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A Genetic Algorithm Based Approach to Solve Carpool Service Problems in Cloud Computing

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Abstract — *Traffic congestion has been a serious problem in many urban areas around the world. Carpooling is one of the most effective solutions to traffic congestion. It consists of increasing the occupancy rate of cars by reducing the empty seats in these vehicles effectively. In this paper, an advanced carpool system is described in detail and called the intelligent carpool system (ICS), which provides carpoolers the use of the carpool services via a smart handheld device anywhere and at any time. The carpool service agency in the ICS is integrated with the abundant geographical, traffic, and societal information and used to manage requests. For help in coordinating the ride matches via the carpool service agency, we apply the genetic algorithm to propose the genetic-based carpool route and matching algorithm (GCRMA) for this multi objective optimization problem called the carpool service problem (CSP).*

The experimental section shows that the proposed GCRMA is compared with two single-point methods: the random-assignment hill climbing algorithm and the greedy assignment hill climbing algorithm on real-world scenarios. Use of the GCRMA was proved to result in superior results involving the optimization objectives of CSP than other algorithms. Furthermore, our GCRMA operates with significantly a small amount of computational complexity to response the match results in the reasonable time, and the processing time is further reduced by the termination criteria of early stop.

I. INTRODUCTION

Recent economic development has resulted in urban and industrial growth, leading to rapid increases in the number of vehicles on roadways and, thus, serious traffic congestion problems in large cities around the world. Severe traffic congestion can have many detrimental effects, such as time loss, air pollution, and increased fuel consumption. Public transportation systems have the capacity to decrease traffic congestion but offer less flexibility, comfort, and freedom than can personal vehicles, so personal vehicles are by far the most popular way to commute. However, each car usually transports just one or two individuals, resulting in many empty seats. This represents an underuse of available transportation resources, a problem whose solution will require considerable effort.

Carpooling (also car-sharing, ride-sharing, liftsharing and covoiturage), 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. Carpooling is seen as a more environmentally friendly and sustainable way to travel as sharing journeys reduces carbon emissions, traffic congestion on the roads, and the need for parking spaces. Authorities often encourage carpooling, especially during high pollution periods and high fuel prices.

Carpooling is a relatively environmentally sound system of transportation in which empty seats are offered to additional passengers and has been found to be one of the best solutions to traffic congestion. Drivers share their cars with one or more people who have similar transportation routes. By reducing the number of empty seats in these vehicles, occupancy rates are significantly increased. Consequently, fewer vehicles would be required to transport the same quantity of commuters to their respective destinations, resulting in substantially fewer cars on the road. Other carpooling benefits include reductions in travel cost, energy consumption, and vehicle emissions. As a result of technological advances such as the development of smart handheld device software and hardware, along with mobile Internet technology, the website-based carpool system has become more advanced and is now appropriately referred to as the intelligent carpool system (AICS). Through the use of smart handheld devices with Global Positioning System (GPS) navigation and mobile communication ability , drivers and passengers can instantaneously access real-time carpool service via the structure of AICS, with their current locations and other required information input by their smart phones, tablet computers, or other devices. Several such start-up systems, such as Carma , sidecar , Flinc , Zimride , and go2gether , have been developed to coordinate ride match communication between drivers and passengers in real time carpool settings. However, these systems lack dedicated optimization abilities by which to adapt performance capability to resource distributions. Thus, the optimization technique is imported into our AICS called Blue Net-Ride.

II. LITERATURE SURVEY

Provide extensive reviews of the history of carpooling activity in the United States. Since the world oil shortages in the mid-1970s, Federal and local governments have implemented a variety of policies and programs to encourage carpooling activity. After that period, carpooling became increasingly popular in United States, with nearly 20% of commute trips using a carpool in the 1970s. However, this decreased precipitously after 1980, and has dropped to approximately 10% in 2010. Decreasing oil prices, improving transportation facilities, and increasing incomes are potential reasons for this decrease in carpool trips.

To encourage carpooling, many transportation agencies have built extensive networks of HOV lanes. However, the efficiency of–and benefits from—HOV lanes remain topics of controversy investigated the influence of carpool lanes on overall transportation network performance. That research found that, using actual trip data, the presence of a reserved carpool lane on a congested highway can increase commute time. Similarly, have found that the overall efficiency of a highway decreases with the presence of an HOV lane. It has been observed that HOV lanes frequently carry fewer people than general-purpose lanes demonstrated that a high proportion of two-person family carpools, also known as "fampools", dramatically reduced the expected benefit of HOV lanes that were built with the expectation of carpools or vanpools carrying three persons or more per vehicle. This finding provides a primary motivation for the research presented here. If efficient means of generating larger carpools can be implemented, the expected benefits of HOV lanes can be more easily realized. Carpool matching services can lead to larger carpool sizes, and the ability to efficiently match multiple carpool users effectively multiplies the benefits of the carpool. This research presents methods for doing so.

2.1 Existing System

There are some existing systems like Carpool Global and Share Your Ride. In carpool Global system, users can search for requests and get the appropriate matching output. But this system cannot work on Geographical Information System (GIS). So it cannot provide real time location.

Share Your Ride uses map based interface to accept requests from user and provide digital GIS support in order to match requests. It doesn't make use of Global Positioning System(GPS) handheld devices due to which it cannot provide instant services to get information regarding user locations.

III. PROPOSED SYSTEM

The proposed system consist two modules such as Mobile Client Module and Cloud Global Carpool Service Module. Both modules communicate with each other through HTTP protocol with the help of Web Services.

