# Air Quality Data Visualization

**Submitted By :**
**Name – Pushpender Kumar**
**Roll No. – 234161020**

**Submitted to:**
**Dr. Neeraj Sharma**

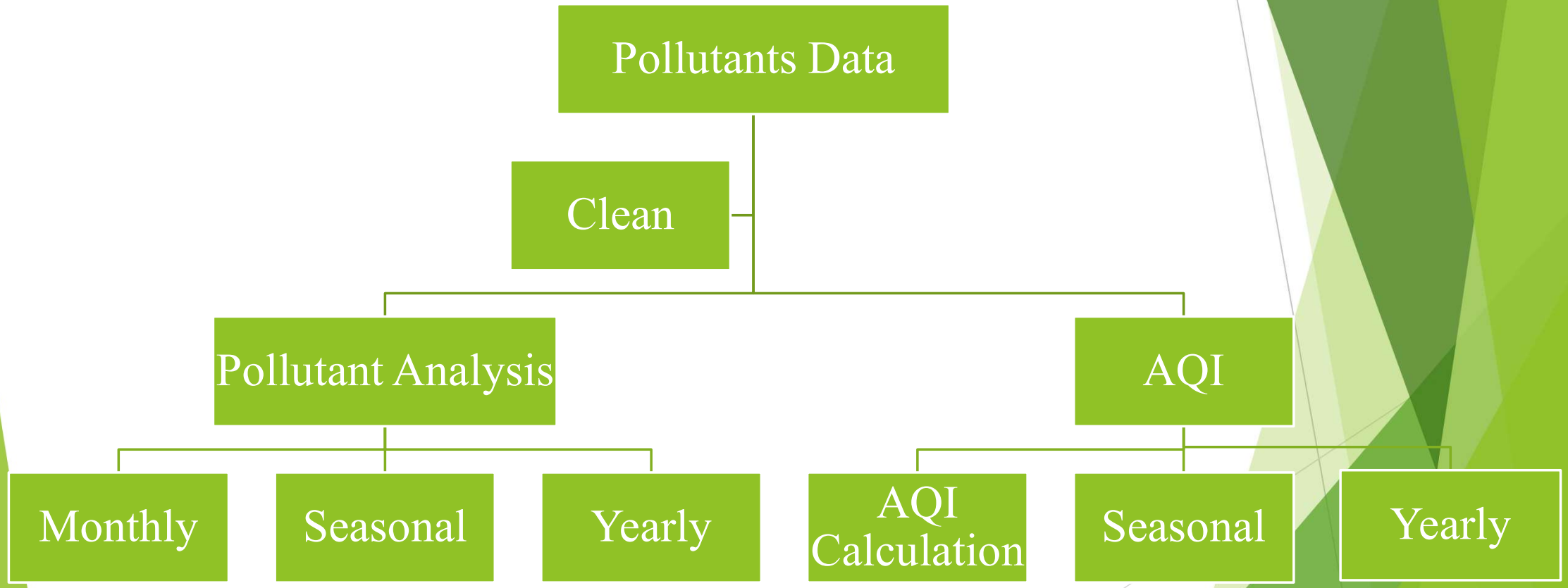
# Motivation: Understanding Air Quality through Visualization

- **Importance of Air Quality:**
  - Environmental Impact: Urbanization and industrial activities contribute to air pollution.
  - Public Health: Poor air quality directly affects respiratory health and well-being.

- **Need for Understanding:**
  - Monitoring air quality is crucial for environmental conservation and public health.
  - Raw data often inaccessible to the general public.

- Visualization transforms complex data into accessible insights.
- Uncover patterns and trends in air quality data.

# Block diagram



# Pseudocode

- **Load and Clean Data:**
  - load_data(file_path): Load data from CSV.
  - print_clean_data_info(df): Display data shape, info, handle missing values.

- **Data Visualization:**
  - plot_monthly_mean_trend(df): Plot trends for pollutants.
  - plot_yearly_mean_values(df): Plot yearly mean pollutants.
  - plot_pie_chart(mean_percentages): Pie chart of mean pollutant percentages for a particular year.
  - plot_correlation_matrix(df): Heatmap of pollutant correlations.
  - plot_seasonal_changes(df): Bar plot of seasonal changes.
  - plot_average_pollutant_levels_by_season(df): Pie charts of average pollutant levels.

- **Sub-index functions for pollutants:**
  - calculate_aqi(row): Calculate AQI.
  - get_AQI_Category(x): Categorize AQI.

