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Railway Seat Allocation System Using Iterative Method

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Abstract— Availability of seats in trains to the passengers nowadays have become a major concern as the number of passengers is increasing day by day. There are certain areas where passengers wish to get seats in chunks but are not able to get due to our current running system, as it fails to allocate request in parts. As a result, seats are going vacant because our system allocates seats as per availability in one shot only on the passenger's request. This paper describes the optimization of the seats in chunks using iterative method approach that they be fairly distributed across passengers on their wish. This technique serves two purposes, namely, resource optimization and revenue generation. If implemented on the existing railway system, will directly increase the railway revenue. It can be a great contribution to our government and travelers.

Keywords— Resource Optimization, Iterative method, Seat Allocation

I. Introduction

The word repetitious or Iteration refers to the technique that solves any linear system issues with consecutive approximation at every step. There are two methods under iterative methods one is stationary iterative method, and another is a non-stationary Iterative method. Stationary strategies' area unit older, less complicated to grasp and implement, but usually not as effective. Nonstationary methods are a comparatively recent development; their analysis is typically more durable to grasp, but they can be highly effective. The non-stationary methods are based on idea of sequences of orthogonal vectors. In arithmetic procedure, a repetitive technique could be a mathematical procedure that uses an initial guess to generate a sequence of approximate solutions for a category of issues, within which the nth approximation comes from the previous ones. A specific implementation of a repetitive technique, together with the termination criteria, is an algorithm of the iterative method. A repetitive technique is named merging if the corresponding sequence converges for given initial approximations. A mathematically rigorous convergence Analysis of a repetitive technique is typically performed but, heuristic-based iterative methods are also common. In distinction, direct strategies arrange to solve the matter by a finite sequence of operations. In the absence of reckoning errors, direct methods would deliver an exact solution. Iterative ways' area unit usually the sole selection for nonlinear equations. However, repetitive strategies' area unit usually helpful even for linear issues involving an oversized range of variables (sometimes of the order of millions), where direct methods would be prohibitively expensive (and in some cases impossible) even with the simplest offered computing power.

Paper Structure: Section 2 provides the related work. Section 3 contains the methodology used. Section 4 shows experimental results and analysis. Section 5 concludes the paper and suggests future enhancements.

II. Related Work

A Modified Iterative Alternating Direction Minimization Algorithm for Impulse Noise Removal in Images: Images unit area typically corrupted by impulse noise. In the impulse noise removal, distributed illustration is remarkably effective at smoothing away noise, however it may lose image structures that aren't sparsely depicted by its predefined basis such as wavelet. [1] Although the adaptive dictionary training improves the denoising performance, its computation value of coaching dictionaries whereas removing noise is comparatively high. Besides, the commonly used total variation is highly related to enforce the sparsity of finite difference of images. However, total variation assumes that pictures area unit piece wise smooth; so, textures would be simply lost when denoising. Therefore, exploring the distributed illustration for impulse noise removal remains difficult. Image denoising could be a basic drawback in image process. Besides the ordinarily processed mathematician noise, impulse noise is another typical type of noise generated due to noisy sensors or channel transmission errors. An alternating direction minimisation with continuation algorithmic rule is changed and Iteratively wont to take away the impulse noise in pictures by exploring its self-similarity. Mathematically, we model the denoising problem as an $l1$-$l1$ minimization problem with PANO which provides the sparse representation of similar image patches. In mural images, the impulse noise-like artifacts are also observed because of the bacterial plaque or missing objects. A classical impulse denoising method is median filtering, which replaces the central pixel with a median-value within a local window. Median filtering is with low computation, however typically loses image structures once noise is significant. The denoising performance is expected as greatly improved if the image structures are extracted and preserved in denoising. A patch-based nonlocal operator, and sparse representation optimization model also applied to suppress impulse noise-like artifacts in real mural images. To solve the optimization problem, a fast iterative alternating direction minimization with continuation algorithm is developed by taking the patch-based representation property into account. Similarity is often rooted in repeated patterns of images and greatly improves image quality in deblurring and medical image reconstruction. Similarity data were antecedently investigated in block matching 3D frames. Patch-based nonlocal operator (PANO) could be an operator to model the thin illustration of comparable patches, which can be viewed as an alternate type of the block matching 3D frames. Unlike the conventional sparsifying ways, for instance, typical wavelets or finite distinction, PANO provides associate adaptive distributed illustration of image with a really quick coaching section. Besides, the one-dimensionality of PANO permits putting in place expressly a sparsity-based denoising model.

