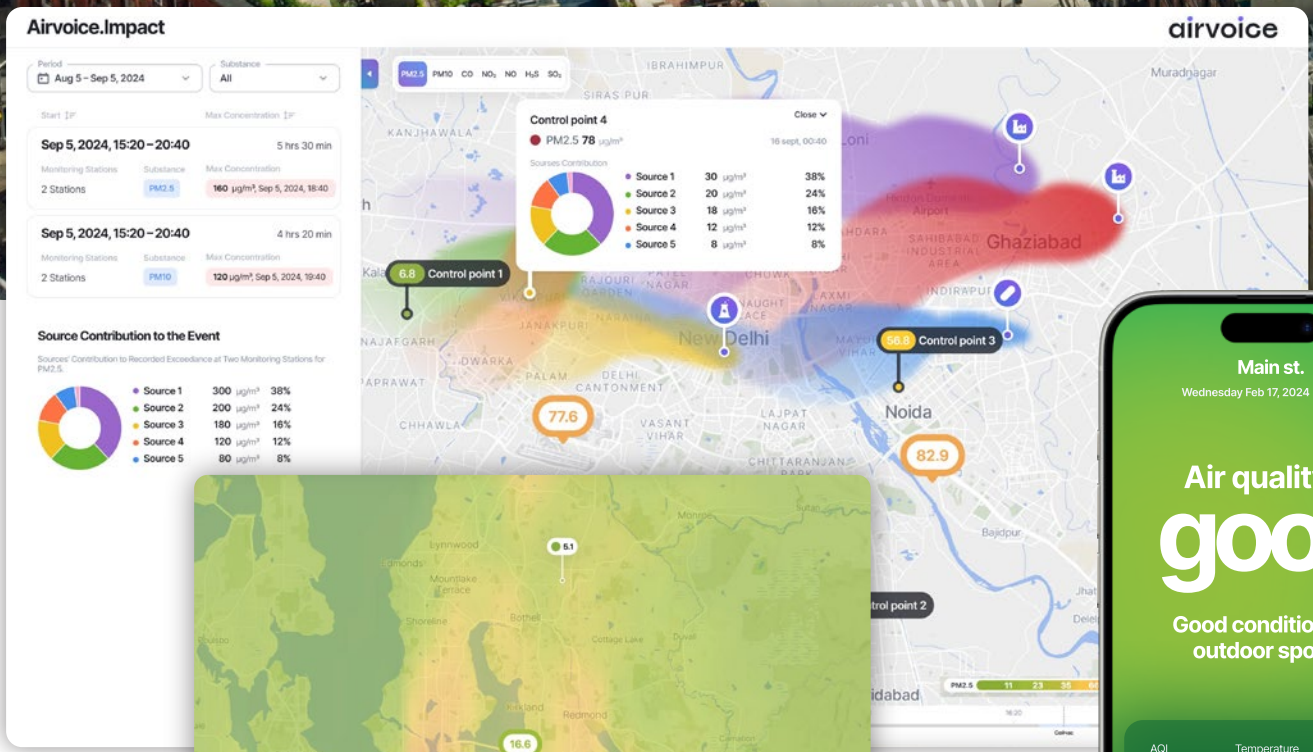
* Due to confidentiality agreements, specific project details are not disclosed. All photos and screenshots are for illustrative purposes only and do not depict the actual site or data.

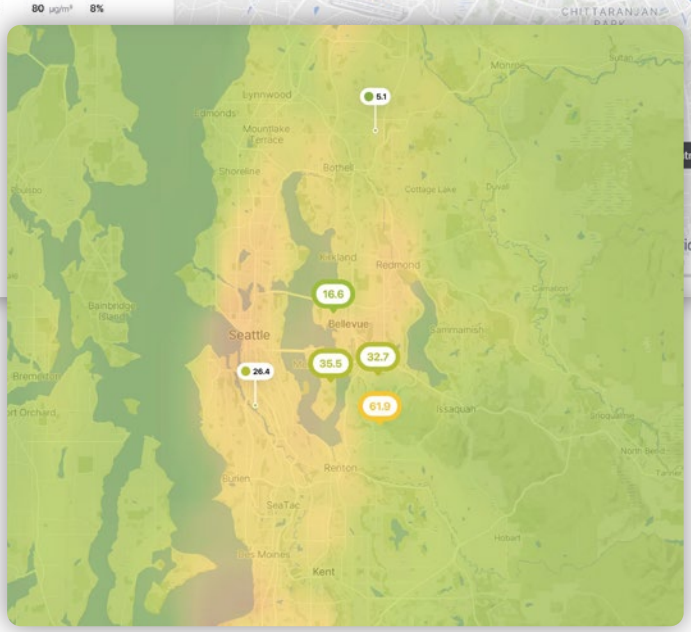
Ready to take control of your industrial air impact?

Talk to our team to explore how Airvoice.Industry opportunities.

namaste@airvoice.global


86
8
Good Outdoor Air Quality
10th, No.18, Mayura Street
12
Fair Outdoor Air Quality
14th St, Clyde Hill
122
198
6
84


Airvoice.Impact
airvoice
Aug 5 – Sep 5, 2024
All
Sep 5, 2024, 15:20 – 20:40
5 hrs 30 min
2 Stations
Sep 5, 2024, 15:20 – 20:40
4 hrs 20 min
2 Stations
Source Contribution to the Event
Source 1 300 38%
Source 2 200 24%
Source 3 180 16%
Source 4 120 12%
Source 5 80 8%
Control point 4
PM2.5 78
Control point 1
Control point 3
77.6
82.9
New Delhi
Noida
Ghaziabad


16.6
35.5
32.7
26.4
61.9
Seattle
Bellevue
Redmond


Main st.
Wednesday Feb 17, 2024 | 2:25 pm
Air quality is
good
Good conditions for outdoor sports!
AQI
1 point
Temperature
23 °C
Humidity
44 %
PM2.5
3 µg/m³
PM10
5 µg/m³
NO₂
16 µg/m³
SO₂
31 µg/m³

airvoice

Air Value Management System for Cities

Community Engagement
ESG Goals
Public Health
Policy Support
Urban Planning
Environmental Monitoring
Emissions Control
Smart City Tools

Environmentally Conscious Solutions for City Managers

Turning Air Quality Data into Action

The Airvoice solution for cities is designed to address the challenges of outdoor air quality monitoring and management across a city, region, or even an entire country. It enables municipalities to track air quality in real time, verify compliance, detect pollution episodes early, and communicate transparently with the public. By supporting both strategic planning and operational decision-making, the system helps enhance public health and advance sustainability efforts.

The Airvoice Ambient Air Quality Monitoring Platform accommodates a wide range of user roles with tailored access levels — from regional authorities and environmental specialists to individual residents accessing public data.

Hyperlocal Air Data

Deploy a dense network of compact near-reference monitors to get immediate insights into current air quality conditions.

Urban Planning with Air Quality in Focus

Use airflow and pollution dispersal insights to guide development, infrastructure, and zoning decisions.

Tracing Pollution & Forecasting Trends

Pinpoint sources and hotspots to take effective action. Understand the potential impact of events, seasons, or activities.

Public Awareness and Trust

Make air quality data accessible through maps, displays, and apps,building transparency and community engagement.

Expertly Tailored Solutions for Your City's Unique Air Quality Challenges

Danila Maglitsov
Head of Product Design

> At Airvoice, we don't just deliver a platform — we build solutions.

Our dedicated team of researchers works closely with each city to develop a tailored approach. From diagnostics to forecasting, sensor network design to stakeholder reporting, we ensure every project meets the local context and objectives.

Whether you're upgrading a monitoring network, implementing policy-backed interventions, or improving transparency with residents, we provide the expertise and tools to deliver meaningful, measurable results.

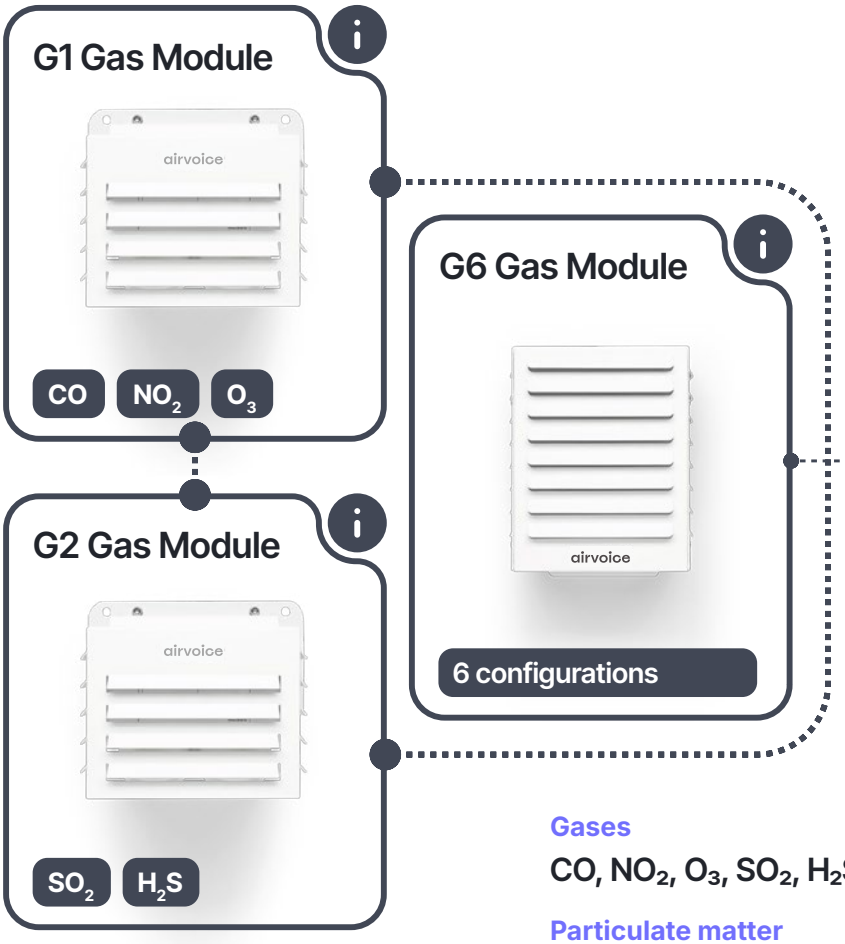
From Local Needs to Measurable Change

Ambient Air Quality Monitors

Scalable, High-Resolution Monitoring for Urban Environments

Airvoice Ambient Air Quality Monitoring Systems (AAQMS) are compact and cost-effective, allowing cities to build dense, high-resolution networks capable of real-time urban air monitoring at scale.

