

Predicting Air Pollution Level in Specific City

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ABSTRACT

Air pollution has become a significant environmental and public health concern especially in rapidly urbanizing cities. Due to increased industrial activity vehicle pollution and population growth air quality has significantly decreased posing major threats to human health and environment. Accurate air pollution level forecasting is necessary for efficient environmental management early warning systems and informed decision-making. This project Predicting Air Pollution Level in a Specific City aims to build a data-driven prediction system that uses ML approaches to forecast air pollution levels in a metropolitan area.

In addition for historical air level data the introduced method looks at atmospheric factors such as temperature humidity wind speed and atmospheric pressure. Analysis takes into account important air impurities such as PM_{2.5}, PM₁₀, NO₂, SO₂, CO, and O₃. ML is used to precisely predict future pollution levels and capture the complex and non-linear relationships between these variables. The projected values are used to calculate the Air Condition Index (AQI) which is separated into Good Moderate Poor and Severe levels for ease of understanding.

I. INTRODUCTION

Air pollution in urban areas worldwide is the important environmental issues. Fast industrialization more cars on the road population growth and unchecked urbanization are the reasons why the quality of the air in cities has gotten worse. Peoples health is seriously jeopardized by unhealthy air conditions which reduces life expectancy and increase the possibility of heart and lung problems. As a results

air pollution forecasting is crucial for both safety and efficient use of environmental resources.

The aim of the project: "Predicting Air Pollution Level in a Specific City" is the progress of an intelligent system capable of accurately predicting air pollution levels on the basis meteorology & quality of air values in the previous years. Apart from meteorology parameters such as temperature, humidity, wind speed, and air pressure, the system collects and analyses data about major air pollutants such as PM_{2.5}, PM₁₀, NO₂, SO₂, CO, and O₃. These parameters influence air pollutant concentration and distribution in the atmosphere.

II. LITERATURE REVIEW

Present air pollution monitoring systems primarily depend on traditional air quality measurement techniques managed by various governmental and environmental organizations. These systems measure pollutants like PM_{2.5}, PM₁₀, NO₂, SO₂, CO, and O₃ using stationary air quality monitoring stations placed at selected sites around the city. The results obtained are normally accessible online in the form of historical or instantaneous air quality status reports.

Instead of forecasting future conditions, most current systems lie more in the domain of descriptive analysis, providing data on air pollution levels at a specific time or in past. The retrieved information is usually studied using conventional methods, which limit their potential in pursuing complex, non-linear relations among air pollution levels and influencing factors like traffic patterns and meteorology. Also, the coverage area is usually insufficient because most air pollution control stations cover only a certain number of sites.

Additionally, the current system doesn't cover an efficient early-warning mechanism to provide advance alerts about potential pollution spikes. decision-making is not easy due to the delay in data reporting and the need for manual interpretation. The need for an automated intelligent and predictive system that can support proactive environmental management and offer precise air pollution forecasts is thus highlighted by the current circumstances.

III. METHODOLOGY

Information Meteorological and pollution data collection from trusted sources like government-based pollution measurement sites, publicly available internet-based datasets, and IoT sensors is the first step. The parameters that are part of the data collection are PM2.5, PM10, NO₂, SO₂, CO, temperature, humidity, and wind speed. To enhance the accuracy of predictions, both past and present data is collected. Pre-processing The errors, duplication, and outliers are removed from the raw data collected. The missing values in the data are handled using the proper method such as interpolation or mean replacement. To guarantee consistency and compliance with the machine learning algorithm data transformation and normalization are carried out.

Feature Analysis and Selection Statistical tools and correlation analysis are used to find important aspects that affect air pollution. By removing unnecessary or redundant features the model becomes simpler and more accurate.

Model Choice Appropriate ML models include Time Series Decision Tree Random Forest or Linear Regression depending on the features of the data. To find the best model various models can also tested.

Training and Testing Models After training the models on historical data their performance is evaluated using specific accuracy metrics like accuracy RMSE or MAE.

Prediction of Pollution The model is used for forecast future pollution levels in a specified city. Forecasts are updated continuously when a new information is discovered.

Calculating AQI The predicted levels of pollutants are transformed into Air Quality Index (AQI) values to present an easily comprehensible state of air quality.

Reporting and Visualization Trends forecasts and the Air Quality Index are displayed via dashboards graphs and reporting.

