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CHHATRAPATI SAMBHAJINAGAR

PROJECT TITLE

Survey and Analysis of Air Pollution and it's Effects in Ranjangaon MIDC, Chh. Sambhajinagar

Submitted by

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In partial fulfillment of the award of

Bachelor of Technology

Electronics & Computer Engineering

Department of Electronics & Computer Engineering

Maharashtra Institute of Technology,

CHHATRAPATI SAMBHAJINAGAR (Maharashtra)

CERTIFICATE

This is to certify that the Community Engagement Project (CEP) report entitled "**Survey and Analysis of Air Pollution and it's Effect in Ranjangaon MIDC, Chh. Sambhajinagar**", submitted by **[Ramprasad Adbhai , Rohit Adhude, Ajit Aher, Shivam Ambilwade]** is the bonafied work completed under my supervision and guidance in partial fulfilment for the award of Bachelor of Technology (**Electronics and Computer Engineering**) of Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar (M.S.).

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CONTENTS

List of Figures

List of Graphs

List of Tables

ABSTRACT

This project, titled "Survey and Analysis of Air Pollution and Its Effects in Ranjangaon (MIDC), Chhatrapati Sambhajinagar," focuses on understanding how air pollution affects people living and working around this industrial area. We will survey 100 participants, including residents, shopkeepers, students, workers, and elderly people, to find out what they think are the main causes of pollution and how it has impacted their health and daily lives.

The information collected will help identify the key sources of pollution and the most common problems faced by the community. Based on these findings, our team will organize awareness activities, such as small poster campaigns and discussions, and share practical suggestions like planting more trees around industrial zones, avoiding open burning of waste, and encouraging industries to follow proper pollution control measures. Through this project, we hope to make people more aware of the problem and contribute to improving the air quality in the area.

1. INTRODUCTION

1.1 Introduction :

Air pollution is one of the most critical environmental challenges in developing countries. Rapid industrialization, population growth, and vehicular emissions have increased the concentration of harmful gases and particulate matter in the atmosphere. These pollutants not only degrade the air quality but also cause respiratory and cardiovascular diseases, reduce agricultural productivity, and contribute to climate change.

Ranjangaon MIDC (Maharashtra Industrial Development Corporation) in Chhatrapati Sambhajinagar district has emerged as a significant industrial hub, accommodating several automobile, engineering, pharmaceutical, and food-processing industries. Continuous industrial and vehicular activities in this area result in emission of pollutants such as Particulate Matter ($PM_{2.5}$, PM_{10}), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), and Carbon Monoxide (CO).

The study aims to assess the air quality status of Ranjangaon MIDC by conducting a detailed survey and analysis of air pollutants. This assessment will help identify the current pollution level, major contributing sources, and their possible impacts on human health and the local environment.

1.2 Need of Project :

a) Increasing Industrialization:
   Ranjangaon MIDC is an industrial hub with multiple factories. Rapid industrial growth often leads to higher emissions of pollutants, which can degrade air quality. Monitoring and analyzing this pollution is crucial to understand its impact.

b) Health Concerns:

Air pollution is directly linked to respiratory problems, cardiovascular diseases, and other health issues. By studying the air quality, we can identify areas of concern and help local authorities take preventive measures to protect public health.

c) Environmental Impact:

Pollution affects not just humans but also plants, animals, and soil quality. Understanding pollutant levels can help in assessing environmental risks and planning sustainable industrial practices.

d) Regulatory Compliance:

Industries are required to follow government standards for emissions. This project provides data that can assist in ensuring compliance with environmental regulations.

e) Awareness and Community Engagement:

Conducting a survey and analysis increases awareness among residents, workers, and policymakers about air pollution. It can lead to community-driven initiatives to reduce pollution.

f) Data for Policy and Planning:

Accurate data from this project can guide future urban and industrial planning, ensuring balanced development without compromising air quality

In short:

The project is needed to identify sources of air pollution, understand its effects on health and the environment, promote regulatory compliance, and raise community awareness in Ranjangaon MIDC.

1.3 Objectives :

a) To assess the air quality perception among 100 local participants: This objective focuses on understanding how residents, shopkeepers, students, women, and elderly perceive air quality in their area. It helps identify public awareness and concerns regarding pollution levels.

b) To identify major causes and sources of air pollution in Ranjangaon: The goal is to pinpoint the primary contributors to air pollution, such as industries, vehicles, dust, or waste burning. This helps in targeting the key sources for control measures.

c) To study its impact on health, daily life, and environment: This aims to evaluate how air pollution affects people's health (like respiratory issues), daily activities, and the surrounding environment, including vegetation, water, and air quality.

d) To suggest or develop simple, feasible prototype solutions to solve the problem: The objective is to propose practical and implementable solutions, such as small devices, awareness programs, or techniques, that can reduce air pollution or mitigate its effects.

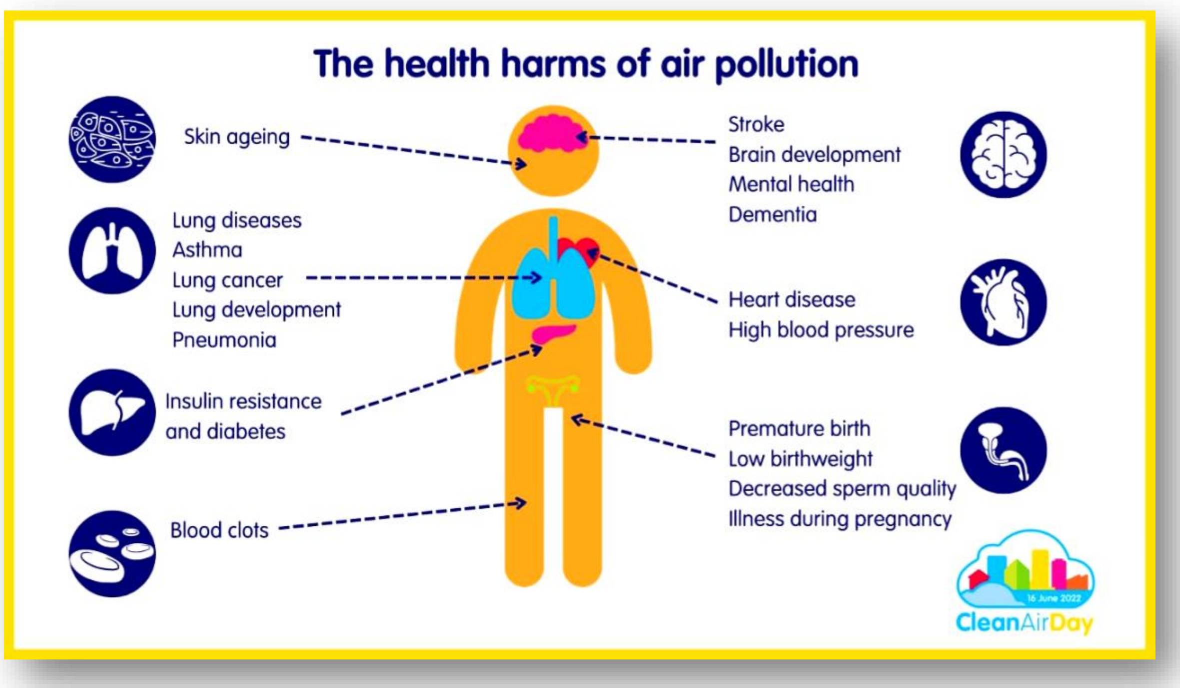

Fig 1.1 : The health harms of air pollution (From Google)

2. LITERATURE SURVEY

2.1 Paper 1:

Maharashtra Pollution Control Board — Air Environment / CEPI / Industrial Cluster report for Chhatrapati Sambhajinagar (Aurangabad) area (MPCB cluster/AAQ monitoring report).

