Dataset Sample:

	City	Date	PM2.5	PM10	NO2	SO2	\
0	New York	2023-01-01	77.132641	43.466530	31.664474	23.356303	
1	Los Angeles	2023-01-02	140.233736	87.958787	13.968916	7.414001	
2	Beijing	2023-01-03	148.077368	57.589949	34.170819	14.222562	
3	Mumbai	2023-01-04	79.255199	59.737832	32.208471	20.801676	
4	Sydney	2023-01-05	101.645865	70.049007	13.130936	9.689168	

	CO	O3	Temperature	Humidity	AQI
0	1.397615	49.566763	25.074644	25.391487	131
1	0.244452	14.970502	22.858254	38.099501	179
2	1.634707	14.415332	19.746074	62.835133	220
3	1.899675	22.316514	-0.117744	28.439051	232
4	0.168274	51.585902	11.028266	55.315208	101

Missing Values:

City	0
Date	0
PM2.5	0
PM10	0
NO2	0
SO2	0
CO	0
O3	0
Temperature	0
Humidity	0
AQI	0

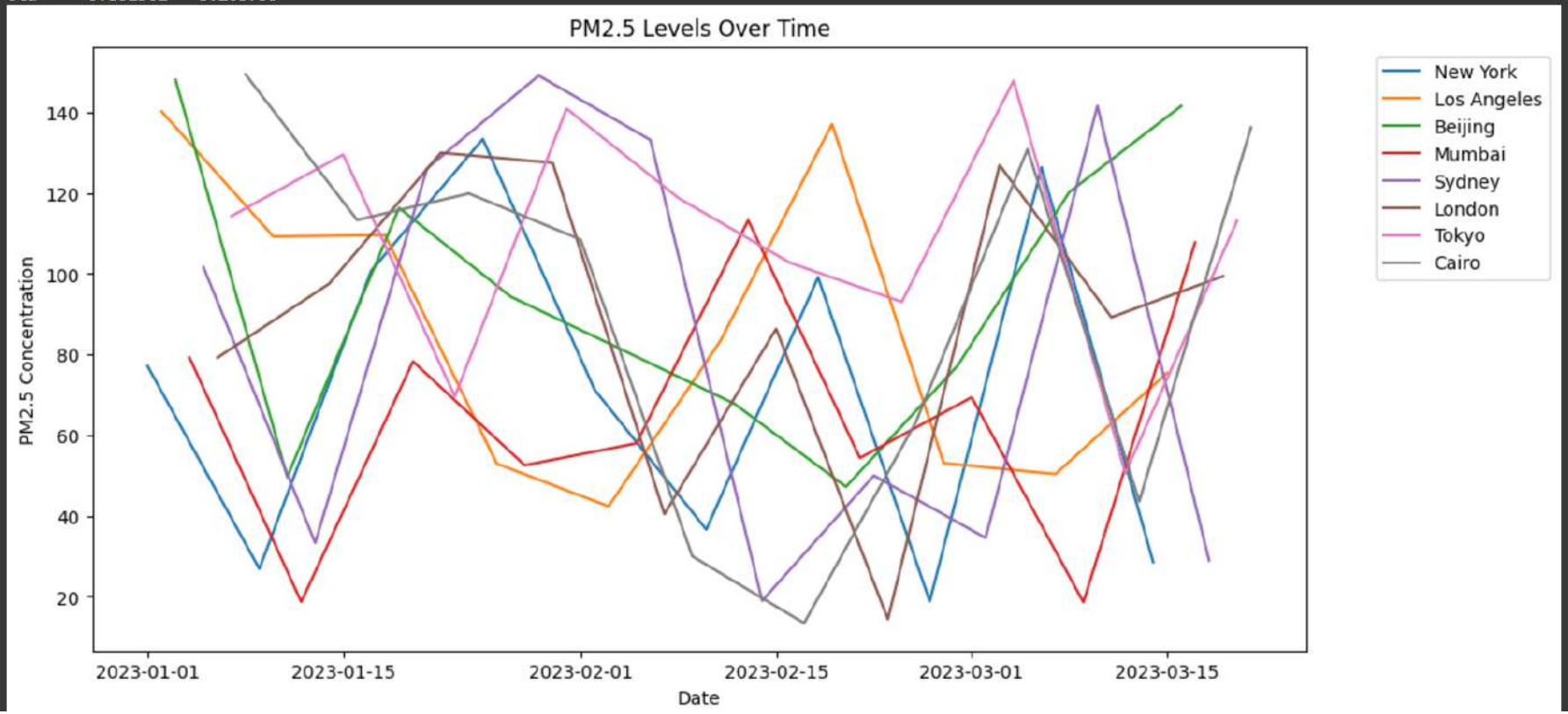
dtype: int64

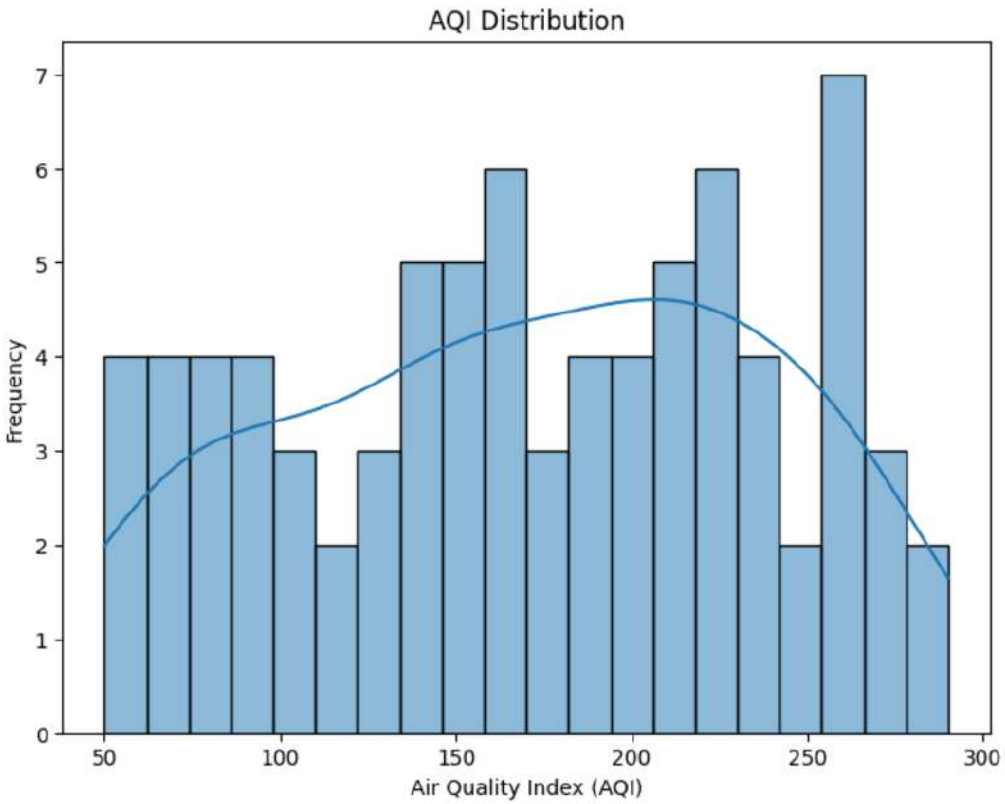
Dataset Statistics:

