Import Library

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
from statsmodels.tsa.stattools import adfuller
from statsmodels.tsa.seasonal import seasonal_decompose
from statsmodels.tsa.arima.model import ARIMA
```

Load Data

```
df=pd.read_csv(r"C:\My python Files\AQI_Airpollution.csv")
df.head()
```

	Date	Country	Status	AQI Value
0	21-07-2022	Albania	Good	14
1	21-07-2022	Algeria	Moderate	65
2	21-07-2022	Andorra	Moderate	55
3	21-07-2022	Angola	Unhealthy for Sensitive Groups	113
4	21-07-2022	Argentina	Moderate	63

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 18227 entries, 0 to 18226
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   Date       18227 non-null  object
 1   Country    18227 non-null  object
 2   Status     18227 non-null  object
 3   AQI Value  18227 non-null  int64 
dtypes: int64(1), object(3)
memory usage: 569.7+ KB
```

Clean Data

```
print(df[df['Date'].isna()])
```

```
Empty DataFrame
Columns: [Date, Country, Status, AQI Value]
Index: []
```

```
df['Date']=pd.to_datetime(df['Date'],errors='coerce')
df.info()
```

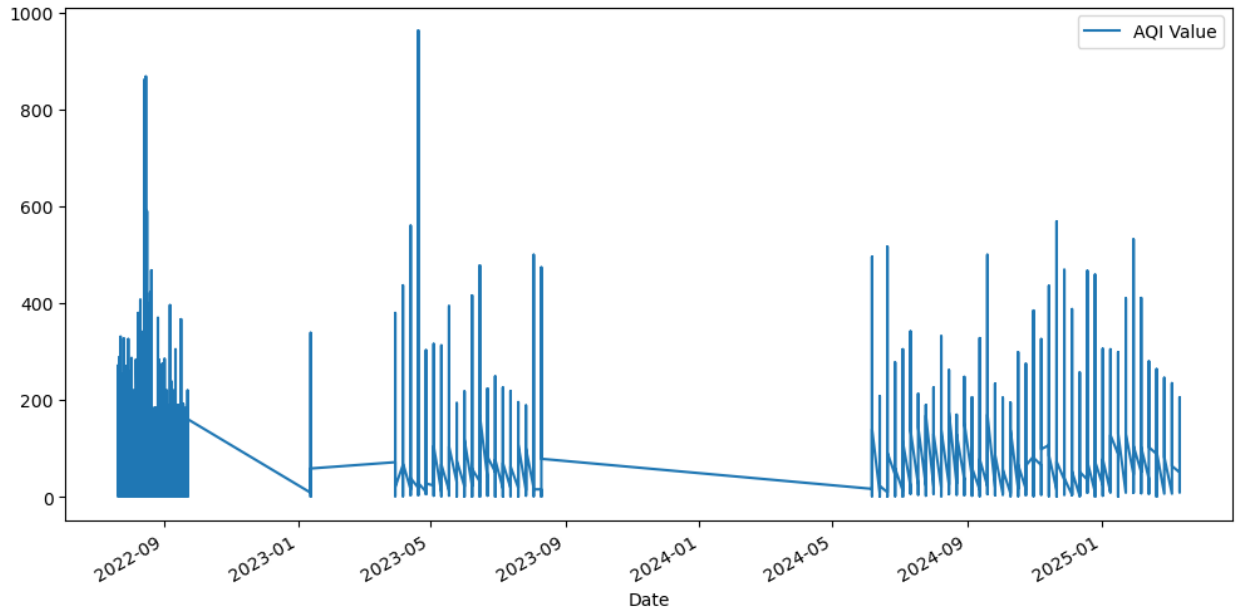
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 18227 entries, 0 to 18226
Data columns (total 4 columns):
```

```
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   Date       18227 non-null  datetime64[ns]
 1   Country    18227 non-null  object
 2   Status     18227 non-null  object
 3   AQI Value  18227 non-null  int64
dtypes: datetime64[ns](1), int64(1), object(2)
memory usage: 569.7+ KB

C:\Users\DELL\AppData\Local\Temp\ipykernel_8856\3864997176.py:1:
UserWarning: Parsing dates in %d-%m-%Y format when dayfirst=False (the
default) was specified. Pass `dayfirst=True` or specify a format to
silence this warning.
  df['Date']=pd.to_datetime(df['Date'],errors='coerce')
```

```
df.set_index("Date",inplace=True)
df.head()
```

Date	Country	Status	AQI Value
2022-07-21	Albania	Good	14
2022-07-21	Algeria	Moderate	65
2022-07-21	Andorra	Moderate	55
2022-07-21	Angola	Unhealthy for Sensitive Groups	113
2022-07-21	Argentina	Moderate	63

