Requirements Document

# Introduction

This document outlines the requirements extracted using Recap AI, an AI-powered system for automated requirement gathering.

# Functional Requirements

* The system shall support the goal: 1.2)Objectives of the Project
* The system shall support the goal: The primary objectives of the Carbon Footprint Emission Calculator project are as follows:
* The system shall support the goal: To develop a comprehensive database system that stores users' emission-related data, including their activities and associated carbon footprints.
* The system shall support the goal: To provide an easy-to-use interface that allows users to enter data related to their daily activities (such as travel, energy consumption, waste management, etc.), and accurately calculates their carbon emissions using predefined emission factors.
* The system shall support the goal: To generate reports that provide users with a breakdown of their emissions, categorized by different activities, and offer suggestions for reducing their carbon footprint.
* The system shall support the goal: To raise awareness about the importance of reducing carbon emissions, and align the tool with Sustainable Development Goal (SDG) 13 (Climate Action), which aims to combat climate change and its impacts.
* The system shall support the goal: To promote sustainable practices by encouraging users to adopt more eco-friendly behaviors, such as reducing energy consumption, using public transport, or recycling waste.
* The system shall support the goal: 1.3)Problem Statement
* The system shall support the goal: Climate change remains one of the most critical global challenges, and one of the key contributors to this issue is the increasing concentration of greenhouse gases (GHGs) in the atmosphere. Among these gases, carbon dioxide (CO2) is the most prominent, and human activities are responsible for a significant portion of its emissions. Major sources of CO2 include transportation, electricity usage, and industrial activities. However, many individuals and organizations are unaware of the full extent of their carbon footprints, often overlooking the environmental impact of their day-to-day actions.
* The system shall support the goal: Despite the increasing awareness of climate change, there is still a significant gap in the tools available to individuals and businesses to accurately track their emissions and make informed decisions about reducing them. Current tools are either too simplistic, difficult to use, or not sufficiently comprehensive. There is a need for a robust and accessible system that can help people assess their carbon footprint, gain insights into how their activities contribute to emissions, and provide guidance on reducing their impact on the environment.
* The system shall support the goal: Relevance to Sustainable Development Goals (SDGs)
* The system shall support the goal: The Carbon Footprint Emission Calculator aligns with SDG 13: Climate Action, which urges individuals, businesses, and governments to take immediate actions to mitigate the adverse effects of climate change. By helping users track their carbon emissions, the project contributes to the global efforts to reduce greenhouse gas emissions and achieve net-zero emissions by mid-century. Furthermore, by promoting sustainable living, the project aligns with other SDGs, such as SDG 7: Affordable and Clean Energy and SDG 12: Responsible Consumption and Production.
* The system shall support the goal: Chapter 2:
* The system shall support the goal: SOFTWARE REQUIREMENTS:
* The system shall support the goal: 2.1.1. Frontend Technologies
* The system shall support the goal: The frontend is the part of the system that users interact with directly. The following technologies are used for building the user interface:
* The system shall support the goal: HTML5: HTML is the markup language used to structure the content of the website.
* The system shall support the goal: Purpose: Defines the webpage structure (forms, tables, etc.), making the content accessible and organized.
* The system shall support the goal: CSS3: Cascading Style Sheets are used to style the content and layout of the website.
* The system shall support the goal: Purpose: Adds visual styles to the HTML elements (colors, fonts, spacing, etc.) and ensures the website is aesthetically appealing and user-friendly.
* The system shall support the goal: JavaScript: JavaScript is used for adding interactivity and dynamic functionality to the website.
* The system shall support the goal: Purpose: Facilitates the calculation of carbon emissions on the client side, manages user input, and interacts with the backend to display results.
* The system shall support the goal: Bootstrap (optional): A responsive front-end framework.
* The system shall support the goal: Purpose: Provides pre-built components and responsive design, making the website adaptable to different screen sizes (desktop, tablet, mobile).
* The system shall support the goal: jQuery (optional): A JavaScript library.
* The system shall support the goal: Purpose: Simplifies JavaScript operations and interactions, such as form validation, animation, and DOM manipulation.
* The system shall support the goal: 2.1.2. Backend Technologies
* The system shall support the goal: The backend is responsible for the server-side logic, database management, and business logic behind the scenes.
* The system shall support the goal: Python (Flask or Django): Python is a versatile language used to build the server-side application.
* The system shall support the goal: Flask: A lightweight web framework used to build the backend APIs and handle requests from the frontend.