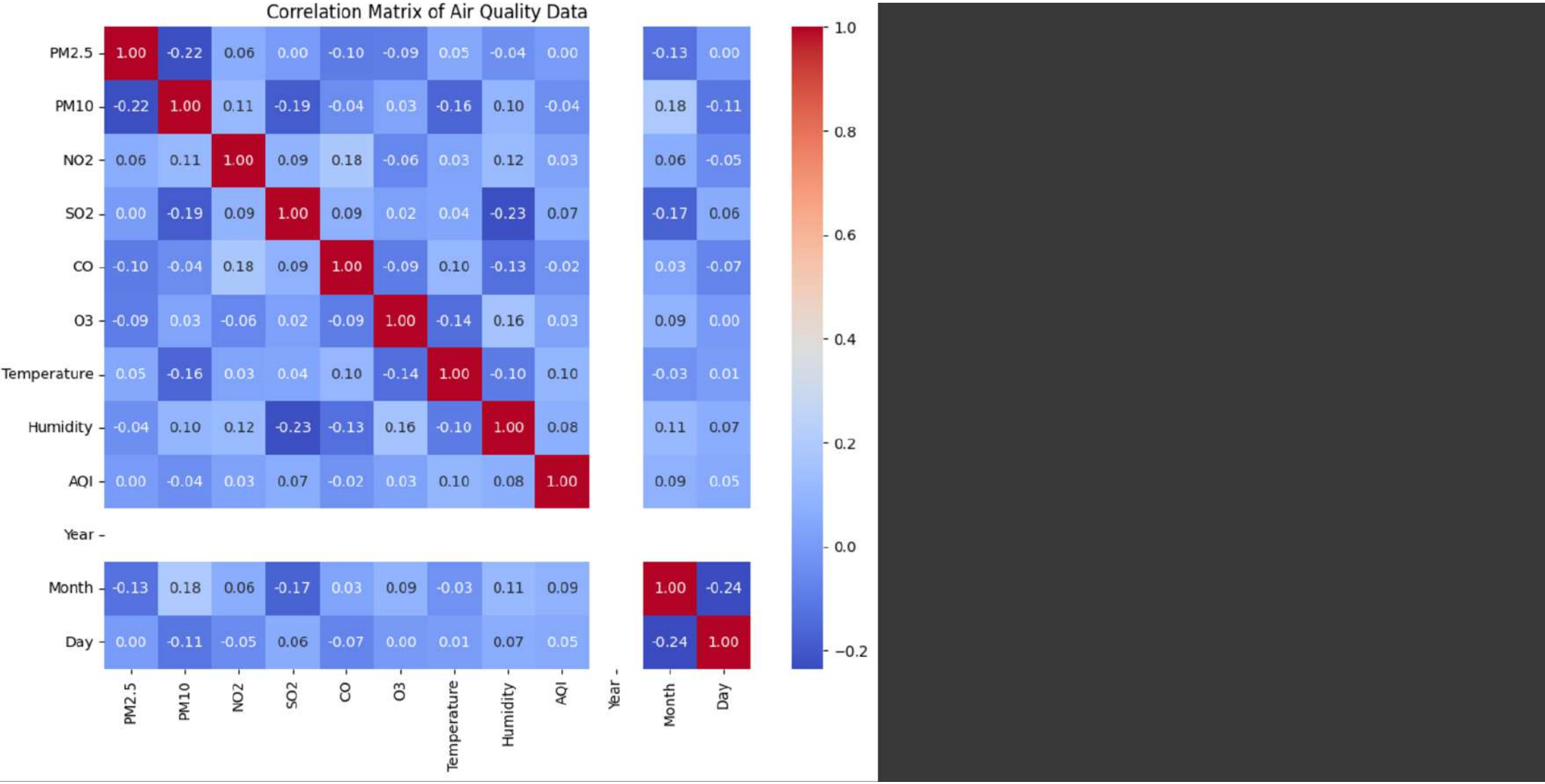
	Date	PM2.5	PM10	NO2	SO2	\
count	80	80.000000	80.000000	80.000000	80.000000	
mean	2023-02-09 12:00:00	85.817823	99.174861	25.949618	15.955716	
min	2023-01-01 00:00:00	13.450048	20.902639	6.078654	2.087541	
25%	2023-01-20 18:00:00	50.534232	55.457353	13.947361	9.005398	
50%	2023-02-09 12:00:00	87.820876	89.221860	27.953037	14.731829	
75%	2023-03-01 06:00:00	120.018046	142.702410	34.516235	22.264143	
max	2023-03-21 00:00:00	149.465751	198.248454	48.895292	29.401732	
std	NaN	40.525008	51.033463	12.881966	7.774301	

