Phase 5
Topic: Air Quality Analysis in Tamil Nadu

Team Members :
Sangamithra T - au2021103573
Sreenithi A - au2021103051
Shrivarshini Kp - au2021103048
Shri Sakitha D - au2021103047

Steps in Data Preprocessing Step 1: Import the necessary libraries

```
# importing libraries
import pandas as pd
import scipy
import numpy as np
from sklearn.preprocessing import MinMaxScaler
import seaborn as sns
import matplotlib.pyplot as pit
```

Step 2: Load the dataset

```
from google.colab import drive
drive.mount('/content/gdrive')
```

```
Mounted at /content/gdrive
```

```
# Load the dataset
df = pd.read_csv('/content/gdrive/MyDrive/ADS_PHASE 3.csv')
print(df.head())
```

```
   Benzene Eth-Benzene MP-Xylene        BP 0 Xylene     PM10 PM2.5      RH \
0     1.08         0.04       0.00 754.05       2.50 140.23 90.62 42.51
1     0.83         0.03       0.00 754.28       1.74 124.91 61.11 28.34
2     1.38         0.27       0.06 754.49       2.39 114.27 70.89 36.48
3     1.97         0.47       0.12 7S4.28       3.51 128.15 78.52 43.68
4     1.80         0.75       0.20 754.00       4.00 122.36 70.48 51.57

       SR   Temp      WD    WS    CO    NH3     NO    NO2    NOx Ozone     SO2
0 125.03 17.90 119.19 0.97 0.51 20.53   4.29 22.95 27.24 44.36            4.97
1 148.95 20.04     71.50 1.21 0.53 17.37      2.80 25.59 28.38 53.04      5.59
2 131.87  18.31 147.10 1.00 0.78 18.45        6.85 30.91 37.75 41.94 10.22
3 129.32 18.56 182.79 1.06 0.81 22.52         7.36 29.05 36.41 44.15 30.99
4 145.73 18.81 183.47 0.91 0.96 19.14 13.15 28.60 41.74 37.13 15.78
```

```
df.info()
```

```
‹c1ass ' pandas . core. frame . DataF rame
' › Rangelndex: 298 entries, 0 to
297 Data columns (total 19
columns):
 #   Column       Non-Null Count Dtype

 0   Benzene      298 non-null   float64
 1   Eth-Benzene 298 non-null   float64
 2   MP-Xylene    298 non-null   float64
 3   BP           298 non-null   float64
 4   0 Xylene     298 non-null   float64
 5   PM10         298 non-null   float64
 6   PM2.5        298 non-null   float64
 7   RH           298 uou-null   float64
 8   SR           298 nou-null   float64
 9   Temp         298 uou-null   float64
 10  WD           298 non-null   float64
 11  WS           298 non-null   float64
 12  CO           298 non-null   float64
 13  NH3          298 non-null   float64
 14  NO           298 non-null   float64
 t5 N02           298 uou-null   float64
 16  N0x          298 non-null   float64
 17  Ozone        298 uou-null   float64
 18     SO2       298 uou-null
float64 dtypes: float64(19)
memory usage: 44.4 KB
```

```
df.head()
```

Benzene Eth- NP- en e

```
df.tail()
```

	Benzene	Eth-Benzene	MP-Xylene	BP	Xylene	PM10	PM2.5	RH	SR	Temp	WD	WS	CO	NH3	NO	NO2	NOx
293	1.31	0.22	0.08	757.14	2.57	178.71	81.02	29.44	207.84	28.43	210.70	1.01	1.01	23.42	6.62	32.33	38.13
294	0.64	0.01	0.00	756.64	2.24	158.81	76.39	32.40	214.16	28.21	132.54	1.20	0.62	21.50	8.26	25.42	33.68
295	0.71	0.07	0.03	756.01	2.03	138.19	63.19	30.18	202.04	28.75	172.23	1.18	0.72	19.76	8.66	27.63	36.29
296	0.89	0.10	0.04	755.72	2.51	144.54	58.81	29.82	206.48	29.82	214.90	1.36	0.83	19.35	9.01	27.79	36.80
297	1.10	0.20	0.08	756.84	2.82	152.39	62.50	34.85	167.95	28.89	169.89	0.97	0.91	17.60	8.92	33.32	42.24

