AeroVision: Predicting Air Quality for Healthier Lives

IIT Indore has developed a breakthrough technology called **AeroVision**, which works like a weather forecast system but instead of predicting rain, it tells you how clean or polluted the air will be in your city for the next six days. This innovation by **Prof. Manish Kumar Goyal** and his research team including **Mr. Kuldeep Singh Rautela** from **Civil Engineering Department, IIT Indore**. It acts like a crystal ball for air quality, helping people make informed decisions about their health and daily activities.

Air pollution has become one of the biggest health challenges of our time. Every day, invisible harmful particles float in the air we breathe—tiny dust particles, smoke from vehicles, chemicals from factories, and gases that can make us sick. These pollutants can cause breathing problems, heart disease, and other serious health issues, especially for children, elderly people, and those with existing health conditions. Usually, we only know how bad the air quality is at the moment, but not what it will be like tomorrow or in the coming week. This uncertainty makes it difficult to plan outdoor activities, decide when to exercise, or take precautions for health.

AeroVision works like a super-smart computer system that has been trained by studying 12 years of hourly air quality data. This is equivalent to having a student who has been learning about air pollution patterns every hour for over a decade. The system gathers information from multiple sources to create a comprehensive environmental picture. It tracks six major air pollutants—PM2.5 and PM10 (tiny particles that can get deep into your lungs), carbon monoxide (CO), sulfur dioxide (SO2), nitrogen dioxide (NO2), and ozone (O3). It also collects weather information such as temperature, rainfall, wind speed, air pressure, and humidity, as well as atmospheric conditions like how high pollution can rise in the atmosphere and how many hours of sunshine are available. This data is collected hourly from a 25-kilometer grid across different regions.

AeroVision uses artificial intelligence (AI) with three advanced computer learning methods Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU). These are like three different experts with unique abilities. One expert is good at recognizing spatial patterns (how pollution spreads across an area), another is skilled in understanding time-based patterns (how pollution changes hour by hour), and the third combines both approaches for a complete analysis. The system uses an "ensemble voting" technique to combine predictions from all three experts, resulting in a final forecast that is more accurate than any single method alone.

The system has been tested extensively and shows remarkable accuracy: 96.9% for PM2.5 particles, 97.4% for PM10 particles, and consistently above 95% accuracy for other pollutants.

The USP of AeroVision is its real-world benefits. It offers six-day air quality forecasting, unlike most systems that only show current conditions. It covers every city and town in India, not just major metropolitan areas. It provides health warnings and recommendations based on predicted air quality levels and presents the information in a user-friendly format that anyone can understand.

AeroVision converts complex pollution data into a simple Air Quality Index (AQI) number that follows Indian national standards (NAAQS). This AQI works like a traffic light system: Green (0-50) indicates good air quality, Yellow (51-100) is moderate but requires caution for sensitive people, Orange (101-200) is unhealthy for sensitive groups, Red (201-300) is unhealthy for everyone, and Purple (301+) is very unhealthy—outdoor activities should be avoided.

The system has many practical applications. Families can use it to decide whether to let children play outside. Athletes and fitness enthusiasts can plan their training sessions for days with better air quality. People with asthma, heart conditions, or respiratory issues can take preventive measures. Urban planners and city officials can use the data to implement traffic restrictions or industrial controls on days when pollution levels are expected to be high. The system is also valuable for managing large-scale events such as conferences, workshops, or public gatherings by helping organizers assess air quality in advance.

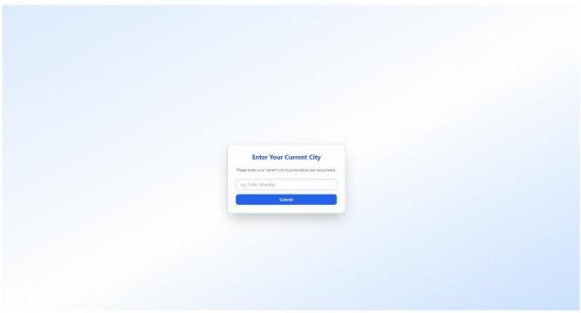
The web portal https://airqualitycities.iiti.ac.in makes this technology easily accessible. Users can visit the site through the given link or by scanning the QR code, select their city, and get real-time air quality conditions along with a six-day forecast. The system continuously updates its predictions using real-time data, ensuring accurate and relevant forecasts. It's like having an intelligent assistant that never sleeps, always monitoring air quality for you.

AeroVision marks a major advancement in environmental health technology. By making air quality forecasts as accessible and routine as weather updates, it empowers individuals and communities to take control of their well-being. This technology not only predicts the future but helps create a healthier one by enabling proactive steps to reduce the impact of air pollution.

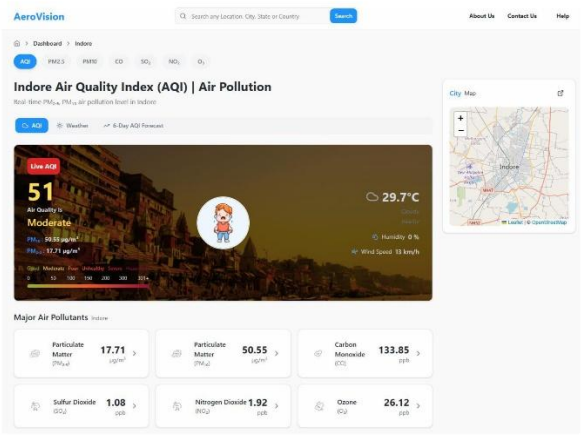
Prof. Goyal said, “This research provides a real time air quality index of each city and demonstrates the potential of AI technologies to enhance air quality forecasts and promote future research as real-time pollution monitoring and data-driven decision-making.”

