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Fair Queue Scheduling With Smart Card Based Dynamic Waiting List Passenger Seat Allocation System (WLPSAS) For Train Ticket Reservation in Indian Railways

Prof. Dinesh Kumar M, Prof. Raj Kumar Y, Ms. Kaviya R, Ms.Merlin A
Assistant Professor, Professor
Department. of Computer Science and Engineering
AVS Engineering College, Salem, Tamilnadu, India.
Corresponding author's email id: *rkrajdeveloper34@gmail.com*

Abstract

The paper proposes the model of dynamic seat allocation (DSA) by incorporating the RFID technology using an android application that encompasses fair-queuing scheduling mechanism. At present there is no system that facilitates fair queue based seat allocation for waiting list passengers (i.e., both long distance & short distance waiting list passengers) during their journey. RFID technology using an android application with the help of NFC (Near Field Coupling) technology has been evolved as an idea that replaces the manual checking and verification of train tickets done by the TTE's. The system enables the dynamic allocation of seats which is both system and passenger specific. This eliminates the need for human effort, time and money by increasing the revenue for the Indian Railways Department. The idea has been evolved by modernizing Indian Railways and to eliminate the drawbacks in the present system.

Keywords: *- Android Application, RFID (Radio Frequency Identification), WLPAS (Waiting List Passenger Allocation System), DSA (Dynamic Seat Allocation), TTE (Train Ticket Examiner), NFC (Near Field Coupling).*

INTRODUCTION

Indian railways is one of the largest human transportation system which has 2 crore passengers all over India which deals with problems like allocation of seats for waiting list passengers and immediate cancellation/getting down at the destination by the confirmed list of passengers. Passengers who don't buy tickets from TTE's buy tickets from touts which leads to the unavailability of seats for waiting list passengers resulting in the violation of rules. The number of waiting list passengers in Indian railways has been increasing drastically in every year at the rate of 25 to 50%. Such increase leads to inefficient allocation of seats for waiting list passengers. In the current system there is more space for touts to book tickets illegally and they sell them at an exaggerated price. The TTE's still use pen and reservation charts to check & verify the passenger details. Also TTE's can't keep track of passengers who have reached their destination. The passengers in the waiting list cannot get any allocation of seats throughout their journey. A seat can remain vacant if passenger has not arrived and even after departure of train if he cancels the ticket. This may lead to the loss of revenue for the Indian railways. During the peak seasons, increase in the number of reservations grows higher which makes passengers uncomfortable. TTEs still use pens and reservation charts which are prepared four hours earlier of train departure which lacks optimization too. There is no dynamic seat allocation for waiting list passengers in the place of vacant seats. In the current ticket booking system the PNR is used as a key value for verifying the passenger's details that has been stored in the database. This verifying process takes much time and hence the passengers cannot get the confirmation as soon as possible.

The waiting list passengers can't be able to confirm their seats due to rush. The Indian Railways on trying to solve this problem increases the number of coaches for waiting list passengers to make their tickets to be confirmed. Another problem faced by the Indian Railways is that the large number of passengers travels without tickets which bear a loss of revenue of about 5 crores every year. By improving the drawbacks in the existing system our dynamic system eliminates space for touts who book tickets illegally. This reduces the selling of tickets at an exaggerated price in less exposure. This eliminates the verification and authentication of tickets done by the TTE's which is cumbersome. By using chiper carnet, android application with the help of

internet connectivity the passengers can have access to seats in an effortless way.

RFID tags are of two types: Active and Passive tags. Active tags emit radio waves which are more expensive and require external power supply whereas the passive tag doesn't require any external source. Instead, of using active tags we can use passive RFID tags with which can be used for object tracking, logistics, supply chain management, etc.,

LITERATURE SURVEY

Indian Railways have provided both online and offline reservation for its passengers. Railways have also introduced both tatkaal and normal reservation schemes which reduces the tension of last minute booking cancellations. This saves a lot of effort and money which become a boon for the waiting list passengers. The android application has made the technology and internet access much faster than unusual which books the tickets in an efficient way. Pranjali et.al [1] proposed an android application for both verification & validation of tickets using the mobile network. It suggests the use of a smart phone application that facilitates the need for buying tickets online. Even though, it replaces the manual ticket processing and verification by digital verification it still needs human effort and time. Hou Tsan Lee et.al [2] proposed an alternative approach of electronic ticketing systems for traditional tickets in order to avoid the manual verification of tickets. Though it incorporates the use of QR code it does not consider the problem of allocation of seats for waiting list passengers prevail. Joydeep Singh [3] proposed a dynamic seat allocation for waiting list passengers with the help of QR code thus reducing the use of conventional paper based manual verification of tickets by the TTE's. However it doesn't provides a means to reduce human effort in an effective way. Mehul Yadav et.al [4] proposed a QR code based dynamic seat allocation for waiting list passengers if he/she cannot book for a ticket after the charting of train is done and a seat remains unused if a passenger did not board a train or cancels his ticket after the charting of train. Man Mohan Swarup et.al [5] proposed a system which replaces the complex reservation charts carried by the TTE's that facilitates allocation of seats for short distance passengers but still have the advantage of transparency in seat allocation. Venugopal et.al [6] proposed the way of modernizing the Indian railways by the use of RFID technology with the help of a smart cards and a RFID reader. Omprakash Yadav et.al. [7] proposed a dynamic seat allocation by the use of QR