- **AQI Visualization:**
  - plot_aqi_categories_over_years(df): Line graph of AQI categories over years.
  - plot_aqi_category_pie_by_season(df): Pie charts of AQI categories by season.

# Some Pythonic features

**Function Application:**

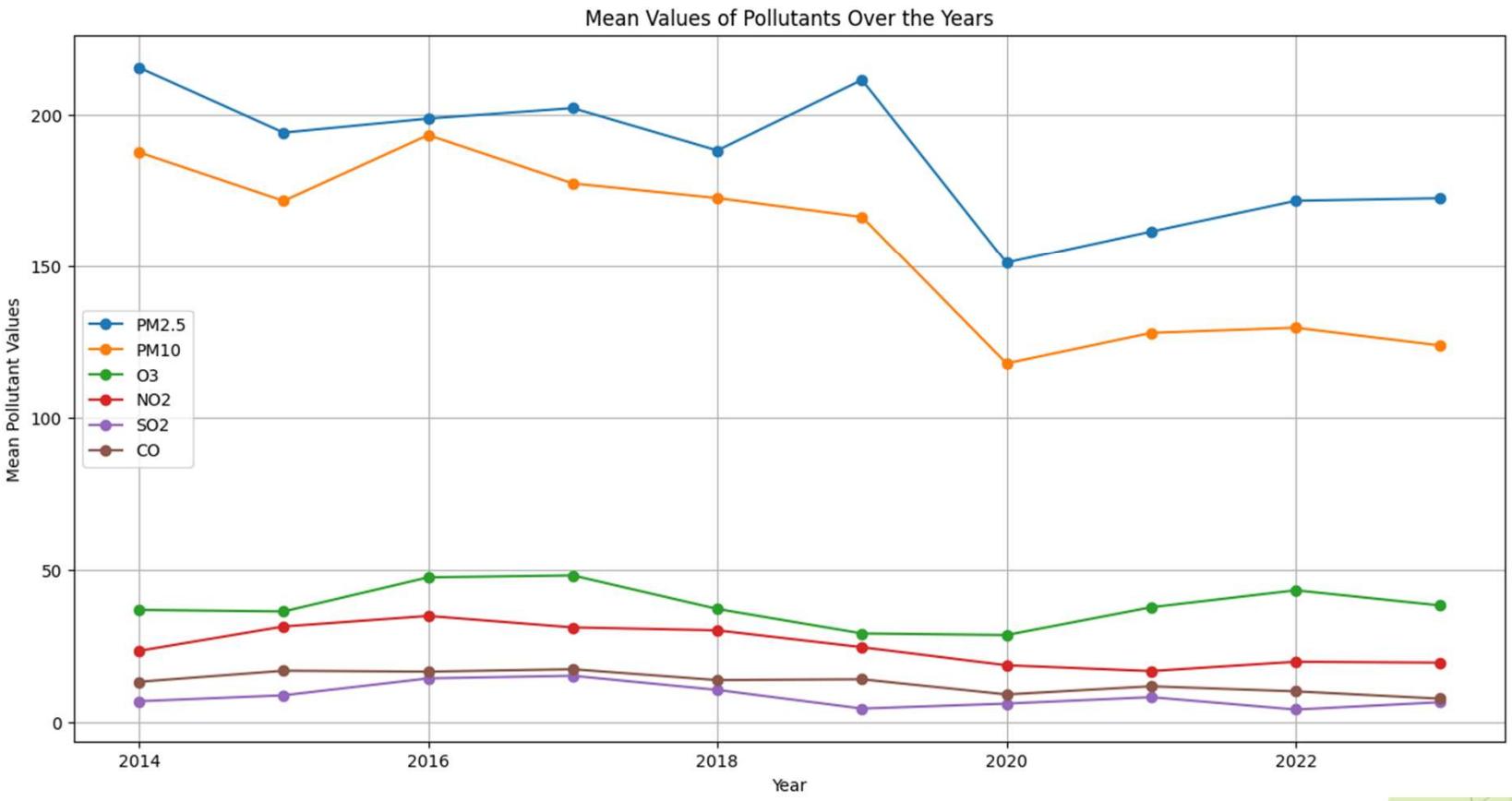
```
df['AQI'] = df.apply(calculate_aqi, axis=1)
df['AQI_Category'] = df['AQI'].apply(get_AQI_Category)
```

**Pandas Grouping and Resampling:**

```
monthly_data = yearly_data.groupby(yearly_data.index.month).mean()
monthly_mean = df.resample('M').mean()
```