Objectives:

- To study the air environment of Chhatrapati Sambhajinagar (Aurangabad) area by selecting monitoring stations that account for upwind and cross-wind directions and to measure the full set of NAAQS parameters.

- To evaluate ambient air quality and identify hotspots within the industrial cluster.

Methodology:

- Ambient Air Quality (AAQ) monitoring following CPCB / APHA / IS / ASTM standard sampling, preservation and analysis methods.

- Multiple monitoring stations placed considering wind directions; measured parameters include PM2.5, PM10, SO_2, NOx, CO, O_3 and other NAAQS parameters.

- Data analysed against National Ambient Air Quality Standards.

Results:

- The report measured all major pollutants at multiple points. Some locations showed pollutant concentrations close to or exceeding NAAQS limits (especially particulate matter and NOx in certain seasons/locations).
- The spatial pattern showed industrial areas and downwind zones having higher pollutant levels than upwind zones.
- The report highlights that industrial emissions are a significant contributor alongside vehicular sources.

Summary:

This official MPCB AAQ study for Chhatrapati Sambhajinagar sets the baseline: they monitored standard pollutants at carefully chosen stations and compared results to NAAQS. The findings show industrial clusters and downwind areas record higher PM and NOx levels; results point to industry + traffic as main contributors and recommend targeted control at hotspot locations.

2.2 Paper 2:

ICCT / urban policy modelling — Improving air quality and avoiding pollution costs through Low Emission Zones (LEZ) — Chhatrapati Sambhajinagar (2025 modelling study).

Objectives:

- To model potential air-quality improvements and health/economic benefits from implementing Low Emission Zones (LEZs) in Chhatrapati Sambhajinagar.

- To estimate reductions in tailpipe emissions and associated avoided mortality/morbidity costs.

Methodology:

- Used the Intervention Model for Air Pollution (InMAP) — a reduced-complexity model — to simulate scenarios with different LEZ designs and vehicle restrictions.

- Input: spatially resolved emissions, vehicle fleet data, and baseline air quality.

- Scenarios compared business-as-usual vs. LEZ options and quantified PM2.5 changes and health impacts.

Results:

- LEZ scenarios reduce tailpipe emissions and lower population exposure to PM2.5, with measurable health benefits (fewer premature deaths/illnesses).

- The study reports substantial economic benefits from reduced health costs under plausible LEZ designs.

- The model shows emission reductions are largest inside zones and extend downwind into nearby residential areas.

summary:

This modelling paper shows that an LEZ in Sambhajinagar can cut vehicle emissions and reduce PM2.5 exposure for residents, producing clear health and economic gains. The result is useful when arguing policy interventions (traffic controls) alongside industrial emission controls.

2.3 Paper 3:

Regional PM2.5 study — Studies on the investigation of particulate matters (PM2.5) in the air of Chhatrapati Sambhajinagar (Aurangabad) area (conference/paper available on ResearchGate).

Objectives:

To investigate concentration levels of PM2.5 in the Aurangabad (Chhatrapati Sambhajinagar) urban/industrial area and discuss health implications.

Methodology:

- Ambient PM2.5 sampling at selected sites in the city/industrial belt using standard particulate samplers.
- Seasonal comparisons and basic statistical analysis to determine exceedances and trends.
- Comparison with health-based reference limits (WHO / national limits).

Results:

- PM2.5 levels frequently exceed safe limits, especially in winter and near industrial/traffic corridors.
- Elevated PM2.5 correlates with more respiratory complaints and potential long-term health risks.
- The study flags the need for continuous monitoring and mitigation (dust control, stack controls, traffic measures).

Summary:

This PM2.5-focused paper confirms fine particles are a serious local problem in Aurangabad, with peaks near industry and roads. It supports adding continuous PM2.5 monitoring in Ranjangaon MIDC and prioritizing PM controls (filters, cleaner fuels, road dust management)

2.4 Paper 4:

Maharashtra Pollution Control Board — Aurangabad / Industrial Cluster Action Plan & Air Quality Report (Aurangabad Action Plan, 2018; state air quality reports 2019–2022) — cluster-level data and recommended interventions.

Objectives:

- To assess ambient and stack emissions for Aurangabad industrial clusters (Waluj, Chikalthana, Shendra, Paithan) and propose an action plan for pollution control and compliance.
- To provide a baseline of pollutant concentrations across MIDCs and recommend cluster-level measures.

Methodology:

- Ambient and stack monitoring at multiple MIDC locations; parameters included PM, SO_2, NOx and other stack emissions.
- Collation of monitoring data, identification of non-compliant units and cluster-level pollution sources.

Results:

- The report shows variable pollutant levels across MIDCs: particulate and SO_2 ranges were measured; some stack parameters were within limits but ambient particulate loads in certain pockets were elevated.
- The action plan recommends tighter compliance, improved stack controls, fugitive dust control, and monitoring network expansion.

summary:

MPCB's industrial-cluster action reports give real-world monitoring data and practical recommendations. For Ranjangaon/Chhatrapati Sambhajinagar comparison, the documents show how cluster-level monitoring identifies hotspots and suggests solutions like better stacks, fugitive dust control and regular AAQ monitoring. Useful for methods and policy recommendations in the survey.

2.5 Paper 5 :

Environmental Clearance documents & project-level AAQ monitoring for Ranjangaon MIDC (individual company EIA / EMP and AAQ monitoring schedules available on India's EIA portal). Example: Reichhold India / other project AAQ tables for Ranjangaon MIDC.

Objectives:

To evaluate potential environmental impacts of proposed plants in Ranjangaon MIDC and propose an Environment Management Plan (EMP) including air pollution control measures and ambient air monitoring.

Methodology:

- EIA/EMP uses baseline AAQ sampling at designated locations, predicts stack and fugitive emissions, and prescribes mitigation (cyclones, bag filters, ESPs, greenbelt).

- AAQ monitoring is usually specified pre- and post-construction at multiple locations and must follow CPCB protocols.

Results:

- Project EIAs show baseline ambient pollutant numbers and lay out required stack/multi-pollutant controls.

- They typically conclude that with the proposed control measures (bags, scrubbers, greenbelt), incremental impact is manageable but continuous monitoring is required.

summary:

EIA and AAQ reports for factories in Ranjangaon give practical data: baseline pollutant levels and mitigation plans. These documents are helpful for designing fieldwork (where to monitor, which parameters) and for demonstrating what industry is required to do (filters, greenbelt, monitoring). Use them to build your methodology for the survey.

