Being a data analysis and data science enthusiast, I decided to analyze the air quality data of my own country to find some underlying principles or patterns which might give me an insight into how severe the problem it is

THE APPROACH

The following data analysis is carried out in python

DATA PREPROCESSING

All data pre-processing are handled using Python. When dealing with air quality historical data, we need to replace all unknown value to zero or some meaningful value. Here, the original data use special characters to denote the value is invalid. For example,

means the value is detected as invalid by instruments.

- Means the value is detected as invalid by computer programs.

X means the value is detected as invalid by human beings.

Blank means the value is missing. For simplicity, all invalid data are currently replaced by 0.

DATASET

The dataset contains the following features :

Stn_code : Station code. A code is given to each station that recorded the data.

Sampling_date: The date when the data was recorded.

State: It represents the states whose air quality data is measured.

Location: It represents the city whose air quality data is measured.

Type: The type of area where the measurement was made.

So2: The amount of Sulphur Dioxide measured.

No2: The amount of Nitrogen Dioxide measured

Rspm: Respirable Suspended Particulate Matter measured.

Spm: Suspended Particulate Matter measured.

Location_monitoring_station: It indicates the location of the monitoring area.

Pm2_5: It represents the value of particulate matter measured.

Date: It represents the date of recording (It is a cleaner version of 'sampling_date' feature)

FEATURES PREDICTED WHILE TESTING AIR QUALITY

SO_2: Sulphur Dioxide is a gas. It is one of the major pollutants present in the air.

It is colourless and has a nasty, sharp smell.

It combines effortlessly with other chemicals to form harmful substances like sulphuric acid, sulfurous acid, etc.

Sulfur dioxide affects human health when it is inhaled. It irritates the nose, throat, and airways to cause coughing, wheezing, shortness of breath, or a tight feeling around the chest. Those most at risk of developing problems if they are exposed to sulfur dioxide are people with asthma or similar conditions. Also, the concentration of sulfur dioxide in the atmosphere can influence the habitat suitability for plant communities, as well as animal life.

Inhaling sulfur dioxide is associated with increased respiratory symptoms and disease, difficulty in breathing, and premature death.

It also causes acid rain.

NO_2: Nitrogen Dioxide is a reddish-brown gas with a pungent, acrid odour.

It can cause bronchoconstriction, inflammation, reduced immune response, and may have effects on the heart. Direct exposure to the skin can cause irritations and burns.

The following gives a rough idea of nitrogen dioxide's impact on health :

10–20 ppm can cause mild irritation of the nose and throat

25–50 ppm can cause oedema leading to bronchitis or pneumonia

Levels above 100 ppm can cause death due to asphyxiation from fluid in the lungs.

High levels of NO_2 can harm vegetation, including leaf damage and reduced growth. It can make vegetation more susceptible to disease and frost damage.

Longer exposures to elevated concentrations of NO_2 may contribute to the development of asthma and potentially increase susceptibility to respiratory infections.

Particulates: These are also known as Atmospheric aerosol particles, atmospheric particulate matter, particulate matter (PM) or suspended particulate matter (SPM).

These are microscopic solid or liquid matter suspended in the atmosphere.

Particulates are the deadliest form of air pollution due to their ability to penetrate deep into the lungs and bloodstreams unfiltered, causing permanent DNA mutations, heart attacks, respiratory disease, and premature death.

Worldwide exposure to PM 2.5 contributed to 4.1 million deaths from heart disease and stroke, lung cancer, chronic lung disease, and respiratory infections in 2016. Overall, ambient particulate matter ranks as the sixth leading risk factor for premature death globally.

The internet is filled with the harmful effects of the above pollutants, and hence it makes them an essential factor to be analyzed and considered when discussing air pollution.

Coming back to the analysis.

OBJECTIVES

The objectives for analysing air quality trends are characterizing pollution patterns, protecting the public health, and determining compliance with air quality standards.

POLLUTION HOTSPOTS

These are the areas where air pollution emissions expose individuals to increased negative health effects. Hotspots denote areas in which a population's exposure to pollution and estimated health risks are high.