A New Iterative Procedure for Deconvolution of Seismic Ground Motion in Dam-Reservoir-Foundation Systems: Monitoring and assessment of dam performance area unit important for guaranteeing dam safety. To study the unstable performance of a concrete gravity dam numerically, it's necessary to model the system realistically by incorporating the results of interaction among dams, foundation, and reservoir. The concrete gravity square measure dams are designed to perform satisfactorily throughout associate earthquake since the consequence of the failure is harmful to the downstream communities. The foundation during a dam is sometimes sculptures que by a sub structuring approach for the aim of unstable response analysis. However, the sub structuring can't be used for finding nonlinear dynamic issues which will be encountered in dam-reservoir-foundation systems. [2] For that reason, the time domain approach is most well-liked for such systems. The deconvolved earthquake input model is most well-liked because it will take away the unstable scattering effects thanks to artificial boundaries of the semi-infinite foundation domain. Deconvolution may be an operation that permits the adjustment of the amplitude and frequency contents of an unstable ground motion applied at the bottom of the inspiration to get the required output at the dam-foundation interface. The deconvolution is a signal processing technique where one signal is usually obtained from another by point by-point division of the two signals in the Fourier domain, by dividing the Fourier transforms of the two signals and then inverse-transforming the result. Practically, Fourier deconvolution in signal method may be an artificial due to reverse the results of a convolution occurring inside the physical domain, for instance, to reverse the signal distortion impact of associate degree electrical filter or of the unstable wave propagating through associate degree elastic medium. Since the signal distortion is particular to the physical medium through that the signal passes, the deconvolution procedure to get the signal from the output or the distorted signal is domain specific. It is determined that the prevailing procedures of deconvolution don't seem to be effective for every type of earthquake records. A changed procedure has been introduced here for economical deconvolution of every type of earthquake records as well as high-frequency and low-frequency ground motions. It is conjointly determined that the deconvolution by ADP needs a lot of iterations and therefore the convergence is poorer compared to MDP. It is necessary here to notice that whereas solely two-dimensional models area unit thought of here. Computer program SHAKE developed by Schnabel for deconvolution of seismic ground motion was used in many previous studies. However, the deconvolution method victimization the procedure employed in SHAKE is quite cumbersome because the response obtained through such analysis is extremely sensitive to the values of the dominant parameters like the shear modulus and therefore the equivalent.

Application of the Picard's iterative method for the solution of one-phase Stefan problem: An unvarying relation is developed, that permits to work out the temperature distribution within the thought-about domain. The unknown perform, describing the position of the moving interface, is approximated with the help of the linear combination of some assumed base functions. Some examples, that illustrate the precision and speed of convergence of the considered iterative procedure, are also shown. we take into account the one-phase Stefan downside, which consists of determining the temperature distribution in the given domain and the function describing position of the moving interface (the freezing front). [3] The Stefan downside could be a mathematical model of thermal processes, during which the changing of phase is taking place, connected with the heat absorption or emission. The samples of such reasonably processes may be natural process of pure metals, melting of ice, freezing of water, deep freezing of foodstuffs and so on. For some simple cases of the Stefan problem there are chances of finding the analytical solution, but for most of cases the approximated methods must be applied. A domain decomposition technique, combined with some minimization procedure, for finding the approximate solution of one-phase Stefan problem. Application of the variational iteration technique for shrewd the approximate resolution of the direct and inverse Stefan downside is taken into account in paper. Besides, some new approach for solving the one-phase Stefan problem is presented. In this approach, the considered problem is first transformed for the domain of the unit square and after that, such transformed problem is solved by using the variational iteration method. Another application of the variational iteration method for solving problems connected with the heat conductivity are presented. The Picard's unvarying technique consists of formulating the unvarying procedure, which enables to determine the form of the unknown function, describing the temperature distribution in the given domain, on the ground of the heat conduction equation and initial condition, which should be satisfied. Another unknown perform, describing position of the moving interface, is approximated in the form of the linear combination of some assumed base functions. The coefficients of this linear combination are calculated by minimizing the properly constructed functional. Presented examples show, that the approximate solution, obtained even for small number of iterations, in satisfactory way reconstructs the sought solution, and the sequence of successive approximations, we receive in this method, is convergent to the exact solution, if it exists. In the enough conditions of this convergence area unit developed, however, they're troublesome to see in most of cases. That is why the matter of formulating and proving the convergence conditions of the Picard's technique, simple to verify for any equation remains open.

