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Investigation of Air Quality for Malegaon Region

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Abstract: ***The purpose of this study is to examine the quality of the air in the Malegaon region by identifying, quantifying, and evaluating contaminants and their effects on the environment and public health. The Malegaon region's air quality has been a rising topic of concern because of industrial operations, vehicle emissions, and other human-caused factors. elevated concentrations of many pollutants, including Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2), Particulate matter ($PM_{2.5}$, PM_{10}), and Ozone (O_3).It's an intriguing problem to comprehend the mechanics of air pollution in a semi-urban location like Malegaon. The dispersion and concentration patterns of pollutants are influenced by various factors, including terrain, meteorological circumstances, and industrial expansion. The challenge is further complicated by evaluating the combined effects of several pollution sources on air quality. In order to thoroughly evaluate the state of the air in the Malegaon region, this study uses a multidisciplinary method that combines statistical analysis, atmospheric modeling, and air quality monitoring.***

Keywords : Pollution, Air quality monitoring, Vehicle emissions, Particulate matter ($PM_{2.5}$, PM_{10}), Ozone (O_3), Nitrogen dioxide (NO_2), Sulfur dioxide (SO_2), Carbon monoxide (CO)

I. INTRODUCTION

In recent years, the Indian state of Maharashtra has seen a tremendous increase in both urbanization and industrialization in the city of Malegaon. Air quality issues have become a major environmental problem in the region due to growing industrial operations and population increase. Long-term environmental issues as well as urgent health dangers for locals are presented by the declining quality of the air.

The purpose of this study is to evaluate the degree of pollution levels across a range of parameters and explore the numerous factors influencing Malegaon's air quality. Understanding the sources, patterns, and implications of air pollution is vital for creating effective policies to alleviate its detrimental effects on public health and the environment. Identification of key sources of air pollution in Malegaon, including industrial emissions, automotive exhaust, construction activity, and biomass burning.

Measurement and assessment of major air pollutants, nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and particulate matter (PM_{10}). Examination of the negative effects of air pollution on Malegaon local health, focusing on respiratory conditions. Heart conditions and other associated hazards. Measuring the health cost of poor air quality emphasizes how urgent intervention.

II. LITERATURE REVIEW

Mohammad Asif, Pranav Mahajan, "Impact of COVID-19 lockdown and meteorology on the air quality of Srinagar city: A temperate climate region in Kashmir Himalayas" The report illustrates how the COVID-19 lockout measures affected six important air contaminants and meteorological indicators by highlighting their temporal variance. It is interesting to observe that during lockdown periods, some pollutants, like NH_3 and NO_2, witnessed significant declines, while other pollutants, like SO_2 and O_3, exhibited an increased tendency. This shows that human activity, climatic factors, and lockdown procedures interact intricately to affect air quality. The results highlight the possible advantages of enforcing strict lockdown protocols during periods of severe air pollution in order to lessen the detrimental effects of pollutants from a variety of sources, such as industrial and vehicle sources.

Aditya Dubey, Akhtar Rasool, "Impact on Air Quality Index of India Due to Lockdown", Particulate matter $(PM)_{2.5}$, PM_{10}, nitrogen dioxide (NO_2), and the Air Quality Index (AQI) all significantly decreased during the lockdown, according to the study in the report, indicating improved air quality standards and cleaner air. This shows that, despite possible negative effects on economic growth, even brief lockdowns can be beneficial in reducing air pollution.

C.M.Payus, M.S. Nur Syazin, "Extended air pollution index (API) as tool of sustainable indicator in the air quality assessment: EI-Nino events with climate change driven", This main purpose of this research is to detect the air quality The major goal of this research is to identify changes in air quality over a shorter timeline in space, which will help to enhance and optimize risk characterization and concurrent air quality evaluation.

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Many different physical, chemical, and biological parameters, such as temperature, humidity, air pressure, particle matter (PM), carbon monoxide (CO), and sulphur dioxide (SO_2), can be used to determine the quality of the air. However, since each measure signals a distinct sort of quality class, it is frequently difficult to comprehend the results of the air quality status when many quality elements are studied.

