ISSN No. 0976-5697

Volume 2, No. 5, Sept-Oct 2011

International Journal of Advanced Research in Computer Science

RESEARCH PAPER

Available Online at www.ijarcs.info

Applying Wall Layer Building Algorithm for Optimizing the Equal Dimension Boxes in Vehicle Load Filling

J. Sheik Mohamed*
Asst. Professor, MCA Department
SITAMS, Chittoor, A.P., India
Sheik_50@yahoo.co.in

B. Narendra Babu
MCA Department
SITAMS, Chittoor, A.P., India
bnarendra781@gmail.com

Dr. S. Sreekanth
Professor & Director
Department of MCA
SITAMS, Chittoor, A.P., India

Dr. N. Ch. S. N. Iyengar
Sr. Professor
School of Computing Science & Engineering
VIT University, Vellore, T.N. India

***Abstract*:** In today's global markets, enterprises are integrated in order to produce value for the end customers. Logistics optimization is the biggest opportunity for most companies to significantly to satisfy the customer.. It is the integration of information, transportation, inventory, warehousing, material handling, packaging and security. Transportation management is one of the main process in Logistics world. Transportation management include, among others, load planning and delivery route planning. In the existing logistics business process, the load planning was established for different types of boxes in order to minimize the wastage of space or maximum utilization of vehicle space. But there is no procedure or method to load similar type of boxes into vehicle with maximum utilization of space. This approach establishes or evaluates the load optimization for similar type of boxes by selecting the vehicle from availability. The load optimization is done for similar type of boxes using three algorithmic procedures. Among three algorithms, one algorithm gives the best optimal solution for load filling.

***Keywords*:** Load Optimization, Vehicle Parameters, Space Utilization, Logistics.

I. INTRODUCTION

Logistics optimization is the biggest opportunity for most companies to significantly to satisfy the customer. It is the integration of information, transportation, inventory, warehousing, material handling, packaging and security. In logistics, transportation includes load and route optimizations. The load optimization is handled in the form of different type of boxes. But for Similar type of boxes how to optimize the load in a selected vehicle. So it is proposed to use three algorithmic approaches, which one of the algorithm minimize the unused space and optimize the load in the vehicle. The main objective of this approach is to optimize the load with similar type of boxes for the selected vehicle.

II. RELATED WORK

Logistics deals with the planning and control of material flows and related information in organizations, both in the public and private sectors. Broadly speaking, its mission is to get the right materials to the right place at the right time, while optimizing a given performance measure (e.g. minimizing total operating costs) and satisfying a given set of constraints (e.g. a budget constraint). In the military context, logistics is concerned with the supply of troops with food, armaments, ammunitions and spare parts, as well as the transport of troops themselves. Container loading problems may be grouped in different ways [2]. A basic distinction exists between cases in which a given set of goods has to be loaded completely and cases which allow some goods to be left behind [2].

The algorithms for the single and multiple container loading problems, use the algorithm for pack a certain amount of boxes of a single type onto a given surface. There are two basic approaches used to solve the single container loading problem [2]. These methods are based on wall-building and layer-building. The wall-building approach constructs vertical walls across the container(height wise), while the layer-building approach(Width wise) builds the loading plan layer by layer. There are two main container loading problems. The problem is to load the entire or part of the consignment into a single container.

The objective is to maximize volume utilization or to minimize the unused container volume. The second problem is to load the entire consignment into one or more containers. The objective is to minimize the number of containers used. We adopt the following notation, the container has length L, width W and height H; the n types of boxes are denoted as Box 1, Box 2, ..., Box n, while each box type i has dimensions li, wi, hi.

The transportation cost is calculated by considering several parameters [2]. The parameters are which influencing the cost. Mainly the parameters include which source, which destination, number of km need to transport, the capacity of truck, mileage of truck, labors for load and unload the goods, availability of trucks, cost of diesel and traffic [6]. The loading constraints are also influencing the transportation cost, which less than truck load and truck load, the arrangement of goods in truck, wastage of space in truck. The operation of Transportation determines the loading of goods and vehicle routing. It determines the efficiency of moving products [7]. The progress in techniques and management principles improves the moving load, delivery speed, service quality, operation costs, the usage of facilities and energy saving. Transportation takes a crucial part in the manipulation of logistics [7].

Figure. 1 Vehicle with load

III. PROBLEM DESCRIPTION

In logistics, for loading goods into the vehicles is very complex. Here the goods are packed in boxes (different dimensions) and loaded into the vehicle without eliminate the unused space. And there is no specific method or approach for loading the similar type of boxes into the vehicle. So we proposed to use three algorithmic approaches in which one of them minimizes the unused space.