Fractal Image Coding Based on a Fitting Surface: A no-search fractal image coding method based on a fitting surface is proposed. In order to reduce the matching error between the range block and its matching domain block, an improved gray-level transform with a fitting surface is introduced. Firstly, the fitting surface can approximate the range block better. Consequently, higher quality of the decoded image will be achieved with relation to the opposite 3 similar ways. Moreover, we tend to adopt constant fitting surface for the vary block and its matching domain block by combining all the fitting surfaces, a fitting surface image (FSI) is additionally planned to hurry up the shape coding. [4] This can save many bits and result in improving Bpp. fractal image coding, kernel issue is to find an iterated function system whose fixed point can approximate the input image well. After many years of improvements, it has been successfully used in many image processing applications such as image compression, image denoising, image retrieval, image magnification, and image watermarking. Although the shape writing technique has the advantage of potential high compression quantitative relation, resolution independence, and fast decoding, its main drawback is very time-consuming in the encoding process. Generally, fast the shape decipherment is realised by 2 ways: one is to adopt improved iteration methods, such as the one buffer decoding method. The other one is to pick associate initial image which may approximate the first image well. Moon proposed an approximated range-averaged image as the initial image and the range averaged image is considered as the ideal initial image. In this research a novel initial image which can provide faster decoding speed. Since the planned fitting surface itself is additional almost like the corresponding vary block, all the fitting surfaces can constitute a better fitting surface image (FSI) as the initial image in fractal decoding process without extra computations. In order to scale back the process complexness of shape secret writing, converting the global search to local search is an effective way to solve this problem. It mainly consists of classification techniques and feature vector techniques. For the previous ones, the vary blocks and domain blocks area unit 1st divided into completely different classes and therefore the block matching is just meted out among constant class. The block matching process is carried out in the feature space for the latter ones. Due to the lower dimension of features and more effective searching strategies, such as kd-tree method, the fractal encoding process can be finished in a short time at the expense of poor quality of the decoded image.

On the computational efficiency index and some iterative methods for solving systems of nonlinear equations: Two new iterative methods are built up and analyzed. A generalization of the potency index utilized in the scalar case to many variables in unvaried strategies for solving systems of nonlinear equations is revisited. The concept of the computational efficiency index is revisited introducing a necessary parameter in order to take into account the computational cost of all the computations needed and reduced to multiplication units. The key idea is to use formal power series. Two modified methods for solving systems of nonlinear equations whose order of convergence are higher than that of other well-known competitive methods are analyzed. [5] Analytic proofs of the local order of convergence based on developments of multilineal functions and numerical concepts that will be used to illustrate the analytic results are given. The preceding technique to prove the local order of convergence and the computational efficiency index are illustrated with several examples in which generalizations of the one-dimensional case to m-dimensions are carried out. Because of the increase in the number of applications where it is required to use a higher level of numeric precision, numerical experiments resented with multi-precision arithmetic's facilities are most appropriate in a modern large-scale scientific computing environment. An approximation of the computational order of convergence (ACOC) is obtained when the root is unknown. These results confirm theoretical results obtained previously. There is no doubt that Newton's method is one of the best root-finding methods for solving nonlinear equations, $F(x) = 0$. Recent results improving the classical formula at the expense of an additional evaluation of the function, an additional evaluation of the first derivative or a change in the point of evaluation can be found in the literature on the subject. In those works, the order of convergence and the efficiency index in the neighborhood of a simple root have been improved. The computation of the local order of convergence for known two-step and new multi-step iterative methods is performed by means of expansions in formal developments in power series of the functions F, F ′ and (F ′) −1. We have analyzed and compared the computational efficiency index of two well-known methods, Newton's method and the harmonic mean method, with two new methods called Traub's method and the modified harmonic mean method. In order to analyze this parameter for the two methods we have studied the problem from two points of view: numerical and geometrical. Numerical examples that illustrate the theoretical results. An approximation of the root with high precision is obtained if we use multi-precision arithmetic's. two different software's are used: MAPLE 13 and MPFR library in C++. To illustrate the technique presented four examples have been studied and completely solved. In each one, the fourth iterative method has been carried out and compared with the other three. An approximation of the computational order of convergence has been computed independently of the knowledge of the root. Moreover, a new way to compare execution time is presented. Namely, we have computed the necessary time to get one correct decimal of the solution which is the ratio between the necessary execution time to accomplish the stopping criterion and the total number of correct decimals obtained.

