Sep 2025

Air Quality Index (AQI) Report

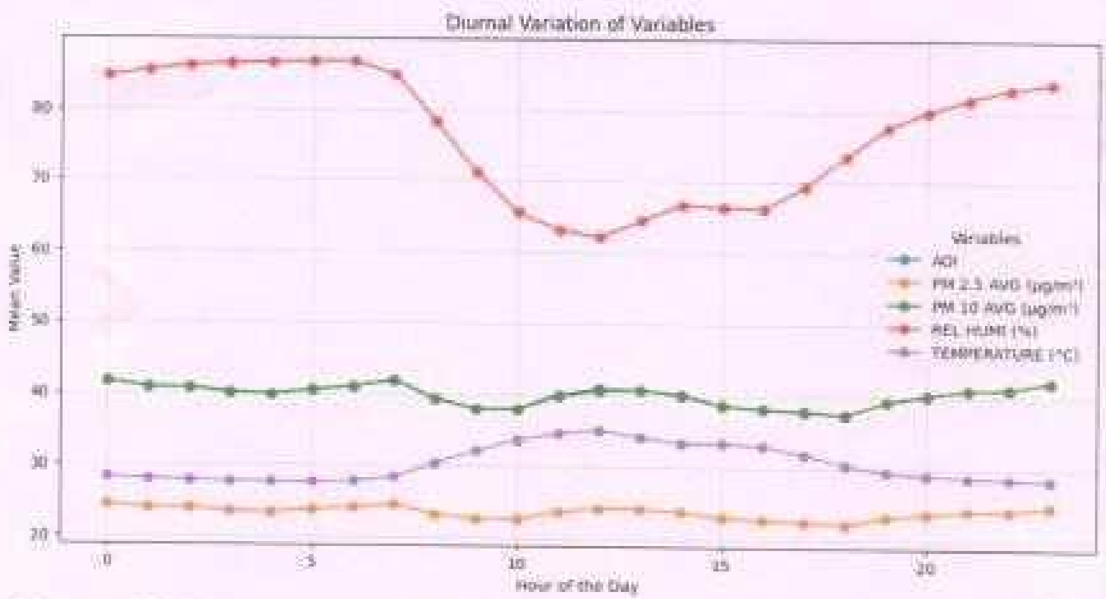
Data Source: West Bengal Pollution Control Board
Station: Bhasa,2nd Campus of Asutosh College
(Sept_2025)

Introduction

Air Quality Index (AQI) is a standardized indicator used to measure and report the quality of air in a specific area. It translates complex air pollution data into a single number and colour code, making it easy for the public to understand how clean or polluted the air is. AQI mainly considers pollutants such as PM2.5, PM10, nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), and carbon monoxide (CO). Higher AQI values indicate poorer air quality and greater health risks, especially for vulnerable groups. AQI helps people take precautionary measures and supports authorities in managing air pollution.

AQI serves as an important tool for environmental monitoring and public health awareness. By categorizing air quality into levels such as "Good," "Moderate," "Poor," or "Severe," it helps people understand the potential health effects of the air they breathe. Governments and environmental agencies use AQI data to issue alerts, manage traffic and industries, and plan pollution-control strategies. Overall, AQI acts as a bridge between scientific pollution data and everyday decision-making for safer and healthier living.

The graph shows how **AQI**, **PM2.5**, **PM10**, **Relative Humidity**, and **Temperature** change over a 24-hour period. The patterns indicate typical urban atmospheric behaviour influenced by traffic,



meteorology, and daily human activities.

1. AQI (Air Quality Index)

- AQI remains **moderate and fairly stable** throughout the day, ranging roughly between **38–42**.
- Slight increases occur around **8–9 AM** and **12–1 PM**, possibly because of morning traffic and midday emissions.
- In the evening (around **6–8 PM**), AQI again decreases slightly, reflecting reduced activity.

2. PM2.5 Concentration

- PM2.5 values mostly stay between **23–25 µg/m³**.
- A small rise around **7–9 AM** matches peak traffic hours.
- Lowest values appear during **early afternoon (12–2 PM)** when atmospheric mixing is stronger.
- A minor evening increase (8–10 PM) corresponds to reduced dispersion.

