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Design and Implementation of a Carpooling and Ride Sharing Web Application

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Abstract - Traffic congestion, fuel wastage, and environmental pollution are major concerns in urban areas, largely caused by the dominance of single-passenger vehicles. Carpooling provides an effective solution by enabling individuals to share rides, thereby reducing travel costs and contributing to sustainable transportation. This paper presents the design and development of a web-based carpooling system that connects drivers and passengers with common routes and schedules. The system allows drivers to publish available rides while passengers can search for suitable options based on destination, time, and vehicle capacity. The platform offers a user-friendly interface to facilitate secure communication and ride matching between car owners and commuters. By enabling the efficient use of mobility resources owned by individuals, the proposed solution aims to minimize traffic congestion, reduce carbon emissions, and provide an affordable travel alternative. The system demonstrates how technology can promote eco-friendly commuting practices and improve the overall urban transportation experience.

Keywords: Carpooling, Ride Sharing, Web Application, Sustainable Transportation, Environment Friendly.

INTRODUCTION

Urban areas face increasing challenges such as traffic congestion, fuel consumption, and environmental pollution, largely due to the dominance of single-passenger vehicles. Carpooling offers a practical solution by allowing multiple individuals to share a single vehicle for trips with similar routes. This not only reduces travel expenses such as fuel and tolls but also minimizes stress and the demand for parking spaces.

The proposed Carpooling and Ride Sharing Web Application provides a platform where drivers traveling alone can offer seats to fellow passengers, while daily commuters can conveniently find rides with drivers heading to the same destination. Unlike commercial ride-hailing services, this system is designed to promote cost-sharing rather than profit, enabling drivers and passengers to split expenses fairly.

By optimizing the use of available mobility resources, the system contributes to reducing traffic congestion, lowering carbon emissions, and supporting sustainable urban transportation. Carpooling is particularly effective in regions with high population density and significant commuting activity, making it a viable alternative to traditional transportation methods.

LITERATURE REVIEW

Mayur K. Thorat and Rahul M. Lahakare [1] proposed a carpooling system with SMS alerts, focusing on addressing earlier limitations and improving system security. Their model extended usability to both inter-city and intra-city travel and incorporated accessibility features for visually impaired users through speech recognition technology.

R. Manzini and A. Pareschi [2] developed a decision support system designed to help passengers identify and select appropriate vehicles for carpooling. Similarly, Swati R. Tare, Neha B. Khalate, and Ajita A. Mahapadi [3] emphasized improving user-friendliness, particularly for passengers, and highlighted the importance of reliability in real-time systems along with enhanced safety measures for women travelers.

BlaBlaCar [4], the world's largest long-distance ridesharing platform, founded in 2006, connects drivers and passengers to share inter-city rides and costs. With over 20 million members across 19 countries, it has successfully built trust through online profiles, ratings, and reviews. However, its services remain largely restricted to inter-city travel, leaving a gap in intra-city commuting solutions.

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FolksVagn introduced a corporate-based ride-sharing model, requiring users to register with corporate emails and make payments through prepaid wallets. While effective in reducing commuting costs for employees, its limited scope restricts broader adoption. Similarly, *Taxifares* [5], an Android-based application, pioneered carpooling services for vacationers, offering cheaper shared rides on specific routes such as Chandigarh–Delhi and Mysore–Manali. Although innovative, its availability remains geographically limited.

From the review of existing systems, it is evident that current solutions either focus on inter-city travel, corporate commuters, or specific routes. Few provide a unified and accessible platform that combines intra-city and inter-city commuting with reliability, cost-effectiveness, and safety.

PROPOSED SYSTEM

The proposed **Carpooling and Ride Sharing Web Application** is designed to be user-friendly, secure, and efficient. It ensures smooth interaction between administrators, drivers, and passengers while providing real-time ride management. The system maintains a centralized database that stores driver, passenger, and vehicle details with strong authentication and security mechanisms.

