

Autorent: AI-Powered Intelligent Fleet Rental System

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Abstract:

The AI-Driven Fleet Rental System powered by AI, machine learning, and GPS tracking takes vehicle renting to a new level by enabling rapid and easy uploading of rental requests, personalized vehicle selection, and improved navigation. It improves user experience, performance, and decision-making. It also aims to facilitate the use of shared natural modes of transport by advocating for shared mobility, electric vehicles and a smaller carbon footprint. It also assists administrators with wide range of features for managing bookings, maintenance and clients. This system integrates advanced technology and natural resource conservation in order to increase consumer happiness and improve effectiveness.

Keywords: Artificial Intelligence, Real-Time GPS Tracking, Route Optimization, Vehicle Recommendation.

1. Introduction

In recent times vehicle rental sector experienced digital change. Online platforms contributed to this evolution. Integration of new technologies was key. The goal was to meet customer growing requirements. Traditional rental systems and ride-hailing services grant access to vehicles. Yet often they miss delivering highly personalized efficient and environmentally mindful experience.

Artificial intelligence (AI) is an emergent

technology. It created new ways to enhance rental process. Advanced GPS tracking also became relevant. Both foster smarter decision-making. It allows for data-driven operations and customized solutions. These solutions target user requirements and operational difficulties.

This document is the founding precedent of an AI-driven fleet rental system. This system revolutionizes vehicle rental services. It offers a seamless service to the customer. This service is automated and accessible from any part of the world. By using AI and GPS tracking, the system produces personalized suggestions. Route optimization is also a key feature. An upsurge in operational efficiency is witnessed. This innovative approach intensifies user's satisfaction. It promotes sustainable practices too. Shared mobility is one. Reduced emissions is another. All these align well with broader environmental objectives. The platform gives administrators power. They are provided with potent management tools. This leads to effective oversight of tasks. Reservations management is one. Vehicle maintenance is another. They can maintain customer support as well. Lastly transaction tracking is skillfully managed.

Study is aimed at emphasizing benefits of integrating AI in vehicle rental industry. It's a study of transforming traditional rental models. Also, it offers a substitute to ride-hailing. There is evaluation of the system's influence on satisfaction of customer. Also its influence on operational

efficiency and sustainability. The paper examines how AI-driven solutions influence standards in vehicle rental industry. These solutions can promote a sustainable transport-centric approach.

2. Literature Survey

A. Overview

Ansh Agrawal and Rishabh Mathur's. "Online Vehicle Rental System"[1] highlights the transformative impact of digital advancements in the vehicle rental

industry, showcasing the shift from manual operations to automated, user-centric online systems. Platforms now offer seamless booking, payment processing, and notification management for users, while administrators benefit from streamlined workflows for vehicle management, rent monitoring, and feedback resolution. Advanced technology stacks, like the MEAN framework, ensure high performance, scalability, and secure data handling through robust login modules. Additionally, these systems focus on cost-effective travel, operational efficiency, and reducing dependence on physical locations. Sustainable practices, including eco-friendly solutions, are emphasized, setting the groundwork for integrating AI and machine learning. These technologies promise to further revolutionize the industry by enhancing personalization, optimizing operations, and advancing environmental sustainability.

Amey Thakur's "Car Rental System"[2] which was published in 2021 showcases the evolution of the car rental business through Computerized frameworks, moving from filling forms by hand to efficient online platforms. PHP and MySQL facilitate secure transactions and safe data handling while enabling smooth booking and customer service systems. Operational efficiency and customer satisfaction are further improved with such features as instant updates, automatic database management and availability around the clock. Other factors out-with functional issues such as reliability and error management provide seamless experiences. The interest is also paying attention to the most recent innovations such as AI and machine learning for customization and

optimization, thus opening new opportunities for further developments within the sector.

According to Rahman and Rusli in their article titled "Development of a Web-based Car Rental Business Management System"

[3] while looking at the rural areas or

regions that are difficult to get to, and are not well served by public transportation, it discusses the concerns of every ordinary car rental systems. It comments on the manual car renting processes that are ineffective such as using paper-based advertisements and the dangers of losing customer tracking information. Other researches regarding this topic are mainly focusing the potential of ICT in facilitating the establishment of integrated web based systems which would make it easier for the intended users to operate. They also argue within such systems, the management of data, the risks related to operations and the satisfaction of users will be enhanced by having a combination of searches, booking options and feedback systems within the web based system. Citing of earlier researches and methodologies articulates the necessity of such improvements in the field of car rental management, thus creating opportunities for development of new ideas for example the one being presented in the paper.

