IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

An Overview of Intelligent Truck Booking Recommendation System

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Abstract: The truck booking system in urban logistics play a crucial role in facilitating efficient goods and services movement. The current manual truck selection process has been burdened by time-consuming procedures and errors, leading to customer dissatisfaction due to mismatched truck-cargo combinations. To overcome these challenges, the "Study of Intelligent Truck Booking Recommendation System" delves into the application of advanced algorithms and data-driven insights, aiming to automate and enhance the selection process. Through a comprehensive survey, historical data, customer feedback, truck prices, and freight rates are analyzed to generate accurate and efficient truck recommendations. The study emphasizes sophisticated machine learning algorithms, thorough past record analysis, incorporation of customer feedback, cost optimization, cargo weight consideration, and user-based recommendations for new customers. The findings show promising results in terms of increased efficiency, cost savings, improved customer experience, data-driven decision-making, and scalability, offering transformative benefits for the urban logistics industry.

Keyword **-** Intelligence truck booking, Recommendation system, Truck selection, Cargo maintenance, Booking system, Machine learning, Cost optimization.

I. Introduction

Urban logistics have become an integral part of modern cities, facilitating the efficient movement of goods and services. In this context, the "Intelligent Truck Booking Recommendation System" emerges as a groundbreaking project with the potential to revolutionize the logistics industry. By harnessing the power of machine learning, this system aims to optimize truck selection for freight delivery, providing tailored and data-driven recommendations to enhance overall efficiency.

The traditional method of manual truck selection for freight delivery has been a long-standing issue, characterized by time-consuming procedures and potential errors. Recognizing these challenges, the Intelligent Truck Booking Recommendation System seeks to automate and streamline this process by employing advanced algorithms and data-driven insights.

At the heart of this project lies the truck registration, which integrates various machine learning techniques to analyze and make informed decisions regarding truck selection for specific freight. These techniques include collaborative filtering, content filtering, and user-based recommendation algorithms. By leveraging these powerful algorithms, the system can draw from past records, customer feedback, truck prices, freight rates, and individual user preferences to generate accurate and efficient truck recommendations.

1.1 Key Features of the Intelligent Truck Booking Recommendation System:

- **Machine Learning Algorithms:** Sophisticated machine learning algorithms are utilized to analyze historical data, individual preferences, and various characteristics of vehicles and cargo. These algorithms play a pivotal role in ensuring informed decisions are made and accurate recommendations are provided for optimizing truck choices.
- **Previous Record Analysis:** The system comprehensively analyses past truck booking statistics to perceive patterns, successful truck-cargo combinations, and standard overall performance. This analysis forms the inspiration for making well-informed tips for destiny truck bookings.
- **Customer Feedback Incorporation:** By considering purchaser remarks and opinions, the advice device can continuously enhance its accuracy and enhance consumer satisfaction. Positive and negative feedback is taken into consideration to optimize truck choices for specific cargo types.
- **Cost Optimization:** The algorithm considers the pricing information associated with each truck type and provides alternative recommendations that match the budgetary limitations of the consumer or commercial enterprise.
- **Cargo Weight Consideration:** Different vehicles have various load-carrying capacities. The undertaking factors in shipment weight specs to ensure the encouraged vehicles can manage the particular weight requirements efficiently.
- **User-Based Recommendations:** For new customers without long-standing booking records, the device employs the consumer primarily based on recommendation techniques, taking cues from comparable users to signify suitable truck options.

1.2 Advantages of the Intelligent Truck Booking Recommendation System:

- **Increased efficiency:** By automating truck selection, the process significantly reduces effort and manual handling time, enabling logistics companies to be more efficient.
- **Cost Savings:** Successful truck recommendations based on cost measurements help companies optimize their costs and reduce unnecessary expenses.
- **Improved customer experience:** Customized truck recommendations improve customer satisfaction when deliveries are made with the most appropriate truck, reducing delays and breakdowns.
- **Data-Driven Decisions:** The system relies on data-driven insights to ensure smart, informed truck booking decisions are made, resulting in better business outcomes.
- **Scalability:** With the ability to handle large amounts of data, the business can easily scale to meet growing urban logistics demands and cater to an expanding user base.