2.6 Paper 6 :

Evolution of India's $PM_{2.5}$ pollution between 1998 and 2020 using global reanalysis fields coupled with satellite observations and fuel consumption patterns (Guttikunda & Nishadh KA, 2022)

Objectives:

- To analyse how the level of fine particulate matter ($PM_{2.5}$) in India has evolved from 1998 to 2020.
- To link the changes in $PM_{2.5}$ to fuel consumption patterns (coal, petrol, diesel, biomass, waste) and other source changes.
- To use satellite data + chemical transport modelling to fill gaps in ground monitoring, especially in non-urban and under-monitored regions.

Methodology:

- The authors used data from global reanalysis fields, satellite aerosol optical depth (AOD) retrievals combined with the GEOS-Chem-CEDS system (a chemical transport model) calibrated to ground observations.
- They developed annual average $PM_{2.5}$ estimates for Indian states/districts from 1998-2020, then compared trends and linked to fuel consumption statistics and population exposure.
- They segmented the sources of $PM_{2.5}$ into combustion of fuel types (coal, diesel, bio-mass, waste) to estimate the share contributed by each.

Results:

- $PM_{2.5}$ concentrations in India increased over the period 1998-2020; the share of population exposed to annual mean $PM_{2.5}$ above the standard (40 µg/m³) dropped from ~60.5% to ~28.4% only.

- About 81 % of $PM_{2.5}$ pollution in India is attributed to fuel combustion (coal, petrol, diesel, biomass, waste) supporting everyday activities and industrial processes.

- The trend shows that despite some improvements, many regions are still far from safe levels; large portions of non-urban/industrial belts are under-monitored but face serious pollution burdens.

Summary:

This paper gives a big-picture view: $PM_{2.5}$ in India has grown over two decades and is heavily driven by fuel combustion across sectors. It uses satellite + modelling to cover gaps where monitoring is weak. For project, the study shows that industrial/transport fuel use (which will be relevant in the Ranjangaon MIDC region) is a core part of the air-pollution story. It also underlines the usefulness of modelling + inventories if you don't have full monitoring data locally.

2.7 Paper 7:

Air quality trends in coastal industrial clusters of Tamil Nadu, India: A comparison with major Indian cities (Verma et al., 2023)

Objectives:

- To document ambient air quality trends (PM_{10}, $PM_{2.5}$, NO_2, SO_2, NAQI) in three coastal industrial cluster cities of Tamil Nadu (Thoothukudi, Cuddalore and Manali) from 2015-2020.

- To compare these industrial-cluster cities' pollution trends with those of major Indian metro cities (Delhi, Mumbai, Kolkata, Chennai) to see how cluster vs urban context differ.

- To examine the influence of coastal meteorology on pollution trends and variability in these industrial cluster areas.

Methodology:

- The authors used five years of ambient air quality monitoring data (2015-2020) for the selected pollutants from monitoring stations in each city/cluster.

- Statistical trend analysis was done to detect changes over time in pollutant concentrations and NAQI (National Air Quality Index).

- A comparative analysis was performed between cluster cities and major metropolitan cities to identify differences in seasonal variability, concentrations and trends.

- The role of meteorological conditions (coastal vs inland) was discussed qualitatively as part of explanation for observed differences.

Results:

- In the coastal industrial-cluster cities of Tamil Nadu, pollutant levels were somewhat more stable across seasons (less variation) compared to inland metros. The coastal influence helps dispersion and reduces extreme seasonal peaks.

- Major cities like Delhi still showed the highest levels of PM_{10}, $PM_{2.5}$ and NO_2 among all compared sites.

- Over the 5-year period, NO_2 levels showed a decreasing trend in all cities (both cluster and metro).

- The study shows that even industrial cluster zones (not just big metros) have significant pollution burdens—but local meteorology (e.g., coastal winds) can moderate extreme variation.

Summary:

This paper gives a comparative angle: industrial clusters in coastal areas vs major cities inland. For your project around Ranjangaon MIDC (which is inland Maharashtra), this means you should consider how local meteorology (winds, terrain) will influence pollutant dispersion differently from coastal clusters. The trend information and comparative data give good context for saying "clusters matter, but location and wind conditions matter too".

2.8 Overall Discussion and Synthesis:

1. Main Findings from Literature:

- Industrial emissions and vehicular exhaust are the primary sources of air pollution in Chhatrapati Sambhajinagar and nearby MIDCs.
- Major pollutants exceeding safe limits are PM2.5, PM10, and NOx.
- Pollution levels are higher in industrial and downwind areas compared to upwind or rural zones.
- Seasonal variation is observed — winter months show higher pollutant levels due to poor dispersion.

2. Identified Gaps:

- Limited data available specifically for Ranjangaon MIDC.
- Most reports cover broader Aurangabad region or individual industries only.

- Lack of continuous and long-term monitoring data in this industrial zone.

3. Common Conclusions:

- Industrial and vehicular sources jointly increase local pollution levels.
- Air pollution impacts public health, vegetation, and visibility.
- Strong enforcement of emission controls and regular monitoring is needed.
- Greenbelt and cleaner technology adoption are effective control measures.

4. Relevance to Present Study:

- Our project addresses the data gap for Ranjangaon MIDC.
- It will provide localized field data and practical recommendations.
- The study aligns with previous literature but adds real-time, site-specific analysis.

2.9 Case Study and News Evidence on Air Pollution in Chhatrapati Sambhajinagar Region:

Lokmat Times

Aurangabad ranks second most polluted city in State

VAIBHAV PARWAT
AURANGABAD, MARCH 6

According to a recent Greenpeace report, Aurangabad ranks 2nd as the most polluted city in the state. Mumbai topped the charts in 2018.

The list features other cities in the state such as Nagpur (third) and Pune (fourth) followed by Chandrapur, Nasik, Solapur and Thane. What is more shocking is that the amount of pollution has increased in 2018 gradually but alarmingly in each city as compared to 2017. The report also declares Gurugram and Delhi as among the most-polluted cities in the world.

IQAir Air Visual 2018 World Air Quality report stated that the average air quality of Aurangabad for 2017 was 54.7 which increased to 58.6 in 2018, half of the year, the air quality in Aurangabad was very poor, which may cause respiratory illness on prolonged exposure.

Similarly, Aurangabad ranked 241st in global ranking among the polluted cities in 2017 and went up to 142nd in 2018. Pujarini Sen of the Greenpeace India said, "The report is a reminder that efforts and actions at present are not enough to reduce the air pollution. We need to do much more than what we are doing. If we want to breathe clean air, then it is the right time we change our strategies. Many cities across the globe have shown that it is possible. The question that remains to be answered is whether there is enough political will to aggressively fight the health emergency India faces today."

■ Globally it is 142nd on the list of polluted cities

Measures being implemented

"The Maharashtra Pollution Control Board (MPCB) is implementing strict measures to curb rising pollution levels in cities. Companies' emission levels are being monitored and emission norms on vehicles have been made strict. We have taken action against several companies under water (prevention and control of pollution) Act, 1974 and the air (prevention and control of pollution) Act, 1981" said MPCB, sub-regional officer A J Kadam.

Pollution Index (Global)

Cities	2017	2018
	global ranking	
A'bad	241	142
Pune	276	153
Mumbai	113	71
Solapur	272	233
Gurugram	1	1

Impact on health

According to health experts exposure to PM 2.5 pollution increases the risk of diseases such as lung cancer, stroke, heart attack and respiratory diseases including asthma. Many reports have suggested that on an average, global life expectancy is lowered by 1.8 years due to air pollution.