Leyo Babu Thomas and V. Vaidhehi, "The Design of Web Based Car Recommendation System using Hybrid Recommender Algorithm"[4]. This research paper evaluates the various literature which is related to the recommendation systems (RS) and specifically their use in the CAR web based recommendation system. It explains the growing importance of RS among other aspects – turning to be e-commerce models aiming at enhancing customer satisfaction, loyalty and sales levels. Several types are highlighted like content-based, collaborative filtering, demographic, knowledge-based and hybrid. The study cites advances like the addition of user feedback, interactive algorithms and clustering to recommendations in the effort to increase their predictive power. It points out the problems in creating complete car datasets particularly over how models of cars change as well as how data sets are scattered over several sites. The hybrid proposed has adopted both user-to-user and item-to-item collaborative filter techniques through adding browsing history and demographic

information so as to effectively recommend cars to the consumer. The body of literature in possession shows that hybrid models do better than the usual types of RS in that they are flexible and more accurate in family oriented applications.

The work on "Chat Bot On E-Car Renting using AI" by Salman Khan , G. Satheeshkumar, and Dr. T. Guhan[5] provides an analysis of the growth of chatbots and their use in different services including the car rental industry. They cite popular AI voice applications such as Apple's Siri and Google's Assistant that offer some form of interaction but aren't very good at complex tasks and multiple commands including ones involving child commands. The paper also highlights some of the drawbacks of the conventional auto rental systems like the filling of forms that are done manually that can affect the level of experience. It aims to improve the quality of interaction in the car renting process with the help of an AI-customized chatbot utilizing Amazon Web Services, thereby solving the problems of current systems and offering a smooth easier method to follow.

The research by John Temitope Ogbiti together with William Aaron under the title "Development of a Web-Based Car Rental Management System"[6]. The research article focuses in details as to how car rentals moved from the use of papers to the use of servers on the internet, pointing out the weaknesses of such techniques as the use of paper books for recording and having restricted access to the records. Research shows the maximum usage of technology pays off, because simple designs of the interfaces, the ability to manage stock in real-time, as well as combining functions such as booking, and paying through the internet are beneficial. Other developments included the application of CRM databases for better service, big data techniques for market demand predictions, the application of new technologies including blockchain and mobile payments for improved security and convenience in transactions. The paper also tackles the issues of importance of customer evaluations, eco-friendly activities, popularity of AI, and IoT technologies and their importance in the industry reform. The

review emphasizes on the use of flexible and safe web oriented systems which would deal with the existing problems of efficiency of operations and improvement of the satisfaction level of the customers.

I would like to recommend Jovie Micayas Gallera's publication through the title, Online Applications for Car Rentals[7]. He indicates in the publication that several studies have been conducted in order to establish the relation between UX and user satisfaction in the context of DL environment. It also specifies main factors of user satisfaction, for example, the ease of use, the ease of access, and overall appearance of the digital interface. The survey cites other authors who also support strong user interface design principle-based designs to improve users' digital library experience and technology's influence to user behaviour. On the other hand, it contains users' influence and the effectiveness of digital resources on perceived user satisfaction, in which case all sub factors should be understood widely in order to enhance digital libraries and more so respond to users' demands. The conclusion of the survey stresses the importance of the relevance of continuing investigation in UX as it changes along with users and technologies.