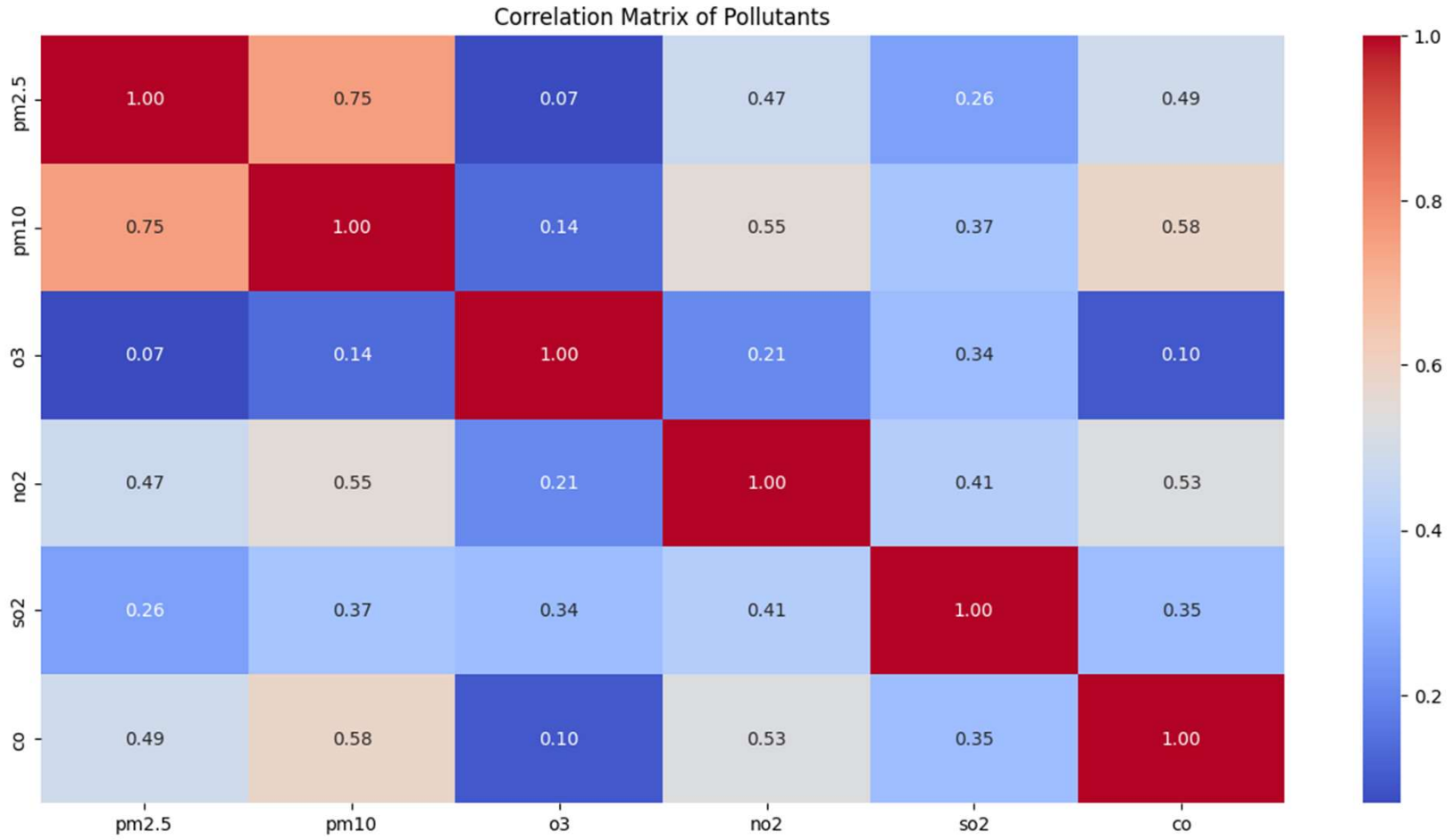
**Matplotlib Plotting:**

```
plt.plot(monthly_data.index, monthly_data['pm2.5'], marker='o', linestyle='-')
plt.pie(values, labels, autopct='%1.1f%%')
```

