An investigation of air quality index in relation to India's worsening pollution level

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ABSTRACT:

Air Quality Index (AQI) is a powerful tool for reporting the level of severity in air quality. It's a metric to determine how air pollution impacts one's health over a short period of time. The Air quality index objective is to make aware individuals about how local air quality affects their health.

In India, the Central Pollution Control Board estimates air pollution and establishes national air quality regulations to protect public health.

The AQI computed by monitoring five different pollutants viz. Ozone, Nitrogen dioxide [NO2], Sulphur dioxide [SO2], Carbon Monoxide [CO], Ammonia [NH3] and two particulate matter i.e. Particulate Matter 10 [PM 10] and Particulate Matter 2.5 [PM 2.5].

The main purpose of this research is to analyze the quality of air which can be used as a basis for taking possible steps and decisions rendering it fit for human consumption.

Keywords: - Air pollution, Air Quality Index (AQI), Monitoring network, Health.

INTRODUCTION:

Air Pollution is a complex mixture of gases, particles, aerosols, water vapor which has originated due to human development and other natural activities [1]. In both developing and developed countries, increased public awareness of air quality has emerged from pollution-related issues. Carbon monoxide (CO), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Ozone (O_3), and other air pollutants have a negative impact on human health [2]. High concentrations of these pollutants can be fatal causing different health illness. They could even lead to cardiac arrest [3].

Many cities across the world use monitoring networks to continually examine air quality [4]. These networks are designed to measure and record air pollutant concentrations at numerous places judged to represent population exposure to these pollutants. According to current research, pollution guidelines cannot be viewed as threshold values below which a zero percent detrimental response can be expected. As a result, unless properly measured, a simple comparison of observed values to guidelines may be misleading. In recent years, governments have made air quality data available to the public in a variety of formats, including annual reports, environmental evaluations, and site or subject-specific analyses/studies [4]. These are typically available or accessible to a small number of people, and they also need time, curiosity, and the requisite background to assimilate their contents. Governments, all over the world have begun to use real-time access to sophisticated database management technologies to give residents with site-specific air quality indexes/air pollution indexes and their potential health repercussions. As a result, a more complex tool, the air pollution index, or air quality index, has been developed to express the health risk of ambient concentrations [4].

According to the World Health Organization (WHO), environmental factors are directly responsible for 25% of all fatalities in underdeveloped countries (WHO, 2006). Increased industrial and other developmental activity have worsened the problem of air pollution and its negative health consequences [5].

The Air Quality Index is a scale designed to help one understand what the air quality around one means to one's health. The AQI reports current air quality based on a specific level of an individual air pollutant. The AQI communicates primarily a number from 1 to 500 indicating the quality of the air. The higher the number, the greater the health risk associated with the air quality [6]. Air Quality Index is calculated by measuring concentrations of pre-determined air pollutants in residential, commercial, and industrial regions [4]. Various methods are used to combine and translate the monitoring data into a single index. As a result, indexing systems and air pollution descriptors vary significantly from one country/region to another. Because people's sensitivity to air pollution varies depending on their geographical location, quality of life, and other factors. A universal technique for measuring the air quality index is not very useful [4].

METHODOLOGY: -

Citizens have become more aware of their environment in recent years. People should be aware of the air they breathe since they are well versed about the negative health implications of poor air quality. By assessing daily air pollution levels, society can have access to this knowledge. Air Quality Index is one such method for canvassing the air we breathe, and it is used to produce total results based on the country's regulations and rules. The Central Board of Pollution Control (CPCB) in India sets these criteria under the Air (Prevention and Control of Pollution) Act, 1981 [7].

When the AQI is less than 100, the air quality is satisfactory, and there is no risk to public health. When the AQI is nearly equal to 100, the measured values of the pollutants are following the legislation. When the AQI rises above 100, however, the quality of the air falls, making it a public health concern [8].

The AQI evaluates contaminants that have a severe impact on human health (PM10, PM2.5, CO, NO2, O3, SO2, NH3) [8].

