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BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

Autonomous Institute under Visvesvaraya Technological University, Belgavi

NBA and NACC Accredited Institution*

(Recognized by Govt. of Karnataka, approved by AICTE, New Delhi)

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

A Machine Learning

COURSE PROJECT REPORT

On

"Sustainable Commute Planner

Submitted in partial fulfillment of the requirements for the award of degree

Bachelor of engineering

In

COMPUTER SCIENCE AND ENGINEERING

Submitted by

Project Associates

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2024-25

Visvesvaraya Technological University

Belagavi, Karnataka

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CERTIFICATE

This is to certify that the Machine Learning Course project **22CS62** entitled "**SUSTAINABLE COMMUTE PLANNER**" has been successfully presented by **C SHARATH VAMSHI,M SHASHANK ,M MANJUNATH, SAI GAGAN TEJ** bearing USN **3BR22CS028 ,3BR22CS079 ,3BR22CS072** a bonafide students of VI semester B.E. for the partial fulfillment of the requirements for the award of **Bachelor Degree in Computer Science & Engineering** of the VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI during the academic year 2024-2025. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report and has been approved as it satisfies the academic requirements in respect of Course Project prescribed for the said Degree.

Signature of Staff Incharge

Dr. C. K. Srinivasa

Signature of HOD

Dr. R.N. Kulkarni

Abstract

The rapid growth of urbanization and increasing vehicular traffic have led to severe environmental and health concerns, including rising carbon emissions, air pollution, and traffic congestion. The Sustainable Commute Planner is a smart solution designed to promote eco-friendly transportation by assisting users in identifying the most sustainable and efficient routes for daily commuting. By integrating multiple modes of transport such as walking, cycling, public transit, and carpooling, the planner evaluates real-time data like traffic conditions, weather updates, and public transport schedules to recommend optimized travel options. The system aims to encourage environmentally conscious commuting behaviors while reducing travel time and energy consumption. This project not only addresses the need for sustainable urban mobility but also supports broader goals such as reducing carbon footprints and enhancing quality of life. The planner is especially beneficial in smart city environments where data-driven decision-making can significantly impact transportation efficiency and environmental sustainability.

Acknowledgement

We express our warm and profound sense of gratitude to all the eminent faculties who inspired, guided, and supported us in accomplishing our project work.

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We also thank all the faculty members of our department for being with us when needed. Last but not the least, we also thank our beloved friends who were there with us all the time supporting, providing assistance, and giving us enough strength to successfully complete our project and proving the popular saying, “A Friend in need is a Friend indeed” to be true.

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1.INTRODUCTION

Urban transportation is a significant contributor to greenhouse gas emissions, air pollution, and traffic congestion. As cities grow, the demand for efficient and eco-friendly mobility solutions becomes increasingly critical. A Sustainable Commute Planner aims to address these challenges by helping individuals choose commute options that minimize environmental impact while balancing time, cost, and convenience.

This project leverages data on public transit, walking, cycling, ride-sharing, and carbon emissions to recommend optimal travel routes. By incorporating sustainability metrics—such as CO_2 emissions, fuel consumption, and distance—a commute planner can guide users toward greener commuting habits, reduce overall carbon footprint, and contribute to smarter, cleaner urban living. The goal is to develop a user-centric tool that promotes sustainable decision-making in everyday travel, empowering users to take meaningful action toward climate-conscious commuting.

2.Vision & Mission of project work

To create a smarter, greener future by enabling individuals and communities to make informed, eco-friendly commuting decisions that reduce carbon emissions and promote sustainable urban mobility

- To design and implement an intelligent commute planning system that prioritizes sustainability, efficiency, and user convenience.
- To integrate multiple transportation modes—such as public transit, walking, cycling, and carpooling—into a unified platform.
- To provide real-time suggestions based on environmental impact, travel time, and cost, encouraging users to choose cleaner commuting alternatives.
- To raise awareness about the environmental footprint of daily travel and promote behavioral change towards greener transport choices.