STEP 3: check the null values

```
df.isnull().sum()
```

```
Benzene       0
Eth-Benzene   0
MP-Xylene     0
                0
```

	Benzene	Xylene	BP	T	PM10	PM2.5	RH	SR	Temp	WD	WS	CO	NH3	NO	NO2	NOx
0	1.08	0.04	0.00	754.05	2.50	140.23	90.62	42.51	125.03	17.90	119.19	0.97	0.51	20.53	4.29	22.95	27.24
1	0.83	0.03	0.00	754.28	1.74	124.91	61.11	28.34	148.95	20.04	71.50	1.21	0.53	17.37	2.80	25.59	28.38
2	1.38	0.27	0.06	754.49	2.39	114.27	70.89	36.48	131.87	18.31	147.10	1.00	0.78	18.45	6.85	30.91	37.75
3	1.97	0.47	0.12	754.28	3.51	128.15	78.52	43.68	129.32	18.56	182.79	1.06	0.81	22.52	7.36	29.05	36.41
4	1.80	0.75	0.20	754.00	4.00	122.36	70.48	51.57	145.73	18.81	183.47	0.91	0.96	19.14	13.15	28.60	41.74

```
0 Xylene
PM10          0
PM2.5         0
RH            0
SR            0
Temp          0
WD            0
NS            0
CO            0
NH            0
3             0
NO            0
N0
2
NOx           0
Ozon          0
e             0
SO2
dtype: lnt64
```

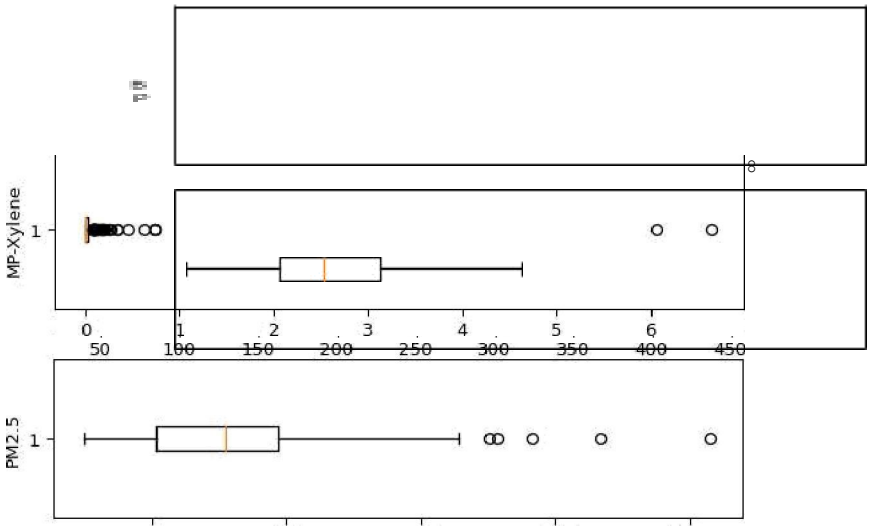
```
df . desc r 1be( )
```

	SR	Temp	
	298.000000	298.00000	2
	208.083020	30.42802	1
	50.891946	5.45345	
	69.960000	16.67000	
	168.785000	28.14250	1
	210.255000	30.86500	2
	249.402500	34.15250	2
	309.610000	40.07000	2

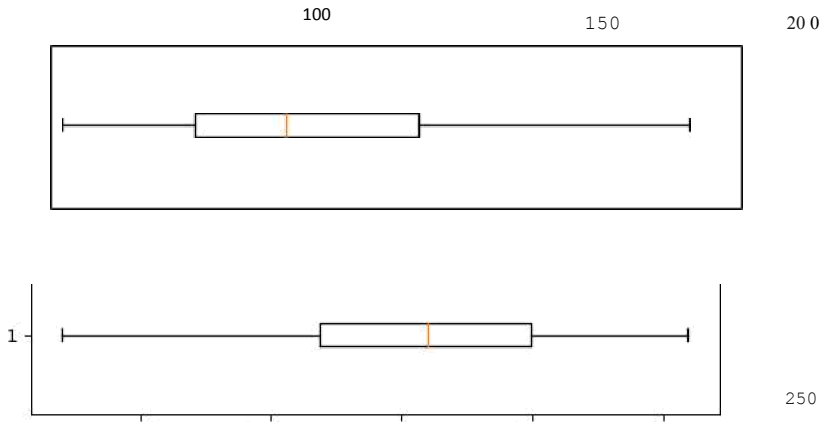
Step 5: Check the outliers

```
# Box Plots
fig, axs = plt.subplots(9,1,dpi=95,
figsize=(7,17)) i = 0
for col in dfcolumns:
    axs[i].boxplot(df[col], vert=False)
```

```
    axs[i].set_label(col)
    1+=1
p1t . show( )
```