Yiyi Wang, Lei Huang, et al, "High-resolution modelling for criteria air pollutants and the associated air quality index in a metropolitan city", the discovery that high ground-level ozone exposure over a wide area dominates the spatial pattern of bad air quality, which is defined as an AQI greater than 100. This emphasizes how important ground-level ozone is as a primary cause of the analysed metropolitan city's poor air quality. To improve air quality and public health in metropolitan areas, tailored interventions and regulations that take into account the main pollutants causing poor patterns of air quality are essential.

III. METHODOLOGY

To check sound quality, systematic data collection methods are applied. A To check sound quality, systematic data collection methods are applied.

A general strategy for sound quality monitoring is as follows:

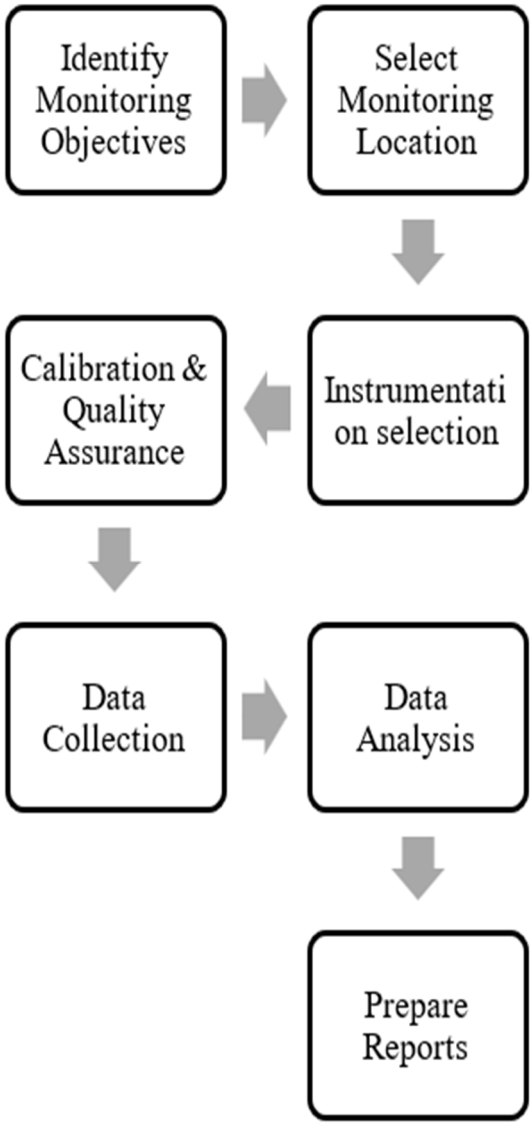


Figure 1 : Flow Diagram of Proposed System

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IV. STUDY AREA

In the Indian state of Maharashtra, in the Nashik District, is the city and Municipal Corporation of Malegaon. Situated along the Girna River, the city is divided into two pieces by the Mosam River, which flows through its center. Malegaon's loom industries are well-known. Malegaon is located at 18.42°N 77.53°E, at the junction of the Girna and Mosam rivers, at an elevation of 438 meters (1437 feet). Mumbai, the state capital, is located 280 miles to the northeast. It is well connected to neighboring cities like Nashik, Pune,Mumbai, Indore, Surat, and Dhule due to its central location. Malegaon's total area is 33.56 km² (1296 sq. m), with an elevation of 438 m (1437 ft.). Malegaon's total population is 481228.

Measurement of Samples

Seven randomly selected sampling locations were used to cover the Industrial and Residential study region, as depicted in Figure 2. In the sampling design for the study area, the residential area received one point, the industrial area received three points, the educational area received one point, and the bus stand area received two points.

