CarbonFit: An Application to Monitor and Calculate Carbon Footprint

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Abstract - *Ever since the 19th century, the amount of carbon released in the environment has been on the rise. The rise can be attributed to the industrial revolution and recently to the technological revolution. This rise paired with the change in the lifestyle of humans which is now mainly dependent on technology have contributed to a variety of ecological problems. Ecological problems like global warming, endangering of species etc. have a direct relation to the amount of greenhouse gases being emitted each year. Carbon Fit aims for people to educated themselves on their contribution to the global footprint, its effects on the environment and ways to contribute towards the cause.*

Key Words**: Carbon Footprint, Carbon Emissions, Alternatives, Offsetting, Flutter, NodeJS, Pytorch, Chatbot.**

1.INTRODUCTION

Carbon releases have been on the rise since the modernization of the humanity. We can't point to a single cause for this increase but we do know the harmful repercussions it has on the environment. The measure we use to calculate the amount of GFG (Greenhouse Gas) released is tons of CO2/year which makes up our Carbon Footprint.

World Carbon Footprint has been on a steep ascent since the early 2000s. In the year 2000 the CO2 emission was 25Gt (Giga tonnes) which in contrast to the 35Gt in 2021 is a far smaller number. This jump is 29% faster than the previous 10GtCO2/year jump (1969-2000).

To counter this situation, educating the people by having them calculate their individual prints based on their everyday choices seems to be the need of the hour. With this resolution in the mind, Carbon Fit proposes to help individuals to calculate their print and show ways to reduce the same.

The project aims specifically at the people of India and all the values considered are specific to India.

2. RELATED WORKS

This section highlights the notable previous efforts that have been made in this field. It includes the works from notable organizations like WWF (World Wildlife Fund for Nature).

WWF proposed a system for the calculation of an individual's Carbon Footprint living in the United Kingdom but the same carbon factors and choices cannot be applied here as the demographics, geography and the spectrum of choices a person living in India will make is very different from that of the UK.

Carbon Watch was a project developed by Sparrow Analytics for the city of Chandigarh, India but failed to deliver the promised results as the final results were not averaged out for an individual depending on the family members.

Time-dependent climate impact of beef production – can carbon sequestration in soil offset enteric methane emissions?[6]

Shows how beef production has impacted the climate including the changes in soli as well as the carbon footprint. Took into consideration, pesticides, fertilizers, grazing, fossil fuels etc, used in the production of beef.

Carbon footprint assessment tool for universities: CO2UNV [7]

Carbon Footprint is a very useful decision-making tool that allows organizations and individuals to measure the effect of their everyday activities on the environment. is designed to calculate the carbon footprint of universities. The tool calculates the Carbon Footprint based on direct GHG emissions, electricity, and other indirect GHG emissions. Capable of evaluating the evolution of the CF over time.

Carbon footprint: current methods of estimation [8]

The increasing greenhouse gases concentration in the atmosphere has its own consequences. The measure of greenhouse gasses intensiveness is expressed in carbon footprints. Standards of greenhouse gasses accounting are the common resources used in footprint calculations, although there is no mandatory provision of footprint verification.

Life cycle CO_2 footprint reduction comparison of hybrid and electric buses for bus transit networks.[9]

Potential of electrification the bus rapid transit network in Spain evaluated. Hybrid and electric bus show 40% decrement and 30% increment of CO2 Well-to-Tank. Hybrid and electric bus show 40% and 60% decrement of CO2 life cycle emissions. Hybrid and electric bus show 30% increment and 60% decrement of driving range. Hybrid and electric bus show 2.5% reduction and 30% increase in the life cycle cost.

Assessing the carbon footprint across the supply chain: Cow milk vs soy drink [10]

Provides insights as to how vegan milk(soy) could be a better substitute to cow milk in terms of carbon footprint. Also, asses the difference between the prices of and nutritional values of both.

Evaluating food supply chain emissions from Japanese household consumption [11]

Summarizes how meat consumption can cause disparities between the carbon footprints of different regions. Also shows how most of the food related carbon footprint released is during the production phase. Dining out is also majorly responsible for food related emissions.

A comparative study of carbon footprint and assessment standards.[12]

Focuses on the research methods and steps involved in carrying out studies on different types of carbon footprint. Comparative study of different carbon footprint assessment standards was carried out to identify their similarities, differences and deficiencies. Guidelines had been made on these issues from existing assessment standards, but further improvement is still needed.

A Review of Footprint analysis tools for monitoring impacts on sustainability[13]

This study presents an overview of footprints as defined indicators that can be used to measure sustainability. We can also check the footprint of two more combined people. Several tools for calculating the carbon footprint are available.

Towards a universal carbon footprint standard: A case study of carbon management at universities.[14]

All types of organizations contribute to the greenhouse gas emissions. Higher education institutions play a critical role in education systems all over the world, spanning international borders and economic systems. The following paper introduces a methodology by which carbon foot printing is applied to higher education institutions.

