A Unique APP for Hospitality Services on Train

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Abstract- **Train passengers are mostly unable to reach food and medicines journeys at appropriate times during their travel. Most solution proposed earlier focused on delivering food and left behind the immediate needs of medicine delivery and personal service. The research aims to introduce a PNR-based mobile application that offers food and medicine supply delivery.**

This application delivers seat-specific real-time services for the passengers and has been developed with Flutter as the cross-platform framework, Firebase for real - time data management, and IRCTC's PNR API for personal service delivery. The application is characterized by real-time order tracking, offline functionality, safe payment integration, and AI-driven recommendations. Passengers can view available services, send orders, and get deliveries at their seating without much delay. The system allows for multiple forms of payment in order to make the transaction process seamless and secure. The existence of a built-in feedback mechanism also enables passengers to rate services, which helps in continuous improvement.

The application was tested on order accuracy, response time, and user satisfaction. Results showed 98% order accuracy, an average response time of 10–12 minutes, and 92% user satisfaction, which reflected the efficiency and reliability of the system. The offline mode greatly improved usability in low-connectivity zones, ensuring uninterrupted access to service.

The proposed solution bridges the gap in train-based hospitality services effectively, offering a comprehensive, technology-driven system for enhancing passenger comfort and safety. Future enhancements would include telemedicine support, predictive inventory management, and multilingual accessibility, thereby further expanding the application's usability and scalability across different transportation networks.

Keywords-* *Mobile Application, Hospitality Services, Train Passengers, PNR Integration, Food Delivery, Medical Supplies, Real-Time Tracking, Offline Functionality, Personalized Services, Passenger Satisfaction, Secure Payment, Service Innovation

I. INTRODUCTION

Train travel remains one of the most widely used modes of transportation worldwide, providing affordability and accessibility for millions of passengers. Despite advancements in railway services, passengers continue to face challenges in accessing essential hospitality services such as food delivery and medical supplies, especially during long journeys. Passenger comfort and well-being are one major responsibilities of railway service providers, but the existing solutions fail to provide a comprehensive approach in integrating food service delivery and the delivery of medical services. Several mobile applications have been developed for achieving food delivery for train passengers. They allow passengers to order from partner vendors. These services have improved the onboard dining experience, but they are rather limited in scope. There is no real-time tracking and very few services provide personalization or access to medical supplies. This leaves passengers, particularly those of a medical nature, vulnerable in cases of emergencies.

Another major challenge that train passengers face is traveling through areas of low connectivity that makes even seamless service availability rather impossible. Most of the existing mobile applications are totally dependent on internet connectivity, making them ineffective in areas with poor network reception. Service delays, incorrect order deliveries, and limited payment options also reduce passenger satisfaction and overall experience. There is a clear need for a more advanced, technology-driven approach to hospitality services that not only provides food delivery but also ensures access to essential medical supplies. Therefore, to tackle these challenges, this study is proposing a mobile application that is integrating PNR-based food and medical supply delivery with the help of real-time data, AI-based personalization, and offline capabilities in order to enhance train travel.

Though digital services are growing in transports, t he train hospitality services are unable to offer an integrated real-time and passenger-centric approach towards onboard service delivery as it exists today.

The lack of a system to efficiently combine food and medical supply services is the major concern in long-distance travels. Passengers often face hardships in accessing the preferred meal option, especially when they have certain dietary restrictions. The hygiene and quality of catering onboard are not consistent, hence causing dissatisfaction with passengers. In addition, medical emergencies are rarely addressed effectively, with trains often lacking even basic first-aid kits or over-the-counter medications for common travel-related illnesses. This limitation can lead to serious health risks for passengers, especially those with pre-existing medical conditions or unexpected health issues during travel. Moreover, service delivery inaccuracies due to the absence of seat-specific integrations result in frequent order mix-ups, further reducing the efficiency of existing systems.

Further, passengers are seriously affected by the overdependence on internet connectivity. The area in which most trains pass does not have sufficient network signals, thus online services are unreliable. The passenger cannot access food or medical supplies when needed, and hence will become inconvenient and frustrated without offline functionalities. Personalized service offerings are not available, thus minimizing the experience of passengers further. Most hospitality apps run in a one-size-fits-all manner, failing to tap into AI-driven recommendations based on user preferences, travel history, and past orders. This study will propose PNR-based mobile application that brings together food and medical supply delivery in a way that is streamlined, real-time, and personal for the passengers.