The modular system measures gaseous pollutants, particulate matter, and meteorological parameters. Data is transferred every minute, enabling rapid response and detailed diagnostics.



Measured parameters:

Gases

CO, NO_2, O_3, SO_2, H_2S

Particulate matter

$PM_{2.5}$, PM_{10}

Weather

Temperature, humidity, pressure, wind speed and direction

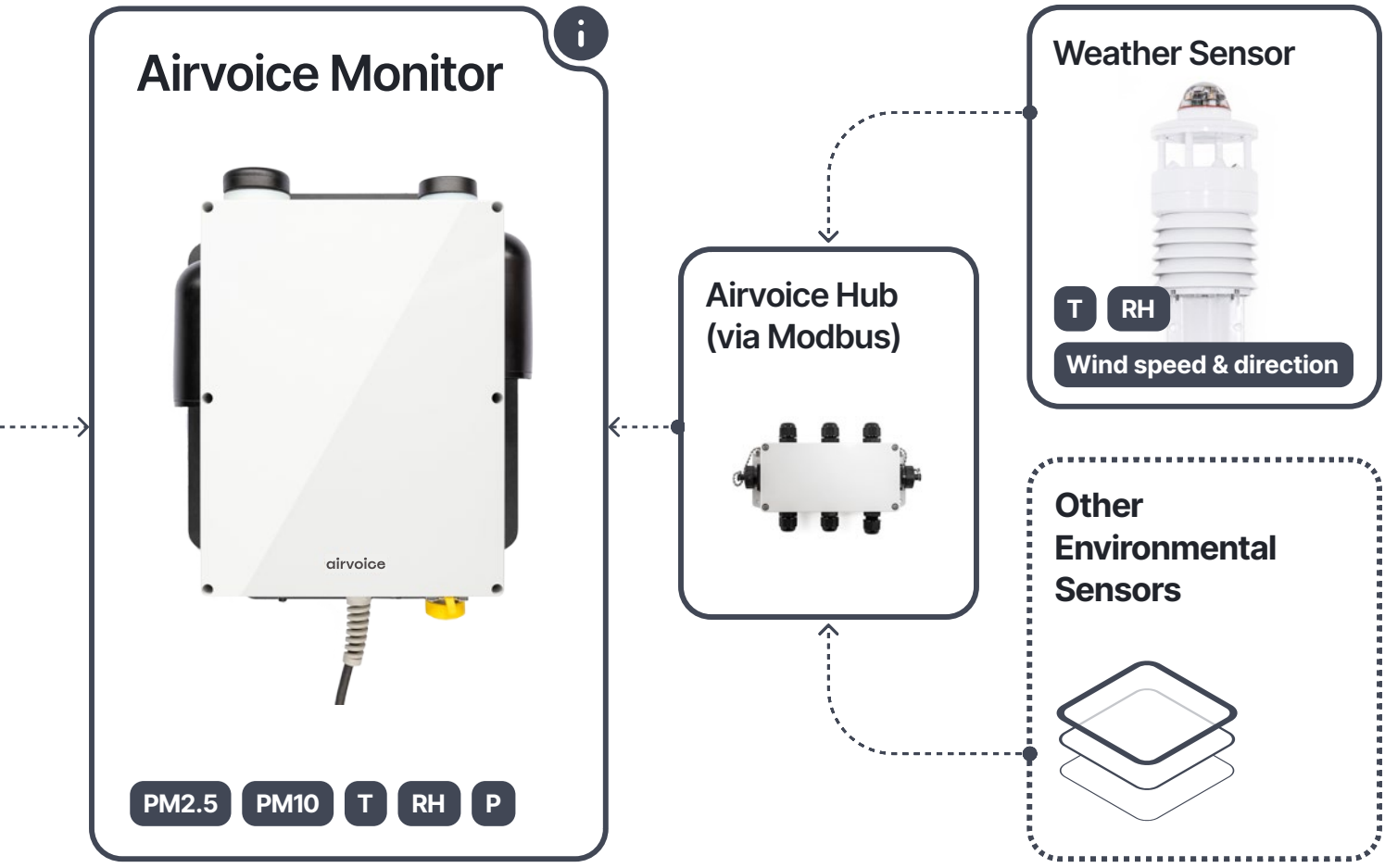
Key Advantages

Compact and Easy to Deploy
Small form factor and flexible mounting (walls, poles, towers). Self-powered options available.

High Measurement Accuracy
Calibrated against reference-grade equipment for high correlation and trusted performance.

Validated Across Weather Conditions
Sensors are tested under a wide range of environmental conditions to ensure stable readings.

Modular Architecture
Add-on modules allow customized configurations with gas or weather sensors as needed.



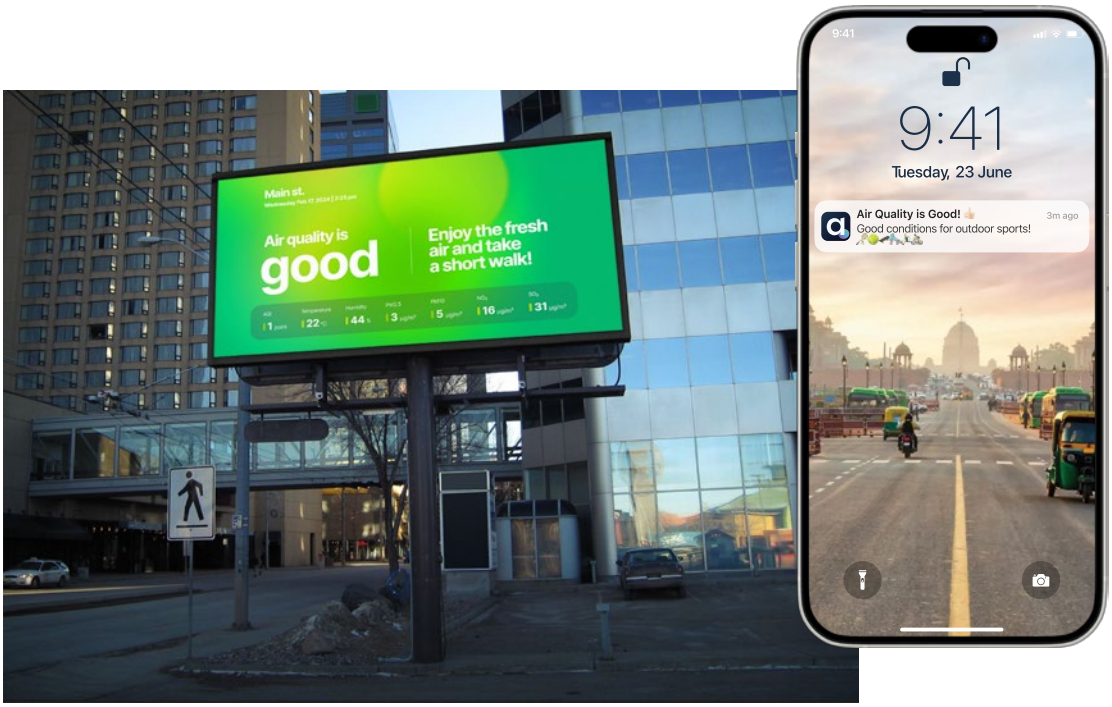
Airvoice Ambient Air Quality Management Platform

A Complete, High-Resolution Picture of Urban Air Quality

The platform brings together data from sensors, models, and third-party sources into one seamless interface, enabling proactive data-driven decisions at every level.