IV. PROBLEM ARCHITECTURE

In this approach, the ordered customers are taken based on booking date when the goods are available. After orders selection, the total goods weight and tonnage of the vehicle is compared, from this the suitable matching vehicle is selected. And then the boxes are best fitted in to the vehicle based on the evaluation of three algorithms. From each algorithm the number of boxes fitted are vary. Among three algorithms, one algorithm gives most boxes loaded, one gives less boxes like wise. So based on these three algorithms, the best load fitting can be found out. In these three algorithms the length, width, height of the boxes are changed according to the type of algorithm.

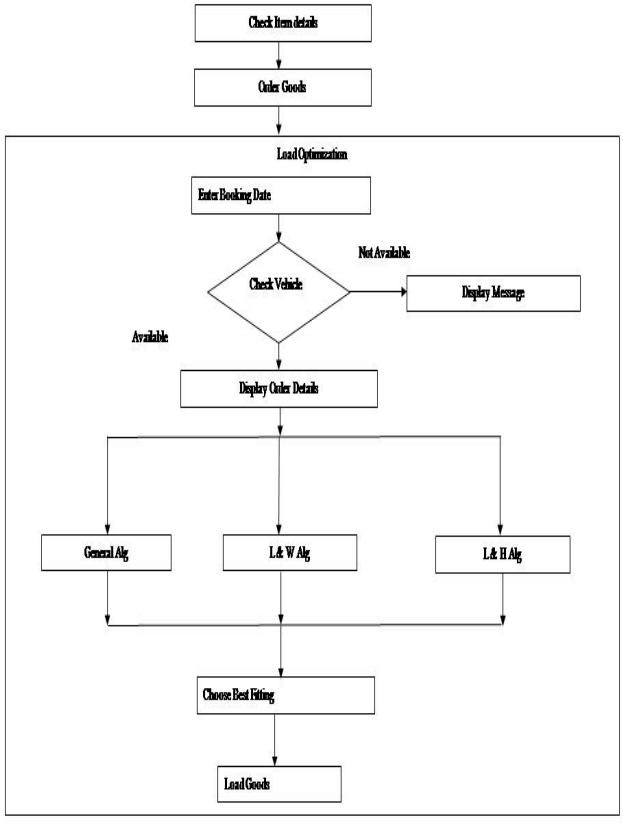


Figure. 2 Problem Architecture

V. PROPOSED ALGORITHM AND ANALYSIS

In each algorithm, there are 3 steps,

A. Algorithm Analysis:

In each algorithm, there are 3 steps,

a. Initialization of parameters
b. Interchanging of box parameters
c. Load fitting

Step 1: Initialize parameters
1. No. 2. LV 3. LBASE 4. BV 5. BBASE
6. HV 7. HBASE 8. lb 9. bb 10. hb 11. l
12. b 13. h 14. TGW 15. TT
Step 2: Interchange parameters
For General Algorithm
1. lb = l 2. bb = b 3. hb = h
For L & W Algorithm
1. lb = b 2. bb = l 3. hb = h
For L & H Algorithm
1. lb = h 2. bb = b 3. hb = l
Step 3: Repeat Step 4 until i<No, where i=0
Step 4:

```
if(hb[i] <= HV)
                    {
                     if(bb[i] <= BV)
                      {
                        if(lb[i]<= LV)
                          {
                           LV = LV-lb[i];
                           box = box+1;
                            }
                          else
                             {
                          BV = BV-bb[i];
                         LV = LBASE;
                          i = i -1;
                           }       }
                    else
                      {
                     BV = BBASE;
                     LV = LBASE;
                    HV = HV - hb[i];
                    i = i -1;
                    }   }
                 else
              {   break;  }
```

Figure. 3 Wall Layer Algorithm

B. Explanation:

a. Initialization of Parameters:

In this step, the box and vehicle parameters are initialized. The parameters includes,
lb = box length,
bb = box bredth,
hb = box height,
LBASE = vehicle length,
BBASE = vehicle bredth,
HBASE = vehicle height,
No = no of boxes to be loaded,
tg = Total goods weight.

b. Interchange of box Parameters:

In General Alg, the box parameters are not interchanged. That is lb, bb and hb are same.

In L & W Alg, the box parameters lb is interchanged as bb and bb is interchanged as lb, the hb is initialized as hb.