* The system shall support the goal: Django (optional): A more feature-rich framework if the application requires a more complex backend, including user authentication and built-in database support.
* The system shall support the goal: MySQL : A relational database management system (RDBMS) for storing user data, emission records, and reports.
* The system shall support the goal: Purpose: Organizes data in tables with relationships, such as user data, carbon emission factors, and calculations.
* The system shall support the goal: 2.1.3. Data Visualization and Reporting
* The system shall support the goal: To display results in an easy-to-understand format, the following technologies are used:
* The system shall support the goal: PDF or CSV Generation (optional): For generating downloadable reports.
* The system shall support the goal: Purpose: Allows users to download detailed emission reports in formats like PDF or CSV for further analysis or printing.
* The system shall support the goal: 2.1.4. Other Tools
* The system shall support the goal: Git: A version control system for managing source code.
* The system shall support the goal: Purpose: Keeps track of changes in the codebase, allowing multiple developers to collaborate on the project efficiently.
* The system shall support the goal: Visual Studio Code (VS Code): A code editor for writing and debugging the application.
* The system shall support the goal: Purpose: Provides features like syntax highlighting, autocompletion, and debugging tools to streamline the development process.
* The system shall support the goal: 2.2. System Requirements
* The system shall support the goal: System requirements refer to the hardware and software necessary to run the Carbon Footprint Emission Calculator on both the development and user sides.
* The system shall support the goal: 2.2.1. Hardware Enviornment
* The system shall support the goal: Operating System: Windows, macOS, or Linux.
* The system shall support the goal: Purpose: The development tools and programming languages used in the project are compatible with most major operating systems.
* The system shall support the goal: Processor: Minimum Intel Core i3 or equivalent.
* The system shall support the goal: Purpose: Ensures the system can handle the basic operations required for web development (coding, compiling, testing).
* The system shall support the goal: RAM: Minimum 4 GB RAM (8 GB recommended for smoother performance).
* The system shall support the goal: Purpose: Provides enough memory to run the development tools (IDE, browser, etc.) while working on the project.
* The system shall support the goal: Storage: Minimum 10 GB of free disk space.
* The system shall support the goal: Purpose: Necessary to store the development files, databases, and dependencies.
* The system shall support the goal: Web Browser: Google Chrome, Mozilla Firefox, or Microsoft Edge.
* The system shall support the goal: Purpose: The frontend should be tested in multiple browsers to ensure cross-browser compatibility.
* The system shall support the goal: Chapter 3: 3. Working Concept and ER Model
* The system shall support the goal: 3.1. Working Concept of the Carbon Footprint Emission Calculator
* The system shall support the goal: The Carbon Footprint Emission Calculator is designed to help users calculate and track their carbon emissions based on their daily activities. The working concept revolves around the user inputting data related to their lifestyle and activities, which is then processed to estimate the corresponding carbon emissions. The system calculates emissions using predefined emission factors, which are standardized values representing the amount of CO2 emitted per unit of activity (such as per kilometer traveled, energy consumed, or waste generated).
* The system shall support the goal: The overall flow of the system is as follows:
* The system shall support the goal: User Registration and Login:
* The system shall support the goal: Users need to create an account to store their data securely.
* The system shall support the goal: The login page allows registered users to securely access their data and track their emissions over time.
* The system shall support the goal: Data Input:
* The system shall support the goal: Users provide data related to their activities such as:
* The system shall support the goal: Transportation: Type of vehicle used (car, bus, train, etc.), distance traveled.
* The system shall support the goal: Energy Consumption: Type of energy used (renewable, non-renewable), electricity consumption.
* The system shall support the goal: Waste Generation: Amount of waste generated, and methods of disposal (recycling, landfilling).
* The system shall support the goal: The data can be entered via forms in the frontend, which are processed by JavaScript to prepare the information for backend calculations.
* The system shall support the goal: Emission Calculation:
* The system shall support the goal: The backend uses predefined emission factors (such as grams of CO2 emitted per km for cars or per kWh of energy used) to calculate the total carbon emissions for each activity.
* The system shall support the goal: This information is retrieved from a database or predefined constants.
* The system shall support the goal: Report Generation:
* The system shall support the goal: After calculating the emissions, the system generates a report showing the breakdown of carbon emissions by category (transportation, energy, waste).
* The system shall support the goal: The report is displayed in a user-friendly format with graphs (charts) for better visualization and understanding.
* The system shall support the goal: Suggestions for Reduction:
* The system shall support the goal: Based on the calculated emissions, the system provides suggestions for reducing the carbon footprint, such as switching to public transportation, using energy-efficient appliances, or reducing waste.
* The system shall support the goal: Data Storage:
* The system shall support the goal: All the user data, including their emission records and reports, are stored in a secure database to be accessed in future sessions.
* The system shall support the goal: Downloadable Reports:
* The system shall support the goal: Users can download their reports in CSV or PDF format for future reference or sharing.
* The system shall support the goal: 3.2. Entity-Relationship (ER) Model
* The system shall support the goal: The Entity-Relationship (ER) Model represents the data model of the Carbon Footprint Emission Calculator system. The model outlines the key entities and their relationships, which are crucial for understanding how the system handles data. Here’s a basic ER diagram structure:
* The system shall support the goal: Entities and Attributes:
* The system shall support the goal: User
* The system shall support the goal: Attributes:
* The system shall support the goal: User\_ID (Primary Key)
* The system shall support the goal: Username
* The system shall support the goal: Password
* The system shall support the goal: Email
* The system shall support the goal: Registration\_Date
* The system shall support the goal: Transportation
* The system shall support the goal: Attributes:
* The system shall support the goal: Transportation\_ID (Primary Key)
* The system shall support the goal: User\_ID (Foreign Key from User)
* The system shall support the goal: Type (Car, Bus, Train, etc.)
* The system shall support the goal: Distance (in kilometers)
* The system shall support the goal: CO2\_Emission\_Factor (grams of CO2 per km)
* The system shall support the goal: Total\_Emissions (calculated by Distance × CO2\_Emission\_Factor)
* The system shall support the goal: Energy\_Consumption
* The system shall support the goal: Attributes:
* The system shall support the goal: Energy\_ID (Primary Key)
* The system shall support the goal: User\_ID (Foreign Key from User)
* The system shall support the goal: Energy\_Type (Renewable, Non-Renewable)
* The system shall support the goal: Consumption (kWh)
* The system shall support the goal: CO2\_Emission\_Factor (grams of CO2 per kWh)
* The system shall support the goal: Total\_Emissions (calculated by Consumption × CO2\_Emission\_Factor)
* The system shall support the goal: Waste\_Generation
* The system shall support the goal: Attributes:
* The system shall support the goal: Waste\_ID (Primary Key)
* The system shall support the goal: User\_ID (Foreign Key from User)
* The system shall support the goal: Waste\_Amount (kg)
* The system shall support the goal: Disposal\_Method (Recycling, Landfill, Composting)
* The system shall support the goal: CO2\_Emission\_Factor (grams of CO2 per kg of waste)
* The system shall support the goal: Total\_Emissions (calculated by Waste\_Amount × CO2\_Emission\_Factor)
* The system shall support the goal: Report
* The system shall support the goal: Attributes:
* The system shall support the goal: Report\_ID (Primary Key)
* The system shall support the goal: User\_ID (Foreign Key from User)
* The system shall support the goal: Report\_Date
* The system shall support the goal: Total\_Emissions
* The system shall support the goal: Suggestions (Text Field for reduction suggestions)
* The system shall support the goal: Relationships:
* The system shall support the goal: User to Transportation:
* The system shall support the goal: One-to-many relationship: One user can have multiple transportation records (multiple trips). A user’s transportation data is linked to the user via User\_ID.
* The system shall support the goal: User to Energy\_Consumption:
* The system shall support the goal: One-to-many relationship: One user can have multiple energy consumption records (monthly or annual data). This is also linked through User\_ID.
* The system shall support the goal: User to Waste\_Generation:
* The system shall support the goal: One-to-many relationship: One user can generate waste over multiple sessions, with each record linked to the user via User\_ID.
* The system shall support the goal: User to Report:
* The system shall support the goal: One-to-many relationship: A user can have multiple reports over time, with each report detailing the carbon footprint for a given period.
* The system shall support the goal: CONCLUSIONS
* The system shall support the goal: The Carbon Footprint Emission Calculator provides a structured way for users to measure their environmental impact. By implementing a well-designed database using the ER model, the system efficiently handles user data, emissions calculation, and trend analysis. This project aligns with SDG 13 (Climate Action) by encouraging users to adopt sustainable practices. Future developments will enhance the accuracy and usability of the tool, making it a valuable asset in global sustainability efforts.
* The system shall support the goal: Future Potential and Enhancements
* The system shall support the goal: Integration with IoT sensors: Real-time tracking of emissions from devices.
* The system shall support the goal: AI-based Emission Predictions: Machine learning models to predict future carbon footprints.
* The system shall support the goal: Mobile Application: Android/iOS application for wider accessibility.
* The system shall support the goal: Gamification Features: Reward-based emission reduction tracking.
* The system shall support the goal: Carbon Credit System: Connecting users with organizations for carbon credit exchanges.