8 760 762



100 150 20 0 250

250 300

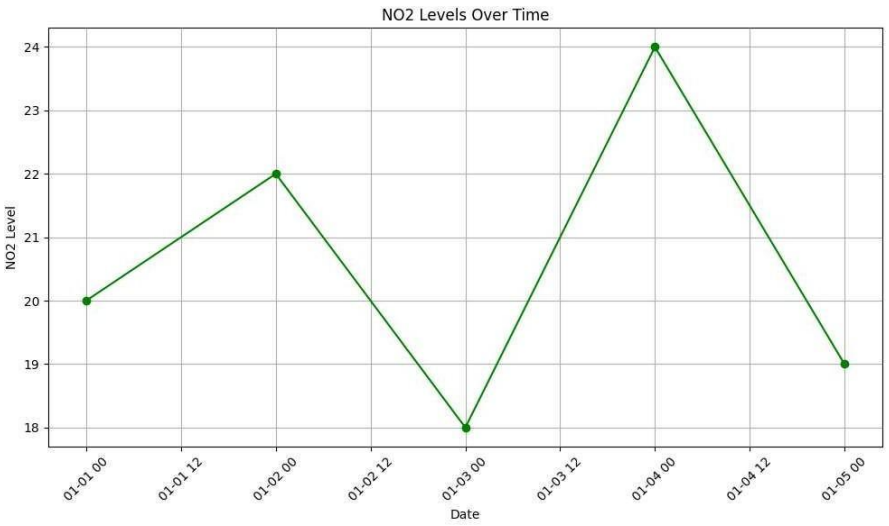
STEP 1: create visualization for SO2

```
import matplotlib.pyplot
as plt import pandas as pd

# Sample data (replace this with your actual SO2 dataset)
data = {
    'Date': ['2023-01-01', '2023-01-02', '2023-01-03', '2023-01-04', '2023-01-05'],
    'SO2_Level' : [15, 18, 12, 14, 16] # Replace with your SO2 data


# Create a DataFrame from the data
df = pd.DataFrame(data)
df['Date'] = pd.to_datetime(df['Date']) # Convert Date column to datetime format

# Plot the S02 levels
plt.figure(figsize=(10, 6))
plt.plot(df['Date'], df['S02_Level'], marker='o', linestyle='-',
color='b') plt.title('S02 Levels Over Time')
p1t.x1abe1('Date')
plt.ylabel('SO2 Level')
plt.gnid(Tnue)

# Format the x-axis to display dates nicely
plt.xticks(rotation=45)

# Show the
plot
plt.tight_la
yout()
plt.show()
```

STEP 2: create visualization for NO2

```
import matplotlib.pyp1ot
as plt import paudas as
pd

# Sample data (replace this with your actual NO2
dataset) data = {
    'Date': ['2023-01-01', '2023-01-02', '2023-01-03', '2023-01-04', '2023-01-05'],
    'N02_Level' : [2B, 22, 18, 24, 19] # Replace with your N02 data
```

