FINAL PROJECT

REPORT



Subject: WEB APPLICATION PROGRAMMING

Department: Industrial Engineering

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**Table of Contents**

1. **Introduction**
   * Project Background
   * Objectives
2. **Tools and Technologies**
   * Software and Libraries
   * APIs and Data Sources
3. **Methodology**
   * Data Collection and Preprocessing
   * Model Development
4. **Results**
   * Analysis Findings
   * Model Performance
5. **Challenges and Limitations**
   * Issues Faced
6. **Conclusion**
7. **Introduction**

This project aimed to develop an air pollutant dashboard and data analysis system. The primary objective was to provide real-time information on pollutant levels based on the user's location and offer insights into country-specific air quality. Additionally, the project included various visualization analyses based on 2020 air pollutant data from South Korea, focusing on identifying relationships between different pollutants.

1. **Tools and Technologies**

* Software and Libraries

• **Chart.js**: Used for creating interactive and dynamic visualizations for air quality data.

• **PapaParse**: To parse and process CSV data files for easy integration into the dashboard.

* APIs and Data Sources  
  **APIs:** OpenWeatherMap for live air quality data.

**2020 Air Pollutant Emissions Statistics**: Data sourced from the *National Fine Dust Information Center* in South Korea. This dataset includes emissions statistics by administrative district (city, county, district), emission sources, and fuel types.

1. **Methodology**

**[Home page]**To provide real-time air quality data to users, a feature was implemented that displays current air quality based on the user's location.

* Data Collection  
  Real-time air quality data is collected via the OpenWeatherMap API and integrated into the dashboard.
* Development

The page retrieves real-time data via the OpenWeatherMap API and visualizes it in various formats:

**Temperature, Humidity, and Discomfort Index:** These data points are updated in real-time and displayed in both text and chart form. This allows users to quickly grasp the current air quality conditions in their region.

**Charts:** A line chart for real-time temperature and humidity, along with bar and donut charts for pollutant levels, are provided. These charts are updated every minute, allowing users to track changes in air quality easily.

**[Global page]  
The global page provides users with the ability to view air quality data from** various countries. It offers a global perspective on air quality, displaying real-time data from around the world through the OpenWeatherMap API.

**[Data page]**

* Data Collection and Preprocessing

The dataset was obtained from the *National Fine Dust Information Center*. The dataset's columns were reviewed and organized to ensure relevance for the project's objectives.

- Original data  
텍스트, 스크린샷, 번호, 폰트이(가) 표시된 사진

자동 생성된 설명

- Modified data

텍스트, 스크린샷, 번호, 폰트이(가) 표시된 사진

자동 생성된 설명

The following columns were used for analysis:

• City/Province (시도)

• County/District (시군구)

• Emission Source (Large Category) (배출원대분류)

• Emission Source (Medium Category) (배출원중분류)

• Emission Source (Small Category) (배출원소분류)

• Fuel (Large Category) (연료대분류)

• Fuel (Small Category) (연료소분류)

• Pollutants: CO, NOx, SOx, TSP, PM-10, PM-2.5, VOC, NH3, BC

* Exploratory Data Analysis (EDA)

Various visualization techniques were applied to uncover patterns and relationships between pollutants. Examples of visualizations include:

**• Bar Charts:**

- drawBarChart: Creates a bar chart showing the pollutant levels (CO, NOx, PM2.5) by region.

- drawTBarChart: Creates a total bar chart showing the total emissions for different pollutants like CO, NOx, PM-2.5, etc.

**• Pie Charts:**

- drawPieChartByRegionExpanded: Creates a pie chart showing the total emissions by pollutant type across all regions.

- drawPieChart: Creates a pie chart that shows fuel type distribution based on pollutant emissions.

**• Scatter Plot:**

- drawScatterChartByRegion: Creates a scatter plot showing the relationship between CO and PM2.5 levels by region.

* Model Development

The visualization framework was implemented using Chart.js to create interactive graphs.

1. **Results**<https://hgy2124.github.io/WebApp_FinalProject/>
2. **Challenges and Limitations**① When accessing the GitHub link, the real-time chart does not appear immediately on the homepage. The chart only shows up after navigating to another page and returning or after manually clicking again. This issue results in a delay in visualizing the chart upon initial access.

② There is some visual discomfort when displaying the chart. The layout or design may not be entirely intuitive, causing difficulty in interpreting the data or making the chart less user-friendly.

1. **Conclusion**

This project successfully developed an air quality monitoring dashboard that provides real-time data on pollutants and visualizes country-specific air quality statistics. By utilizing data from the National Fine Dust Information Center and integrating live air quality data from OpenWeatherMap, the dashboard serves as a useful tool for understanding the levels of various pollutants, such as CO, NOx, PM2.5, and others, across different regions.

The visualizations, including bar charts, pie charts, and scatter plots, effectively highlight patterns and relationships between pollutants, fuel types, and emission sources.

Despite the project's successes, some challenges were encountered, such as delays in chart rendering on the homepage and some visual discomfort with the layout. These issues can be addressed in future iterations by improving the chart rendering logic and refining the user interface for a more intuitive experience.

Overall, this project contributes valuable insights into air quality monitoring and provides a foundation for further enhancement, such as integrating more advanced predictive models or expanding the dataset to include additional regions and pollutants.