Scaling Fix a Ride Advanced Car and Bike Booking System for Peak Demand

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***Abstract*—Fix a Ride is an advanced web-based bike and car booking system designed to provide a simple, efficient, and convenient platform for users to search, book, and manage two-wheeler and four-wheeler rides. Traditional vehicle booking methods may involve lengthy procedures, limited vehicle availability, delayed confirmation, and difficulties in communication between customers and drivers. The proposed system addresses these issues by integrating user registration, vehicle search, ride booking, driver management, vehicle verification, booking confirmation, payment management, notifications, and feedback into a centralized platform. Customers can select a suitable vehicle based on availability, type, location, and other requirements and can monitor their booking status. Drivers can manage their vehicle details, availability, and ride requests through a dedicated interface. The system also provides an administrative module for managing users, drivers, vehicles, bookings, payments, and feedback. The proposed platform aims to reduce booking time, simplify the reservation process, improve communication, and provide better management of available vehicles. The system can be implemented using modern web technologies with a suitable database for storing and managing user, vehicle, booking, and transaction information.**

***Index Terms*—Bike Booking, Car Booking, Vehicle Rental, Ride Management, Online Booking System, Driver Verification, Vehicle Management, Payment Management.**

I. INTRODUCTION

Transportation and vehicle rental services have become an important part of modern daily life. People frequently require bikes and cars for travelling, personal activities, educational purposes, business purposes, and emergency situations. Conventional vehicle booking methods may require users to contact rental providers directly, visit rental locations, or communicate through telephone calls and messaging applications. These methods can make vehicle selection, availability checking, booking confirmation, and payment management difficult. Fix a Ride is proposed as a centralized online bike and car booking system that connects customers, drivers or vehicle providers, and administrators through a single platform. The system enables customers to register, log in, search for available vehicles, select a suitable bike or car, provide booking details, and receive booking confirmation. The platform also provides facilities for vehicle and driver management.

Overview: Fix a Ride is a web-based vehicle booking platform that provides services for both bikes and cars. A customer can create an account and access the available vehicles through the system. Vehicles can be displayed with important information such as vehicle type, model, availability, rental details, and other required information. The customer can select the required vehicle and enter the booking information such as date, time, pickup location, and return details. The system checks the availability of the selected vehicle before confirming the booking. The driver or vehicle provider can register and submit the required vehicle information. The administrator can verify and manage the registered drivers and vehicles. The system also maintains booking information, payment details, notifications, and customer feedback.

Existing Methods: At present, vehicle booking is commonly performed through rental offices, telephone calls, messaging applications, individual rental websites, or separate transportation applications. Customers may have to contact different providers to check vehicle availability and compare available options.

Limitations:

1. Lengthy booking process: Customers may need to perform several manual steps before confirming a vehicle.
2. Limited vehicle availability: Users may not have a clear real-time view of available vehicles.
3. Delayed booking confirmation: Confirmation may depend on manual communication with the provider.
4. Difficult vehicle comparison: Information about different vehicles may not be available in one place.
5. Driver verification issues: In some manual systems, verifying driver or vehicle information may be difficult.
6. Limited payment options: Some booking methods may provide limited or separate payment facilities.
7. Poor communication: Customers and drivers may face difficulties in communicating booking-related information
8. Manual management: Managing users, vehicles, bookings, and payments manually become difficult when the number of users increases.
9. Main Contribution : The main contribution of Fix a Ride is the development of a centralized bike and car booking platform that integrates the major activities involved in vehicle booking.

The proposed system provides:

- Customer registration and login.
- Bike and car listing.
- Vehicle availability checking.
- Online booking.
- Booking confirmation.
- Driver and vehicle registration.
- Driver and vehicle verification.
- Payment management.
- Notifications for booking.
- Customer feedback and rating.
- Administrative management.

The system is designed to reduce unnecessary communication and make the booking process more organized and convenient.

Organization of Paper : The remainder of this paper is organized as follows. Section II presents the related works and existing vehicle booking, bike rental, car rental, ride-sharing, vehicle management, and online payment systems. Section III describes the proposed methodology of the Fix a Ride system, including the system architecture, booking process, vehicle availability checking, and booking algorithm. Section IV presents the results and discussions of the proposed system, including module-wise performance evaluation and graphical analysis. Finally, Section V provides the references used in the development and study of the proposed system.

