 **GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE-13**

**DEPARTMENT OF ECE**

**Comprehensive Analysis of Air Quality Data**

**in Tamil Nadu**

**PHASE-IV**

**TEAM MEMBERS**

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Air Quality Analysis

Air Quality Analysis in Tamil Nadu: Breathing Easier through DataAim:The aim of this document is to emphasize the significance of air quality analysis in Tamil Nadu and provide a practical example of how it can be executed using Python. We will combine theory with code to create a comprehensive understanding of the subject.Understanding Air Quality Challenges in Tamil Nadu:Tamil Nadu encounters various air quality issues, driven by factors such as industrial emissions, vehicular pollution, and geographical conditions. The primary pollutants of concern in the region include:Particulate Matter (PM2.5 and PM10)Ground-level Ozone (O3)Nitrogen Dioxide (NO2)Sulfur Dioxide (SO2)Carbon Monoxide (CO)These pollutants not only degrade air quality but also pose severe health risks to the population. Respiratory diseases, heart ailments, and reduced life expectancy are some of the consequences of poor air quality.Modern Approach to Air Quality Analysis:To address these challenges, Tamil Nadu has adopted a modern approach to air quality analysis, which includes:Air Quality Monitoring Stations: The state has established a network of real-time air quality monitoring stations across cities and industrial areas. These stations provide continuous data on air quality parameters, helping authorities make informed decisions.Digital Dissemination of Data: The collected air quality data is made available to the public through mobile apps, websites, and public displays. This empowers citizens to take necessary precautions based on real-time information.Algorithm: Air Quality Analysis with PythonNow, let's delve into a practical example of how air quality analysis can be done using Python. We'll demonstrate how to load, preprocess, and analyze air quality data, as well as train a machine learning model to predict air quality.import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

# Load air quality data

data = pd.read\_csv('air\_quality\_tamilnadu.csv')

# Check for missing values

print("No. of Null Values:\n", data.isnull().sum())

data is data.dropna()

# Analyze air quality data

correlations = data.corr(method='pearson')

plt.figure(figsize=(15, 12))

sns.heatmap(correlations, cmap="coolwarm", annot=True)

plt.title("Air Quality Correlation Heatmap")

plt.show()Selecting Features and Labels:Next, we select the features and labels for our air quality prediction model. In this example, we'll consider the following features:PM2.5 (Particulate Matter ≤ 2.5 micrometers)PM10 (Particulate Matter ≤ 10 micrometers)O3 (Ozone)CO (Carbon Monoxide)NO2 (Nitrogen Dioxide)SO2 (Sulfur Dioxide)The Air Quality Index (AQI) serves as the label we want to predict.# Select features and labels

X = data[["PM2.5", "PM10", "O3", "CO", "NO2", "SO2"]]

y = data["AQI"]Splitting Data and Training a Machine Learning Model:We split the data into training and test sets and then train a Random Forest Regressor model.# Split data into training and test sets

from sklearn.model\_selection import train\_test\_split

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, test\_size=0.2, random\_state=42)

# Train a machine learning model

from sklearn.ensemble import RandomForestRegressor

model = RandomForestRegressor()

model.fit(X\_train, y\_train)Final Output: Air Quality Prediction and EvaluationWe use the trained model to make air quality predictions and evaluate its performance using Mean Squared Error (MSE) and R-squared (R2) Score.# Make air quality predictions

predicted\_aqi = model.predict(X\_test)

# Evaluate the model

from sklearn.metrics import mean\_squared\_error, r2\_score

mse = mean\_squared\_error(y\_test, predicted\_aqi)

r2 = r2\_score(y\_test, predicted\_aqi)

print(f"Mean Squared Error: {mse}")

print(f"R-squared (R2) Score: {r2}")Conclusion:Air quality analysis in Tamil Nadu is a critical endeavor aimed at safeguarding public health. By adopting technology, enforcing regulations, and involving the community, the state strives to provide cleaner air. The goal is to create a healthier, more vibrant Tamil Nadu where every breath is a breath of fresh air.