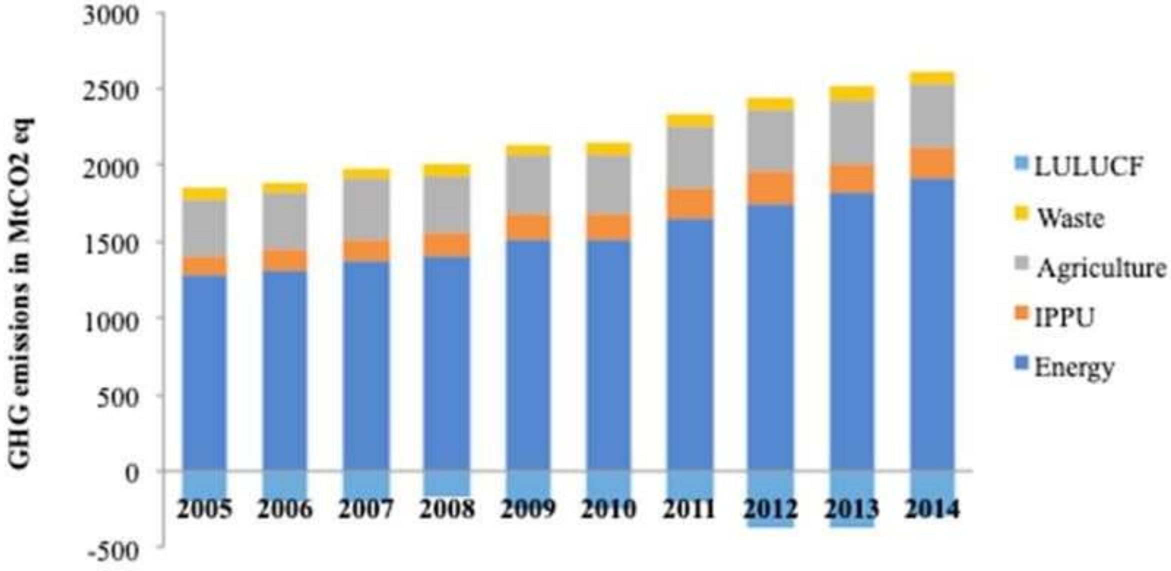
Carbon Foot Print Of India In Recent Years



The bar graph show India's greenhouse gas emissions (GHG) measured in Million tonnes of CO_2 equivalent ($MtCO_2e$).

It covers the years **2005 to 2014**.

Each horizontal bar is divided into **sectors that contribute to emissions**:

Sectors (color-coded)

- **Blue** – Energy
- **Orange** – IPPU (Industrial Processes & Product Use)
- **Grey** – Agriculture
- **Yellow** – Waste
- **Light Blue** – LULUCF (Land Use, Land Use Change & Forestry)
    - Note: LULUCF is sometimes *negative* because forests absorb CO_2.

Trend Summary (2005–2014)

1. Total Emissions are Increasing

From 2005 to 2014, India's total GHG emissions **steadily rise**.

- 2005 → around **1,300 $MtCO_2e$**
- 2010 → around **1,700 $MtCO_2e$**
- 2014 → around **2,000+ $MtCO_2e$**

This shows **consistent growth** in emissions over the decade.

2. Energy Sector is the Largest Contributor

The **blue section** dominates all bars.
This means:

- Electricity generation
- Vehicle fuel
- Industrial energy use
  → These are India's biggest pollution sources.

Energy is responsible for **over 60% of all emissions** each year.

3. Agriculture is the Second Largest Contributor

The **grey section** remains stable across years.
Agriculture contributes:

- Methane (from rice fields, livestock)
- Nitrous oxide (from fertilizers)

This contributes **15–20%** of total emissions.

4. IPPU and Waste contribute less

- **IPPU (orange)**: small, but slowly increasing
- **Waste (yellow)**: very small and stable
  These make up **less than 10%** combined.

5. LULUCF gives a slight negative offset

- Shown in **light blue**
- Represents forests absorbing CO_2
- The value remains almost constant
- Slight negative contribution means forests help lower net emissions

Introduction

Climate change is one of the most pressing global challenges today, with vehicular emissions being a major contributor to carbon dioxide (CO_2) levels. While governments and industries monitor emissions at large scales, individuals lack simple and effective tools to understand and reduce their personal carbon footprint. Most people are unaware of how their daily travel choices impact the environment.

