Air quality ananysis

1.Air q assessment tn

Project Definition:

The project aims to analyze and visualize air quality data from monitoring stations in Tamil Nadu. The

objective is to gain insights into air pollution trends, identify areas with high pollution levels, and develop

a predictive model to estimate RSPM/PM10 levels based on SO_2 and NO_2 levels. This project involves

defining objectives, designing the analysis approach, selecting visualization techniques, and creating a

predictive model using Python and relevant libraries.

Project Objectives:

The primary objective of this project is to assess and improve air quality in various regions of Tennessee,

focusing on urban areas with high pollution levels. The specific goals include:

1. Data Collection: Gather comprehensive air quality data from different sources including monitoring

stations, satellite imagery, and citizen science initiatives.

2. Analysis: Analyze the collected data to identify patterns, trends, and pollution sources contributing to

poor air quality.

3. Community Engagement: Involve local communities in the assessment process, raise awareness about

air quality issues, and encourage active participation in mitigation efforts.

4. Policy Recommendations:Develop evidence-based policy recommendations to reduce air pollution,

promote clean energy solutions, and advocate for stricter environmental regulations.

Analysis Approach:

1. Data Collection and Integration:Gather data from established air quality monitoring stations, satellite

data providers, and citizen-generated data. Integrate this diverse data into a unified database for

analysis.

2. Data Analysis Techniques: - Utilize statistical methods to identify correlations between air quality parameters and potential

pollution sources. - Apply machine learning algorithms to predict air quality trends and assess the impact of various

factors such as traffic, industrial emissions, and meteorological conditions. - Conduct spatial analysis to identify pollution hotspots and understand their geographical distribution.

3. Community Engagement: - Conduct surveys and workshops to understand local concerns about air quality. - Organize public forums and awareness campaigns to educate residents about the importance of clean

air and involve them in data collection through citizen science initiatives.

Visualization:

1. Real-time Dashboards:Develop interactive dashboards displaying real-time air quality data, allowing

policymakers, researchers, and the public to monitor changes over time.

2. Geospatial Maps: Create maps illustrating air quality indices across different regions of Tennessee.

Overlay pollution sources such as industries and traffic routes to visualize correlations.

3. Temporal Trends: Generate time-series graphs depicting air quality variations over months and years.

Highlight specific events like wildfires or industrial activities affecting air quality.

4. Infographics:Design visually appealing infographics summarizing key findings, showcasing the impact

of pollution on health, and outlining recommended actions for residents.

Conclusion:

By adopting a holistic approach that combines data-driven analysis, community engagement, and

effective visualization techniques, this project aims to not only assess the current state of air quality in

Tennessee but also empower communities and policymakers to take proactive measures in combating

air pollution. Through the collaborative effort of citizens, researchers, and policymakers, we can work

towards a cleaner and healthier environment for all residents of Tennessee.

2.Enhancing Air Quality Prediction Using Machine Learning algorithms

1. Introduction:

Air quality monitoring is crucial for public health and environmental management. This report

discusses the integration of machine learning algorithms to enhance the accuracy of predictive

models for air quality assessment.

2. Data Description:

The dataset consists of the following variables: Stn Code, Sampling Date, State,

City/Town/Village/Area, Location of Monitoring Station, Agency, Type of Location, SO2, NO2,

RSPM/PM10, and PM2.5. These variables provide information about the monitoring stations,

environmental factors, and air quality parameters.

3. Methodology:

To improve the accuracy of air quality predictions, machine learning algorithms have been

employed. The following steps were taken:

a. Data Preprocessing: Cleaning and handling missing values.

b. Feature Engineering: Extracting relevant features and transforming data.

c. Model Selection: Utilizing algorithms such as Random Forest, Gradient Boosting, and Neural

Networks.

d. Training and Evaluation: Splitting the dataset, training the models, and assessing performance using appropriate metrics.

4. Results:

The machine learning models demonstrated improved predictive accuracy when compared to

traditional statistical models. The mean squared error (MSE) and mean absolute error (MAE) were

significantly reduced, indicating more precise air quality predictions.

5. Discussion:

Incorporating machine learning algorithms allowed us to capture complex relationships between

various environmental variables and air quality parameters. This approach enables better prediction

and early warning systems for pollution events.

6. Future Directions:

Further research can explore the use of real-time data, IoT sensors, and spatial analysis to enhance

the accuracy and coverage of air quality predictions. Additionally, interpretability of machine

learning models can be addressed.