Key Features

- Unified platform for data from sensors, models, and external sources
- Interactive maps and charts for real-time and historical analysis
- Third-party monitor integration available
- Built-in verification and compliance tools
- Remote equipment diagnostics and control
- Personalized alerts for threshold exceedances
- Custom reports to support accountability
- High-level data security ensured

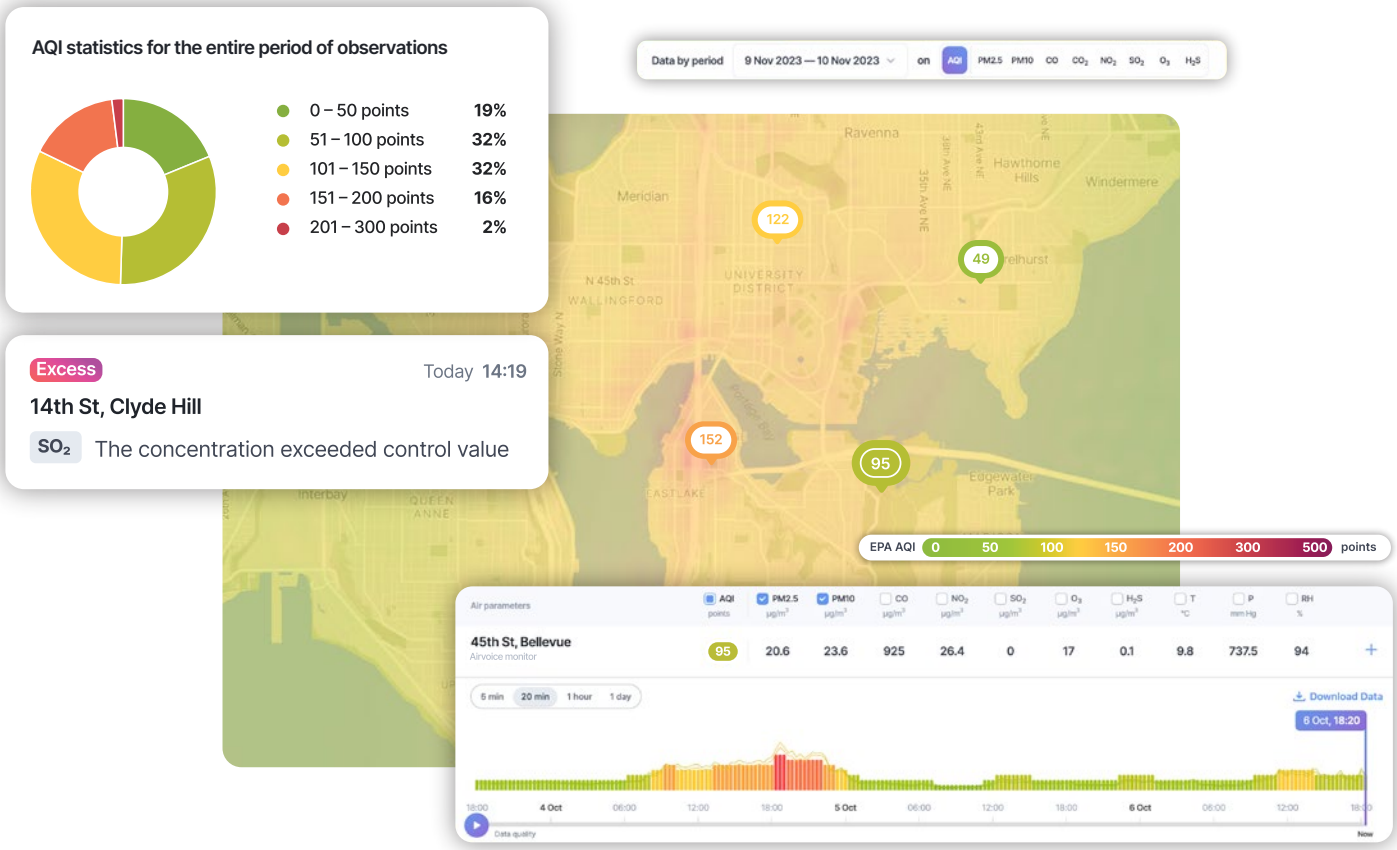


From Real-Time to Forecast: Your Toolkit for Proactive Air Quality Planning

Airvoice's modeling toolkit equips cities with powerful tools for end-to-end air quality monitoring, forecasting, and analysis — tailored to the scale of your territory, from neighborhoods to full regions.

By combining real-time data with advanced mathematical models, cities can track pollution patterns, anticipate future risks, and support better operational and strategic decisions.

The toolkit can be adapted to the specific geography, emission landscape, and policy needs of each project.



Airvoice.Forecast delivers a full air quality picture, even in unmonitored areas, by predicting pollution movement up to 72 hours ahead

Airvoice.Forecast analyzes and predicts air pollution levels up to 72 hours in advance. It strengthens existing monitoring networks by providing detailed forecasts in between sensors, helping cities and industries ensure full area coverage.

The software integrates emissions inventories, weather, and topographic data to generate high-resolution maps and forecasts. It shows whether pollutants will accumulate or disperse, aiding city managers in reducing pollution exposure and keeping communities informed.

The tool helps city and industry managers to:

Detect and predict regional and local pollution events

Analyze long-term air quality trends for strategic planning

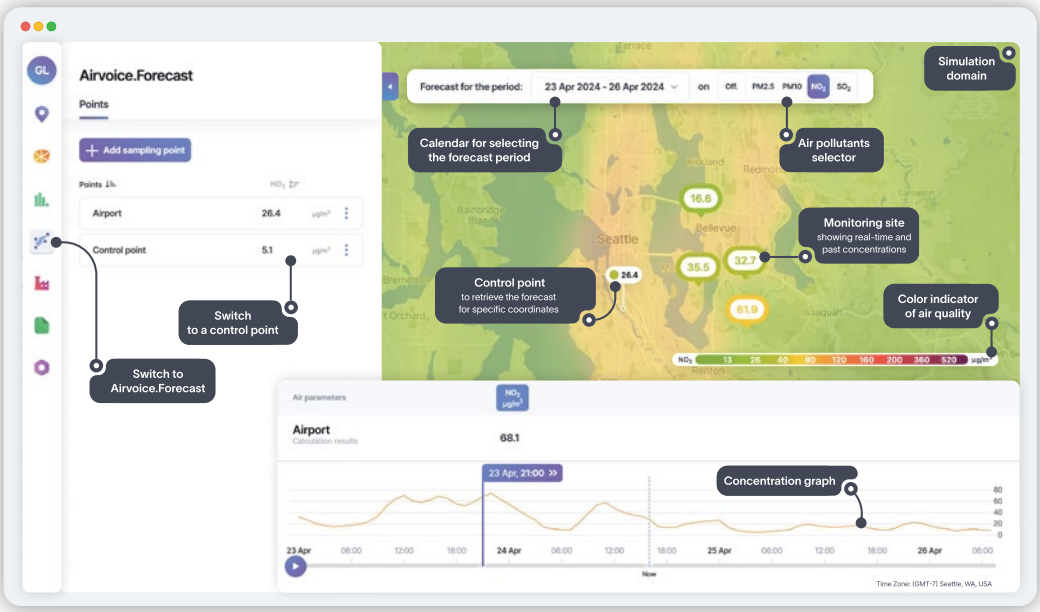
Notify the public of high pollution levels to promote preventive measures

Identify non-weather related **pollution sources**

Pre-evaluate pollution control strategies

Plan urban and industrial activities with air quality considerations

Enhance community trust through transparent air quality data



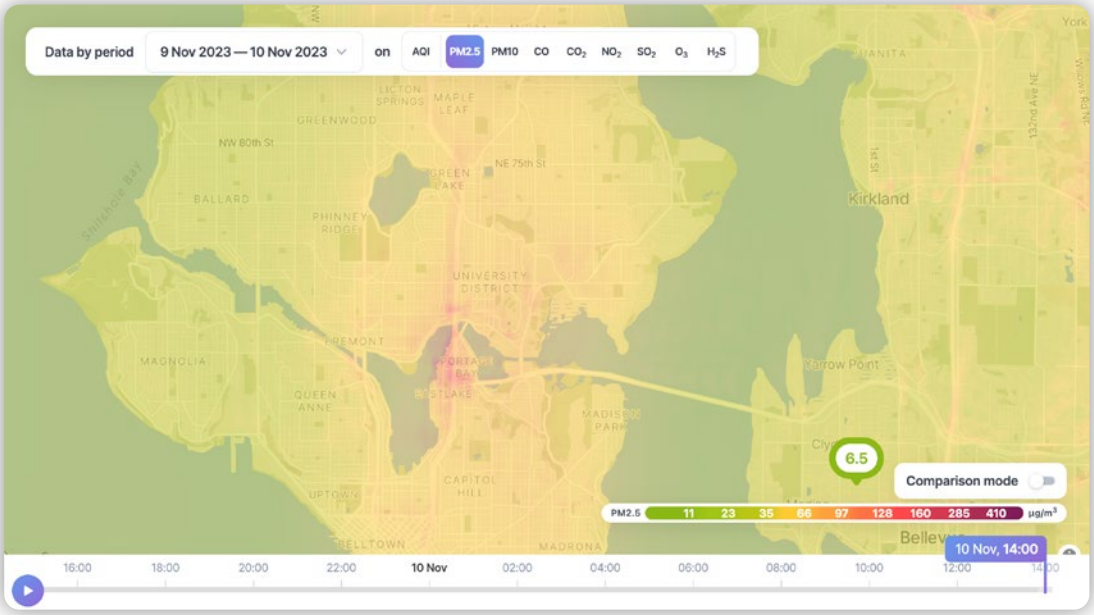
Airvoice.Lens enhances air quality management with hiperlocal mapping and street-level insights

Airvoice.Lens provides real-time and forecasted air quality maps with street-level resolution (up to 100 meters). By integrating traffic and infrastructure data, it offers a detailed view of urban air quality patterns.

This high-resolution modeling helps identify pollution hotspots, assess the impact of road traffic, and inform both immediate responses and long-term planning.