In L & H Alg, the box parameters lb is interchanged as hb and hb is interchanged as lb, the bb is initialized as bb.

c. Load Fitting:

In this step the box parameter lb, bb and hb are compared with vehicle parameters. Based on the comparison, the boxes are loaded into the vehicle.

VI. IMPLEMENTATION AND DISCUSSION

The following are the screen shots which shows the simulated results of the proposed algorithms

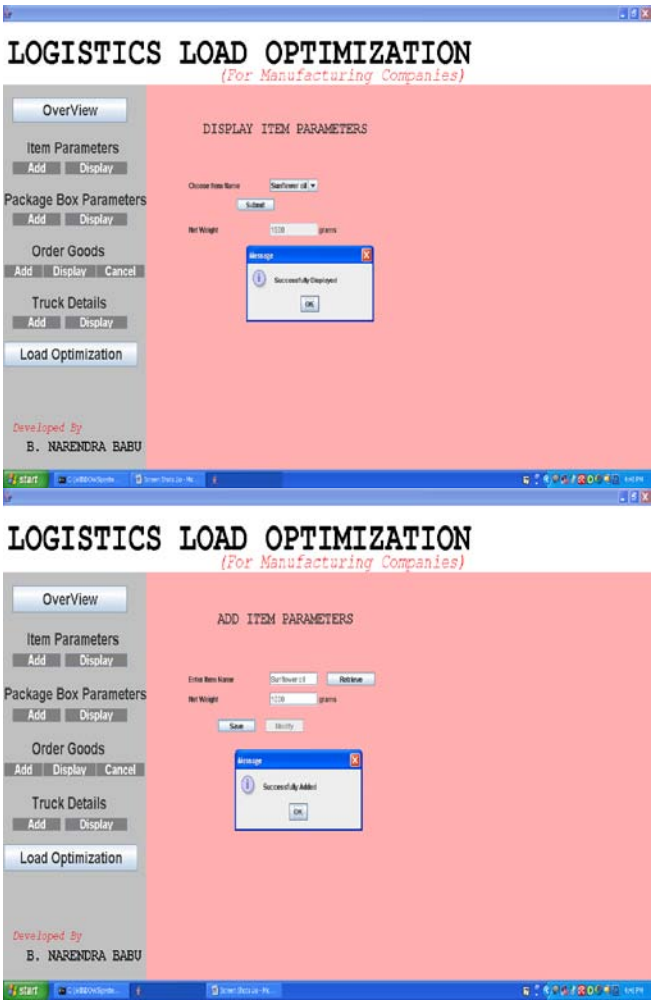
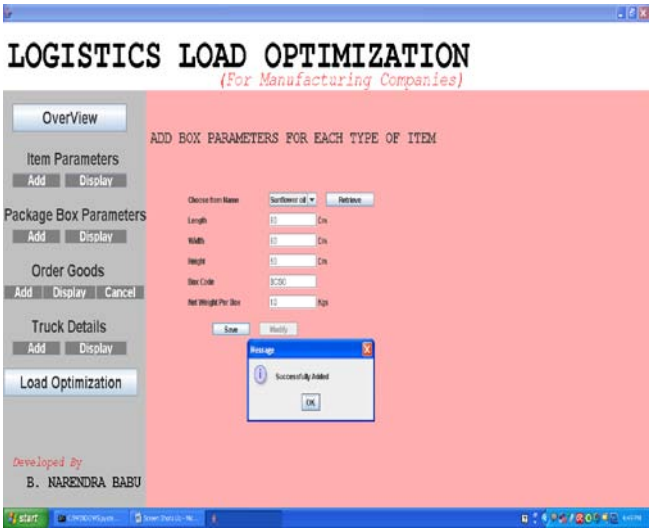


Figure. 4 Required item wise parameters

This screen is used to add the parameter for every item such as name of the item and measures(weight) of that item which is required for filling the load by calculating the total weight for that item based on individual measures and further it compares this total weight with total tonnage capacity of the selected vehicle. It is also used to display the parameters for the existing items.