```
df.plot(figsize=(12,6),subplots=True)
plt.show()
```



1. The graph represents the AQI(Air quality index) values from mid of 2022 to 2025.
2. There are gaps in data where values drop to zero.

3. High AQI values are seen in mid-2022, early 2023, and mid-2024 with worsening air quality.
4. These spikes suggest poor air quality may be due to industrial activities

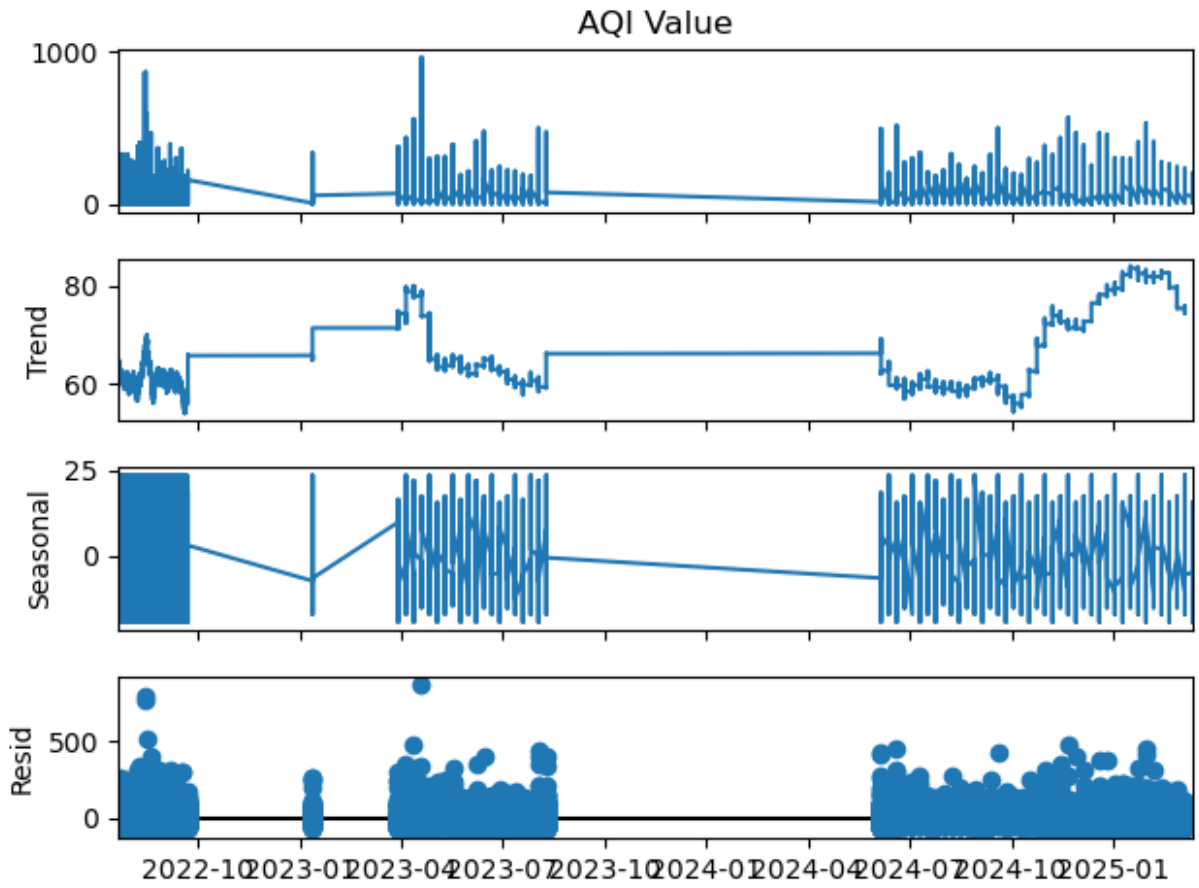
Stationarity

```
adfuller_result=adfuller(df['AQI Value'])

print(adfuller_result)
if adfuller_result[1] < 0.05:
    print("Stationary")
else:
    print("Non-Stationary")
```

```
(-15.215400453061477, 5.579625689083851e-28, 45, 18181, {'1%': -
3.4307097284809336, '5%': -2.86169898646948, '10%': -
2.566854624305701}, 193290.32233171744)
Stationary
```

Decomposing

```
decomposing=seasonal_decompose(df['AQI
Value'],model='additive',period=365)

decomposing.plot()
plt.show()
```



1. Original Time Series:

- In 2023-07 there is a high in AQI Value
- IN 2023-10 to 2024-04 there is decrease in AQI Value

1. Trend:

- The trend show variation in the AQI Value , there is a drastic increase in 2022-10 to 2023-01.
- There is constant AQI value in 2023-10 to 2024-04.
- The AQI value is increase at 2024-10 to 2025-01

1. Seasonal:

- The seasonal component is varying according to every year.
- The air quality changes, possibly due to weather, festival crackers, or industrial gas release. 3.resid
- There is less number of outliers in the data.
- Large variations indicate unexpected spikes in pollution.

Split Data

```
len(df)
```

```
18227
```

```
print(len(df)*0.8)
```

```
14581.6
```

```
train=df.iloc[0:14581]
test=df.iloc[14581:]
```

Create ARIMA Model

```
mymodel=ARIMA(train['AQI Value'],order=(1,1,1))
```

```
mymodel=mymodel.fit()
```

```
AQI_Value=mymodel.forecast(steps=len(test))
print(AQI_Value)
```

```
14581    59.775437
14582    60.125750
14583    60.134658
14584    60.134885
14585    60.134891
           ...
18222    60.134891
18223    60.134891
18224    60.134891
18225    60.134891
18226    60.134891
Name: predicted_mean, Length: 3646, dtype: float64