What Airvoice.Lens enables:

- Informs and supports local pollution reduction strategies
- Helps urban planners make data-driven infrastructure and zoning decisions
- Promotes preventive action by making neighborhood-level pollution visible to residents



Airvoice.Insights is a source attribution toolkit that models the contribution of individual emission sources to ambient air pollution in real time

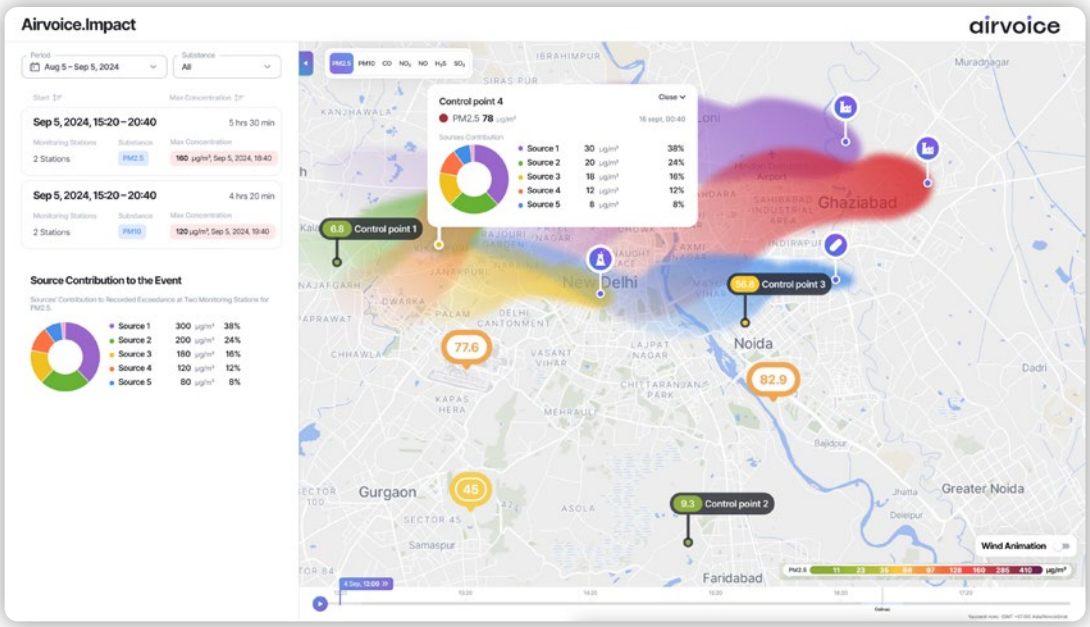
Airvoice.Insights enables local governments and industrial operators to identify who is polluting, when, and by how much.

By combining emissions inventory data, real-time pollutant measurements, meteorological inputs, and spatial modeling, the system helps track pollutant dispersion patterns, locate pollution hotspots, and generate dynamic impact forecasts. This integration enables faster response and better decision-making during pollution episodes.

Custom dashboards give authorities instant access to diagnostics and trends, supporting both immediate interventions and long-term planning.

Key use cases include:

- Analyzing the root causes of environmental incidents
- Modeling the impact of facility operations on regional air quality
- Assessing the effectiveness of the existing monitoring network and recommending expansions
- Enabling daily operational oversight of air pollution around industrial sites



Want to explore how Airvoice can help you monitor, manage, and improve urban air quality?

Email us to schedule a conversation:

namaste@airvoice.global

Enhancing Environmental Management in an Island Region in Northeast Asia

Airvoice installed 34 monitors across 23 locations, providing vital air quality data to enhance the region's ecology. Open communication of AQ data fosters public trust and boosts the region's tourism appeal.

Objectives	• Establish comprehensive AQ monitoring throughout the island, including hard-to-reach areas • Improve public health, awareness, and safety with real-time air quality updates • Boost the region's appeal as a tourist destination by ensuring a clean and safe environment
Solution	• Deployed a network of 34 Airvoice monitoring stations in 23 locations, including remote areas • Created an open air quality map with a user-friendly index on the regional portal • Provided authorities with access to detailed air quality analytics for informed urban planning
Results	• Real-time data enable proactive air quality management (e.g. street cleaning) • Increased public awareness and engagement, contributing to public health improvements • Enhanced the region's reputation sustainable and attractive tourist destination

* Due to confidentiality agreements, specific project details are not disclosed. All photos and screenshots are for illustrative purposes only and do not depict the actual site or data.

Air Quality Monitoring and Source Attribution in an Industrial Northeast Asian Region

Airvoice deployed a network of 24 air quality monitors across one of Northeast Asia's most polluted cities, empowering local researchers and to better understand pollution trends and root causes.

Challenge

The area is home to multiple industrial enterprises and experiences complex air pollution dynamics. Authorities lacked a clear understanding of which sources were responsible for pollution peaks, making it difficult to respond effectively and build accountability. This created an urgent need for real-time data and accurate source attribution.

Solution

- Deployed a dense network of compact, cost-efficient monitors designed to withstand extreme conditions
- Placed monitors near weather stations to ensure continuous calibration and data accuracy
- Expanded monitoring to remote areas and major industrial zones to enhance citywide coverage
- Calibrated key stations against professional-grade equipment to ensure data credibility

Results

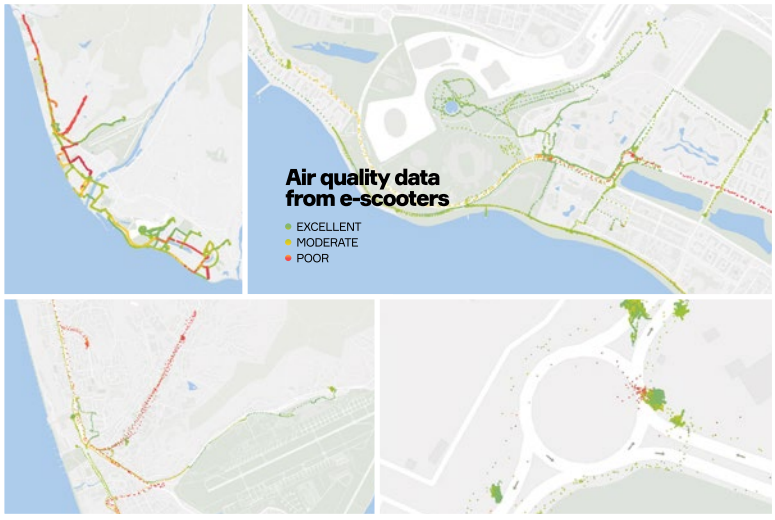
- Identified dominant sources of pollution during specific episodes
- Enabled informed dialogue between stakeholders
- Improved understanding of local air quality dynamics through continuous data collection and source attribution

* Due to confidentiality agreements, specific project details are not disclosed. All photos and screenshots are for illustrative purposes only and do not depict the actual site or data.

Using Kick Scooters as Mobile Air Quality Monitoring Stations

Whoosh and Airvoice launched electric scooters equipped with air quality sensors in a city to collect extensive environmental data.

Objectives	• Provide comprehensive air quality data across the city in real time • Test mobile monitors for reliable hyperlocal air quality mapping • Enhance urban air quality management and support data-driven urban initiatives
Solution	• Fitted eight scooters with mini sensor boxes to measure dust and nitrogen dioxide • Engineered vandal-proof housing and a compact, scooter-powered monitoring system • Processed and transmitted air quality data in real-time via a cloud platform
Results	• Scooters covered extensive city areas, collecting data at 1,000,000 points in one week • Visualized data using a color-coded AQI on a detailed city map • Offered granular insights into urban pollution, influencing city planning and public health strategies

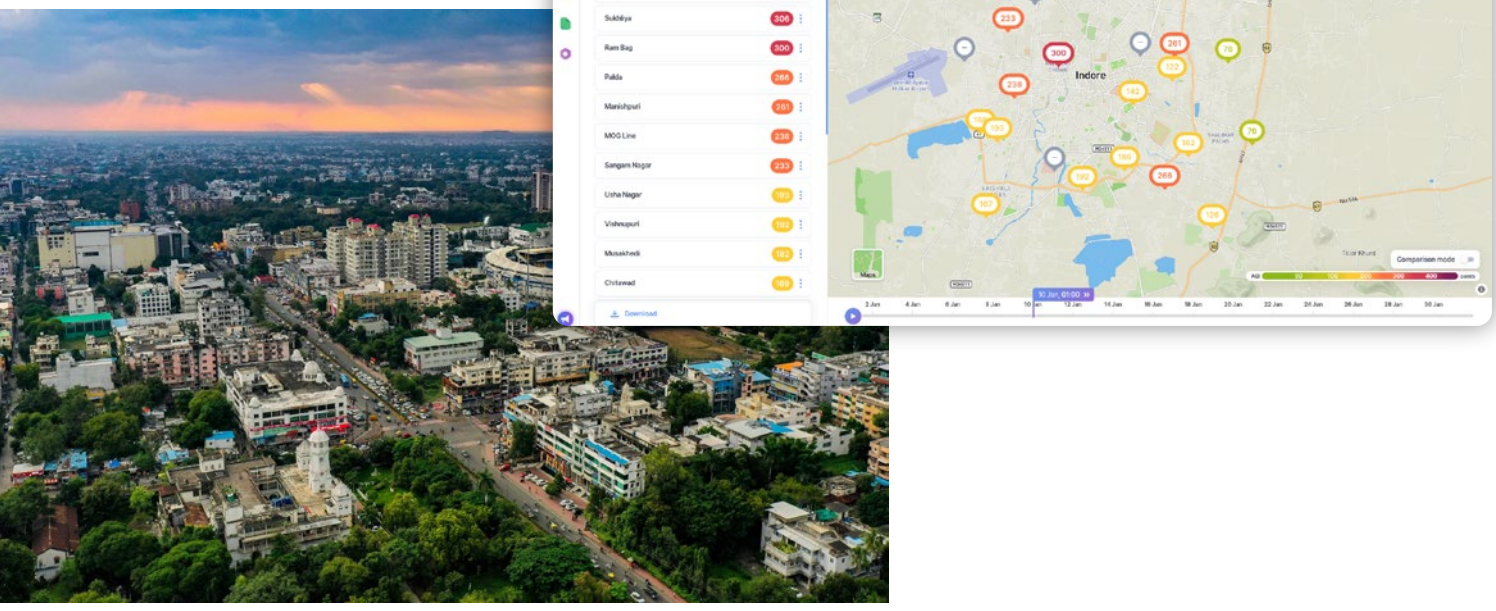


* Due to confidentiality agreements, specific project details are not disclosed. All photos and screenshots are for illustrative purposes only and do not depict the actual site or data.