	CO	O3	Temperature	Humidity	AQI	Year	\
count	80.000000	80.000000	80.000000	80.000000	80.000000	80.0	
mean	1.048950	35.599636	16.645828	52.004740	170.487500	2023.0	
min	0.107676	10.327387	-9.973718	20.889958	50.000000	2023.0	
25%	0.476820	22.820711	3.465198	34.397334	118.250000	2023.0	
50%	1.121650	38.363338	17.877819	50.477659	172.500000	2023.0	
75%	1.492447	46.971054	28.988286	70.636277	224.250000	2023.0	
max	1.996333	59.927596	39.874468	88.844084	290.000000	2023.0	
std	0.581324	14.178470	14.431811	20.501228	67.171233	0.0	

	Month	Day
count	80.000000	80.000000
mean	1.875000	14.162500
min	1.000000	1.000000
25%	1.000000	7.000000
50%	2.000000	14.000000
75%	3.000000	20.250000
max	3.000000	31.000000
std	0.801502	8.263759

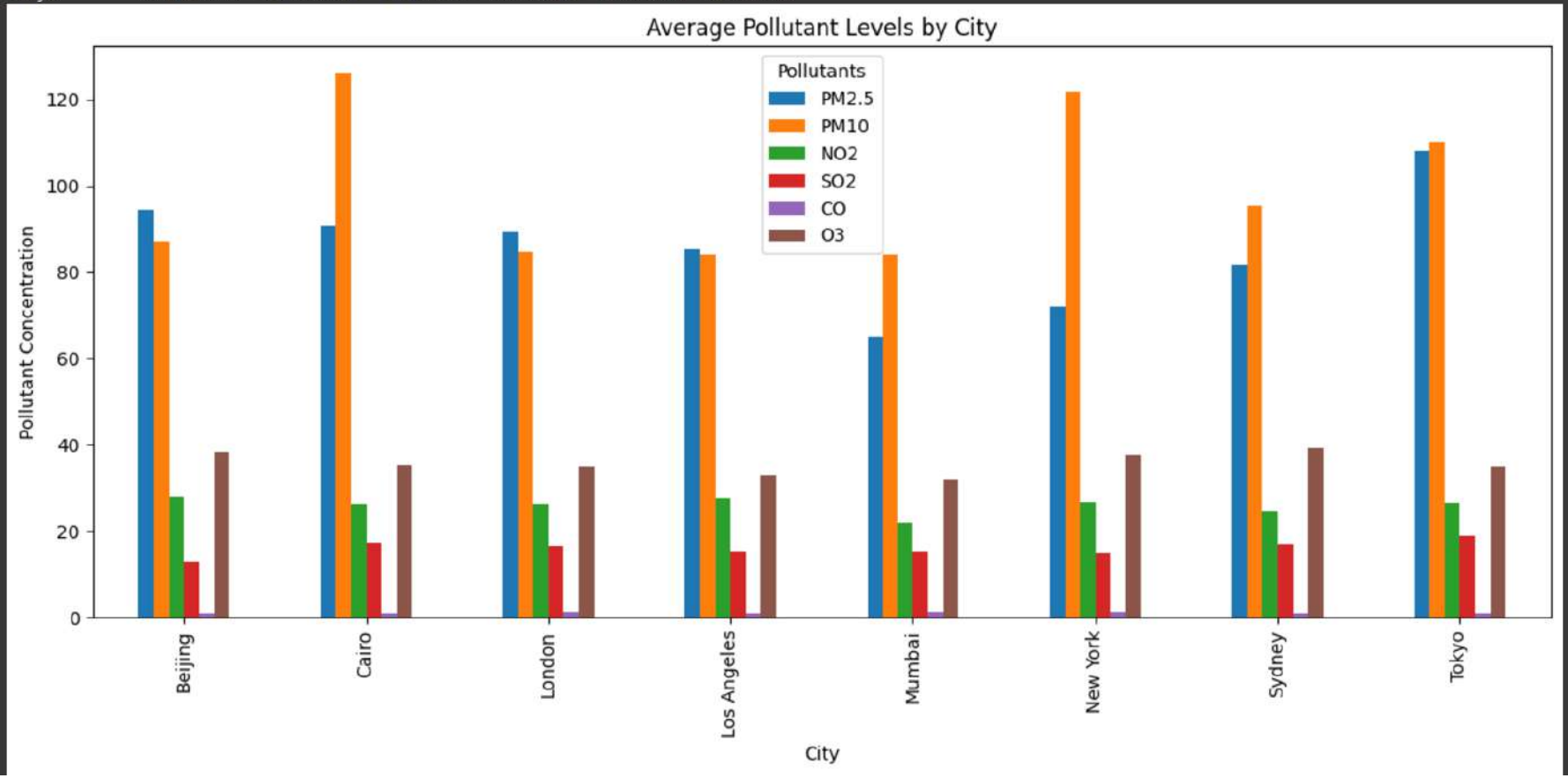



AQI Distribution
Frequency
Air Quality Index (AQI)
0
1
2
3
4
5
6
7
50
100
150
200
250
300