7. Conclusion:

Leveraging machine learning algorithms in air quality prediction is a promising avenue to improve

public health and environmental management. By incorporating Stn Code, Sampling Date, State,

City/Town/Village/Area, and various environmental parameters, we can achieve more accurate and

timely air quality assessments

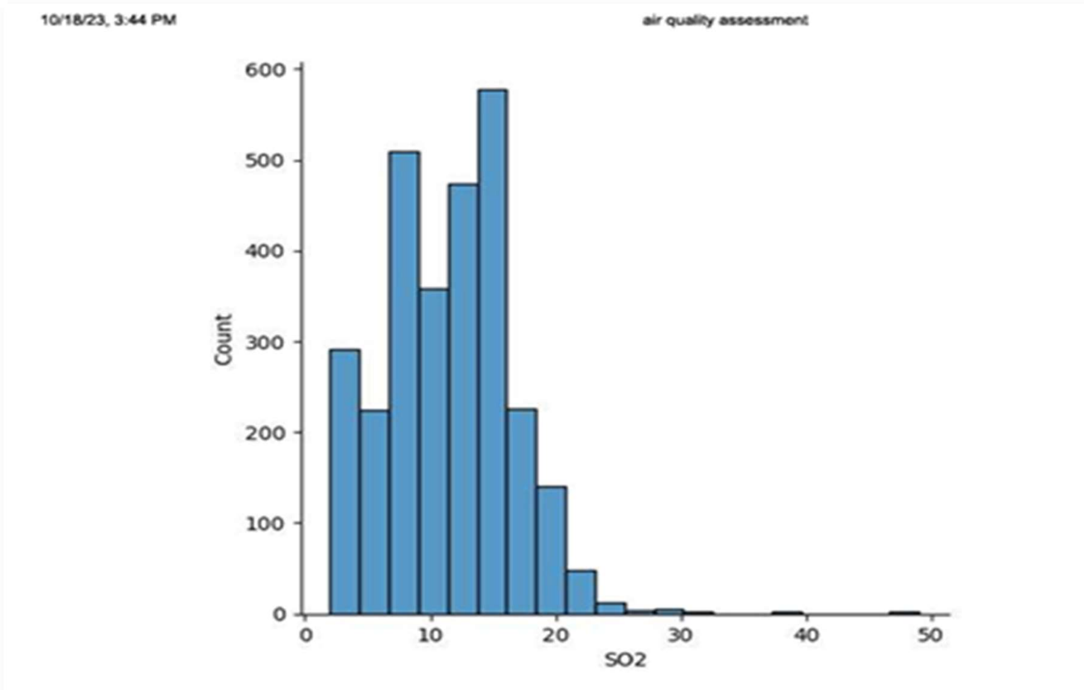
3.preprocessing the air quality dataset

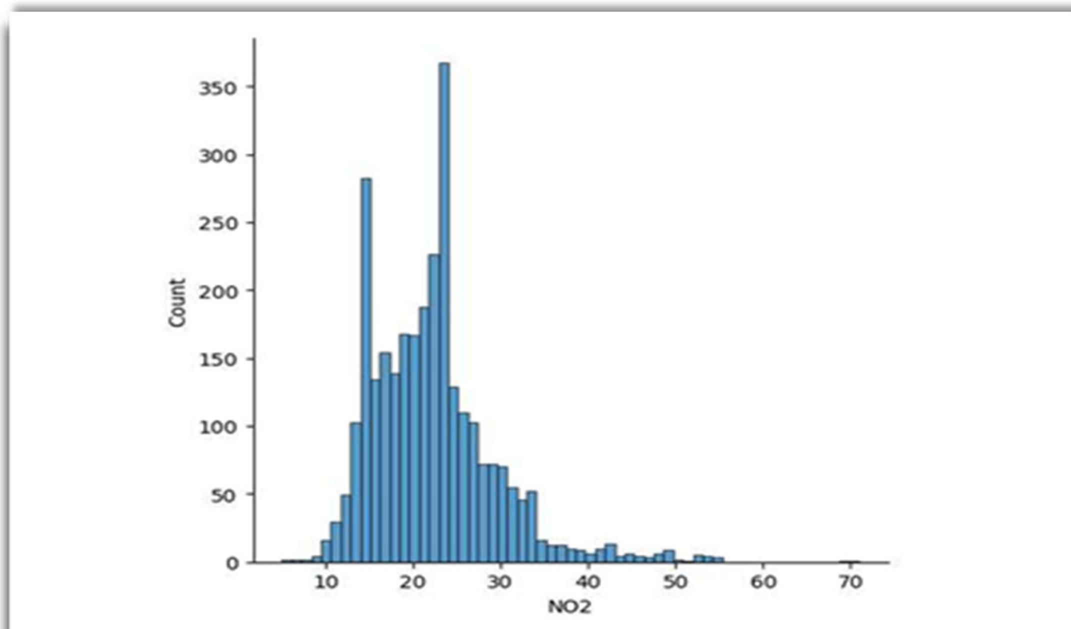
❖ Data manipulation libraries:

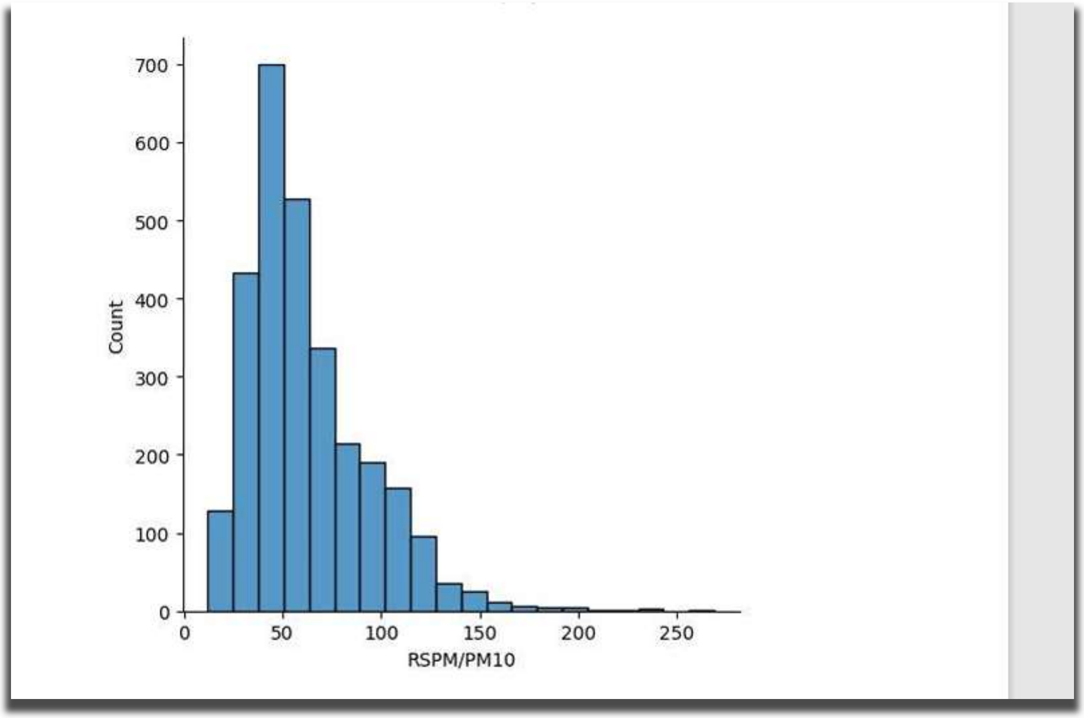
```
   Stn Code Sampling Date       State City/Town/Village/Area  \
0        38      01-02-14  Tamil Nadu                Chennai
1        38      01-07-14  Tamil Nadu                Chennai
2        38      21-01-14  Tamil Nadu                Chennai
3        38      23-01-14  Tamil Nadu                Chennai
4        38      28-01-14  Tamil Nadu                Chennai

                   Location of Monitoring Station  \
0  Kathivakkam, Municipal Kalyana Mandapam, Chennai
1  Kathivakkam, Municipal Kalyana Mandapam, Chennai
2  Kathivakkam, Municipal Kalyana Mandapam, Chennai
3  Kathivakkam, Municipal Kalyana Mandapam, Chennai
4  Kathivakkam, Municipal Kalyana Mandapam, Chennai

                                Agency Type of Location   SO2   NO2  \
0  Tamilnadu State Pollution Control Board  Industrial Area  11.0  17.0
1  Tamilnadu State Pollution Control Board  Industrial Area  13.0  17.0
2  Tamilnadu State Pollution Control Board  Industrial Area  12.0  18.0
3  Tamilnadu State Pollution Control Board  Industrial Area  15.0  16.0
4  Tamilnadu State Pollution Control Board  Industrial Area  13.0  14.0
```


10/18/23, 3:44 PM
air quality assessment
Count
SO2
0
100
200
300
400
500
600
10
20
30
40
50