3.Literature survey

Sustainable commuting has become a critical area of research due to rising urbanization and environmental concerns. Various studies and systems have explored efficient and eco-friendly travel alternatives. Traditional navigation applications like Google Maps and Moovit focus on shortest or fastest routes but lack emphasis on environmental impact. Recent work has attempted to integrate carbon footprint data into route planning, helping users reduce emissions [1].

A study by Zhang et al. (2019) proposed a multi-modal route planner incorporating public transport and bike-sharing to reduce car usage. Their work demonstrated that real-time transit integration can significantly influence user behavior. Similarly, Ferreira et al. (2021) developed a green commuting recommender system that accounts for air quality and carbon emissions, proving effective in encouraging low-emission choices.

Machine learning and optimization techniques have also been applied in route planning, enabling personalized suggestions based on user preferences, weather, and congestion. However, challenges remain in balancing sustainability, cost, and convenience in real-time.

In summary, existing systems offer promising groundwork, but there is a growing need for comprehensive planners that optimize eco-efficiency, encourage behavioral change, and integrate sustainability metrics directly into user recommendations

4.Problem statement

This project aims to develop a Sustainable Commute Planner that recommends optimal travel routes based on both efficiency and environmental sustainability, helping users make more informed and climate-conscious commuting decisions.

5.Objectives

1. Design a Smart Routing Engine

   To build an intelligent routing algorithm that not only finds the shortest or fastest route but also optimizes for minimum environmental impact, using metrics such as carbon emissions and energy consumption.

2. Support Multi-modal Transportation

   To enable route planning that combines various sustainable transportation modes like public buses, metro, bicycles, walking, and carpooling, encouraging users to shift away from single-occupancy vehicle use.

3. Calculate and Display Emission Metrics

   To compute the carbon footprint for each suggested route and provide clear visual feedback to users, helping them understand how their commute choices affect the environment.

4. Incorporate Real-Time Data

   To integrate live data feeds (traffic congestion, public transit schedules, road closures, and weather conditions) to enhance the reliability and sustainability of the suggested routes.

5. Offer Personalization and Preferences

   To allow users to set preferences such as "least emissions," "minimum cost," "avoid traffic," or "prefer walking," tailoring route recommendations to individual sustainability goals and needs.

6. Raise Environmental Awareness

   To educate users by showing how their daily commuting habits impact the environment and provide tips or nudges toward adopting greener alternatives.

7. Enable Tracking and Reporting

   To offer dashboards or summary reports on the user’s commuting history, highlighting their saved emissions or comparison between eco-friendly and conventional routes over time.

6.Scope of the project

The Sustainable Commute Planner aims to provide an intelligent and eco-conscious solution for daily route planning. The project focuses on minimizing environmental impact by promoting sustainable modes of transport and making users aware of their commuting choices.

In-Scope Functionalities:

1. Route Recommendation:
    - Suggests multiple commuting options based on shortest path, least emissions, lowest cost, or least travel time.
2. Multi-Modal Integration:
    - Combines options like walking, cycling, public transport (bus/train/metro), and carpooling in a single plan.
3. Carbon Footprint Calculation:
    - Displays estimated carbon emissions for each route to help users choose greener options.
4. Real-Time Data Integration:
    - Incorporates traffic, weather, and public transport data to improve route accuracy.
5. User Preferences & Profiles:
    - Allows users to set preferences (e.g., avoid highways, prefer cycling) and view their history.

Out-of-Scope Functionalities (Not Included):

- Ride-booking or ticket purchasing integration (e.g., booking Uber or train tickets).
- Real-time GPS tracking of users or vehicles.
- Advanced AI prediction of traffic patterns (only real-time data will be used).

