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Personal carbon footprint tracker

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Abstract: Climate change and growing concern for the state of the environment are prompting individuals to do their part to minimize greenhouse gas emissions. However, most people are unaware of how their daily activity influences the environment. Eco Track – Personal Carbon Footprint Tracker is a digital solution created to help users measure, monitor and reduce their carbon footprint. The system allows users to log their activities related to their choice of transportation, energy consumption, food consumption, and lifestyle choices and calculates the associated carbon emissions using standard emission factors.

The application provides users with insights at the individual level along with reports that are visual representations of their environment impacts and recommendations to encourage users towards making environmentally friendly decisions. Eco Track takes it a step further by gamifying sustainability through progress tracking and setting goals for users to support their adoption of greener habits. This initiative combines data analytics to estimate the emissions associated with specific activities, whilst making recommendations for practical change, such as considering public transport, reducing energy consumption, and utilizing sustainable products.

I.INTRODUCTION

In recent years, the world has faced environmental difficulties that have never been encountered before: climate change, global warming, air and water pollution, and fastdepleting natural resources. These have threatening implications for our ecosystems and healthy living. The world continues to facilitate environmental issues mainly due to levels of Greenhouse Gas (GHG) emissions from human practices - known essentially as carbon (C) emissions, which have clear and direct relations with human transportation, energy production, diets, and waste production etc.

Environmental sustainability and carbon footprints have come into the lexicon the world over, as people become more aware and attentive to environmental sustainability issues and challenges. A carbon footprint is defined as the total GHG emissions, measured in terms of carbon dioxide equivalents (CO2e), from a person's daily practices and habits directly or indirectly. As a result, if individuals understand their carbon footprints, and take action to reduce them, they can make a significant difference in negating environmental impacts, as well as promoting sustainable lifestyle alternatives.

Eco Track - Personal Carbon Footprint Tracker is a digital tool designed to help individuals track, measure, analyse and minimize their carbon emissions. The app allows users to calculate carbon footprints for daily, weekly and monthly timeframes by measuring several factors; chosen modes of transport, energy used in the home, food choices and waste habits. Eco Track then helps users visualize their data, provides personalized insights, actionable eco-friendly recommendations and ultimately empowers each user to adopt a more sustainable lifestyle and make informed decisions that positively affect the environment.

Eco Tracks main goal is to educate and increase awareness about the environment, encourage accountability, and provide practical actions that help reduce personal carbon emissions. Eco Track uses technology to support the global effort of tackling climate change and achieving sustainable development goals (SDGs), and contribute towards a greener and healthier planet.

II.LITERATURE SURVEY

The research on Personal Carbon Footprint (PCF) Tracking shows a clear shift in methods and technology, moving from basic carbon calculators to more complex, hybrid systems that use data. Traditional PCF calculators mostly used fixed, activity-based estimates that were not very accurate and did not account for indirect emissions from supply chains and services. Newer methods focus on combining process-based Life Cycle Assessment (LCA) techniques with Environmentally Extended Input–Output (EEIO/MRIO) models. This combination helps capture both direct and indirect emissions linked to personal behaviour.

Hybrid Methodology: Process LCA and EEIO/MRIO Models

The hybrid approach represents current best practices by using detailed data on activities, such as kilowatt-hours (kWh) of electricity used, kilometres (km) travelled, kilograms (kg) of food consumed, and flights taken. It connects this information with reliable life-cycle and economywide emission factors. Process-based LCA follows well-known standards, including ISO 14067, PAS 2050, and the GHG Protocol Product Standard. These standards define clear boundaries, allocation rules, and guidelines for managing biogenic carbon, cut-offs, and methodology transparency. This setup allows for consistent and verifiable calculations of carbon emissions from producing, using, and disposing of products and services.

EEIO and MRIO models like EXIOBASE offer a broader view by linking personal spending habits to overall emissions in the economy. This approach is especially useful for tracking low-

frequency, complex purchases where keeping direct records is challenging.

Importance of High-Quality Data Source

Recent research emphasizes the need for high-quality, current emission factors and datasets to ensure that carbon footprint estimates are accurate and reliable. National guidelines, such as the UK Government's 2024 Conversion Factors for Company Reporting, and datasets like Eco invent are updated regularly. These updates reflect advancements in technology, energy sources, and life-cycle inventories. Moreover, the global warming potentials (GWPs) from the latest IPCC AR6 report are recommended for CO_2-equivalent (CO_2e) calculations, ensuring that the latest scientific findings are used in footprint assessments.

III.PROBLEM STATEMENT

Climate change is one of the world's most significant challenges at present, with long-term impacts on ecosystems, public health, and economies. Personal consumption patterns such as energy consumption, travel, food consumption, and waste generation contribute significantly to the world's greenhouse gas emissions. Citizens are largely unaware of their personal carbon footprint despite rising awareness.

Existing carbon footprint indicators are flawed in numerous ways. The majority provide ballpark estimates rather than site-specific ones that would reflect the end-use energy matrix, the fleet, or the consuming patterns, so they only apply in broad terms in select countries like India. Most are input-based, which reduces efficiency and convenience, and fail to offer transparent information as well as customized, actionable guidance that would induce behavioural changes.

