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Carbon Footprint Android Application and Data Generation on Vehicle Usage

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Abstract:

This study is mainly focused on direct carbon emissions which are being emitted from vehicles. In India, about 90% of carbon is emitted from transportation. The main objective of calculating carbon footprint from individual users is to create a dataset and statistics to provide the overall estimated value to the Department of pollution control. This paper also discusses the reduced and increased difference in carbon footprint in the datasets. The overall value will be presented on the application's interface.

Keywords: Vehicles, direct emissions, carbon calculator, and carbon footprint (CF).

Introduction:

We all know that greenhouse gases, which are the main contributor to global warming, are primarily produced by human activities. The phrase "carbon footprint," which is widely used to estimate CO2 emissions from an activity, is helpful for controlling emissions and assessing mitigation tactics. However, calculating a person's carbon footprint manually requires formula-based calculations and has proven to be difficult due to the numerous aspects that must be taken into account.

The carbon footprint is measured in carbon dioxide equivalents (CO2e), which account for the potential global warming of other greenhouse gases such as methane and nitrous oxide. Individuals and organizations can lower their carbon footprint and move towards more sustainable practices by estimating their carbon footprint.

There are multiple online carbon footprint calculators that estimate carbon emissions using various approaches and criteria. These calculators, however, serve as a starting point for individuals and organizations to become more conscious of their carbon footprint and take efforts to reduce their environmental impact.

A typical passenger using a vehicle emits about 4.6 metric tonnes of carbon dioxide annually which is 12.95kg per day. In order to build datasets on the growth rate and reduced rate of carbon emission, the

program uses the values previously estimated and compares the average estimated value to the value now calculated. The Departments of environmental control, greenhouse gases, and automakers can all benefit greatly from these datasets.

Despite the fact that carbon footprint calculators are recognized as crucial tools for minimizing individual carbon emissions, their use and trend among Internet users have decreased in recent years. As a result, there is a need to increase the appeal of such technologies, and boosting adoption among end-users is becoming increasingly important. Improving system usability is a well-known approach to encourage system adoption. According to Nielsen, usability is a quality criterion that measures how simple and enjoyable it is to use system features. Previous research on carbon footprint calculators concentrated on methodology for assessing an individual's carbon footprint rather than the usability and uptake of such tools.

With this constraint in mind, this article explores the usability of a suggested carbon footprint calculator and makes recommendations for improving this quality aspect of such products. The findings presented in this work are designed to assist policymakers, researchers, and carbon calculator designers in better understanding the usability of such tools in order to improve their design and promote their use.

Background Literature:

Several studies on carbon footprint measurement have been undertaken, and researchers have created numerous methods for measuring it. Some studies, for example, have explored carbon footprint measuring at the personal level, whereas others have examined it at the organizational or national level. The application's primary goal is to compute the amount of carbon emitted by vehicles. To calculate the carbon footprint, several criteria such as fuel type, amount of gasoline consumed, and emission factor of the fuel are taken into account. Additional criteria, such as the vehicle's power and size, are employed to improve the calculation's accuracy and precision. Previous research examined how and where carbon dioxide is emitted, with both direct and indirect causes addressed in the computation. Certain articles examined a complete institute to quantify the carbon emitted in an institution by including power, product consumables, college transportation, and the total number of estimated automobiles utilized by college students and faculty. There are existing applications such as Mau carbon footprint which were proposed to obtain simple measures on their carbon emission within India. As a result, this study is being conducted to improve the accuracy of carbon footprint computation by utilizing important components and precise values that cause carbon emissions.

Existing Methods:

Carbon Footprint Calculators:

There are online calculators that estimate an individual's or organization's carbon footprint based on characteristics such as energy use, transportation patterns, trash generation, and lifestyle choices. To produce an approximation, these calculators often employ established emissions factors and calculations.

Life Cycle Assessment (LCA):

LCA is a thorough process for assessing a product's or service's environmental impact across its full life cycle, from raw material extraction to end-of-life disposal. LCA considers the energy and resource inputs, as well as the emissions and waste outputs, for each stage of the product or service.

Carbon Accounting Standards:

To quantify and report their carbon footprints, organizations frequently adhere to specific carbon accounting standards, such as the Greenhouse Gas Protocol. These standards establish criteria and procedures for determining emissions from various sources, such as direct (e.g., fuel combustion) and indirect (e.g., purchased energy).

Proposed Methodology:

Carbon Calculator:

The first module is the **calculation module**, which computes and shows the carbon emission value on the interface. The computation module uses several criteria to calculate carbon emissions from automobiles based on the mode of travel, distance travelled, and journey duration.

The average carbon footprint of a vehicle per kilometre in India is determined by several factors, including the type of gasoline used, the vehicle's fuel efficiency, and the driving circumstances. The average carbon dioxide (CO2) emissions from passenger vehicles in India in 2019 were roughly 118 grams per kilometre (g/km), according to the Indian Ministry of Petroleum and Natural Gas. This equates to about 0.19 kilograms of CO2 emissions per kilometre.