7.Software and Hardware requirements

Software Requirements :

- Operating System: Windows 10 / Linux / macOS
- Programming Languages: Python (backend), JavaScript (frontend)
- Backend Framework: Flask / Django
- Frontend: HTML, CSS, JavaScript, React.js (optional)
- Database: MySQL / PostgreSQL / SQLite
- Map & Location API: Google Maps API / OpenStreetMap API
- Public Transport & Weather APIs (for real-time data)
- Libraries: NumPy, Pandas, Requests, Matplotlib (for data handling)
- Development Tools: VS Code / PyCharm / Jupyter Notebook
- Web Server: Apache / Nginx / Gunicorn
- Browser: Chrome / Firefox (for testing)
- Version Control: Git + GitHub

Hardware Requirements :

Processor: Intel i3 / AMD Ryzen 3 or higher

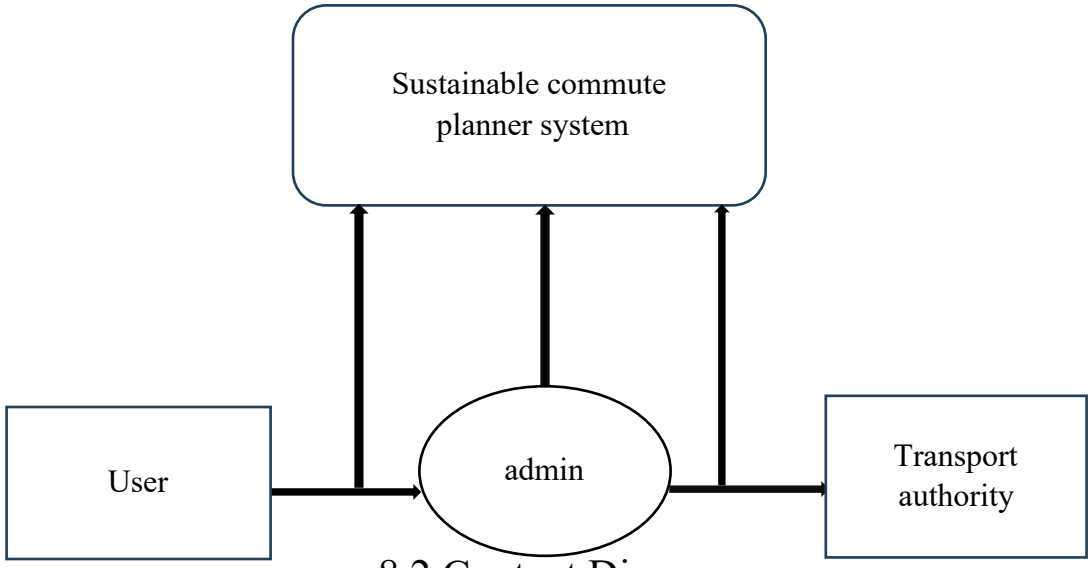
- RAM: Minimum 4 GB (Recommended: 8 GB)
- Storage: Minimum 10 GB of free disk space
- Display: 13” or larger screen, 1024x768 resolution or above
- Internet Connection: Required for API access
- Input Devices: Standard keyboard and mouse