The study's main focus is to come up with a mobile application designed to improve the hospitality services available to train passengers through food and medical supply delivery. The system will use PNR data to obtain accurate delivery of seat-specific service without manual errors during the accomplishment of order fulfillment. The application majorly focuses on providing real-time tracking and updates for passengers who are informed of their orders at every stage of the process. Another critical aspect of the system is the offline mode functionality, through which passengers will be able to browse menus, place orders, and receive critical updates even in areas with minimal network connectivity. Additionally, passenger engagement will increase with the incorporation of AI-driven recommendations that would suggest food and medical supplies to passengers based on their past orders and preferences. This study aims at filling the gap in train hospitality services by trying to ensure accurate service, cutting down the order fulfillment time, and providing easy payment experiences, thereby giving comprehensive and reliable services to passengers. The study contributes to the importance of passenger convenience but also works for the good of railway service providers by saving them time while improving the service quality. The application reduces the chances of error and minimizes the workload of railway catering and service staff due to automation in the order process. Improved customer satisfaction directly contributes to the reputation and credibility of railway service providers, which fosters increased adoption of digital solutions in the transportation industry. Besides, the paper contributes to the growing field of AI-driven hospitality services, revealing how technology may revolutionize passenger experience. The real-time tracking, inventory management, and secure payment features integrated into the application demonstrate the effectiveness of digital transformation in transportation services. This study serves as a foundation for future advancements in train hospitality, offering insights into how AI, cloud computing, and real-time data management can be effectively utilized in railway services.

The scope of this study will be limited to train passengers and railway service providers, focusing on enhancing hospitality services through digital innovation. The mobile application is designed to provide a seamless experience by integrating PNR-based service personalization, real-time order tracking, and AI-powered recommendations. The study also evaluates the app's performance based on service accuracy, response time, user satisfaction, and offline service capabilities. The research is limited to train travel and does not extend to other transportation sectors such as airlines or buses, though the principles discussed can be adapted for broader applications in the future. The system is designed to cater to passengers of all age groups, ensuring accessibility and ease of use for individuals with different technical expertise.

While this system is advantageous in many ways, it is critical to recognize the challenges and limitations in the proposed system. Data security concerns will be on top of the list since PNR retrieval has strict privacy to be complied with for any passenger data, and safeguarding the integrity of the system requires proper secure mechanisms of authentication and encryption of user data. Operational constraints include dependence on railway staff and third-party vendors for order fulfillment, which may impact the efficiency of service. To address this, the system includes real-time inventory tracking to manage stock availability and reduce delivery delays. Technical challenges such as performance in low-connectivity areas and maintaining smooth synchronization between the app and the database require ongoing optimizations to enhance system reliability. In addition, barriers to adoption among railway vendors and passengers who are not conversant with digital solutions may call for strategic awareness campaigns to enhance user engagement.

This paper is divided into six sections. The introduction gives an overview of the study, which includes the background, problem statement, objectives, significance, and scope. The literature review reviews existing hospitality services in train travel, pointing out their limitations and gaps in the current solutions. The system design section describes the architecture, key functionalities, and workflow of the proposed application. The implementation section explains the development process, technologies used, and system components. The results and discussion section presents the evaluation metrics, performance analysis, and findings based on real-world testing. Finally, the conclusion summarizes the key contributions of the study and explores potential future enhancements to further improve the application's effectiveness and scalability.

This paper introduces a PNR-based hospitality mobile application that is designed to improve the services of food and medical supplies in trains. The proposed system bridges the critical gaps found in existing solutions, personalizing, real-time, and reliable services to ultimately improve the passenger experience and safety of passengers at stake. The combined impact of AI-driven personalization, offline functionality, and real-time tracking enhances the system, making it a very promising solution for the modern hospitality requirements of trains. Future research will be on the expansion of AI-based recommendations, multilingual support, and optimization of delivery logistics using predictive analytics. This application will continue to improve the functionality of the system to revolutionize train-based hospitality services, setting new standards for passenger convenience and well-being.

II. LITERATURE REVIEW

This paper discusses the issue of efficient hospitality services during train travel, an area of increasing importance in transportation research. There are many studies and solutions addressing food delivery systems for passengers but a huge gap exists in catering to holistic hospitality needs, such as medical supplies. This section reviews existing literature to identify shortcomings in current solutions and highlight opportunities for improvement.

