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International Journal of Engineering Technology Research & Management
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SUSTAINABLE RIDE-SHARING: A MULTI-FEATURE APPROACH TO CARBON REDUCTION AND USER EXPERIENCE OPTIMIZATION

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ABSTRACT
The increasing environmental concerns associated with urban mobility have driven the need for innovative solutions in the transportation sector. This research paper proposes a novel ride-sharing application designed to address common issues in traditional ride-sharing platforms while enhancing sustainability and user experience. The application introduces several advanced features, each aimed at promoting a greener and safer transportation experience. First, a sentiment analysis module replaces traditional rating systems, enabling the app to monitor user feedback dynamically and filter out inappropriate or negative content, ensuring a positive and safe environment. Additionally, the app incorporates a carbon credit generation and trading system, incentivizing both riders and drivers to choose low-carbon routes, thereby contributing to reduced emissions. An augmented reality (AR) navigation system guides users to precise pick-up points by overlaying real-time directions, especially useful in complex or crowded urban areas. Furthermore, a recommendation system classifies and connects affluent passengers with nearby riders. Safety is a core focus of this app, with an IoT-based SOS button that provides immediate emergency assistance, giving users peace of mind while traveling. The study explores the system's architecture, technical implementation, and potential impact on sustainable urban mobility, demonstrating how emerging technologies can transform ride-sharing into a truly eco-friendly, user-centric service.

INTRODUCTION

The As urbanization accelerates worldwide, cities face critical challenges in managing traffic congestion, pollution, and transportation inefficiencies. Traditional ride-sharing platforms have provided a convenient solution to these issues; however, they also bring several drawbacks, such as lack of environmental incentives, limited safety measures, and unoptimized user experience. With increasing awareness of climate change, there is a growing demand for sustainable transportation solutions that address not only convenience but also environmental responsibility. By integrating emerging technologies such as carbon credits, augmented reality (AR), sentiment analysis, and Internet of Things (IoT) devices, ride-sharing services can be transformed into eco-friendly, user-centric systems that significantly reduce carbon emissions.

This research introduces an advanced ride-sharing application designed to meet these modern demands by embedding sustainability and safety into the core of the system.

The app features a carbon credit system that rewards users for taking low-emission routes, contributing to carbon reduction goals. Additionally, AR-powered navigation aids in pinpointing exact pick-up spots, especially in complex or crowded areas, thereby enhancing the user experience. A sentiment analysis module monitors user feedback dynamically, filtering out negative content to maintain a positive atmosphere within the platform. Moreover, the app includes a recommendation system that matches riders with nearby passengers based on profile analysis, enabling optimized travel routes that reduce unnecessary detours and emissions. To ensure safety, an IoT-based SOS feature allows users to request immediate assistance during emergencies.

By integrating these features, this ride-sharing solution not only addresses common drawbacks in traditional models but also contributes positively to urban environmental goals. contexts.

This paper discusses the app’s architecture, functionality, and the potential societal and environmental impacts of its widespread implementation. Through advanced technology, this application positions itself as a pioneering model for future sustainable urban transportation.

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PROBLEM STATEMENTS

Real- "A Sustainable and User-Centric Approach to Ride-Sharing: Integrating Carbon Credits, AR Navigation, Safety Protocols, and Sentiment Analysis".

Traditional ride-sharing platforms struggle with sustainability, safety, and user experience, often lacking incentives for eco-friendly travel, security features, and reliable navigation in complex areas. This project proposes a comprehensive ride-sharing app that addresses these challenges through a carbon credit system for low-emission routes, augmented reality (AR) navigation to guide users to pick-up points, optimized rider-passenger matching to reduce carbon impact, an IoT-based SOS feature for safety, and sentiment analysis to maintain a positive environment.

Purpose

The purpose of this paper is to investigate the integration of augmented reality (AR), carbon credit generation and trading, and sentiment analysis into a ride-sharing platform, aiming to enhance user experience, promote sustainability, and improve driver and rider safety.

Scope of the project

This project integrates augmented reality (AR) for seamless navigation, carbon credit generation and trading to encourage eco-friendly rides, and sentiment analysis to replace traditional ratings for more accurate driver feedback. It aims to enhance user experience, promote sustainability, and improve safety through real-time features like SOS systems and location sharing, with scalability for global markets..