This average figure, however, can vary greatly based on a variety of factors such as the type of vehicle, its age, fuel efficiency, and driving circumstances. Diesel vehicles, for example, emit more CO2 per kilometre than gasoline vehicles, whereas older, less efficient vehicles emit more CO2 per kilometre than newer, improved vehicles. It is crucial to remember that CO2 emissions from automobiles are not the only contributors to India's overall carbon footprint. Other variables that contribute significantly include emissions from public transit, aircraft, and freight transportation.

Various methods are developed to calculate the carbon emission value based on these assumptions and average speeds. By merging all of these parameters into a single formula, the computation module and output datasets will be more accurate.

The application includes a very useful function for maximizing vehicle efficiency and lowering CO2 emissions. This feature is known as a **carpooling system**. Instead of driving two or more individual automobiles, the user can use

one common vehicle with family and friends. The determined carbon emission value will be distributed among the application's users. As a result of this function, vehicles are used more efficiently.

Trip Module:

The second module is the **trip module**, which allows users to enter vehicle information, daily mileage travelled, and time consumed.

The input will be obtained from the user's emission document, which shows the vehicle's standard carbon dioxide (CO2) emission pressure and emitted CO2 pressure.

The details of the vehicle from the emission document will be recorded in the real-time database and will be updated by the user once every six months.

Gamification module:

The gamification module is the third module. This module displays the daily and monthly rates of growth and reduction in carbon emission value.

The rate of reduction and growth will be shown as a percentage. The computation values are also saved in the real-time database, which displays the user vehicle's carbon emission value.

The calculated carbon emission value is compared to the estimated average person's carbon emission value to generate and store datasets on the growth rate and reduction rate.

Results:

The calculated results, which include the total carbon emission from the vehicle, entries on user emissions, statistics on the increase and decrease in carbon emission, statistics on vehicle usage, and the percentage of reduction or growth in emission, will be displayed on the application's interface.

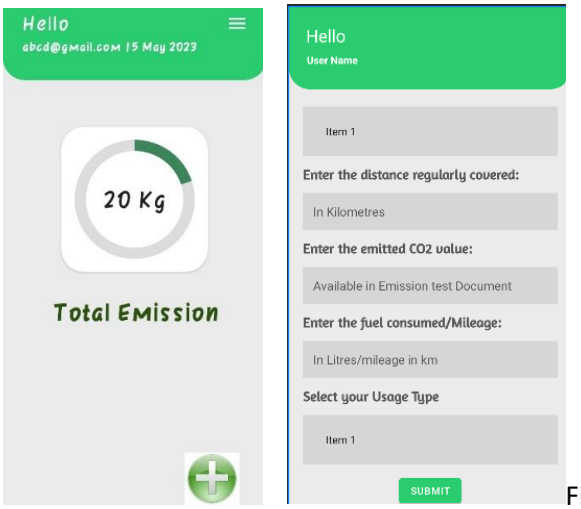

Figure 1

The user's credentials, vehicle details, and input values such as emission factor, fuel consumption rate, and distance are stored in the Firebase's real-time database as shown in Figure 2.

- calculatedvalue: 0.005263157894736842
- email: "presidency@gmail.com"
- emitted_distance: "2.5"
- fuelType: "Petrol"
- fuel_consumed: "57"
- km_dis: "120"
- usageType: "Regularly Used"
- userId: "-NVPWeksnAcThIkPkpHH"
- vehicleId: "-NVT0WT_fM_0UjpGi9I4"
- vehicleType: "2 Wheeler"

Figure 2: Stores the information to calculate.

Figure 3: Shows all the user's calculated carbon footprint values in a linear list.

Discussion & Future Scope:

Because of growing awareness of the detrimental impact of human actions on the environment, the use of carbon footprint applications has grown in popularity in recent years. Individuals and organizations can use these tools to measure and track their carbon emissions and explore strategies to reduce their carbon footprint. Carbon footprint applications have a broad and promising future. These applications can become more accurate, user-friendly, and accessible to a wider audience as technology advances. They can also be combined with other technologies, such as smart buildings and energy management systems, to optimize energy consumption and lower emissions.

The transportation sector is one area where carbon footprint applications can have a substantial influence. They can give real-time emissions data and recommend other modes of transportation, such as public transportation or car. Finally, carbon footprint apps are an important weapon in the fight against climate change. They have the potential to achieve considerable reductions in greenhouse gas emissions and contribute to a more sustainable future with further development and integration with other technologies.

Architecture Diagram of the application:

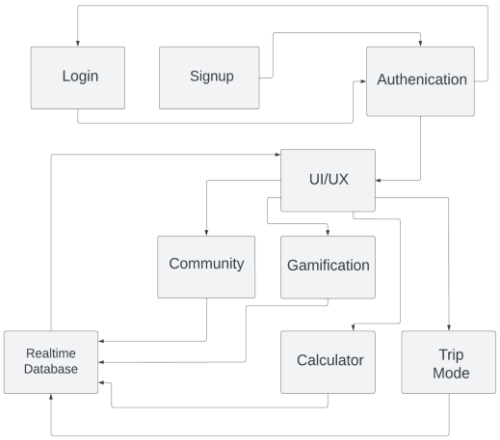

Figure 4

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