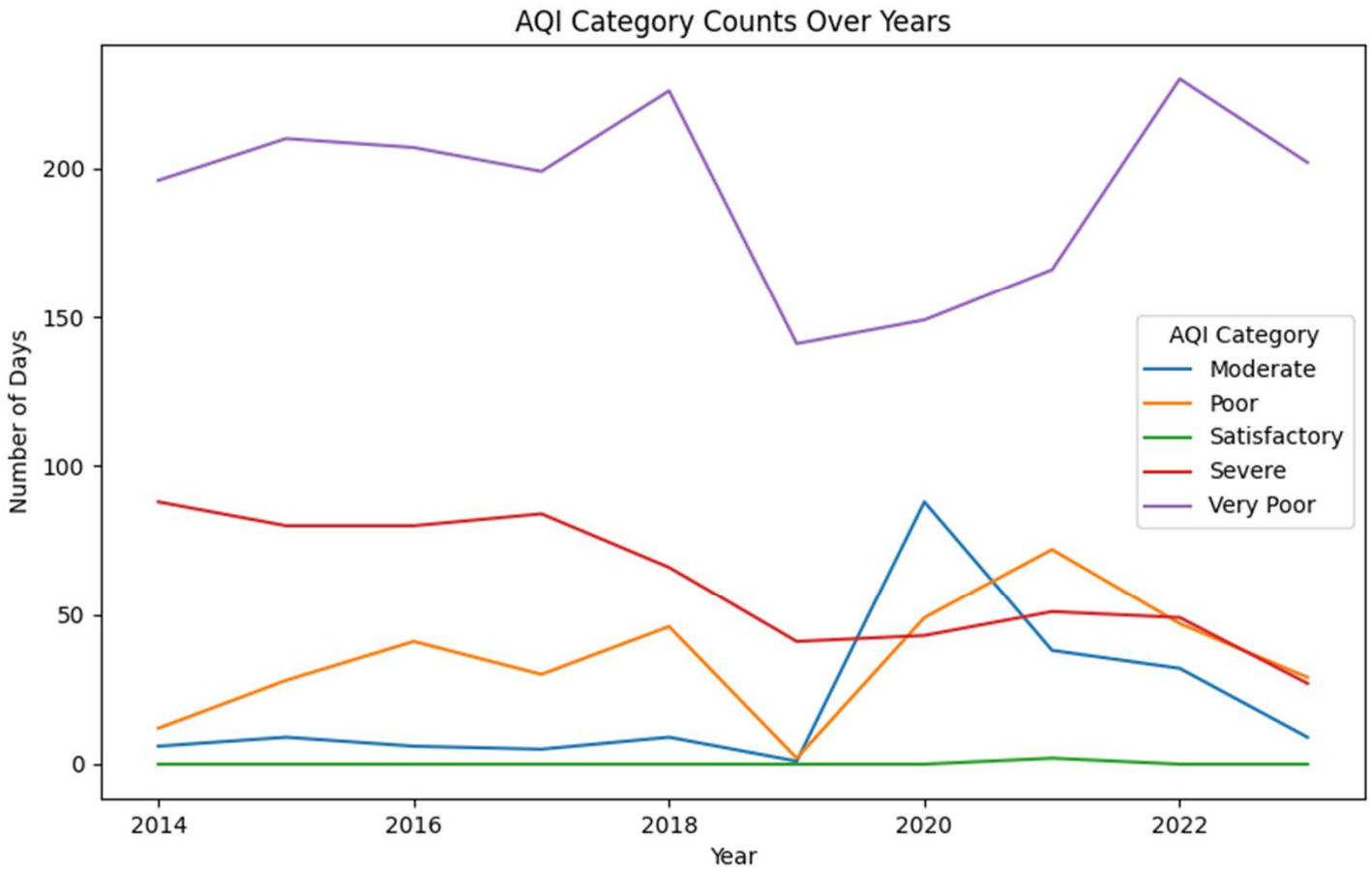



# Observation :

- **PM 2.5 and PM 10:** Witnessed a consistent decrease in levels over the years, indicating a positive trend in air quality.
- **Impact of COVID-19 (2020):** Notably, there was a remarkable decline in 2020, due to the restrictions imposed during this period.
- **CO, NO2, SO2, and O3:** These pollutants demonstrated relatively stable levels with occasional spikes and decrements observed between the years.