Product Perspective

The product aims to offer a sustainable, user-friendly ride-sharing experience by integrating augmented reality (AR) for navigation, carbon credit generation and trading, and sentiment analysis for driver feedback. It focuses on eco-consciousness, safety, and transparency, with features designed for scalability and adaptability across different markets.

Product Functions

Users Augmented Reality (AR): Enhances navigation and pickup/drop-off experience.
Carbon Credit Generation: Tracks and rewards eco-friendly rides.
Carbon Credit Trading: Allows users to trade earned credits.
Sentiment Analysis: Replaces ratings with detailed user feedback on drivers.
SOS System: Provides safety features with real-time location sharing.

User Characteristics

The User target the app's easy navigation (AR), eco-friendly rides (carbon credit rewards), accurate driver feedback (sentiment analysis), safety features (SOS and location sharing), and transparency in driver ratings.

Constraints

The application should have seamless performance on both iOS and Android platforms.
Internet connectivity is required for the live try-on feature

Assumptions and Dependencies

Users have smartphones with GPS/AR, are eco-conscious, and will engage with carbon credits and safety features. Product Relies on third-party APIs for AR, mapping, carbon credits, and legal compliance.

Functional Requirements

User Registration and Authentication

Users must be able to register and log in using email, phone number, or social media accounts.

Ride Booking:

Users can book a ride by entering pickup and drop-off locations.
Real-time ride tracking and ETA updates.

AR Navigation:

Provide AR-based navigation for efficient pickup and drop-off.

Carbon Credit Tracking:

Track and calculate carbon credits earned for each eco-friendly ride.
Display carbon credit balance to users.

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Carbon Credit Trading:
Allow users to trade earned carbon credits with other users or redeem them for rewards.
Sentiment Analysis:
Replace ratings with detailed user feedback on drivers.
SOS System:
Enable users to send real-time location-based SOS alerts in emergencies.
Driver Management:
Allow drivers to register, view ride requests, and accept or decline rides.
Payment System
Provide payment options (credit/debit cards, wallets) for ride payments and carbon credit transactions.
Notifications:
Notify users about ride status, feedback requests, carbon credits, and safety alerts.
Admin Panel:
Manage user accounts, carbon credit data, and ride statistics.
Functional Requirements: The system must allow admin users to add new items to the catalog.
The system must allow admin users to update product details
Non-functional Requirements
Performance Requirements
The app should handle high user traffic with minimal latency, ensuring quick ride booking and real-time tracking.
Usability Requirements
The app should be intuitive, with a user-friendly interface for both passengers and drivers, including easy access to features like AR navigation and carbon credit tracking.
Reliability Requirements
The system should have 99.9% uptime, ensuring high availability for users.
The try-on system should handle errors gracefully, such as loss of camera access or poor image quality.
Security Requirements
User data, including personal information and payment details, should be encrypted and stored securely. Implement secure authentication and authorization protocols..
External requirements
User Interface (UI):
Mobile Devices: The app should provide a responsive and intuitive UI for both iOS and Android platforms.
AR Navigation: Integration with ARKit (iOS) or ARCore (Android) for augmented reality-based navigation during pickup/drop-off.
Third-Party APIs:
Mapping & GPS Services: Integration with Google Maps or Apple Maps for location tracking, route calculation, and real-time traffic updates.
Carbon Credit API: External API to track, calculate, and verify carbon credits (e.g., carbon emission tracking services or blockchain-based platforms for trading).
Payment Gateway: Integration with third-party payment services (Stripe, PayPal) for processing payments for rides and carbon credit transactions.

SOS Location Sharing: Integration with real-time location sharing services like Google Maps or Firebase for sending SOS alerts with the user's current location.