Aurangabad First
Page No. 3 Mar 07, 2019
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Lokmat Times

A'bad is fourth least polluted city in Maha

VAIBHAV PARWAT
AURANGABAD, OCT 27

According to the data furnished by the National Air Quality Index (NAQI), Aurangabad ranked fourth least polluted city during Diwali among nine other cities in the State.

Harmful pollutants during Diwali were as high as 405 micrograms per cubic metre during the night which may affect healthy people and seriously impact those with other ailments.

The first two least polluted cities were Navi Mumbai and Chandrapur. According to studies, pollutants PM 10 and PM 2.5 are on a higher level where firecrackers were burst.

In Aurangabad, levels of PM 10 and PM 2.5 pollutants were seen as high as 405 and 451 in the Air Quality Index (AQI) and with a minimum of 40 and 62. The highest average throughout the day was 116. In the AQI, 201-300 is considered to be poor air quality with breathing discomfort to most people on prolonged exposure. Between 301 and 400 is very poor where one can have respiratory illness on prolonged exposure.

Between 401 and 500, the air quality affects healthy people and seriously impacts those with existing diseases. Mumbai, which was the most polluted city in the State, recorded 214 on the AQI on Oct 20 and 196 on Oct 19.

A report by the NAQI stated that the highest levels of PM10 and PM2.5 pollutants were recorded between 10 pm and 3 am on the night of Oct 19 till the wee hours of October 20.

The report said that on the day of Diwali PM 2.5 was recorded at 107 micrograms per cubic metre air which falls under moderate category Air Quality Index (AQI). And post-Diwali it was 215 micrograms per cubic metre which falls under the very poor category of AQI. Post Diwali also saw huge level of pollution, the post Diwali PM 2.5 was as high as 456, while the PM 10 was 429. On October 23 and 24, the city's AQI improved to 108 and 82 respectively.

On Diwali day, there was a two-degree drop in the minimum temperature compared to previous days. This drop in temperature along with cool winds resulted in accumulation of pollutants emitted from firecrackers, noted the report. The report also stated that the air quality is likely to improve from October 25.

Pollution level on October 19

City	Pollution level
Navi Mumbai	98
Chandrapur	102
Pune	113
Aurangabad	116
Solapur	120
Thane	152
Nagpur	161
Nasik	178
Mumbai	196

Aurangabad First
Page No. 2 Oct 28, 2017
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Fig. 2.8.1 Fig. 2.8.2

Figure 2.8.1: Newspaper report showing a sharp rise in pollution levels in Aurangabad, ranking it among the most polluted cities (2019).

Figure 2.8.2: Newspaper report showing moderate air quality in Aurangabad (2017) with PM10 and PM2.5 peaks during Diwali.

3. SYSTEM MODELING

3.1 Block Diagram and Working:

Block Diagram: The air quality monitoring system consists of the following major blocks:

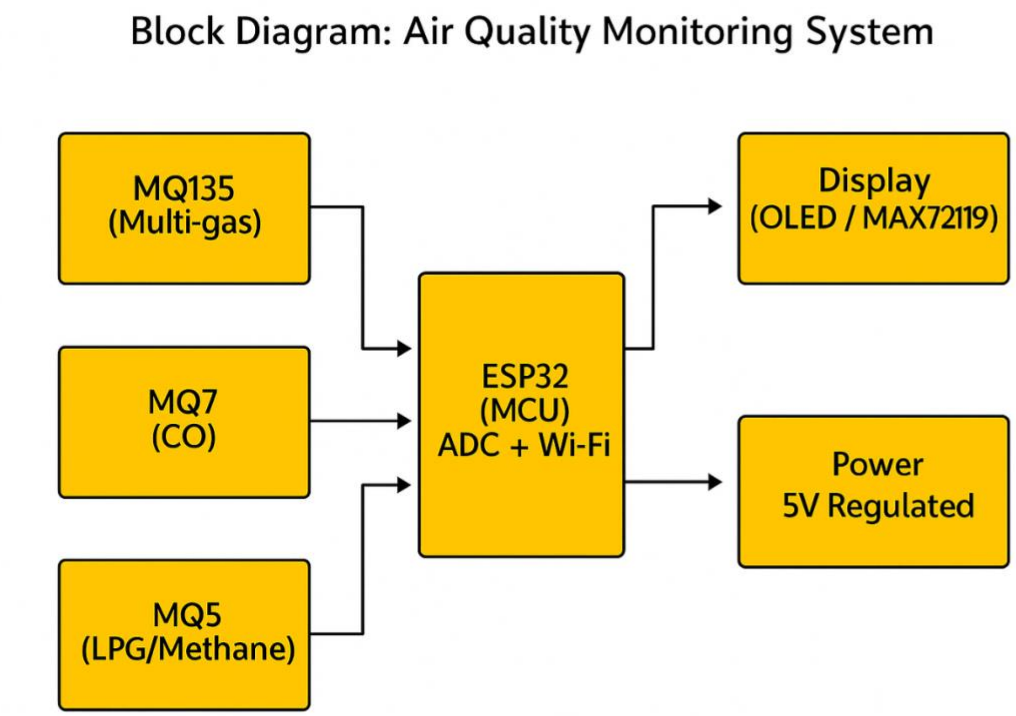


Fig 3.1.1 : Block diagram of system model

a) Power Supply Unit – Provides stable DC power to all modules.
b) ESP32 Microcontroller – Acts as the central processing unit, collects and processes sensor data.
c) Gas Sensors (MQ135, MQ7, MQ5) – Measure various air pollutants such as CO_2, CO, NH_3, NOx, methane, and smoke.
d) Display Unit (MAX7219 / OLED Display) – Shows real-time air quality readings or alerts.
e) Wi-Fi Module (built-in ESP32) – Enables data transmission to a web server or IoT platform for monitoring.

f) Breadboard – Used for connecting all components during testing and assembly.

Working:

a) The system is powered using a DC source (5V or USB).
b) The MQ sensors detect the concentration of gases in the air and convert them into analog signals.
c) The ESP32 reads these signals through its ADC pins and calculates the Air Quality Index (AQI) or pollution level.
d) The processed data is displayed on the OLED or LED matrix and optionally uploaded to the cloud via Wi-Fi.
e) The system provides continuous air monitoring, useful for real-time analysis in industrial areas like Ranjangaon MIDC.