A. System Workflow

1. **Registration & Authentication**
   a. Both drivers and passengers register using verified credentials.
   b. Profile validation ensures authenticity and prevents fake accounts.
2. **Ride Creation**
   a. Drivers specify journey details such as origin, destination, time, and available seats.
   b. The ride is published in the system for passengers to view.
3. **Ride Search & Booking**
   a. Passengers can search available rides using filters (location, time, cost, driver rating).
   b. Booking requests are sent, and drivers receive instant notifications.
4. **Ride Confirmation & Tracking**
   a. Once accepted, booking details are updated in the database.
   b. GPS-based tracking allows passengers to monitor the driver's location in real time.
5. **Feedback & Rating System**
   a. After ride completion, both drivers and passengers can rate each other.
   b. This enhances trust, transparency, and future ride quality.

B. Advantages over Existing Systems

The proposed system offers several improvements compared to manual methods and existing applications:

- **Improved Performance**: Optimized database design ensures faster ride creation and matching.
- **Enhanced Security**: Authentication, encrypted communication, and verified profiles reduce risks.
- **Time Efficiency**: Quick ride search and booking minimize commuting delays.
- **Cost Effectiveness**: Shared rides lower travel expenses and optimize fuel usage.
- **User-Friendly Interface**: Intuitive design ensures minimal learning curve.
- **Real-Time Monitoring**: Administrators and passengers can track rides live.
- **Women Safety Features**: Emergency SOS option and verified driver profiles enhance security.
- **Eco-Friendly**: Reduced vehicle usage lowers congestion and pollution.
- **Scalability**: Can easily expand from intra-city to inter-city rides.

C. System Architecture

The proposed system follows a **three-tier architecture**:

1. **Presentation Layer (Frontend)**
   a. A web-based user interface for passengers, drivers, and administrators.
   b. Built with responsive design for desktop and mobile access.

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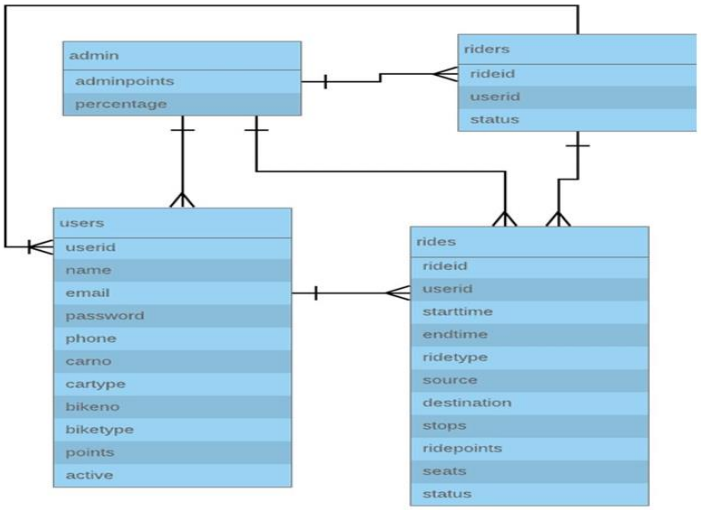
2. **Application Layer (Backend)**
   a. Handles business logic such as ride creation, ride matching, booking, and notifications.
   b. Implements authentication and authorization mechanisms.
3. **Database Layer**
   a. Stores user profiles, ride records, vehicle details, and transaction history.
   b. Optimized for fast query execution and secure data storage.

