AIR QUALITY ANALYSIS

Introduction

Over the past few decades, India has achieved remarkable economic growth, leading to the upliftment of a large population from poverty (UNDP, 2022). This impressive economic progress can be attributed to rapid industrialization, urbanization, construction, power generation, and various other development activities (Wang et al., 2018). However, rapid industrialization and urbanization have adversely impacted human health and the environment (Voumik et al., 2022). Over the years, increased emissions of air pollutants have significantly deteriorated air quality in many urban regions of India.

Air quality parameter City 2015 2016 2017 2018 2019 2020 Net change (2015-2020) Trend Analysis

Air pollutant change per year Overall trend

Mumbai	113	65	6195	97	87	-26	(r2=0)	NT
Kolkata	NA	77	108	129	123	95+18	(r2=0.15)	Inc
Chennai	*59*	65*	62	78	53	63+4	(r2=0)	NT

Study area:

The study area covers three industrial clusters, namely, Thoothukudi (formerly Tuticorin), Cuddalore, and Manali, located along the coastal region in Tamil Nadu - a southern state of India. Fig. 1 showed the geographic locations of Thoothukudi (8.53 °N, 78.36 °E), Manali (13.16 °N, 80.23 °E), and Cuddalore (11.75 °N, 79.75 °E). The area of Thoothukudi City municipal corporation is 353.07 km2, with a population of 237,830 (as per the 2011 census).

Current challenges:

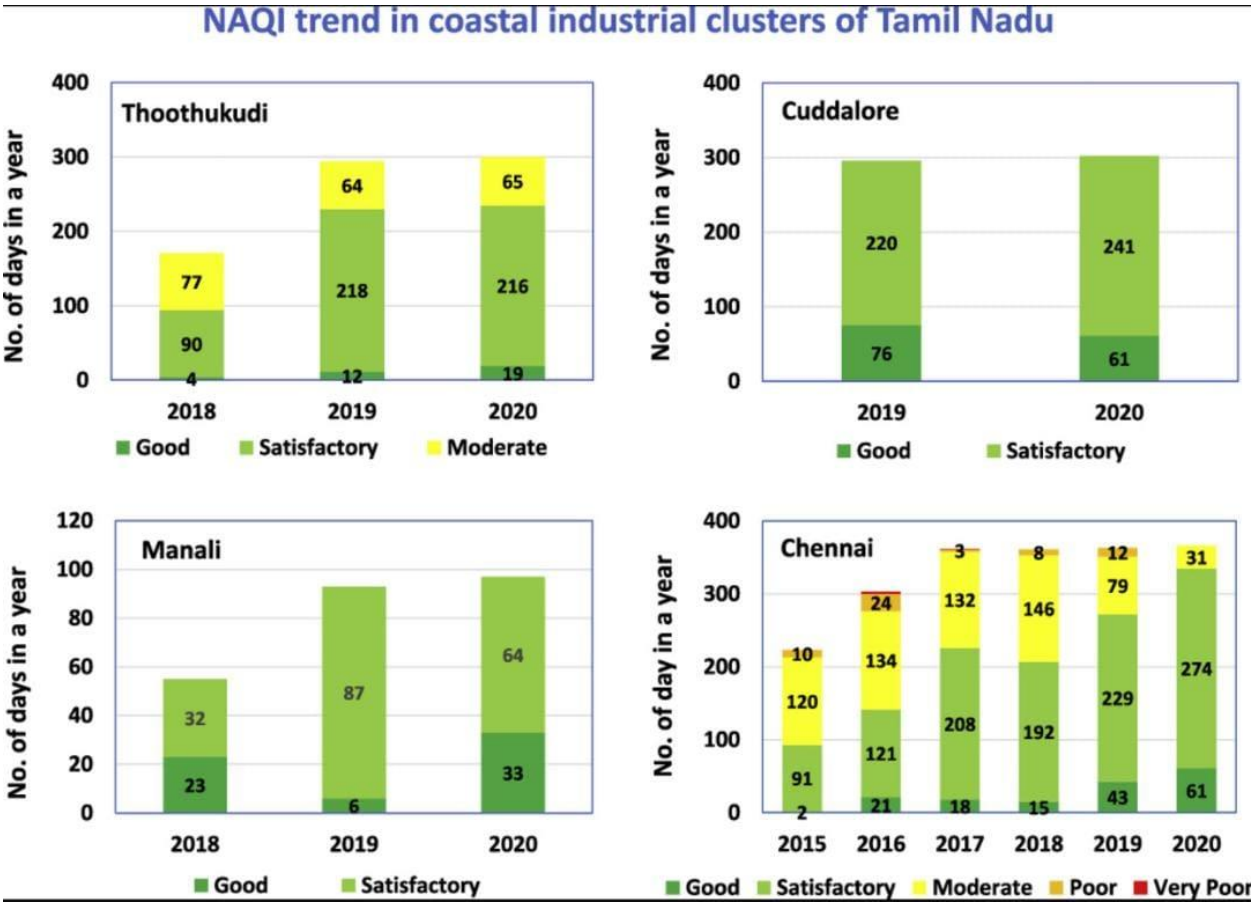
The current challenges for air quality monitoring systems include data delivery in real-time. Pollution characteristics through the integration of multi-sensory data. Also, the use of traditional air quality monitoring systems is generally expensive and provides low-resolution sensing, large bulk, and unstable operation.