Table 1 : Sampling Point In The Study

S/N	Location	Latitude	Longitude
	Mosampul	20.554656°N	74.525647°E
	Daregaon (Sajari road)	20.562427°N	74.563858°E
	Quidwai Road	20.552428°N	74.531779°E
	Dyane Industries	50.571913°N	74.527291°E
	Old Bus Stand	20.560797°N	74.525070°E
	New Bus Stand	20.560797°N	74.525070°E
	Golden Nagar	20.548352°N	74.527286°E

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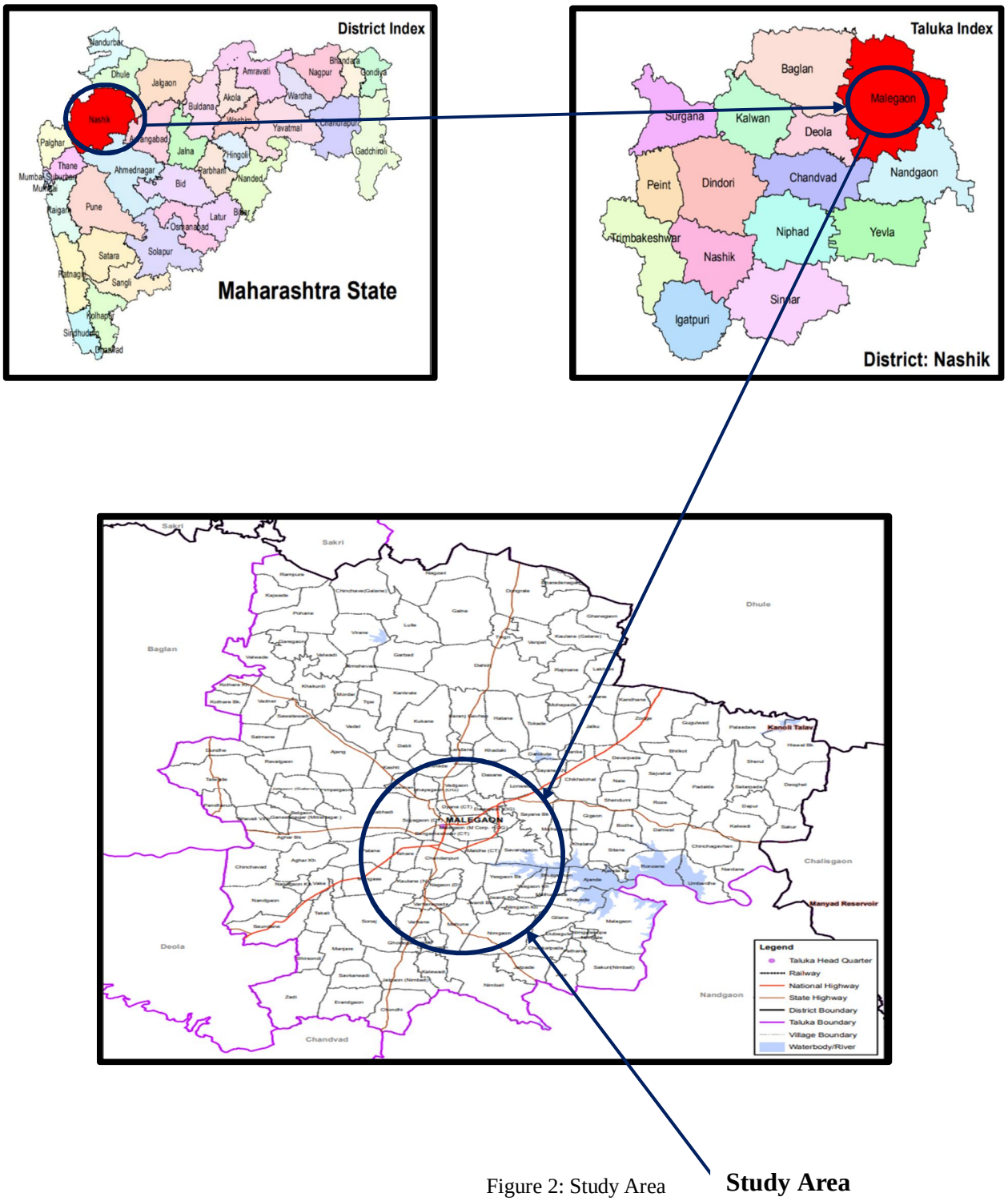


Figure 2: Study Area

V. AIR QUALITY INDEX

"Air Quality Index" is a system that converts the values of various air pollution-related factors (such as SO_2,NO_2,CO,O_3, and Particle Matter) into a single number or a group of numbers. For instance, particulate matter, sulfur dioxide, and nitrogen dioxide are the main pollutants found in the atmosphere of cities.

