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# **Institutional AQI Flag Hoisting Program**

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**ABSTRACT**: This paper focuses on the motivation, development, and implementation of an AIR Plan. The project is discussed in terms of its collaborative roots, public health purpose in addressing the grave threat of air pollution (particularly to vulnerable groups), technical aspects in deploying air monitoring technology, and broader goals for the dissemination of an air quality index linked to specific health messages and suggested actions to reduce harmful exposures. The city of Ahmedabad is among the first cities in India where city leaders, state government, and civil society are proactively working together to address the country's air pollution challenge with a focus on public health. The lessons learned from the development of the AIR Plan serve as a template for other cities aiming to address the heavy burden of air pollution on public health. Effective working relationships are vital since they form the foundation for long-term success and useful knowledge sharing beyond a single city.

KEYWORDS: Air Quality Index, Machine Learning, Linear Regression, AIR Plan, SVM.

#### I. INTRODUCTION

Indian cities struggle with some of the highest ambient air pollution levels in the world. While national efforts are building momentum towards concerted action to reduce air pollution, individual cities are taking action on this challenge to protect communities from the many health problems caused by this harmful environmental exposure. In 2017, the city of Ahmedabad launched a regional air pollution monitoring and risk communication project, the Air Information and Response (AIR) Plan. The centrepiece of the plan is an air quality index developed by the Indian Institute of Tropical Meteorology's System for Air Quality and Weather Forecasting and Research program that summarizes information from 10 new continuous air pollution monitoring stations in the region, each reporting data that can help people avoid harmful exposures and inform policy strategies to achieve cleaner air.

The overall goal of this project was to develop a health-based strategy for monitoring and communicating information about urban air pollution in the region and the new AQI, in the form of the Air Information and Response (AIR) Plan.

#### **II. LITERATURE SURVEY**

II.1: This article looks at how artificial intelligence can help expect the hourly consolidation of air toxin Sulphur ozone, element matter (PM2.5), and Sulphur dioxide. As one of the most excellently procedures, AI can efficiently prepare a model on a large amount of data by using large-scale streamlining computations. This paper suggests advanced analysis to simulate the hourly environmental change focus based on previous days' weather-related data by calculating the expectation for more than 24 hours as an execute multiple tasks learning (MTL) issue<sup>[1]</sup>

II.2: The project is discussed in terms of its collaborative roots, public health purpose in addressing the grave threat of air pollution (particularly to vulnerable groups), technical aspects in deploying air monitoring technology, and broader goals for the dissemination of an air quality index linked to specific health messages and suggested actions to reduce harmful exposures. The city of Ahmedabad is among the first cities in India where city leaders, state government, and civil society are proactively working together to address the country's air pollution challenge with a focus on public health. The lessons learned from the development of the AIR Plan serve as a template for other cities aiming to address the heavy burden of air pollution on public health.<sup>[2]</sup>





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II.3: Air quality index is a key discussion area in today's time in concern with human health and environmental hazards. It directly impacts the human health. In the current scenario, mobile and other wireless based smart devices are playing an important role in day to day life. Hence, it is important and evident that the same must be used efficiently to tackle our daily problems. One common issue related to quality of surrounding environment is to know about whether the air in surrounding is under the danger level index.<sup>[3]</sup>

II.4: The aim of this paper is to find the most effective way for AQI prediction to assist in climate control. The most effective method can be improved upon to find the most optimal solution. Hence, the work in this paper involves intensive research and the addition of novel techniques such as SMOTE to make sure that the best possible solution to the air quality problem is obtained. Another important goal is to demonstrate and display the exact metrics involved in our work in such a way that it is educational and insightful and hence provides proper comparisons and assists future researchers.<sup>[4]</sup>

II.5: To demonstrate the performance of the proposed MKL model, its performance is compared to that of classical autoregressive integrated moving average (ARIMA) model; widely used parametric models like random forest (RF) and support vector machine (SVM); popular neural network models like multiple layer perceptron (MLP); and long short-term memory neural network. Datasets acquired from a coastal city Hong Kong and an inland city Beijing are used to train and validate all the models. Experiments show that the MKL model outperforms the other models.<sup>[5]</sup>