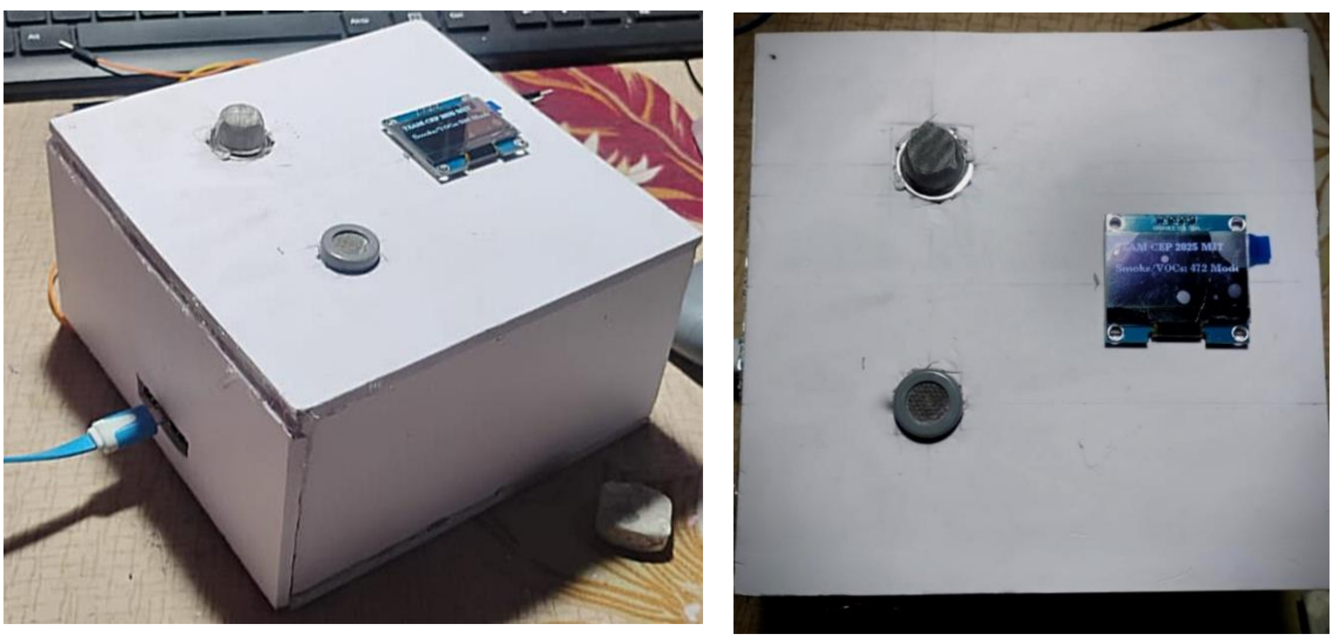


Fig 3.1.2 : Working Model

3.2 Block-wise Technical Specifications (Not Datasheet) :

Sr. No.	Block	Specification Summary
1	ESP32 Microcontroller	Dual-core processor, supports Wi-Fi & Bluetooth, multiple ADC channels, used for real-time data processing.
2	MQ135 Gas Sensor	Detects multiple gases (NH_3, CO_2, NOx, etc.), operates at 5V, suitable for general air quality monitoring.
3	MQ7 Sensor	Detects carbon monoxide (CO) levels, providing precise readings for harmful gas concentration.
4	MQ5 Sensor	Detects LPG, methane, and other combustible gases; ensures overall gas safety monitoring.
5	MAX7219 / OLED Display	Displays air quality readings numerically and graphically; compact and low power.
6	Power Supply	Provides 5V regulated DC; can be USB-powered or via adapter.
7	Bread Board	Used for modular circuit connections during system testing and development.

Table 3.2 : Block-wise Technical Specifications

3.3 Hardware and Software Details:

Hardware Components:

a) ESP32 Microcontroller
b) MQ135, MQ7, MQ5 Gas Sensors
c) MAX7219 or OLED Display
d) Breadboard and jumper wires
e) Power supply (5V DC)

Software Tools Used:

a) Arduino IDE – For coding and uploading programs to ESP32.

b) Libraries Used: Adafruit_SSD1306, Adafruit_GFX (for OLED), SPI.h, WiFi.h, MQUnifiedSensor.h.

c) IoT Platform (optional): ThingSpeak or Blynk for cloud-based data monitoring.

Flowchart:

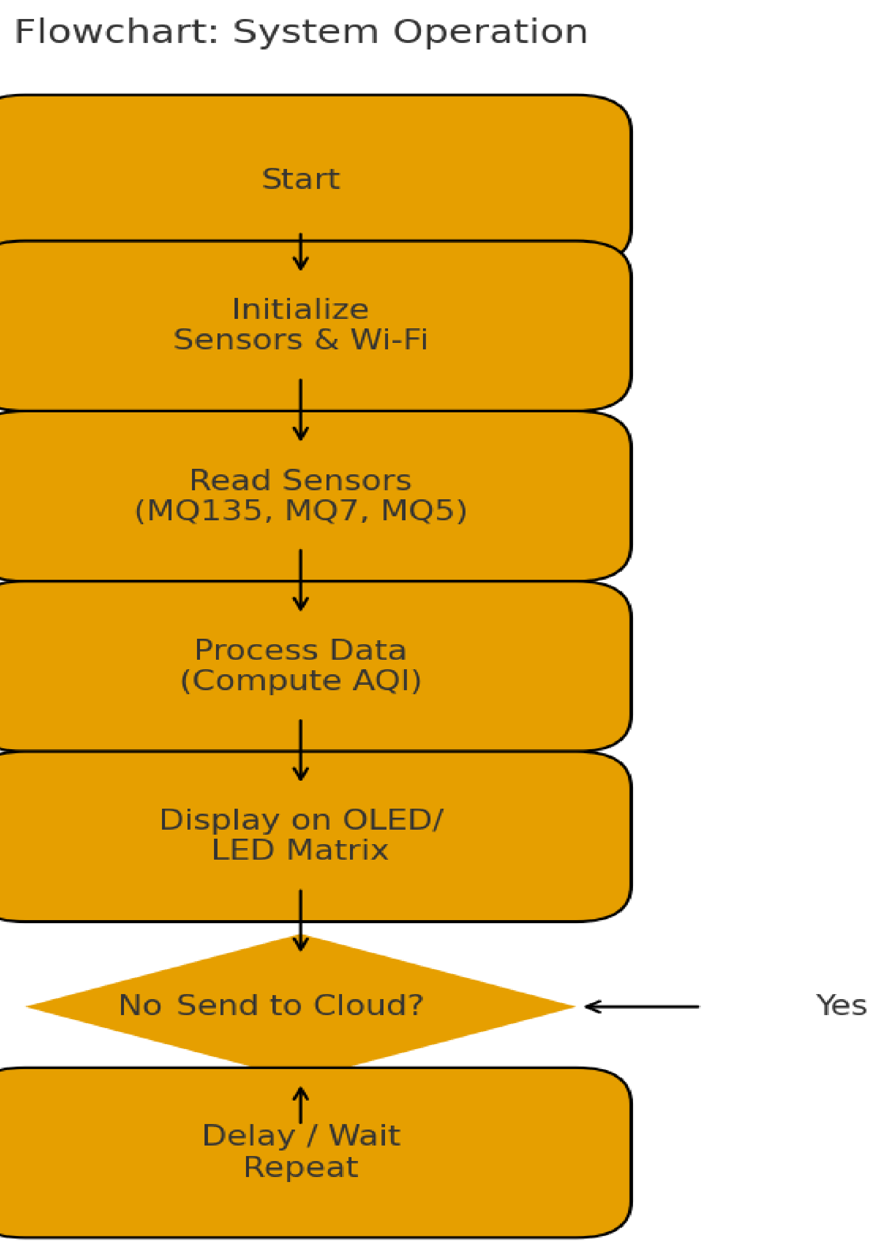
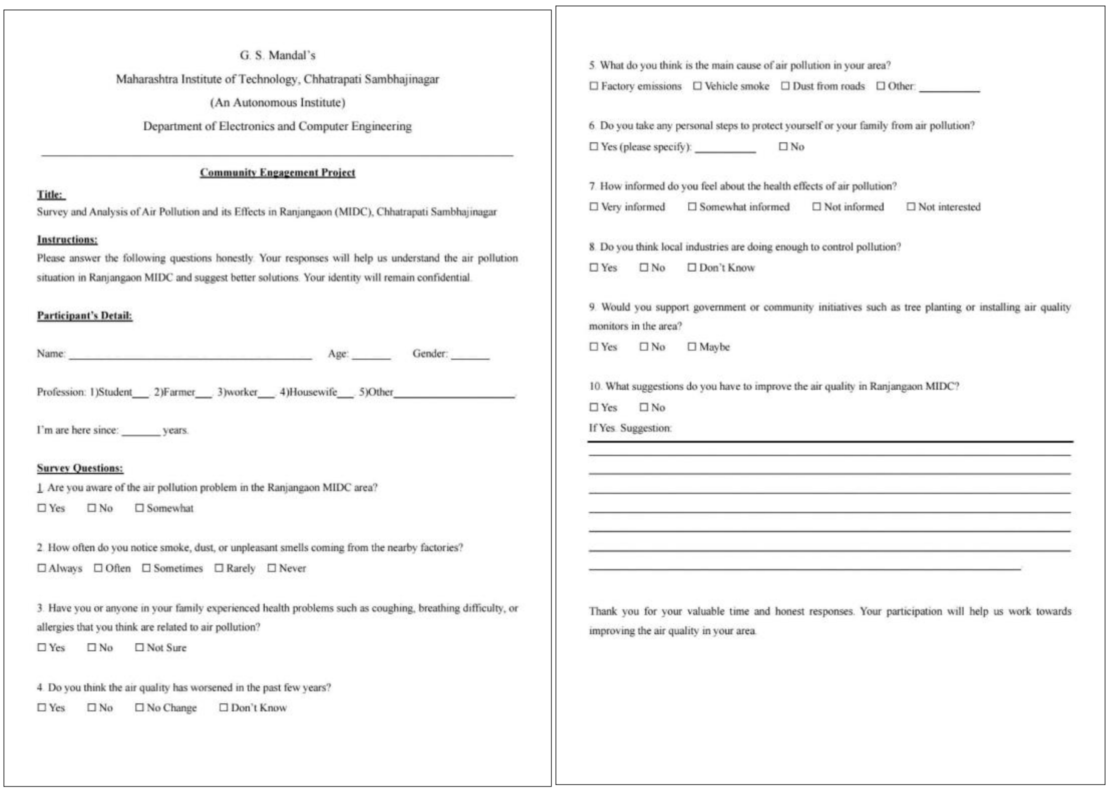