B. Limitations

The studies reviewed concerning online car rental services, as well as related technologies, demonstrate a marked development in the rental processes but equally identify critical issues, which affect their functionality. In many cases, systems primarily emphasize automation of basic tasks such as opening user accounts, booking, and payments, but do not support complex tasks such as real time tracking of vehicles, AI-assisted engine, surge pricing elasticity, predictive taps and personalized features. A few others intend to go beyond increasing user interface experience but are often non-flexible, cannot handle bulk and simultaneous users greatly and are non-scalable. Testing with realistic or real data has little to do with the relevance of the insights and the actual working of the car rental systems in the highly

dynamic automotive rental sector in the real world since it mainly uses static or synthetic data. Security measures tend to be quite rudimentary and the systems appear therefore to be only weakly protectable against such forms of abuse as biometric palm print recognition and abnormal transaction detection have been omitted. Many systems also do not go along the promotion of electric vehicles or shared mobility which are now required for meeting the global sustainable development objectives. The limitations for the use and scope of mobile terminals and some of the payment systems are also quite concerning. Additionally, issues constituents of AI Chabot technology immediate interactions, for example dealing with comprehensive user requests and trust of users, affect the effectiveness of chatbots systems. Also, most of the systems are not connected with the external real time data, geolocation and other advanced technologies like Internet of Things and block chain, which can improve the business processes. In general, these limitations imply that although these systems have progressed in the automation of car rental processes, they still require a great deal of further enhancement of operational features, scalability, eco-friendly processes and user interface design in order to be able to cope with future market and technology developments.

3. Objectives

3.1. Boost User Experience with AI-Driven Personalization: It is true that the principles of machine learning are implemented. The recommendations of vehicles are automated. It is user-centered or rather user defined. There is a history of leases. And, monetary allowances are taken into account. This serves to improve satisfaction of the clientele.

3.2. Integrate Dynamic Pricing to Optimize Cost: Leverage AI for adjustment of prices depending on the specifics of the market scenario. These adjustments do deliver according to demand. In addition they rely on the season too. In this way it is possible to guarantee a competitive price. Also, pricing in the internal market is clear

and straightforward.

3.3. Enhance Security with Advanced Authentication: Threats to security are minimized. This is through advancement of features. Biometric authentication is one. Plus, there is the use of abnormal movement detection. It helps in preventing safeguarding the user's data & unauthorized access.

3.4. Maximize Fleet Management via Real-Time Tracking: GPS technology is use and tracking devices are multilingual. Why? To check the location of the vehicle. For maximum vehicle distribution and improved fleet management.

3.5. Promote Sustainable and Eco-Friendly Options: Additions or changes must be made for greener options. Donor them importance. Add electric cars. The so-called rimless Venus. That impresses users. The environmentally concerned users. That also contributes towards the sustainability goals.

4. Methodology

The AI-Driven Fleet Rental System has a developed methodology from start which makes certain that the platform delivers a reliable, adaptable, and user focused designing that incorporates AI and GPS technologies. It is critical and this requires a proper understanding of the limitation offered by current vehicle rental systems through proper requirement analysis. Key user groups were surveyed as well as administrators which pointed out to the major issues such as system not being integrated, difficulties in booking, and performance tracking not being possible. After analyzing these functional requirements were set out such as, AI generating recommendations systems, GPS and Dynamic Pricing, in addition to non-functional ones including system robustness, user accommodation, and data protection.

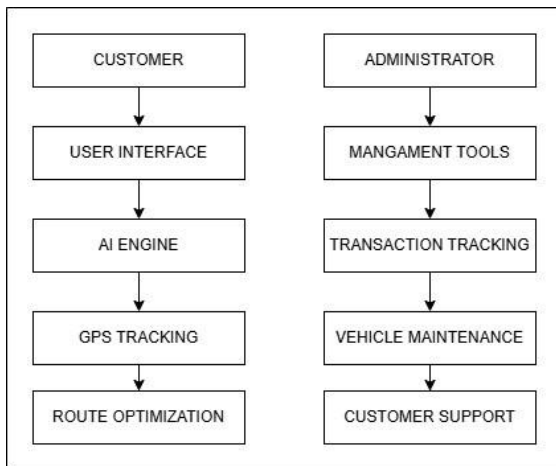


Fig 1: Process View of AI Driven Fleet Rental System

The system architecture was then designed around the modular principle in order to improve the manageability and the extendibility of the system. Three-tier architecture was implemented including the user interface, the server application, and the data storage components. The business logic and APIs were mapped out using Spring Boot for the backend while the MySQL relational database was used for data management. AI components such as a recommendation engine for customized vehicles and a Chabot for customer queries were programmed in Python. The interface was designed with an emphasis on usability whereby HTML, CSS, and JavaScript were utilized for easy use.

