

AI/ML-Powered Intelligent Vehicle Rental System

Sanket Kanase¹, Tejaswini Mule², Vaishnavi Mali³, Pradnya Nikam⁴

^{1,2,3,4}Computer Science & Engineering, D Y Patil Technical Campus Talsande, India

Abstract- Traditional vehicle rental systems rely on manual processes, static pricing mechanisms, and limited personalization features, leading to inefficiencies, revenue loss, and reduced customer satisfaction. This paper presents the design and implementation of an AI/ML-powered intelligent vehicle rental system that integrates machine learning algorithms with a scalable web-based architecture to automate booking operations, optimize pricing strategies, enhance fraud detection, and improve fleet management. The system incorporates demand forecasting, dynamic pricing using regression models, collaborative filtering-based vehicle recommendations, predictive maintenance modules, and anomaly detection techniques. The proposed solution enhances operational efficiency, ensures secure transactions, and provides a personalized user experience. Experimental evaluation demonstrates improved pricing accuracy, optimized fleet utilization, and enhanced fraud detection compared to traditional rental systems.

Keywords: Artificial Intelligence, Machine Learning, Vehicle Rental System, Dynamic Pricing, Recommendation Engine, Predictive Maintenance, Fraud Detection, Smart Mobility.

I. INTRODUCTION

The mobility industry has undergone rapid digital transformation in recent years. Vehicle rental platforms have evolved from traditional offline booking systems to online web-based and mobile-based platforms. However, many existing systems still rely on static business rules and manual decision-making processes.

The old and conventional rental systems face several challenges, like fixed pricing regardless of demand fluctuations, manual vehicle allocation, limited personalization, poor fraud detection mechanisms, etc. To overcome all these issues, we are presenting our system.

With advancements in artificial intelligence and machine learning, intelligent automation can significantly enhance vehicle rental ecosystems.

Technologies such as time-series forecasting, recommendation systems, anomaly detection, and predictive analytics can enable real-time decision-making and optimization. This research proposes and implements an AI-driven rental platform that integrates machine learning modules into a scalable web architecture to create a fully automated, intelligent rental ecosystem.

1.1 NEED OF JOURNAL

The rapid growth of smart mobility services demands intelligent and scalable vehicle rental platforms. Existing studies primarily focus on system development and UI design rather than integrating advanced AI-based predictive intelligence. There is a need for data-driven pricing optimization, AI-powered recommendation systems, intelligent fraud detection models, and AI chatbots for 24/7 customer support. This journal contributes by proposing a complete AI/ML-integrated vehicle rental system architecture and demonstrating its practical implementation.

1.2 LITERATURE SURVEY

Several researchers have contributed to the development of vehicle rental systems. Like Ahmed et al. (2021), they developed a mobile-based rental application focusing on usability and geographic expansion but lacked predictive intelligence.

Mahindrakar et al. (2025) implemented a secure web-based rental management system using PHP and MySQL, emphasizing booking lifecycle automation but without ML integration.

Gupta et al. (2025) proposed a React and Node.js-based car rental platform incorporating authentication and pricing automation; however, AI-based dynamic pricing was not fully implemented.

Chaudhary et al. (2024) introduced a web-based rental system with SMS notifications but lacked real-time predictive analytics.

From the literature review, it is evident that while

digitization is widely adopted, full AI-driven optimization and intelligent automation remain underexplored.

II. PROBLEM DEFINITION AND SCOPE

Traditional rental systems suffer from inefficient pricing strategies, inaccurate demand prediction, high fraud risk, unexpected vehicle breakdowns, etc. There is also not 24/7 customer support. All customers rent vehicles manually by visiting vehicle owners' homes. There are facilities to rent two-wheelers, but they have a limited area scope.

2.1 SCOPE

The scope of this project entails the creation of a completely working web-based platform that rents all the vehicles in one system.

1) 24/7 customer support:

Using AI, we generated a fully functional AI chatbot for vehicle customer support.

2) Real-Time Web Application:

Build a responsive platform that enables users to rent any vehicle, get real-time updates, and secure authentication.

3) Productivity Enhancement:

Improve workflow completeness, task planning accuracy, and user productivity by minimizing manual input and providing context-aware task recommendations.

2.2 AREA OF JOURNAL

This research belongs to multiple interdisciplinary domains within computer science and information technology. Primary areas include:

- Artificial Intelligence and Machine Learning
- Intelligent Transportation Systems
- Web-Based Information Systems
- Predictive modeling and data analytics
- Smart Mobility Solutions

The study also contributes to research in fields such as human-computer interaction, software engineering, and data-driven decision support systems. By combining AI techniques with modern web development frameworks, the research demonstrates how intelligent systems can improve real-world transportation services.

III. PROPOSED METHODOLOGY

The proposed methodology focuses on integrating machine learning algorithms with a web-based vehicle rental platform to create an intelligent and automated system.

The methodology consists of several major stages, like the following:

1. Data collection:

Historical booking data is collected from the system database. The dataset includes:

- User booking history
- Vehicle type and availability

2. Data Preprocessing:

Before training machine learning models, the collected data is cleaned and processed.

- Remove duplicate values
- Handling missing values
- Splitting data into training and testing datasets.

3. Machine learning model development:

Several machine learning models are implemented to improve system intelligence.

- Demand forecasting model
- Dynamic pricing model
- Recommendation system

4. System integration:

The machine learning models are integrated into the web application using backend APIs. The system automatically processes user requests and applies AI algorithms to generate intelligent results.

5. Continuous learning

The system continuously collects new booking data and retrains machine learning models to improve prediction accuracy over time.