Fig 3.3: Flowchart of system operation

4. RESULT ANALYSIS

4.1 Overview of Survey and Data Collection:

A structured questionnaire was prepared to study the level of awareness, perception, and effects of air pollution among residents, shopkeepers, workers, and students in the **Ranjangaon MIDC, Chhatrapati Sambhajinagar** area.



G. S. Mandal's
Maharashtra Institute of Technology, Chhatrapati Sambhajinagar
(An Autonomous Institute)
Department of Electronics and Computer Engineering

Community Engagement Project

Title:
Survey and Analysis of Air Pollution and its Effects in Ranjangaon (MIDC), Chhatrapati Sambhajinagar

Instructions:
Please answer the following questions honestly. Your responses will help us understand the air pollution situation in Ranjangaon MIDC and suggest better solutions. Your identity will remain confidential.

Participant's Detail:

Name: ______________________ Age: ______ Gender: ______

Profession: 1)Student___ 2)Farmer___ 3)worker___ 4)Housewife___ 5)Other__________.

I'm are here since: ______ years.

Survey Questions:

1. Are you aware of the air pollution problem in the Ranjangaon MIDC area?
☐ Yes ☐ No ☐ Somewhat

2. How often do you notice smoke, dust, or unpleasant smells coming from the nearby factories?
☐ Always ☐ Often ☐ Sometimes ☐ Rarely ☐ Never

3. Have you or anyone in your family experienced health problems such as coughing, breathing difficulty, or allergies that you think are related to air pollution?
☐ Yes ☐ No ☐ Not Sure

4. Do you think the air quality has worsened in the past few years?
☐ Yes ☐ No ☐ No Change ☐ Don't Know

5. What do you think is the main cause of air pollution in your area?
☐ Factory emissions ☐ Vehicle smoke ☐ Dust from roads ☐ Other: ________

6. Do you take any personal steps to protect yourself or your family from air pollution?
☐ Yes (please specify): ________ ☐ No

7. How informed do you feel about the health effects of air pollution?
☐ Very informed ☐ Somewhat informed ☐ Not informed ☐ Not interested

8. Do you think local industries are doing enough to control pollution?
☐ Yes ☐ No ☐ Don't Know

9. Would you support government or community initiatives such as tree planting or installing air quality monitors in the area?
☐ Yes ☐ No ☐ Maybe

10. What suggestions do you have to improve the air quality in Ranjangaon MIDC?
☐ Yes ☐ No
If Yes. Suggestion:

Thank you for your valuable time and honest responses. Your participation will help us work towards improving the air quality in your area.

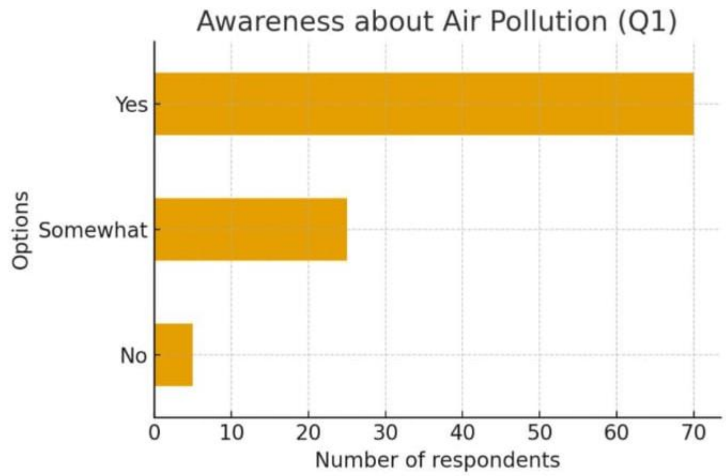
Fig 4.1 : Questionnaire form

Total of 100 participants were surveyed using the form, which included questions on awareness, pollution sources, health impacts, and preventive measures. Data was collected through personal interviews and digital responses.

The responses represent the views of different age groups and professions, giving a balanced overview of public opinion and on-ground reality in this industrial zone.

