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Reducing empty truck problem and route optimization for enhanced and sustainable logistic transportation

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Abstract: This paper is analysis problem in logistic transportation, empty truck problem and importance of route planning Logistics transportation between cities are subject to considerable slow queues and congestion, revealing a lack of medium and/or short-term logistic planning. One of the causes is the number of trucks travelling with empty containers, performing one-way trips, from one city to another city. This issue may be reduced by combining trips, i.e., after bringing goods to the (export trip), a truck should, when possible, carry goods from that city to the origin or a nearby city (import trip). We investigate a combinatorial optimization drawback wherever a collection of import/export/inland journeys should be combined so as to reduce total traveling time, that successively reduces the amount of empty trucks traveling to/from the cities. Traffic blockage wastes time, energy, and causes pollution. during this paper, we have a tendency to propose associate application taking advantage of transport communications, specifically dynamic route planning. In dynamic route arranging, the route from a travel origin to its destination, rather than being statically decided at the travel beginning time, is occasionally recomputed according to real-time traffic information. Also, This paper investigation the issue almost the transportation in logistics. And proposes the idea to decrease transportation cost and increment client fulfillment by applying ITS (intelligent transportation system) technology and the other technologies.

***Index Terms* - Trips Combination, Combinatorial Optimization, GPS, ITS, Logistic, Transportation, Management, Carbon emission.**

I. Introduction

The aim of this paper is to make a step in this direction One of the causes is the number of trucks travelling with empty containers, the truck travels from one city to another to transport goods from customer to customer and returns empty to the origin point, due to lack of return demand or vice versa. performing one-way trips, from one city to another city. This issue may be reduced by combining trips, i.e., after bringing goods to the (export trip), a truck should, when possible, carry goods from that city to the origin or a nearby city (import trip). Route planning is one of the core problems in transportation studies. Though diverse path making plans algorithms been proposed, just a few of them were deployed to the actual world. It could be very critical to moderately and efficiently distribute automobile scheduling and automobile routing to reduce transportation costs.

Logistics transportation between cities are subject to considerable slow queues and congestion, revealing a lack of medium and/or short-term logistic planning. we focus on one specific such application, dynamic route planning, which has the potential of considerably increasing the efficiency of a road network. In dynamic route planning, the route from a travel origin to its destination as computed by, say, a car navigation system — is periodically recomputed according to real-time traffic information, rather than being statically determined at the travel starting time. Delivering real-time traffic information to vehicles will be soon enabled exploiting wireless V2V and/or V2I communications, so it makes sense to start investigating how to best use this information in order to reduce travel times.

II. LITERATURE SURVEY

Logistics Transportation System based on ITS Technology: Natthida Leemekanond, Fumio Akagi.

Transportation is the important thing in the logistics. Therefore, if we can manage transportation, we also can save the costs and get more opportunity. For example, to respond quickly to customer's demand, etc. One of the hard and difficult problems of logistics is small lots size and multiple loads to multiple stores during the short time, e.g. convenience stores. Navigation system's data of autos and mobile terminals ones of drivers should be analyzed.

Reducing Empty Truck Trips in Long Distance Network by Combining Trips.: Barbara da Costa Rodrigue, Andr´e Gustavo dos Santos

Brazilian import and export activities on ports are subject to considerable slow queues and congestion, revealing a lack of medium and/or short-term logistic planning. One of the causes is the number of trucks traveling with empty containers, performing one-way trips, from inland cities to the port or from the port to the cities. This issue may be reduced by combining trips, i.e., after bringing goods to the port (export trip), a truck should, when possible, carry goods from the port to the origin or a nearby city (import trip). In this paper we investigate a combinatorial optimization problem where a set of import/export/inland trips should be combined in order to reduce total traveling time, which in turn reduces the number of empty trucks traveling to/from the port. Individual trips and combined trips must obey national law regulation of resting time, as typical road trips in Brazil covers hundreds, even thousands of kilometers. We also consider opening operation hours on each location (time windows), which may force a driver to wait upon arriving. We test exact and heuristic approaches, and present the total travel time and number of trucks needed for each solution, considering instances based on real freight data.

