DGR - Milestone 2

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I. Project Goal

Our project explores how air quality in the European Union has changed over the past 20 years and projects future trends based on current data. We will analyze various pollutants and metrics, examining their sources and effects. Through interactive visualizations, we aim to engage both experts and the general public. A dedicated *Curiosities* section will present striking visuals on topics like the impact of electric vehicles and the influence of air pollution on real estate.

II. Outline

Our website is structured as a single-page application to ensure a smooth and logical flow, enhancing the overall user experience. The content follows a top-down approach, beginning with a broad overview of air quality in Europe and gradually narrowing the focus—first to individual countries, then to specific pollutants, as the user scrolls down the page. The journey concludes with a dedicated Curiosity Section.

At the top of the page, the title (**SmogSense – Understand the Unseen**) is accompanied by a transparent background showing a timelapse map of Europe. This animation visualizes the evolution of air pollution over time, using a colored cloud that changes in size and intensity based on the total pollutant concentration. The data is aggregated from the **AirBase Dataset** [1].

Following a short introduction outlining the educational goals of the platform, the first interactive visualization appears:

- It features a heatmap of Europe, initially displaying the most recent daily measurements of overall air quality (combined data from all pollutants).
- A dropdown menu allows users to change the timeframe, choosing between the last 24 hours, last month, last year, or a specific year.

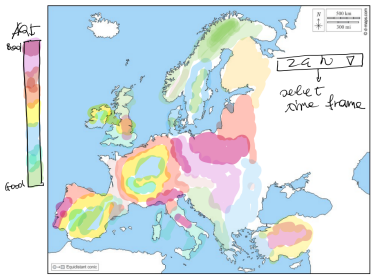

Fig. 1: Map showing quality index with selectable time frame

This visualization offers an immediate, intuitive overview of air quality across Europe, helping users quickly grasp pollution levels and distribution, and raising environmental awareness.

Users can then select a specific European country through a second dropdown menu. This triggers an animated zoom-in to the selected country, and the screen splits into two sections:

- **Left side:** A detailed map showing pollution levels across cities.

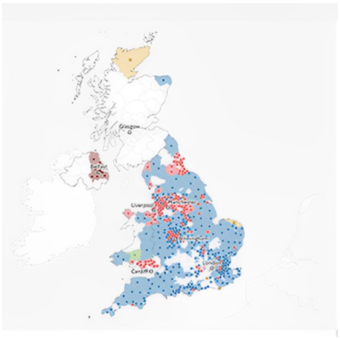

Fig. 2: Close-up view of the country

- **Right side:** Descriptive statistics, including:
  - A bar chart showing the distribution of pollutants by type, after normalization (z-score), (e.g., PM2.5, CO, NO_2), highlighting the dominant pollutant.

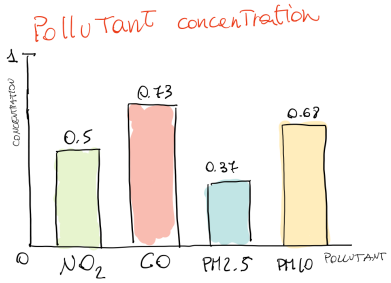

Fig. 3: Vertical bar graph pollutant per country

  - A line graph illustrating the changes in concentration of the three most prevalent pollutants over time, with the option to customize the selected pollutants if time permits.

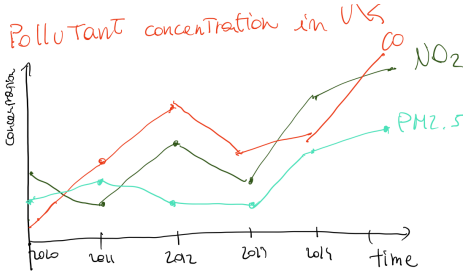

Fig. 4: Line graph showing pollutant evolution per country

Further down the page, the focus shifts to individual pollutants:

- A dropdown lets users select a specific pollutant.
- A horizontal bar chart displays the top 5 countries with the highest average concentrations over the past year.