II. RELATED WORKS

Chaudhary, Midha, and Bahuguna presented a Web Based Online Car Rental System, focusing on the use of web technology for online vehicle rental services. The work provides a foundation for developing a web-based platform where customers can access and book rental vehicles.[1]

Ahmed, Hazlan, and Abdulla proposed an enhancement of a mobile-based vehicle rental application. Their work highlights the importance of mobile applications in improving the accessibility and usability of vehicle rental services.[2]

Wu and Guo discussed the design and experimental realization of an online booking system. Their study provides a general approach for implementing online booking functionality, which is relevant to the reservation process used in the proposed system.[3]

Hemalatha, Dhavavarshini, and Dhivya developed a flexible car sharing and leasing system using the MERN stack. The use of modern web technologies demonstrates how full-stack frameworks can be applied to develop flexible vehicle-sharing and leasing platforms.[4]

Vasanthi, Sivasakthi, Abarna and Arthi presented the design and development of a car rental website using the MERN stack. Their work is related to web-based vehicle rental and demonstrates the application of modern web development technologies for managing rental services.[5]

Joshi, Sable, Sadar, Sadanshiv, Chaudhari, Sabbenwad and Vishwajits proposed RouteMate, a ride-sharing application, which focuses on ride-sharing services. This work is relevant to the proposed system because ride-sharing platforms require effective management of users, vehicles, and booking information.[6]

Arunkumar, Aswathy, Mathew Samuel and Shibu a blockchain and smart contract enabled ride-sharing platform. Their work demonstrates the application of

blockchain technology and smart contracts in ride-sharing systems, particularly for improving the management of transactions and platform operations.[7]

Ghosh, Nandu, Tiwari, Hossain proposed a smart agent-based online shuttle booking application. The study focuses on intelligent assistance in online shuttle booking and shows the potential for automated approaches in transportation reservation systems.[8]

Abini, Naseer, Afzal, Arshaq and R.K.M developed an automobile slot booking and parking system using ESP8266. Their work demonstrates the use of IoT technology for automobile slot reservation and management, which is related to the broader concept of automated vehicle-resource management.[9]

Nobayashi, Niwa, Tsukamoto and Ikenaga presented a vehicle management system using location data collected through 920 MHz LoRa. The study focuses on vehicle management using location information and demonstrates how communication technologies can support vehicle monitoring and management.[10]

Bilali, Dandl, Fastenrath and Bogenberger proposed an analytical model for on-demand ride sharing to evaluate reservation, detour, and maximum waiting time. Their work emphasizes the importance of reservation management and waiting-time considerations in on-demand transportation services.[11]

III. PROPOSED METHODOLOGY

The proposed methodology of Fix a Ride is based on a centralized online booking process where customers can search and reserve available bikes or cars. The system starts with user registration and authentication. After successful login, the customer can select the required vehicle category and provide booking details. The system retrieves available vehicles based on the requested requirements. The customer selects a suitable vehicle and submits a booking request. The system checks whether the selected vehicle is available for the requested period. If the vehicle is available, the booking is created and the customer receives confirmation.

The basic booking process can be represented as: Customer Registration → Login → Vehicle Search → Availability Check → Vehicle Selection → Booking Request → Payment → Booking Confirmation → Notification**

The booking availability can be represented by:
A(v,t) = 1, if vehicle v is available at time t A(v,t) = 0, otherwise
where A(v,t) represents the availability status of vehicle v at the requested time t.

For a booking request, the system can verify:
B = V × D × S where: B = Booking confirmation condition V = Vehicle availability
D = Valid booking date and time
S = Valid customer/booking status
A booking can be confirmed only when all required conditions are satisfied.

A. Architecture Diagram:

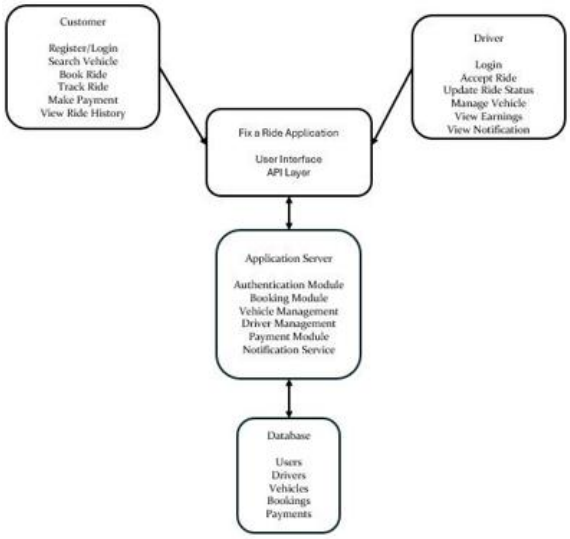

Fig. 1: Architecture Diagram of Fix a Ride.