3. PM10 Concentration

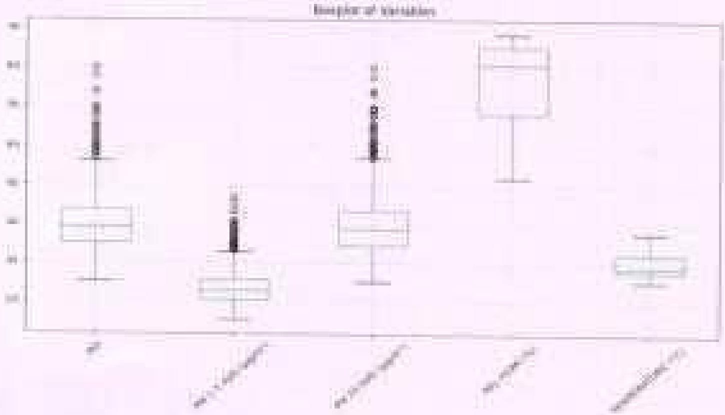
- PM10 shows higher variability than PM2.5.
- Early morning levels (around **6–8 AM**) are relatively higher, likely due to road dust resuspension and morning activities.
- A dip occurs around **9–10 AM**, then a slight midday rise follows.
- Evening hours show gradual increase, reflecting stable atmospheric conditions and increasing emissions.

4. Relative Humidity (RH%)

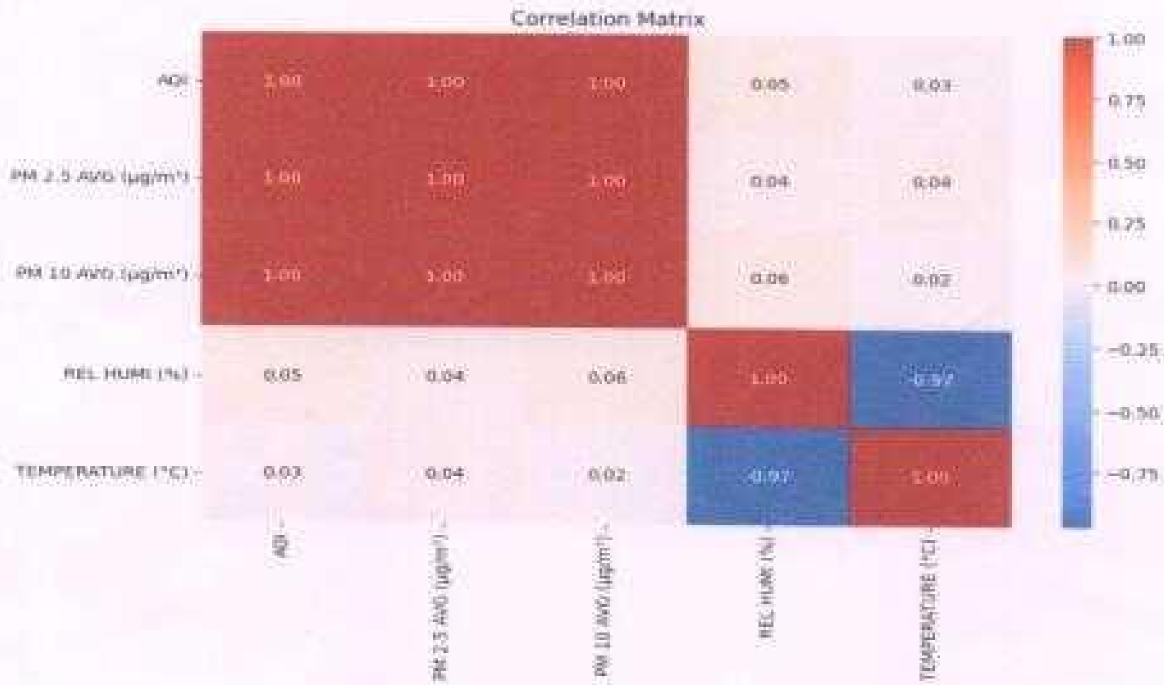
- RH is **highest at night and early morning** (~85–87%).
- It drops sharply after **8 AM**, reaching its **lowest point (~62–65%) around 11 AM – 2 PM**, due to increased temperature and evaporation.
- After sunset, humidity rises again steadily toward night.

5. Temperature (°C)

- Temperature stays **lowest (~28°C)** during early morning hours.
- Increases from **8 AM onward**, peaking between **11 AM – 2 PM** (~34–35°C).
- After 3 PM, temperature gradually decreases, reaching **around 28–29°C** at night.



The boxplot illustrates the overall distribution and variability of the five environmental variables—AQI, PM2.5, PM10, Relative Humidity, and Temperature—highlighting their central tendencies and the presence of outliers. AQI, PM2.5, and PM10 all show moderate variability, with their median values lying close to the center of their respective interquartile ranges, indicating relatively stable pollutant concentrations. However, each of these variables exhibits several upper outliers, suggesting occasional pollution spikes caused by short-term emission sources or atmospheric conditions. Relative Humidity shows the widest spread among all variables, ranging from about 52% to nearly 90%, with a high median around 82%, reflecting strong diurnal and seasonal influences. Temperature displays the smallest variability, with a narrow interquartile range between approximately 28°C and 32°C, indicating consistent thermal conditions. Overall, the boxplot highlights that while temperature remains steady, pollutant levels and humidity experience noticeable fluctuations, with humidity being the most dynamic variable.