Correlation Matrix of Air Quality Data
PM2.5 1.00 -0.22 0.06 0.00 -0.10 -0.09 0.05 -0.04 0.00 -0.13 0.00
PM10 -0.22 1.00 0.11 -0.19 -0.04 0.03 -0.16 0.10 -0.04 0.18 -0.11
NO2 0.06 0.11 1.00 0.09 0.18 -0.06 0.03 0.12 0.03 0.06 -0.05
SO2 0.00 -0.19 0.09 1.00 0.09 0.02 0.04 -0.23 0.07 -0.17 0.06
CO -0.10 -0.04 0.18 0.09 1.00 -0.09 0.10 -0.13 -0.02 0.03 -0.07
O3 -0.09 0.03 -0.06 0.02 -0.09 1.00 -0.14 0.16 0.03 0.09 0.00
Temperature 0.05 -0.16 0.03 0.04 0.10 -0.14 1.00 -0.10 0.10 -0.03 0.01
Humidity -0.04 0.10 0.12 -0.23 -0.13 0.16 -0.10 1.00 0.08 0.11 0.07
AQI 0.00 -0.04 0.03 0.07 -0.02 0.03 0.10 0.08 1.00 0.09 0.05
Year
Month -0.13 0.18 0.06 -0.17 0.03 0.09 -0.03 0.11 0.09 1.00 -0.24
Day 0.00 -0.11 -0.05 0.06 -0.07 0.00 0.01 0.07 0.05 -0.24 1.00
PM2.5
PM10
NO2
SO2
CO
O3
Temperature
Humidity
AQI
Year
Month
Day
1.0
0.8
0.6
0.4
0.2
0.0
−0.2

Average Pollutant Levels by City:

