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Project task in the subject

DATA VISUALIZATION

**Comparative Visualization of Energetic Transition:**

**Climate change impact on production of energy**

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In Osijek, June 2023

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# KV1 - Defining a Project Task

## Project Task

Task name: Comparative Visualization of Energetic Transition: Climate change impact on production of energy

Problem description: How can data visualization comparing CO2 emissions and renewable energy production between countries effectively highlight disparities, identify best practices, and show efforts to address climate change on a global scale?

Task description: The main objective of the project is to visually represent and compare the impact of climate change and the progress of the energetic transition in France and selected countries over several decades. By examining the data on CO2 emissions and renewable energy production, the project aims to provide a comprehensive view of the different trajectories and challenges faced by both advanced countries like France and other nations.

Objective of the project: The purpose this project is to effectively communicate the complex dynamics of climate change and the energetic transition. By comparing the data on CO2 emissions and renewable energy production between countries, the project seeks to highlight disparities, identify best practices and an assessment during the ecological transition.

To achieve these objectives, the project will collect and analyze relevant data from multiple countries, with a particular focus on France as a benchmark for comparison. This may include historical data on CO2 emissions, renewable energy production, energy consumption, and other relevant indicators.

Link to git repository of the project: <https://github.com/TheMysters/VD-Project>

## Data

[Find data sources and describe the data to be used for visualization.]

* + 1. *Two* datasets are used to achieve the objective of the project.

The first one is about CO2 emissions (<https://www.kaggle.com/datasets/ulrikthygepedersen/co2-emissions-by-country>)

The second one is about production of renewable energy (<https://pxweb.irena.org/pxweb/en/IRENASTAT/IRENASTAT__Heat%20Generation/>)

* + 1. The first dataset combines records of CO2 emissions by country over more than 200 years. It is compiled from various sources, including the United Nations Framework Convention on Climate Change (UNFCCC) and the International Energy Agency (IEA).

The second set of data gathers records concerning the sources of different renewable energy production as well as the amount produced by country from 2000 to 2021. It is compiled from the IRENA (International Renewable Energy Agency).

## Data processing

[Describe the data processing and linking operation performed.]

* + 1. *Process the collected data and link it to create a complete set of data. This includes cleaning and processing of data, as well as checking their consistency, topicality, integrity, i.e. quality and correctness.*

For the CO2 dataset, I selected only the column that contained information about country, year and co2 emission.

For the Renewable energy dataset, I had to merge the producer type column because the information was not relevant, only the number corresponding was.

## Relevant display types for the data used

It is possible to use different ways to display data that would be appropriate for climate change and energetic transition such as line charts, stacked charts, bar charts, heat map, scatter plot.

* + 1. To understand the dynamic of climate change and the energetic transition, there are several possible ways:

1. Line charts to display trends in CO2 emissions and renewable energy production over time.
2. Stacked area charts to showcase the contribution of different renewable energy sources to overall renewable energy production over time.
3. Bar charts to compare CO2 emissions and renewable energy production between different countries.
4. World map with gradient of color: to represent CO2 emissions and renewable energy production on a geographical scale.
5. Scatter plots to explore the correlation between CO2 emissions and renewable energy production.

# KV2 - Data visualization design.

## Questions that visualization answers

* + 1. Each type of graph will be able to answer to a specific question:
* Line charts:
  + - * 1. How have CO2 emissions changed in France and other countries over the past few decades?
        2. What is the trend in renewable energy production in France compared to other countries?
* Stacked area charts:
  + - * 1. How has the composition of energy sources changed over time?
        2. Which renewable energy sources have shown significant growth or decline in their contribution to energy production?
* Bar charts:
  + - * 1. How does France's CO2 emissions compare to other countries?
        2. How does renewable energy production in France compare to other countries?
        3. Which countries have made significant progress in reducing emissions or increasing renewable energy production?
* Heat map:
  + - * 1. What are the regions or countries with the highest CO2 emissions?
        2. Which areas have made substantial progress in renewable energy production?
        3. Are there any geographical patterns or disparities in emissions and renewable energy production across different countries or regions?
* Scatter plots:
  + - * 1. Is there a relationship between CO2 emissions and renewable energy production in a specific country?
        2. Are countries with higher renewable energy production generally associated with lower CO2 emissions?
        3. How strong is the correlation between CO2 emissions and renewable energy production in different countries?

## Data visualization draft

[Show sketches of different ways of displaying data, explaining their purpose]

* + 1. *Create sketches of the final data visualization, which will include all the elements necessary to solve the problem. This includes different types of graphs, diagrams and other visual elements that will be included in the visualization of data.*

## Existing solutions and examples

* + 1. They are plenty of projects about data visualization of climate change and renewable energy.