IV.OBJECTIVES :

The overriding purpose of the Eco Track – Personal Carbon Footprint Tracker is to motivate individuals through the offer of a data-driven, reliable mode of quantifying, analysing, and reducing carbon footprint. The following are the specific project goals:

1. To Accurately Measure Individual Carbon Footprints

Develop an effective system that calculates person-level greenhouse gas (GHG) emissions based on principal daily activities like use of energy, mode of travel, food consumption, and consumption patterns in general.

2.Offer Real-Time and Automated Tracking

Integrate multiple automated data feeds such as utility bills, travel history based on GPS, banking and payment records, and electronic receipts so that user activity information is automatically accumulated.

Employ intelligent data categorization and inferencing features so that the input requirements are reduced to the minimum, thus improving end-user convenience and reducing errors in data input.

Make sure that the system offers real-time or near-real-time observations of the user's carbon footprint, so that people can see the emissions as they take place.

3.Raising Awareness and Encouraging Sustainable Conduct

Provide succinct and insightful data visualizations that illustrate the individual's highest carbon-emission sources, empowering the person with actionable details on their environmental impact.

4.Facilitating Goal-Setting and Tracking Progress

Allow users to create customized carbon reducing goals (daily, weekly, monthly) and track their milestones over time.

5.Behavioural Change Support through Engagement

Add gamification elements such as badges, achievement streaks, and progress milestones in order to foster sustainable behaviour and create feelings of achievement.

V.PROPOSED SYSTEM

The system being developed, Eco Track – Personal Carbon Footprint Tracker, is web- and mobile-focused software with the goal of enabling individuals to accurately measure, track, and reduce their personal carbon outputs. The system involves the application of a hybrid estimation engine that combines detailed activity-based information (such as in-home energy consumption, fuel use, travel miles driven, and food consumption) with spend-based estimates from conventional and reputable databases of emission factors.

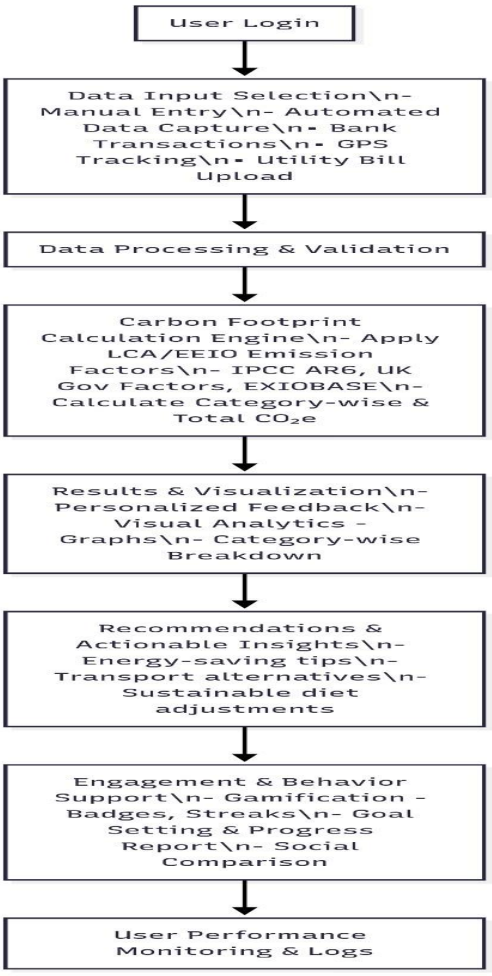

Figure.1 Workflow of the entire system

VI.OUTCOMES

The EcoTrack – Personal Carbon Footprint Tracker project is expected to deliver outcomes that empower individuals to understand, monitor, and reduce their environmental impact. The system will provide users with accurate estimates of their daily, monthly, and annual carbon footprint based on activities such as energy use, transportation, and consumption patterns. It will visualize footprints with interactive dashboards, highlight high-emission activities, and suggest personalized strategies for reduction (e.g., energy-saving tips, greener travel options, sustainable food choices). Users will be able to set goals, track progress over time, and receive real-time feedback or nudges to encourage behaviour change. Additionally, the project will raise environmental awareness, promote sustainable living, and contribute to broader climate action efforts by engaging individuals in emission reduction at the grassroots level.

VII.CONCLUSION AND FUTURE SCOPE

Platform for measuring, monitoring, and analysing their daily carbon emissions across key domains such as energy usage, transportation, food, and purchases. By integrating activity-based and spend-based data with reliable emission factors, the system empowers users to identify their environmental hotspots and take meaningful steps toward sustainable living. The project demonstrates how digital tools, when combined with transparent methodologies and user-friendly interfaces, can promote climate awareness and encourage behavioural change for emission reduction.

In the future, EcoTrack can be enhanced by incorporating real-time data collection through IoT devices and smart meters, making footprint estimates more accurate and automated. Integration of machine learning algorithms can help predict user habits and suggest personalized carbon-saving strategies. The platform can also expand to include community based comparisons, gamification, and reward systems to motivate sustainable behaviour. On a larger scale, Eco Track can be scaled to support enterprise or institutional carbon tracking, linking with government sustainability initiatives, and integrating verified carbon offset marketplaces. Additionally, localization with regionspecific emission factors and policy frameworks will increase the tool's accuracy and relevance globally.

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