The Seat Reservation Problem: Researchers investigated on the matter of giving seat reservations on-line. They assumed that a train travels from a begin station to associate finish station, stopping at k stations, as well as the primary and last. Reservations can be made for any trip going from source station to any destination station. The train has a fixed number of seats. The seat reservation system attempts to maximize income. They take into account the case during which all price tickets have an equivalent worth and also the case during which the worth of a ticket is proportional to the length of the trip. For each cases, we tend to prove higher and lower bounds of $\Theta(1/k)$ on the competitive quantitative relation of any "fair" settled rule. They additionally outline the accommodating quantitative relation that is analogous to the competitive quantitative relation except that the sole sequences of requests allowed are sequences that the best off-line rule could accommodate all requests.[6] They prove higher and lower bounds of Θ (1) on the accommodating quantitative relation of any "fair" settled rule, within the case during which all tickets have an equivalent worth, but $\Theta(1/k)$ within the case during which the price ticket worth is proportional to the length of the trip. The most stunning of those results is that each one "fair" algorithms are a minimum of 1/2-accommodating once all tickets have an equivalent worth. They proved similar results bounding the performance of associate "fair" randomized rule against an accommodative on-line mortal. They additionally take into account concrete algorithms; additional specifically, First-Fit and Best-Fit. They investigate the matter of giving seat reservations on-line. They assumed that a train with n seats travels from a start station to an end station, stopping at $k \geq 2$ stations, including the first and last. The seats are numbered from 1 to n. The start station is station 1 and the end station is station k. Reservations can be made for any trip from a station s to a station t where $1 \leq s < t \leq k$. The passenger is given a single seat number when the ticket is purchased, which can be any time before departure. The algorithms (ticket agents) attempt to maximize income, i.e., the sum of the prices of the tickets sold. Thus, the performance of an on-line algorithm will depend on pricing policies for train tickets. They consider two different policies: one in which all tickets have the same price, the unit price problem, and one in which the price of a ticket is proportional to the distance travelled, the proportional price problem. In addition, they define the accommodating ratio which is similar to the competitive ratio, except that the only sequences of requests allowed are sequences for which the optimal off-line algorithm could accommodate all requests. This assumption, that there are enough seats for the optimal fair on-line algorithm, is appropriate whenever the management has done a reasonable job of predicting ticket demand and has thus assigned an appropriate number of cars to the train. They show that there is a significant difference between the competitive and accommodating ratios for the unit price problem. This difference indicates that with that pricing policy, underestimating how many seats are needed can have a dramatic effect on earnings. Since the accommodating ratio is essentially the competitive ratio, except that only specific restricted sets of request sequences are considered, the accommodating ratio is a special case of the performance ratio defined. In addition, on-line algorithms for bipartite matching have restricted the inputs to graphs which actually have a perfect matching. For political reasons, the ticket agent may not refuse a passenger if it is possible to accommodate him when he attempts to make his reservation. Thus, if there is any seat which is empty for the entire duration of that passenger's trip, the passenger must be assigned a seat. They will call an algorithm which has this restriction fair and will only consider fair algorithms. The seat reservation problem is similar to the problem of optical routing with a limited number of wavelengths, which was considered for the off-line case for tree networks and for a number of on-line versions. In, similar problems for the pre-emptive case are considered. Interval scheduling and the one-wavelength version of the call control problem is similar to trains with one seat. However, the fairness restriction makes the seat reservation problem different from the problems considered before. Without this restriction, the seat reservation problem is the same as the on-line call admission and wavelength selection problem restricted to graphs which are simple paths. Their technique is not applicable to fair algorithms. Note that since they are trying to maximize income rather than minimize cost, a lower bound is obtained by proving a bound on the worst case behaviour of an algorithm, and an upper bound is obtained by giving an adversary argument. We prove upper and lower bounds of on the accommodating ratio of any fair deterministic on-line algorithm for the unit price problem, but for the proportional price problem. For both the unit price problem and the proportional price problem, they prove upper and lower bounds of on the competitive ratio of any fair deterministic algorithm. The lower bound on the accommodating ratio for any fair deterministic on-line algorithm is especially interesting because intuitively one first expects that it must be possible to design a truthful on-line rule that accommodates fewer than the quantity of requests the foremost effective off-line rule would possibly. Our result, however, shows that this is not possible when there are enough seats so that the optimal off-line algorithm can accommodate all requests. They also consider randomized algorithms, and prove similar results bounding the performance of any "fair" randomized algorithm. In addition, they consider concrete algorithms; more specifically, First-Fit and Best-Fit, proving tight bounds on their performance for the unit price problem.

