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Study On Autonomous Vehicle Transportation System

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Abstract - *A smart city provides its people with high standard of living through advanced technologies and transport is one of the major focus. With the advent of autonomous vehicles (AVs), an AV-based public transportation system providing new forms of transportation services with high efficiency, high flexibility.Technology of autonomous vehicles (AVs) is becoming mature, and many AVs will appear on roads in the near future. In future AV's technology is used to for all public. The AVs become connected with the support of various vehicular communication technologies. It manages a fleet of AVs to be coordinate transportation requests, offering point-to-point services with ride sharing. In order to perform its task, it is mounted by infrared sensors, camera and GPS receiver .There are two main problem in this system : scheduling and admission control.The scheduling problem is formulated as a mixed integer linear program, and the admission control problem is cast as a bilevel optimization.We validate the performance of the algorithm with real-world transportation service data.*

Key Words **: Autonomous vehicle (AV), Admission control, Bilevel Optimization, Smart City.**

1. INTRODUCTION

Many people depend on public transport to move from one place to another when the their journeys are not short distances. The road-based public transport are buses and taxis, every transport system having some pros and cons. Buses generally used fixed routes offering shared ride so that more passengers can be served on each single journey. On the other hand, taxis offer private services and run on adjustable fixed routes based on the passengers' requests. Nevertheless, no single one type can support high throughput and flexibility at the same time[1]. The efficiency and capacity of the whole public transportation system may be increased if there exists a new public transport which can coordinate many people in a short period of time and concur high mobility. It may maintain flexibility by offering point-to-point enhancing efficiency by supporting shared ride[11]. Such kind of public transport requires different features possess public transport. To established such a public transport, the vehicles need to cooperate to take up customers' requests instead of going around the city for incidental offers.

Unmanned Vehicle (UV) is a smart autonomous vehicle that mainly capable to do tasks without the need of human operatoR[4]. The unmanned bus is referred as Autonomous Vehicle.There are already autonomous buses driving in trial mode in some local routes, like: China and Switzerland. The technology is almost ready and most experts and researches outline a timeline where the technology will mature to be used in production in 5-10 years. An intelligent AV-based public transportation system manages a fleet of AVs to coordinate transportation requests, offering point-to-point services with ride sharing. We focus on two important problems in the system: scheduling and admission control. The former is about how to assign the designated vehicles to the admissible transportation requests, and when and where the vehicles should reach to provide services with the lowest cost. The latter is to determine the set of admissible requests among all requests to achieve maximum revenue.

AVs are utilized as the conveyances tocarry passengers in a city. The system can be made automatic and adaptive to transportation requests, with the consideration of traffic conditions. There is a control center (e.g., a central computing facility) for managing and scheduling the AVs, and making other related decisions for the system. Through adaptive scheduling, the optimal routes with the minimum operational cost can be determined for the AVs. With advanced vehicular communications technologies, like vehicular ad-hoc networks , the AVs become connected able to exchange information with the control center. Due to the unmanned nature, the AVs can coordinate with each other, and loyally and accurately follow the instructions from the control center. The system allows ride sharing; passengers may share their rides with other people, as buses.

[1]Moreover, the system supports point-to-point services; a passenger can specify the pick-up and drop-off locations with various time requirements, as taxis. In future most of the people depend on transportation systems. Transportation systems also having several opportunities but several challenges as well. The Economic strength and Development of country mostly depend on the performance of transportation systems.

2. SYSTEM MODEL

2.1 Autonomous Vehicle Public Transportation System

The AV public transportation system was firstly proposed in which the control center coordinates a fleet of AVs to provide transportation services. Customers submit transportation requests to the control center with necessary information, including pickup and dropoff locations, service times, number of passengers, etc[11]. After collecting a number of transportation requests, the control center assigns appropriate AVs to serve the requests. When serving the requests, the AVs may be carrying the passengers from other requests and this realizes ride-sharing. Due to the unmanned nature of the vehicles, we need to determine the schedules and routes for the designated AVs in order to admit the transportation requests. Moreover, not every request can be served because the requirements stated in the request may not simultaneously be satisfied by any vehicle available. We need to perform admission control to screen out those infeasible requests for effective scheduling. The admission control problem is given as a bi-level optimization, in which the scheduling problem is considered as a constraint.

2.2 Operations

The data collection sub-interval and duty assignment sub-interval are the operations performed in this system. The control centre performed all these operations. The system is managed and operated by a control center whose main duties are to collect all the required information and assign the AVs to serve the transportation requests. The system operates in a fixed time interval basis and each time interval is divided into data collection and duty assignment sub intervals (Figure.1).The data collection sub-interval is longer than the duty assignment one[1].