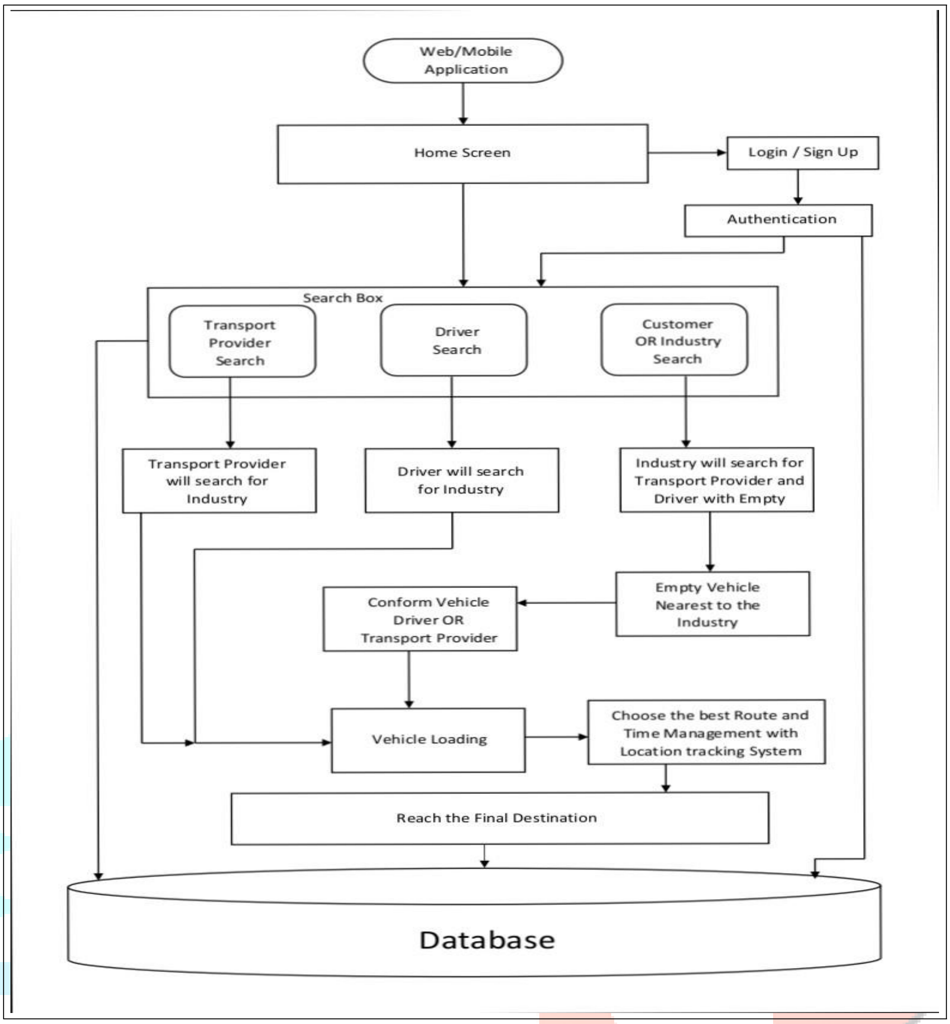
Dynamic Route Planning in Vehicular Networks based on Future Travel Estimation.: Stefano Fontanelli, Enrico Bini, Paolo Santi

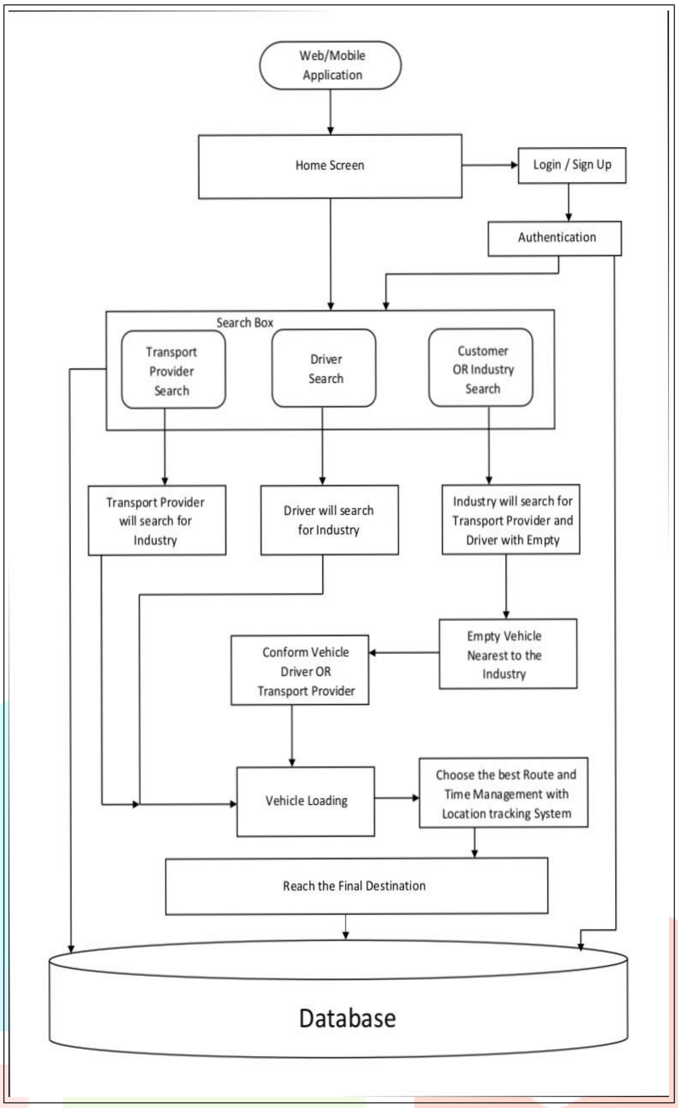
Traffic congestion wastes time, energy, and causes pollution. In this paper, We propose an application taking advantage of vehicular communications, namely dynamic route planning. In dynamic route planning, the route from a travel origin to its destination, instead of being statically determined at the travel starting time, is periodically recomputed according to real-time traffic information. Estimating future travel time is indeed central to the dynamic route planning problem. Since knowing future travel times cannot be achieved, a major challenge its estimation. In this paper, we consider three estimates for the future travel time: the latest travel time heuristic commonly used in the literature, an improvement of the latest travel time heuristic, and a novel approach based on exploiting the observed correlation between vehicle density in a road segment and travel time. We show through accurate simulation that all these heuristics are able to considerably improve traffic efficiency, with up to 60time reduction with respect to the case of the static route planning. Among the considered heuristics, the one based on vehicle density is consistently outperforming the others, especially in presence of traffic build up/decongestion situations (e.g., accidents).