On-line Seat Reservations via Off-line Seating Arrangements: When reservations are made to for instance a train, it is an on-line problem to accept or reject, i.e., decide if an individual is fitted in given all earlier reservations. However, determining a seating arrangement is an off-line problem with the sooner reservations and also the current one as input. We develop algorithms with optimal running time to handle problems of this nature. [7] Here the stations are numbered 1, 2, 3, and 4, and we assume that the train has only two seats, seat 1 and seat 2. The first reservation is (1, 2), and without loss of generality, we give the seat number 1. The next reservation is (3, 4). If we give seat 2 to this reservation, then the next reservation will be (1, 4), which we must reject, even though it could have been accommodated had we given seat 1 the second time as well. If, on the other hand, we give seat 1 to the reservation (3, 4), then we might get first (1, 3), which we can give seat 2, and then (2, 4), which we must reject. Thus, no matter which decision we make on the second reservation, we may accommodate fewer than possible, if we knew the entire future. Because of these results, it is tempting to switch to a different system, where seat numbers are not given in response to a reservation, but instead announced later. Many people expect that soon we will almost all be equipped with PDAs (personal digital assistants) or just cell phones, so it will be practically feasible to send the seat number to the customer shortly before the train may be boarded. An electronic bulletin board inside the train could inform the remaining customers of their seat number. Notice that in both the example scenarios above, it would be possible to seat all customers, if seat numbers are not determined until after all reservations are made. In the on-line seating arrangement problem, the requests are given one by one and the algorithm has to decide about each request before knowing the later requests. on-line algorithms measured as the ratio of the number of requests for reservations which are accommodated by the on-line algorithm to the number of requests which are accommodated by an optimal off-line algorithm. The problem we consider is in some sense in between the on-line and off-line problems, since we wish to compute the final seating arrangement, but we must decide on-line for each reservation whether or not it can be accommodated. Here, a reservation can be accommodated if the inclusion of the reservation into the collection of already accepted reservations will still allow for a solution, given the number of seats available. Further, as in the on-line version of the problem, the off-line algorithm is given the reservation requests in a sequence and has to accept as many as possible under the two restrictions that the requests are treated in the order they are given, and that a request must be accepted whenever this is possible.

The Off-line Group Seat Reservation Problem: we address the problem of assigning seats in a train for a group of people traveling together. We consider two variants of the problem. One is a variant of two-dimensional knapsack where we consider the train as having fixed size and the objective is to maximize the utilization of the seats in the train. The other is a variant of two-dimensional bin packing where all requests must be accommodated while trying to minimize the number of passenger cars needed. [8] We present a number of bounds for these two variants and develop exact algorithms for solving the problems. Computational results are presented for various instances known from the packing literature adapted to the problems addressed. We are considering the off-line group seat reservation problem (GSRP). In this problem it is the objective to maximize the use of the seats in a train subject to a number of constraints: A train consists of a number of seats which are numbered consecutively. A seat reservation brings a person from a station to station b without changing seat. A group of people, all having the same station of origin and destination, may wish to sit together, i.e. being assigned to seats with consecutive numbers. Since the problem is off-line, it is assumed that all data are given in advance. The GSRP can be interpreted geometrically in the following way. A (group) reservation can be represented by a rectangle having width equal to the number of seats reserved and height equal to the distance travelled. For the train, the entire route corresponds to the height and the availability of seats is represented by the width. This corresponds to a two-dimensional orthogonal packing problem where no rotation is allowed and where the position of each reservation is fixed in height. Suppose train travels from station y1 to station y4. Five reservations are given in the table to the left and a packing of the train is shown to the right. The group seat reservation problem has numerous applications. A straightforward application is the reservation of hotel rooms, where people wish to have adjacent rooms. Also some job scheduling problems can be seen as a group seat reservation problem. Each job has a fixed starting time and a completion time, and it should be carried out on a number of adjacent machines. Finally, the group seat reservation problem finds application in the cutting of two-dimensional material, where the quality of the material varies from top to bottom. In the on-line version of the group seat reservation problem, reservation requests arrive one by one, and should be assigned a group of seats immediately. The on-line algorithm must be fair, i.e. it should only reject a request if it cannot be satisfied at the present moment. Various performance measures for on-line algorithms have been presented. The most common measure is the competitive ratio which is defined as the worst-case ratio over all possible input sequences of the on-line performance to the optimal off-line performance. In the relative worst-order ratio one compares two on-line algorithms by considering the ratio on how the two algorithms perform on their respective worst ordering of the sequence. Boyar and Medvedev considered the single-customer version of the on-line problem, and showed that if all tickets have the same price, first-fit and best-fit are better than worst-fit in the relative worst-order ratio. This also holds for the case where the price of the ticket is proportional to the distance traveled. Moreover, they showed that the off-line version of the single-customer group seat reservation problem where all tickets have the same price, is equivalent to a maximum k-colorable subgraph problem for interval graphs, which can be solved in polynomial time.