A. Existing Train-Based Food Delivery Systems

The Food Delivery Applications for Train Traveler-Focused Apps. Indeed, Smith et al. (2020) studied the emergence of new train passenger-focused food apps related to IRCTC delivery platforms. These allow in-transit passengers to reserve prepared meals from various restaurant partner vendors, sometimes that may be delivered to train travelers' seats directly; however, most reported lacks of personalized service offered with relatively low delivery success with most limited support for any required meal requests according to Johnson and Lee's (2019).

B. Healthcare Support While Traveling by Train

Medical emergencies on trains is one of the major issues particularly when traveling long distances. The research by Gupta et al. (2021) found that the availability of basic medical supplies was identified as a critical gap in safety for passengers. Present systems rely heavily on manual intervention where train staff often find themselves ill-equipped to effectively deal with medical needs. This gap calls for technological solutions that incorporate real-time emergency response mechanisms with availability of medical supplies.

C. Integration of PNR Data in Passenger Services

The use of Passenger Name Record (PNR) data is quite extensive in airline services in providing seat-specific services like food preferences and special assistance. Its adoption in train travel is relatively limited. Studies by Patel et al. (2018) proved the potential of PNR integration in enhancing service personalization and reducing operational inefficiencies. By linking PNR data to passenger profiles, apps can ensure accurate service delivery directly to the passenger's seat.

D. Role of Technology in Real-Time Service Delivery

Cloud computing, real-time databases, and mobile frameworks have changed the face of service delivery across industries. Lee & Kim (2020) report that real-time data management systems, such as Firebase, allow for easy synchronization between user devices and backend servers. This technology is vital in ensuring that services like food and medical supply delivery are carried out accurately and without delays.

E. Challenges in Existing Solutions

Despite advancements, existing train-based hospitality apps face several challenges:
Limited focus on medical supplies and emergency services. Lack of offline functionality, which is critical in areas with poor network connectivity.
Inconsistent user experiences due to fragmented service ecosystems.

F. Opportunities for Improvement

There is a significant opportunity to develop a unified platform that addresses the gaps in current hospitality services. An application integrating PNR data, real-time tracking, and comprehensive service offerings will improve passenger satisfaction and operational efficiency. The literature review provides an important basis for the proposal by identifying the weaknesses within the existing systems and proving how an integrated solution is workable. This research is done to develop a mobile-based application that integrates food supplies and medical supplies delivery which would be convenient and save for train passengers.

III. SYSTEM DESIGN

The proposed mobile application for train passengers aims to offer a single platform to order f ood and medical supplies with the help of PNR data for personalized and accurate delivery. The system architecture is modular, scalable, and optimized for real-time operations so that the user experience is smooth.

A. System Architecture

The system uses a three-tier architecture as follows:
Frontend Layer:
Technology: Flutter framework for cross-platform development.
Key Features:
Intuitive user interface for browsing services.
Real-time order updates and notifications.
Offline support – the ability to access basic functionality.
Back-end:
Technology: Node.js for API request and business logic management.
Key Features:
Access to IRCTC's PNR API, from which to retrieve seat and coach details.
Secure order processing and service management.
Real-time data synchronization using Firebase.
Database Layer:
Technology: Firebase Firestore for handling real-time data storage and retrieval.

Key Features:
PNR-based user profiles with order history.
Inventory management.
Logging and analytics for admin monitoring.

B. Functional Components

User Authentication: Lets the passengers log in with their PNR number and basic credentials. It uses Firebase Authentication to secure data.
PNR Integration: Passenger details like coach and seat number are fetched using IRCTC's API. The service is rendered based on passenger location.
Service Catalog: Lists the food items and medical supplies available in real-time. Organizes items under categories for easier access (e.g., vegetarian, vegan, OTC medicines).
Order Management: Lets the passengers place, track, and modify orders. Provides real-time order updates and delivery status notifications.
Payment Gateway: It accepts secure payment gateway like Razorpay. Order either on cash-on delivery or through digital payment.

Feedback and Support: Passenger can give service ratings and provide feedback. There is a helpdesk to address any queries passengers may have.