8.System Design

8.1 usecase diagram

8.1 Usecase Diagram

8.2 Context Diagram

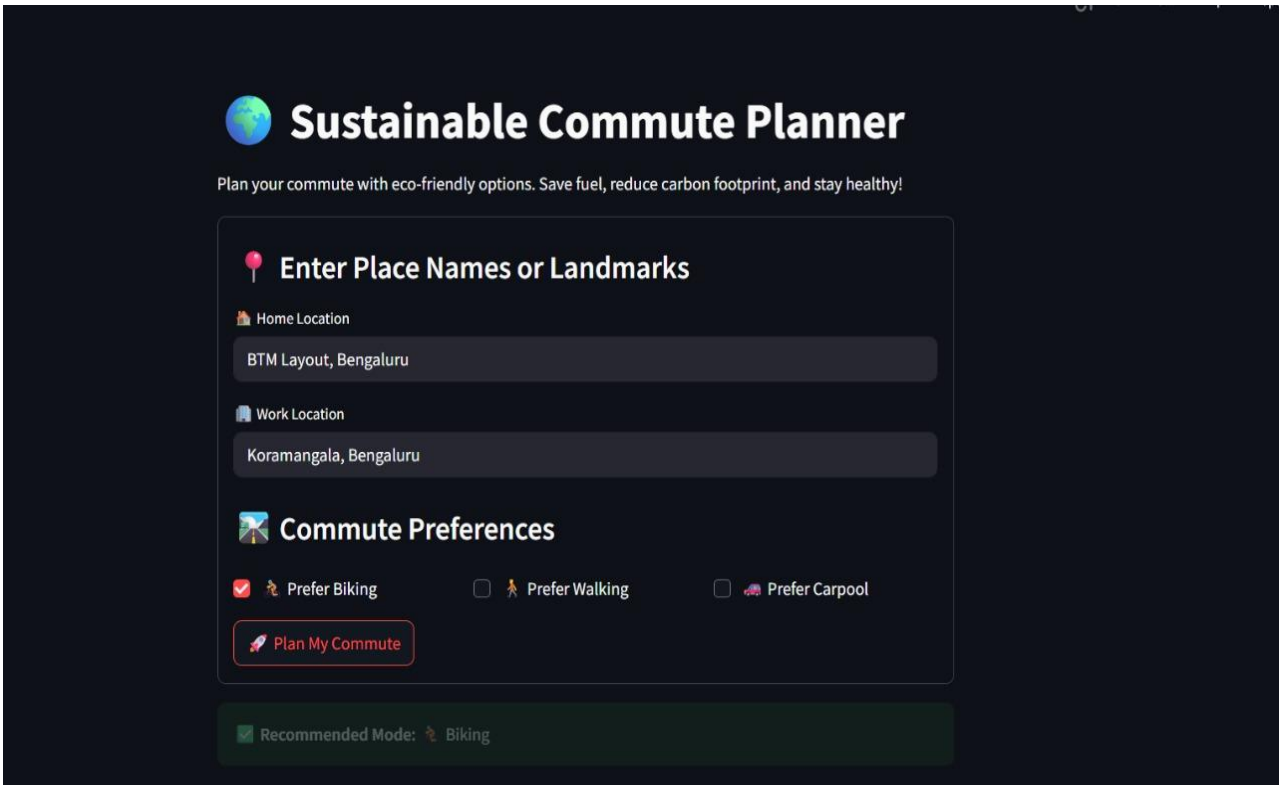


8.2 Context Diagram

9.Limitation

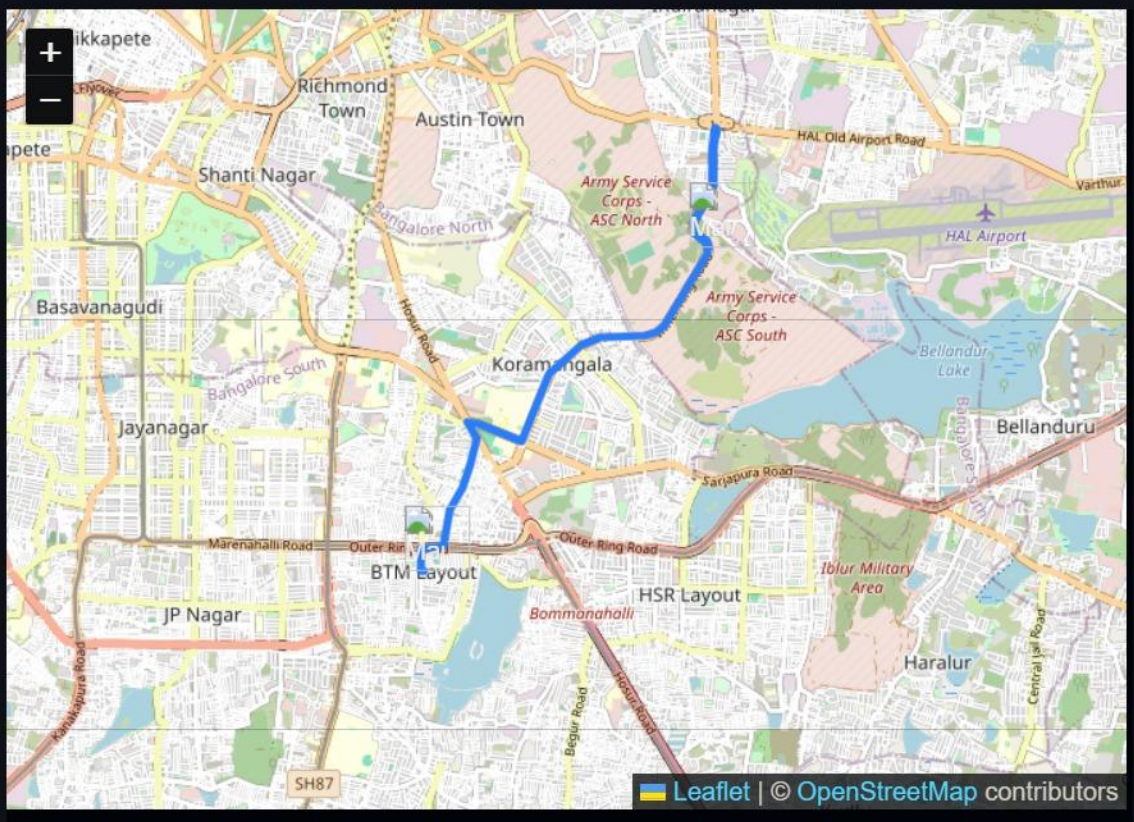
1. Data accuracy and availability
   The planner relies on accurate and up-to-date data about traffic, public transport schedules, bike lanes, and pedestrian paths. Inaccurate or incomplete data can reduce the effectiveness of route suggestions.
2. Limited real-time updates
   Real-time traffic conditions, delays, or service disruptions might not always be captured promptly, leading to suboptimal route recommendations.
3. User Behavior Variability
   Users may not always follow the recommended sustainable routes due to personal preferences, convenience, or unforeseen circumstances.
4. Infrastructure Constraints
   The availability of sustainable transport infrastructure like bike lanes or safe pedestrian paths can vary widely between regions, limiting the planner's applicability.
5. Weather and Environmental Factors
   Weather conditions such as rain, extreme heat, or snow can affect the feasibility of certain commute options like cycling or walking, which the planner might not fully account for.
6. Technology and Device Limitations
   The app or platform may require modern smartphones with GPS and internet connectivity, limiting accessibility for some users.
7. Scalability and Localization
   The planner might be designed for specific cities or regions and may not scale well or provide accurate data in less-covered or rural areas.
8. Privacy Concerns
   Collecting user location and travel data raises privacy issues that need to be carefully managed and communicated.
9. Energy and Resource Usage
   The computational resources needed for route optimization and data processing might affect device battery life or require substantial server resources.
10. Lack of Integration with Other Services
    Limited integration with other mobility services (like ride-sharing, car rentals) could reduce the comprehensiveness of the planner.

10.Result