High cost and large bulk make it impossible for a large-scale installation. This system can only be installed in key monitoring locations of some key enterprises thus system data is unavailable to predict the overall pollution situation.

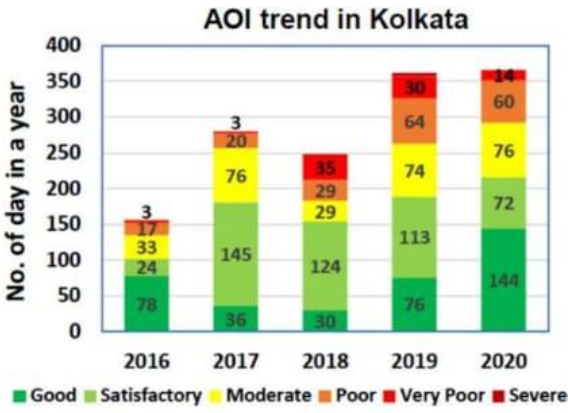
Methodology:

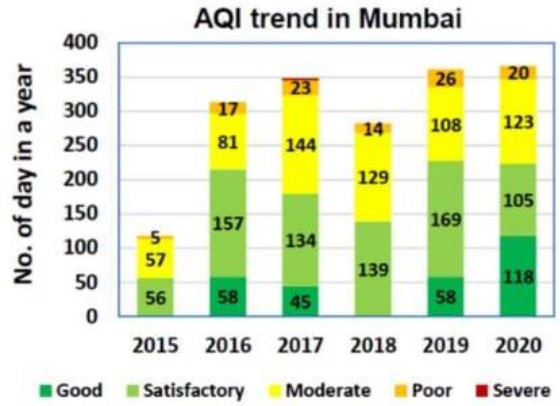
It is giving us a value of 90 when there is no gas near it and the air quality safe level is 350 PPM and it should not exceed 1000 PPM. When it will exceed the limit of 1000 PPM, it will cause Headaches, sleepiness,

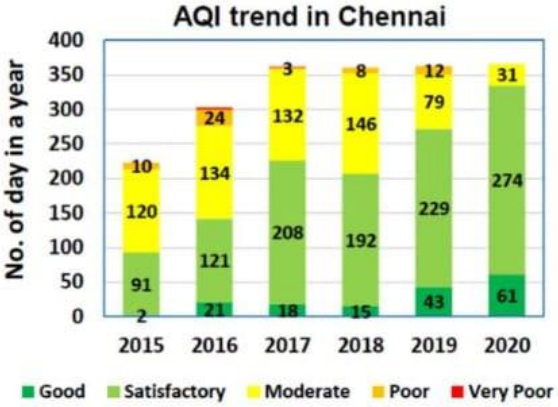
and stagnant, stuffy air. If it exceeds 2000 PPM then it will cause increased heart rate and many different diseases.

