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Next-Gen Railway Ticketing: ARTS with Real-Time QR Code Validation

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ABSTRACT

Through the use of QR code technology, the Advanced Railway Ticket Generation System streamlines ticketing and passenger management. A digital ticket in the form of a QR code will be sent to customers who purchase tickets via an online platform. The QR code is validated at the train coach's entrance using external readers. A centralized web server manages passenger data, waiting lists, and ticket information to guarantee seamless operations. Payments can be made using prepaid services or credit card gateways. Through the automation of ticket validation and passenger tracking, this system boosts productivity, reduces human work, and enhances the overall travel experience.

Keywords: - QR-Code, Digital Ticket, Priority

1. INTRODUCTION

Passengers have traditionally had to wait in large lines at train stops in order to purchase tickets for the unreserved portion of the train. This can take a lot of time and be inconvenient. The introduction of computerized reservation systems improved this process, but further modernization is still needed, particularly in light of the rising use of smartphones and electronic payments. The Railway Ticket Generation System you are creating uses an Android-

based software and QR codes to significantly speed up the ticket purchasing procedure. This method allows travelers to purchase unreserved tickets directly from their cellphones, eliminating the need to stand in line at the station. This new approach not only benefits passengers but also simplifies the task for railroad officials.

Train Timetable and Fare Information: The system provides passengers with the most recent information on train schedules and ticket prices. This ensures that passengers may get the most up-to-date information on available trains and related prices.

QR Code for Ticket Generation: Passengers can scan the QR code on each train using the program. This QR code contains information about the train, such as its schedule, route, and available seats. Once the code has been scanned, the passenger can proceed with booking a ticket.

Purchase of Unreserved Tickets: Traditionally, travelers in the unreserved sector must physically visit the station and stand in line in order to purchase a ticket. Passengers can use their mobile devices to create unreserved tickets with this technology. They merely input the desired number of seats, supply their payment information, and obtain an electronic ticket.

Because it may considerably improve passenger convenience and expedite railway operations, the QR code-based web-based railway ticket generation system is relevant. By allowing travelers to purchase unreserved tickets directly from the internet, eliminating the need to stand in line, the strategy expedites and simplifies the ticketing process.

It also promotes contactless, paperless transactions, which aligns with post pandemic safety and

environmental sustainability efforts. For railroad operators, the unified database and real-time inventory management ensure efficient seat distribution and prevent overbooking. Furthermore, in the case that a user cancels or does not arrive at the platform, this solution provides a priority waiting list that allocates tickets according to priority.

2. RELATED WORK

Mrs. Khonde in the paper [3] proposed this framework manages the turn of events and execution of a PDA framework to purchase the metropolitan tickets which is basic and simple to utilize. Our ticket can be purchased with the assistance of a PDA framework as well likewise with assistance of web server, where your metropolitan railroad tickets can be conveyed in your telephone as a Fast Reaction code. The tagging data of the client is put away in the data set. It utilizes the PDAs office to approve the ticket and erase it consequently after a particular time frame once the client has arrived at the objective. With the assistance of a scanner in the checker framework, the ticket checker can examine the customer's ticket and determine whether it is legitimate by looking at the data set. The client framework comprises of individual data gathering, purchasing ticket, pin-code approval, creating QR code and putting away it into cloud data set.

In paper [2], Mr. Rathod, proposed coordinated installment door should be possible through prepaid administrations, for example on the off chance that the client consents to continue, the same measure 'of the ticket will be deducted from the equilibrium of the portable no. Other installment entryway will utilize Mastercards to pay for the ticket. After installment, QR code is created on server side, saved in the data set and furthermore sent back to the client versatile and saved in the framework 's memory which fills in as a ticket for the client. The checker framework is to approve the ticket by filtering the QR code got by the client and looking through in the rail route data set to check whether the client has purchased the ticket.

In the paper [7] creator has proposed a number of key regions that relate to this work that different specialists have recently done will be checked out and the methodologies utilized in carryout these investigations according to e-tagging. In his work, Chase (2010) argues that the one dynamic electronic ticket, known as the widespread pass, can be used and reused to get sufficiently close to multiple events, such as purchasing movie tickets, purchasing tickets, and booking travel tickets, as opposed to each ticket for each event separately. This pass framework he demonstrated has the advantage of getting a credit only occasion going diminishing the danger have by robbery by assisting occasion coordinators with keeping practically zero cash within reach. Via correlation crafted by Olaniyi, et.al (2010) and Chase (2010) took a gander at a method for secure purchasing and conveying e-passes to client. Notwithstanding, giving a general pass could be troublesome as it expects that all associations wishing to utilize the widespread pass should embrace similar norm across all stages for the framework to work successfully.

