



# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 8.699**

**Volume 14, Issue 4, April 2025**

# **Artificial Intelligence based Customized Time Slot Delivery of Articles and Parcels**

**Arjun Guntimadugu, Keerthan Gowda J M, Shivashakthi K, Sridhar M, Ashwini Tuppad**

School of Computer Science and Engineering, REVA University, Bengaluru, India

School of Computer Science and Engineering, REVA University, Bengaluru, India

School of Computer Science and Engineering, REVA University, Bengaluru, India

School of Computer Science and Engineering, REVA University, Bengaluru, India

Assistant Professor, School of Computer Science and Engineering, REVA University, Bengaluru, India

**ABSTRACT:** This study explores the development of an AI-driven logistics platform designed to enhance delivery efficiency and customer satisfaction through time-slot scheduling. Focusing on optimizing last-mile delivery, predictive analytics, and customer engagement, the platform addresses the growing demand for flexible and reliable delivery services. By analysing existing literature and systems, the study identifies critical features and challenges associated with modern logistics solutions. The proposed platform emphasizes a customer-centric design, offering dynamic time-slot selection, real-time tracking, and predictive route optimization. Detailed methodologies, including system architecture and AI implementation strategies, are presented. The anticipated outcomes suggest that such a platform can significantly reduce delivery failures, improve operational efficiency, and cater to the diverse needs of modern consumers while promoting sustainability in logistics.

**KEYWORDS:** Time-Slot Scheduling, AI-Driven Logistics, PredictiveAnalytics, Last-Mile Delivery, Route Optimization, Real-Time Tracking, Customer Satisfaction, Dynamic Scheduling, Machine Learning Models, Operational Efficiency.

## **I. INTRODUCTION**

The fast-paced and demanding modern lifestyle, particularly among Gen Z, has led to an increased expectation for customized and time-bound doorstep delivery services. Leading e-commerce platforms like Amazon and Flipkart, as well as financial institutions such as ICICI and HDFC, have successfully incorporated advanced technologies, including artificial intelligence (AI) and machine learning, to provide efficient and flexible delivery solutions [1][3]. These innovations have set new benchmarks for customer satisfaction and operational excellence, making time-bound delivery a fundamental expectation [2].

Despite its established network, traditional delivery systems often face challenges in meeting these expectations due to rigid schedules and operational inefficiencies. A common issue arises when recipients are unavailable during standard delivery hours, typically 10 AM to 5 PM, resulting in repeated delivery attempts, wasted resources, and dissatisfaction among both senders and receivers [4][5]. This inefficiency not only affects service quality but also leads to increased costs and reduced performance indices [6].

## **II. LITERATURE SURVEY**

The literature on AI-driven delivery systems and time-slot scheduling highlights several existing solutions and their contributions to improving last-mile logistics. Studies emphasize the critical role of dynamic scheduling systems, which allow users to select and modify delivery time slots based on their availability [2][4]. These systems reduce delivery failures by adapting to customer preferences and historical data patterns. Machine learning models further optimize scheduling by predicting recipient behaviour, ensuring higher delivery success rates and reduced operational inefficiencies [3].



Predictive analytics and real-time route optimization play a pivotal role in enhancing logistics performance. AI-driven platforms utilize real-time traffic data, weather conditions, and delivery density to calculate optimal delivery routes. These advancements minimize delays and fuel consumption, thereby reducing costs and environmental impact [1][7]. Additionally, route optimization algorithms improve resource allocation, enabling logistics providers to handle higher volumes during peak demand [5].

Customer engagement has emerged as a central focus in modern delivery systems. Platforms incorporating real-time tracking, SMS alerts, and app notifications ensure transparency, allowing customers to stay informed about their delivery status [6]. These features also enable users to modify delivery preferences, fostering trust and improving the overall experience. AI-powered chatbots further enhance user interaction by providing instant support and resolving common issues efficiently [8].

Scalability and system integration are crucial for addressing the needs of a growing user base. AI-driven delivery platforms are often built on scalable frameworks, such as the MERN stack, which supports seamless data management and efficient processing of high transaction volumes [7]. Blockchain technology adds another layer of security and transparency, enabling immutable tracking of delivery records and fostering customer trust [3]. Emerging innovations, including drones and autonomous vehicles, offer promising solutions for future logistics challenges by improving speed and cost-efficiency [4][6].

The global landscape of AI-powered logistics showcases the potential of integrating advanced features such as augmented reality (AR) and geolocation-based recommendations. AR tools allow users to visualize delivery timelines and package contents before acceptance, enhancing customer satisfaction. Geolocation-based systems provide personalized recommendations, ensuring that logistics services remain contextually relevant and efficient [5][7].

