Weather forecasting website

Project, Group 5

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Introduction:

Understanding the weather is important because the mere existence of humankind is dependent on it. By studying weather in its current form and how it has changed in the past few decades, we can learn to overcome many major problems the earth faces today, like global warming, energy crisis, and food and water shortage.

For example, let's talk about Global warming, which is a process by which the earth gradually becomes warmer. Scientists show grave concerns that due to global warming, the planet may become so hot that eventually, no living specie may be able to survive on it. How can we overcome this challenge? By analyzing global warming patterns worldwide, we observed that the magnitude of its effects is not the same everywhere; in some areas, its propagation rate is higher, while it is pretty low in other areas. *We can know this vital information with the help of "weather forecasting systems."* By studying global warming propagation and where it is high and low, we can tell its causes and ways to fix it.

Let's talk about another challenge that we can resolve by studying weather and weather forecasts: food and water shortage. Weather is an essential aspect when we talk about crops growth and development. Under the right weather conditions, great crops could be obtained and maintained for longer. But how do we know the "right" weather condition for the crops? Through *weather forecasting systems* just like the one, we have created (Here). With its help, we can study rains and understand when and how much it could rain in some areas and at some specific time and make a strategy for crop development accordingly.

Lastly, it is a well-known fact that weather has a significant effect on human behavior. It dramatically affects human psychology, making us happy or sad, smile or cry. It may boost our work productivity or even decreases it. Therefore, studying weather becomes even more vital if we wish to enhance others' lives.

We have created a website to study the weather that gives historical data about weather plus its present status and future forecast to overcome the challenges discussed above. Weather data would be including temperature, pollution, and wind speed.

Inspiration:

There are several reasons why weather forecasts are essential. It is a product of science that impacts the lives of many people. Today the planet earth is confronted with many challenges, and we believe many of them could be mitigated by studying and understanding the weather. This belief is the core of our inspiration. To name a few challenges:

1. Global warming is a growing threat to humanity (Discussed in detail above).
2. Many major cities are facing a lower Air Quality Index (AQI).
3. Studying weather is also important because it may help boost the economy through agriculture and crops development.
4. It may help people prepare for how to dress (warm weather, cold weather, windy weather, rainy weather)
5. It helps businesses and people plan for power production and how much power to use (power companies, where to set thermostat)
6. Helps people plan outdoor activities (to see if rain/storms/cold weather will impact outdoor events)
7. The weather can also produce some pretty unique visualizations for our project.

Project Development:

Here we'd like to discuss how we created the project. We developed the website's framework on HTML and the grid on bootstrap. We use APIs (Weathermap and RapidApi) as the primary data sources or data providers, while the visualizations and dashboards are on plotly. The mechanism works as follows; The temperature changes from kelvins to Fahrenheit and labels are added on the axis. Hence creates a current temperature map. Lastly, we have added a helper function for the ten requests.

Data Sources:

Our primary data source for this project will be coming from open Weathermap and RapidAPI. They will be providing us with information related to weather forecasting, air pollution, and air quality worldwide. APIs JavaScript to clean the data, perform aggregate functions, and create visualizations on the website.

https://openweathermap.org/api/air-pollution

https://rapidapi.com/category/Weather

The data source then provided us with the following datasets: Current weather conditions of a particular area, history of weather in that area, and the future possible weather conditions.

Data Cleaning:

Our project does not require Data Cleaning because the data comes directly from APIs.

Visualization Analysis:

Now we'll analyze the weather conditions of a few cities.

Our visualizations are mainly limited to six parameters.

i) Current Air Quality Index (AQI)
ii) Current Pressure
iii) Current Humidity
iv) Current Temperature
v) Historical AQI (up to 5 days)
vi) AQI forecast (up to 5 days)

