Global Data visualization

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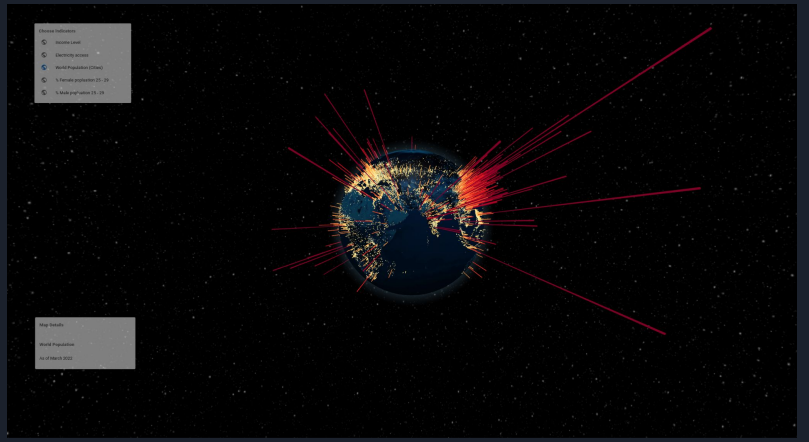
3d globe interactive visualization - *population, economic growth and energy access*

Problem ?

- Visualize the following global data for the below indicators
  - Economic Growth
  - Electricity access
  - Total population visualization
  - Visualization of the younger population
- Using 3D visualization to develop an easy and rich interface for users to interact.
- Help the users gain a higher understanding and visualize the historical trends.



World population showing population per city

Dataset

- The datasets have been gathered from several sources.
  - Younger population data (male, female 25 - 29) & Income levels per country - https://databank.worldbank.org/home.aspx
  - % Electricity access to the population per country and the total TWh world(1990 - 2021) - https://ourworldindata.org/energy#country-profiles
  - Total world population per city (until March 2022)- https://simplemaps.com/data/world-cities (Gathered data from NASA, US Census)
- The dataset has been processed using pandas and structured for optimized performance. Notebooks can be found in the root folder of the project.
  - The floating point values were rounded to 2 decimal places in most simulations.

Tasks

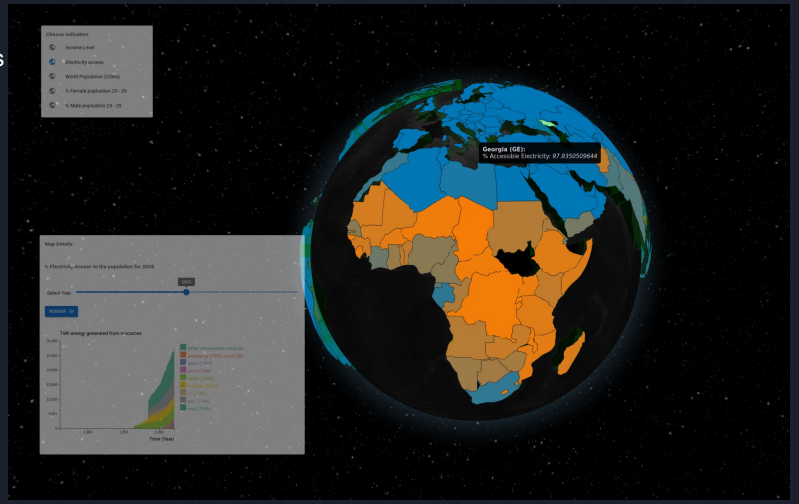
- Representation of global data on a 3D globe can help anyone to understand the data better and compare it with other countries.
- The visualization is meant for presentation.
- Develop interactive components such as - sliders, buttons, and mouse interactions.
- Since it is 3D visualization, the webpage space must be efficiently utilized, and the control interface should not hinder the view of the visualization.
- Catch the user's attention to do a more detailed analysis with the visualization.
- Use cases involve the following items.
    - We are identifying the higher income levels.
    - We are identifying the economic progress.
    - We are identifying the energy access.
    - Identifying the population and working class age of the population.

Implementation

- Use ReactJS framework for developing the web app (SPA- single page application).
  - Implement the web app using the react functional components and hooks.
  - React store has been avoided on purpose because of time constraints.
- Use three js frameworks and react globe library for 3D rendering in the browser.
- Use d3js for plotting the charts.
- Use material UI with React JS for the interface styling.
  - Material UI was used for buttons, cards, icons, and typography.
  - The Grid system has divided the page into several sections and organized the content.
- Pre-process the data using Python Pandas.
- Most datasets must be converted from CSV to JSON using python.
- The react application has been hosted using render.com but currently has some lag; however, the local setup works seamlessly.
  - https://worldvis.onrender.com/

Interaction - Electricity Access per country (1990 - 2020)