Seat inventory control methods for Chinese passenger railways: Railway seat internal control methods play a vital role within the growth of profit and train ratio. The railway traveler seat internal control downside in China was addressed. Chinese traveler railway operation options and seat internal control apply were analyzed first of all. [9] A dynamic demand foretelling technique was introduced to forecast the approaching demand in an exceedingly price tag booking amount. By agglomeration, passengers' historical bookings were wont to forecast the demand to return in an exceedingly ticket booking amount with method of least squares support vector machine. Three seat internal control methods no nested booking limits, nested booking limits and bid price management, were sculptures que below a single fare category. Different seat internal control strategies were compared with an equivalent demand supported price tag booking information. The result shows give railway operators evidence to adjust the remaining capacity in a ticket booking period. Revenue management (also known as yield management) is a useful tool for the control of a kind of perishable products. It is widely studied in the transportation research field, especially the airline transportation. Seat inventory control problem is an important part of revenue management, which is concerned with the problem of determining whether or not to accept a request for a certain perishable product at a certain fare under the condition that unsold inventory is lost after the sales season. In railway passenger transportation, discount pricing strategy has the advantage of attracting customers to fill the potential empty seats. However, this strategy may lead to the situation in which rail companies have to deal with the seat inventory control problem, which is concerned with allocating seats to different fare classes with the aim of maximizing the overall expected revenues. Even with single fare class, seats need to be allocated among different origin and destination pairs in order to achieve a good profit and train load factors. There are also some researches about railway passenger revenue management, investigated a multi-segment single fare railway seat allocation problem. They dealt with a deterministic linear programming model in which demands were assumed to be constants and a probabilistic nonlinear programming model in which demands were assumed to be normal random variables. YOU adopted the advantages of mathematical and meta-heuristics approaches to develop a hybrid heuristic approach for finding the booking limits for the rail network seat inventory problem. They introduced two types of fares. Meanwhile, they also considered overbooking. the demand from sales data analyzed and built a mathematical model to develop a pricing system for Auto Train. Interpreted the strategy of overbooking in terms of waitlist management by Indian railways and cancellation action of customers. Most of these researches were focused on pricing strategies. In China, price is controlled by the government, though it is the trend for railway to take dynamic pricing, however, what kind of fare classes the operators would take is still unsettled. Hence, in this work, we still focus on seats allocation between different OD (origin and destination) pairs under a single fare class. On traditional railway lines, which cover most areas of China, are the main railway lines. However, train frequencies on these lines are very low, and most time just one train per day.

Hence, the capacity is less than demand in most time in a year. According to revenue management strategies, when demand is high, seat inventory control is the main strategy to improve revenue. Hence, we focus on single fare seat inventory control strategies on traditional railway lines with different revenue management methods. In this work, we present the first part of a large research project dealing with yield improvement with the adoption of ticket booking data in Chinese passenger railways. Our aim is threefold. Firstly, we wish to gain a better understanding of the features of passenger railway and seat inventory control practice in China. Secondly, and more specifically, we hope to dynamically forecast the coming demand in a ticket booking period based on the information of the accepting bookings. Thirdly, and more importantly, an attempt is made to develop the best seat inventory control strategy, by comparing different control strategies based on the same demand.