The integration of these technologies demonstrates the transformative potential of AI-driven delivery systems. By addressing existing challenges and incorporating customer-centric features, logistics platforms can significantly improve delivery performance, operational efficiency, and user satisfaction [8]. The advancements reviewed in this section form the foundation for developing innovative, scalable, and sustainable delivery solutions.

### **III. METHODS**

#### **A. Methodology**

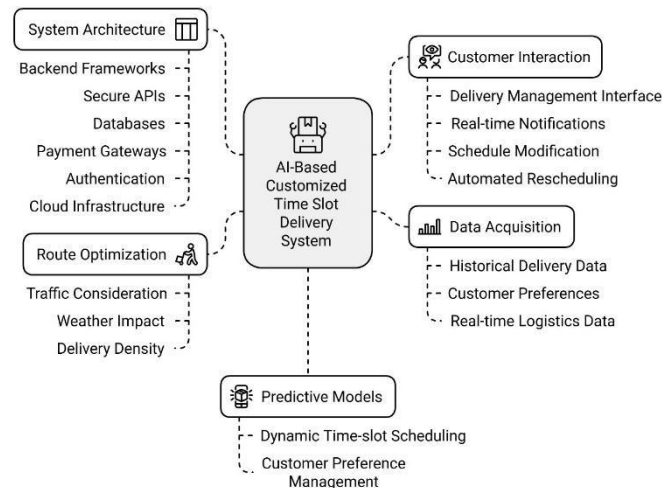
##### **Data Acquisition and Processing**

1. **Data Sources:** The system leverages historical delivery data, customer preferences, and real-time logistics data. GPS tracking and traffic updates provide insights for route optimization, while customer interaction data helps in personalizing time-slot recommendations.

2. **Data Preparation:** Geospatial and historical data are integrated to create predictive models. Standardization and normalization of datasets ensure compatibility across systems. AI algorithms are trained using large-scale datasets to improve accuracy in time-slot recommendations and route optimization. **Time-Slot Scheduling and Optimization**

3. **Dynamic Scheduling:** Machine learning models predict customer availability and suggest optimal delivery slots. These models adapt to historical patterns, ensuring flexibility and convenience for both senders and recipients. **Route Planning:** AI-driven route optimization algorithms consider traffic conditions, weather, and delivery density to generate the most efficient delivery paths. This reduces delivery times and operational costs.

## B. System Architecture



**Fig 1. System Architecture**

1. **Frontend Interface:** A user-friendly web and mobile interface allows senders to select preferred delivery slots and recipients to modify them as needed. Real-time tracking and notifications keep users updated.

2. **Backend Systems:** The backend integrates AI models and database systems to manage time-slot schedules, customer profiles, and delivery data. Secure authentication protocols using JSON Web Tokens (JWT) ensure data security.

3. **Payment Integration:** Secure payment gateways process transactions seamlessly. The system supports multiple payment methods, enhancing user convenience.

## Real-Time Operations

1. **Communication and Notifications:** SMS and app notifications keep customers informed about delivery updates. Users can modify time slots until the day before delivery, ensuring flexibility.

2. **Delivery Execution:** The system assigns optimized delivery routes to personnel based on time-slot selections. Failed deliveries trigger automated rescheduling and notifications to both senders and recipients.

## Testing and Validation

1. **Performance Evaluation:** The system undergoes rigorous testing using past delivery data to validate its accuracy in time slot recommendations and route optimization. Efficiency metrics include delivery success rates, resource utilization, and user satisfaction scores.

2. **Scalability Tests:** Simulated high-demand scenarios ensure the system can handle increased volumes during peak periods.

#### IV. EXPECTED OUTCOMES

Aspect	Expected Outcome	Key Benefit
<b>Customer Experience</b>	Dynamic timeslot scheduling and real-time tracking	Enhanced flexibility, reduced missed deliveries, and increased trust and retention
<b>Operational Efficiency</b>	Predictive analytics and route optimization	Reduced delivery times, efficient resource allocation, and lower operational costs
<b>Scalability</b>	Scalable architecture and large-scale data handling	Seamless performance during peak periods and international deployment capabilities
<b>Sustainability</b>	Optimization of delivery routes and minimized redundancies	Lower carbon footprint and reduced transportation-related inefficiencies

Table 1. Expected Outcomes of the AI-Driven Time-Slot Delivery System

Specifically, the performance key factors with regard to scalability, functionality, and client satisfaction may be expected to be scaled up through the use of the AI-integrated time-slot delivery system. The method is expected to serve consumers better flexibly due to Dynamic time-slot scheduling, which may decrease the chances of deliveries being missed and enhance delivery convenience. Real-time tracking and notifications are expected to increase openness and confidence, which says something about user retention rates.