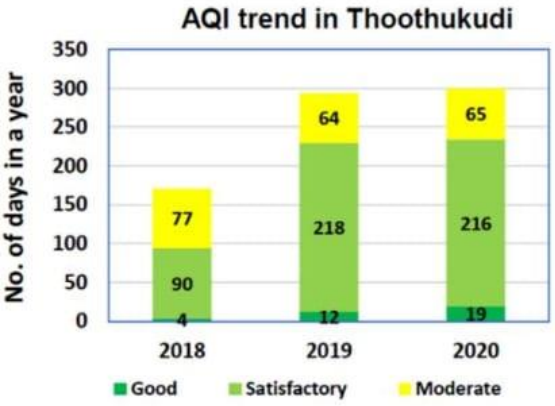


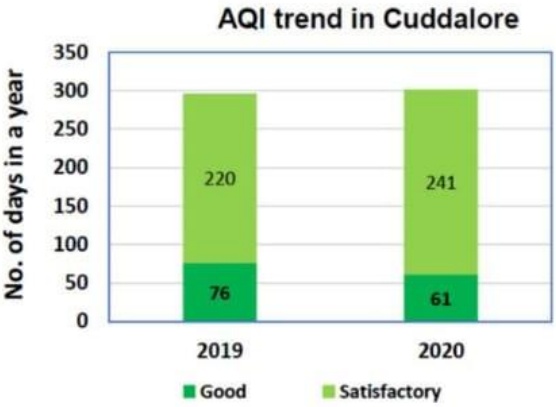

AQI trend in Delhi
No. of day in a year
2015 2016 2017 2018 2019 2020
Good Satisfactory Moderate Poor Very Poor Severe

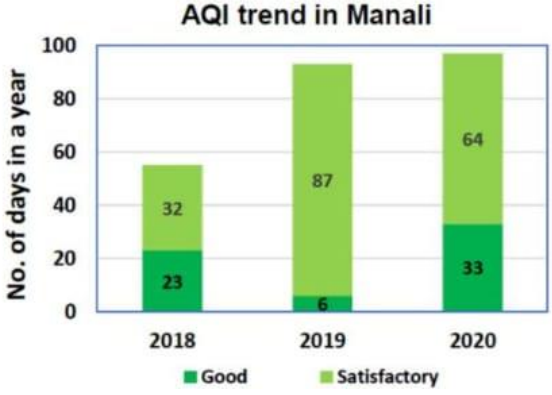

AOI trend in Kolkata
No. of day in a year
2016 2017 2018 2019 2020
Good Satisfactory Moderate Poor Very Poor Severe


AQI trend in Mumbai
No. of day in a year
2015 2016 2017 2018 2019 2020
Good Satisfactory Moderate Poor Severe


AQI trend in Chennai
No. of day in a year
2015 2016 2017 2018 2019 2020
Good Satisfactory Moderate Poor Very Poor


AQI trend in Thoothukudi
No. of days in a year
2018 2019 2020
Good Satisfactory Moderate


AQI trend in Cuddalore
No. of days in a year
2019 2020
Good Satisfactory


AQI trend in Manali
No. of days in a year
2018 2019 2020
Good Satisfactory

Program :

```
Import pandas as pd

Web_data = pd.read_csv("D:\air-quality-analysis.csv",header = 0,sep = ",")

Web_data.dropna(axis = 0,inplace=True)

Print(Web_data)
```

Output:

```
      Row        Day  Day.Of.Week       Date Page.Loads Unique.Visits  \
0       1     Sunday             1  9/14/2014      2,146          1,582
1       2     Monday             2  9/15/2014      3,621          2,528
2       3    Tuesday             3  9/16/2014      3,698          2,630
3       4  Wednesday             4  9/17/2014      3,667          2,614
4       5   Thursday             5  9/18/2014      3,316          2,366
...   ...        ...           ...        ...        ...            ...
2162 2163   Saturday             7  8/15/2020      2,221          1,696
2163 2164     Sunday             1  8/16/2020      2,724          2,037
2164 2165     Monday             2  8/17/2020      3,456          2,638
2165 2166    Tuesday             3  8/18/2020      3,581          2,683
2166 2167  Wednesday             4  8/19/2020      2,064          1,564

     First.Time.Visits Returning.Visits
0                1,430               152
1                2,297               231
2                2,352               278
3                2,327               287
4                2,130               236
...                ...               ...
2162             1,373               323
2163             1,686               351
2164             2,181               457
2165             2,184               499
2166             1,297               267

[2167 rows x 8 columns]
```

Program:

```
import numpy as np

import matplotlib.pyplot as plt

import  seaborn as sns

|

plt.style.use('ggplot')

df = pd.read_csv("D:\air-quality-analysis.csv")

df
```

Output:

Out[3]:

	Row	Day	Day.Of.Week	Date	Page.Loads	Unique.Visits	First.Time.Visits	Returning.Visits
0	1	Sunday	1	9/14/2014	2,146	1,582	1,430	152
1	2	Monday	2	9/15/2014	3,621	2,528	2,297	231
2	3	Tuesday	3	9/16/2014	3,698	2,630	2,352	278
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4	5	Thursday	5	9/18/2014	3,316	2,366	2,130	236
...	...	...	...	...	...	...	...	...
2162	2163	Saturday	7	8/15/2020	2,221	1,696	1,373	323
2163	2164	Sunday	1	8/16/2020	2,724	2,037	1,686	351
2164	2165	Monday	2	8/17/2020	3,456	2,638	2,181	457
2165	2166	Tuesday	3	8/18/2020	3,581	2,683	2,184	499
2166	2167	Wednesday	4	8/19/2020	2,064	1,564	1,297	267