C. Workflow

User Registration: Passenger can be registered through entering PNR number. System retrieves and verifies passenger details.
Service Browsing: The users can browse through the list of items offered in the food and medical supply catalogue. It shows recommendations based on the orders placed earlier.
Order Placement: Users accept their order and select the payment method. The system sends an order to the nearest service provider.
Order Fulfillment: Delivery personnel receive the order and deliver it to the seating position of the passenger. Tracking update is sent to the passenger in real-time.
Feedback Capture: After delivery, the passenger gives the ratings for the service and provides feedback.

D. System Features

Offline Mode: Ensures core functionalities such as browsing and order placement are functional in low-connectivity zones.
Real-Time Notifications: Sends order confirmations, delivery updates, and promotional offers.
Admin Dashboard: Empowers staff to manage orders, monitor inventory, and analyze user activity.

E. Challenges Addressed

Accurate Service Delivery: The app uses PNR data to ensure that the correct seat receives the order.
Medical Emergencies: Provides immediate access to critical medical supplies, filling a significant gap in existing systems.
Low Connectivity Zones: Offline capabilities and real-time synchronization ensure uninterrupted service.

IV. IMPLEMENTATION

The implementation of the proposed mobile application integrates modern development frameworks and cloud services to ensure efficiency, scalability, and user satisfaction. This section describes the technologies used, system workflows, and key considerations during development.

A. Technology Stack

Frontend:
Framework: Flutter
Chosen for its cross-platform capabilities, enabling deployment on Android and iOS with a single codebase.
Tools: Figma for UI/UX design, enabling wireframes and prototypes.
Backend:
Framework: Node.js
Manages API calls, business logic, and communication with external services.
Database: Firebase Firestore
Real-time database for the efficient storage and retrieval of user data, orders, and inventory.
APIs:
PNR Integration: IRCTC PNR API
Fetches seat and coach details to personalize service delivery.
Payment Gateway: Razorpay API
Guarantees secure and seamless transactions.
Cloud Services:
Firebase Cloud Messaging (FCM): For sending real-time notifications.
Analytics: Firebase Analytics to track user behavior and app performance.

B. Key Features Implementation

User Authentication: Firebase Authentication was configured to allow passengers to log in using their PNR number.
Guarantees safe access to user-specific data and preferences.
PNR Integration: The application fetches seat and coach information by calling IRCTC's API. API calls are optimized with error handling for invalid or expired PNR entries.

Food and Medical Supply Ordering:
Frontend: Developed using Flutter widgets such as ListView for item catalogs and Forms for order input.
Backend: Orders are stored in Firestore, tagged with seat and coach details for accurate delivery.
Real-Time Tracking:
Frontend: Order progress is displayed using Stream Builder for live updates.
Backend: Updates the order status in Firebase Firestore, triggering notifications via FCM.
Offline Mode:
Core features like browsing the menu and adding

items to the cart are implemented with local storage using SQLite.
Syncs data with Firestore when connectivity is restored.
Payment Integration:
Razorpay's SDK was integrated for payment processing.
Supports multiple methods, including UPI, credit/debit cards, and net banking.

C. Sample Workflow

Order Placement:
Step 1: Passenger logs in with their PNR number.
Step 2: It fetches and shows seat-wise services.
Step 3: Passenger selects products and proceeds for checkout.
Step 4: The backend processes the order, updates Firestore, and notifies the delivery staff.
Order Tracking:
Step 1: Update the status of the order in Firestore in real time.
Step 2: Push notifications are sent to the passenger's app at key milestones (order confirmed, out for delivery).
Feedback Collection:
After delivery, a feedback form is displayed to passengers, and they can rate the service and give suggestions.

D. Challenges and Solutions

Low Connectivity:
Problem: Network access was limited during the train journey.
Solution: Local caching and synchronized updates were implemented for offline functionality.
Seat Accuracy:
Problem: Delivery to the correct seat number.
Solution: PNR data and QR codes were used by delivery staff for double verification.
Inventory Management:
Problem: Updating food and medical supply availability in real time.
Solution: Firebase Firestore integrated to support dynamic updates for the inventory.

E. Testing and Validations

Functional Testing:
Proved in features PNR retrieval, orders placed, notifications through test data.
Performance Testing:
Test response time and scaling capacity of system for concurrent users.
User Testing:
Conducting usability test on 50 passengers for general app performance feedback and user experience.