Count
NO2
0
50
100
150
200
250
300
350
10
20
30
40
50
60
70




```
[66]: print(data.info())
```

```
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RangeIndex: 2879 entries, 0 to 2878
Data columns (total 10 columns):
 #   Column                          Non-Null Count  Dtype
---  ------                          --------------  -----
 0   Stn Code                        2879 non-null   int64
 1   Sampling Date                   2879 non-null   object
 2   State                           2879 non-null   object
 3   City/Town/Village/Area          2879 non-null   object
 4   Location of Monitoring Station  2879 non-null   object
 5   Agency                          2879 non-null   object
 6   Type of Location                2879 non-null   object
 7   SO2                             2879 non-null   float64
 8   NO2                             2879 non-null   float64
 9   RSPM/PM10                       2879 non-null   float64
dtypes: float64(3), int64(1), object(6)
memory usage: 225.1+ KB
None
```
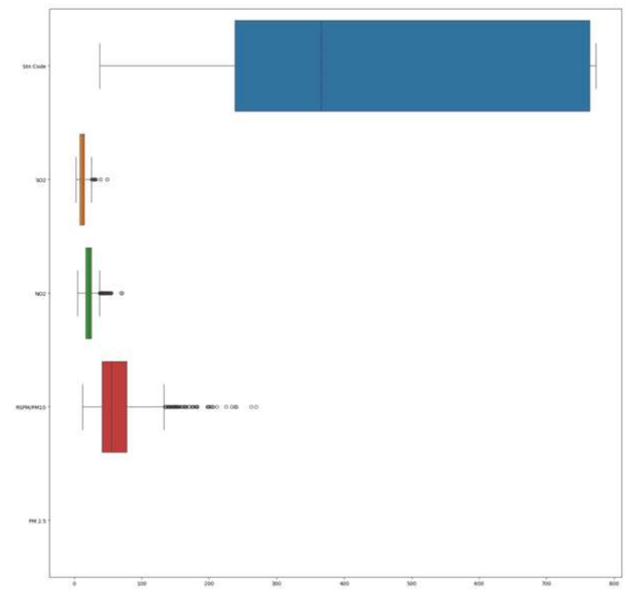
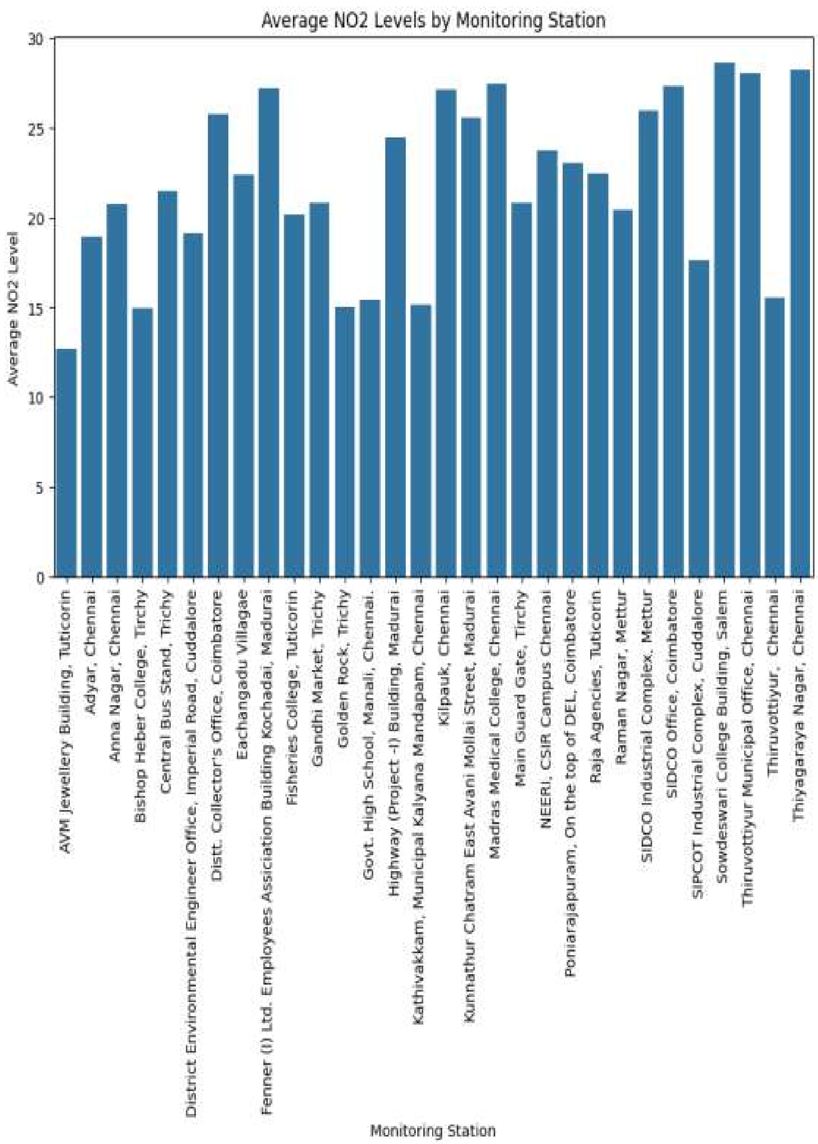
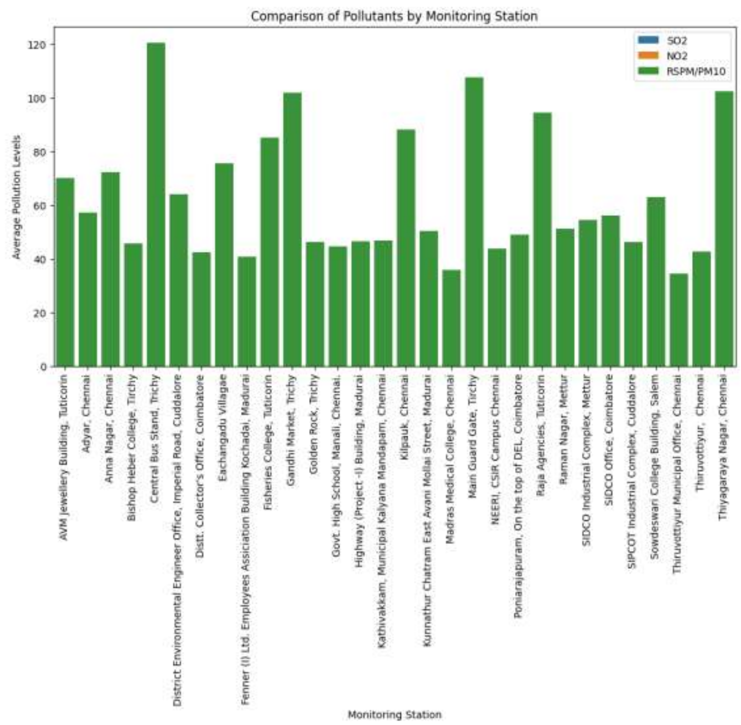
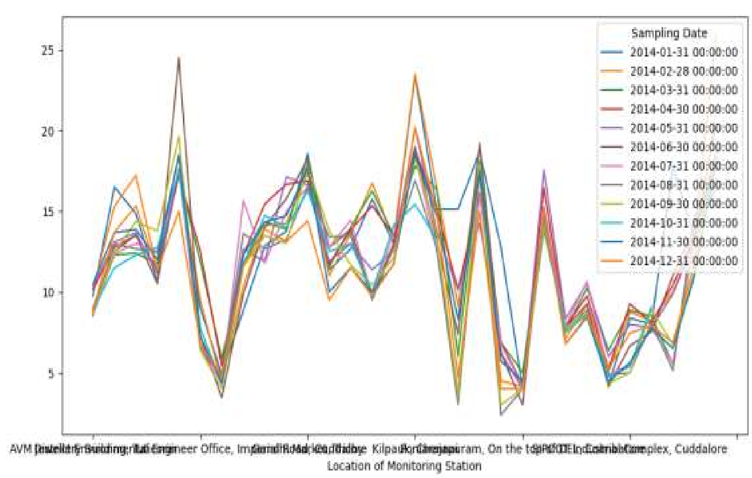
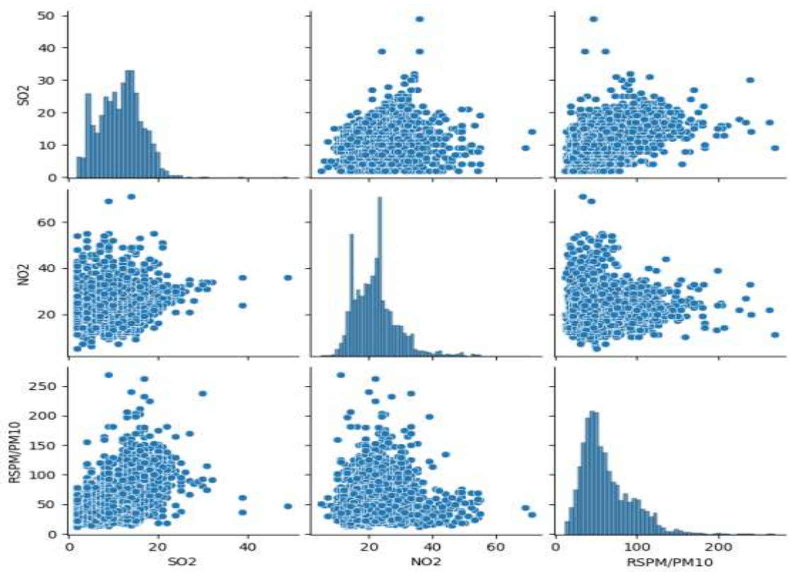