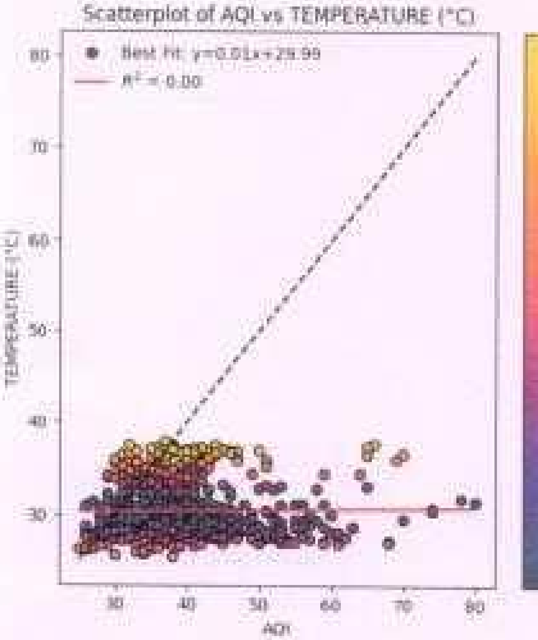


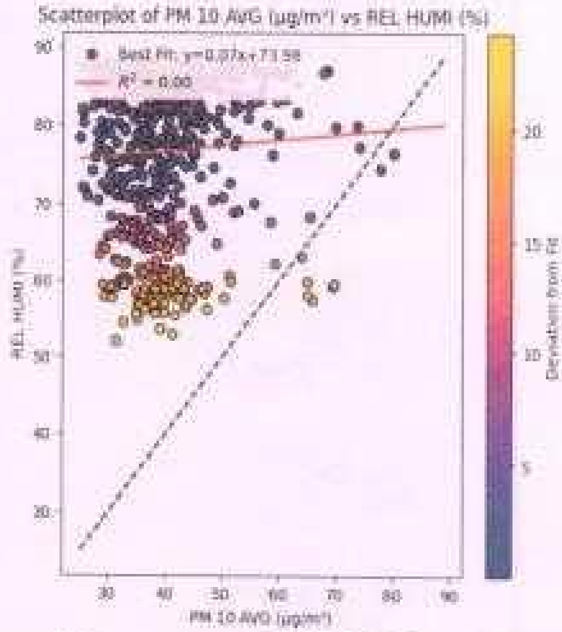
The correlation matrix provides insights into how the different environmental variables—AQI, PM2.5, PM10, Relative Humidity, and Temperature—are related to each other. The most striking feature of the matrix is the **perfect positive correlation (1.00)** among AQI, PM2.5, and PM10. This indicates that the AQI values in the dataset are strongly and directly influenced by particulate matter concentrations. In other words, whenever PM2.5 or PM10 increases, AQI rises proportionally, reflecting the heavy dependence of air quality on particulate pollutants.

Relative Humidity (RH) and Temperature show **no meaningful correlation** with AQI or particulate matter concentrations (correlation values between 0.02 and 0.06). These near-zero correlations suggest that variations in humidity or temperature do not directly affect pollutant levels in this particular dataset, or their influence may be indirect or overshadowed by stronger anthropogenic factors such as traffic and emissions.

A very important relationship appears between **Relative Humidity and Temperature**, with a **strong negative correlation (-0.97)**. This almost perfect inverse relationship indicates that as temperature increases, relative humidity decreases sharply, and vice versa. This aligns with typical atmospheric behaviour, where warm air holds more moisture, causing relative humidity levels to drop during daytime heating and rise during nighttime cooling.

Overall, the correlation matrix reveals that **air quality is dominantly driven by particulate pollution**, while **meteorological factors such as humidity and temperature are closely linked to each other but have minimal direct influence on AQI**. This distinction helps in understanding that pollutant emissions, rather than weather conditions, are the primary contributors to air quality variations in the given dataset.

