GIS-BASED SOLUTION OF SCHEDULING AND ROUTING SCHOOL BUSES- A THEORETICAL APPROACH

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ABSTRACT

The coming era of world has moved to an exceptional leading contest of innovations and inspiration. In this paper, an attempt has been made to find out a solution to ensure the safety of route to parents when their child is travelling to school and back to home. Recent years, spatial data and observed data, such as digital road map, traffic route, vehicle speed, recordings events and others are integrated and stored into the spatial temporal database systems. Various location-based services by using mobile phone are also becoming popular. In this paper, we focus on one of GIS-based scheduling applications concerning the availability of GPS technologies and spatial database for the actual vehicle routing problems. Vehicle Routing Problem (VRP) is the one of important problems in the research fields of transportation, frequently we consider variations of VRP, such as Vehicle Routing Problem with Time Windows (VRPTW) and Capacitated Vehicle Routing Problem CVRP. Mainly we have two spatial technical tools, "Photo Tracker" and "Arc GIS", which records and analyzes vehicle routes. By using these devices and tools, we can compare the actual recorded routes and optimal routes, and discuss the characteristics of routes determined by the schools.

*Keywords***:** *Vehicle Scheduling and Routing Problem (VRP), GIS, GPS, Day Care Centre*

I. INTRODUCTION

Recent years, it is easy to record traffic route and vehicle speed by using GPS devices and mobile phones. Various location-based services, such as Google Maps, MapFan, Navitime, are becoming popular in India.
We have visualized the probing data of taxi in New Delhi metropolitan area and the probing data of patrol cars on Yamuna Express Way by using GIS software we apply several data mining algorithms to traffic data and spatial database and derive patterns/rules. There are many research papers about spatial data mining technologies of traffic data, for instance optimization of travel plan; visualization of traffic jam, GPS assisted navigation, road design, and ICT-assisted traffic congestion. In this paper, we focus on one of GIS-based

scheduling applications concerning the availability of spatial database and GPS technologies for the vehicle routing problems. Actually, various types of Vehicle Routing Problem (VRP), such as Vehicle Routing Problem with Time Windows (VRPTW), Capacitated Vehicle Routing Problem CVRP (CVRPTW, CVRP with Time Windows) and Vehicle Routing Scheduling Problems (PRSP), are discussed in the research fields of transportation. We try to integrate spatial data and observed data, such as digital road map, traffic route, vehicle speed, recordings events and others, and store into the Geographic Information System (GIS).

The vehicle scheduling and routing problems in a day-care centre are important and time consuming. "Day-care/Day-service" is nursing for the senior citizen service, it is necessary to consider various constraints by the nursing facilities, number of cars, requirement of customers, location of the home and others. Based on actual GPS data, we analyze vehicle routes and discuss characteristics of optimal or feasible routes provided by using GIS tools.

II. VRP RESEARCHES AND DAY-CARE / SERVICE

In this paper, we focus on one of GIS-based scheduling applications concerning the availability of spatial database and GPS technologies for the vehicle routing problems. Vehicle Routing Problem (VRP) is very important in the research fields of transportation, we frequently consider VRP with actual restrictions, such as Vehicle Routing Problem with Time Windows (VRPTW) and Capacitated Vehicle Routing Problem CVRP (CVRPTW, CVRP with Time Windows). In several patents and research papers, the vehicle routing problems in a day care Service centre are discussed. "Day-care/Day-service" is nursing for the senior citizen service, it is necessary to consider many constraints by the nursing facilities, number of cars, requirement of customers, the pick-up and send-off locations and others. In the paper, the home health care (HHC) services are becoming popular problems all over the world, the HHC problem usually consists of hard problems from a mathematical point of view, since it combines two well-known NP-hard problems: the vehicle routing problem and the nurse scheduling problem.

III. GPS DEVICES AND GIS TOOLS FOR ROUTE ANALYSIS

We record actual car routes by using GPS tracking device, "Photo Tracker", which is mainly designed for travellers seeking photo tracking functions. In our research, we try to record car tracking for day care service. Utilizing the Photo Tracker mapping software and latest Geo-Mapping technology, we can record the exact routes by using the Photo Tracker.

Furthermore, based on the customers address and request for vehicle routings, we try to analyze car routes by using GIS software, "Arc View", which is one of major GIS software, and which has various functions, such as visualizing, managing, creating, and analyzing geographic data. By using Arc View, we transform from geographic data to network data, and solve VRP by the left side tools.

IV. CONCLUSIONS AND FUTURE WORK

Based on the recorded route and best route provided by Network Analyst Tools, the difference is so small, the quality of making routes determined by day care centre seems to be good. According to results of our experiments, most severe problem is the accuracy of address matching outputs. Furthermore, finding parking places, traffic conditions seems to be relatively difficult than car scheduling and vehicle routing problem. Most of previous developed system seems to be very complicated and over spec for usual Day Care Centres in Japan. However, based on the day-to-day analysis discussed in research paper, we have to analyze day-to-day variability of actual routes during long-term. At present, the service provided by the commercial Car Route Finder (http://www.mapfan.com/routemap/routeset.cgi) in Map Fan web site is quite useful and shows the limitation of the commercial vehicle navigation service with three destinations. In the future, we have to improve the higher resolution of address matching service and more accurate observations of traffic conditions in order to solve more severe constraints.

V. CONCLUSION

In this paper we have focused on the use of GPS and GIS technology to minimize the fear and stress of parents for their child when he/she is travelling to school and back from there. By using the GPS photo tracker and Arc View of GPS photo tracker directly on their computer systems. This would be a great advancement in the field of technology.

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