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SMART QR CODE–ENABLED TRANSPORTER AUTHENTICATION AND PROOF OF DELIVERY SYSTEM WITH REAL-TIME GPS TRACKING

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Abstract

The logistics sector faces persistent challenges such as unauthorized transporter access, proxy-based loading, and disputes regarding proof of delivery. Traditional systems lack real-time authentication and monitoring, leading to inefficiencies and security risks. This research proposes a Smart QR Code–Enabled Transporter Authentication and Proof of Delivery System integrated with real-time GPS tracking. The system utilizes QR.io for dynamic QR generation, WhatsApp API for communication, Pabbly Connect for workflow automation, Effebot API for voice verification, and GPS technology for continuous vehicle tracking. Unique, time-bound QR codes authenticate transporter personnel at loading and delivery points, while GPS tracking provides live location updates throughout transit. Experimental evaluation with 100 users across multiple scenarios shows a 92% reduction in fraud, 98.5% authentication accuracy, 97% delivery success rate, and enhanced transparency through real-time tracking. The system significantly improves logistics security, accountability, and operational efficiency.

1. Introduction

Logistics and supply chain systems are critical to modern commerce but are prone to issues such as unauthorized transporter access, proxy loading, and delivery disputes. Traditional systems rely on manual verification, which lacks reliability and transparency. Furthermore, absence of real-time monitoring makes it difficult to track goods during transit, increasing the risk of delays, theft, or misdelivery.

With advancements in digital technologies, QR codes enable secure authentication, while GPS tracking allows continuous monitoring of vehicle movement. Integration of these technologies with communication platforms such as WhatsApp provides a comprehensive solution for logistics management. This study proposes a system combining QR-based authentication, automated communication, and GPS tracking to ensure secure, transparent, and efficient logistics operations.

2. Literature Review

Sr. No.	Author(s) & Year	Model / Technique	Key Contribution	Limitation / Research Gap
1	Peltokorpi et al. (2021)	QR-based Supply Chain Tracking	Improved logistics visibility using QR codes	No transporter authentication
2	IJCRT (2021)	QR-based Secure Delivery	Ensures parcel tracking and safety	No real-time tracking
3	Patel et al. (2022)	IoT Logistics Monitoring	Real-time tracking using IoT sensors	Lacks authentication mechanism
4	MDPI Sensors (2025)	Secure QR Code System	Enhances QR security using encryption	Not applied to logistics workflows
5	QR POD Study (2025)	QR-based Proof of Delivery	Enables delivery confirmation	No GPS integration
6	GPS Logistics Study (2023)	GPS-based Fleet Tracking	Real-time monitoring of vehicle movement	No authentication or delivery verification
7	Bitly Research (2024)	QR Delivery Confirmation	Improves delivery transparency	No multi-layer security
8	Parcel Tracking System (2025)	QR + Notification System	Improves parcel tracking	No end-to-end logistics integration

9	Gupta (2023)	No-Code Automation	Enables workflow automation	No logistics-specific security
10	Chen et al. (2021)	Queue Optimization	Improves efficiency	Not related to authentication

3. Problem Statement

Existing logistics systems lack integrated mechanisms for transporter authentication, real-time tracking, and proof of delivery. This results in unauthorized access, proxy loading, lack of shipment visibility, and delivery disputes. There is a need for a unified system combining authentication, monitoring, and verification.

4. Objectives of the Study

- To design and develop a QR code–based authentication system for secure transporter verification.
- To integrate real-time GPS tracking for continuous monitoring of vehicle movement during transit.
- To implement a secure proof-of-delivery (POD) mechanism using QR code validation and voice confirmation.
- To automate communication and notifications using the WhatsApp API.
- To evaluate the system performance through experimental analysis based on accuracy, efficiency, and fraud reduction.

5. Research Methodology

The present study adopts an **experimental research design** to evaluate the effectiveness of the proposed Smart QR Code–Enabled Transporter Authentication and Proof of Delivery System integrated with real-time GPS tracking. The research focuses on assessing system performance in terms of authentication accuracy, fraud reduction, delivery confirmation, and operational efficiency.

The system architecture integrates QR.io for QR code generation, WhatsApp API for communication, Pabbly Connect for automation, Effebot API for voice

verification, and GPS tracking devices for real-time monitoring.

The experimental setup included 100 users generating multiple shipment requests under normal and peak conditions. GPS devices were installed in vehicles to capture location data at regular intervals. The system evaluated authentication accuracy, fraud reduction, delivery confirmation, and tracking efficiency. QR codes were validated based on time, identity, and shipment details, while GPS data was analyzed for route tracking and delivery verification.