Table 2 lists the values of the air quality index together with the related quality standards.

Table 2 : List The Values Of The Air Quality Index

Value of Index	Level of Concern	Daily AQI Colour	Description of Air Quality
0-50	Good		Air quality is satisfactory, and air pollution poses little or no risk.
51-100	Moderate		Air quality is acceptable. However, there may be a risk for some people, particularly those who are usually sensitive to air pollution.
101-150	Unhealthy for sensitive groups		Members of sensitive groups may experience health effects. The general public is less likely to be affected
151-200	Unhealthy		Some of the general public may experience health effects; members of sensitive groups may experience more serious health effect.
201-300	Very unhealthy		Health alert: The risk of health effect is increased for everyone.
301 & Higher	Hazardous		Health warning of emergency condition : everyone is more likely to be affected.

VI. RESULT

This study's main objective was to evaluate Malegaon's air quality overall, with a particular emphasis on PM_{10}, NO_2, SO_2.. A number of factors, including natural processes, and industrial activity, have an impact on air quality, which is a serious environmental and public health concern. After calculating the Air Pollution Index, the findings:

Table 3 : Air Quality Value Of Malegaon Region

AIR QUALITY VALUE OF MALEGAON REGION									
LOCATION	PM10 ($\mu g/m^3$)	AQI	SO_2 ($\mu g/m^3$)	AQI	NO_2 ($\mu g/m^3$)	AQI	Final AQI	Value of Index	AQI CATEGORY
Mosampul	130	88	75	100	49	46	100	51-100	Moderate
Daregaon (Sajari Nagar)	52	48	52	71	52	49	71	51-100	Moderate
Quidwai Road	65	55	73	97	40	38	97	51-100	Moderate

Dyane Industries	92	69	107	114	89	88	114	101-200	Unhealthy for sensitive groups
Old Bus Stand	88	67	69	92	78	76	92	51-100	Moderate
New Bus Stand	85	65	49	67	92	91	91	51-100	Moderate
Golden Nagar	90	68	85	104	98	98	104	101-200	Unhealthy for sensitive groups

1) Standard values of AQI based on SO_2, NO_2 and PM_{10} :

Standard values of AQI based on SO_2, NO_2 and PM_{10} are given in table No 4.

Table 4 : Standard values of AQI based on SO_2,NO_2 and PM_{10}

Indian AQI	SO_2	NO_2	PM_{10}
0-50	0-40	0-40	0-50
51-100	41-80	41-80	51-100
101-200	81-380	81-180	101-250
201-300	381-800	181-280	251-350
301-400	801-1600	281-400	351-430
401-500	1600+	400+	430+

2) Air Quality Index and Health Impacts

The Health Impacts as regulated by the authority are given below in Table no 5:

Table 5 : Air Quality Index and Health Impacts

Range In ppm	Air Quality Index	Health Impact
0-50	Good	Less effects
51-100	Moderate	Low breathing distress
101-200	Unhealthy for sensitive groups	Breathing discomfort &soreness to people
201-300	Unhealthy	Breathing disturbs & cause great impact
301-400	Very Unhealthy	Cause respiratory sickness
401-500	Hazardous	Severe respiratory lungs problems

The AQI of seven sites is shown in Figure 3, which depicts the value of AQI for Malegaon city. Overall the value of AQI is more for Dyane Industries due to heavy industrial pollution.