# Non-Functional Requirements

* CARBON FOOTPRINT CALCULATOR
* MINI PROJECT REPORT
* for
* 21CSC205P- Database Management Systems
* Submitted by
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* Under the Guidance of
* Balachander S
* In partial fulfilment of the requirements for the degree of
* BACHELOR OF TECHNOLOGY
* in
* COMPUTER SCIENCE ENGINEERING
* DEPARTMENT OF DATA SCIENCE AND BUSINESS SYSTEM SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
* KATTANKULATHUR- 603 203
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* SRM INSTITUTE OF SCIENCE AND TECHNOLOGY KATTANKULATHUR – 603 203
* BONAFIDE CERTIFICATE
* Certified that Computer Architecture and Organization Mini Project report titled “CARBON FOOTPRINT CALCULATOR” is the bonafide work of Abhinav Raj [RA2311042010031], Nouman Shafique [RA2311042010047], who carried out the project work under my supervision. Certified further, that to the best of my knowledge, the work reported herein does not form any other work
* INDEX
* ABSTRACT:
* The Carbon Footprint Emission Calculator is a comprehensive system designed to help individuals and organizations track and manage their carbon emissions. The project focuses on calculating carbon footprints based on various categories, including transportation, energy consumption, and waste generation. It aims to raise awareness of the environmental impact of everyday activities and provide actionable insights for reducing emissions. The system uses a database management approach to store user data, calculate emission values based on predefined factors, and generate reports that offer suggestions for sustainable practices. The application is intended to support efforts in reducing carbon footprints in line with global sustainability goals, particularly SDG 13 (Climate Action). The system is developed using MySQL for database management, with a user-friendly web interface built using HTML, CSS, and JavaScript. This project provides a crucial tool for both individuals and organizations to assess and reduce their carbon emissions, contributing to environmental sustainability.
* CHAPTER 1: INTRODUCTION:
* Overview of the Project
* The Carbon Footprint Emission Calculator is an innovative system designed to assist individuals, organizations, and communities in measuring, tracking, and managing their carbon emissions. With the growing concern over climate change and the need for more sustainable practices, it has become crucial for people to understand the environmental impact of their daily activities. This project offers a database-driven solution that calculates the carbon emissions generated from various sources, including transportation, energy consumption, and waste production. The tool empowers users to make informed decisions about reducing their carbon footprints and adopting more eco-friendly practices.
* The system provides a user-friendly web interface where users can input data regarding their activities (such as travel, electricity usage, and waste generation). Based on this data, the system calculates the carbon emissions and provides detailed reports with suggestions on how to reduce them. By offering real-time tracking and actionable insights, the Carbon Footprint Emission Calculator is an essential tool in the global effort to combat climate change.

# Priority (MoSCoW Method)

Could: 3

Must: 8