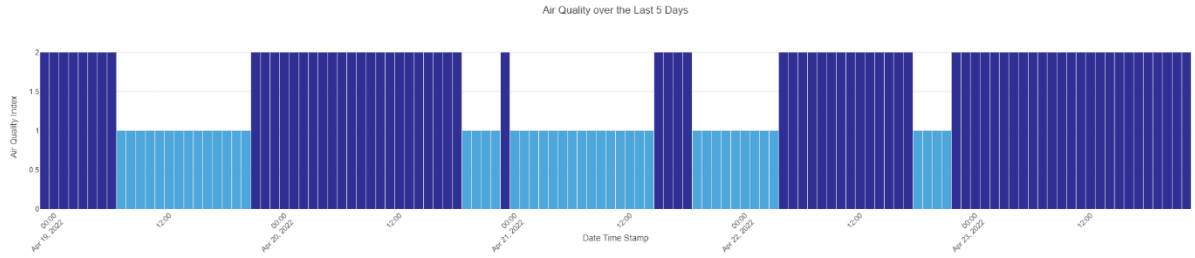
The reason for such a limited set of visualization is the type and amount of data we have. For example, due to the amount of API requests we could send at a given moment we were not able to figure out or have time to do a temperature verses AQI comparison or historical data of humidity and pressure etc.

For now, we'll see their present status, historical data, and future forecast for the following cities for our observation purposes.

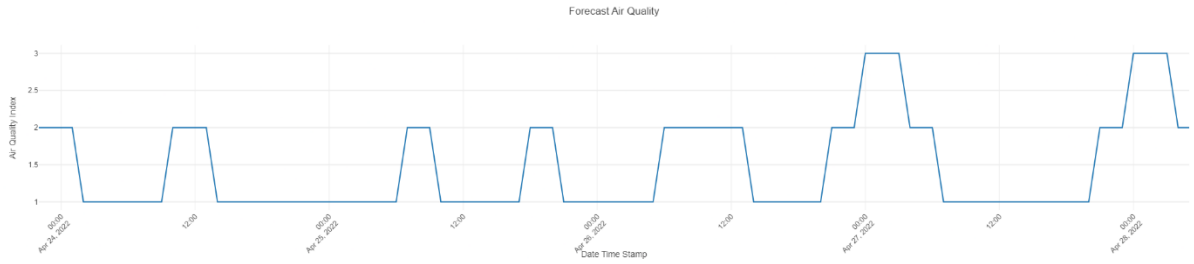
1. Dallas

We can see the current weather conditions in Dallas in the chart below. The temperature is suitable, and the air quality is not perfect but still quite impressive.

We can observe the Air Quality Index in Dallas for the last few days from the chart below. We observed that the overall AQI remains constant at 2, but at some point of times, it reaches 1.



Lastly, from the below chart, we can see the forecast of Dallas for the Air Quality index for upcoming days, which will keep fluctuating between 2 to 1.

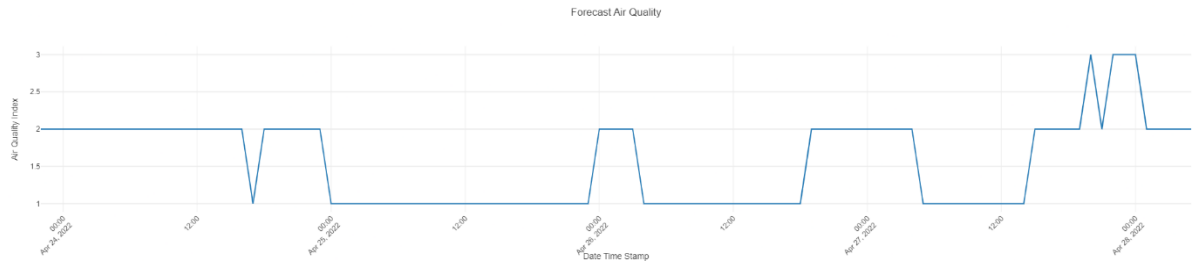


2. Miami

We can see the current weather conditions in Miami in the chart below. The weather conditions are pretty similar to Dallas. The temperature is also good, and the average Air Quality Index is 2.