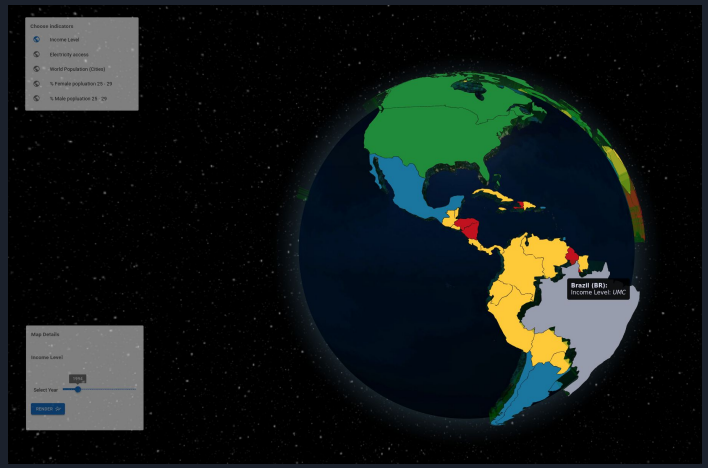
- The visualization for all the indicators generally has 2 transparent cards on the left side.
  - The top left will re-render the globe with the chosen indicator.
  - The bottom left corner will show the map information and charts (optional)
  - The bottom card also has a slider to change the year, and after choosing the desired year, the user clicks render to regenerate the globe.
  - These cards remain transparent unless the user hovers over the cards to get a full view of the globe.
- The visualization on the right is a screenshot of the electricity access per country. The following interactions are possible in this visualization.
  - The user can use the slider to change the year and re-render the globe for that specific year.
  - Hover over a country to see the % electricity access in the tooltip.
  - The bottom card will also display the chart of the energy generated from different resources used for generating electricity.
  - The globe is colored; accordingly, wrt % electricity access going from blue(highest) to orange (lowest)



% electricity access per country

Interaction - Income level per country (1987 - 2021)

- The visualization on the right shows the global income level per country.
- The user can use the slider to select the year and re-render the globe.
- The countries are colored accordingly based on 4 income groups -
  - HIC - green
  - UMC - blue
  - LMC - Yellow
  - LIC - Red



Income group visualization

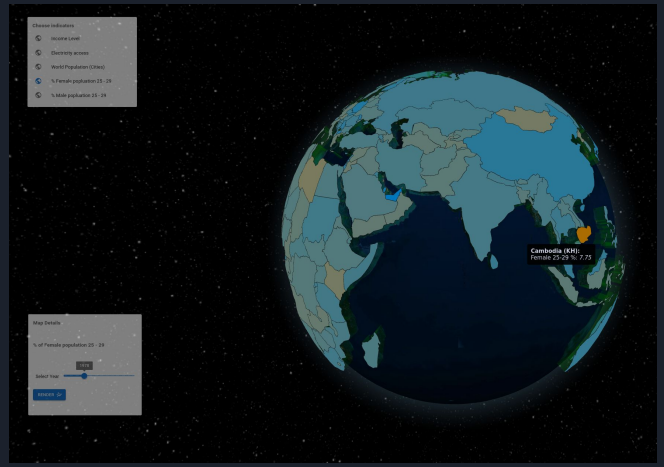
Interaction - Population (until March 2022)

- The visualization on the right shows the total world population per city.
- This visualization has close to 42K data points and has the most recent data until March 2022.
- This visualization is non-interactive and has been avoided because of performance issues.

Visualization of total world population per city

Interaction - Younger population (1960 - 2021)

Visualization of % of male population 25 -29



Visualization of % of female population 25 -29

- The top visualization shows the % male and female population between the ages 25 -29
- In both the visualization, the users can use the slider to select the years and re-render.
- The map is colored wrt % of the male/female population blue(indicate highest) and orange (indicates lower %)

Conclusions

Indicators	Conclusion
Income Level	Many countries have generally moved from a LIC to LMC or UMC. Therefore, this is a good indicator showing that many countries will become self-sustaining and flourish.
% Electricity access per country	The late 1990s-2000s have been gaming changing for many countries. Most of them moved from 50% -> 70%. In 2020 most parts of the world had 95% access except for a few African countries, but Africa is making good progress.
World Population per city	Tokyo still holds as the most heavily populated city in the World. From the 3d projections, it can be seen that southeast Asian cities are thriving with people. Australia has a population spike in the coastal cities. The same goes for the West and East coasts in the USA.
% Young Population per country	India has a young population of 8.7% as of 2021. China took a heavy hit in the young population from 1980 - 2021, but the male/female population dropped by an avg. of 2.7%. Japan has ~5% of the young population as of 2021. The USA has a young population of 6.6-7% of young people as of 2021.

Questions ?