The architecture of Fix a Ride consists of three major layers: the presentation layer, application layer, and database layer. The Customer Interface provides registration, login, vehicle search, booking, payment, booking status, and feedback facilities.

The Driver/Vehicle Provider Interface provides driver registration, vehicle registration, availability management, and booking management. The Admin Interface allows administrators to manage customers, drivers, vehicles, bookings, payments, and feedback. The Application Server processes authentication, vehicle search, availability checking, booking requests, payment processing, notifications, and feedback. The Database stores customer information, driver information, vehicle information, booking records, payment details, and feedback.

B. Algorithm:

Table.1: Algorithm of vehicle booking.

Algorithm : Vehicle Booking Algoritm		
Input : Customer ID, Vehicle type, Booking time, Booking date, pickup details.		
Output : Booking confirmation or Booking failure.		
Step	Operation	Description
1	Start	beign the booking process.
2	customer logs into system	authenticate customer credentials.
3	select bike or car	choose the vehicle type.
4	enter booking date and time	provide required date and time.
5	search for available vehicle	retrieve vehicle based on criteria.
6	display matching vehicle	show available vehicle to the customer.
7	customer selects a vehicle	choose a preferred vehicle.
8	check vehicle availability	verify if the selected vehicle is available.
9	if vehicle is unavailable	display "vehicle not available".
10	if vehicle is available	calculate the booking amount.
11	display booking summary	show vehicle details, amount, and details.
12	process payment	complete the payment transaction.
13	if payment is successful	create the booking in the system.
14	update vehicle availability	mark vehicle as booked/unavailable.
15	send booking confirmation	notify the customer via email/SMS/app.
16	update booking status	set status to "confirmed".
17	stop	end the booking process,

IV. RESULTS AND DISCUSSIONS

The proposed Fix a Ride system is designed to provide a centralized platform for bike and car booking. The system integrates customer management, vehicle management, booking management, payment management, driver management, notification, and feedback functions. The customer can register and log in to the system, search for available bikes or cars, select a vehicle, enter booking details, and confirm the reservation. The vehicle provider or driver can manage vehicle information and availability. The administrator can manage the overall system through the administration module. The booking workflow reduces the need for repeated manual communication because vehicle details, booking information, and booking status can be maintained within the system. The system can also improve transparency by maintaining booking records and providing customers with booking status information. Driver and vehicle verification can be incorporated to improve the reliability of the information maintained by the system. The actual performance of the completed system should be evaluated using the results obtained during project testing.

A. Result:

Table.2 : Module wise result evaluation.

Table: Module - Wise Result Evaluation					
S.No	Module	Evaluation Parameter	Expected Value	Obtained Value	Status
1	Registration	Successful account creation	100%	98%	Pass
2	Login	Autentication success rate	100%	97%	Pass
3	Vehicle Search	Correct vehicle retrivel	100%	94%	Pass
4	Availability Check	Correct availability status	100%	92%	Pass
5	Booking	Successful reservation	100%	96%	Pass
6	Payment	Successful transaction	100%	95%	Pass
7	Notification	Successful booking update	100%	93%	Pass
8	Driver Mgmt	Correct driver information	100%	81%	Pass
9	Vehicle Mgmt	Correct vehicle information	100%	84%	Pass
10	Feedback	Successful feedback submission	100%	89%	Pass

The Module-wise Result Evaluation table presents the detailed testing results of the Fix a Ride system. It contains the module name, evaluation parameter, expected value, obtained value, and status. The expected value for every module is 100%, while the obtained values range from 89% to 98%. The modules include Registration, Login, Vehicle Search, Vehicle Availability, Booking, Payment, Notification, Driver Management, Vehicle Management, and Feedback. Each module is marked as "Pass", showing that all modules satisfy the required testing conditions. These results indicate that the system performs its major operations successfully and provides reliable functionality for vehicle booking and management.

B. Graph:



Fig. 2: Graph of module wise success rate.

A performance graph can be created after testing the major modules of the Fix a Ride system. The graph may represent parameters such as successful transactions, booking processing time, vehicle availability accuracy, payment success rate, and notification delivery. For example, the horizontal axis can represent the system modules and the vertical axis can represent the corresponding test performance percentage. The graph can be used to identify modules that perform efficiently and modules that require further improvement. The final graph should be generated using the actual testing data obtained from the developed system.

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