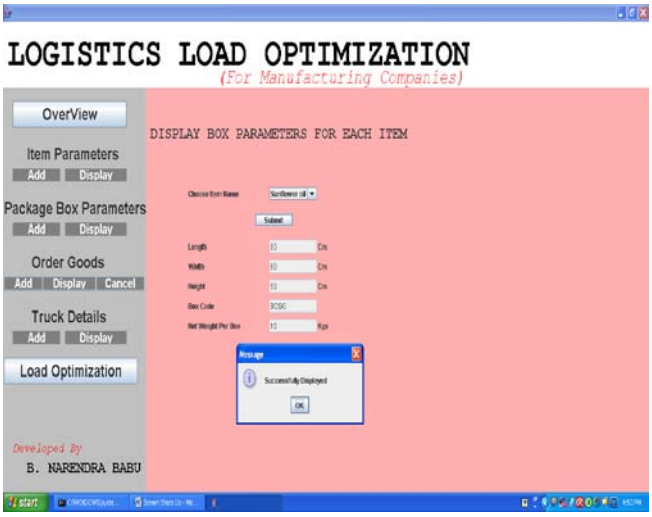


Figure. 5 Required package box parameters

This screen is used to add the parameter for every box such as length, breadth and height, code for box, maximum weight for that box based on item nature in which it is required for filling the load by calculating the total weight for the number of boxes and further it compares this total weight with total tonnage capacity of the selected vehicle as well as it compares the total length, breadth and height for all the boxes that is used to be fit with total length, breadth and height of the vehicle. It is also used to display the parameters for the existing parameter of box. Here it is consider that, all the box size are equal but item weight that is filled in box may vary in which total weight would be vary accordingly.

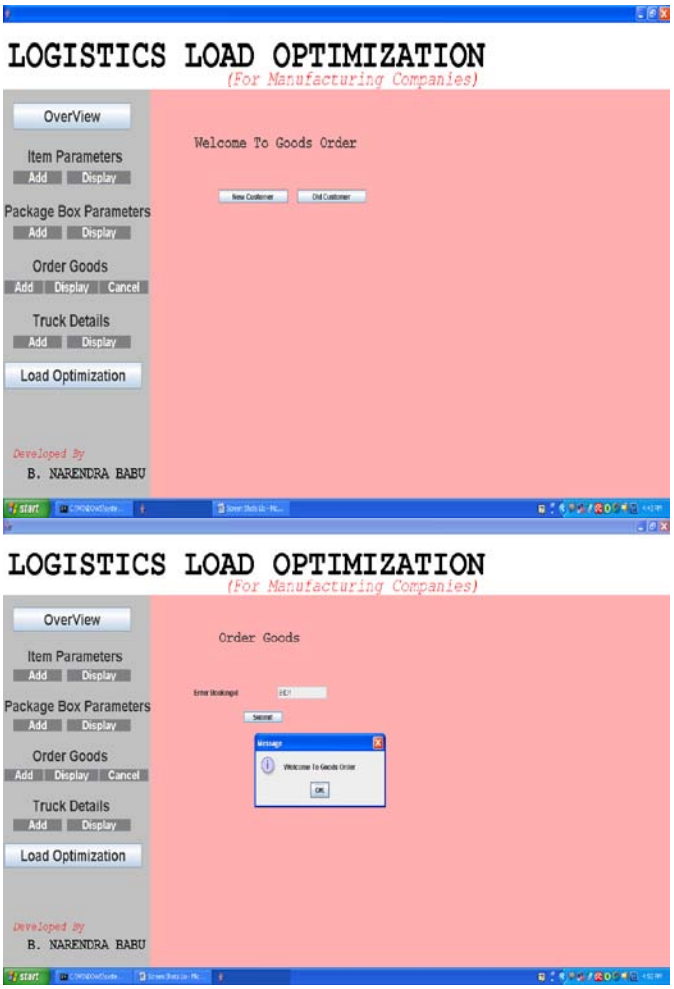


Figure. 6 Order entry by each customer

This screen is used to open the order form for every customer for booking the item by clicking the submit button after generating the Booking_id automatically.

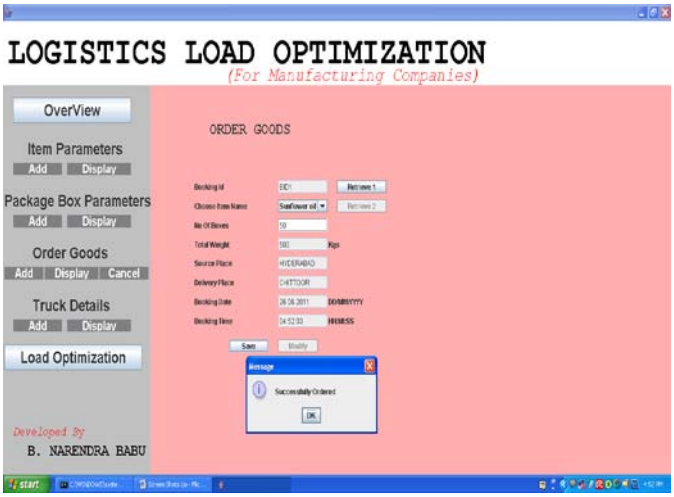


Figure. 7 Item ordering by each customer

This screen is used to enter the item required for the concern customer which includes the source and destination to which the items has to be sent, item name, number of boxes and total weight of that item, booking date for customizing the load fitting.