3. PROPOSED SYSTEM

The proposed system, takes input from the user about his everyday choices specifically their transportation, food habits, electrical consumption, LPG consumption and waste production. Based on this input Carbon Fit calculates the total Carbon Footprint of the individual for that year in tCO2/year. The emission factors for all the parameters have been taken from trusted sources which include government presented data.

Besides the calculation part, Carbon Fit offers alternatives to reduce the user's print in the area which contributes the most, offsetting, to offset the user's footprint by donating to organizations and projects which are working towards the same cause and a chatbot to help the user with anything they might need.

Carbon Fit's flowchart/design is given in Fig 1.

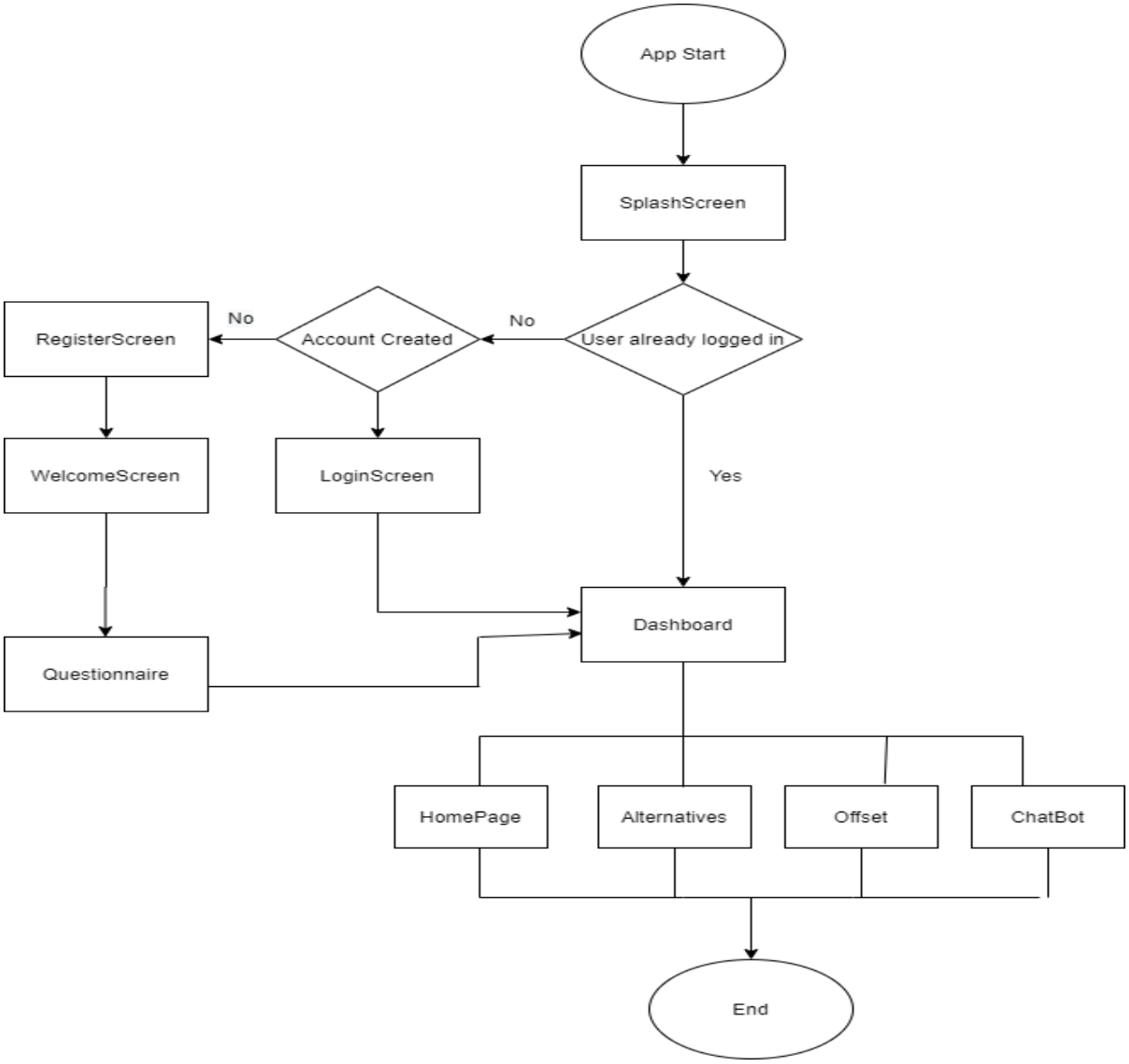

Fig 1. Frontend Design

The project's technological aspect can be divided into 3 main parts based on the functionality namely Authentication and Calculation, Alternatives and Carbon Offsetting, Ember- the AI Chatbot

There are 3 APIs to handle requests for these 3 functions which are explained as: -

1) Authentication and Calculation- The backend uses MongoDB and NodeJS to handle requests from the client and responds with the total value of the footprint after calculating the values for each parameter based on the carbon emission factors.