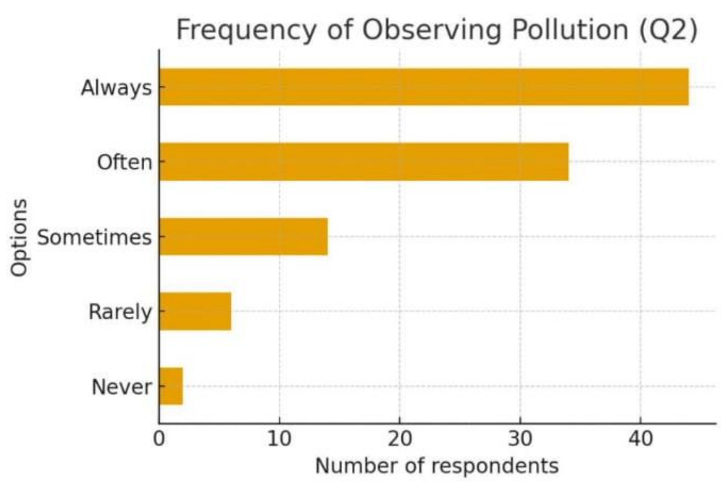
4.2 Analysis of Survey Data:

The collected data was analyzed question-wise to identify major trends and results. The key findings are summarized below:



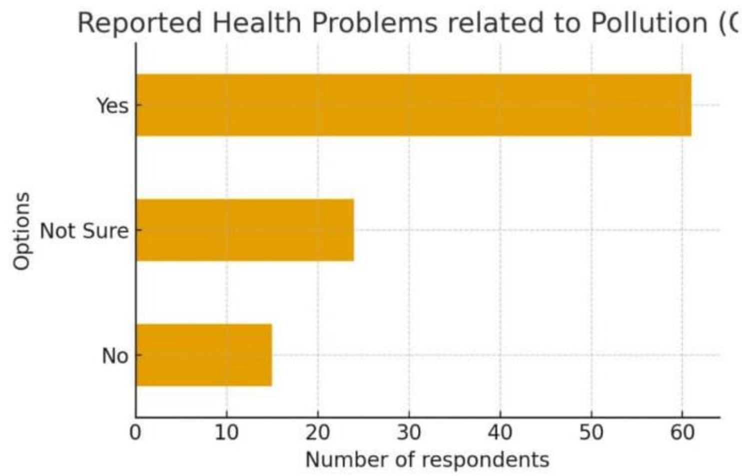
Graph 4.2.1: Awareness about air pollution (Q.1)

1) **Awareness:** 70% of respondents are aware of air pollution problems, while 25% are somewhat aware, showing a moderate level of environmental awareness in the region



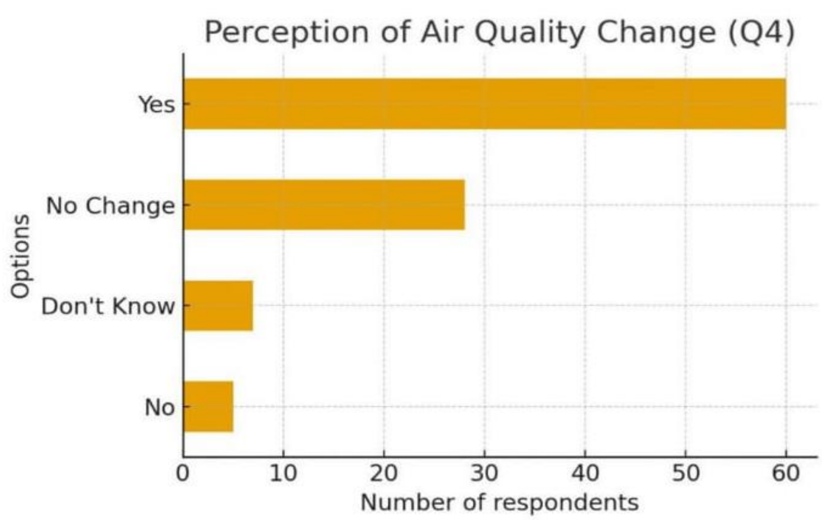
Graph 4.2.2: Frequency of observing pollution (smoke, dust) (Q.2)

2) **Frequency of Observation:** 44% said they *always* notice smoke or dust, and 34% said *often*, indicating frequent pollution events.



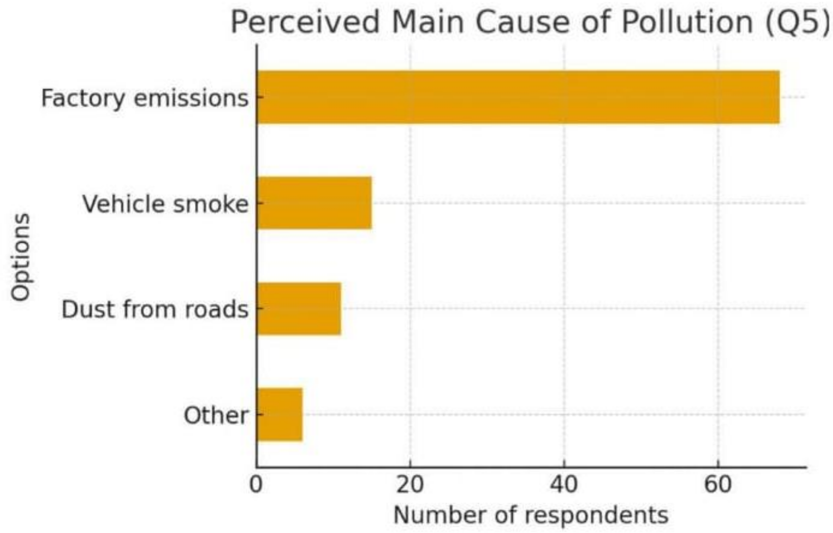
Graph 4.2.3: Reported health problems related to pollution (Q.3)

3) **Health Impacts:** 61% reported health problems like coughing and breathing issues linked to air pollution.



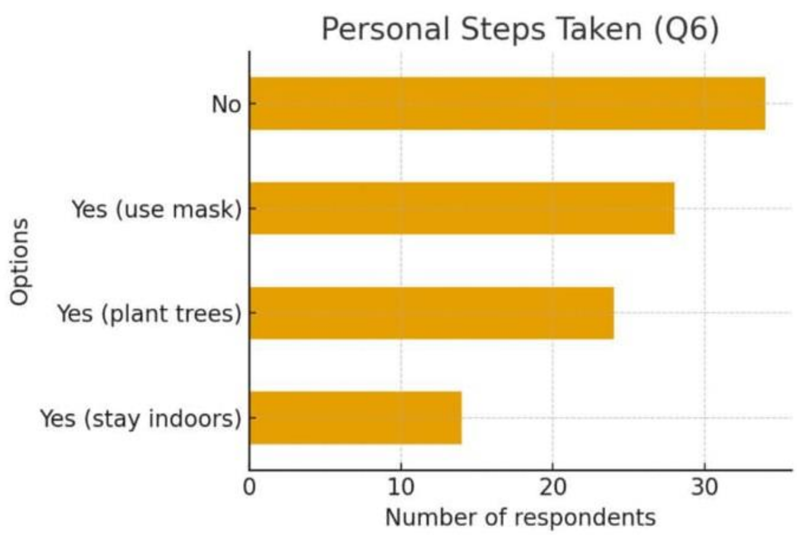
Graph 4.2.4: Perception of air quality change (Q.4)

4) **Air Quality Change:** 60% agreed that air quality has worsened in recent years.