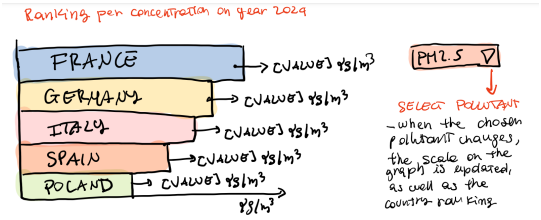

Fig. 5: Horizontal bar graph visual

- As a possible enhancement, a timelapse animation could illustrate the evolution of the top five countries with the highest concentrations of the specified pollutant over the past decade.
- A flashcard provides key information about the selected pollutant: its name, acceptable concentration range, associated health risks, and emission sources.

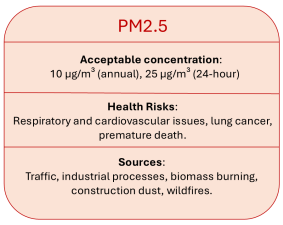

Fig. 6: Mock up visualization of the flashcard.

This section is impactful in raising awareness, as it connects raw data to health and environmental concerns. It helps users understand how different pollutants affect their lives and where action may be most needed.

In the final section, users can explore the correlation between

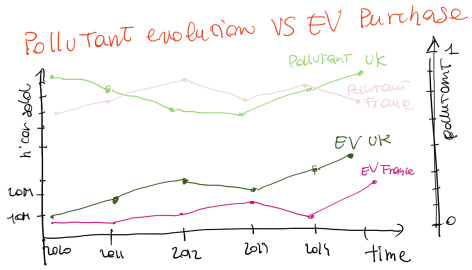

Fig. 7: Line graph showing the relation between EV purchase and air quality

air quality and the number of electric vehicles purchased in different countries.

- A line graph displays the evolution of both EV purchases and pollutant concentrations over time.
- Users can compare two countries side by side or focus on a single country for a more detailed analysis.

This section encourages curiosity by linking environmental data to personal and societal choices, helping users understand how their actions can impact the broader community.

III. Technologies

For this project, we will not use any frameworks. Instead, we will build with native `HTML` and `CSS`, as introduced in the lecture *Basic Web Development*, and use `JavaScript` together with the libraries `Plotly` and `D3.js`, following the lectures *JavaScript*, *D3.js*, *Interactions*, and *Interactive D3*. Furthemore, we will make use of `JQuery` and `SASS`.

To handle data, we will preprocess the full dataset in `Python` using `Pandas`, as discussed in the *Data* lecture.

Map visualizations of air pollutants across Europe will be designed according to guidance from the *Maps* lecture.

To enhance clarity and impact, we will also draw from the following lectures:

- *Perception Colors* and *Mark and Channels* for choosing appropriate visual encodings.
- *Do and Don't* for practical tips on visualization design.
- *Storytelling* to structure and present our insights effectively, particularly in the curiosity section.

IV. Additional Ideas

Time permitting, and without impacting the user experience, we would like to implement the following ideas:

- An interactive widget—such as a draggable lung icon—could be added to the map. As users move it across Europe, the lung would darken based on pollution levels, offering an intuitive visual cue of air quality.

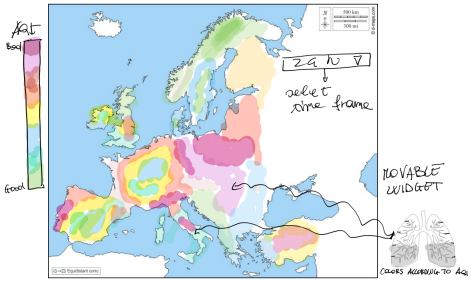

Fig. 8: Map showing quality index with widget

- In the *Curiosities* section, we could highlight data completeness issues. A map with red markers could indicate areas with missing data, while a histogram could show the percentage of missing values per pollutant, raising awareness about dataset limitations.
- Time-based visualizations could be extended to include short-term predictions, providing a forward-looking view of air quality trends beyond the latest available data.

References

[1] Environmental European Agency , " European Air Quality Dataset ," https://eeadmz1-downloads-webapp.azurewebsites.net/, 2025, accessed: 2025-03-20.