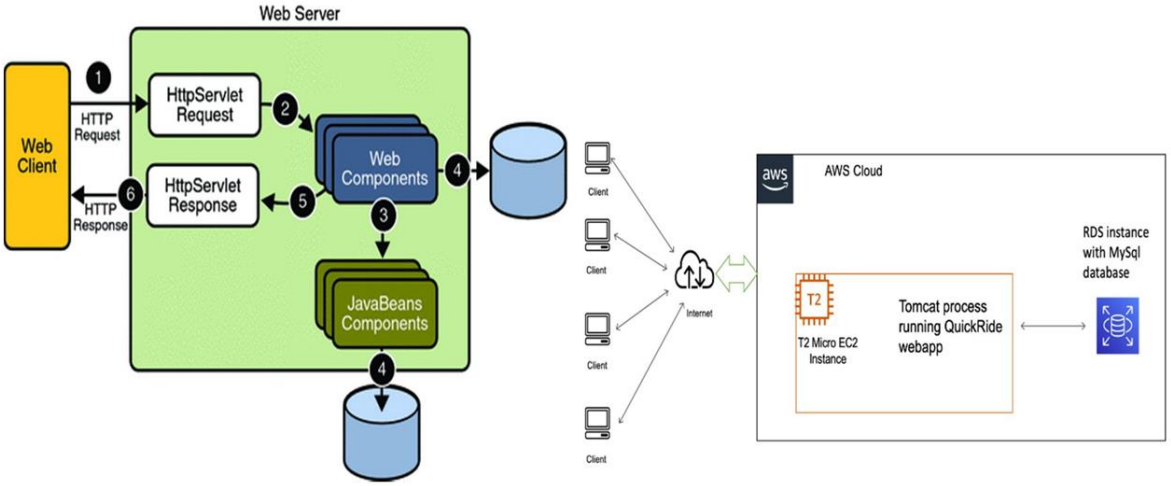


D. Feasibility Study

- **Economic Feasibility**: Reduces passenger costs and optimizes driver expenses, making it cost-effective.
- **Operational Feasibility**: User involvement during development ensures acceptance and ease of adoption.
- **Technical Feasibility**: Uses readily available web technologies, making the system practical for deployment.

E. Future Scope

- Integration with digital payment gateways for seamless transactions.
- AI-based route optimization to minimize travel time.
- Expansion to corporate and inter-city ridesharing.
- IoT and Smart City integration for intelligent transportation.



F. System Modules and Functions

1) Admin Module

- Has full access to all modules.

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- Accepts registration requests from users (approval required before login).
- Manages driver and passenger records.
- Generates reports of all rides, transactions, and registered users.
- **User Module**
- Represents travelers and commuters who either want to book a ride or offer a ride.
- A user can act as both a **Driver** or a **Rider** within the same account.

2) Driver Module

- Can register vehicle details (car/bike).
- Publishes trips with journey details (origin, destination, time, cost, available seats).
- Can accept or reject passenger requests.
- Views earned points/rewards for trips.
- Updates trip status (active, completed, canceled).

3) Rider Module

- Searches for available rides based on source, destination, date, and cost.
- Sends requests to join a ride of interest.
- Views ride details including driver info, vehicle details, and trip status.
- Tracks ride in real-time and checks status updates.

CONCLUSION

The proposed **Carpooling and Ride Sharing System** is designed to reduce fuel consumption—one of the most valuable non-renewable resources—while minimizing traffic congestion on roads. By encouraging shared rides, the system promotes eco-friendly and sustainable transportation. It not only reduces travel time and expenses but also contributes to a cleaner environment and better traffic management. the application is designed to be **user-friendly, reliable, and secure**, and has been tested with appropriate test cases to ensure smooth functionality.

The system will be developed using the **MERN stack** (MongoDB, Express.js, React, Node.js) in a Windows environment. This modern technology stack provides scalability, high performance, and flexibility for future enhancements.

It achieves several goals, including:

- **Instant access** to ride and user information.
- **Improved productivity** through automation of ride management.
- **Efficient record management** with centralized data storage.
- **Optimal utilization of resources** by encouraging shared travel.
- **Simplification of operations** for drivers, riders, and administrators.
- **Reduced processing time** with quick ride search and booking.
- **Portability and scalability**, making it adaptable for future improvements such as AI-based route optimization or integration with smart city systems.

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