DATA EXPLORATION

```
In [5]: df.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 435742 entries, 0 to 435741
Data columns (total 13 columns):
stn_code                        291665 non-null object
sampling_date                   435739 non-null object
state                           435742 non-null object
location                        435739 non-null object
agency                          286261 non-null object
type                            430349 non-null object
so2                             401096 non-null float64
no2                             419509 non-null float64
rspm                            395520 non-null float64
spm                             198355 non-null float64
location_monitoring_station     408251 non-null object
pm2_5                           9314 non-null float64
date                            435735 non-null object
dtypes: float64(5), object(8)
```

Now, let us check the null values

```
In [6]: df.isnull().sum()
Out[6]:
stn_code                        144077
sampling_date                        3
state                                0
location                             3
agency                          149481
type                              5393
so2                              34646
no2                              16233
rspm                             40222
spm                             237387
location_monitoring_station      27491
pm2_5                           426428
date                                 7
dtype: int64
```

SAMPLE DATASET IN DIFFERENT AREAS

238	12-08-14	Tamil Nadu	Coimbatore	Distt. Collecto Tamilnadu StaResidential, R
238	12-11-14	Tamil Nadu	Coimbatore	Distt. Collecto Tamilnadu StaResidential, R
238	15-12-14	Tamil Nadu	Coimbatore	Distt. Collecto Tamilnadu StaResidential, R
238	18-12-14	Tamil Nadu	Coimbatore	Distt. Collecto Tamilnadu StaResidential, R
238	22-12-14	Tamil Nadu	Coimbatore	Distt. Collecto Tamilnadu StaResidential, R
238	29-12-14	Tamil Nadu	Coimbatore	Distt. Collecto Tamilnadu StaResidential, R
759	01-04-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	01-08-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	01-11-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	18-01-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	22-01-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	25-01-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	29-01-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	02-01-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	02-05-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	02-08-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	02-12-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	15-02-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	19-02-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	22-02-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	26-02-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	03-01-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	03-05-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	03-08-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	03-12-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	15-03-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	19-03-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	22-03-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	26-03-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	29-03-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	04-03-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	04-07-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	04-10-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	15-04-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	19-04-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	23-04-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	28-04-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	05-02-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	05-06-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	05-09-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	13-05-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	16-05-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	20-05-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	23-05-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	27-05-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R
759	30-05-14	Tamil Nadu	Cuddalore	Eachangadu VTamilnadu StaResidential, R

IN MADURAI

306	17-03-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	20-03-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	24-03-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	27-03-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	04-03-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	04-07-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	04-10-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	17-04-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	21-04-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	28-04-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	05-05-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	05-08-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	05-12-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	15-05-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	19-05-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	22-05-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	26-05-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	29-05-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	06-02-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	06-05-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	06-09-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	06-12-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	16-06-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	19-06-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	23-06-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	26-06-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	30-06-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	07-03-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	07-07-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	07-10-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	14-07-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	17-07-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	21-07-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	24-07-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	28-07-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	31-07-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	08-04-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	08-07-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	08-11-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	14-08-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	18-08-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	21-08-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	25-08-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	28-08-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	09-01-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R
306	09-04-14	Tamil Nadu	Madurai	Highway (Proj Tamilnadu StaResidential, R

IN SALEM

309	17-03-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	19-03-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	21-03-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	24-03-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	27-03-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	31-03-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	04-02-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	04-04-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
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309	05-09-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	05-12-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	14-05-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	16-05-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
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309	21-05-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	23-05-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	26-05-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	28-05-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	30-05-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
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309	06-04-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	06-06-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	06-09-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	06-11-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
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309	16-06-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	18-06-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	20-06-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	23-06-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	25-06-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	27-06-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	30-06-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	07-02-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	07-04-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	07-07-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R
309	07-09-14	Tamil Nadu	Salem	Sowdeswari C\Tamilnadu StaResidential, R

IN TRICHY

769	03-11-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	13-03-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	18-03-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	20-03-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	25-03-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	27-03-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	04-01-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	04-03-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	04-08-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	04-10-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	17-04-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	19-04-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	22-04-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	29-04-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	05-06-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	05-08-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	13-05-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	15-05-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	20-05-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	22-05-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	27-05-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	29-05-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	06-03-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	06-10-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	17-06-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	24-06-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	07-01-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	07-08-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	15-07-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	22-07-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	08-05-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	08-12-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	19-08-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	21-08-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	28-08-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	28-08-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	09-02-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	09-04-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	09-09-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	09-11-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	16-09-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	18-09-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	23-09-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	25-09-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	30-09-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R
769	10-07-14	Tamil Nadu	Trichy	Gandhi MarkeTamilnadu StaResidential, R

