AirWatch Insight : Air Quality Monitoring

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Abstract. The study provides a comprehensive analysis of air quality dynamics, investigating the intricate interplay between air quality, traffic patterns, and meteorological conditions in LA County over the past month. Exploring the correlation between major atmospheric pollutants and meteorological elements, the research sheds light on the complex relationship shaping air quality trends. Notably, the project delves into the impact of precipitation on the Air Quality, emphasizing the interconnected nature of air quality with meteorological factors. Utilizing a one-month dataset spanning from October 18, 2023, to November 18, 2023, collected from sensors strategically positioned in Downtown LA, Santa Monica, and Long Beach, this study contributes significantly to enhancing our understanding of localized air quality dynamics.

Keywords: Air Quality Index(AQI) · Atmospheric Pollutants · Meteorological Conditions.

1 Introduction

This paper introduces a vital Air Quality Monitoring dashboard to address the escalating impact of air quality on public health amid rapid economic growth in the USA. With a focus on safeguarding public well-being, the dashboard provides accessible information on air quality and environmental conditions. Timely data is crucial, given the adverse effects of poor air quality on respiratory and cardiovascular health. The user-friendly design emphasizes the Air Quality Index(AQI), offering a quick reference for assessing pollution levels and climatic implications.

Designed for a diverse audience, including residents, health professionals, environmentalists, and policymakers, the dashboard serves as a versatile tool for informed decision-making. Beyond data presentation, it aims to guide policymakers and urban planners by providing detailed, localized insights into air quality, traffic congestion, and climate conditions. The analysis of traffic patterns presents an opportunity to contribute to more efficient traffic management strategies, reducing vehicular emissions and enhancing overall air quality.

2 Dashboard Design

2.1 The Relationship between AQI and Climate : In an effort to understand the intricate correlation between the Air Quality Index (AQI) and cli-

matic conditions, our study involved a thorough examination, leveraging insights from historical data and real-time observations[1]. The primary focus was on the monthly average AQI during the season over the past month, in conjunction with corresponding weather patterns.

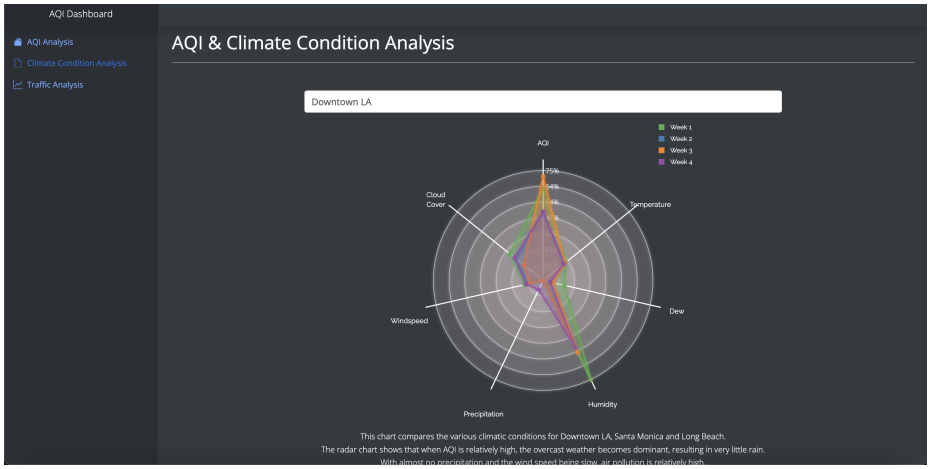

Fig. 1. This chart compares various climatic conditions weekly

Our study delves into the intricate correlation between the Air Quality Index (AQI) and climatic conditions, utilizing insights from historical data and real-time observations[1]. Focusing on the monthly average AQI during the past month, we examine corresponding weather patterns.

Figure 1 illustrates a radar chart comparing AQI with meteorological data over the past month across three locations. The default is Downtown LA, switchable via a dropdown.

On-the-ground data, particularly from Downtown LA, aligns with these patterns. The radar chart reveals that elevated AQI periods coincide with overcast weather and limited rainfall, coupled with slow wind speeds. This contributes to heightened air pollution levels, with Downtown LA exhibiting the most significant AQI.

Our study reaffirms the established inverse relationship between precipitation and pollutant concentrations, offering localized evidence of specific weather conditions' influence on air quality dynamics. These findings underscore the potential for targeted climate-informed interventions to enhance air quality in urban environments, such as Downtown LA

2.2 The Relationship between AQI and traffic count : The dynamic relationship between Air Quality Index (AQI) and traffic count unfolds valuable insights into the complex interplay between air quality and vehicular activity,

as visually depicted in the Figure. Traffic count values, sourced from machine counts at the nearest intersection to the sensor for each day, constitute the basis for this analysis[2].