2167 rows × 8 columns

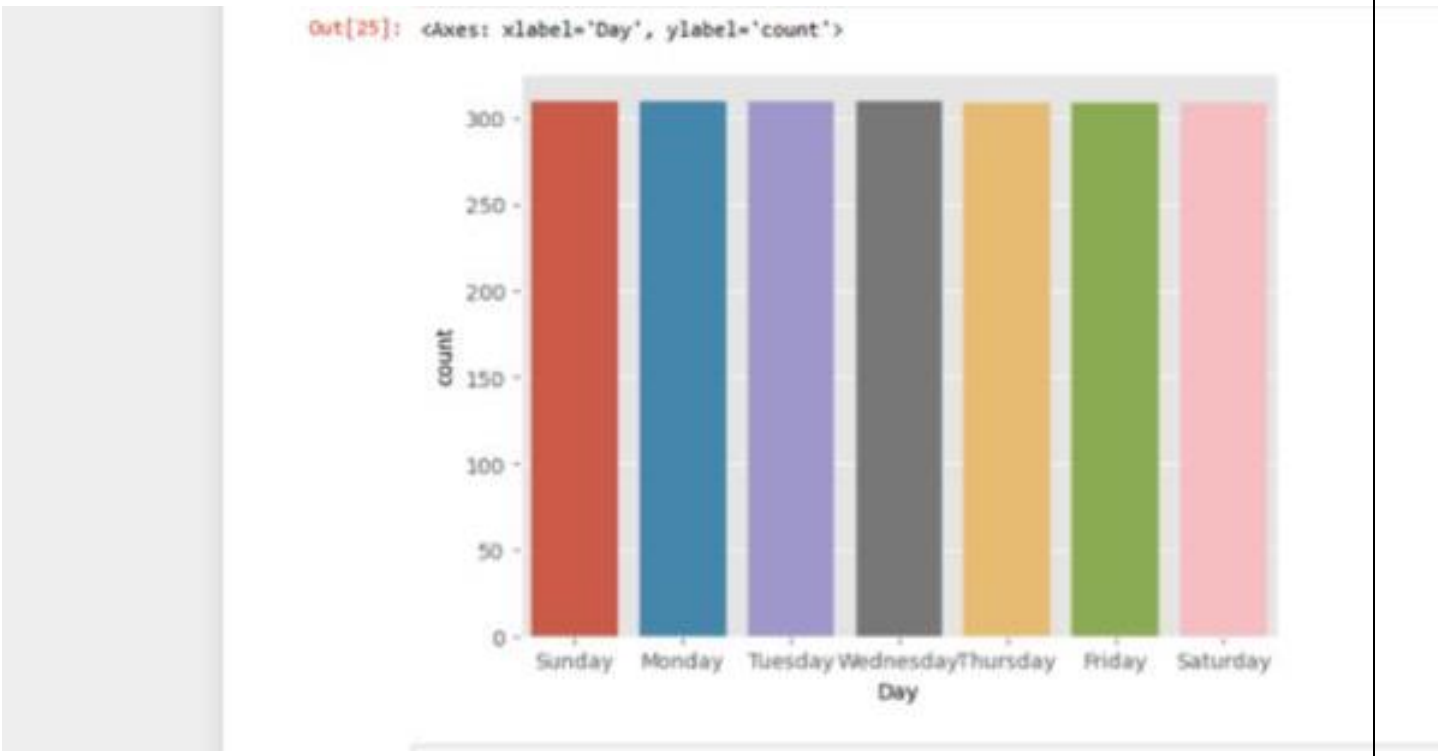
Program:

```
import seaborn as sns

sns.countplot(x='Day',data=df)
```

Output:

< Axes: xlabel='Day',ylabel='count'>



Conclusion:

In this study, we reported air quality trends (between 2015 to 2020) in industrial clusters (Thoothukudi, Cuddalore, and Manail) of Tamil Nadu and compared them with those in major Indian cities (Delhi, Mumbai, Kolkata, and Chennai). Our findings suggest no significant impact of coastal meteorology on the air quality of industrial cluster cities because the seasonal variations in the concentration levels of key air quality parameters were insignificant. The seasonal impact on air quality in Delhi is slightly more pronounced than that observed in other cities. The concentration levels of key air quality parameters, including, NAQI in Thoothukudi, Manali, and Cuddalore, were lower than those of Delhi, Mumbai, Kolkata, and Chennai.