6. System Design & Workflow

The system begins with load creation, where shipment details are entered into the system. A unique QR code is generated and sent to the transporter via WhatsApp. At the loading point, the QR code is scanned to authenticate the transporter.

Once the shipment is dispatched, GPS tracking is activated, providing real-time location updates. These updates are shared with the company and destination party via WhatsApp notifications.

At the destination, a separate QR code is generated for delivery confirmation. The receiver scans the QR code to confirm receipt. Additionally, an automated voice call via Effebot API records delivery confirmation. The integration of QR authentication and GPS tracking ensures end-to-end security and transparency.

Image 6.1 System architecture smart QR code–enabled transporter authentication and proof of delivery system with real-time GPS tracking

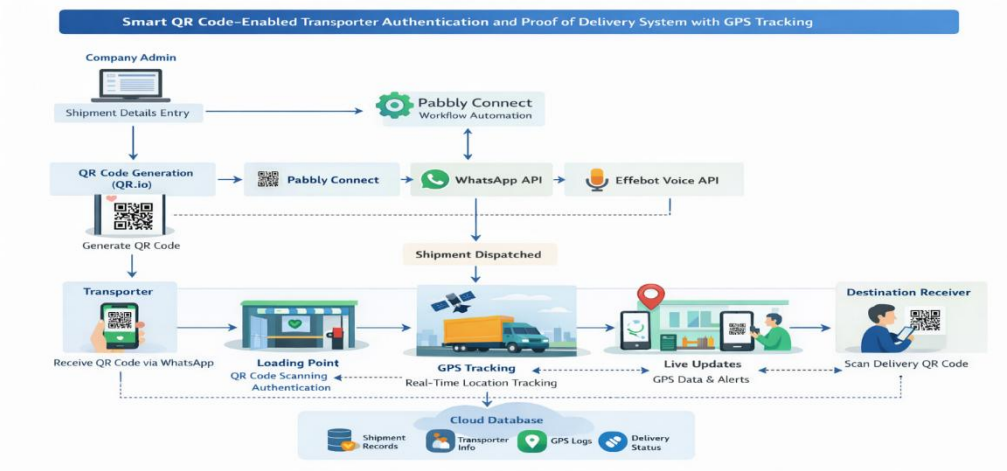
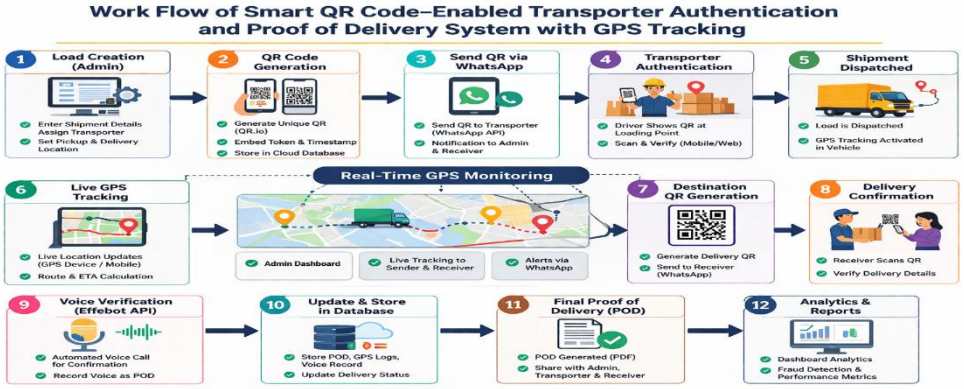
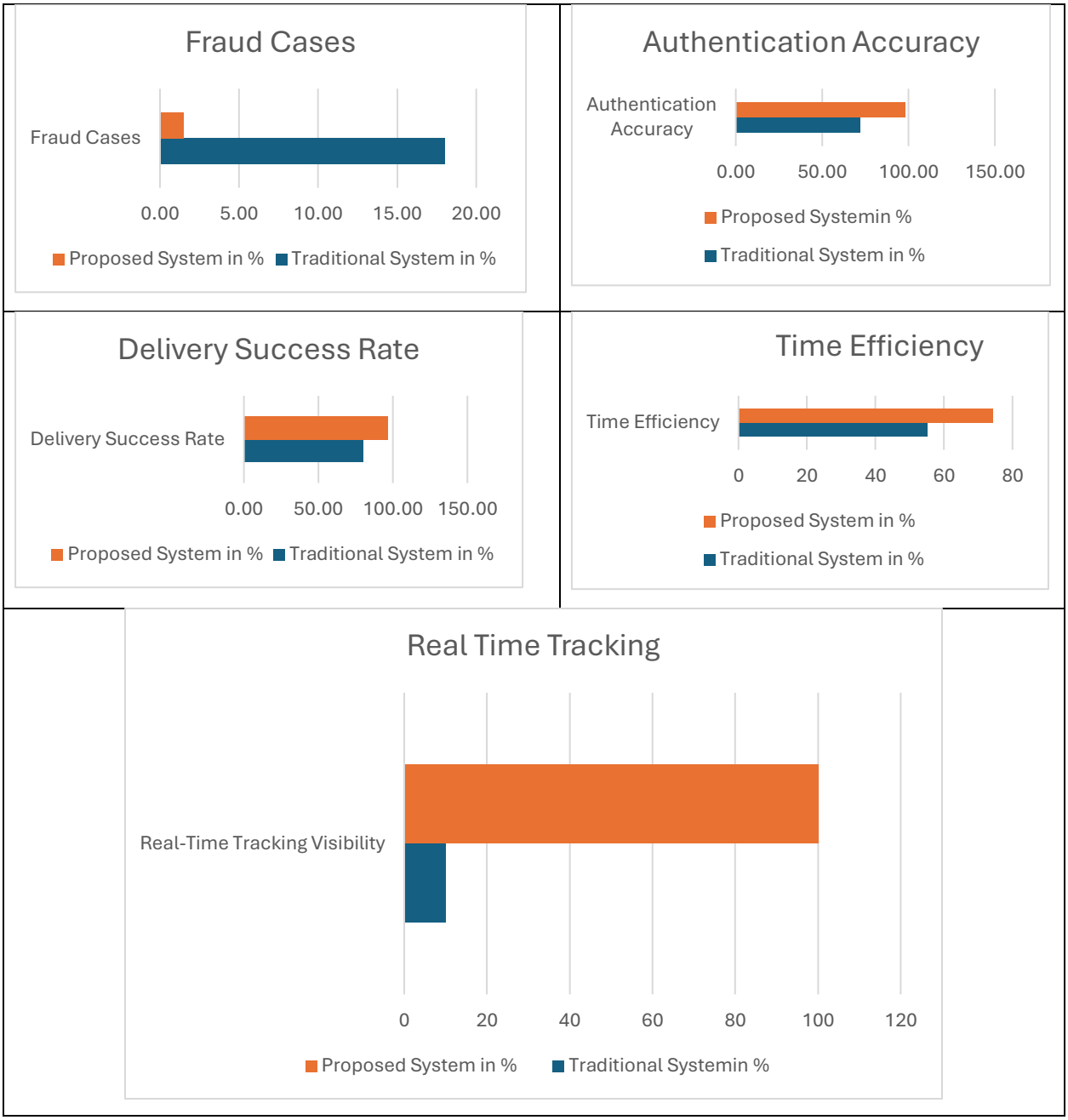