https://airqualitycities.iiti.ac.in

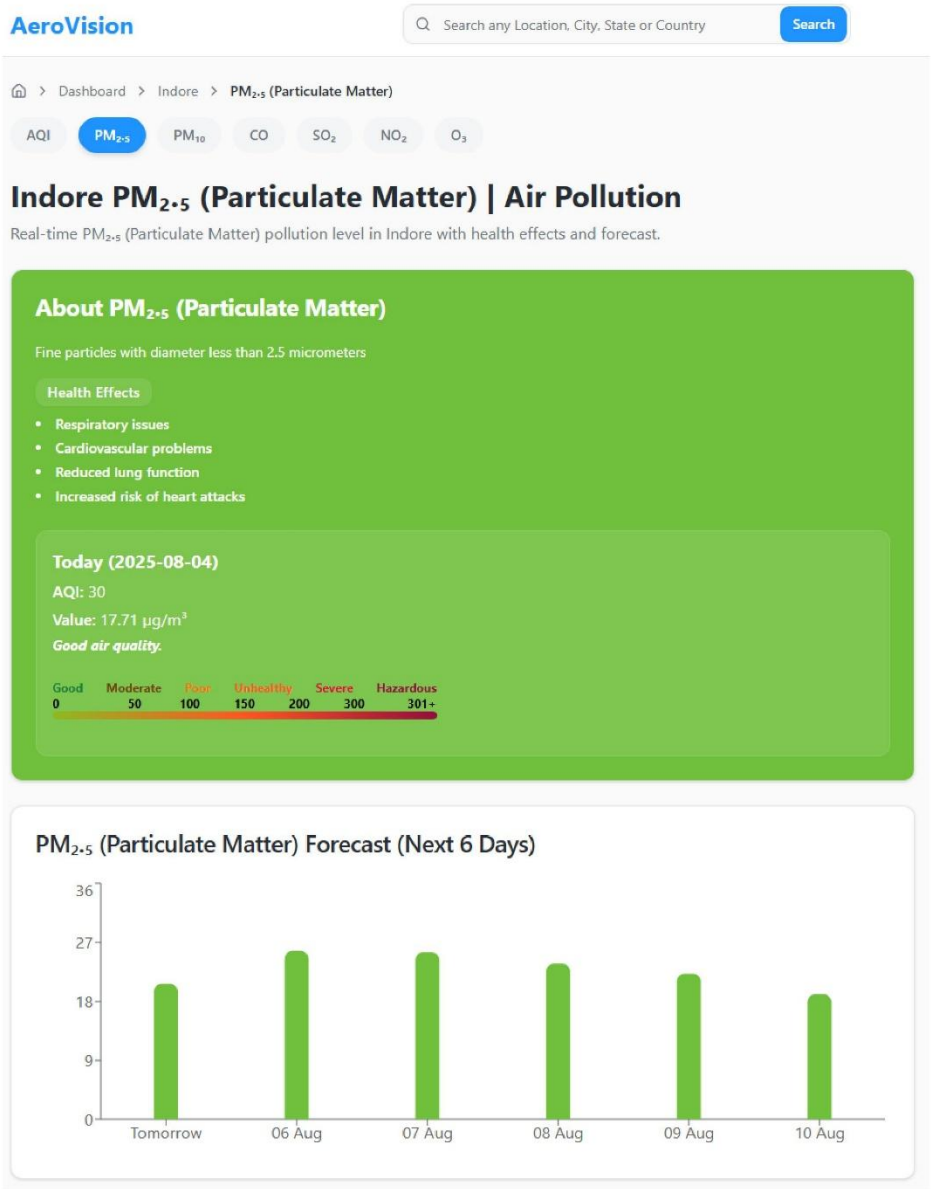
Step I: Type- airqualitycities.iiti.ac.in; and type the city name: Ex: Indore



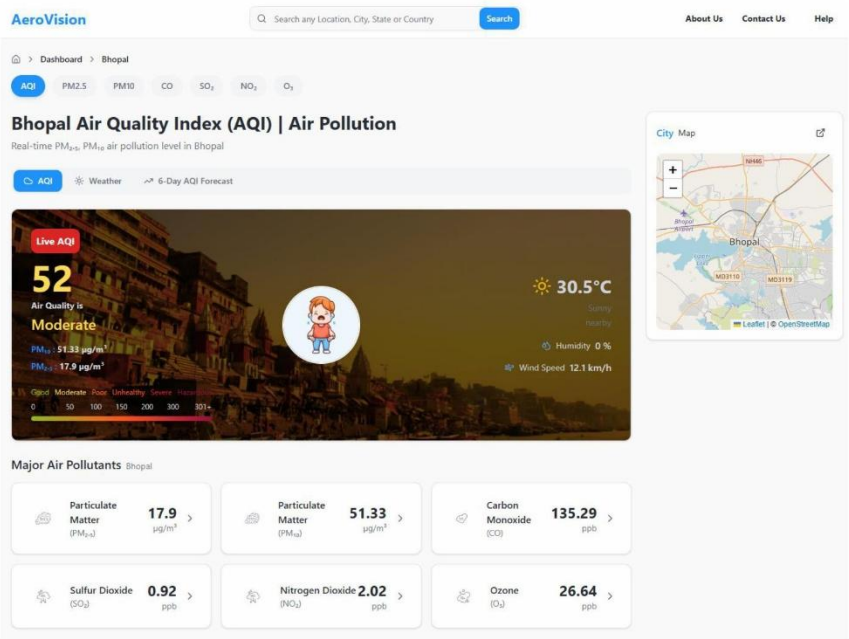
Step II: Dashboard: Which Shows the present air quality index and pollutant concentrations for the entered city.



Step III: See Forecast (Example: PM2.5 individual AQI)



Bhopal city



Delhi (NCR)