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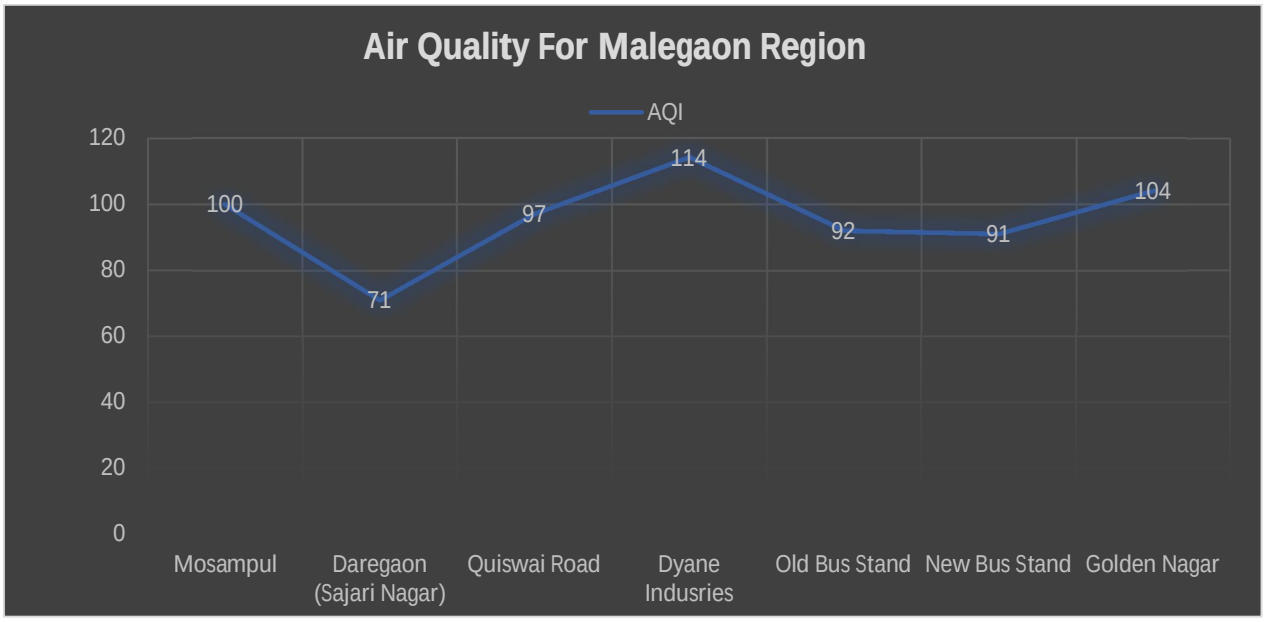


Figure 3 : Chart of Air Quality For Malegaon Region

VII. DISCUSSION

1) The sources of air pollution in our study are industrial source.
2) The air quality of Malegaon city is from AQI 71 to 114 which is unhealthy to breathe for humans.
3) Since AQI has an adverse effect on human health, revising Air quality is evident.
4) The data collected from air quality parameters are like, PM_{10}, NO_2, of each site is discussed in result.
5) Since AQI needs data regarding CO_2, CO, O_3 also, but High Volume Sampler was unable to detect these gases. This is the limitations of our instrument.
6) Mitigation strategies like afforestation, use of filter in chimneys, should be implemented to reverse the effect of air pollution.

VIII. CONCLUSION

1) Air quality of Malegaon is unhealthy and need to be revised.
2) Air quality of Malegaon is affected due to industrial sources.
3) AQI primarily depends upon various factors like, temperature, seasonal variation, altitude, location etc.
4) AQI also depends upon PM_{10} values; the range of AQI varies with value of PM_{10}.
5) AQI need major issues to be addressed, but pollutants like CO, CO_2, and O_3 are not addressed due to limitation of instrument. In future these parameters can be thoroughly monitored.
6) Last but not the least, human intervention in Environment has led to adverse effect of air quality and ultimately resulted in damaged to air quality.