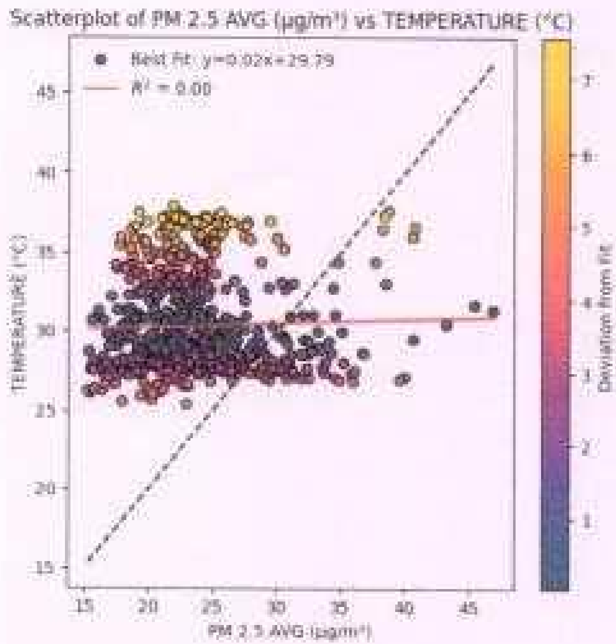


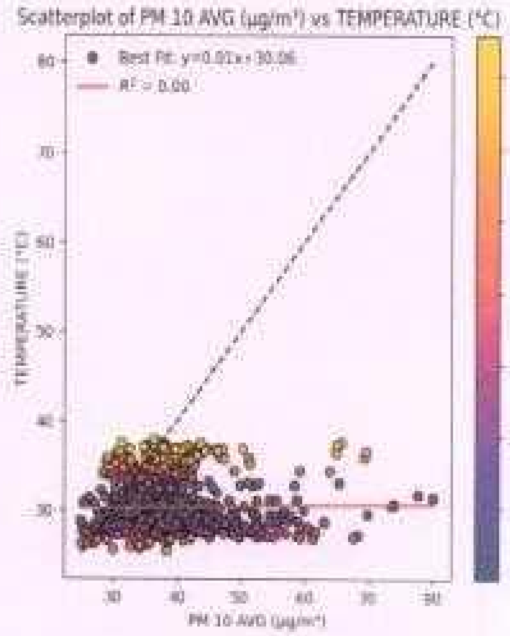


The correlation matrix shows very strong positive correlations among **AQI, PM2.5, and PM10** (all at **1.00**), indicating that the Air Quality Index in this dataset is almost entirely driven by particulate matter concentrations. This means that increases in PM2.5 and PM10 directly and proportionally raise AQI values, highlighting the dominant role of particulate pollution in determining overall air quality.

In contrast, **Relative Humidity** and **Temperature** display **very weak correlations** with AQI and particulate matter (values close to 0), suggesting that meteorological factors do not significantly influence pollution levels in this dataset. The most notable relationship is the **strong negative correlation** between **Relative Humidity and Temperature (-0.97)**, showing that when temperature rises, humidity drops sharply, and vice versa. This reflects natural atmospheric behaviour rather than pollution dynamics.

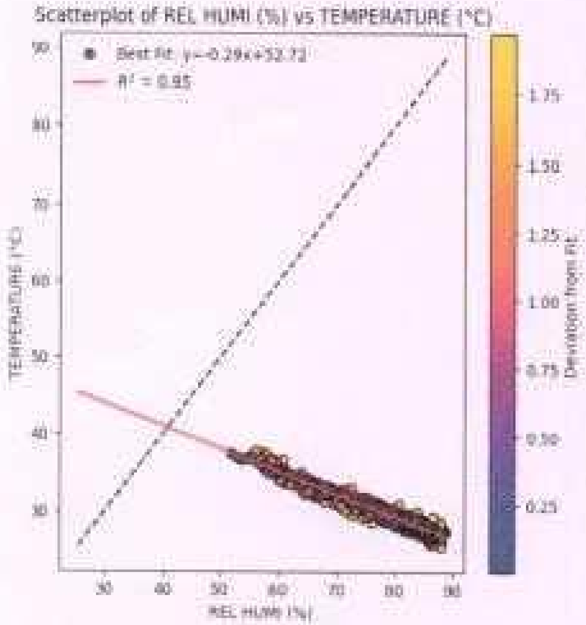
Overall, the matrix indicates that **air quality variations are mainly controlled by PM concentrations**, while **weather variables primarily influence each other, not AQI**.