code which contains the passenger information in the form of 2-D matrix. The traditional verification and checking of train tickets done by the TTE's is replaced by the android application which reduces the burden of TTE's. However, it does not facilitate allocation of seats for long distance waiting list passengers. The reservation of railway tickets in India is done by any of the three alternatives. The first way is that the individual book the ticket in advance i.e. reservation of ticket. The second alternative provided by the Indian railways is to use Information Technology without standing in the long queues that saves time & effort too. Also an individual can book tickets through the agents approved by Indian railways. The problem exists when one tries to book a General Class ticket. To book a General ticket, one has to go to the railway station or book from the authorized agents. But this process becomes quite time consuming due to lots of crowds. Due to the reason, people are afraid of losing the train which makes people to travel without ticket. This becomes a serious issue for the government as the revenue of the railways department gets affected. The problem can be solved effectively with the use of Information Technology. Since Tsan Lee et.al [3] and Swarup et.al [5] describes the dynamic seat allocation for waiting list passengers, it hasn't considered the fair allocation means. Our proposed system tries to provide the fair allocation of seats dynamically for waiting list passengers (i.e., long distance and short distance passengers) with the incorporation of RFID tag. The proposed methodology considers the use of android application incorporated along with the smart card generating module which will be imprinted in the ticket in both forms via online and sms. The summary of the paper is as follows: Section I describes about the abstract of the paper; Section II depicts the nature & inefficiency in analyzing the scenario of the existing system; Section III provides the overview of the proposed system; Section IV describes the methodology & algorithm for the proposed system; Section V depicts the flowchart of the proposed methodology & Section VI proves the advantages & Section VII concludes the paper

PROPOSED METHODOLOGY

Smart card based dynamic WLPSAS suggests the combination of RFID technology along with the QR code for train ticket reservation. The methodology has been proposed exclusively for the waiting-list passengers to book the tickets from counters and through online even if the train had started their journey. Passengers can have both e-ticket, m-ticket and in

printable form. Since mobile phones plays a inevitable role in human life the proposed system that emphasizes on reducing the human effort required for the manual verification of tickets which is usually done by the TTE's. The proposed methodology saves human effort and time thus increasing the revenue for the Indian Railways. Instead of using the physical tickets made of paper, a smart card enabled e-ticket which contains the RFID code can be used. Based on the information provided by the user/passenger during the reservation a unique RFID code gets generated. Using this, the passenger can be tracked efficiently if the passenger is in the train or if he has gets down during the journey. The manual verification and validation done by the TTE's has to be replaced by an android application installed in the TTE's HHT (Hand-Held Device). The RFID tag contains the RFID code with the PNR number emits radio waves with which the passenger status can be found out. The PNR number acts as a key value and generates the details of the passengers with the help of PRS (Passenger Reservation System) for the TTE's. The android apps installed in the HHT used by the TTE's scan the RFID code which decodes and retrieves the PNR number which is already stored in the DSA server. In the case of m-ticket RFID code image is sent to the multimedia handset of passenger. If the passenger does not have any multimedia handset, he/she must take printout of the ticket. When the passenger starts their journey they have their tickets either confirmed or wait-listed.

FAIR QUEUE SCHEDULING WITH SMART CARD BASED DYNAMIC WAITING LIST PASSENGER SEAT ALLOCATION SYSTEM

Though [3] and [5] proposed a seat allocation system for waiting list passengers, it becomes inefficient in allocating seats only of long-distance passengers. The paper mainly focused on allocation of seats for both long-distance and short-distance waiting list passengers. The implementation is mainly based on Deque (Double Ended Queue) with which the long distance passengers are inserted at the front end and the short distance passengers are inserted at the rear end. Deque (Double Ended Queue) is a queue with which both the insertion and the deletion occurs at both the ends. The Fair Queue based Scheduling algorithm for the waiting list passengers are as follows:

Indian Railways has given two ways for booking the train tickets. i.e., online & offline reservations.