EcoTrack is designed to bridge this gap by providing an intelligent, user-friendly system that tracks vehicle-based carbon emissions automatically and delivers actionable insights. By minimizing manual input and leveraging vehicle data, EcoTrack empowers users to make environmentally responsible decisions effortlessly.

Problem Statement

Vehicle emissions significantly contribute to air pollution and climate change, yet individuals have no easy way to measure their personal impact. Existing carbon calculators rely on manual inputs, estimates, and generic averages, making them inaccurate and inconvenient. This lack of real-time, personalized emission tracking prevents users from understanding their habits and adopting sustainable travel behaviors.

Objectives of EcoTrack

- To calculate vehicle-based carbon emissions accurately
- To reduce user effort by automating data collection
- To provide real-time and monthly emission insights
- To categorize emissions into understandable levels
- To suggest practical actions for emission reduction
- To encourage long-term sustainable mobility behaviour

Existing System vs Proposed System

Existing System

- Manual carbon footprint calculators
- Generic emission estimates
- Requires repeated user input
- No vehicle-specific tracking
- Limited or no actionable insights

Proposed System (EcoTrack)

- Automated vehicle data extraction via scanning or sensors
- Optional OBD-II integration for real-time data
- Accurate emission calculation per trip
- Monthly emission categorization
- Personalized eco-friendly suggestions
- Minimal user interaction required

System Overview

EcoTrack is a mobile-based application supported by a backend processing system. Users can scan vehicle details or connect an optional OBD-II adapter to automatically retrieve necessary data. Distance traveled is tracked via sensors, GPS, or OBD-II inputs. The system calculates emissions, stores trip history, and provides insights and recommendations through a clean user interface.

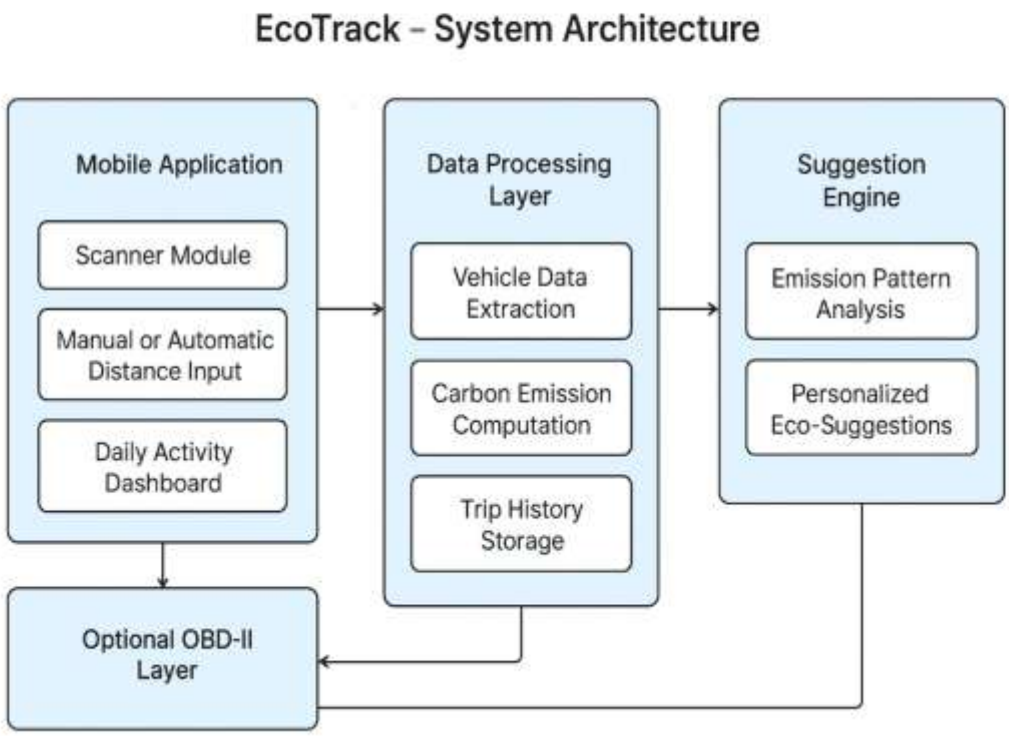
Architecture Design

EcoTrack consists of four main layers:

1. Mobile Application Layer
    - Vehicle scanning module
    - Trip logging interface
    - Emission dashboard
2. Data Processing Layer
    - Emission calculation engine
    - Distance aggregation logic
    - Monthly analysis module
3. Optional OBD-II Integration Layer