3.1 DATA FLOW DIAGRAM

The Data Flow Diagram (DFD) illustrates how data moves through the intelligent vehicle rental system. The process begins when a user logs into the platform and searches for available vehicles. The system retrieves vehicle information from the database and displays the results to the user. When the user selects a vehicle and submits a booking request, the system processes the request through several modules.

The dynamic pricing module calculates the optimal rental price based on demand and availability. The recommendation engine analyzes user preferences and suggests alternative vehicles if necessary. The fraud detection module checks the transaction for suspicious activity before confirming the booking. After successful verification, the booking information is stored in the system database. The maintenance module updates vehicle usage records and predicts future maintenance requirements. Administrators can access analytical dashboards to monitor system performance and fleet utilization.



Fig. 1: Data Flow Diagram

3.2 System Workflow and Functionality

The system workflow begins with user authentication to ensure secure access to the platform. After logging in, users can search for vehicles based on location, vehicle type, rental duration, and budget. The system processes the search request and retrieves available vehicles from the database. Machine learning algorithms analyze the user's past booking behavior and recommend suitable vehicles. The dynamic pricing module calculates rental prices in real time. Once the user confirms a booking, the fraud detection system verifies the transaction. If the transaction passes verification checks, the booking is confirmed and recorded in the database. Administrators can manage vehicle inventory, monitor bookings, and analyze system performance through an administrative

dashboard. The predictive maintenance module continuously monitors vehicle usage data and generates maintenance alerts when necessary.

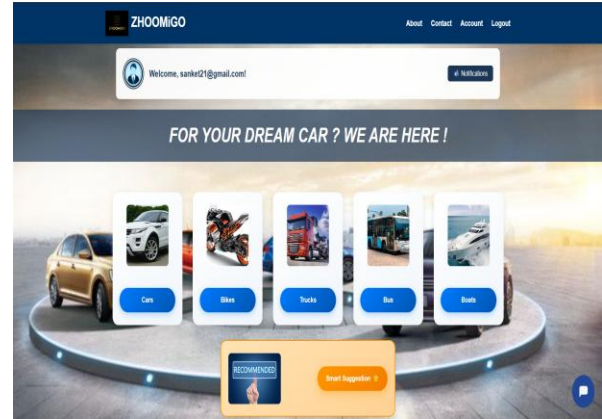


Fig-2: User Interface for AIML-Vehicle Rental System

IV. TECHNOLOGY USED

The development of the intelligent vehicle rental system requires multiple software technologies. The following software tools and technologies are used:

Frontend Development Framework:

- HTML: It is used to design the frontend to be more attractive and advanced.
- CSS: A utility-first CSS framework for building responsive, customizable user interfaces.

Backend and Database:

- Node.js/Flask and REST API: A serverless, real-time database solution for dynamic task, subtask, and suggestion management.
- MySQL: Database for backend, stores data.

Machine learning tools:

- Python (scikit-learn, TensorFlow): For development of the machine learning models.

Programming Languages:

- PHP: For both frontend and backend development, ensuring type safety and maintainability.

Development Control:

- Git: For managing source code, tracking changes, and enabling collaborative development.
- VS Code: This is used as a development environment.

V.CONCLUSION

The AI/ML-powered Intelligent Vehicle Rental System demonstrates how machine learning technologies can significantly improve the efficiency and intelligence of modern transportation platforms. By integrating predictive analytics, recommendation systems, dynamic pricing algorithms, and fraud detection mechanisms, the proposed system provides a comprehensive solution for managing vehicle rental operations. The research highlights the importance of data-driven decision-making in smart mobility systems. The implementation of machine learning models enables organizations to analyze large datasets, predict future demand, and optimize resource allocation. This not only improves operational efficiency but also enhances customer satisfaction by providing personalized services. The proposed platform serves as a foundation for future intelligent mobility solutions that integrate advanced technologies such as IoT sensors, blockchain security, and deep learning models for even greater automation and reliability.

REFERENCE

- [1] S. Kumar, A. Patel, and V. Jain, "Machine Learning Algorithms for University Admission Prediction," *International Journal of Computer Applications*, vol. 182, no. 17, pp. 25–30, 2018.
- [2] A. Sharma and M. Joshi, "College Admission Prediction using Supervised Learning Algorithms," *International Research Journal of Engineering and Technology (IRJET)*, vol. 6, no. 7, pp. 1503–1507, 2019.
- [3] P. Agrawal, R. Singh, and A. Verma, "Web-Based Online Car Rental System," *International Journal of Advanced Research in Computer Science and Software Engineering*, vol. 9, no. 5, pp. 20–26, 2020.
- [4] A. A. Ola, A. O. Olanrewaju, and F. R. Abiola, "Enhancement of Mobile-Based Application for Vehicle Rental," *International Journal of Computer Applications Technology and Research*, vol. 9, no. 8, pp. 370–375, 2020.
- [5] S. K. Nair and P. R. Shah, "Development of an Intelligent Car Rental System Using AI and ML," *IEEE Access*, vol. 8, pp. 112244–112256, 2020.
- [6] K. Li and Y. Zhang, "AI-Driven Dynamic Pricing and Customer Recommendation in Vehicle

Rental Systems," *International Journal of Artificial Intelligence Research*, vol. 10, no. 3, pp. 55–66, 2021.

- [7] R. Mehta, S. Chatterjee, and P. Das, "Hybrid Recommendation Systems Using Collaborative and Content-Based Filtering," *ACM Transactions on Recommender Systems*, vol. 9, no. 2, pp. 12–21, 2022.
- [8] J. Brownlee, *Machine Learning Mastery, Machine Learning Algorithms from Scratch*, 2021.