IN THOOTHUKUDI

309	26-11-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	12-01-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	12-03-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	12-05-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	12-08-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	12-10-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	17-12-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	19-12-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	22-12-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	24-12-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	29-12-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
309	31-12-14	Tamil Nadu	Salem	Sowdeswari C Tamilnadu Sta Residential, R
239	01-02-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	01-06-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	01-09-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	13-01-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	20-01-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	23-01-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	27-01-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	30-01-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	02-03-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	02-06-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	02-10-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	13-02-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	17-02-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	20-02-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	24-02-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	27-02-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	03-03-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	03-06-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	03-10-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	13-03-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	17-03-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	20-03-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	24-03-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	27-03-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	04-03-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	04-07-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	04-10-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	17-04-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	21-04-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	28-04-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	05-05-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	05-08-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	05-12-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R
239	15-05-14	Tamil Nadu	Thoothukudi	Fisheries Colle Tamilnadu Sta Residential, R

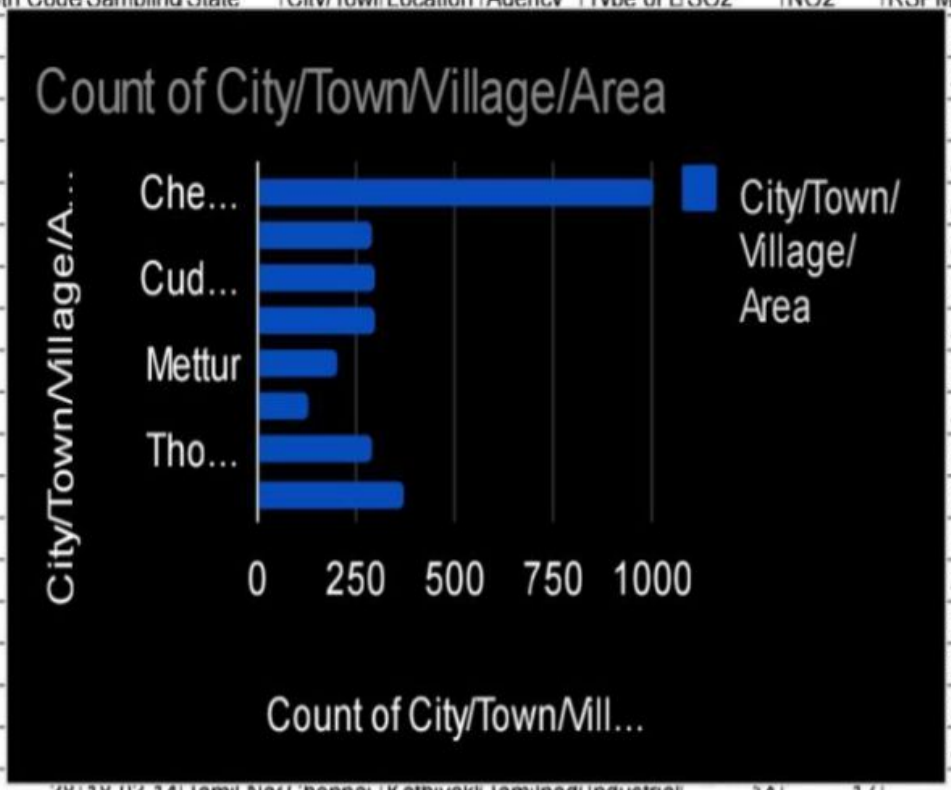
Now let us consider the type feature.

It represents the type of area where the data was recorded like industrial, residential, etc.

Let us see how many types of area were considered :

```
In [4]: df['type'].value_counts()
Out[4]:
Residential, Rural and other Areas    179014
Industrial Area                        96091
Residential and others                 86791
Industrial Areas                       51747
Sensitive Area                          8980
Sensitive Areas                         5536
RIRUO                                   1304
Sensitive                                495
Industrial                               233
Residential                              158
Name: type, dtype: int64
```