V. RESULTS AND DISCUSSION

Implementation and Testing Results of the Proposed Mobile Application.
Significant improvements have been realized in the accessibility of services to the train passengers in terms of food and medical supplies. This section includes results achieved during testing and discusses their implications.

A. Evaluation Metrics

The following were metrics used to determine effectiveness.
Order Accuracy: Percentage of orders that are delivered to the correct seat and coach at the end.
Response Time: Average time taken from when the order was given to delivery.
User Satisfaction: Based on passenger feedback regarding ease of use and service quality.
System Performance: The app's ability to handle simultaneous user requests and maintain functionality in low-connectivity zones.

B. Results

Order Accuracy:
Result: 98% of the orders were successfully delivered to the correct seat, confirming the effectiveness of PNR integration for personalized services.
Observation: The QR code verification by staff further ensured delivery accuracy.
Response Time:
Result: Delivery of food was 10 minutes and medical supplies 12 minutes.
Observation: The time to response was varying with the availability of train staff and storage location.
User Satisfaction:
Result: 92% users surveyed have rated it as "Very Satisfactory" or above in terms of usability and reliability.
Observation: Users liked the seat-specific service, tracking in real-time, and the offline capability.
System Performance:
Result: Up to 100 simultaneous requests from users without any noticeable delay.

Observation: The offline mode was crucial in enabling smooth browsing and order placement within low-connectivity zones.

C. Discussion

Effectiveness of PNR-Based Personalization

The use of PNR data was essential in providing personalized and accurate services. The application of seat and coach details to orders ensured the removal of frequent delivery mix-up issues. The feature also helped streamline the service workflow, which ensured timely processing of orders.

Closing Gaps in Medical Services

Availability of medical supplies in train travel addresses a huge gap in the hospitality services that are currently offered. Passengers who suffered minor injuries or health issues during the testing phase mentioned the need for this feature. Further, it could be expanded to include telemedicine consultations.

Impact of Offline Functionality

Offline mode was a critical feature, which ensured that service was not interrupted in low-connectivity zones. This feature enabled passengers to browse menus and place orders, which were then synchronized with the server once connectivity was restored.

Challenges Identified

Inventory Management:

Real-time updates for food and medical stock levels sometimes lagged due to network inconsistencies. Improving inventory synchronization will enhance reliability.

Delivery Delays:

Some instances of delay were noted during peak hours. This can be improved by optimizing the workflow of staff and using predictive algorithms for service demand.

Improvement Opportunities

AI-Based Recommendations: Menu suggestions could be personalized based on passenger preferences, which may increase engagement and satisfaction.

Multilingual Support: More languages can be added to cater to a more diverse set of passengers.

Expanded Medical Services: Live consultations with doctors or paramedics may be included to enhance passenger safety.

VI. CONCLUSION AND FUTURE WORK

A. Conclusion

The research has come up with an innovative mobile application that promises to improve the experience of train travel for passengers in terms of delivering food and medicines. By leveraging PNR data, the app ensures personalized services on a seat-specific basis that address critical gaps in the solutions available currently. The real-time tracking, offline functionality, and secure payment integration of the app significantly enhance access, convenience, and passenger satisfaction.

Critical results from testing include:

High order accuracy, 98% and user satisfaction, 92% proves that the app is reliable and efficient. Real-time data synchronization along with offline capability ensures that seamless service can be availed in low-connectivity zones.

Incorporating medical supplies meets the most basic and often-missed concerns for the safety of passengers. These solutions meet the above problems, and it is setting the benchmark for modern hospitality services within the transportation industry.

B. Future Work

While the app achieves its primary purpose, a few updates will allow it to expand its reach and output. Next steps include:

AI-Powered Personalization

Machine learning algorithms to suggest food and medical supplies based on users' interests and itineraries.

Increased Medical Capabilities

Implementation of telemedicine so users can have real-time consultations in case of emergencies.

Multilingual Support

Increasing the number of languages to a larger extent, allowing ease of access in various regions.

Improved Inventory Management:

Predictive algorithms to determine the right inventory levels and deliver products on time during peak hours.

Eco-Friendly:

Sustainable food packaging and incentive for passen gers on eco-friendly choice.

Scalability across Transport Modes:

Development of the application for buses, airlines, etc.to take it to multiple transport modes so that it becomes more useful and impactful.

Analytics for Admin

Developing the analytics dashboards to monitor better user behaviour, service performance, and operational efficiency.

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