IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

System For Booking And Displaying Missed Train Tickets

[1]Rudra Amin, [2]Boudhik Chawada, [3]Shagun Metha, [4]Isha Waghela, [5]Ahmedraza Sayyed

[1]Student, [2]Student, [3]Student, [4]Student, [5]Student

[1]B-Tech (Computer Science And Engineering),

[1]Dy Patil Dnyaan Prasad Global University, Pune, India

Abstract : Indian Railways has often struggled with many empty seats on trains because individuals cancel at the last-minute or do not show up or exit a train before their final destination. When the train is in motion, the existing static on-board reservation system has no capability for real-time knowledge and distribution of vacant seats or to shuffle them. As a result, the railways are losing revenue for which they have already received money and this is a major issue where RAC and waitlisted passengers do not get confirmation of berths.

In this work, an innovative real-time seat management solution, which uses IoT sensors to detect seat occupancy automatically, GPS to track the position of trains and confirm departures, and Firebase Real-time Database for live integration of seat information, is presented. Authenticated users have the opportunity to log in by entering one-time passwords to their mobiles, view missed seats currently available in real time, choose one, and pay for booking through Razorpay.

The proposed system allows for immediate allocation of empty seats even after the train leaves, thus ensuring maximum utilization of the available seats without requiring any manual efforts. The initial results indicate successful real-time monitoring and dynamic allocation of tickets.

INTRODUCTION

The Indian Railway has one of the largest railway networks in the world catering to passengers and serves millions of passengers every day. However, one of the major challenges faced by Indian Railways is wasted seats due to cancellations, no shows or early exit from the train. With real-time seat availability data feed not being available to the current system and seats are hence deemed as fixed post the train starting, leading to an inefficient process.

This has resulted in huge financial losses to the organization, making it difficult for passengers with RACs and waitlisted tickets to have reserved berths or requesting the same manually from the TTE (Ticket Checking Staff).

There is an increasing demand for Internet of Things (IoT) and real-time technology implementations within railways for enhancing operational effectiveness, passenger satisfaction, and optimal use of resources. This research paper proposes a model for designing and implementing a real-time detection and booking of missed train ticket seats.

Motivation and Objectives:

Motivation

Firstly, one reason to develop the project is that the existing mechanism of train seat reservation has a number of deficiencies since it lacks flexibility and does not allow making any changes after departure. The seats remain unoccupied; however, passengers who are waiting cannot hope to get their preferred seats either. In addition, the manual process involved in Train Ticket Examiner takes time and cannot be considered reliable.

In this regard, IoT cannot be ignored because this innovative technology allows for automatic recording of seat usage in an entirely autonomous manner without involving any human intervention. Specifically, IoT will be integrated with the GPS functionality, as well as Firebase for updating the information in real time. Using these advanced technologies, a special adaptive algorithm will be developed to allocate unoccupied seats properly.

Objectives

- To design and implement an IoT based hardware setup for real-time detection of vacant seats in moving trains.
- To develop a secure web-based platform with OTP login and Razorpay integration for dynamic booking of missed tickets.
- To integrate GPS tracking and Firebase Realtime Database for accurate train status validation and live seat availability updates.
- To minimize manual intervention and reduce seat wastage through automated redistribution.
- To evaluate the system's performance and identify pathways for future scalability and integration with existing IRCTC infrastructure.

Related Work:

Sr. No.	Author(s)	Year	Title of Paper	Method / Technology Used	Key Findings	Limitations
1	Arora & Sharma	2021	Prediction of Train Ticket Confirmation Using Machine Learning	Machine learning models	Accurate prediction of confirmation chances	Prediction only, no automated ticket reassignment
2	Das & Chakraborty	2020	Dynamic Ticket Allocation Algorithms for Railways	Algorithmic modeling and performance evaluation	Better seat utilization through dynamic allocation	Lacks real-time web implementation for end users
3	Tiwari et al.	2019	Passenger Information Systems for Train Ticketing	UX analysis, system prototyping	Simplified display improves passenger understanding	Does not include booking of missed or unused tickets
4	Srinivasan et al.	2018	Analysis of Indian Railway E-T icketing System	Survey-based analysis, usability testing	Identified issues in real-time availability and system response	Internet dependency