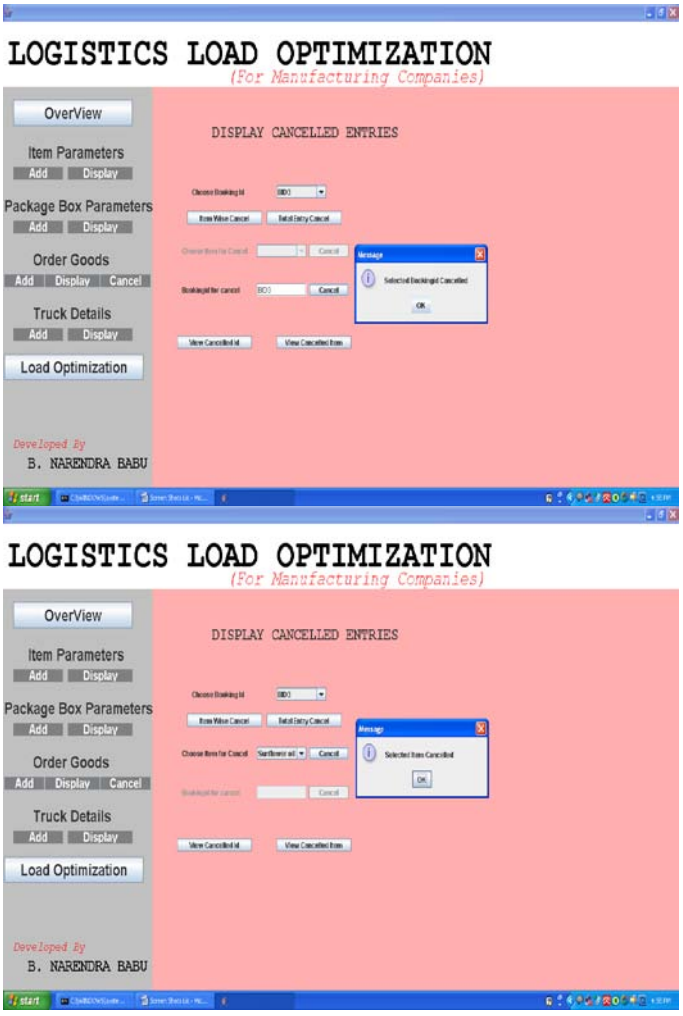


Figure. 8 Cancellation of booked order

This screen is used to cancel the items either partially(single item cancellation for multiple items ordered under same booking_id). Or completely(entire order).

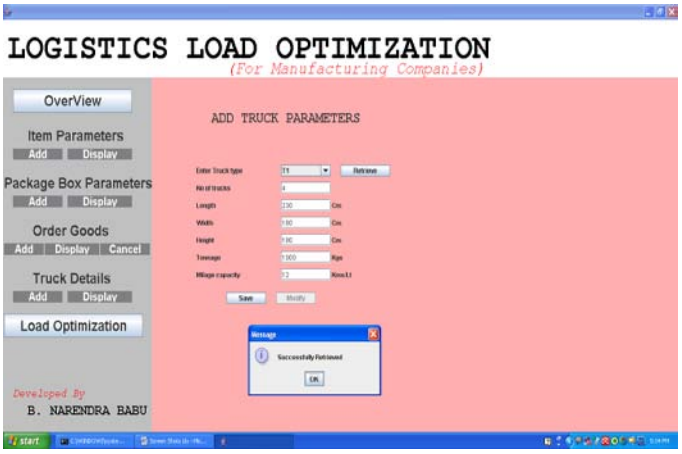


Figure. 9 Truck details

This screen is used to enter the parameter required for each type of vehicle or truck. It is required for fitting the load based on the ordered items on the specific booking date with respect to vehicle parameters such as tonnage capacity, length, breadth and height