AI technologies became an integral element of the system. Users' vehicles preferences and past vehicle use patterns were combined using Collaborative and content-based filtering algorithms to recommend suitable vehicles. Also, an automatic responder was integrated into the system, which received users' questions and responded to them with pre-set answers thanks to the natural language processing technology. Some predictive analytics were also added to improve the use of the fleet and predict the time for maintenance of vehicles to avoid idle time and improve efficiency.

The integration of appropriate real-time GPS tracking for accurate vehicle location tracking and transparency was guaranteed. Geofencing features

were added to provide security alerts if the vehicle goes outside of set parameters. It ensures sustainable development by also implementing route optimization algorithms which lessen fuel consumption and time taken for the journey. The aim was also to increase the interactivity among the components by migrating the system to the cloud for easier hosting and maintenance.

At last, the system was put through a thorough testing to check performance, functionality and it was also measured how satisfied the users are. A set of unit testing, integration testing and system testing was carried out in order to safeguard seamless interaction of the components. The system was subjected to load testing to determine the number of users it could support simultaneously and user acceptance testing UAT was done to obtain input for the next round of development. This articulated approach contributed to the successful construction of a fleet rental system driven by artificial intelligence of the modern-day industry and that was friendly to use.

5. Results

The implementation of the AI-Driven Fleet Rental System has demonstrated improvements in operational efficiency, user experience, and sustainability. The integration of AI-powered vehicle recommendations streamlines the booking process by providing users with personalized options based on their preferences and past rentals. Real-time GPS tracking and route optimization contribute to better fleet management by minimizing idle time and improving overall efficiency. Additionally, user feedback from preliminary testing indicates that the system offers a seamless and user-friendly experience, making vehicle rentals more accessible, efficient, and sustainable.

6. Conclusion and Future Work

The AI-Driven Fleet Rental System is set to transform the vehicle rental market through a combination of AI-based recommendations and GPS-based emphasis on usability and efficiency. It also deals with the inadequacies of existing solutions by means of giving each user individual vehicle recommendations, convenient bookings, and better insurance through robust and scalable technologies. And because it is also in compliance with modern requirements that are environmentally friendly, it is well ahead of its time.

Future expansions will also include self-adapting AI for estimating future demand and managing fleet sizes autonomously, implementing EV charging-locator functionality, and building a mobile solution. The system also promises multi-lingual interfaces, location based services, mobile technology and safe transactions using blockchain to help it integrate and stay current in the global marketplace.

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Fig.2. Home Page

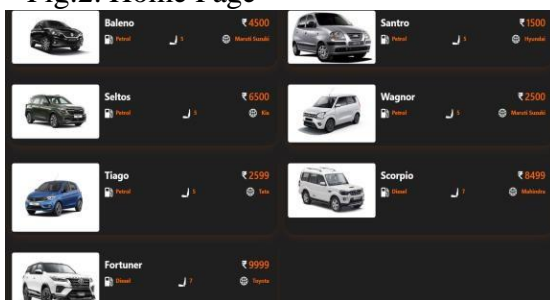


Fig.3. Car Collection



Fig.4. Login Page

| Variant | Name | Company | Description | Fuel Type | Seat Capacity | Model | Year | Is AC | Price | Action |
|----------|--------------|------------|-------------|-----------|---------------|-------|------|-------|----------|--------|
| Baleno | Mazda Suzuki | Delta | Petrol | 5 | WE2 | 2018 | No | 4500 | Bookings | |
| Santro | Hyundai | Delta | Petrol | 5 | WE1 | 2014 | No | 1500 | Bookings | |
| Seltos | Kia | HTK | Petrol | 5 | SF3 | 2024 | No | 6500 | Bookings | |
| Wagor | Mazda Suzuki | Vet | Petrol | 5 | ME15 | 2015 | No | 2500 | Bookings | |
| Tiago | Tata | Revolution | Petrol | 5 | XE | 2022 | No | 2599 | Bookings | |
| Scorpio | Mahindra | Challie | Diesel | 7 | h1 | 2020 | No | 4499 | Bookings | |
| Fortuner | Toyota | Legendier | Diesel | 7 | 1309 | 2021 | No | 9999 | Bookings | |

Fig.5. Car in Database



Fig.6. Payment Page

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