III. PROPOSED SYSTEM AND METHODOLOGY

Vehicle routing problems constitute an important and well-studied class of optimization problems within Operations Research, since a huge number of applications are related to vehicle routing. Examples are school bus routing, airline and railway fleet scheduling, fuel oil delivery, urban transit, and many others. In this paper, various describe numerous routing issues and discuss the relations between them. specifically, we have a tendency to show that the log truck planning problem may be a very general routing drawback. For this purpose, we have a tendency to begin by describing the most basic routing issues and proceed by adding and removing constraints till the log truck scheduling problem comes.

3.1 Architecture





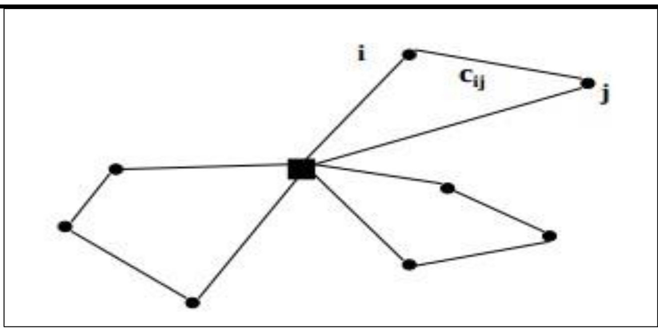
3.2 The travelling salesman problem

The traveling salesman problem the foremost basic routing problem is that the traveling salesman problem (TSP), a problem that has been studied for over fifty years. The traveling salesman drawback remains a vital subject for analysis, and therefore the ways used for solving it are often applied to vehicle routing issues. The TSP corresponds to routing one vehicle through a number of points, and therefore the route should end at the same point as wherever it started. every town should be visited specifically once and therefore the objective is to determine the order within which all the cities are visited, that minimizes the entire travel value and distance. though the TSP is simple to state, it's an NP-hard downside , and no polynomial algorithms for solving it can be found. The TSP has been studied extensively, and today, many methods based on heuristics and optimization theory are used successfully to solve quite large instances; these methods include genetic algorithms, simulated annealing, cutting planes, branch-and-bound, dynamic programming.

3.3 The vehicle routing problem

In the basic Vehicle Routing Problem (VRP), a number of vehicles with a given capacity, q, must be routed to service n demand points, or customers, and all routes must start and end at a depot. Customer i includes a specific delivery demand, d i , that has got to be met, and also the value of travelling between customers i and j is c ij . In different words, the VRP consists of finding a group of lowest value routes, one for every vehicle empty routes wherever the vehicles lodge in the depot are also allowed, in order to satisfy the demands of the customers. The constraints on the routes are the following:

- Every route should begin and finish at the depot.
- Every client should be visited specifically once.
- The total demand from Users that are served by every vehicle should not exceed the capability of the vehicle.