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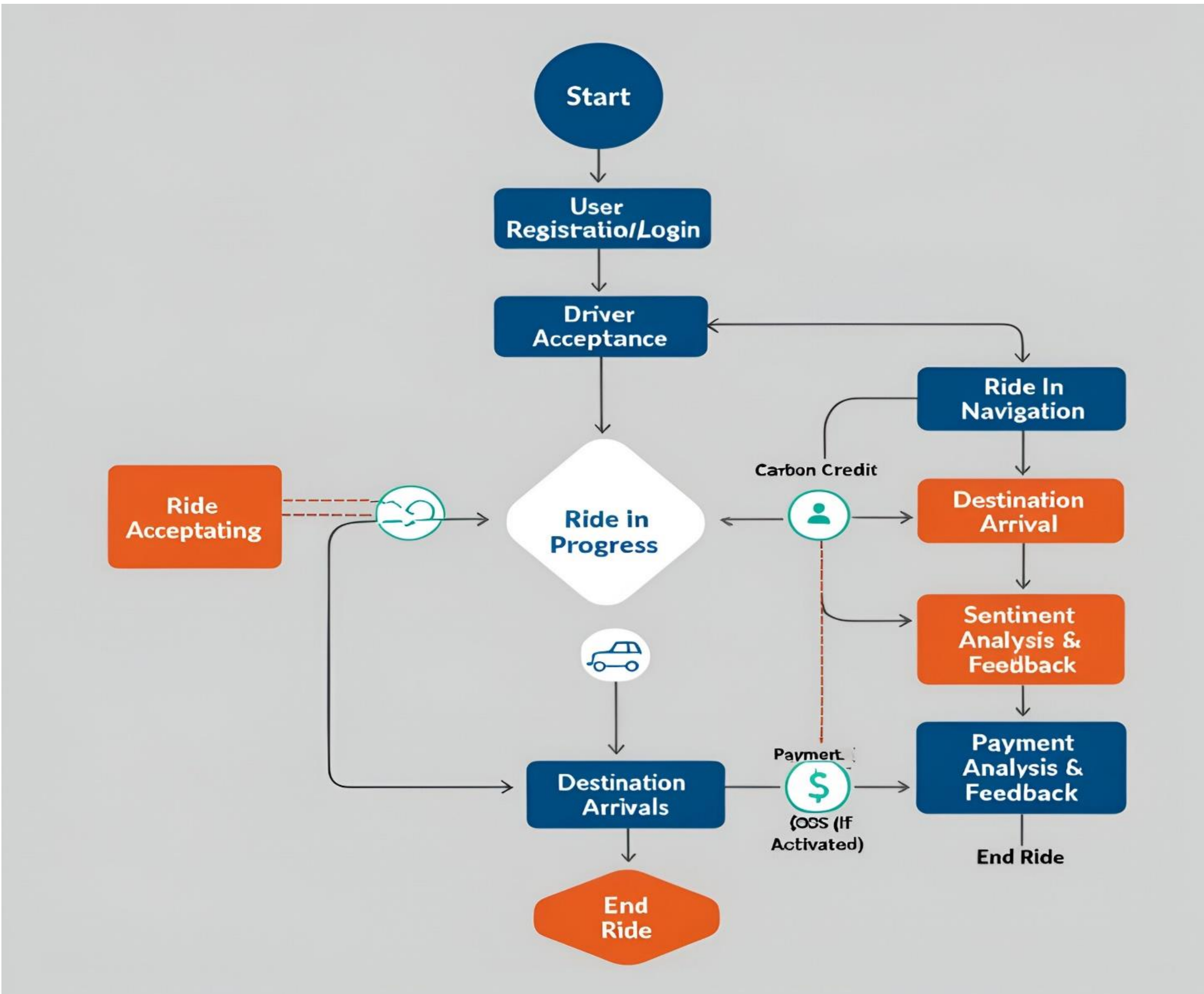
Flowchart:



1. **Start**
2. **User Registration/Login**
   - Action: User enters credentials
   - Decision: Is the user registered?
     - Yes → Go to Ride Booking
     - No → Proceed to Register New User

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3.Ride booking

- Action: App calculates route and finds driver.
  - Decision: Is a driver available?
    - Yes → Proceed to Driver Acceptance
    - No → Show "No Drivers Available" message