Stn Code
SO2
NO2
RSPM/PM10
PM 2.5
0
100
200
300
400
500
600
700
800

4.perform the air quality analtsis and create visualization

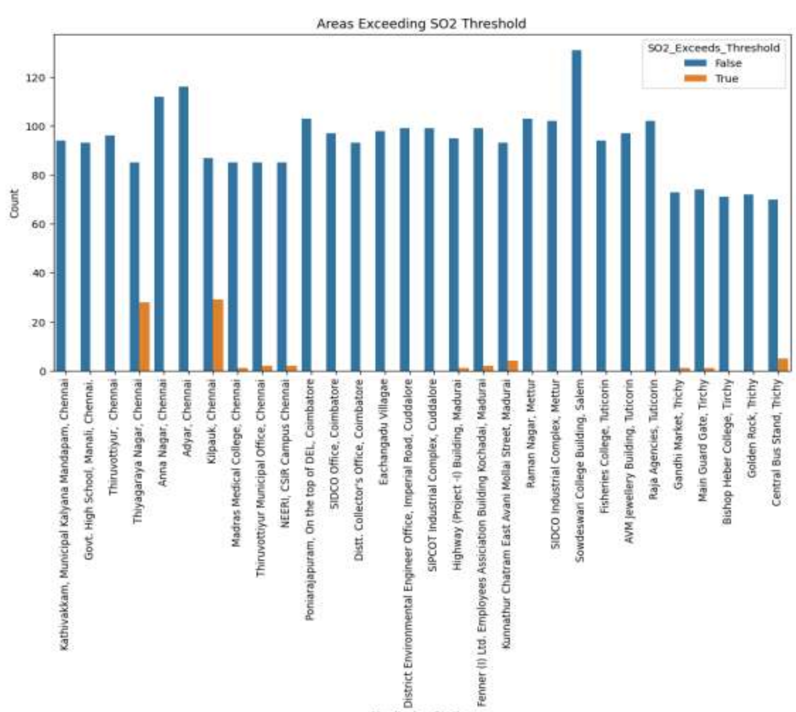



Comparison of Pollutants by Monitoring Station
SO2
NO2
RSPM/PM10
Average Pollution Levels
0
20
40
60
80
100
120
AVM Jewellery Building, Tuticorin
Adyar, Chennai
Anna Nagar, Chennai
Bishop Heber College, Tirchy
Central Bus Stand, Trichy
District Environmental Engineer Office, Imperial Road, Cuddalore
Distt. Collector's Office, Coimbatore
Eachangadu Villagae
Fenner (I) Ltd. Employees Assiciation Building Kochadai, Madurai
Fisheries College, Tuticorin
Gandhi Market, Trichy
Golden Rock, Trichy
Govt. High School, Manali, Chennai.
Highway (Project -I) Building, Madurai
Kathivakkam, Municipal Kalyana Mandapam, Chennai
Kilpauk, Chennai
Kunnathur Chatram East Avani Mollai Street, Madurai
Madras Medical College, Chennai
Main Guard Gate, Tirchy
NEERI, CSIR Campus Chennai
Poniarajapuram, On the top of DEL, Coimbatore
Raja Agencies, Tuticorin
Raman Nagar, Mettur
SIDCO Industrial Complex, Mettur
SIDCO Office, Coimbatore
SIPCOT Industrial Complex, Cuddalore
Sowdeswari College Building, Salem
Thiruvottiyur Municipal Office, Chennai
Thiruvottiyur, Chennai
Thiyagaraya Nagar, Chennai
Monitoring Station