The authors in paper [13] propose a system that leverages advanced technologies like Radio Frequency Identification (RFID) and barcode scanning to streamline the ticket-checking process, reducing manual intervention and minimizing errors. The solution involves embedding RFID tags or barcodes in tickets, which are scanned at entry and exit points of railway stations to validate travel credentials. This system ensures faster passenger verification, reduces fraud, and enhances overall operational efficiency [14].

The authors in paper [17] focus on addressing privacy concerns in public transportation ticketing by proposing a cryptographic set-membership proof mechanism. This mechanism enables users to prove their valid ticket ownership without revealing sensitive details such as ticket identifiers or personal information. The system ensures that only authorized tickets are validated, preventing fraud while maintaining user anonymity. The paper elaborates on the design and implementation of the proposed cryptographic techniques, including their integration with NFC technology for seamless and secure ticketing. It also evaluates the practicality of the solution by analyzing its performance in terms of computational efficiency and user experience.

In audit made with references, to present the highlighted framework as referenced to determine trouble looked in before framework concentrated as under. The worth of paper-based paper tickets versus E-Ticket or Electronic Tickets has frequently been discussed. The two methods have been the subject of numerous investigations, with both their benefits and drawbacks examined. Essentially, the advantages of using E-Tickets or Electronic Tickets outweigh those of traditional paper evaluations. A significant impediment of paper ticket is the significant expense related with the interaction. The quantity of work force required as well as the printing, appropriating, checking, rekeying, recording and chronicling is exorbitant. When foundations switch to E-Tickets or Electronic Tickets, these significant costs can frequently be reduced by approximately 50%[5].
Portable tagging with Close to Handle Correspondence (NFC) innovation has acquired critical consideration in the vehicle business because of its capacity to give crease less, contactless tagging arrangements. [9] Exploration features NFC's ef further developing traveler stream and lessening the requirement for actual tickets, improving both client accommodation and framework productivity. Studies, for example, those by Li et al. (2018), have investigated how NFC-empowered cell phones permit travelers to tap their gadgets at entryways or ticket perusers, working with speedier loading up and diminishing lines. Kumar et al. (2017) stressed the security of NFC in transport tagging, with encryption conventions guaranteeing secure exchanges. However, as Ghosh et al. demonstrated, challenges in widespread reception include ensuring similarity across devices and organizations and redesigning the foundation. (2019) [10].

In paper [22], the system simplifies the ticketing process by generating a unique QR code for each transaction, which is scanned at checkpoints for verification. This approach reduces operational costs, minimizes fraud, and improves user convenience by offering a seamless digital solution. The paper discusses the architecture, functionalities, and implementation of the application, emphasizing its user-friendly interface and secure transaction mechanisms.

The author in paper [26] explores how the transition from traditional, manual ticketing to digital platforms has transformed the booking experience by offering greater convenience, time efficiency, and transparency. The study highlights the advantages of online booking systems, including ease of access, reduced crowding at ticket counters, and improved record-keeping. Additionally, it discusses challenges faced by users, such as technical issues, lack of digital literacy, and security concerns during online transactions. The authors provide an in-depth analysis of the system's implications for Indian Railways, focusing on increased operational efficiency, cost savings, and enhanced customer satisfaction.

By and large, NFC-based versatile tagging is perceived for further developing proficiency and offering a

practical answer for current public transportation frameworks.

The ability of QR codes and 2D standardized identifications to enhance intuitive learning has been highlighted in studies of their application in educational and learning frameworks. As a result, Regulation (2010) investigated the use of QR codes in education, demonstrating that they can provide quick access to educational resources, thereby increasing commitment and learning proficiency. Their examination, distributed in the Diary of Instructive Innovation Improvement and Trade, stresses the simplicity of coordinating QR codes into homeroom exercises and advanced learning stages.

In a similar vein, at the sixth IEEE/ACIS Worldwide Meeting on PC and Data Science, Liu, Tan, and Chu presented a framework for English language learning that made use of expanded reality (AR) and 2D scanner tags. Their research demonstrates how standardized tag innovation and augmented reality (AR) can create vivid learning environments that provide students with an intuitive and connected method for improving their language skills. The two examinations highlight the developing job of versatile advancements in present day training.

In paper [31], the proposed system automates the ticket booking process while dynamically assigning seats based on availability, enhancing operational efficiency and passenger convenience. By leveraging IoT devices and sensors, the system maintains a live database of seat occupancy and availability, ensuring accurate and immediate updates for passengers and railway authorities. Features include automated ticket generation, real-time seat tracking, and seamless payment integration, reducing manual intervention and long booking queues. The authors detail the system's architecture, components, and implementation, emphasizing its scalability and potential to reduce errors in seat allocation. The paper highlights the benefits of this approach, including optimized resource utilization, improved customer satisfaction, and reduced instances of overbooking or vacant seats

The authors propose [33] a smart and dynamic ticketing platform that utilizes machine learning techniques to optimize the ticket booking process. By analyzing historical data and passenger demand patterns, the system is designed to offer dynamic pricing, allowing for more efficient management of ticket distribution and better resource allocation. The approach aims to reduce manual intervention, minimize ticket fraud, and improve overall user experience by offering real-time ticket availability and personalized recommendations.