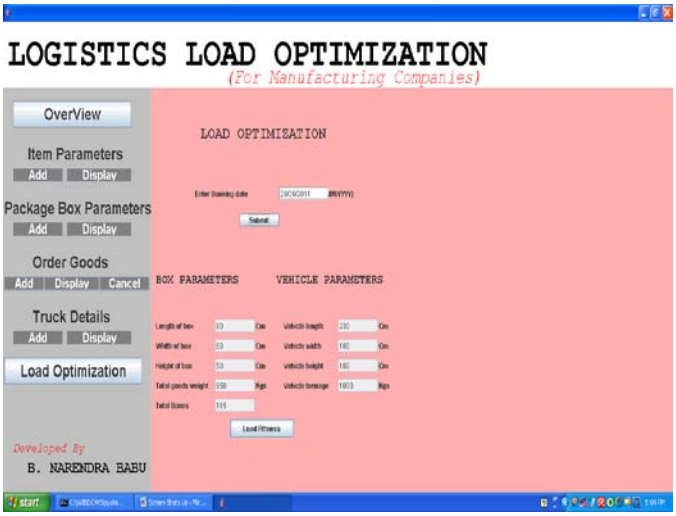


Figure. 10 Booking date selection for load fitting

This screen is used to retrieve and display the box and vehicle parameters by entering the booking date. It retrieves the suitable vehicle from the available vehicle automatically by comparing the total number of boxes and total weight of the various items that is to be fitted in the vehicle for the selected booking date.

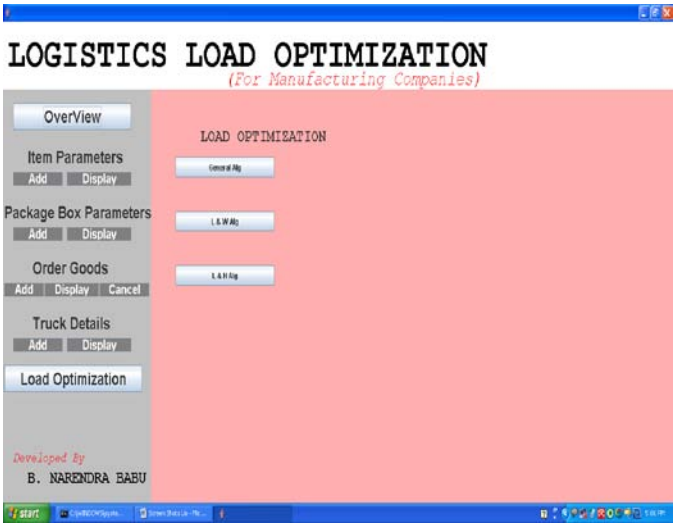


Figure. 11 Algorithm selections for load fitting

This screen is used to select the proposed implemented algorithm to find out the best suitable load fitting for the selected booking date and available number of boxes(optimization).

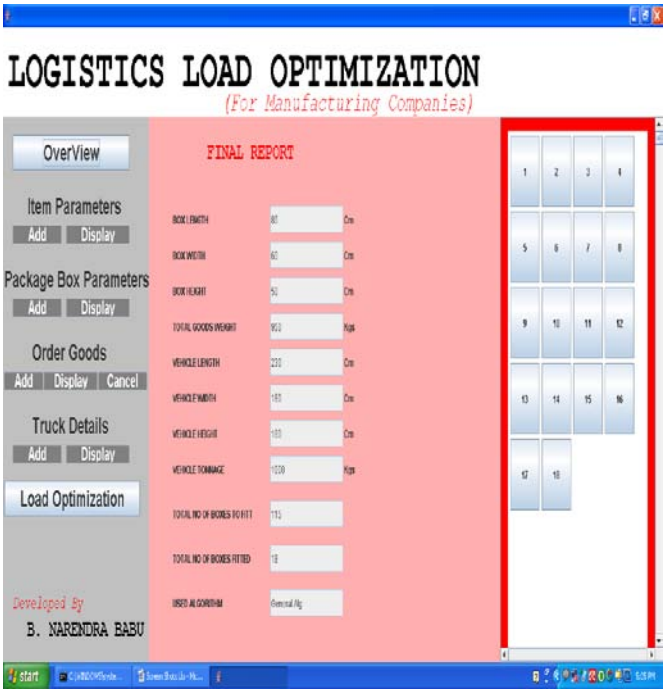


Figure. 12 Load fitting – General Algorithm

This screen shows the Load fitting with general algorithm. The total numbers of boxes fitted through this algorithm are 18 boxes based on the input shown in Fig. 10

