Real Time Dynamic Carpooling System

Vinay Kulkarni[1] Shivani Shetye[2] Surabhi Sonparote[3] Madhuri Ghuge[4]
[1,2,3]Student [4]Assistant Professor
[1,2,3,4]Department of Computer Engineering
[1,2,3,4]Bharati Vidyapeeth College of Engineering, Navi Mumbai-400614

Abstract— Carpooling is the sharing of car journeys so that more than one person travels in a car. By having more people using one vehicle, carpooling reduces each person's travel costs such as fuel costs, tolls, and the stress of driving.This method is very useful as it has great value and great use in normal life. People can travel together and can use this method in a great way. In this carpooling method, it has a nomal method and our proposed method. We are going to use the heuristic method in our proposed system as this will decide the exact time and delay of the vehicles in which the people are going to travel. The heuristic method is done by carrying out the case study based on suitable assumptions and real-time data and the same can be useful in practice.
Key words: Carpooling, proposed system, heuristic method, optimization, driver, passenger, arcs, lagranges method

I. INTRODUCTION

Car Pooling has been thought of as a strategy to minimize cost of travel and fuel consumption. Public transportation systems have been in pace since the invention of cars however they don't provide access to each and every location that a traveler wants to visit. Carpooling can be looked at as a solution for that. In an effort to reduce traffic and encourage carpooling, some governments have introduced high-occupancy vehicle lanes in which only vehicles with two or more passengers are allowed to drive. HOV lanes can create strong practical incentives for carpooling by reducing travel time and expense. In some countries it is also common to find parking spaces that are reserved especially for carpoolers. There are two groups namely passenger group and driver group and the problem is divided into three types 1.One-to-Many problem 2.Many-to-one problem 3.Many-to-many problem. In this paper, we are going to solve many-to-many carpooling method.

II. MODEL

This study focuses on the development of an effective planning tool for the long-term many-to-many car pooling problem, where each participant group joins the carpool plan every-day during the planning period. The model is more complicated than long-term/daily many-to-one or one-to-many car pooling problems. An efficient plan for this model may require matching participant groups to a car on a semi common route or assigning a participant group to different cars on different days. It is very difficult to simultaneously and optimally determine every participant group's role (driver group or passenger group), driver group schedules, and passenger group deliveries, as well as to suitably match several participant groups in a car while still keeping in mind fairness considerations. This process involves complicated movements of driver groups (or vehicles) and passenger groups in both time and space, with consideration of driver/passenger traveling costs.There are two parts in this particular model.They are:

A. *Driver-Flow Time-Space Network:*

This method of displaying the information of carpooling model with time networks and it is very efficient to represent routings in this form. In the following figure, the number of such networks are established associated with the driver groups and planning days, it represents the movement for the driver group. In fig1,it is shown that if there are k driver groups and d planning days,then the total network will be calculated as kd network. The stations are represented by horizontal axis and time duration is by the vertical axis. A node acts as a station at a specific time.

The time length of the network is according to the length of the time window specified for each driver group. The starting time for the time window where the network begins is the earliest time at which the driver group leaves the origin,and the ending time for the time window where the network ends is the last time.

1) *Driver Travel Arc:*

A driver travel arc represents a driver group trip which is associated with a vehicle which travels from one time–space point to another. Once the driver group has left from its origin point, it does not return to the origin to service which will be given to other participants. Even when the driver group has arrived its destination, it does not leave to give services to other passenger groups.

Therefore, at each time–space point associated with the driver group's origin, we need only build a travel arc from their origin to the other stations.

2) *Driver Holding Arc:*

A driver holding arc represents the holding of a driver group at a station in a particular time period. The arc cost which is defined denotes the time cost incurred for holding a driver group at this station in the corresponding time period. Since our model is a planning model, the carpool coordination center will be able to notify driver groups of the actual departure or the arrival time. Driver groups do not need to arrive before their departure time or stay after their time of arrival. Therefore, this arc is set to zero. Both the arcs are explained with the help of diagram.

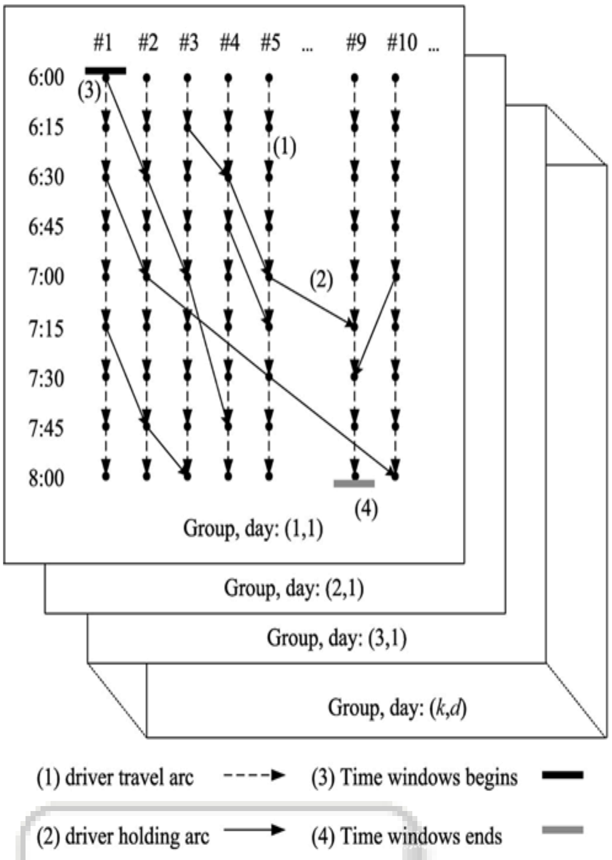

Fig. 1:

B. *Passenger Flow-Time Space Networks:*

The passenger time–space network is actually also adopted to formulate the movements of the passenger groups in time and space.This is also one part with respect to the driver group.To facilitate the passenger's problem solving,these networks are symmetrically designedto those networks.The number of layers and time for each networks are same as that of driver's flow networking concept.The two types of arcs in such networks are:

1) *Passenger Travel Arc:*

It represents the passenger group trip from one time–space point to another space point.It is also the time cost for passenger to travel between stations.The upper and lower arcs are same as that of driver's arcs.

2) *Passenger Holding Arcs:*

It represents the holding of a passenger group at a station in a time period.This arc cost denotes the time cost incurred for holding a passenger group at this station in the particular time period.It is same as the driver holding arcs in driver flow networks.In this,the station points are set to zero.

III. SOLUTION ALGORITHM

The solution algorithm for this method is the Lagrangian relaxation with subgradient method which is known for its fast convergence and efficient allocation of memory space when solving large-scale integer linear programs. Therefore,this algorithm is selected for the approximation of near-optimal solutions. The solution process is described as taking the Constraints and are relaxed to construct an lagrangian method to solve the lower bound of the optimal solution.After this,heuristic is developed to solve for the upper bound of the optimal solution.A subgradient method is then utilized to revise the Lagrangian multipliers.The process is done by iterating the form of lower and upper bounds until an acceptable convergence result is obtained.This algorithm includes the lower bound and the upper bound of the optimal solution,subgradient and the solution process.

A. *Lower Bound Optimal Solution:*

The steps for searching the lower bound are as follows:

- *Step 1:* Both the side constraints are relaxed with the corresponding non-negative Lagrangian multipliers p and d and are added to the objective function of Model, resulting in one specific different Model 1.
- *Step 2:* Model 1 is decomposed into two independent models: Model 2 and Model 3.
- *Step 3:* The decomposition of Model 2 into several independent days of networks leads to a significant reduction in problem size.
- *Step 4:* Although there are no constraints on variable "a" in Model 1, in fact variable "a" must be greater than zero and smaller than a reasonable upper bound.So, constraints are added to Model 3 to suitably reduce the solution space to a feasible space.
- *Step 5:* The lower bound of the optimal solution is obtained by summing up the objective values from Model 2 and Model 3.

B. *Upper Bound Optimal Solution:*

For the upper bound optimal solution,the steps are listed as:

- *Step 1:* Choose one of original independent days to generate the zeroth independent day model, and let d =0.
- *Step 2:* Let the driver flows from Step0, Step3, or Step6 solution.Construct a modified model for dth independent day model as specified in the flowchart.
- *Step 3:* Construct a modified model for the dth independent model.
- *Step 4:* If object 2 is less than object 1,then go to step1 otherwise go to step 4.
- *Step 5:* In this step,there must be the improvement of the route which is taken by the driver and the passenger.
- *Step 6:* Take the optimality solution to it and modify the route of the passenger and the driver.

The following steps are shown in the form of flowchart as under:

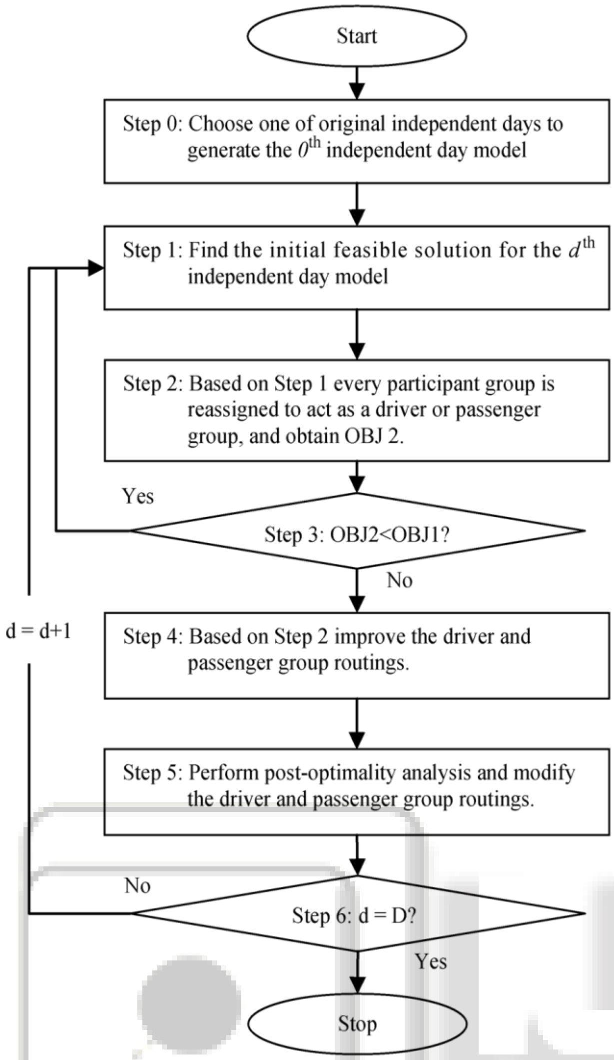

Fig. 2:

IV. CASE STUDY

This case study is shown in the diagram as follows:

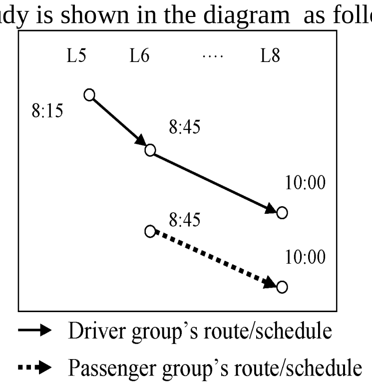

Fig. 3:

We use the driver–passenger-flow matching method to match all the arc chains between the driver-and passenger flow networks.To save space, only one example of the matching between a driver group and a passenger group is shown in Fig. 3. This example shows that a driver group departs from L5 at 8:15 and then the same travels to L6 to carry a passenger group at 8:45.Finally, they arrive together at L8 at 10:00.So this is one case study which is based on driver and passenger travelling schedule.

V. PROPOSED SYSTEM

We employ a network flow technique to systematically develop a long-term car pooling model. The model is formulated as a special integer multiple-commodity network flow problem.

A. Advantages Of Proposed System:

(1) Reduce each participant's cost-The cost of travelling for those who would be participating in this method would be reduced.
(2) Any destination according to need can be reached-Any passenger who needs to travel anywhere,they can use this system.

B. Module Description:

1) User Module:

– User Registration

Every user need to be register to access car pooling system.

– User login

Only authorized user can access car pooling system, authorization process includes user username and password which is enter at the time of registration.

In this,there is a search route option in which when user enter source and destination for search a route user will see the route on the map. User can view trip which is also added by the driver. User can also send trip request for driver.

2) Driver Module:

– Driver Registration

Driver need to be register to access car- pooling system.

– Driver Login

Only authorized user can access car-pooling system, authorization process includes user username and password which is enter at the time of registration. In this, the driver can create new trip for user. The driver can also delete old created trip. The same can also approve the send request for trip.

C. Methods Of Carpooling:

The two methods which are in the proposed system of carpooling method are:

1) Slugging Car-Pooling Method:

Slugging, also known as casual carpooling, is the practice of forming the ad-hoc,informal carpools for purposes of commuting,essentially a variation of ride share commuting and hitch-hiking.Typically slugging is motivated by an incentive such as a faster HOV lane or a toll reduction.

2) Flexible Car-Pooling Method:

Flexible Carpooling is carpooling that is not arranged ahead of time, but instead makes use of designated meeting places. It seeks to replicate the informal 'slug-lines' that form in Washington DC, Houston, and San Francisco, by establishing more formal locations for travelers to form carpools without advance contact.

Following are the modules which we are going to develop to full-fill applications need:

(1) Login
(2) Registration
(3) Search cars
(4) Update details
(5) Ratings module

VI. Heuristic algorithm

A special case of the problem considered is tackled in this case.The case studies that the number of goods to be picked up is equal to the goods to be delivered and the demand (supply) at every delivery (pickup) location is equal to one. This problem is an extension of the swapping problem where the vehicle's capacity is also set to one. The case also propose an approximation algorithm with a worst case bound of 9.5. They use heuristic to construct a traveling salesman tour, one contain method only in the pickup locations, and one containing only delivery locations.These two tours are then combined by means of decomposition and matching. Also,polynomial time iterated tour matching algorithm for the same problem is proposed.Also other solution approaches are briefly discussed.

The first algorithm is of the construction-improvement type, using a greedy construction procedure that is improved by 2-opt and 3-opt exchanges. The second heuristic is based on incomplete optimization. The branch and cut procedure,with restrictions on the search space is applied. Random instances with up to 500 customers were solved.An approximation algorithm on a tree graph was also proposed. It is based on a recurrent construction process and has a worst case bound of 2.

Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The most common example is the physical use of roads by vehicles.When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion.As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up. Traffic congestion can lead to drivers becoming frustrated and engaging in road rage.

VII. Conclusion

The aim of this model is not only to reduce each participant's cost but to reduce the difference in cost among participants as well.Our system has used the heuristic method approach with the Lagrangian relaxation algrorithm. Although the results show that the model and the solution would be useful, more tests should be conducted to allow the authorities to better grasp the limitations of the model and the solution before putting them to practical use.

VIII. Acknowledgment

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