C:\Users\DELL\anaconda3\Lib\site-packages\statsmodels\tsa\base\
tsa_model.py:836: ValueWarning: No supported index is available.
Prediction results will be given with an integer index beginning at
`start`.
  return get_prediction_index(
```

```
test['AQI_Value']=AQI_Value
test.head()
```

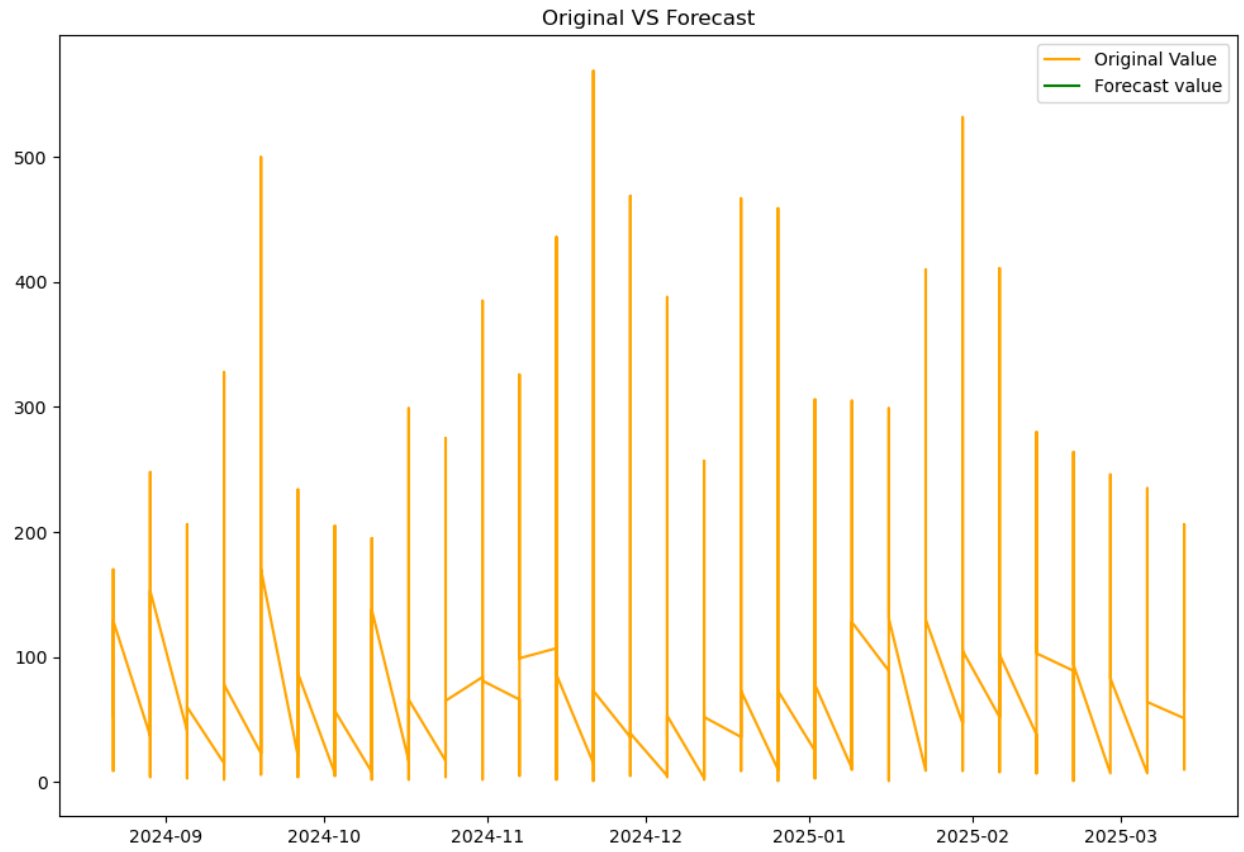
```
C:\Users\DELL\AppData\Local\Temp\ipykernel_8856\506810572.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  test['AQI_Value']=AQI_Value
```

	Country	Status	AQI Value	AQI_Value
Date				
2024-08-22	Croatia	Moderate	53	NaN

```
2024-08-22              Cyprus  Moderate          55         NaN
2024-08-22      Czech Republic      Good          49         NaN
2024-08-22             Denmark      Good          14         NaN
2024-08-22  Dominican Republic      Good          23         NaN
```

Vistualization

```
plt.figure(figsize=[12,8])
plt.plot(test.index,test['AQI Value'],color='orange',label='Original
Value')
plt.plot(test.index,test['AQI_Value'],color='green',label='Forecast
value')
plt.title("Original VS Forecast")
plt.legend()
plt.show()
```



- The peak value is at between 2024-11and 2024-12.
- There is lot of fluctuation in the given graph.