3. **Driver Acceptance**
   - Action: Driver receives and accepts/declines the request
   - Decision: Did the driver accept the ride?
     - Yes → Proceed to AR Navigation
     - No → Notify User and End Process
4. **AR Navigation for Pickup**
   - Action: App shows AR navigation to the driver's location
   - Action: User meets driver at the pickup point
   - Proceed to Ride in Progress
5. **Ride in Progress**
   - Action: Ride is completed with real-time tracking
   - Action: Monitor ride for any issues (traffic, delay)
   - Proceed to Destination Arrival
6. **Destination Arrival**
   - Action: User reaches the drop-off point
   - Action: Ride completion message
   - Proceed to Carbon Credit Tracking
7. **Carbon Credit Tracking**
   - Action: Calculate and add carbon credits to the user's balance
   - Proceed to Sentiment Analysis & Feedback
8. **Sentiment Analysis & Feedback**
   - Action: User and driver provide feedback
   - Action: Sentiment analysis replaces traditional ratings
   - Proceed to Payment Process
9. **Payment Process**
   - Action: User makes payment (via credit card, wallet)
   - Action: Process payment and confirm ride completion
   - Proceed to End Ride
10. **SOS System (If Activated)**
    - Action: User activates SOS
    - Action: Share real-time location with emergency contacts
    - Proceed to End Ride
11. **End Ride**
    - Action: Ride history is updated
    - Action: Carbon credits and feedback stored
    - End

System of carbon credit :

Ride Booking & Completion

- User books and completes a ride.

Emission Calculation

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- The system calculates emission savings based on distance traveled, vehicle type, and number of passengers sharing.

Credit Allocation to Wallet

- Carbon credits are awarded to the user's digital wallet based on emission savings.

Trading or Redemption

- User has the option to trade credits in the marketplace or redeem them for rewards within the app.

Marketplace Transaction

- If the user chooses to trade, the transaction is processed within the marketplace module.

Secure Credit Transfer

- Credits are securely transferred between users through a ledger (optionally blockchain-based).

Monitoring & Reporting

- The system regularly updates users on their accumulated carbon credits, transaction history, and total environmental impact, encouraging engagement.

Mathematical calculation
1.Define Variables:
• Let D be the total distance traveled per trip (in kilometers). • Ev: Emission factor for the vehicle type (e.g., grams of CO_2 per kilometer). Different vehicle types (e.g., electric, gasoline, diesel) will have different values. • N: Number of trips or users.
2. Calculate Emissions Per Trip:
• For each trip, the carbon emission C can be calculated as C = D × Ev This gives the CO_2 emissions for a single trip based on the distance and the vehicle's emission factor. **3. Total Emissions for All Trips:**
For N trips, the total emissions C total is: Ctotal =i=1∑N (Di ×Ev,i) where D and Ev,i are the distance and emission factor for each individual trips.
4. Estimating Reductions: • If the app's goal is to reduce emissions, calculate the baseline emissions for individual car usage without sharing. • The difference between baseline emissions and the sharing model can show the carbon reduction impact.

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HIGH LEVEL DESIGN

- **User Data**:
  - Enters through **User Interaction Module**.
  - Flows to **Ride Matching**, **Credit Management**, **Sentiment Analysis**, and **Reporting Systems**.
- **Ride Data**:
  - Starts from **Ride Booking** to **Credit Generation** and **Recommendation System**.
- **Credit Data**:
  - Moves from **Credit Generation** to **User Wallets** and **Trading Module**.
- **Feedback Data**:
  - Collected post-ride, processed by **Sentiment Analysis** and updated in **Monitoring and Reporting**.

CONCLUSION

The ride-sharing app successfully addresses environmental and user-experience challenges in the shared mobility space by promoting eco-friendly travel and leveraging modern technology to enhance usability and engagement. The implementation of **carbon credit generation and trading** encourages users to reduce their carbon footprint, rewarding

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them for choosing sustainable transportation options. Through **sentiment analysis**, the app gains valuable insights into user satisfaction, enabling continuous improvement of service quality without relying on traditional rating systems.
Furthermore, the app's **recommendation system** ensures a smooth and relevant ride-matching process, optimizing user convenience and fostering a supportive community around carbon reduction. The integration of these features makes the platform both impactful and user-centric, setting it apart from other ride-sharing solutions.
Ultimately, this project demonstrates the potential for technology to drive behavior change and contribute to environmental sustainability, aligning individual incentives with collective benefits. The app serves as a scalable model that can expand to other cities and regions, inspiring more people to participate in a greener future.
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