The Intelligent Truck Booking Recommendation System offers numerous advantages in urban logistics, addressing the need for real-time data and adaptability. This system processes and analyses data instantaneously, enabling logistics companies to adapt to fluctuations in demand, traffic conditions, and weather. By providing real-time recommendations, the system empowers logistics professionals to make agile decisions, optimize truck selection, and ensure seamless transportation of goods. This real-time capability enhances operational efficiency and contributes to a more responsive urban logistics ecosystem.

The "Intelligent Truck Booking Recommendation System" is poised to revolutionize the logistics industry through its use of machine learning algorithms, providing customized and tailored truck selection recommendations. With its advanced features and numerous benefits, this project offers a powerful solution to simplify truck booking and increase overall efficiency in urban freight operations. As this innovative system gains momentum, it is expected to transform the landscape of urban logistics and elevate the standards of freight delivery for businesses and customers alike.

II. EXISTING APPROACHES

M. Zhang et al (2020) [1] described the significance of various factors in driving green logistics development, emphasizing the need for a balanced and holistic approach towards sustainability. implementing the recommended strategies will not only lead to improved logistics operations but also support the broader vision of sustainable and environmentally friendly practices in the supply chain.
W. Li et al (2020) [2] described a smart path-finding method for diversified passenger travel paths in metro networks. it uses a generalized path impedance model to accommodate varying travel times, transfer penalties, and congestion tolerance. validation with real-world data from shenzhen metro confirms its efficiency and lower algorithmic complexity, making it suitable for large-scale networks.
A. Ntakaris et al (2019) [3] described the advancement of mid-price movement prediction, providing valuable insights into leveraging limit order book data, econometric features, and deep learning models. They hope that the findings will inspire further research in this area and foster the development of more accurate and reliable stock price movement prediction methods in the future.
S. Kanwal et al (2021) [4] described Text-Based Recommendation Systems (RS) and their significance in handling online textual data. They emphasize benchmark datasets, feature extraction techniques, computational approaches, and evaluation metrics. Future research should explore other languages and domains.
R. Kwieciski et al (2023) [5] describe the RP3Beta model for batch and real-time recommendation systems, achieving superior performance compared to advanced models. A/B tests showed a 10% increase in job ads application using real-time systems compared to batch methods. This approach can improve user satisfaction and system performance in recommendation-based applications, facilitating informed decision-making and enhancing overall system performance.
Y. Ma et al (2021) [6] described the HERE Places API to gather POIs and DeepPredict to embed meaningful embeddings from accommodation descriptions. They found DeepPredict outperformed state-of-the-art algorithms by 60% in the macro F1-score, improving user experience and enhancing recommendations on online lodging platforms.
C. Feng et al (2020) [7] described how the analysis exposed a gap in addressing the various challenges present in the news domain. While the literature covered a broad range of challenges, only a few were explicitly addressed in the examined studies. This underscores the potential for further research to tackle these unexplored challenges, potentially leading to significant advancements in the field of news recommendation.
C. -Y. Lin et al (2018) [8] described the hybrid real-time incremental stochastic gradient descent (RI-SGD) updating technique for implicit feedback matrix factorization (MF) recommendation systems. This computationally efficient and accurate time-variant system combines alternating least squares, weight regularization, and stochastic gradient descent, maintaining real-time updates while preserving recommendation accuracy. Integrating RI-SGD into a real-time music recommendation system shows nearly identical accuracy, requiring only 0.02% retraining time.
P. Nousi et al (2019) [9] described machine learning (ML) algorithms to predict stock price movements using limit order book data. The study combines handcrafted features from raw order book data with ML-extracted features, resulting in feature vectors with varying dimensions. Three classifiers are evaluated, spanning two evaluation setups and three prediction scenarios. Despite the complexities of the limit order book, promising results are obtained, highlighting the efficacy of ML in this task. This research highlights the potential of ML in financial market analysis and future research.
J. Zhang et al (2020) [10] described a sufficient recommendation algorithm using user profile attributes and virtual opinion leaders to generate movie recommendations with precision and computational efficiency. The method reduces complexity and maintains comparable performance. The successful implementation of MovieWatch opens up new possibilities for personalized recommendations in various domains.
Y. Huo et al (2023) [11] described the data-driven collaborative forecasting method for logistics network throughput using graph learning. The approach uses graph neural networks to identify temporal correlations and temporal attention weight vectors, enabling accurate forecasting and optimal resource scheduling in complex, interconnected systems.
H. Ling et al (2021) [12] described an intelligent approach to generating many-to-many matches for vehicle-cargo matching platforms. They use a mathematical model to maximize matching rate and profit, and an innovative ant colony optimization method. The algorithm uses bacterial foraging chemotaxis and k-means