Multi-leg Seat Inventory Control Based on EMSU and Virtual Bucket: Optimization of airline seats aims to allocate reasonable numbers of seats for the different levels of fare, in order to maximize flight revenue. The most well-known airline seat inventory control method today is the expected marginal seat revenue (EMSR) method proposed by Belobaba. This technique employs a static model to study the dynamic reservation method, and does not take into account the risk tolerance of policy makers. EMSR has two disadvantages. First, a reservation limit produced by EMSR cannot be changed as the reservation process progresses. [10] In other words, the method is static. Secondly, the method does not consider the risk in the decision-making process. EMSU has been applied in the single-leg seat control algorithm; however, for the multileg seat management downside there's not nevertheless a sound answer. This paper applies the Markov decision-making process to simulate the flight reservation process and builds a dynamic multi-leg seat inventory control model.

III. METHODOLOGY

The requirements of passengers at a given point of time to different stations were taken in slot of source and destination in the numerical form. Total number of stations that was taken of size 6. Data was taken from the sheet where all the seats are occupied as per the current running system of railway. Here on sheet we can add as many seats as we want for one data set and all those seats are occupied as per the running system of railway. Now we can find the vacant seats in between two stations in continuous manner for all the seats. So, from this available bunch of seats we get, we can accommodate more passengers in the form of chunks. The requirement of passengers was compared with this available data and was get accommodated to the passenger. This will directly increase the revenue of the railway as well as the utilization of the resources in train. Which in turn increase the number of passengers also in bogies. Figure 1 shows the flowchart of the entire process.

IV. RESULTS AND DISCUSSION

The algorithm provides an optimization of seats. As we were not able to get seats due to our current running system of railways for reservation. As some seats are left vacant for the two pairs of station in the increasing order to the number of stations. With this new and improved system passenger would be able to book the seats in chunks also as per there wish on an instant basis where the seats are available. Table 1 shows the results of the implementation and comparison of allotted seats between current and proposed system. This will increase the overall revenue of the railway to a great extent. Even the local passengers were also able to get the reservation between smaller distance of 2 to 3 stations or even for the single pair of stations. This brings up the revenue of railways as well as also controls the traffic of local general bogies. Figure 2 shows a graphical representation of comparison between current and proposed system.

Table 1: Experimental Results

S. No	Total Seats	More Requirements	Request Fulfilled through Current System	Extra Request Fulfilled through New System
1.	15	10	3	3
2.	15	15	7	3
3.	15	20	8	3
4.	15	25	11	3
5.	15	30	12	3