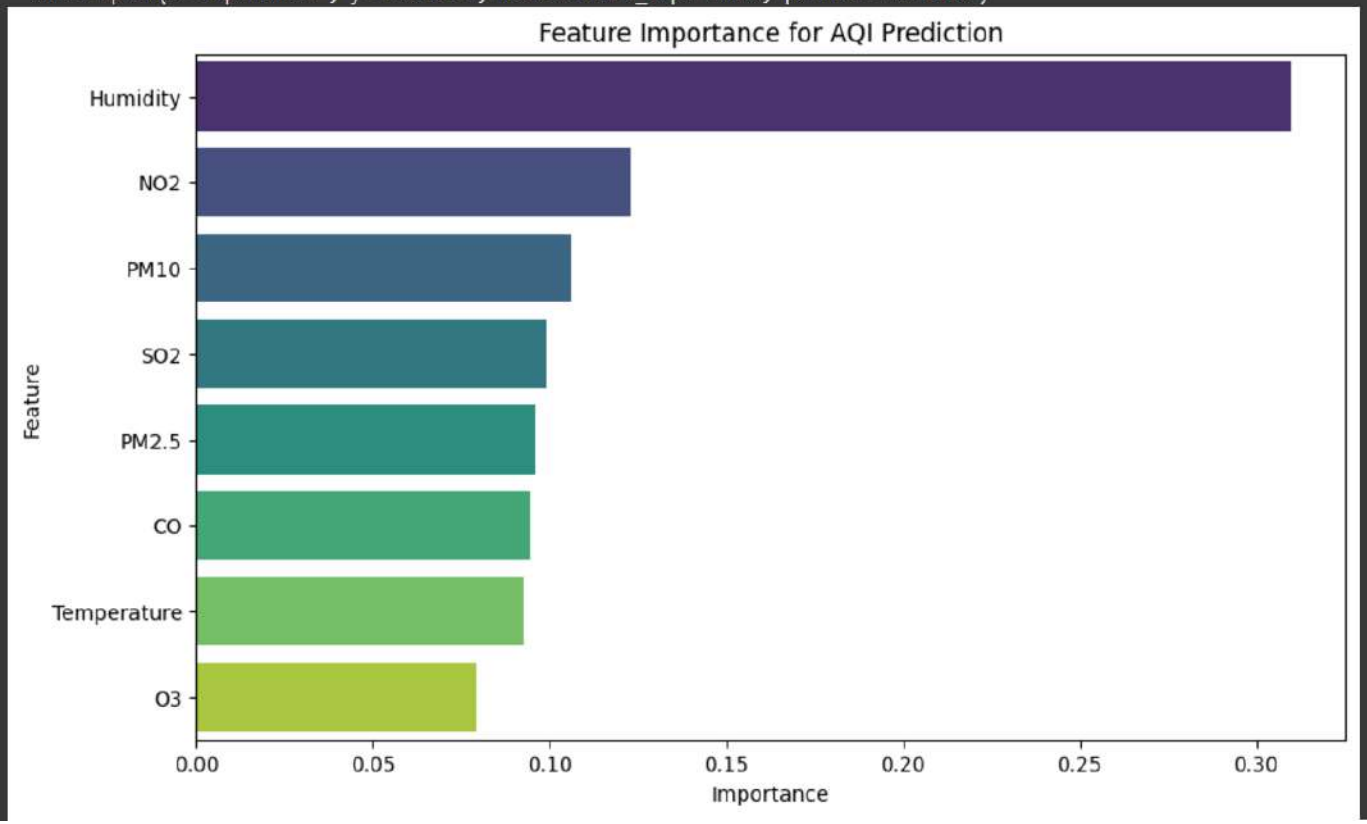
City	PM2.5	PM10	NO2	SO2	CO	O3
Beijing	94.387876	87.275407	28.027435	12.734619	1.059773	38.251470
Cairo	90.871972	125.950693	26.200857	17.369453	0.819705	35.256744
London	89.125546	84.714689	26.273873	16.511158	1.309289	34.894548
Los Angeles	85.384189	84.116416	27.627328	15.139825	1.024311	32.738023
Mumbai	65.038767	84.087747	21.738794	15.111711	1.188189	31.760426
New York	71.911475	121.706856	26.781795	15.015248	1.142917	37.773784
Sydney	81.753480	95.213112	24.463727	17.024616	0.905424	39.204450
Tokyo	108.069280	110.333971	26.483131	18.739101	0.941989	34.917642