II.6: The Air quality of the Pune city day by day will change and goes on the benchmark of pollution. Presently MPCB and IMD monitored air quality of Central Pune city on continuous and intermittent basis. This paper and study has main aims to develop effective monitoring mechanism to monitor the concentration of CO and NOX at existing and new monitoring stations and includes scenario of gaseous air pollutants due to vehicular emission in different areas of Pune city and surroundings so that the station wise air quality and its respective parametric concentrations will analysed.<sup>[6]</sup>

#### **III. METHODOLOGY**

III.1: Background Information:

The background information that needs to be collected includes details of sources and emissions, health status, demography, population growth, land use pattern, epidemiological studies. Such prior information will provide immense help to identify the likely effects and in particular health impacts resulting from population exposure to air pollutants.

#### III.2: Sources and Emissions:

Sources in a city include vehicles, industries, domestic etc. In an industrial area, information should be obtained on the type of industries including their number, fuel used, composition of fuel, pollutants emitted etc. Information on number and distribution of sources should be collected. This information will help in identifying which pollutants can be expected in an area and thus should be measured. In case of industrial stacks, locations of maximum ground level concentrations should be determined by modelling. The stations should be located at locations where maximum ground level concentrations are expected. Information on type and number of vehicles should be obtained. Information on domestic fuel that is used in household should be obtained. Pollution load emanating from these sources should be estimated so as to identify sources that are generating significant amount of pollution.

#### III.3: Health and Demographic Information:

Investigations shall be carried out based on the public complaints received from an area related to air pollution. If the results of such investigations reveal that the levels are high that area can be considered for ambient air quality monitoring. Areas where population density is high (more than one million) can be considered for locating monitoring stations. Information on age and socio-economic status of population is also important for making a decision on initiation of ambient air quality monitoring. Location of monitoring station in such areas will help in finding exposure levels to population which can be used further in epidemiological studies to evaluate health effects of air pollutant.





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Fig (III.A): Machine-learning-DFD-for-the-prediction-of-AQI

#### III.4: Meteorological Information:

Meteorological data with respect to temperature, relative humidity, wind speed and direction should be collected. Predominant wind direction plays an important role in 10 determining location of monitoring stations. Due to effects such as land and sea breezes, valley effects etc. it is important to collect local meteorological data specific to the site. The monitoring stations should be located in areas that are downwind from the sources.

#### III.5: Topographical Information:

Local winds and stability conditions are affected by topography. In river valleys there is increased tendency of developing inversions. More number of monitoring stations should be located in areas where spatial variations in concentrations are large. Mountains, hills, water bodies also affect dispersion of pollutants.

#### III.6: Previous Air Quality Information:

Any previous information collected on ambient air quality can serve as a basis for selecting areas where monitoring should be conducted and previous studies may include data collected for any health studies etc. Previous studies can be used to estimate the magnitude of the problem. Once the background information is collected, the ambient air quality monitoring is to be initiated and selection of type of pollutant to be measured, number and distribution of monitoring stations etc. should be made.

Air Quality Descriptor	AQI Value	PM <sub>2.5</sub> (μg/m <sup>3</sup> ) 24-hr Average	PM <sub>10</sub> (μg/m <sup>3</sup> ) 24-hr Average	O3 (ppb) 8-hr Average	NO <sub>2</sub> (ppb) 24-hr Average	CO (ppm) 24-hr Average
Good	0-100	0-60	0-100	0–50	0-43	0-1.7
Moderate	101-200	61-90	101-250	51-84	44-96	1.8-8.7
Poor	201-300	91-120	251-350	85-104	97-149	8.8-14.8
Very Poor	301-400	121-250	351-430	105-374	150-213	14.9-29.7
Severe	401-500	251-350	431-550	375-450	214-750	29.8-40

Fig (III.B: IITM-SAFAR air quality descriptors, AQI numeric values, and corresponding air pollution concentration thresholds and temporal averaging periods [95,140]).