Air Quality Management Solutions for Indore

In partnership with the Confederation of Indian Industry (CII), Airvoice utilized data from existing air quality monitoring networks, integrating it into a single universal and easy to use platform. This platform enables not only instant data access but also comprehensive analysis and strategy development to improve Indore's air quality.

Challenge	Historical air quality monitoring efforts, often grant-funded and therefore temporary, resulted in fragmented and hard-to-access data across Indore.
Solution	Airvoice consolidated air quality data from 47 monitoring stations (active from 2021 to 2023) onto one platform, allowing for the preservation and analysis of historical data to inform city-wide air quality improvements.
Results	Using the platform and analysis provided by Airvoice, CII: • Delivered a detailed air quality assessment for Indore, covering the specified period • Produced a comprehensive report providing actionable insights for local policy-making • Recommended a set of measures including the establishment of ongoing AQ monitoring and low emission zones



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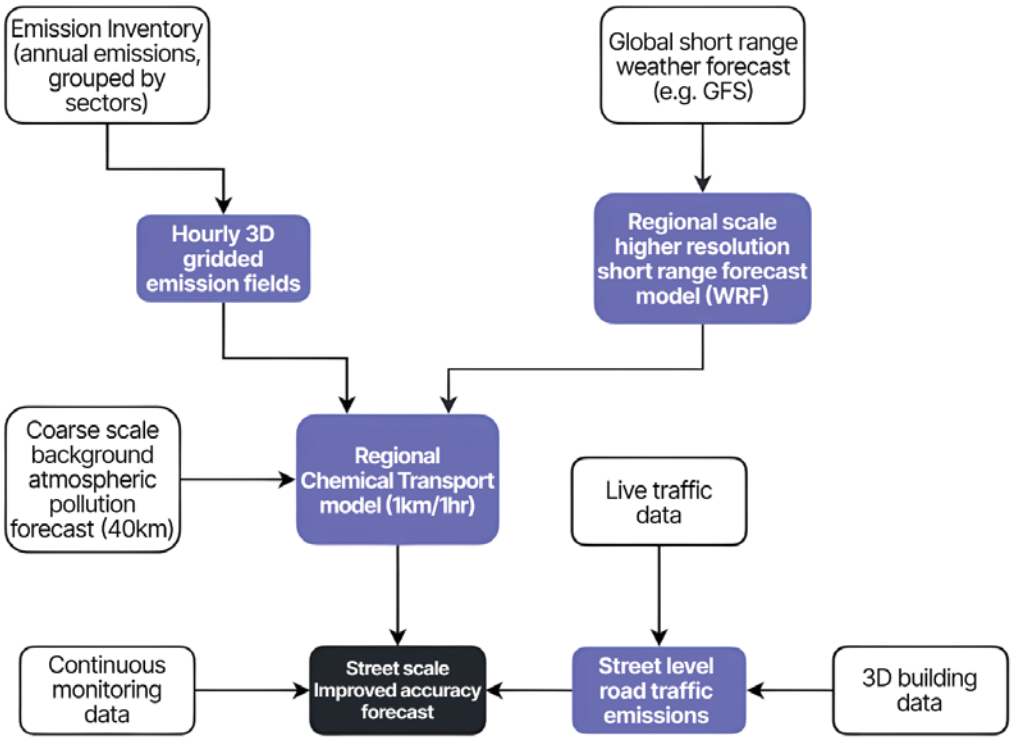
Air Quality Management for Pune and Pimpri-Chinchwad

Partnering with CII, Airvoice is developing a high-resolution forecasting model to integrate comprehensive emission and traffic data, facilitating air quality strategies development.

Challenge	Local air quality initiatives were hindered by lacking or fragmented data, which prevented effective urban environmental management.
Solution	Airvoice deployed its Airvoice.Forecast tool, demonstrating advanced capabilities in real-time to CII, incorporating detailed emissions and traffic data for street-scale resolution mapping.
Results	• Air Quality Management: Enhances local authorities' ability to manage air pollution • Effective Policies: Supports the development of targeted environmental policies • Scalability: The solutions can potentially be scaled to facilitate pollution mitigation strategies and measures across India



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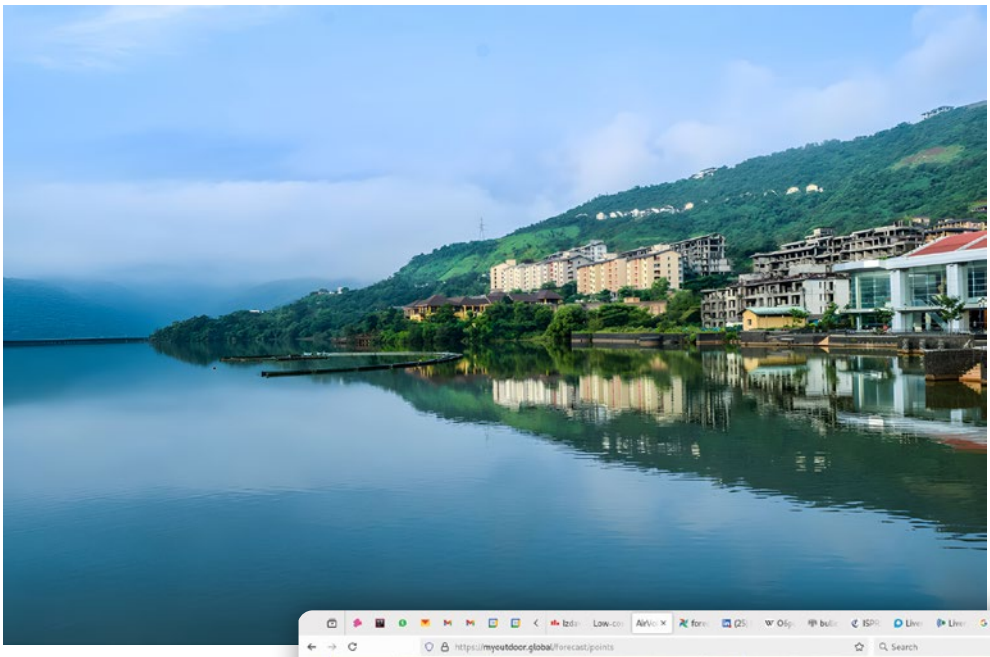