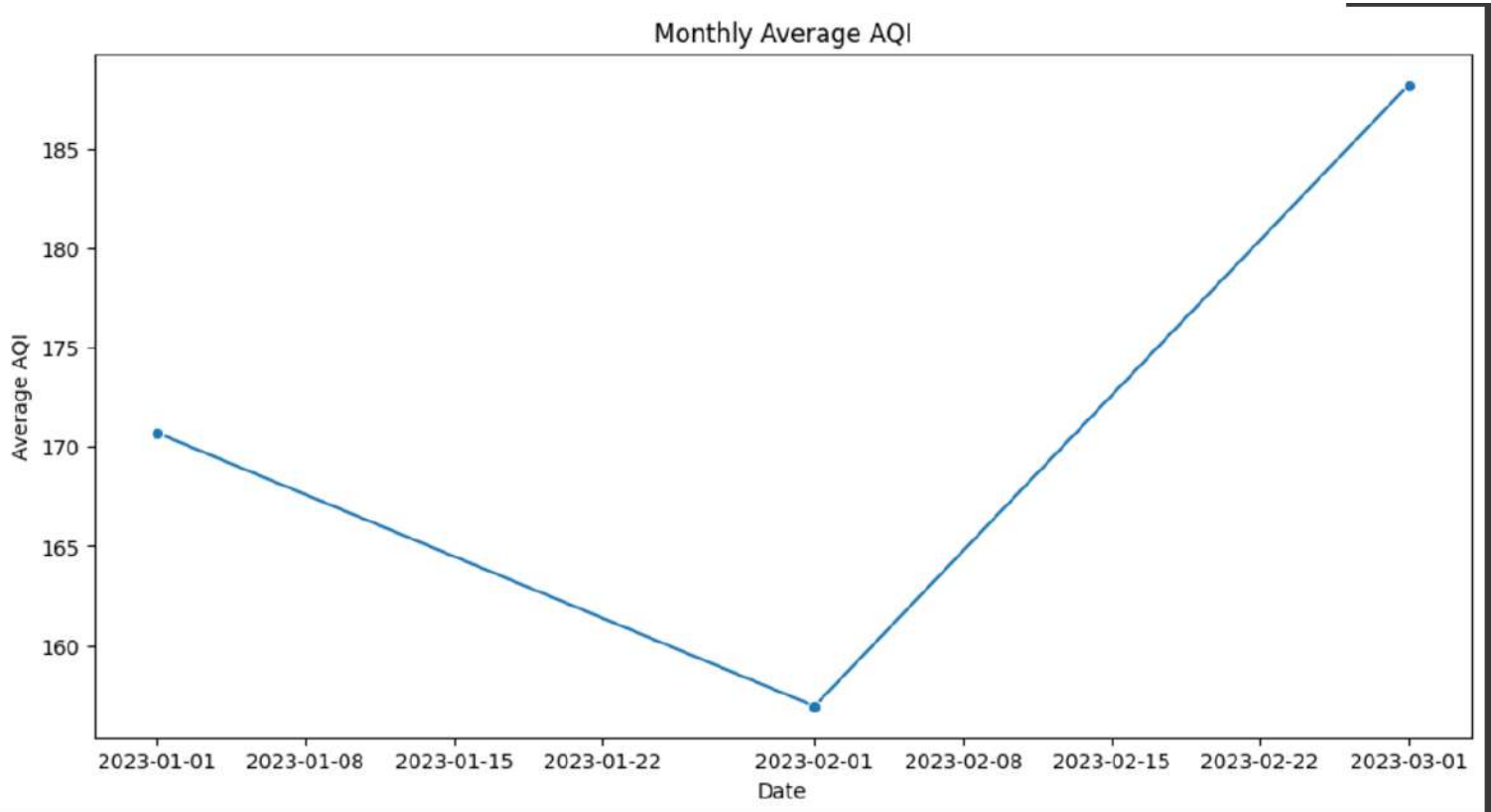


```
Model Performance:
Mean Absolute Error (MAE): 59.67
R-squared (R2): -0.21
<ipython-input-3-24f376eae6e6>:107: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(x="Importance", y="Feature", data=feature_importance, palette="viridis")
```