- Real-time distance tracking
- Fuel consumption monitoring

4. Storage Layer
   - User profiles
   - Vehicle data
   - Trip and emission history



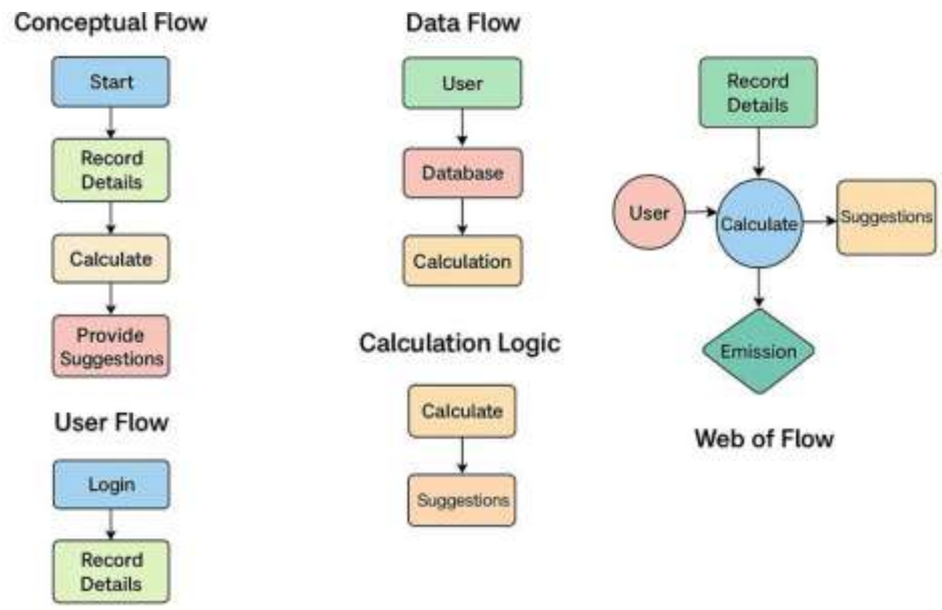
Data Flow & Workflow

I. User registers/logs into the application
II. Vehicle details captured using scanner or sensor
III. Distance traveled collected via GPS, OBD-II, or manual fallback
IV. Fuel usage estimated based on mileage
V. Carbon emissions calculated per trip
VI. Emissions aggregated monthly
VII. Emission category assigned
VIII. Personalized suggestions generated and displayed

Data Model

- User: Stores authentication and preferences

- Vehicle: Stores fuel type, mileage, emission factor
- Trip: Stores distance, date, and emission value
- EmissionRecord: Monthly total emissions
- Suggestion: Eco-friendly recommendations based on patterns.



Core Algorithms

Fuel Consumption Calculation

Fuel Used = Distance Traveled / Mileage

Carbon Emission Calculation

CO_2 Emission = Fuel Used × Emission Factor

Monthly Aggregation

Total Monthly Emission = Sum of all trip emissions in a month

Emission Categorization

- Low: < 90 kg CO_2/month
- Moderate: 90–240 kg CO_2/month
- High: 240–450 kg CO_2/month
- Very High: > 450 kg CO_2/month

Technology Stack

Frontend

- Flutter / React Native
- Camera API (vehicle scanning)
- Dashboard UI

Backend

- Python
- Flask / FastAPI
- SQLite / Firebase / MongoDB

Optional Technologies

- OBD-II Adapter (Wi-Fi/Bluetooth)
- GPS Sensors
- OCR for document scanning
- ML models (future scope)

Security & Privacy Considerations

- Secure user authentication
- Encrypted storage of user data
- No data sharing without user consent
- Vehicle data anonymization
- Optional sensor integration with full user control

Feasibility Analysis

Technical Feasibility

- Uses existing smartphone sensors and APIs
- Compatible with low-cost OBD-II adapters

Economic Feasibility

- Minimal infrastructure cost
- Free or low-cost user adoption

Operational Feasibility

- Simple interface
- Minimal user interaction required

Limitations & Future Enhancements

Limitations

- OBD-II not available in all vehicles
- Sensor accuracy may vary
- Initial setup required

Future Enhancements

- AI-based emission prediction
- Integration with EV and public transport data
- Government policy and incentive mapping
- Community challenges and rewards