The paper [39] proposes a framework that integrates big data analytics with real-time data streams, enabling the collection, storage, and processing of data in a timely manner. By leveraging tools such as Hadoop, Spark, and other big data technologies, the system is designed to handle large-scale, high-velocity data in a distributed manner. This approach provides better decision-making capabilities for railway operators, such as predictive maintenance, traffic optimization, and enhanced safety management. The authors emphasize how big data analytics can optimize train operations, improve scheduling accuracy, and reduce delays, ultimately leading to more efficient and safer railway systems.

In paper [40], author focuses on integrating intelligent control systems to enhance railway safety and automation. The authors propose a system that utilizes advanced control algorithms and real-time data processing to improve the safety and operational efficiency of railway networks. The system is designed to automatically detect and respond to various safety hazards, such as train collisions, signal failures, and track malfunctions.

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3. SYSTEM ARCHITECTURE

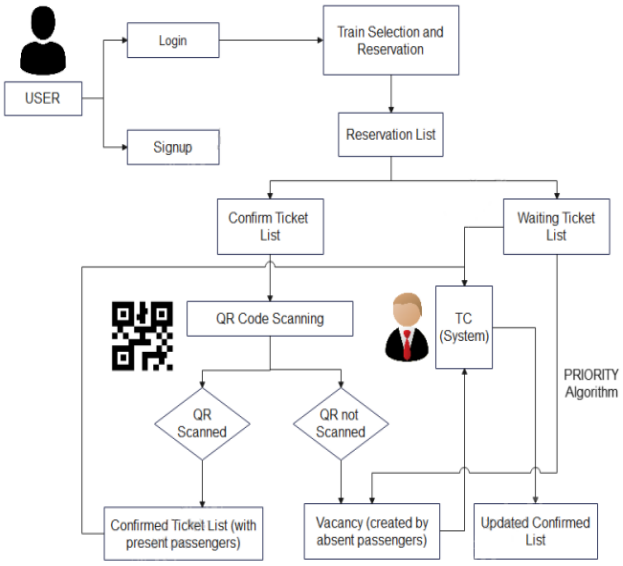

Fig: - System Architecture.

Module 1: Ticket Generation

Generates a unique, encrypted QR code containing key details like the train number, passenger info, and payment status when a user books a ticket.

Module 2: QR Scan at Station

At the station, the passenger's QR code is scanned. The system decrypts the code, retrieves ticket details from the database, and verifies them for validity.

Module 3: Ticket Validation

After scanning, the ticket is marked as "used" in the database to prevent reuse. Only valid and active tickets are accepted.

Module 4: No-Show or Cancellation Handling

If a passenger cancels or doesn't arrive on time, the system flags the ticket as available and reassigns it to a high-priority or waitlisted passenger.

Module 5: Journey Status Update

Maintains a real-time log of all ticket-related activities—usage, cancellations, and reassignments—for accurate tracking and auditing.

4. Implementation and Algorithm

Steps in the RBAC (Role-Based Access Control) Algorithm:

1. **Initialization**
   Identify all users, roles, and permissions. Establish mappings between roles and their corresponding permissions, as well as between users and their roles.

2. **Role-Assignment**
   Assign one or more roles to each user. A user can have multiple roles, and each role defines specific access rights.

3. **Permission-Assignment**
   Link appropriate permissions to each role. Permissions define allowed operations like read, write, or execute on system resources.

4. **Permission-Granting**
   Once roles and permissions are set, users can access system resources based on the permissions of their assigned roles.

5. **Access-Control-Enforcement**
   The system checks user roles and permissions to determine whether a requested action is allowed, ensuring secure and controlled access.

5. Results

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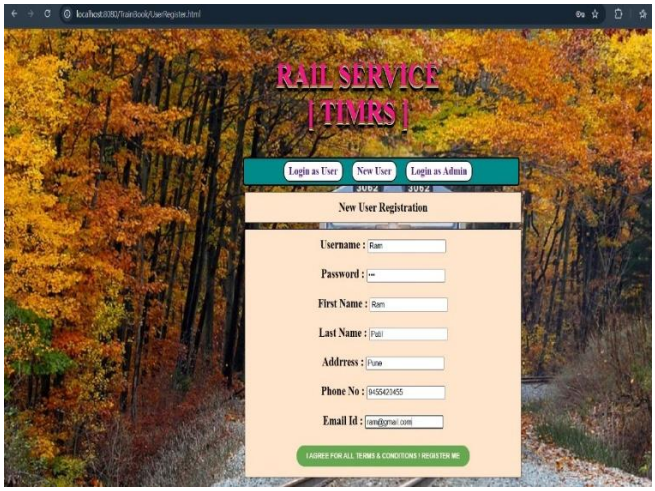