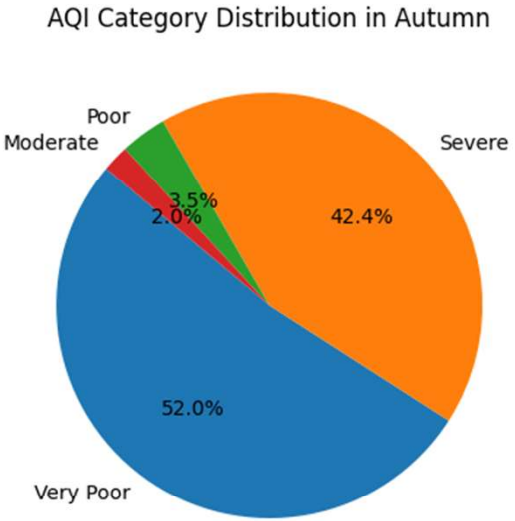

- The substantial correlation between PM 10 and PM 2.5 suggests shared sources and similar factors influencing their levels.
- CO, PM 10, and NO2 exhibit some correlation, the strength of their relationship is comparatively lower than that of PM10 and PM2.5.

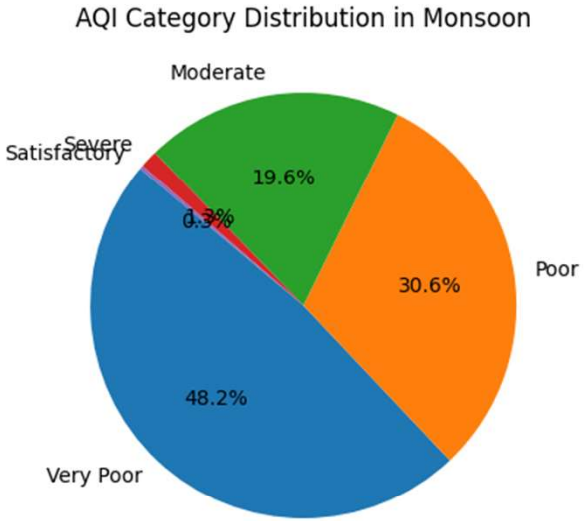


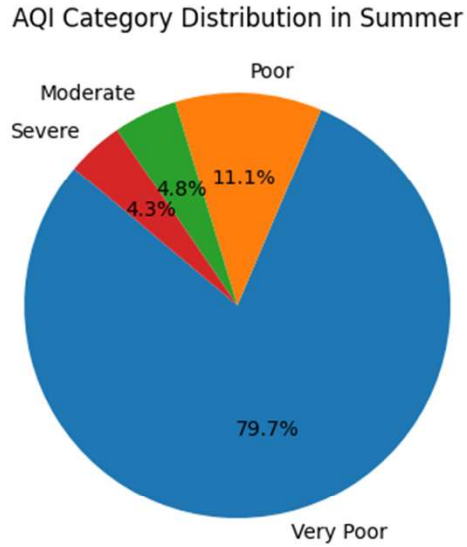

• The negligible presence of "Satisfactory" days emphasizes the challenges in maintaining a consistently acceptable air quality standards.

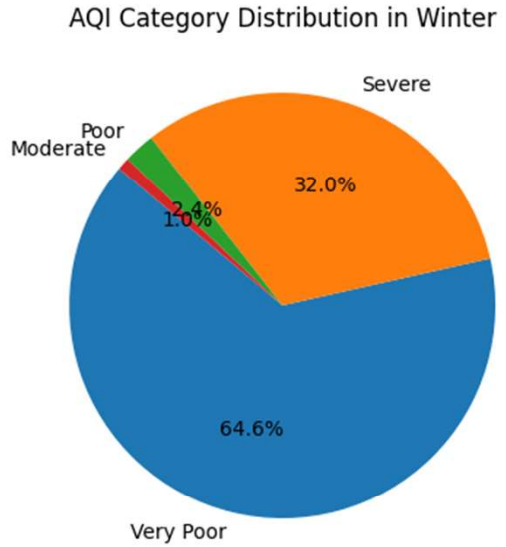
• The decreasing trend in "Severe" days is a positive sign but demands continuous vigilance.

• The spike in "Moderate" days in 2020 indicates the direct impact of external events, such as COVID-19 restrictions, on AQI.




- The correlation between severe air quality and autumn conditions highlights the need for targeted interventions during specific seasons.
- The prevalence of "Very Poor" air quality signals a persistent issue that demands comprehensive strategies for improvement.
- The scarcity of "Satisfactory" days underscores the ongoing challenges in maintaining optimal air quality standards.
- AQI levels are greatly impacted by the levels of rainfall/ precipitation and wind speed which are prime facilitators for dispersal of the pollutants / emissions.

# References:


- Data collection is from https://waqi.info
- https://matplotlib.org/stable/index.html
- https://pandas.pydata.org/docs/
- https://docs.python.org/3/
- AQI Information CPCB


THANK YOU