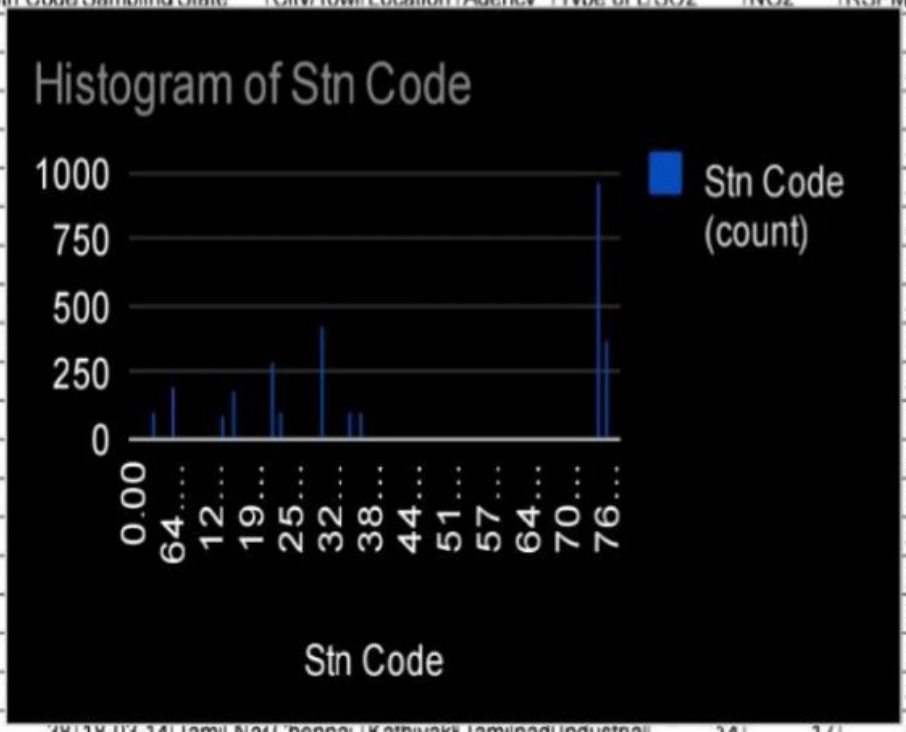
DATA VISUALIZATION



Stn Code	Sampling	State	City/Town	Location	Agency	Type of L	SO2	NO2	RSPM/PI	PM 2.5
									55	NA
									45	NA
									50	NA
									46	NA
									42	NA
									43	NA
									51	NA
									46	NA
									50	NA
									48	NA
									32	NA
									29	NA
									17	NA
									44	NA
									25	NA
									29	NA
									29	NA
									41	NA
38	18-03-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	14	17	43	NA
38	20-03-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	14	14	42	NA
38	25-03-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	14	17	54	NA
38	27-03-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	15	19	62	NA
38	04-01-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	14	15	66	NA
38	04-03-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	11	16	40	NA
38	04-08-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	14	17	56	NA
38	04-10-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	15	17	50	NA
38	15-04-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	12	14	49	NA
38	17-04-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	15	16	63	NA
38	22-04-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	15	18	42	NA
38	29-04-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	12	18	44	NA

HISTOGRAM OF GATHERED DATA

The historical line chart displays information as a series of data points connected by straight line segments. we show all the historical data of one specific item at one station. Generally speaking, a line chart is often useful to visualize a trend in data over time.Here,this histogram is represented with the station code which is given to each district to record the air quality analysis data



Stn Code	Sampling	State	City/Town	Location	Agency	Type of L	SO2	NO2	RSPM/PI	PM 2.5
									55	NA
									45	NA
									50	NA
									46	NA
									42	NA
									43	NA
									51	NA
									46	NA
									50	NA
									48	NA
									32	NA
									29	NA
									17	NA
									44	NA
									25	NA
									29	NA
									29	NA
									41	NA
38	18-03-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	14	17	43	NA
38	20-03-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	14	14	42	NA
38	25-03-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	14	17	54	NA
38	27-03-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	15	19	62	NA
38	04-01-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	14	15	66	NA
38	04-03-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	11	16	40	NA
38	04-08-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	14	17	56	NA
38	04-10-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	15	17	50	NA
38	15-04-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	12	14	49	NA
38	17-04-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	15	16	63	NA
38	22-04-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	15	18	42	NA
38	29-04-14	Tamil Na	Chennai	Kathivaki	Tamilnad	Industrial	12	18	44	NA