Case 1: In case of offline reservations, a smart card based train tickets which contains a unique RFID code for each passenger is generated. The RFID code contains the PNR number generated based on the details provided by the passengers such as Passenger name, age, From-To Destinations, etc.,

Case 2: In case of inline reservations, an e-ticket or m-ticket a unique RFID code gets generated which becomes easy for the TTE's to book the train tickets respectively. TTE's can efficiently use the RFID scanners or readers by means of an android application installed in the HHT (Hand-Held Device). Based on the information updated in the DSA server the database contains a list of passengers either confirmed or wait-listed. Based on the details a QR code is generated for each passenger that contains the PNR number. Once the registration gets finished m-ticket (Mobile–Ticket) will get automatically generated.

FAIR QUEUE BASED DYNAMIC SECHEDULING ALGORITHM

Assumptions:

Consider a Double-Ended Queue in which both allocation and De-allocation of seats can be preceded dynamically. The Constraints are as follows:

Long Distance Waiting List Passengers are allocated at the front end of the queue.

Short Distance Waiting List Passengers are allocated at the rear end of the queue

Let the front-pointer of the queue be Fq and the rear pointer of the queue be Rq. Passengers: [1:n]

Long Distance Waiting List Passengers be {Ld1, Ld2,……..Ldn}

Short Distance Waiting List Passengers be {Sd1,Sd2,…….Sdn}

Allocation Procedure:

The Fair-Queue based scheduling algorithm consists of long distance waiting list passengers on the front end and the short distance waiting list passengers on the rear end. The seat allocation happens first by allocating the seat for longest distance passenger first, then the second longest distance passenger, then the third longest distance waiting list passenger, and so on. In the same way, on the rear end of the queue the short distance waiting list passengers are first allocated the seat, then the second shortest waiting list passenger and so on.

Case 1: Suppose that if the passenger uses the offline train ticket and if he gets down the train during the journey, then the TTE's can easily find that because the active tags that is used emits radio waves with which the information's are updated in the DSA server through the android application installed in the HHT of the TTE's. The passengers who have left the train can be identified also by making the Indian Railway doors to be smart card enabled with which they can be identified.

Case 2: Suppose that if the passenger uses the online train tickets (i.e., e-ticket or mticket), then during the verification of train tickets the android application reads the RFID code using the passenger's android phones with which the DSA server can be updated.

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Insertion Procedure:
If distance is Longest then follow
Step 1: For (i=1; i<n; i++)
Step 2: Find the Distance from the Database
If (Dist==short) do
Step 3: insert Sdi at the rear end of the queue
Step 4: Rqi++
Step 4: For Subsequent insertions follow
Sdi (t) ++->Rqi
Else
Step 5: insert Ldi at the front end of the queue
Step 6: Fqi++
Step 7: For Subsequent insertions follow
Ldi (t) ++->Fqi
Deletion Procedure:
Step 8: If (Distreached==yes) do
Step 9: Rqi--;
Step 10: If (passengers Decision==getdown) do
Step 11: If (dist==longest) do
Step 12: Fqi--;
Step 13: else Rqi--;
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Fig: 1 Dynamic Seat Allocation and De-allocation procedure

Case 3: According to the proposed methodology, if the shortest distance waiting list passengers gets down during the start or in between the journey, then one of the next longest distance waiting list passengers gets updated in the rear end with which the queue gets updated. Therefore, for each subsequent short distance waiting list passengers, the corresponding longest distance waiting list passenger gets seat allocation thus mitigating the long waiting and standing of the long distance passengers.

Case 4: Suppose that if the Indian Railways uses the passive tag then the RFID code generated can be updated, verified and validated manually by the android app installed in the HHT (Hand-Held Device) available in the hand of the TTE's. This improvises the traditional art of Queue allocation by fair means seat allocation process in the Indian Railways. The methodology improves the time and effort required by the TTE's by replacing the manual verification and validation of train tickets.

CONCLUSION

The proposed methodology provides a radical change in train operation and passenger experience. Hand Held Devices are given to TTE'S for smooth and faster verification of passengers. RFID code is printed on the tickets which are scanned by the android application installed in the HHT device. The smart card contains a RFID code within which a passenger specific PNR is stored, where HHT device encode the PNR number but check-in process redirects to PRS server and fetch the stored data to verify the passenger details. DSA server allot the seats of absent passengers to waitlisted passengers and if still some seats remains vacant then reflected them as available across railway network from where any passenger willing to board on it can book the ticket. Thus the system provides the capability to book the tickets for the passengers on board thus making the system to behave dynamic. These technology inclusions in the railway reservation system introduce transparency and reduce the activities of touts at peak seasons which prove the increase in revenue for Indian Railways.

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