Cutting operating costs and delivery time is achieved in the design of the system by incorporation of predictive analytics and route optimization. Its goal is to provide optimum logistics and supply chain strategies, which reduce duplication and costs. Its capacity to process and adapt to large quantities of data would permanently assure service and performance reliability during periods of rising workload, without compromising quality.

In the long run, it is envisaged that local knowledge accumulated with the advent of advanced predictive models implemented through machine learning will enhance predictive ability and the system's modularity makes for easy deployment in different parts of the world. On a operational level, dynamic scheduling is most likely to impose the highest time and effort load on delivery workers and utilise resources to a minimum.

The solution is expected to increase consumer retention/repeat purchase and reduce lead time which will give a competitive advantage to companies. The ES, MS, and DS are significant for fulfilling consumers' expectations in the modern digital world through such benefit parameters as the possibility of changing the time slot, secure payment methods, and interface design. As a result, it is expected that the flexibility of the platform would help integrate new technologies such as blockchain and augmented reality – opening up further possibilities.

In addition, since the system will reduce the number of unnecessary trips, it is expected to boost the delivery success rates and at the same time, enhance sustainability. In any case, it is expected that the platform will revolutionise the logistical structure of delivery and set new industry benchmarks for efficiency, model size and product engagement.

#### **V. CONCLUSION**

The findings of the project show how solutions based on AI are now changing last-mile delivery operations. As such, the proposed system combining complex decision-support tools and flexible time-table management appears to give a robust base for enhancing customer satisfaction and organizational efficiency.

All these AI enabled services provide flexible, data-based and customer-oriented solutions to the major issues that standard delivery models present such as strict timeframes and high failure rates of delivery.

By its own admission, the delivery ecosystem will be significantly transformed in the future with technology such as blockchain; augmented reality (AR); and driverless cars. However, AR-based solutions will certainly enhance consumer engagement and presence through delivery date and package content visibility, self-driving vehicles, on the other hand, enable speedier and cheaper delivery.

Blockchain provides suitable records for recording performance and tracking in an immutable, secure way to build trust between clients and service providers. The platform positions itself in a way to be able to respond to the increasing demands of the logistics industry as it escalates sustainability through these innovations while adapting a modular design. The carbon footprint of delivery operations can be significantly reduced by reducing unnecessary transportation, excess use of resources, and enhancing the selected route.

Finally, the implementation of these advanced technologies ensures that the overall supply chain logistics progresses into a more reliable, efficient and customer-oriented service. Telegram Platform Customer Perspective Based the customer perspective, the following are key enablers: Talent: Improved employee talent to serve customers more efficiently Technologies: Use of latest technologies to deliver service to the customers Proactivity: Being proactive in customer service to ensure the customer gets value Delivery: Incorporating new technologies and creating new talent to This work creates a foundation for the conceptualisation of the ideal future state of the logistics network in this organisation to deserve the modern customer needs , environmental conservation and operational efficiency .

#### **REFERENCES**

- [1] Akdogan, Kutay & Özceylan, Eren. (2021). Applications of Artificial Intelligence in Last Mile Delivery Operations: A Literature Review.
- [2] didast, F. Z., nassih, R., & ait elbachir, I. (2024). Artificial Intelligence and Logistics: Recent Trends and Development. Preprints. <https://doi.org/10.20944/preprints202410.2141.v1>
- [3] Issaoui, Yassine & KHIAT, Azeddine & Haricha, Karim & Bahnasse, Ayoub & Hassan, Ouajji. (2022). An Advanced System to Enhance and Optimize Delivery Operations in a Smart Logistics Environment. IEEE 10.1109/ACCESS.2022.3141311. Access. PP. 1-1.
- [4] Wang, J., Lim, M. K., Zhan, Y., & Wang, X. (2020). An intelligent logistics service system for enhancing dispatching operations in an IoT environment. Transportation Research Part E: Logistics and Transportation Review, 135, 101886.
- [5] Jintana, J., Sopadang, A., & Ramingwong, S. (2020). Matching consignees/shippers recommendation system in courier service using data analytics. Applied Sciences, 10(16), 5585.
- [6] Vemula, V. R. (2025). AI-Enhanced Self-Healing Cloud Architectures for Data Integrity, Privacy, and Sustainable Learning. In Smart Education and Sustainable Learning Environments in Smart Cities (pp. 93-106). IGI Global Scientific Publishing.
- [7] Kalkha, H., Khiat, A., Bahnasse, A., & Ouajji, H. (2023). The rising trends of smart e-commerce logistics. IEEE Access, 11, 33839-33857.
- [8] de Araujo, A. C., & Etemad, A. (2021). End-to-end prediction of parcel delivery time with deep learning for smart city applications. IEEE Internet of Things Journal, 8(23), 17043-17056.
- [9] Arvindan Badrinarayanan .(2024).AI-Driven Optimization of Last-Mile Delivery.





INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details