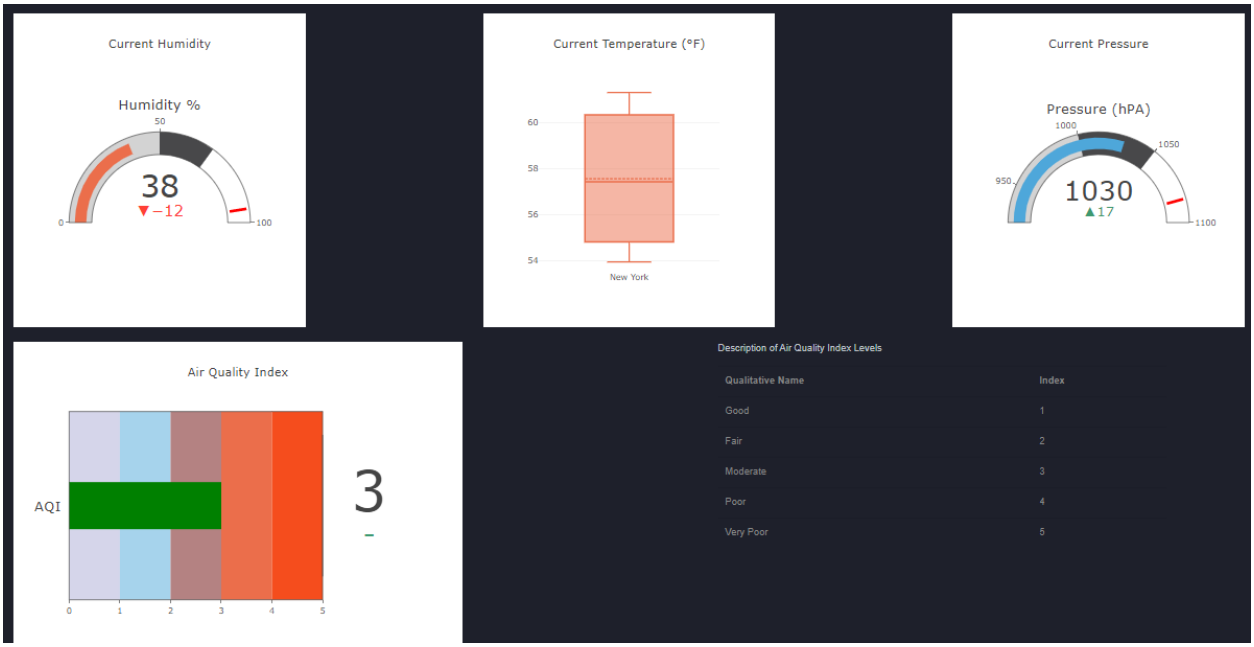
Now let's see historical data of Miami city. We can see an interesting pattern here that during peak hours, the Air Quality Index reaches 3 to 4. It may be due to over traffic and increased temperature.

Lastly, we can see the forecast of Miami for the Air Quality index for upcoming days, which seems to keep fluctuating between 3 to 1.

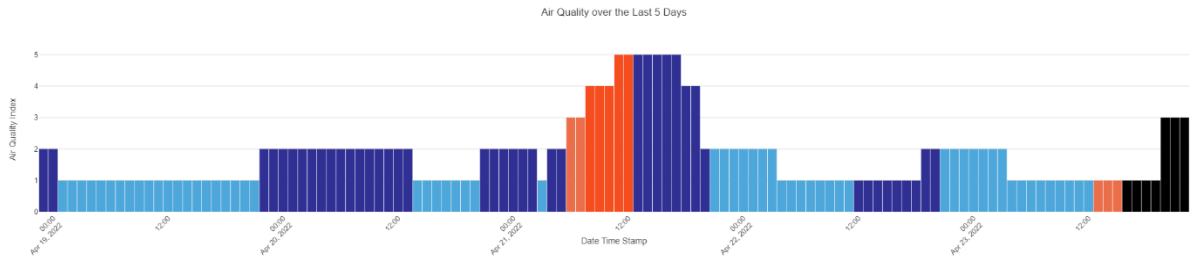


3. New York

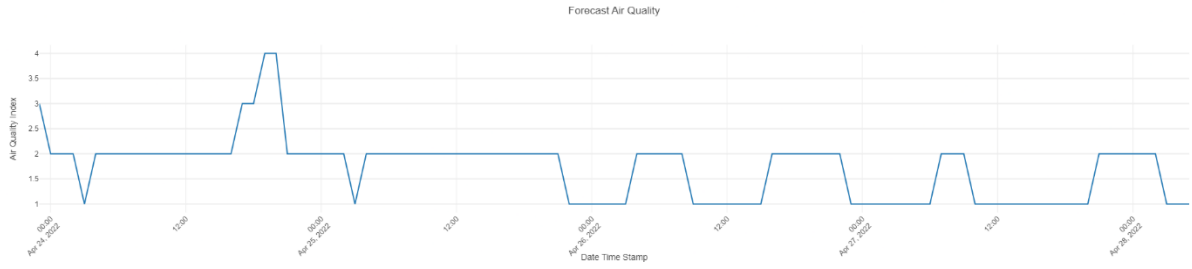
Now, we'll see the current weather conditions of New York. It has a lower temperature than both of the previous cities on our list but an Air Quality index of 3.