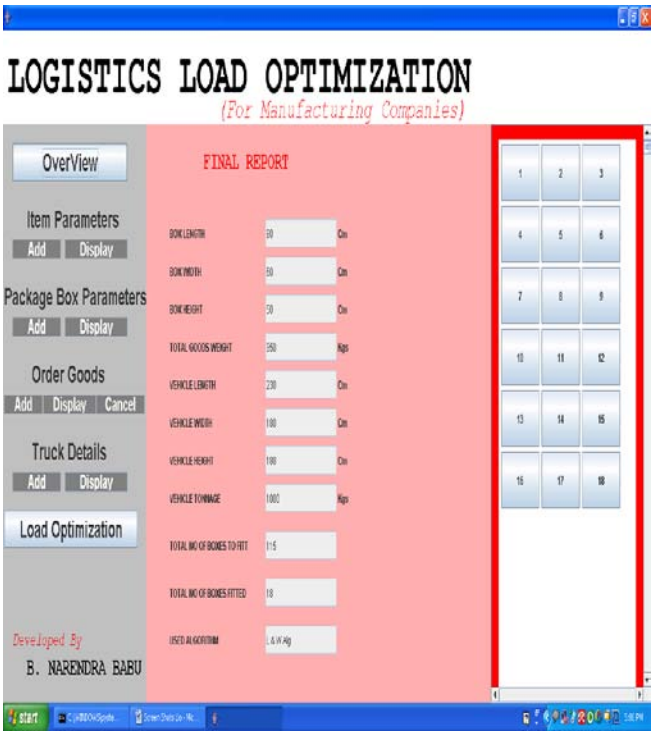


Figure. 13 Load fitting – L & W Algorithm

This screen shows the Load fitting with L & W algorithm. The total number of boxes fitted through this algorithm are 18 boxes based on the input shown in Fig. 10.

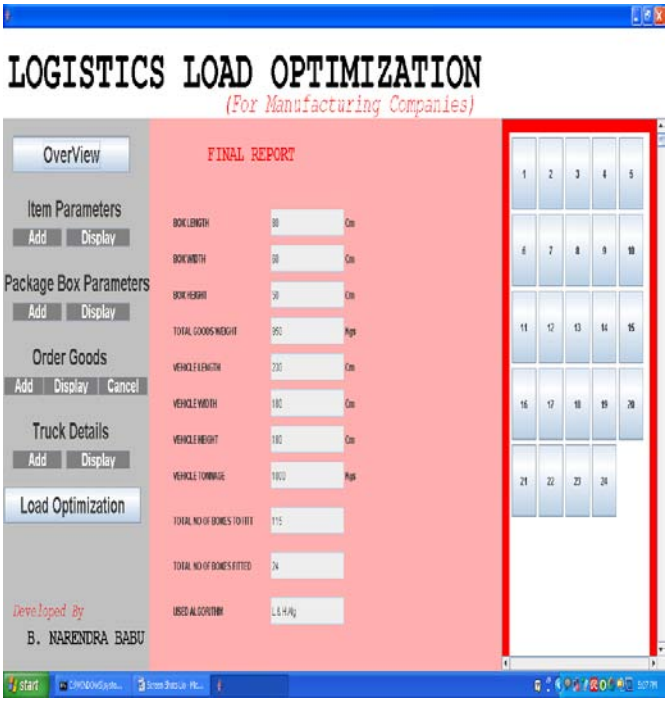


Figure. 14 Load fitting – L & H Algorithm

This screen shows the Load fitting with L & W algorithm. The total number of boxes fitted through this algorithm are 24 boxes based on the input shown in Fig. 10. This shows that, it accommodates more number of boxes than other two algorithms and it is consider as a best approach for the given input. But in some scenario, one among the 3 algorithms may be best according to the vehicle parameters and number of equal size boxes that is to be sent.

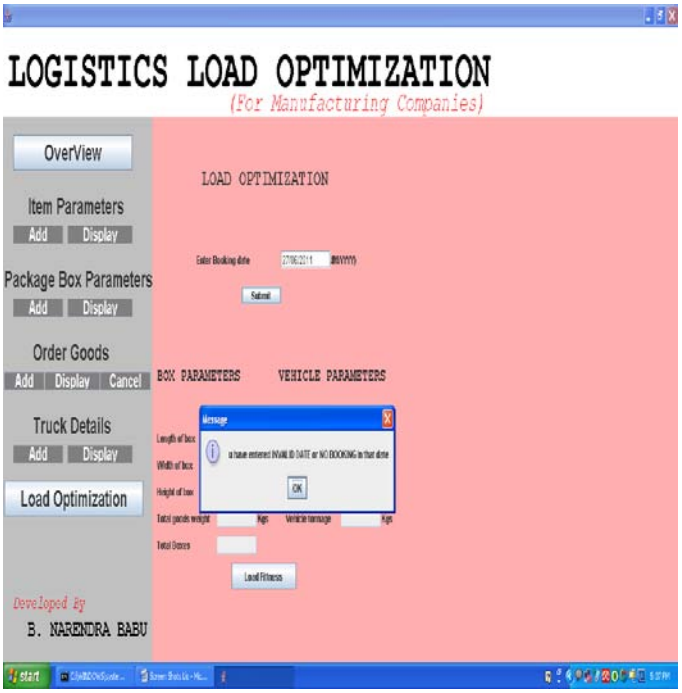


Figure. 15 Load fitting – Invalid entry of booking date

This screen shows the invalid entry of booking date i.e. if we try to retrieve the booking date which the booking order is not taken is consider as invalid date and retrieving such date shows the error message.