IX. MITIGATION METHODS

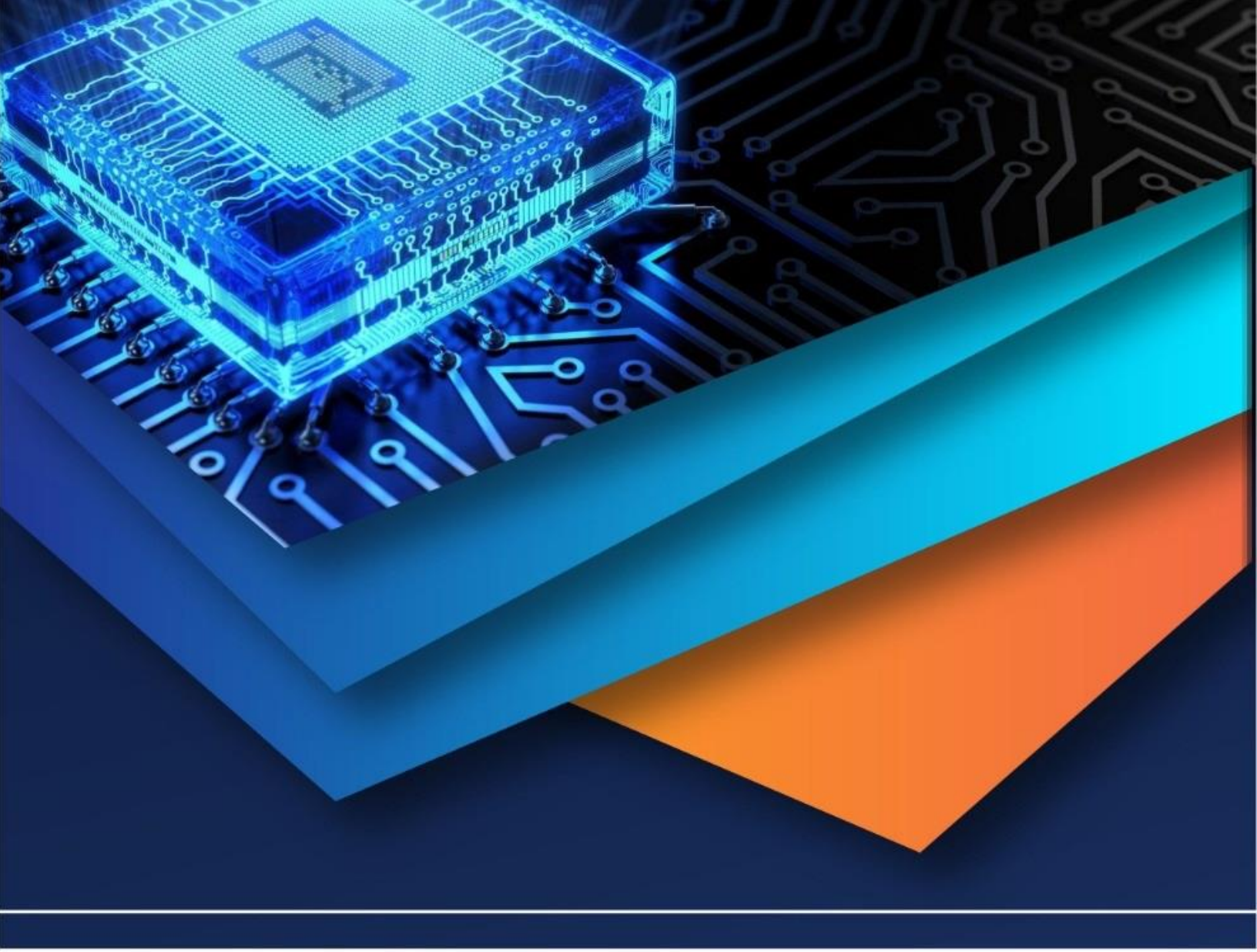
To enhance overall quality of site in Malegaon regarding Air quality some mitigations should be implemented like,

1) Afforestation
2) Air stripers

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