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									55	NA
									45	NA
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									46	NA
									42	NA
									43	NA
									51	NA
									46	NA
									50	NA
									48	NA
									32	NA
									29	NA
									17	NA
									44	NA
									25	NA
									29	NA
									29	NA
									41	NA
38	18-03-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	14	17	43	NA
38	20-03-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	14	14	42	NA
38	25-03-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	14	17	54	NA
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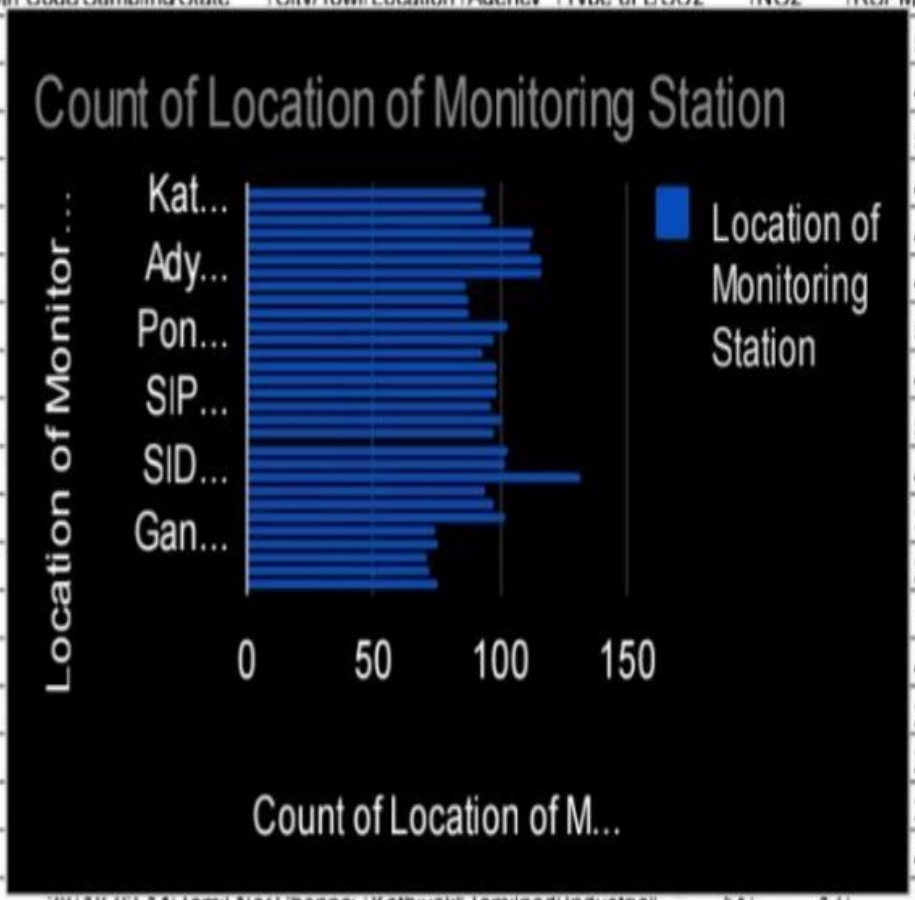
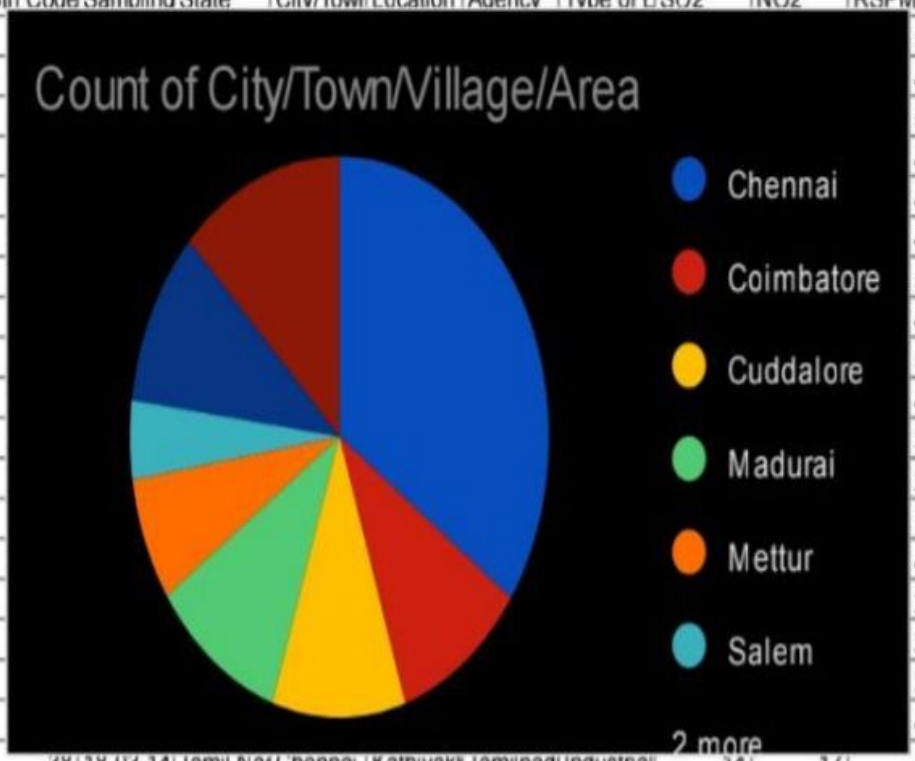
38	22-04-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	15	18	42	NA
38	29-04-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	12	18	44	NA