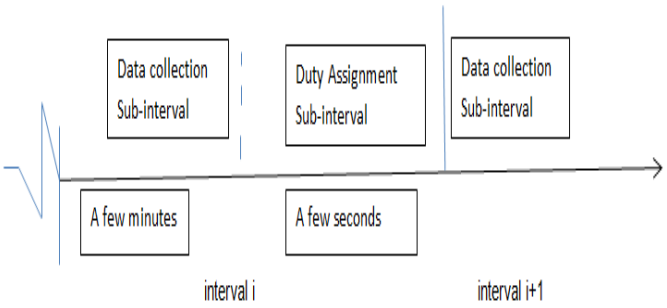

Fig. 1. Operating intervals in the system.

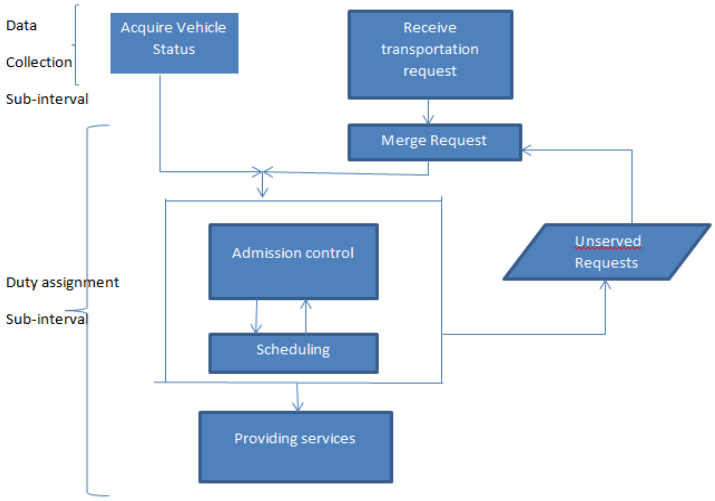

Fig. 2. Operation flow of the system.

Figure 2 explains the operation flow of the system with respect to an operating interval. Customers can also submit their requests to the control center by any appropriate means, e.g., phone calls, mobile apps, etc. After the data collection sub-interval, all the data required to perform duty assignment are ready at the control center.

In the duty assignment sub-interval, the control center processes the collected data and calculate the duty assignment. There may available some incomplete requests incurred from some previous intervals because of their unsuitability in the previous system conditions. They are merged with the newly submitted requests and then all

these requests are considered . The duty assignment further consists of two processes: admission control and scheduling. Admission control checks all the outstanding requests and determines which requests are going to be admitted in the current interval. The unadmitted requests will be reserved for consideration in the next interval again. Any invalid or inappropriate requests are also permanently excluded in the admission control process. We compute the travel schedules of the AVs to serve the admitted requests in the scheduling process.

Scheduling determining the following**:**

I. An assignment of AVs to the requests.

II. The routes of AVs to accomplish the assigned requests.

III. The times by which the AVs should reach particular locations.

Here we assume that all requests being scheduled are admissible , where they admit ability of a request is handled by admission control. Thus all requests will be served by appropriate vehicles after scheduling.If a vehicle is assigned with a request, its schedule settled by the control center needs to satisfy requirements as Complete Route Specification, Time Constraint, Capacity Constraints.

3. ADVNTAGES OF AUTONOMOUS VEHICLE

i. Without the necessity for a driver, cars could become mini-rest rooms. There would be a lot of space and no need for everyone to face forwards. Entertainment technology, such as video screens, could be used to gleam long journeys without the concern of disturbing the driver.

ii. Over 80% of car crashes in the USA are because of driver negligence. There would be no bad drivers and less mistakes on the roads, if all vehicles became driverless.

iii. Travelers would be able to journey overnight and sleep for the duration.

iv. Sensory technology could potentially pereceive the environment better than human senses, seeing farther ahead, better in poor visibility, detecting smaller and bigger obstacles.

v. Efficient traveling also means fuel savings, cutting costs.

vi. Reduced need for safety gaps means that road capacities for vehicles would be significantly increased.

4. DISADVNTAGES OF AUTONOMOUS VEHICLE

i. Driverless cars would be costly for ordinary people when introduced in the market.

ii. Truck drivers and taxi drivers will lose their jobs, as autonomous vehicles increased.

iii. Hackers getting into the vehicle's software and handling or affecting its operation would be a major security issue.

iv. Self-driving cars would be great news for terrorists, as they could be loaded with explosives and used as moving bombs.

v. Human behavior such ashand signals are difficult for a computer system to understand.

vi. If the car crashes ,the fault cannot be detected ,whether it is due to Google/software designer or the owner of the car.

vii. Police cannot interact with the driverless cars especially in the case of accidents and crime.

5. CONCLUSION

In this paper , we introduced new public transporation system occupying Autonmous vehicle. Autonomous Vehicle become performable and can run on the roads. Different vehicular wireless communicatio technologies granted AVs to be connected and respond to instantaneous situations. This constitutes a new form of public transport with high efficiency and flexibility.In This paper, we studied Autonomous Vehicle System Model and Operations on Autonomous Vehicle. Autonomous Vehicle having two major problem : Scheduling and admission control. For solving the problem of Scheduling and admission control Genetic algorithms are used. There are many advantages and disadvantages of Autonomous Vehicle . They are the future of transporation services and provides real time transporation services.

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