A. Mobile Client Module:

Users can submit the requests for carpooling and get matching results through Mobile Client Module (MC) at any time and location. This module works on mobile communication network and users personal phone devices which should be Android base. The advantage of this module is it contain GPS technology, it helps to get current location of user. In this way it supports to Intelligent Carpool System.

B. Cloud Global Carpool Service Module :

Cloud Global Carpool Service Module (CGCS) takes the information from MC module to match the requests for carpool service. CGCS module consist open GIS system. GIS is Geographical Information System which consist global geographical information include Google Maps, Bing Maps etc. This module work on Genetic Based Carpool Route and Matching algorithm (GCRM) provides optimum solutions in minimum time.

3.1 GENETIC-BASED CARPOOL ROUTE AND MATCHING ALGORITHM

In this section, we propose a genetic-based carpool route and matching (GCRM) algorithm with which to dramatically reduce the time required to match a large number of users in the proposed intelligent carpool system.

The proposed GCRM consists of two important modules: (1) the Evolution Initialization (EI) module, and (2) the Genetic Evolution (GE) module.

The EI module is employed to initialize chromosomes in order to generate effective solutions to the carpool services problem by using a chromosome representation procedure and a population initialization procedure. The EI module can express properties of carpool requirements through the chromosome representation procedure. This procedure effectively encodes the solutions to the CSP into chromosomes according to the requirements of driver and passenger(s). The feasible matching candidates of the initial population pool are randomly generated by the population initialization procedure in order to emphasize the diversity of populations in the solutions.

After the effective initial solutions are generated in the EI module, the proposed GE module is then used to accurately find the optimum solutions to the carpool route and matching problem by simulating the natural evolution by the proposed four-step procedures. This involves (1) chromosome evaluation, (2) chromosome selection, (3) chromosome crossover, and (4) chromosome mutation.

The chromosome evaluation procedure determines the quality of each chromosome by evaluating its fitness value. The following chromosome selection procedure, based on the natural law of ”survival of the fittest”, is the process that determines according to fitness value which chromosomes are selected for the next generation. The chromosome crossover procedure is used to generate high quality offspring by utilizing only those parents which contain ideal solution components. Population diversity is increased through the use of the chromosome mutation procedure. By continually repeating the above procedure, the approximate optimal solutions to the CSP are obtained in the intelligent carpool system.

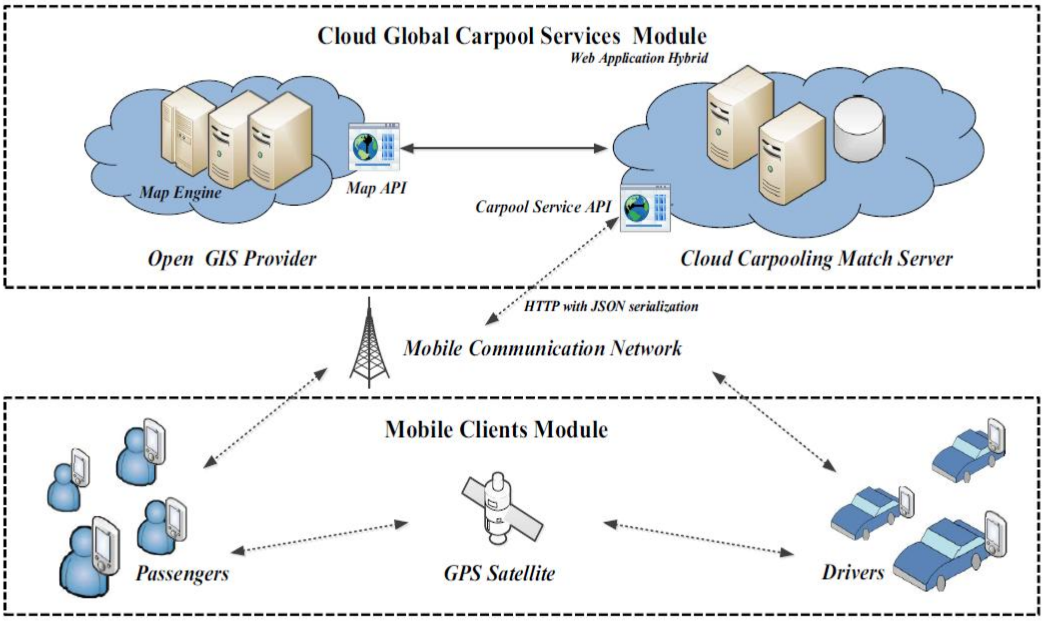

Fig: Framework of the cloud computing based carpool system in service orientation

IV. CONCLUSION

We address the entire framework of the ICS, which provides an environment in which drivers and passengers can easily find carpool matches at any time and in any place. The definition of CSP is also addressed for the application of practical system. Such a problem is successfully solved by our proposed GCRMA, which is based on genetic algorithm and is composed of two major modules: an EI and a GE. The EI module can express the solutions to the CSP via chromosomes and utilizes proposed distance-based greedy heuristics to effectively generate initial population in the solution search space. The GE module is then able to find the optimum carpool route and matching results both accurately and promptly in accordance with the optimization of all objectives. Among that, the dynamic programming method is applied to promptly solve the origin–destination pair route problem within the evaluation process.

The early stop option is additionally activated to facilitate the improvement of processing time. For proving the efficacy of our approach in real world, we propose the generalized movement model to express the real-world test scenarios as the experimental benchmarks. After the results of GCRMA were compared with other algorithms through the use of several test scenarios, our analyses show that the GCRMA outperforms the others to have the optimum performance of both first and second objectives.

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