CIRCULAR HEATMAP

A circular heat map is a graphical representation of data where the individual values contained in a circle shape. It displays quantitative data as an array of circular segments, colored according to value. It is a good way to display cyclic data in a well-chosen time period, in order to show a pattern as value changes



Stn Code	Sampling	State	City/Town	Location	Agency	Type of L	SO2	NO2	RSPM/PI	PM 2.5
									55	NA
									45	NA
									50	NA
									46	NA
									42	NA
									43	NA
									51	NA
									46	NA
									50	NA
									48	NA
									32	NA
									29	NA
									17	NA
									44	NA
									25	NA
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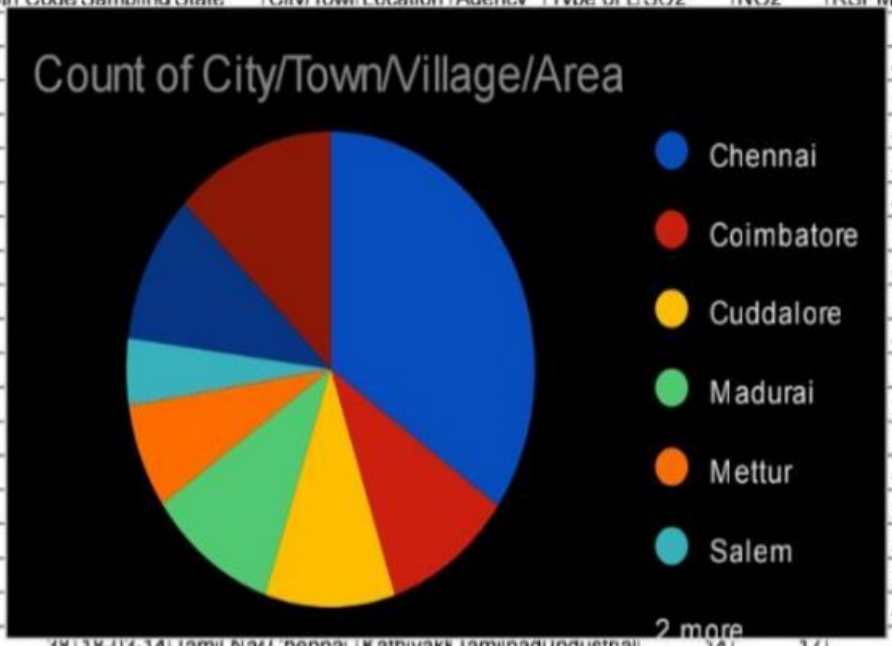
38	04-10-14	Tamil Na	Chennai	Kathivaki	Tamilnadu	Industrial	15	17	50	NA
38	15-04-14	Tamil Na	Chennai	Kathivaki	Tamilnadu	Industrial	12	14	49	NA
38	17-04-14	Tamil Na	Chennai	Kathivaki	Tamilnadu	Industrial	15	16	63	NA
38	22-04-14	Tamil Na	Chennai	Kathivaki	Tamilnadu	Industrial	15	18	42	NA
38	29-04-14	Tamil Na	Chennai	Kathivaki	Tamilnadu	Industrial	12	18	44	NA



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									32	NA
									29	NA
									17	NA
									44	NA
									25	NA
									29	NA
									29	NA
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38	29-04-14	Tamil Na	Chennai	Kathivakk	Tamilnad	Industrial	12	18	44	NA

CONCLUSION

From the above data analysis approach, we conclude that data analysis is a crucial aspect for a better future.It is interesting to see how data analysis and the day to day instances are coherent and how data analysis can be used to deal with significant problems.Not only India other countries are also suffering from air pollution.