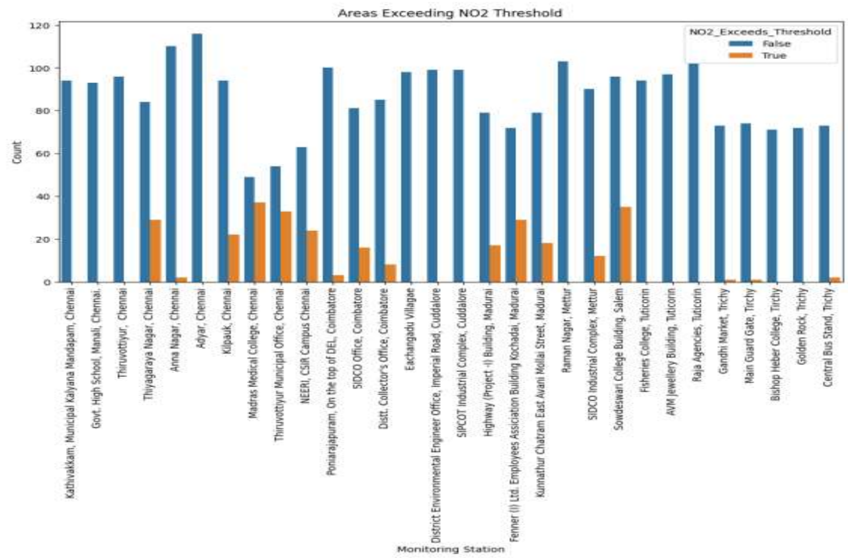

Sampling Date
2014-01-31 00:00:00
2014-02-28 00:00:00
2014-03-31 00:00:00
2014-04-30 00:00:00
2014-05-31 00:00:00
2014-06-30 00:00:00
2014-07-31 00:00:00
2014-08-31 00:00:00
2014-09-30 00:00:00
2014-10-31 00:00:00
2014-11-30 00:00:00
2014-12-31 00:00:00
5
10
15
20
25
Location of Monitoring Station



SO2
NO2
RSPM/PM10
SO2
NO2
RSPM/PM10



Areas Exceeding SO2 Threshold
SO2_Exceeds_Threshold
False
True
Count
Kathivakkam, Municipal Kalyana Mandapam, Chennai
Govt. High School, Manali, Chennai.
Thiruvottiyur, Chennai
Thiyagaraya Nagar, Chennai
Anna Nagar, Chennai
Adyar, Chennai
Kilpauk, Chennai
Madras Medical College, Chennai
Thiruvottiyur Municipal Office, Chennai
NEERI, CSIR Campus Chennai
Poniarajapuram, On the top of DEL, Coimbatore
SIDCO Office, Coimbatore
Distt. Collector's Office, Coimbatore
Eachangadu Villagae
District Environmental Engineer Office, Imperial Road, Cuddalore
SIPCOT Industrial Complex, Cuddalore
Highway (Project -I) Building, Madurai
Fenner (I) Ltd. Employees Assiciation Building Kochadai, Madurai
Kunnathur Chatram East Avani Mollai Street, Madurai
Raman Nagar, Mettur
SIDCO Industrial Complex, Mettur
Sowdeswari College Building, Salem
Fisheries College, Tuticorin
AVM Jewellery Building, Tuticorin
Raja Agencies, Tuticorin
Gandhi Market, Trichy
Main Guard Gate, Tirchy
Bishop Heber College, Tirchy
Golden Rock, Trichy
Central Bus Stand, Trichy
Monitoring Station


Areas Exceeding NO2 Threshold
NO2_Exceeds_Threshold
False
True
Count
0
20
40
60
80
100
120
Kathivakkam, Municipal Kalyana Mandapam, Chennai
Govt. High School, Manali, Chennai.
Thiruvottiyur, Chennai
Thiyagaraya Nagar, Chennai
Anna Nagar, Chennai
Adyar, Chennai
Kilpauk, Chennai
Madras Medical College, Chennai
Thiruvottiyur Municipal Office, Chennai
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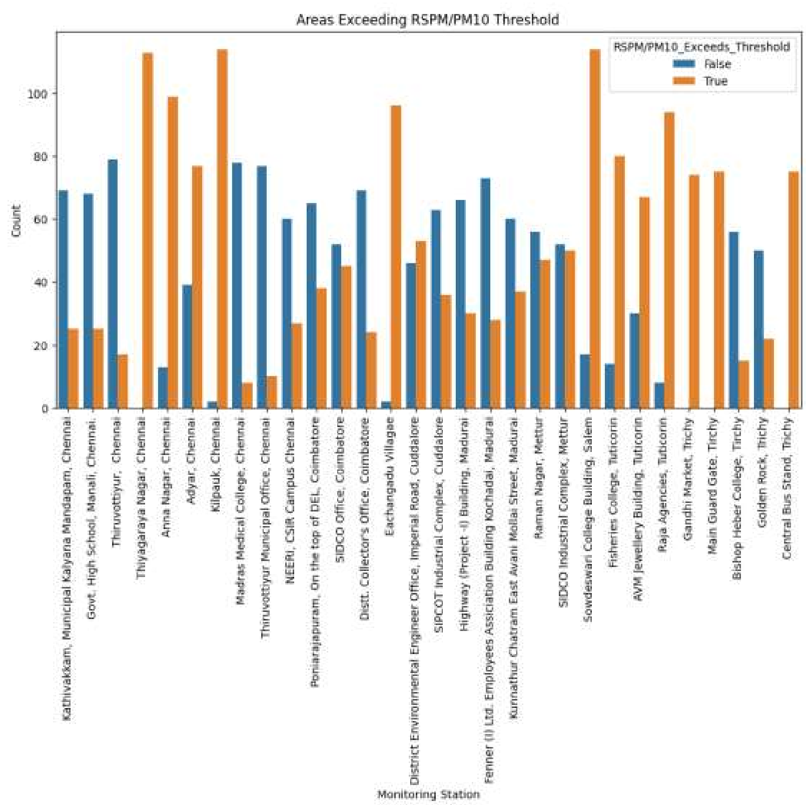
Raja Agencies, Tuticorin
Gandhi Market, Trichy
Main Guard Gate, Trichy
Bishop Heber College, Trichy
Golden Rock, Trichy
Central Bus Stand, Trichy
Monitoring Station