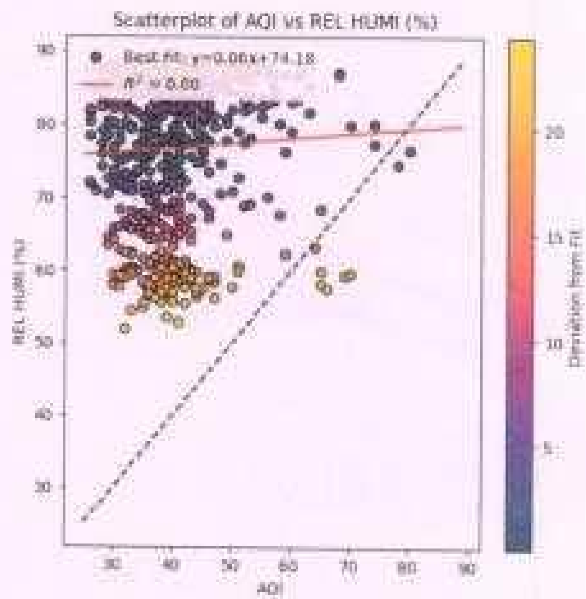




The scatterplot shows the relationship between **PM2.5 concentration** and **Temperature**, and the distribution of points indicates **no meaningful correlation** between the two variables. The best-fit regression line (y = 0.02x + 29.79) is almost horizontal, showing that temperature changes have virtually no effect on PM2.5 levels in this dataset. This is confirmed by the extremely low **R^2 value of 0.00**, meaning the regression model explains *almost none* of the variation in temperature based on PM2.5.The points are widely scattered with no visible upward or downward trend, showing that PM2.5 values remain relatively independent of temperature fluctuations. The color gradient reflects deviation from the regression line, but even these deviations do not form any identifiable pattern. Overall, the plot indicates that **temperature is not a key driver of PM2.5 variations**, and pollutant levels are likely influenced more by emission sources and atmospheric dispersion conditions than by direct thermal effects.The scatterplot demonstrates that there is **no meaningful relationship** between **PM10 concentration** and **Temperature**. The data points are widely scattered without forming any clear upward or downward trend. The best-fit regression line (y = 0.01x + 30.06) is nearly horizontal, indicating that changes in PM10 levels have **almost no effect** on temperature in this dataset. This is further supported by the **R^2 value of 0.00**, which shows that PM10 explains virtually none of the variation in temperature.The color gradient representing deviation from the fit shows random dispersion, reinforcing the absence of a systematic pattern. Overall, the plot suggests that **temperature is not a controlling factor for PM10 variability**, and that PM concentrations are more strongly influenced by emission sources, atmospheric stability, and human activities rather than direct temperature changes.

The provided scatterplot illustrates a strong **negative linear relationship** between **Relative Humidity (REL HUMI)** and **Temperature**. As Relative Humidity increases from approximately 50% to 90%, the Temperature consistently decreases, ranging from about 40°C down to 25°C. This inverse correlation is highly quantified by the **Best Fit equation**, $y = -0.29x + 52.72$, where the negative slope of -0.29 confirms the decreasing trend. Furthermore, the **coefficient of determination (R^2) is 0.95**, meaning that 95% of the variation in temperature is explained by its linear relationship with relative humidity, indicating an exceptionally strong and reliable fit. The colors of the data points show the **deviation from this fit**, with most points clustering close to the red regression line, reinforcing the quality of the linear model.





The scatterplot visually demonstrates **no meaningful linear relationship** between the Air Quality Index (AQI) and Relative Humidity. This is definitively proven by the regression analysis, which yields an **R^2 value of 0.00**. The Best Fit line is nearly flat, and the data points are highly scattered across the vertical axis for any given AQI, confirming that changes in AQI are not a predictor of changes in Relative Humidity. The colored points showing large deviations from the fit further solidify the conclusion that a linear model is unsuitable for describing the relationship between these two variables in this dataset.

Based *only* on the data and analysis presented in this scatterplot, the general conclusion regarding the **Air Quality Index (AQI)** is:

The Air Quality Index (AQI) shows no meaningful linear correlation with Relative Humidity (REL HUMI) in this dataset.

This conclusion is strongly supported by the statistical analysis displayed on the plot:

- ***R2* Value:** The coefficient of determination is $R2=0.00$. This means that **zero percent** of the variation in Relative Humidity can be linearly explained by the AQI.

- **Best Fit Line:** The equation $y=0.06x+74.18$ has a slope of 0.06, which is practically flat. This indicates that as the AQI increases (moving right on the x-axis), there is virtually no corresponding linear change in the average Relative Humidity.
- **Visual Spread:** The data points are widely scattered vertically across the entire range of AQI values, visually confirming the lack of a discernible trend or relationship between the two variables.

In summary, for this particular data, knowing the AQI value provides no useful information for predicting or explaining the level of Relative Humidity using a linear model.

Note:

Report produced by Air Quality Monitoring System Committee

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