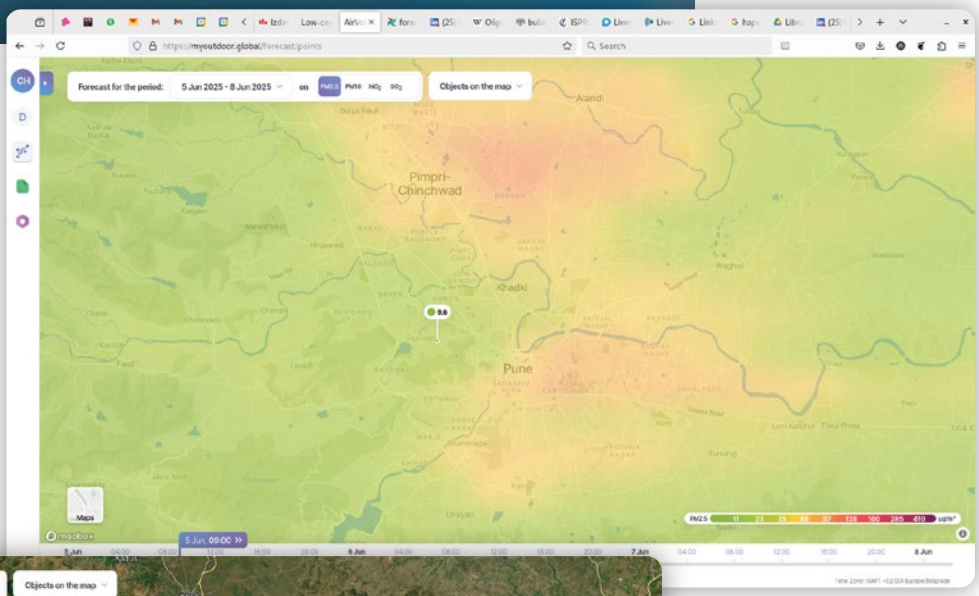

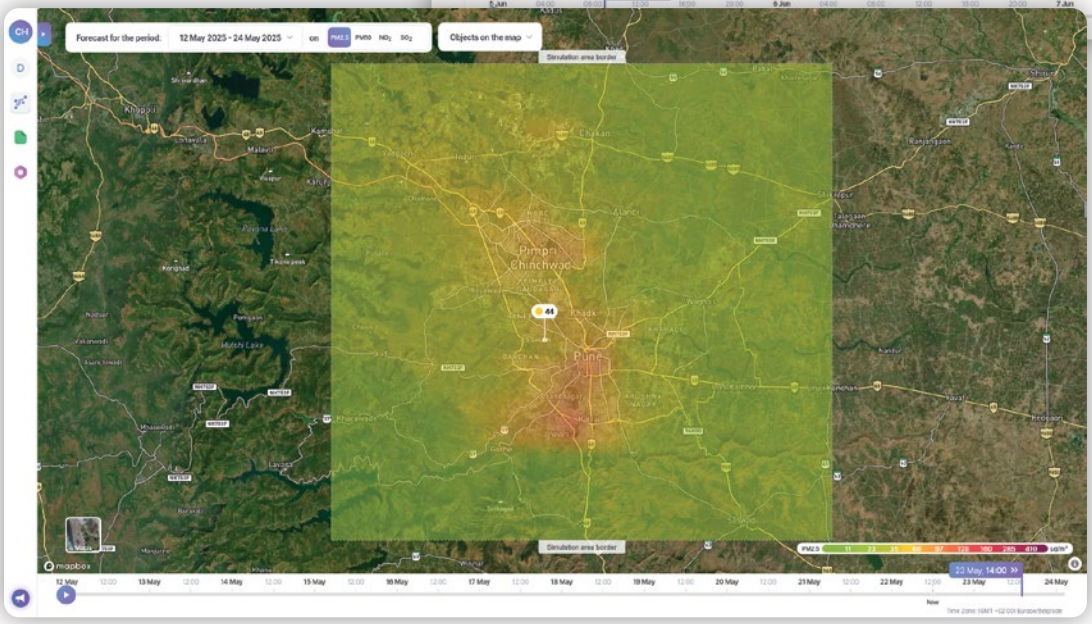

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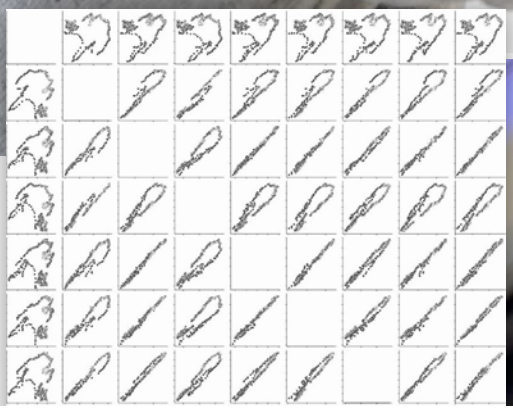
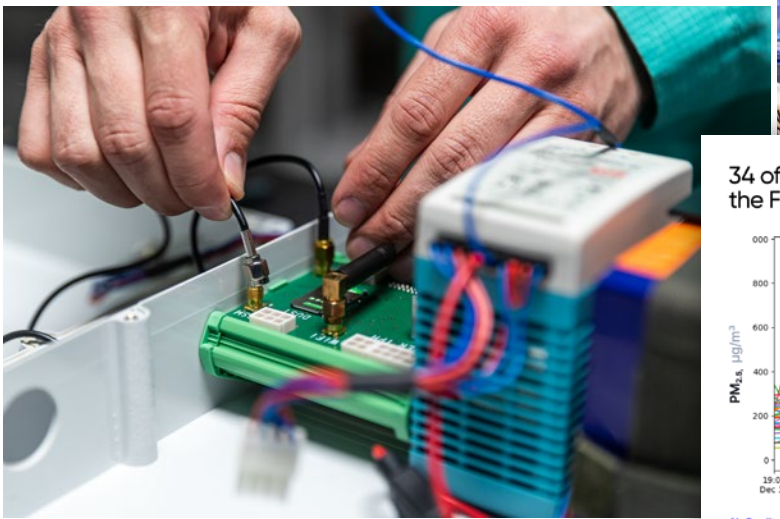
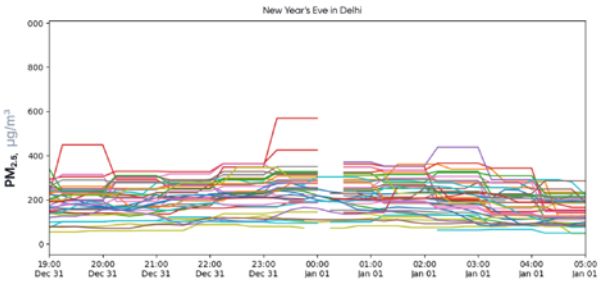




34 of 40 Monitoring Stations in Delhi Went Offline Within the First 15 Minutes of 2025



Air Quality on New Year's Night: Air Quality Overview in India's Largest Cities, European Capitals, and Cities with Large Indian Diasporas.

airvoice

airvoice

Partnering for Research and Innovation

Environmental Science

Healthcare

Sensorics

Building Engineering

Data Science

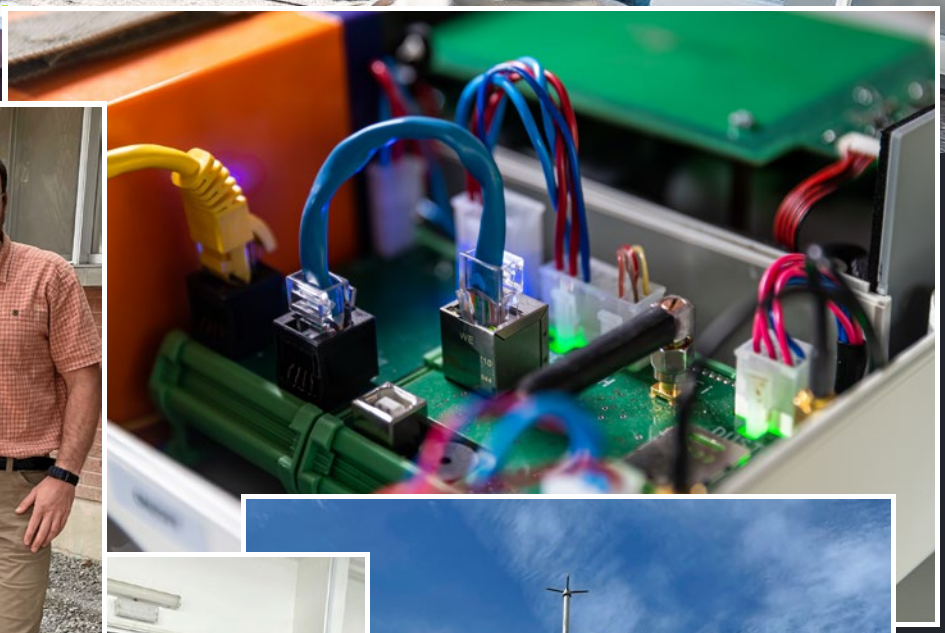
Applied Science & Environmental Justice

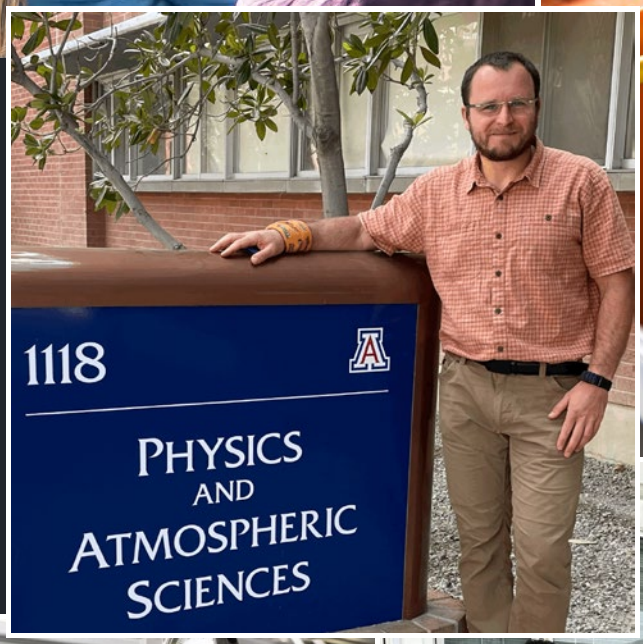
Urban Planning & Architecture

Bridging Research and Real-World Impact

Airvoice transforms advanced research into real-world air quality solutions that benefit cities, industries, and communities. The team collaborates with leading academic, institutional, and industry partners to develop and deploy technologies that address today's most urgent environmental challenges.

The company actively contributes to the advancement of science by enabling research through advanced technologies and data infrastructure. Among its research partners are University of Arizona, Nanyang Technological University, University of Utah, and others.




1118
PHYSICS
AND
ATMOSPHERIC
SCIENCES


CLEAN AIR FUND
Cleaner Air Better Life
CII
Confederation of Indian Industry
Meeting of the
India CEO Forum for Clean Air
18 October 2024
Delhi

Airvoice Collaborates Across Sectors to Unlock New Insights into Air Quality

Environmental Science

Source apportionment, predictive analysis, and pollutant distribution modeling.

Sensorics

Testing and calibration of novel sensing technologies, including e-noses and gas-analytical systems.

Data Science

Creating data-driven models for air quality research and applications.

Urban Planning & Architecture

Integrating air quality data into planning and decision-making.

Healthcare

Investigating the health effects of poor air quality and its correlation with viral spread.

Applied Science & Environmental Justice

Addressing real-world environmental challenges for local communities and assessing the impact of green initiatives.

Building Engineering

Developing algorithms for smart ventilation and analyzing occupant behavioral patterns.

We know how to turn research into solutions and we're ready to adapt them to your project's needs.

Let's talk about how we can collaborate.

research@airvoice.global

Why Do We Develop New Methods for Measuring Air Quality?

Dmitry Trubitsyn

Founder and Visioneer of Airvoice

There are plenty of well-established physical and chemical methods for measuring gas concentrations in the air. So why develop new ones?

Because the challenge today isn't just about measuring, it's about measuring everywhere, reliably and continuously.

As the need for dense, distributed air quality monitoring networks in cities grows, it becomes clear: traditional air quality stations based on instruments like Fourier-transform infrared analyzers or gas chromatograph-mass spectrometers are simply too large, expensive, and power-hungry to scale. Colorimetric methods? Hard to automate.

That's where a new generation of compact monitoring systems comes in. These systems use miniature sensors: electrochemical, chemiluminescent, and other experimental types still waiting for formal names. They make it possible to build small, cost-effective, autonomous systems.

The challenge with such systems is that ensuring accurate and stable measurements is no small task, especially given well-known issues like cross-interference of gases and sensitivity to both the values and dynamics of temperature and humidity.