For example, there is [Global Carbon Atlas](https://www.globalcarbonatlas.org/) project that visualize data about global CO2 emissions and many github projects or kaggle projects about visualization of CO2 emissions and renewable energy production, mainly using python.

* + 1. Code for CO2 emissions can be found in the following link: (<https://www.kaggle.com/code/jacobsharples/country-co2-emission-plots>)

Code for CO2 emissions and renewable energy production can be found here: (<https://www.kaggle.com/code/rodaneradcliffe/global-energy-consumption-renewable-energy-eda>)

* + 1. No part of the code will be used in the project. Some parts will be the same but with using d3 in JavaScript.

Example of a code in python:

Une image contenant texte, capture d’écran, Police

Description générée automatiquement

This code uses Ploty to create an area plot that visualizes the annual CO2 emissions for different countries over time, grouped by country category. The plot has a simple white background, and the legend is ordered to display "Other" followed by the individual country names.

Une image contenant texte, capture d’écran, diagramme, Tracé

Description générée automatiquement

## Customizing data

* + 1. The operations applied on the dataset are selection of some columns to reduce the dataset and take only the column useful for the visualization. A merge has been applied to a dataset to restrain the amount of information.
    2. The data is loaded from a csv file in JavaScript and select the column that it is needed to display it into a chart. To select the data, a variable contains the content of the csv file in JavaScript, and it is used during all the processing of the data.
    3. The data will be displayed with excel.
    4. Une image contenant texte, nombre, ligne, capture d’écran

       Description générée automatiquementHere is an image of one of the datasets loaded from excel with a csv format, the merge of the previous column was successful because the quantity of the dataset has been reduced by 2.

## Colors and data

[Define colors used in visualization and link between visual/graphic elements and data]

* + 1. List of colors used with the accompanying rationale.

# KV3 - Creating prototype data visualization.

[Elaboration of the concept, defining functionality and behavior - prototyping.]

## Basic functionalities and behaviors

[Specify basic visualization functionalities and their behavior]

* + 1. Identify key functionalities that will be required to display data.
    2. Define basic types of behavior.
    3. Select elements with which users will be able to interact and define interactions between users and visualizations with the corresponding description.

## Advanced functionalities and behaviors:

[Specify advanced visualization functionalities and their behavior]

* + 1. Identify the advanced functionalities that will be required for data analysis.
    2. Define advanced types of behavior
    3. Define interactions that will allow users to further analyze data.

## Implementation of basic functionalities

[Describe and support with evidence the process of implementing basic functionalities]

* + 1. Create code that allows predefined functionalities. Prove by describing an example code.
    2. Test functionalities and ensure that they are correct, i.e. to function in the expected way. It needs to be confirmed by a picture.

## Implementation of basic behavior

[Describe and support the process of implementing basic behavior with evidence]

* + 1. Create code that allows predefined behavior. Prove by describing an example code.
    2. Test behavior and ensure it is correct, i.e. to function in the expected way. It needs to be confirmed by a picture.

# KV4 - Creating the final data visualization

## Implementation of basic functionalities

* + 1. Complete the implementation of the code for the missing basic functionality.
    2. Test basic functionalities and ensure that they are correct, i.e. to function in the expected way. It needs to be confirmed by a picture.

## Implementation of basic behavior

* + 1. Complete code implementation for missing basic interactions.
    2. Test basic behavior and ensure it is correct, i.e. to function in the expected way. It needs to be confirmed by a picture.

Or

## Implementation of advanced functionality

* + 1. Identify advanced functionalities that will be implemented.
    2. Implement advanced functionalities. Prove by describing an example code.
    3. Test advanced functionalities and ensure that they are correct, i.e. to function in the expected way. It needs to be confirmed by a picture.

## Implementing advanced behavior

* + 1. Identify advanced behaviors that will be implemented.
    2. Implement advanced behaviors. Prove by describing an example code.
    3. Test advanced behavior and ensure it is correct, i.e. to function in the expected way. It needs to be confirmed by a picture.

# KV5 - Completing the project task and writing documentation

## Possible modifications and refinements of the solution - in agreement with the teacher

[This task refers to potential changes and refinements that need to be made on the solution of the terms of reference, which are agreed with the teacher. It is possible that it is necessary to change some functionalities, corrections in the code or any other finishing to ensure a quality and complete solution.]

## Preparation of documents - project documentation

[In this task, it is necessary to prepare project documentation that will describe the process of preparation and achieved results of the terms of reference. Project documentation usually includes a description of the project task, the necessary tools, the work process, a description of the design and visualization of data, reports on conducted tests and results, conclusion and the like. The goal is to keep the documentation clear, detailed and complete so that others can understand and use your solution.]

* + 1. Project hierarchy.
    2. List of technologies used, without description.
    3. Setup instructions.
    4. Instructions for use.

# Literature

# 

# Annex I

Link to git repository of the project:

Program code