#### III.7: Number and Distribution of Monitoring Locations:

Knowledge of existing air pollutants levels and pattern within the area are essential for deciding number and distribution of stations. Isopleths distribution of ambient concentrations determined from modelling or previous air quality information can be used to determine number and distribution of stations.

#### **IV. EXPERIMENTAL RESULTS**

#### IV.1: Machine learning model testing:

Machine learning testing is the process of evaluating and validating the performance of machine learning models to ensure their correctness, accuracy, and robustness. Unlike traditional software testing, which mainly focuses on code functionality, ML testing includes additional layers due to the inherent complexity of ML models.





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Test Case	Expected Outcome	Actual Outcome	Pass/Fail
Simple Prediction	Correct	Correct	Pass
Short Sentence Analysis	Accurate	Accurate	Pass
Known Failure Mode 1	Detected	Detected	Pass

Fig (IV.A: Testing table for the ML Model.)

IV.2: Testing Techniques:

Many existing ML model testing practices follow manual error analysis (e.g., failure mode classification), making them slow, costly, and error-prone. A proper ML model testing framework should systematize these practices.

- Unit test: Check the correctness of individual model components.
- Regression test: Check whether your model breaks and test for previously encountered bugs.
- Integration test: Check whether the different components work with each other within your machine learning pipeline.



Fig (IV.B: Typical ML development workflow with tests.)



Fig (IV.C: Model development and evaluation workflow.)





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IV.3: Project Implementation and Flowchart:



Fig (IV.D: Flowchart for AIR Plan.)



Fig (IV.E: Home Page.)

	Ai AQI fo	ir Quality Result r Mumbai on 2017-03-29	
	Pollutant	Concentration (µg/m³)	
	PM2.5	67.45057794890306	
	PM10	118.12710293078136	Co. Contraction
	NO	17.574729662029362	
x	N02	28.560659061126955	
÷ 0	NOx	32.30912333307031	A 17.1
l 🗎 î	NH3	23.48347601937197	9 1
	со	0.0	100
1 1 10	S02	14.53197725590996	
	03	34.49143047551845	A 127

Fig (IV.F: ML model prediction.)





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Fig (IV.G: File Structure of the Project.)

#### V. CONCLUSION

The experience of developing and implementing the AIR Plan in Ahmedabad offers a number of tangible lessons to other cities in India and other countries that are striving to address the problem of urban air pollution. First, strong partnerships and community engagement are paramount. Second, the reliance on transparent, tested technology for documenting and reporting air quality builds trust and allows for the establishment of a research base on which to craft informed air quality management policies. Third, it is important to design interventions that achieve near-term benefits while also laying the foundation for sustainable progress towards larger environmental and public health goals. Lastly, a sustained, stakeholder-focused approach that prioritizes community engagement at the outset is vital. As cities around the world strive to achieve healthy and sustainable conditions for their residents, Ahmedabad's leadership with the AIR Plan demonstrates that the combined efforts of government agencies, health professionals, academic leaders, and engaged community members can serve to effectively inform the public about major air pollution-related health risks. This project also lays a foundation for policy measures to improve the city's resilience to other complex environmental health threats. The lessons learned through the development and implementation of Ahmedabad's AIR Plan are instructive for other cities working to address the heavy burden of air pollution on the health of their citizens.

#### REFERENCES

- Predict and Measure Air Quality Monitoring System Using Machine Learning (Turkish Journal of Computer and Mathematics Education Vol.12 No.2(2021), 2562-2571).
- [2] Development of Ahmedabad's Air Information and Response (AIR) Plan to Protect Public Health (International Journal of Environmental Research and Public health).
- [3] Air Quality Monitoring and IoT- Past and Future(2020 8th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO) Amity University, Noida, India. June 4-5, 2020).
- [4] Prediction of Air Quality Index Using Machine Learning Techniques: A Comparative Analysis (International Journal of Environmental Research and Public health Volume 2023 Article ID 4916267).
- [5] A Multiple Kernel Learning Approach for Air Quality Prediction (International Journal of Environmental Research and Public health Volume 2018 Article ID 3506394 ).
- [6] Ambient Air Quality Monitoring In Pune City (May 2015 International Journal of Science and Research (IJSR) 4(5):2909-2913).









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