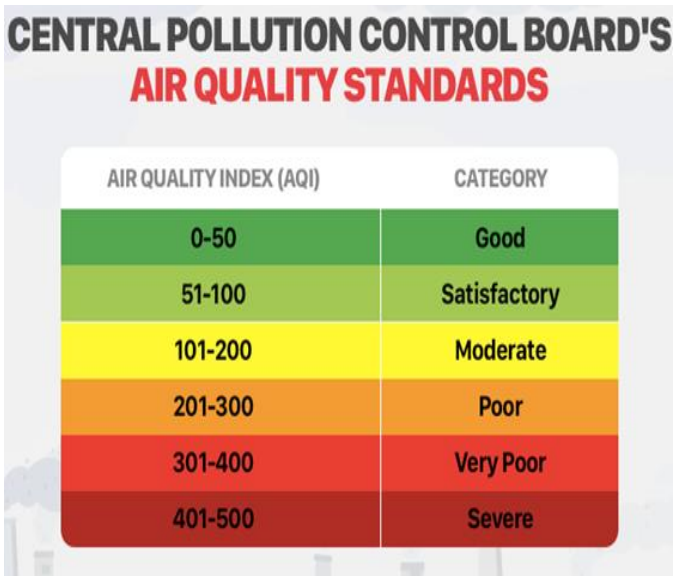

Fig. 1. Air Quality Standard

The decision to include only pollutants with acute impacts may be debatable, but it derives from the fact that this index is designed to provide daily information to the public to avoid short-term repercussions (Cardiovascular and Respiratory systems) [8].

Data is collected from all throughout the country in real time for only one day. This dataset has some missing values and is used for the analysis of the air quality index. The median and mean, which are measures of Central Tendencies, were used to impute this missing value. Using data insights, we identified that Particulate matter 10 is the Predominant Parameter across the country.

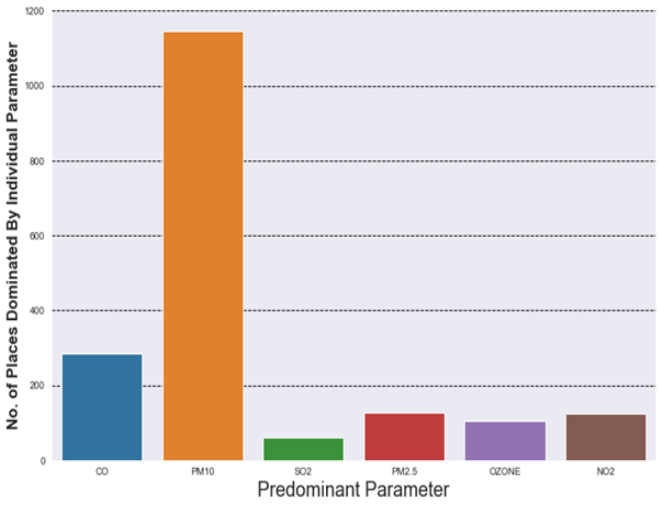

Fig. 2. Different pollutants in air

RESULT AND CONCLUSION:

The Air Quality Index can provide a clear picture of the ambient air and the essential pollutants that are primarily responsible for air quality. The CPCB break point concentration was used to determine the AQIs. According to the AQI study, particulate matter (mostly PM10) was the leading cause of maximum times in the country. PM10 was also recognized as the most prevalent contaminant in the index value. Because of their synergetic activity, Particulate Matter is producing major global public health issues for residents. For the

benefit of civic life, we must seek for proper pollution control and management plans, such as plantations and green belts [9].

- **Good (0–50) -** Minimal Impact
- **Satisfactory (51–100) -** May cause minor breathing difficulties in sensitive people.
- **Moderately polluted (101–200)** - May cause breathing difficulties in people with lung disease like asthma, and discomfort to people with heart disease, children, and older adults.
- **Poor (201–300) -** May cause breathing difficulties in people on prolonged exposure, and discomfort to people with heart disease
- **Very Poor (301–400) -** May cause respiratory illness in people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases.
- **Severe (401-500) -** May cause respiratory issues in healthy people, and serious health issues in people with lung/heart disease. Difficulties may be experienced even during light physical activity.

Dataset and variable selection—considering a large dataset with more parameters and measurements, which can support more accurate air pollution and particulate forecasting models. For predicting the air quality index, data science can be highly useful. And, based on the predictions, we can take whatever steps are necessary to clean up our environment.

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