From the historical data of New York City, we can see that the AQI sometimes reaches 5.



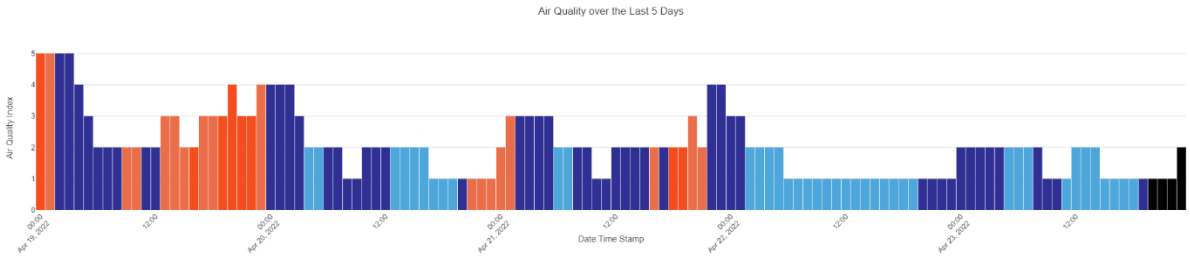
Lastly, we can see the forecast of New York City for the Air Quality index for upcoming days, which will fluctuate between 4 to 1.



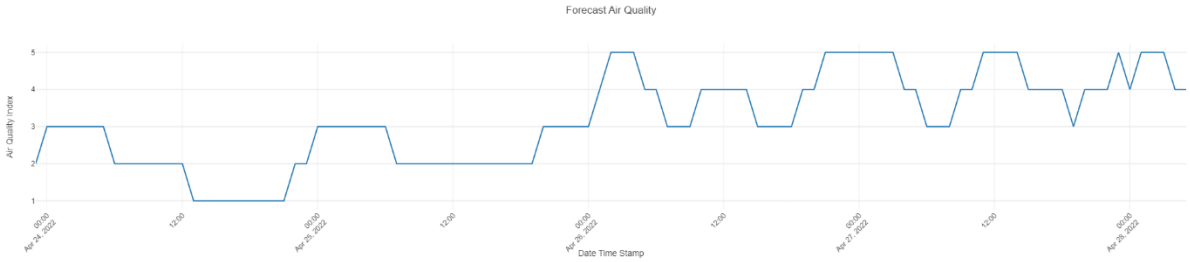
4. Los Angeles

Loss Angeles has the best Air Quality index value on our list, which is 1, and also has a good temperature.

From the historical data of Los Angeles city, we can see the AQI has been fluctuating between 5 to 1 in the past few days.



Lastly, we can see the forecast of Los Angeles city for the Air Quality index for upcoming days, fluctuating between 5 to 1.



Conclusion:

The overall Air Quality Index (AQI) decreases in many major US cities. We also discovered that during some specific time, AQIs become poorer, which may be due to the gasoline smoke coming from heavy traffic or industrial wastage.

Another interesting observation we saw is that Dallas had the best average AQI of 2 compared to other cities.

Recommendations:

Based on our analysis, we recommend using an environmentally friendly approach that includes using a clean source of transport, green energy sources in the industries, and recycling the wastage. This way, we can maintain healthy and clean atmosphere for ourselves and generations to come.

Limitations:

We could only gather historical weather data for up to 5 days, so under the current setup we won't be able to go beyond this time limit. We wanted to include more historical weather data, but only 5 days old data was available within our resources.

Secondly, our website is not as dynamic as we wanted because the weather API would reset at 7pm daily and as our data is all coming from this API our website remains static as long as the API is not updated.

Lastly, we are still working on the website's overall look, we are trying to make it more interactive and aesthetically pleasing for the visitors.

Future Work:

We couldn't answer a few important questions because we did not have historical data, but we'd like to work on them in the future. The questions are:

1. Does air pollution increase with temperature?
2. Does warmer weather increase the likelihood of high pollution?
3. Does precipitation affect the top 10 airports?
4. How do wildfires affect air quality?