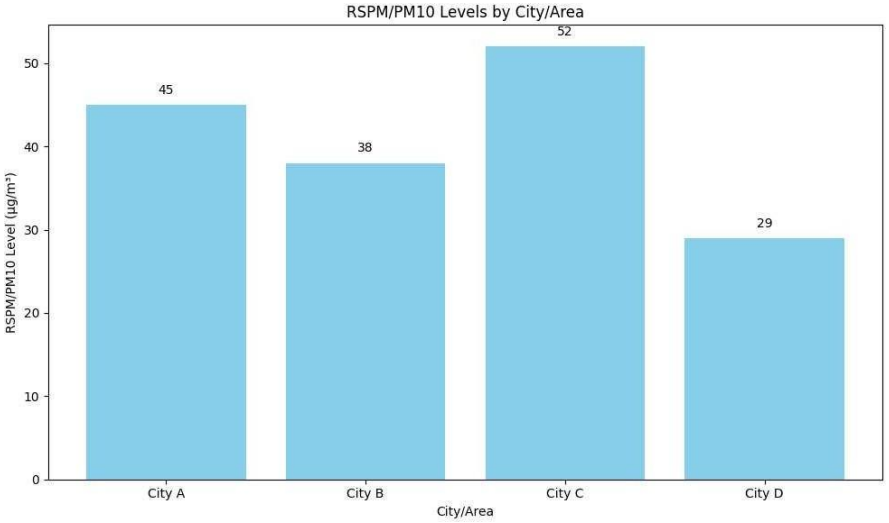
```
# Create a DataFrame from the
data df = pd.DataFrame(data)
df['Date'] = pd.to_datetime(df['Date']) # Convert Date column to datetime format


plt  guhe(N02sieeels0, 6))
plt.plot(df['Date'], df['N02_Level'], marker='o',
liuestyle='-', color='g') plt.title('NO2 Levels Over Time')
plt.xlabel('Date')
plt.ylabel('N02
Level') plt.grid(True)

# Format the x-axis to display dates nicely
plt.xticks(rotation=45)

# Show the
plot
plt.tight_la
yout()
plt.show()
```



STEP 3: create visualization for RSPM/PM10

```
import matplotlib.pyplot as plt

# Sample data (replace this with your actual RSPM/PM10
dataset) categonies = ['City A', 'City B', 'City C', 'City
D']
rspm_pm10_levels = [45, 38, 52, 29] # Replace with your RSPM/PM10 data

# Create a bar chart to visualize RSPM/PM10 levels
plt.figure(figsize=(10, 6))
plt.bar(categories, rspm_pm10_levels,
color='skyblue') plt.title('RSPM/PM10 Levels by
City/Area') plt.xlabel('City/Area')
plt.ylabel('RSPM/PM10 Level (pg/m°)')

   dd d    a       v       a
fo     e e be'en me ete rhpb pm10_levels):
    plt.text(i, level + 1, str(level), ha='center', va='bottom')

# Show the
plot
plt.tight_l
ayout()
```

```
plt.show()
```




```
from google.colab impont
dnive
drive.mount('/content/dri
ve')
```

```
Mounted at /content/drive
```

STEP 4: grouping data

```
import pandas as pd

# Load your data iuto a Pandas DataFrame (replace 'data.csv' with your data file)
df = pd.read_csv('/content/drive/MyDrive/Excel 4.csv')

# Group the data by the desired column (e.g., 'City' or 'Monitoring
Station') grouped_data = df.groupby('CITIES')
```

STEP 5: calculating average

```
# Calculate the average S02, N02, and RSPM/PM10 levels fon
each group averages = grouped_data[['S02', 'NO2',
'RSPM/PM10']].mean()
```

It DI sp1ay the ca1culated averages
print(averages)

```
                    SO2        NO2   RSPM/PM10
CITIES
Chennai        9.433333  23.036667  145.640000
Dindigul      22.880000  23.753333  129.780000
Erode         18.900000  27.065B00  165.580000
Kaunıyakumarı 27.790000  34.330000  148.680000
Kodaıkanaı    12.130000  38.050000  171.910000
Madunaı       13.897500  26.727500  156.572500
Saıem         11.100000  30.060000  160.976667
Thanjavur      3.650000  30.790000  145.180000
Vellore       16.726667  23.116667  141.240000
madurai       10.220000  30.910000  114.270000
saıem         30.990000  29.050B00  128.150000
```

```
# Calculate the average S02, N02, and RSPM/PM10 levels for each
group averages = grouped_data[[ 'RSPM/PM10']].mean()

# Display the calculated
averages print(averages)
```

CITIES	RSPM/PM10
Chenna1	145. 640000
D1nd1gu1	129.780666
Erode	165.580000
Kann1ya kumart	148. 680000
Koda1kana1	171. 910000
Madura1	156.572500
Salem	160. 976667
Thanjavur	145.180000
Vellore	141.240000
madurai	114.270000
sa lem	128.150000