Areas Exceeding RSPM/PM10 Threshold
RSPM/PM10_Exceeds_Threshold
False
True
Count
0
20
40
60
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100
Kathivakkam, Municipal Kalyana Mandapam, Chennai
Govt. High School, Manali, Chennai.
Thiruvottiyur, Chennai
Thiyagaraya Nagar, Chennai
Anna Nagar, Chennai
Adyar, Chennai
Kilpauk, Chennai
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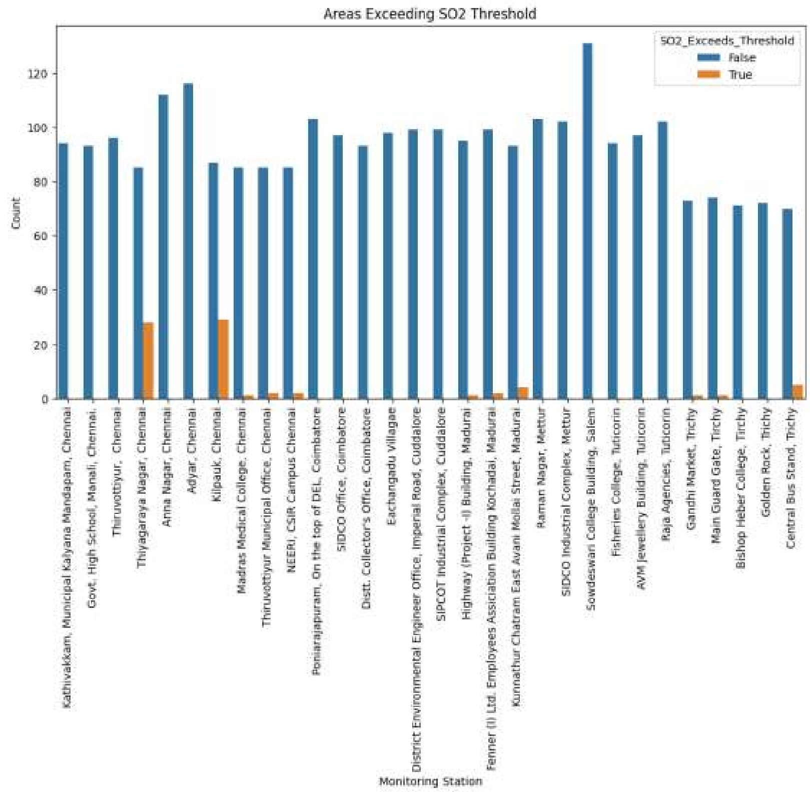
Raja Agencies, Tuticorin
Gandhi Market, Trichy
Main Guard Gate, Trichy
Bishop Heber College, Trichy
Golden Rock, Trichy
Central Bus Stand, Trichy
Monitoring Station


Areas Exceeding SO2 Threshold
SO2_Exceeds_Threshold
False
True
Count
0
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120
Kathivakkam, Municipal Kalyana Mandapam, Chennai
Govt. High School, Manali, Chennai.
Thiruvottiyur, Chennai
Thiyagaraya Nagar, Chennai
Anna Nagar, Chennai
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Monitoring Station