But we believe the benefits outweigh the challenges and that these challenges can be eliminated altogether in the near future. Progress is happening on two fronts:

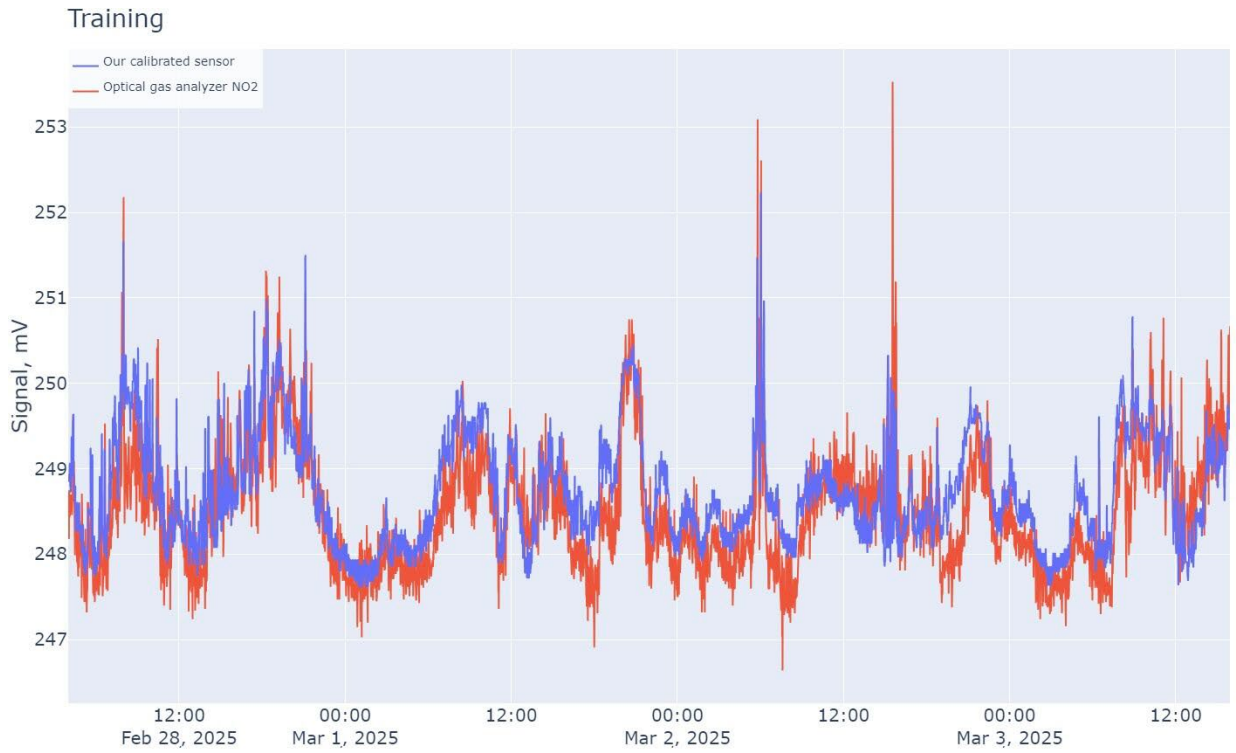
1. Improving the sensors themselves at the level of their physical and chemical characteristics. We're working on this in collaboration with leading universities.

2. Developing advanced signal processing methods. This is where our own engineering team is deeply involved.

One key idea: if you don’t rely on a single sensor, but instead analyze the collective behavior of several over time, the combined signal can contain enough information to accurately reconstruct pollutant concentrations.

Translating electrical potentials into precise gas concentrations isn’t easy. But we’ve made serious progress.

For example, the graph below compares NO_2 concentrations measured by a reference optical instrument against values predicted by our model, using signals from multiple electrochemical sensors. The alignment speaks for itself.



Electrochemical Sensors and Cross-Sensitivity: What You Need to Know

Widely used in ambient air monitoring, electrochemical sensors play a critical role in measuring gas concentrations but interpreting their data requires expertise.

These sensors are inherently cross-sensitive, meaning their readings are influenced not only by the target gas, but also by the presence of other gases and environmental factors such as temperature and humidity.

For example, accurate measurement of hydrogen sulfide (H_2S) requires consideration of nitrogen oxides and carbon monoxide (NO_x, CO). Similarly, sulfur dioxide (SO_2) readings can be distorted by high concentrations of other gases or influenced by ozone levels, creating a chain of dependencies.

To clarify these relationships, Airvoice has compiled a table outlining observed cross-sensitivities based on rigorous lab testing. Some of this information is not readily available from manufacturers, reinforcing the importance of long-term validation and calibration work.

In practice, ensuring reliable measurements of gases like H_2S or SO_2 requires the use of additional sensors — such as those for nitrogen oxide, carbon monoxide, and ozone. Calibrating these sensors involves accounting for all cross-dependencies, including temperature and humidity.

When handled correctly, electrochemical sensors are powerful tools for air quality monitoring. Airvoice engineers and researchers have conducted in-depth testing, collaborated with sensor manufacturers, and validated results to ensure robust, field-ready performance.

Electrochemical Sensor Cross Sensitivity airvoice

Gas	Cross-sensitivity at normal gas concentrations	Cross-sensitivity at peak gas concentrations
CH_2O	[CO, H_2S, SO_2]	[CO, H_2S, SO_2]
CH_4	–	–
CO	–	–
H_2S	[CO, NO, NO_2]	[CO, NO, NO_2, SO_2]
NH_3	[NO_2]	[NO, NO_2, SO_2]
NO	–	[CO, NO_2, SO_2]
NO_2	[CO]	[CO, NO, H_2S, SO_2]
O_3	[CO, NO_2]	[CO, NO, NO_2,SO_2]
SO_2	[CO, NO, NO_2, O_3]	[CO, NO, NO_2, O_3]

How Airvoice Calibrates Sensors — And Why It Matters

Though compact and cost-effective, electrochemical sensors require rigorous calibration to ensure accurate gas concentration readings over time.

This process must account not only for target gas levels, but also for environmental factors such as temperature, humidity, and each sensor's unique technical characteristics.

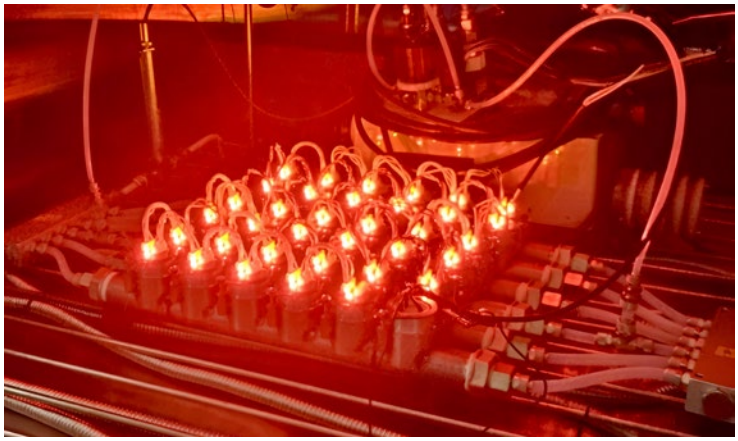
To guarantee accuracy under real-world conditions, Airvoice performs end-to-end calibration of every sensor type using a dedicated calibration bench. This process addresses cross-sensitivities, environmental dependencies, and individual sensor variability.

During calibration, sensors are placed in a controlled chamber where gas concentrations, temperature, and humidity are precisely varied in repeated cycles. Sensor responses are recorded, and mathematical models are built to map electrical signals to actual pollutant levels.

The procedure runs continuously for up to a month to generate statistically reliable data. Each sensor is then assigned a unique calibration factor tailored to its specific behavior.

The image shows a set of 35 sensors before calibration. Each sensor is placed in a socket under carefully maintained conditions. Red LED lights confirm that each sensor is receiving power and responding correctly. Wires connect the sensors to a digital harness, which logs data for model training and quality control.

This rigorous process enables Airvoice to deliver sensors that are field-ready, reliable, and capable of supporting high-resolution air quality monitoring in real time.



Exploring HVAC Energy-Saving Opportunities at NTU

Partnering with Nanyang Technological University in Singapore, Airvoice supported a campus-wide research initiative to explore HVAC energy-saving potential using real-time indoor air quality data and occupancy-based ventilation modeling.

Partner: Nanyang Technological University (Singapore)

Location: Singapore university campuses

Objectives	• Investigate energy-saving opportunities through enhanced HVAC management • Demonstrate significant potential for energy savings in university settings
Solution	• Provided students with IAQ monitors and access to the Airvoice platform for real-time data collection • Students developed a model to adjust ventilation rates based on CO_2 data, improving energy efficiency
Results	• Students predicted up to 50% energy savings by optimizing HVAC operations based on occupancy data • Validated the effectiveness of real-time CO_2-based control of HVAC systems • Demonstrated potential enhancements in air quality and comfort, leading to a more sustainable campus environment

Award: The project received a Teaching Ignition Grant from the School of Electrical and Electronic Engineering, highlighting its innovation and impact.

* Due to confidentiality agreements, specific project details are not disclosed. All photos and screenshots are for illustrative purposes only and do not depict the actual site or data.

Hidden Markov Models for occupancy detection

In partnership with the University of Arizona, Airvoice supported a research initiative to explore CO_2-based room occupancy detection using physics-informed machine learning and real-time air quality data.