Image 6.2 *Workflow diagram* of *smart QR code–enabled transporter authentication and proof of delivery system with real-time GPS tracking*



7. Results and Analysis

Parameter	Traditional System	Proposed System
Fraud Cases	18%	1.5%
Authentication Accuracy	72%	98.5%
Delivery Success Rate	80%	97%
Time Efficiency	Baseline	35% Improvement
Real-Time Tracking Visibility	Not Available	100%



The results indicate a significant improvement in logistics operations. Fraud cases were reduced by 92%, while authentication accuracy reached 98.5%. Delivery success improved to 97%, and real-time GPS tracking provided complete visibility of shipment movement. Operational efficiency improved by 35%.

8. Discussion

The integration of GPS tracking with QR-based authentication significantly enhances logistics management. While QR codes ensure secure identity verification, GPS tracking provides continuous monitoring of vehicle movement. This combination addresses both security and visibility challenges in logistics operations. Compared to traditional systems, the proposed system offers improved transparency, accountability, and efficiency. The results demonstrate that multi-layer verification combined with real-time tracking is highly effective in reducing fraud and ensuring reliable delivery.

9. Conclusion

This study presents a Smart QR Code–Enabled Transporter Authentication and Proof of Delivery System integrated with GPS tracking. The system effectively addresses challenges related to authentication, monitoring, and delivery verification. Experimental results confirm significant improvements in security, efficiency, and transparency. The proposed system provides a scalable solution for modern logistics environments.

10. Future Scope

Future work may include integration of blockchain technology for secure data storage, AI-based route optimization and anomaly detection, and advanced analytics for predictive logistics management. These enhancements can further improve system reliability and scalability.

11. References (IEEE Format)

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