algorithms, adaptive parameters, and randomicity and ergodicity of chaos to overcome local optima challenges. This algorithm enhances efficiency and utilization within logistics service platforms.

Q. Mei et al (2020) [13] described the approach to port of call recommendations for container vessels using AIS data and natural language programming. The approach maps ports onto vectors, suggesting alternative ports during unforeseen disruptions. Validation through geo-analysis demonstrates its practicality and viability, enabling informed decisions and optimizing container vessel operations for a more resilient global supply chain.

W. Wang et al (2019) [14] described discrete-time Markov chains and real-time traffic monitoring data to predict traffic congestion on the National Freeway. The results show a high probability of non-congested traffic during morning and afternoon rush hours, but bottlenecks in links connecting to urban areas significantly impact traffic flow during peak periods. By optimizing vehicle routes and regulating traffic flow, logistics managers can improve transportation efficiency and enhance commuter experiences. The findings contribute valuable insights into traffic prediction and management, enabling stakeholders to make informed decisions that positively impact traffic conditions and travel experiences.

W. Guo et al (2021) [15] described the Tabu Genetic Algorithm to improve container terminal efficiency by considering berth allocation and yard assignment over multiple time periods. The multi-period coordinated optimization approach reduces truck travel distance and enhances terminal efficiency, providing insights into terminal operators' decision-making processes and contributing to continued improvement in terminal operations.

J. Yu et al (2021) [16] described a method to improve recommendation systems by incorporating personal preference fluctuations into collaborative filtering. This method improves accuracy and relevance of item recommendations by quantifying users' preference changes over time. It diverges from conventional approaches by considering diverse interests and outperforms other techniques in recommendation quality and user satisfaction.

F. Vital et al (2021) [17] described the current research on intelligent truck parking, focusing on sensing infrastructure, resource allocation, demand and prediction models, and routing and scheduling mechanisms. It identifies gaps in current practices and explores potential improvements. The research incorporates real-world data to assess the effectiveness of different parking strategies, comparing historical average methods with predictive models. The exploration of intelligent truck parking solutions and predictive models can enhance trip planning efficiency, minimize parking shortages, and promote safer operations in the trucking sector.

G. Meena et al (2020) [18] described an integrated tool for accurate traffic flow prediction and autonomous vehicle readiness. The tool uses machine learning, genetic algorithms, soft computing, and deep learning to analyze big data in transportation systems. It also incorporates Image Processing algorithms for traffic sign recognition, improving autonomous vehicle safety and efficiency.

Z. Cai et al (2020) [19] described the combination of KD-KNN and LR, aiming to recommend suitable marriage candidates to users based on bidirectional matching. The algorithm achieved an impressive accuracy rate of 86%, showcasing the potential of machine learning approaches in enhancing matrimonial services. The successful application of KD KNN-LR in this study paves the way for further advancements in marriage recommendation and personalized matchmaking systems.