2) Alternatives and Offsetting- Alternatives and Offsetting is also handled using NodeJS and MongoDB with only one endpoint i.e., GET. The data for offsetting was web-scraped off of United Nations website which has comprehensive information about the offsetting projects in India including the amount of CO2 the project is able to offset and also any additional information related to the offsetting project.

3) Ember AI chat-bot- Ember is trained using Pytorch and it uses Flask to handle requests from client.

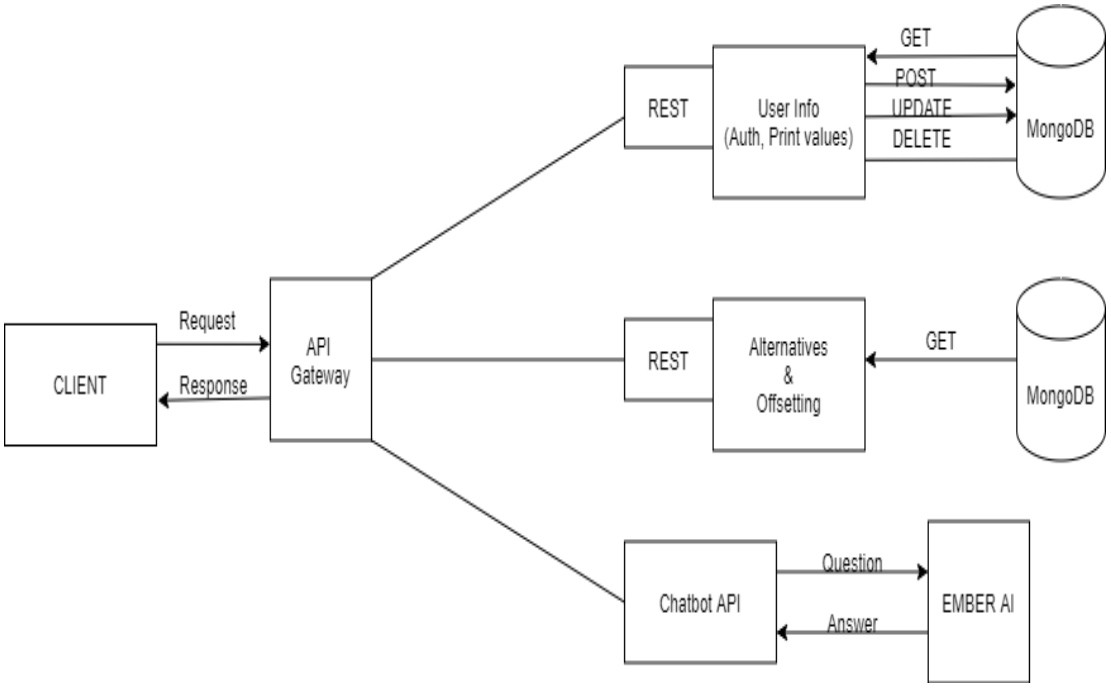

Fig 2. Backend Design

4. DATA

Data used in calculating the footprint plays a key role as the carbon emission calculated will differ based on emission factors. These emission factors have to be very precise and specific to the given country as the geography, demographics and choices of people in a particular region result in the emission factors changing for different locations. We have considered emission factors which are specific to India for the best and most realistic results possible.

Table-1: All the emission factors are given below:

Parameter	Emission Factors	Formula Used (in kg Co2/year)	Source
Transport	2.4745 kg Co2/litre	Input(in litres/year) * E.F	http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
Bus	0.1 kg Co2/km	Considered the general value per person	http://indiaghgp.org
Airplane	0.1404 kg Co2/km	Considered the general value per person	http://indiaghgp.org
Train	0.00795 kg Co2/km	Considered the general value per person	http://indiaghgp.org
LPG	2.983 kg Co2/kg	Input(in kg/year) * E.F	http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
Electricity	0.85 kg Co2/kWh	Input (in kWh/year) * E.F	http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
Waste	0.086 kg Co2/kg	Use(kg/week) * 52 * E.F	http://www.ghgplatform-india.org/methodology-waste-sector
Average Meat consumption	2.5 tonnes Co2/person	Considered the general value per person	https://www.greeneatz.com/foods-carbon-footprint.html
Vegetarian	1.7 tonnes	Considered the	https://www.greeneatz.com/foods-carbon-footprint.html

	Co2/person	general value per person	
Vegan	1.5 tonnes Co2/person	Considered the general value per person	https://www.greeneatz.com/foods-carbon-footprint.html

** denotes the assumptions while calculating the emission

5. CONCLUSION

Addressing the need of the hour regarding the increase in carbon emissions, this was an attempt to educate people about the individual contributions made to the global carbon levels. This project highlights the urgency of this issue and hopes that we stand united against the carbon emissions, take responsibility and contribute by making changes to our daily life choices.

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