Notification and Alert System Alerts are set off when air pollution levels surpass safety thresholds so that people and governments can take preventative measures.

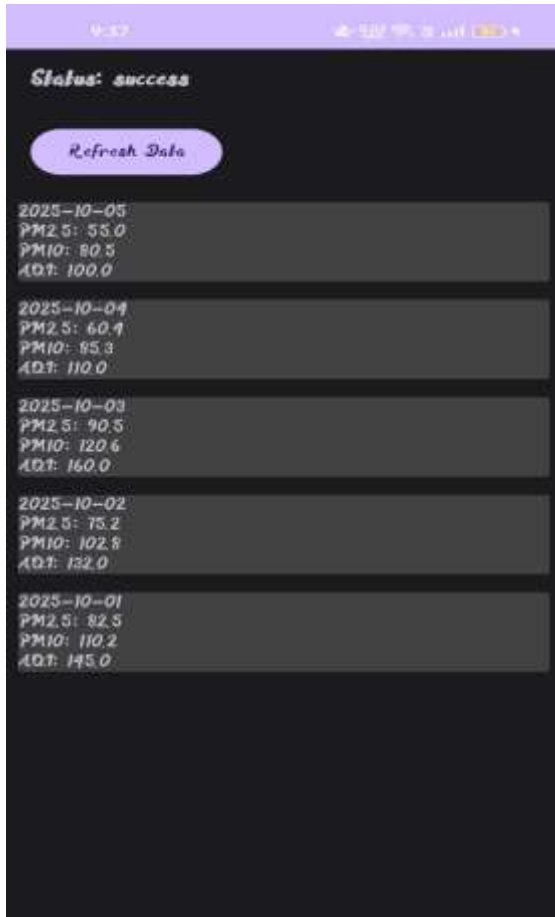
IV. RESULTS AND DISCUSSION

The above output displays the initial screen of a mobile application used for checking system status before prediction. The interface has a dark background with a simple and clean design. At the top, the title "Status Checking" clearly indicates the purpose of the page. Below the title, there is a "Refresh Status" button that allows the user to update or verify the current status. No prediction results are shown on this screen, which means it represents the stage before the prediction process begins. The layout is minimal, user-friendly, and designed to ensure easy interaction and smooth navigation.

The above output displays the application screen after the prediction process has been completed successfully. At the top, the status is shown as "Status: success," indicating that the system has executed the prediction without any errors. Below the status, a "Refresh Data" button is available to update or reload the prediction results. The screen presents multiple records arranged in card format, each containing a date and pollutant values such as PM2.5, PM10, and AQI. These values represent the predicted air quality levels for specific dates. The structured layout makes it easy to read and understand the prediction results clearly.

V. EXPERIMENTAL RESULTS





VI. CONCLUSION AND FUTURE WORK

The project “Predicting Air Pollution Levels in a Specific City” illustrates the app of ML to tackle environmental issues. The model predicts future pollution levels by examining past and present air quality data. This project aids in identifying key locations where air quality becomes dangerous and comprehending trends in air pollution.

Future work includes Several cutting-edge elements could be added to the air pollution level forecasting system to increase its accuracy utility and impact. One crucial development is the addition of real-time IoT sensors which offer consistent and more precise information on air quality. As a outcome the platform can produce predictions that are most accurate and up to date.

VII. REFERENCES

1. WHO Air Quality Guidelines: Global Update Geneva: WHO Press 2005.
2. Central Pollution Control Board and the Government of India National Air Quality Monitoring Program.
3. A U. In S. EPA is the Environmental Protection Agency. The Air Quality Index (AQI) Fundamentals.
4. Bishop Charles. M. (2006). Pattern recognition and machine learning. The Springer.
5. Han, J., Pei, J., & Kamber, M. (2012). Data Mining: Concepts and Techniques (3rd ed.). Morgan Kaufmann.
6. Géron, A., Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, 2019.
7. Box, G. E. P., Jenkins, G. M., and Reinsel, G. C., Time Series Analysis: Forecasting and Control, Wiley, 2015.
8. Kumar and associates. Using Machine Learning Methods to Predict Air Quality. . Software and Environmental Modeling Elsevier.
9. Open Air Quality Data Repository OpenAQ Community and OpenAQ Platform.