Sr. No.	Author(s)	Year	Title of Paper	Method / Technology Used	Key Findings	Limitations
5	Kundu	2017	Automated Waitlist Management in Railway Reservation Systems	System design and simulation	Improved waitlist movement efficiency	No passenger-facing interface for missed ticket booking

Summary:

1. **Arora & Sharma (2021):** Used Machine Learning to predict train ticket confirmation chances. → Error of forecast, yet no script to reassign tickets automatically.
2. **Das & Chakraborty (2020):** Proposed dynamic ticket allocation algorithms for better seat utilization. → Increased efficiency is great, if no real-time web instance to run for the user.
3. **Tiwari et al. (2019):** Focused on passenger information systems and UX for train ticketing. → Better passenger understanding, but ignored missed/unused ticket booking.
4. **Srinivasan et al. (2018)**: Analyzed the Indian Railway E-Ticketing system through surveys and usability testing. → Identified availability and response issues, but heavily dependent on internet.

4. Research Gap:

Although existing literature shows the potential of IoT and sensors for occupancy detection and basic seat management, several key gaps remain:

- **Absence of Real-time Vacancy Management:** There is no way to detect vacancies immediately after a passenger miss\leaves early or to automatically redistribute seats on trains already in transit.
- **Lack of Dynamic Booking Integration:** Current web interfaces do not fully connect with live cloud databases, like Firebase, to allow waiting passengers to book seats dynamically.
- **Security and Payment Deficiencies:** Real-time redistribution scenarios do not strongly focus on secure authentication, such as OTP, or instant payment gateway integration.
- **Lack of Fraud Prevention:** The system can be abused or fraudulent bookings may not get validated as the train crosses the route due to lack of GPS-based validation.
- **Reliance on Manual Labor:** There is minimal effort put towards automation, making the Ticket Examiner (TTE) heavily reliant on manual activities. These problems result in empty seats that are sold but unusable and big hassle for customers. Hence, this work proposed has a very high significance for developing an applicable and easily deployable solution to curb the missed tickets in Indian Railways.

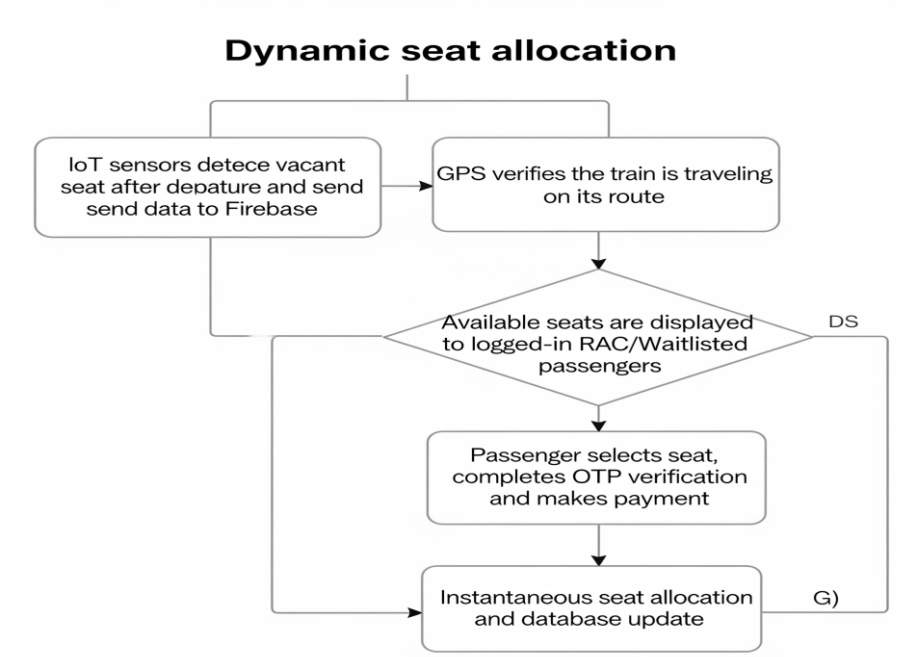
5. Proposed Approach:

The system combines the four colorful layers designed to manage and redistribute missed seats IOT Sensing Layer It performs continuous monitoring of the occupancy status of each berth or seat using pressure, infrared (IR) or ultrasonic sensors. Tracking Layer: Real time location data is provided using a GPS module mounted in the train coach. This ensures that the reallocation of seats does not happen until after the train has left the station. Cloud Processing Layer: Sensor & GPS data is uploaded in Firebase Realtime Dat abase. This blah part updates the status of a seat (empty or filled) in real time and maintains consistency among all parts of the system. Application Layer: Responsive web application layer using HTML/CSS/React js frontend and a Node. js/Python backend. It allows users to log in with a mobile OTP, check for the currently available missed seats on their train, select his/her preferred seat and make secure payments through the Razorpay.

System Operation Flow:

- **Vacancy Detection:** IoT sensors on board detect a vacant seat right after the train leaves,they send this information to the Firebase database.
- **In-Route Verification:** The system uses GPS data to ensure that the train is following its prescribed route.
- **Show Availability:** The confirmed available seat list shown only the passengers having RAC(reservation against cancellation)or wait-listed in its Login. The passenger selects a seat, verifies an OTP and pays. The seat is booked instantly, and the DB gets updated.

Flowchart:



Advantages and Disadvantages:

Advantages:

Optimized seat allocation and revenue: It can accurately identify missed places in real time and immediately redistribute those seats with the lowest user latency; thus saving more on Indian Railway's occupancy wastage than before.

Better Experience For Passengers: It offers better convenience and transparency for RA (Reservation Against Cancellation) and Waitlisted passengers. Minimization of Manual Errors and Bias: As manual intervention from Ticket Traveling Examiner (TTE) is minimal, errors are reduced, and bias in seat allocation is avoided.

Security: It implements OTP (One-Time Password) payment security and integration with Razorpay.

Disadvantages:

One Time Cost: Requires a bulk amount of capital for the installation of IoT sensors and GPS module in every coach of train. Dependence on Connectivity The system assumes accessibility to stable Internet and GPS signals, which can be especially challenging in remote or under the ground conditions (for example tunnels)

Security Threats: Better risk of security cracks or fraudulent practice, requiring supplementary and rugged protective protocols.

Integration Complexity: There are legacy IRCTC operational systems in place and the full-scale implementation of the system will require seamless and smooth integration with these systems.

Applications:

The proposed system offers several key applications, leading to significant benefits:
Dynamic Ticketing: You can change a reservation for RAC (Reservation Against Cancellation) to carry acquisition. Along with this, you can add the feature of "Wait Listing" directly onto your ticket immediately if go for normal booking online-Software automatically assigns its same price fare by train travel agent during the ride.

Scalability: This idea can also be extended to other public transit situations including long-distance buses running between cities over vast stretches of countryside. The notion can also be implemented on subways and light railways as well. No need for any further explanation here--everybody knows how that works. If a technology based on rewriting history is developed, ultimately it will be relevant to our present problems.
Foundation for Future Innovations: A seed crystal for future AI-laden intelligent railway projects--like integrated crowd management and predictive vacancy by forecast

Conclusion:

In this paper, we proposed the innovative real-time system utilizing IoT and web technologies for detecting missing train tickets and make them available to book. This solution is built using seat occupancy sensors, GPS trackable and Firebase Realtime Database along with secure web booking feature to help enforce this long-standing problem of reserving a seat only for it to lie unused until the respective train completes its run. The potential of the proposed system is not limited to ensuring that most seats are utilized and revenue losses minimized as it also adds to an enhanced passenger experience via increased transparency and automation. It is an important step in the ongoing digital transformation and its "smartification" of the Indian Railways.

Some future development prospects involve the development of a mobile application, implementing AI/ML models for predictive seat availability, ticket security with blockchain and attending successful large-scale deployment by making smooth integration through verified IRCTC APIs.

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