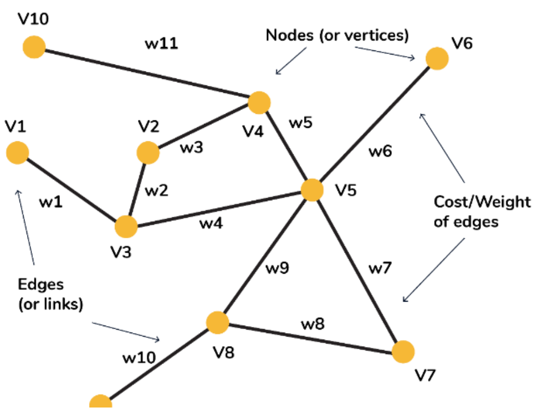
There are a unit after all an outsized range of variations on this basic VRP. One example (of this) is to minimize the quantity of vehicles used rather than minimizing the full routing price. the fundamental VRP generalizes the TSP; the TSP is obtained by considering a VRP with one vehicle of unlimited capability. Thus, the TSP may be a special case of the VRP, that is so NP-hard. The VRP is developed in numerous ways in which, for instance as a supposed set partitioning drawback. This model for the VRP is

$$\begin{array}{llll} \min & \sum_{j \in P} c_j x_j & & (3.1.1) \\ \text{subject to} & \sum_{j \in P} a_{ij} x_j = 1 & \forall i \in C & (3.1.2) \\ & \sum_{j \in P} x_j \leq n & & (3.1.3) \\ & x_j \in \{0,1\} & \forall j \in P & (3.1.4) \end{array}$$

Here every variable, j x, corresponds to a given route j for a vehicle, and it takes the worth one if route j is chosen, and zero otherwise. Further, n is that the variety of vehicles, C is that the set of consumers, P the set of all possible routes, j c the price of route j, and, finally, aij could be a constant with worth one if route j visits client i and zero otherwise. for every route j P, these constants are specified i C aijdi letter of the alphabet. Constraint forces all customers to be visited specifically once, and constraints make sure that at the most n vehicles area unit used. a very important variation of the VRP is obtained by specifying the interval among that the service at every client may be completed; this specific downside is thought because the vehicle routing downside with time windows.

3.4 Dijkstra's Algorithm

Dijkstra's original rule found the shortest path between 2 given nodes, however a additional common variant fixes one node as the" supply" node and notice Dijkstra's s shortest ways from the source to any or all alternative nodes within the graph, manufacturing a shortest-path tree. For a given supply node within the graph, the rule finds the shortest path between that node and each alternative. It may be used for locating the shortest ways from one node to one destination node by stopping the rule once the shortest path to the destination node has been determined. as an example, if the nodes of the graph represent cities and edge path prices represent driving distances between pairs of cities connected by an immediate road for simplicity, ignore red lights, stop signs, toll roads and different obstructions, Dijkstra's rule may be wont to notice the shortest route between one city and eve one different cities.



```
function Dijkstra(Graph, source):
    dist[source] ← 0
    create vertex priority queue Q
    for each vertex v in Graph:
    if v source
    dist[v] ← INFINITY
    prev[v] ← UNDEFINED
     Q.add with priority(v,dist[v])
    while Q is not empty:
    u ← Q.extract min()
    alt ← dist[u] + length(u, v)
    if alt ¡ dist[v]
    dist[v] ← alt
    prev[v] ← u
    Q.decrease priority(v,alt)
    return dist, prev
```

IV. Results

i. We tend to came with a plan wherever we try to give a solution to empty truck problem during which our main focus is to utilize the trucks in such the simplest way that it enhances the normal supply transportation and to maximize the profit with the offered resources.

ii. This solution additionally helps to search out the shortest path between origin city and destination city. that is additionally the main profit relating to low fuel consumption, low cost and save time.

iii. This resolution could be a one step taken to reduce this discharge of carbon dioxide because of huge vehicles running with none load because of improper management in supply transportation.

iv. We will provide the simplest route optimization in order that it will cover the space in less possible time and with lesser consumption of fuel and fewer emission of carbon dioxide.

V. Future scope

The logistics business in Asian country is evolving speedily and it 39s the interaction of infrastructure, technology and new types of service suppliers which is able to outline whether or not the industry is able to help its customers reduce their supply costs and provide effective services. The scope is huge as on-line shopping is increasing day by day as tons of and additional smart good been transferred and other than that more and more works are been established there for an oversized demand has occurred in supply chain. Increasing value among the supply sector, fueled by factors like fuel expenses, personnel worth, and lower turnaround of vehicles is that the key driver for the growth of the route improvement. offer costs are increasing, creating the need to reduce operational expenses. Therefore, the supply sector strives to become economical inside the way it manages transportation costs, and successively the transportation routes and schedules. This drives the growth of the route improvement.

VI. Conclusion

Empty runs are a large problem in automotive logistics. In several places within the world, it's a proven fact that most of the time, return trips are empty for each car transport and container transport. One reason for this is often that up thus far, the automobile trailers weren't able to carry goods other than cars on the return trip. one more reason is that the automobile transporters are generally not involved in non-automotive flows. The convertible trailer and therefore the big data approach will change this. As a result, there would be fewer trucks on the road and more profit for the transporter. i am curious to check what the longer term holds and the way much we are able to reduce empty runs in the automotive business, whereas at a similar time improving the environment. By optimization of routs the less fuel consumption, save money as well as time of the driver and can make faster delivery.

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