Conversely, days with lower traffic counts exhibit a noticeable dip in AQI values, indicating a potential reduction in pollutant concentrations linked to decreased vehicular activity[3]. This highlights the substantial impact of traffic-related emissions on local air quality dynamics Our user-centric dashboard facili-

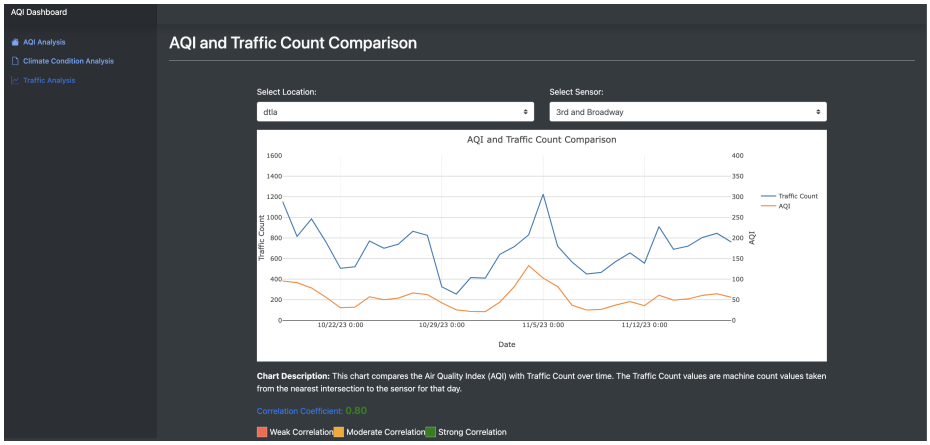

Fig. 2. This figure compares AQI with Traffic count over time. The Traffic count values are machine count values taken from the nearest intersection to the sensor for the day.

tates a streamlined experience for users to interact with and customize air quality insights. The dropdown allows users to select a specific location and any sensor within that location for the past month. Presenting a correlation coefficient, the dashboard confirms the expected: higher AQI on days with a significant traffic spike, especially evident in locations like Santa Monica, affecting residents near the Santa Monica highway.

These nuanced insights contribute to a deeper understanding of the intricate interdependence between urban traffic patterns and air quality. As urban areas navigate the delicate balance between economic activities and environmental sustainability, these findings underscore the necessity for targeted interventions in traffic management and emission control to alleviate the impact on air quality. This understanding is pivotal for policymakers and urban planners in formulating effective strategies to enhance air quality in densely populated regions.

2.3 AQI Analysis: From top to bottom : We have presented a comprehensive aggregated to drill down view of how the AQI is changing for the 3 locations over the past month. A dot map, color coded based on AQI ranges set by EPA along with slider is the main source of interactivity. As it can be seen from figure

3, the pie chart to the right of the map, shows the percentage of time a given location has spent in various AQI ranges over the past month.

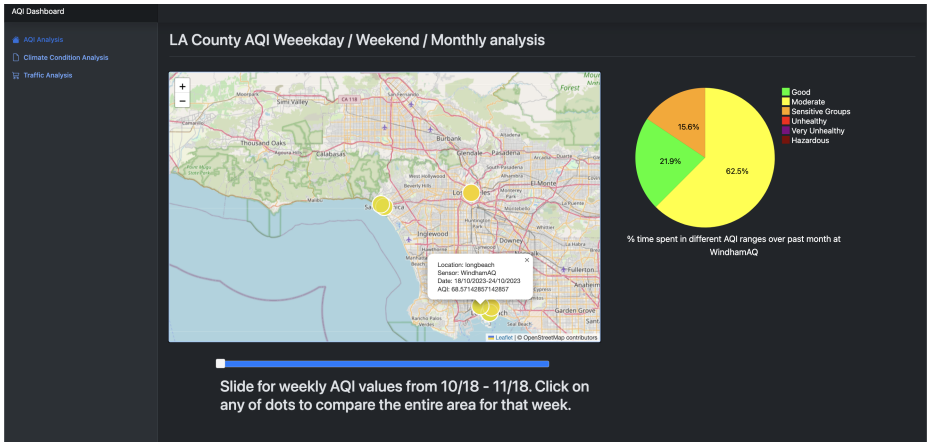

Fig. 3. Weekly and monthly aqi

The slider and the map provide a weekly overview of average AQI for a given sensor, again color coded based on AQI ranges set by EPA. Clicking on any sensor will update the Pie Chart and show that location's aggregate data of past one month. Clicking on the sensor also has another purpose, where in we drill down even further for that given week and do a weekday and weekend analysis for all the sensors in given location. This can be easily seen in figure 4.

We have utilized Vue.js to create this part of our dashboard. Vue provides a lot of advantage over a traditional non vue application in the following sense and we have used this to our advantage

3 Future Work

Future developments for our air quality dashboard are geared towards enhancing user experience and providing more comprehensive data. We plan to introduce real-time notifications, offering instant alerts for sudden changes in air quality that users can customize according to their preferences. In addition, we're focusing on developing prediction algorithms capable of forecasting future air quality trends. Another exciting direction is the integration with wearable devices, enabling users to track their personal exposure to air pollutants more closely. We also aim to strengthen our collaboration with environmental agencies to ensure the reliability and accuracy of the data we provide. Finally, an Expansion is on the horizon, where we'll broaden our reach to more locations, offering enhanced personalizations and customizations to suit diverse user needs.

Fig. 4. Weekday AQI ranges

4 Conclusion

Our air quality dashboard is an open invitation for users to explore interactive charts with real-time data updates. Responsive to user feedback, it actively incorporates suggestions, ensuring ongoing relevance and reliability. The future promises enhanced user interactivity, including personalized alert features. This journey reflects our commitment to providing real-world solutions for a healthier living environment, evolving with user needs.

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