N. Davidich et al (2020) [20] described the impact of driver nervous system types on truck routes for freight transport, focusing on human factors. It aims to understand the correlation between freight transport and drivers' characteristics, enabling the optimization of route selection. The findings could enhance efficiency and safety by tailoring route selections to individual drivers' traits, leading to more informed decision-making in the logistics industry

III. TABLE 1: COMPARATIVE ANALYSIS OF EXISTING ALGORITHMS WITH RESPECT TO VARIOUS REQUIRED PARAMETERS

Paper	Algorithm used	Delivery Time	Cost	F1-Score	Accuracy	Complexity	Feedback	Latency
Green Logistics Development Decision-Making: Factor Identification and Hierarchical Framework Construction	DEMATEL - Decision Making Trial and Evaluation Laboratory and ISM - Interdependency Structure Model	√	√	*	*	*	*	√
A Smart Path Recommendation Method for Metro Systems With Passenger Preferences	forward searching and backward searching	√	*	*	*	√	*	√
Feature Engineering for Mid-Price Prediction With Deep Learning	Multi-layer perceptrons, Convolutional neural network, Long short-term memory	*	*	√	√	*	*	*
A Review of Text-Based Recommendation Systems	Collaborative filtering, Content-based filtering, Hybrid filtering	*	*	√	*	*	√	*
Comparison of Real-Time and Batch Job Recommendations	RP3Beta model	*	*	*	*	√	*	√
DeepPredict: A Zone Preference Prediction System for Online Lodging Platforms	Deep learning, HERE places API, Sent2Vec	*	*	√	*	*	*	√
News Recommendation Systems - Accomplishments, Challenges & Future Directions	Collaborative filtering, Content-based filtering, Hybrid filtering	*	*	√	*	*	√	*
Hybrid Real-Time Matrix Factorization for Implicit Feedback Recommendation Systems	RI-SGD (Robustified Incremental Stochastic Gradient Descent)	*	*	√	*	√	*	√

A Data-Driven Collaborative Forecasting Method for Logistics Network Throughput Based on Graph Learning	Graph learning, Temporal correlation	*	√	*	√	√	*	*
Machine Learning for Forecasting Mid-Price Movements Using Limit Order Book Data	Support vector machines (SVMs), Random forests, Gradient boosting machines	*	*	√	√	√	*	√
An Adaptive Parameter Controlled Ant Colony Optimization Approach for Peer-to-Peer Vehicle and Cargo Matching	Ant colony optimization, k-means algorithm	*	√	*	*	√	*	*
Personalized Real-Time Movie Recommendation System: Practical Prototype and Evaluation	Collaborative filtering, Clustering, Weighted Slope One-VU	*	*	√	√	√	*	√
Port Recommendation System for Alternative Container Port Destinations Using a Novel Neural Language-Based Algorithm	Natural language programming algorithm	*	√	*	√	√	√	*
The Prediction of Freeway Traffic Conditions for Logistics Systems	Discrete-time Markov chain, Probability of traffic congestion	*	√	*	√	*	√	*
Multi-Period Coordinated Optimization on Berth Allocation and Yard Assignment in Container Terminals Based on Truck Route	Tabu genetic algorithm	√	√	*	√	√	*	*
Collaborative Filtering Recommendation with Fluctuations of User' Preference	Collaborative filtering, Recommending in the opposite direction	*	*	*	√	*	√	√

Survey on Intelligent Truck Parking: Issues and Approaches	Routing and scheduling, Demand and prediction models	*	√	*	√	*	√	√
Traffic Prediction for Intelligent Transportation System using Machine Learning	Genetic algorithms, Deep learning, Image processing	*	*	*	√	√	√	√
Marriage Recommendation Algorithm Based on KD-KNN-LR Model	KD-KNN, LR	*	√	*	√	*	*	√
Advanced Traveller Information Systems to Optimizing Freight Driver Route Selection	Decision tree, Neural network	*	√	*	√	√	*	√

IV. Conclusion

Minimizing the delay incurred in the truck booking and recommending the right truck to satisfy the customer are the main issues in the truck booking system. This study provides an overview of some of the methodologies employed in the truck booking system to mitigate these issues. It also provides a comparative analysis of these methodologies based on several important quality attributes. This comparison will help future authors choose the best algorithm for their application, whether it be a single algorithm or a hybrid of multiple algorithms to fulfill the customer's requirements.

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