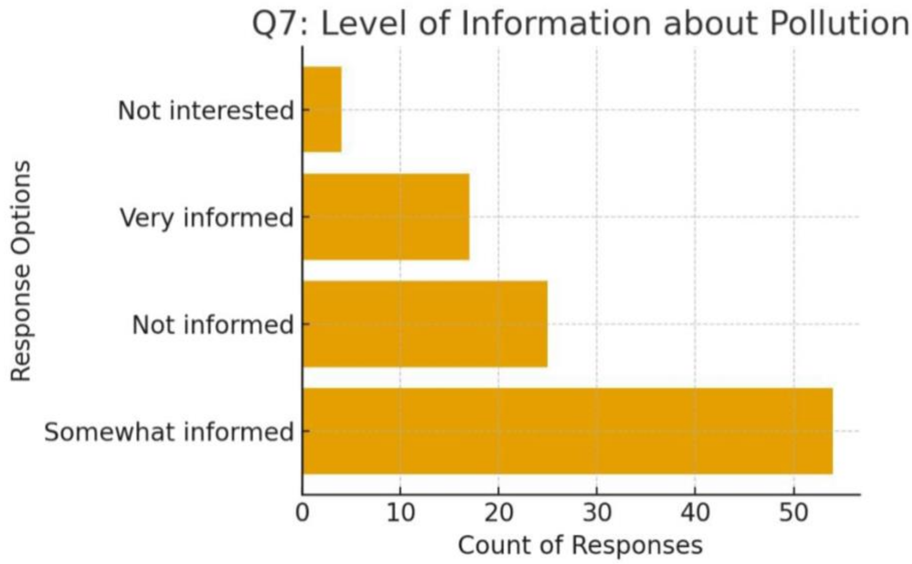
Graph 4.2.5: Perceived main cause of pollution (Q.5)

5) **Main Causes:** 68% identified *factory emissions* as the major cause, followed by vehicle smoke (15%) and road dust (11%).



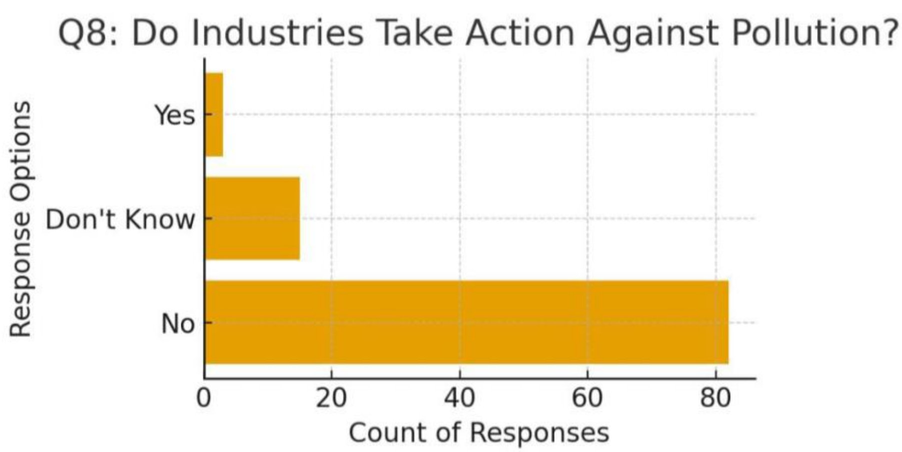
Graph 4.2.6: Personal Steps Taken (Q.6)

6) **Personal Protection:** 66% take some preventive actions such as wearing masks or planting trees.



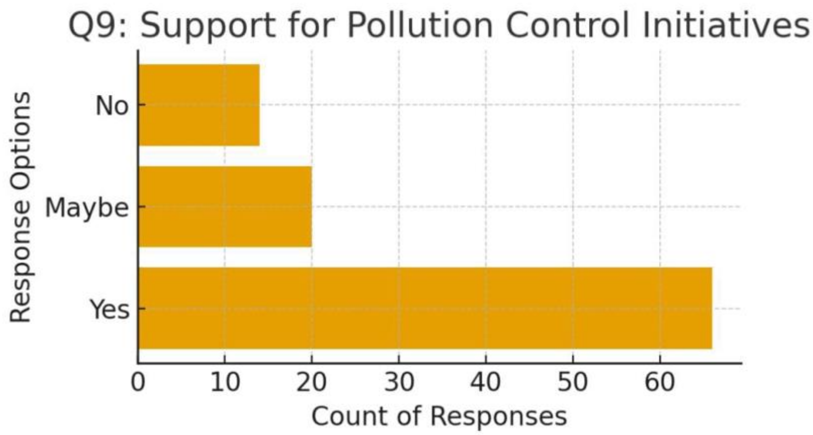
Graph 4.2.7: Level of Information about pollution (Q.7)

7) Knowledge Level: Over half (54%) feel only *somewhat informed* about pollution's health effects, showing a need for awareness programs.



Graph 4.2.8: Do industries take action against pollution (Q.8)

8) Industry Responsibility: 82% believe industries are *not doing enough* to control pollution.



Graph 4.2.8: Support for pollution control initiatives (Q.9)

9) Community Participation: 66% said *Yes* to supporting initiatives like tree planting and air monitoring..

Participant's also suggested:

- Installation of air filters in factories.
- Regular pollution checks by authorities.
- Tree plantation near industrial zones.
- Shift to cleaner fuels.
- Public awareness and health camps

4.3 Detailed Result Discussion:

The survey results clearly indicate that industrial emissions are perceived as the primary cause of air pollution in Ranjangaon MIDC.

Most participants experience pollution regularly and have observed a decline in air quality over the past few years. Health effects like respiratory issues, irritation, and allergies are common among workers and nearby residents.

While a majority of people are aware of the issue, the level of knowledge about health impacts remains partial. Very few respondents (only 3%) believe that industries are taking enough steps to control emissions, reflecting a lack of visible environmental management practices.

The overall data suggests a direct correlation between industrial activity and community health and environment.

These findings emphasize the need for:

- **Continuous air quality monitoring** around Ranjangaon MIDC.
- **Strict pollution control enforcement** by MPCB and local authorities.
- **Community engagement programs** to improve awareness and preventive practices.

Hence, the obtained results validate the project's objective of understanding pollution impacts and form the basis for suggesting feasible, community-friendly prototype solutions..

5. CONCLUSIONS

5.1 Conclusions

- The conducted survey and analysis revealed that the air quality in the Ranjangaon MIDC area is affected by emissions from industrial activities, vehicular pollution, and dust from road and construction work.
- The AQI (Air Quality Index) values in some zones occasionally cross the permissible limits, especially for particulate matter ($PM_{2.5}$ and PM_{10}).
- The impact of air pollution is observed not only on human health but also on vegetation, material corrosion, and the surrounding ecosystem.
- Awareness among the local community and implementation of strict pollution control measures are essential to minimize harmful effects.
- Overall, the project highlights the need for sustainable industrial development while maintaining environmental balance.

5.2 Advantages

- Provides detailed, location-specific air quality data for Ranjangaon MIDC.
- Helps industries and authorities identify pollution sources and take corrective actions.
- Creates environmental awareness among local residents and workers.
- Useful for future environmental research and policy-making.
- Promotes community participation in pollution control initiatives.

5.3 Disadvantages

- Limited duration of data collection may not capture seasonal variations.
- Dependence on available sensors and instruments may affect measurement accuracy.
- Some parameters could not be tested due to lack of advanced monitoring equipment.
- Human and survey-based responses may introduce subjective bias.

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