THE UNIVERSITY OF ARIZONA

Partner: University of Arizona

Location: Tucson, AZ

Objectives

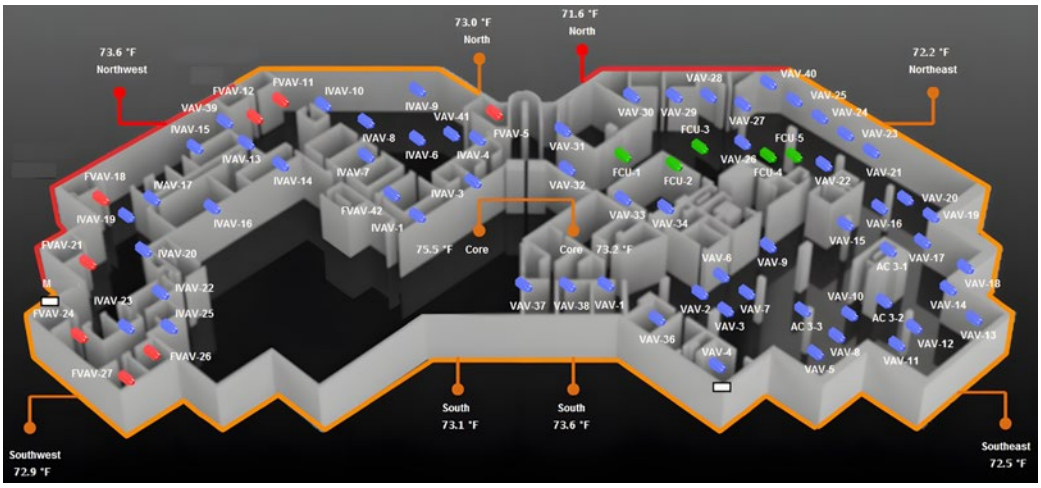
- Design a research platform to explore innovative methods of indoor AQ monitoring and management
- Collect datasets on the relationships between air quality and room occupancy for further research

Solution

- Deployed an air quality monitoring network, enabling real-time collection of CO_2 and other indoor environmental data
- Developed physics-informed machine learning and Hidden Markov models to predict room occupancy status based on CO_2 level dynamics

Results

- Collected a unique labeled dataset on indoor air quality and its relationship to room occupancy status
- The developed model will be further implemented for demand control ventilation systems and the analysis of indoor air quality in buildings
- A scientific publication is under review



Scan to read the preprint publication

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Air Environment Digital Twin for Amusement Park

Airvoice developed a high-resolution digital twin of a 3,000,000 sq. ft. indoor amusement park to simulate airflow, temperature, and pollutant distribution, enabling a comprehensive assessment of air quality and energy use under varying ambient conditions.

Client: 3,000,000 sq.ft. indoor facility | 30,000-person capacity

Objectives

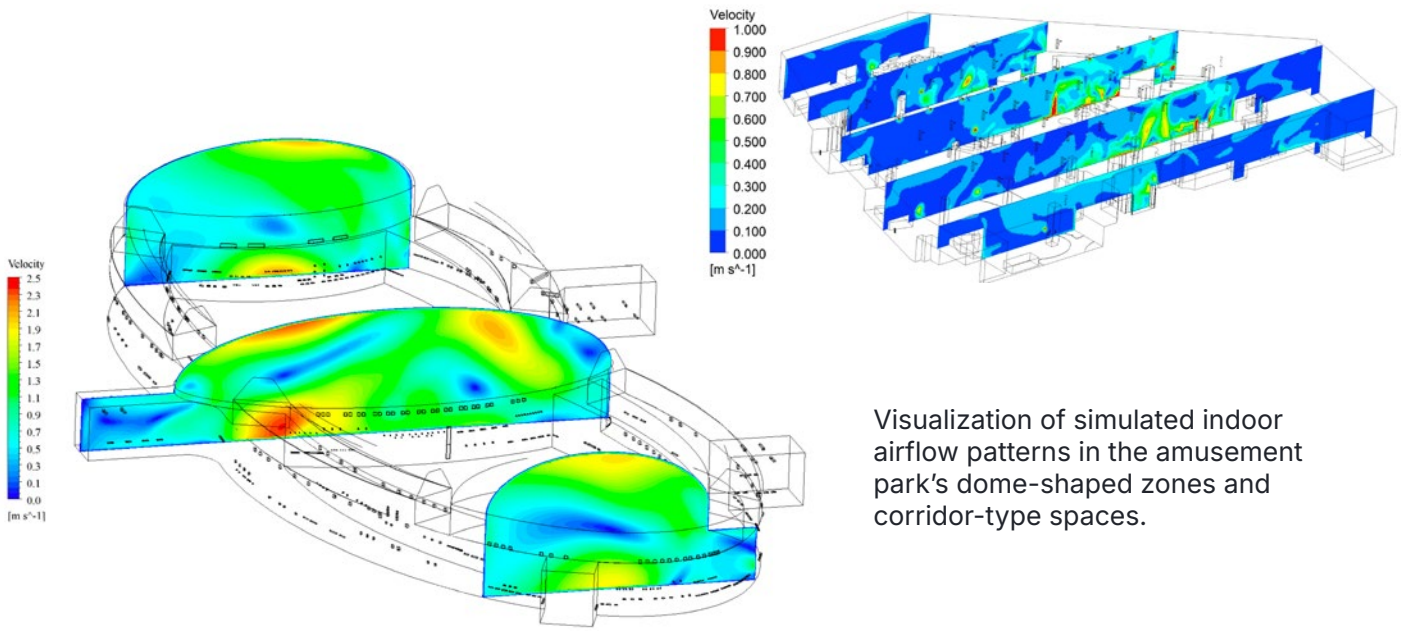
- Assess achievable air quality and energy use under different ambient weather conditions
- Build a digital twin of the amusement park's air environment to simulate airflow, temperature, and pollutant distribution
- Develop data-driven recommendations and algorithms for optimizing indoor climate and energy performance

Solution

- Applied a high-resolution computational model to simulate indoor air dynamics in 3D
- Incorporated building geometry, HVAC configurations, and occupant density patterns
- Performed a full audit based on digital twin outputs and developed an operational improvement roadmap

Results

- Provided a comprehensive visualization of airflow, temperature, and pollutant patterns
- Identified ventilation inefficiencies and energy loss issues
- Enabled data-driven HVAC control strategy decisions to enhance visitor comfort



Visualization of simulated indoor airflow patterns in the amusement park's dome-shaped zones and corridor-type spaces.

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Airvoice’s Report on the Impact of Diwali Firecracker Emissions on India's Air Quality

Airvoice conducted an extensive study on the environmental impact of Diwali firecracker emissions, analyzing data from 180 monitoring stations across 14 Indian states between 2019 and 2023. The goal was to understand the contribution of fireworks to seasonal air pollution and public health risks.

Key Findings

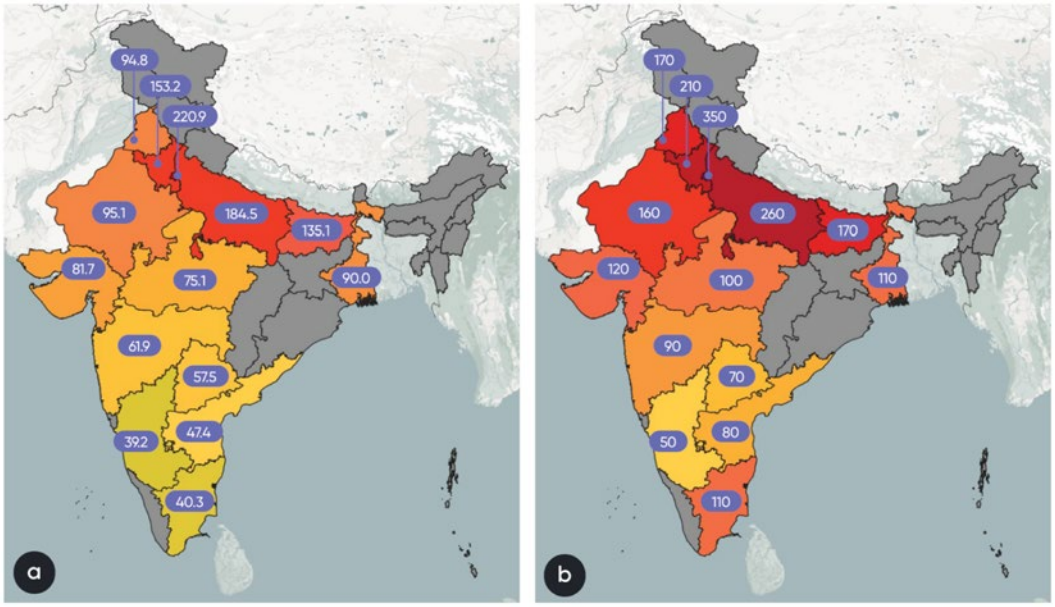
- PM2.5 concentrations on Diwali night spiked dramatically — up to 875% above national standards in some areas.
- Northern states like Delhi, Uttar Pradesh, and Haryana recorded the highest pollution levels.
- Air quality generally returned to pre-festival levels within 24 hours, challenging assumptions about prolonged effects.
- In cities with firecracker bans, pollution still surged, raising questions about policy enforcement.
- The study also detected toxic metals in the air, highlighting long-term health concerns.

Impact & Future Outlook

This report offers one of the most detailed datasets to date on Diwali-related air pollution. The findings support more informed policy decisions and public health strategies. Airvoice plans to expand similar research initiatives in other regions and events to further explore the intersection of cultural practices and environmental impact.

Mean PM2.5 concentrations across the states

(a) for the whole month of November
(b) for the night of Diwali festival of lights.
Mean concentrations for each period are averaged over the span of years from 2019 to 2023.



Access full findings via QR code

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We All Breathe The Same Air

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