Fig. 5.1 User Registration Page

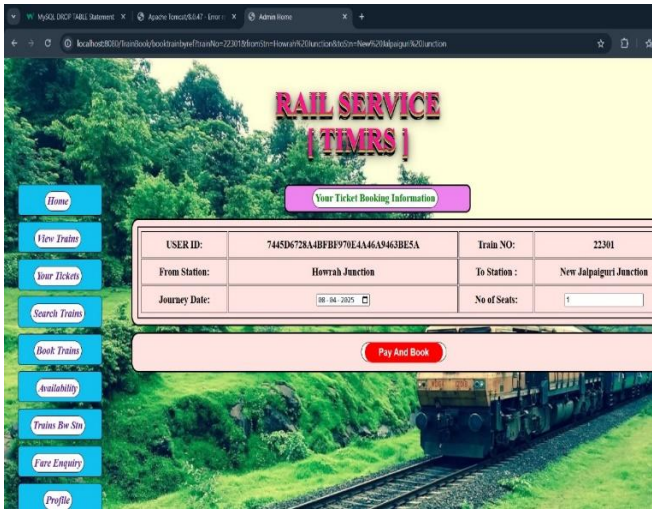

Fig. 5.2 Ticket Booking

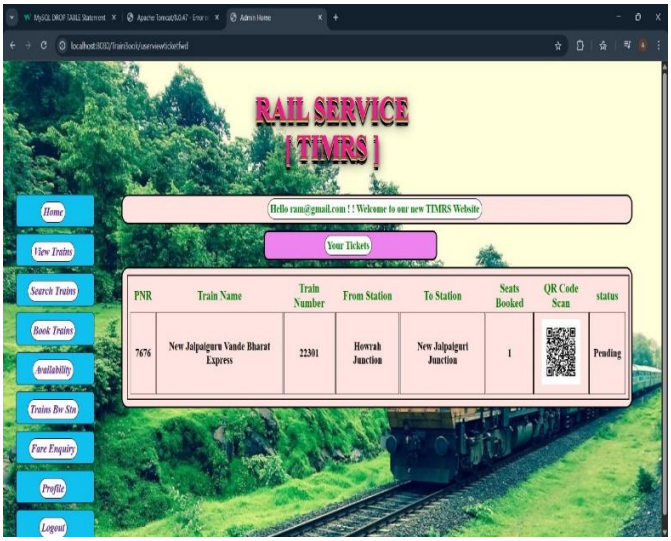

Fig. 5.3 After ticket booking, a QR code is generated; if not scanned by the passenger, the status remains pending.

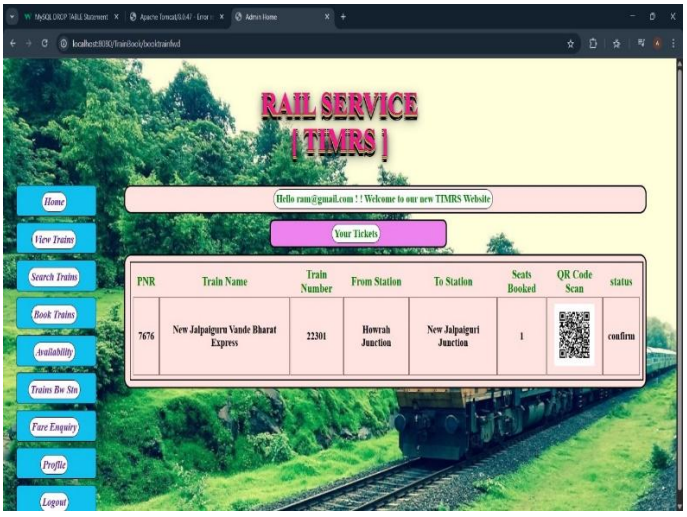

Fig. 5.4 If the QR code is scanned, the status shows as confirmed; otherwise, it's auto-cancelled after a set time.

6. Conclusion

The Advanced Railway Ticket Generation System streamlines the ticketing process by eliminating paper tickets and reducing wait times. It enables users to book tickets online and receive unique QR codes for authentication. The system supports secure payment options such as UPI and credit/debit cards. It offers real-time updates on ticket availability, efficiently handles waitlists, and utilizes a cloud-based infrastructure for enhanced scalability and seamless integration of user data. By validating QR codes, it strengthens security and minimizes the risk of fraud. While the system is user-friendly and environmentally sustainable, it does face challenges such as dependence on internet connectivity and compatibility with certain devices. Overall, its primary aim is to enhance the passenger experience and optimize the efficiency of railway transportation.

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