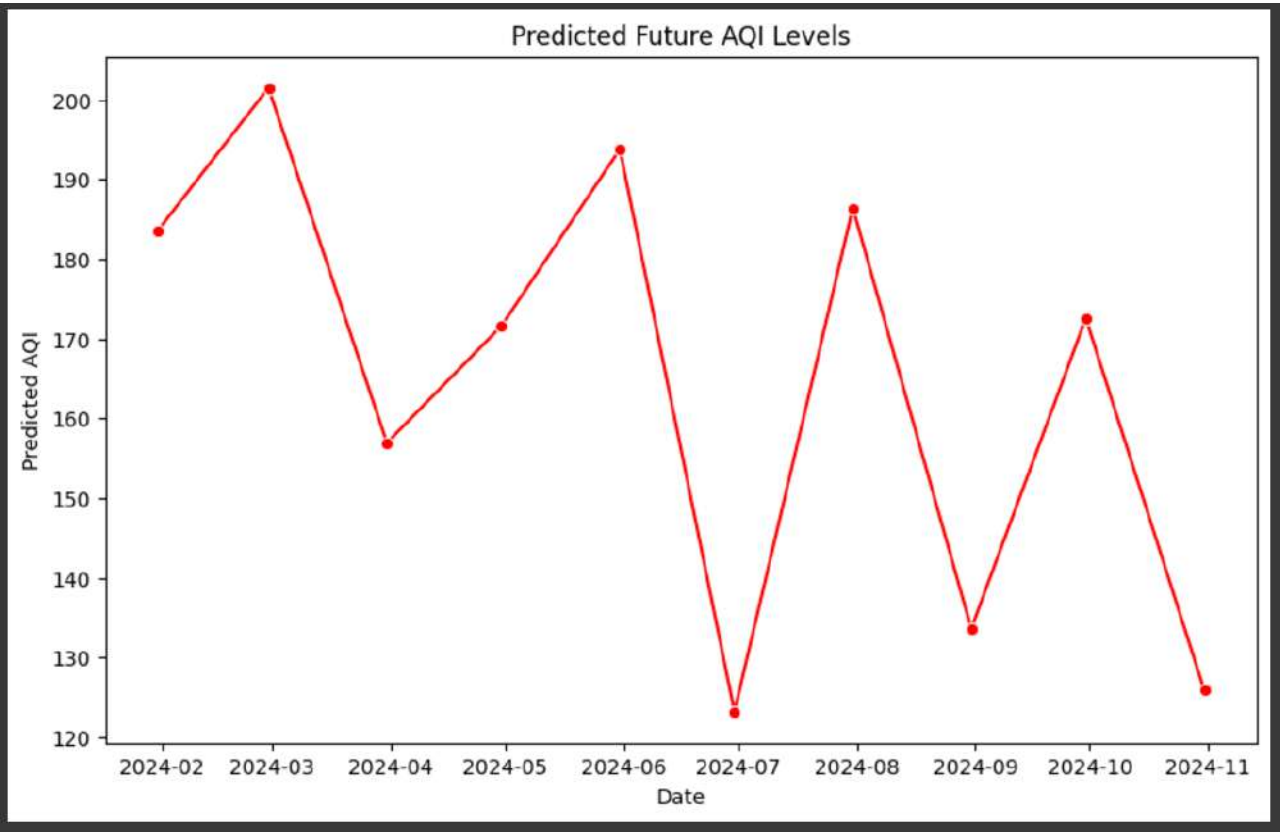





```
<ipython-input-3-24f376eae6e6>:125: FutureWarning: 'M' is deprecated and will be removed in a future version, please use 'ME' instead.
  future_dates = pd.date_range(start="2024-01-01", periods=10, freq="M")
```

Future AQI Predictions:

	Date	PM2.5	PM10	NO2	SO2	CO	O3	Temperature	Humidity	AQI_Predicted
0	2024-01-31	101.047412	119.441999	37.452047	22.415732	1.842371	21.459618	10.228845	63.122460	183.535
1	2024-02-29	18.657681	176.560574	25.869803	17.287422	1.677465	46.097134	31.516622	70.667835	201.455
2	2024-03-31	59.399954	140.480464	29.203835	2.628466	0.562465	39.957085	17.602375	36.875877	156.930
3	2024-04-30	49.801445	195.959277	23.347970	23.029530	0.267711	42.458718	20.930123	42.598588	171.590
4	2024-05-31	61.099487	28.747327	34.883644	22.400906	1.447304	36.614698	35.429546	37.574069	193.750
5	2024-06-30	28.765769	137.689247	48.298616	20.398681	1.028432	21.721343	3.105662	86.153229	123.205
6	2024-07-31	103.499935	118.911759	31.883490	28.334028	0.477519	22.444998	37.658249	57.247645	186.400
7	2024-08-31	40.496224	115.302468	47.199365	8.907958	0.736277	55.104811	1.814317	89.284659	133.620
8	2024-09-30	95.113088	191.386256	36.594197	12.969153	0.339431	44.013296	23.551409	64.955094	172.540
9	2024-10-31	75.972694	36.833382	43.085577	28.424397	0.262731	18.140467	12.382126	87.779382	125.895


Predicted Future AQI Levels
Predicted AQI
200
190
180
170
160
150
140
130
120
2024-02
2024-03
2024-04
2024-05
2024-06
2024-07
2024-08
2024-09
2024-10
2024-11
Date