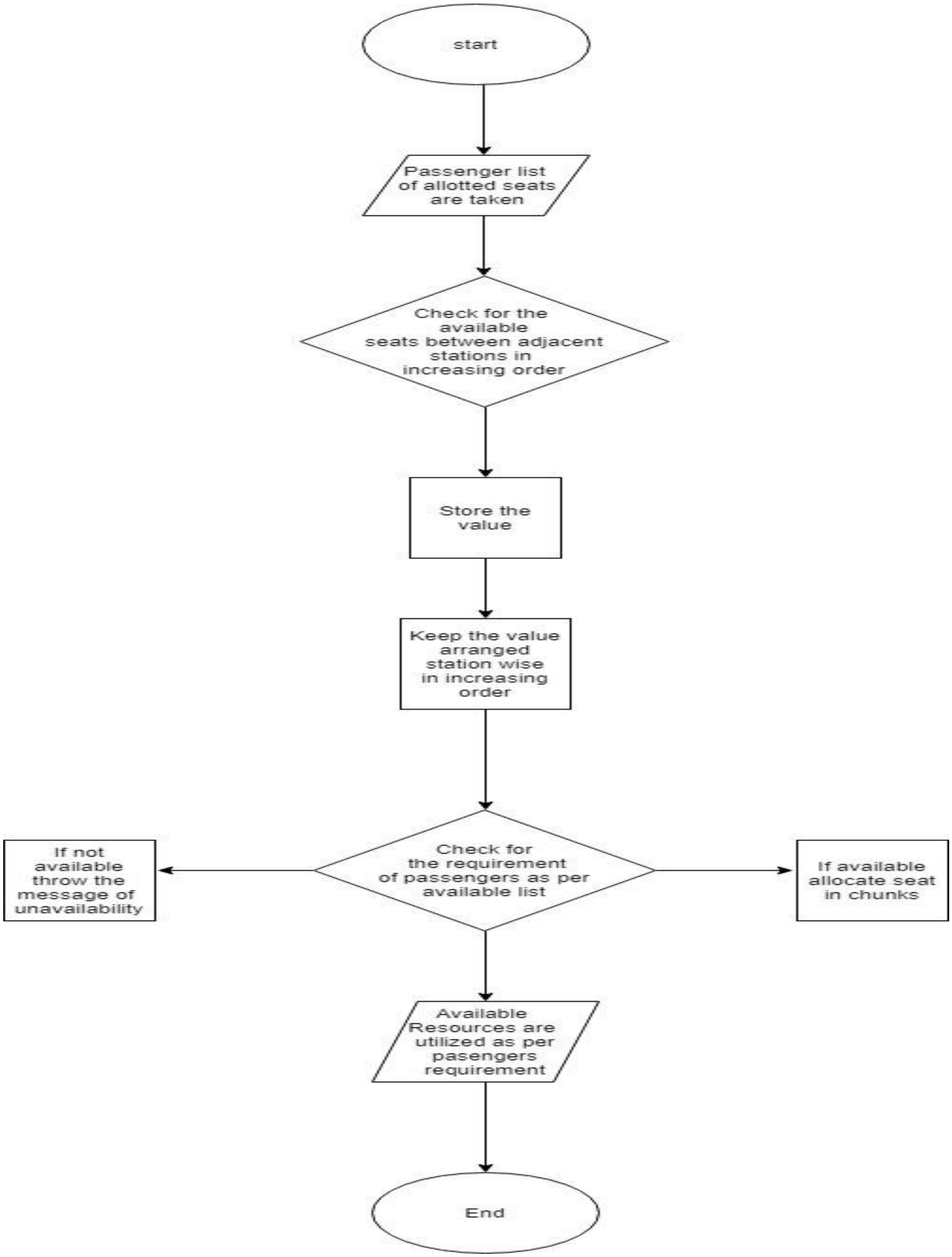

Figure 1: Optimizing Railway Resources

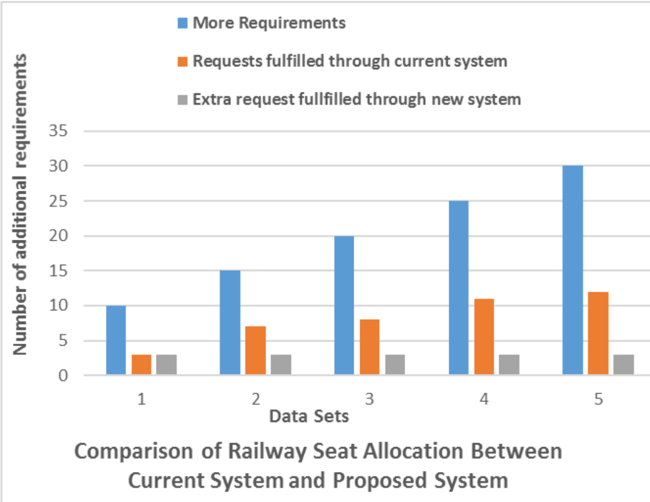

Figure 2: Comparison of Railway Seat Allocation Between Current System and Proposed System

V. CONCLUSION AND FUTURE SCOPE

Seat allocation was done in this approach with the help of iterative method. Focus of the algorithm is to find a solution for the passengers' problem. Presently, there is an uneven distribution of seats across the whole train. At some places, only shorter distance passengers are accommodated which in results show unavailability to the passengers those are willing to book the seat for longer distances who come later to get the reservation. People are left with unavailability of seats and that too it was loss of the resources to the railways. With our method we can solve the problem of passengers as well as it also optimized the resources. With our method after getting availability of the seat list, station by station we can accommodate those seats station by station to the passengers in chunks. If implemented on a large scale, this can be a great contribution to the society and can provide better facilities in the field of railway reservations. This approach if implemented on a large scale can increase the revenue of railways to a great extent. In those scenarios of seat allocation, constraints such as constant seat number need to be kept in mind and have to be planned for future work scope.

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