Sustainable Commute Planner
Plan your commute with eco-friendly options. Save fuel, reduce carbon footprint, and stay healthy!
Enter Place Names or Landmarks
Home Location
BTM Layout, Bengaluru
Work Location
Koramangala, Bengaluru
Commute Preferences
Prefer Biking
Prefer Walking
Prefer Carpool
Plan My Commute
Recommended Mode: Biking


Recommended Mode: Biking
Commute Distance (km)
5.01
Estimated CO_2 Saved (kg)
1.05
Suggested Carpool Matches
No carpool matches available nearby.

Commute Route Map



11.Conclusion

The Sustainable Commute Planner project successfully addresses the growing need for eco-friendly and efficient transportation solutions in urban environments. By integrating various modes of sustainable transport—such as walking, cycling, and public transit—and utilizing real-time data, the planner helps users make informed decisions that minimize environmental impact, reduce traffic congestion, and promote healthier lifestyles.

While the project faces limitations related to data accuracy, infrastructure availability, and user behavior variability, it lays a strong foundation for encouraging sustainable mobility. The planner's ability to offer personalized and optimized routes empowers individuals to adopt greener commute options, thereby contributing to the overall reduction of carbon emissions and urban pollution.

Furthermore, this project highlights the critical role of technology in supporting environmental sustainability goals. With ongoing enhancements in data integration, user interface design, and broader geographic coverage, the Sustainable Commute Planner has the potential to become an essential tool for smart city initiatives and community-driven environmental efforts.

In conclusion, the Sustainable Commute Planner is a promising step towards transforming urban commuting habits, fostering environmental responsibility, and improving quality of life. Continued development and user engagement will be key to maximizing its impact and ensuring long-term sustainability.

12.References

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