VII. CONCLUSION

The Load Optimization is achieved in the form of maximum utilization of space for similar type of boxes by using one of the three proposed algorithms. By using these algorithms the wastage of space between boxes is minimized. Hence we believe that, this approach will be useful for manufacturer of multiple items which they would sent those items to ordered customers

VIII. FUTURE WORK

This approach work for single vehicle loading for similar type of boxes and one source & one destination only. The same approach can be enhanced with,

a. Multiple vehicle loading problem
b. One Source to Multiple Destination.
c. Route optimization

IX. REFERENCES

[1]. P. Davies and E. E. Bischoff., Weight distribution considerations in container loading. European Journal of Operational Research, 114:509–527, 1999.

[2]. Andrew Lim, Xingwen Zhang, The Container Loading Problem,SAC'05,March13-7,2005,SantaFe,NewMexico, USA

[3]. E. E. Bischoff, F. Janetz, and M. S.W. Ratcliff., Loading pallets with non-identical items. European Journal of Operational Research, 84:681–692, 1995.

[4]. G. Scheithauer and U. Sommerwei, Block heuristic for the rectangle packing problem, European Journal of Operational Research, 108:509–526, 1998

[5]. J. A. George and D. F. Robinson., A heuristic for packing boxes into a container. Computer and Operations Research, 7:147–156, 1980.

[6]. Nigeria Somuyiwa, Adebambo layinka,, Analysis of Transportation Cost in Overall Logistics Cost Management of manufacturing Companies in Southwestern. Vol.44 No.3 (2010), pp.420-429

[7]. Yung-yu TSENG, Wen Long YUE, The Role of Transportation in Logistics Chain, Proceedings of the Eastern Asia Society for Transportation Studies, Vol. 5, pp. 1657 - 1672, 2005

[8]. Weijian Huang, Hua Zahao, Liang Huang, Wei Dum, Management Information System Applied In the Logistics, 2010 International Conference on Intelligent Computation Technology and Automation, DOI 10.1109/ICICTA.2010.370, pp. 628 – 628

[9]. Xusheng Xu, Haillong Ma, Application in logistics enterprises for knowledge management, 2010 International Conference on E-Business and E-Government, DOI 10.1109/ICEE.2010.840, pp. 3343-3346

AUTHOR'S PROFILE

J. Sheik Mohamed has obtained MCA Degree from Bharathidasan University in the year 2000, who is currently pursuing Ph.D(PT) Computer Science at S.V.University, Tirupathi, Andhra Pradesh. He has published 8 papers in international and national journals. He is working as an Asst. Professor in SITAMS, Chittoor, A.P. with the experience of 11 years. He is a life member of CSI and ISTE.

P. Narendra Babu has obtained MCA degree from JNTUA, Anantapur through MCA Department, SITAMS, Chittoor, A.P.

Dr. S. Sreekanth has obtained M.Sc. Degree from S.K. University, Anantapur and M.Phil., Ph.D., Degrees from S.V.University, Tirupathi and M.E.(CSE) from Sathyabama University, Chennai. Currently he is guiding 2 Ph.D. scholars in Computer Science at Rayalaseema University, Kurnool, Andhra Pradesh. He is working as a Professor & Director in MCA Department, SITAMS, Chittoor, Andhra Pradesh with the experience of 16 years**.** He has published 13 research papers both in international and national journals of mathematics and computer science

Dr.N.Ch.S.N. Iyengar(M.Sc,M.E,Ph.D.) is a Senior Professor in School of Computing Science and Engineering at VIT University, Vellore, Tamil Nadu, India. His research interests includes Agent based Distributed Computing, Data Privacy and Security, Cryptography, Intelligent computational methods and Bio informatics. He has authored several textbooks and had nearly 100 research Publications in International Journals. He chaired many international conferences and delivered invited/ technical lectures/ keynote addresses besides being International program committee member.