Goal-Driven Approach to Optimize Matching Mechanism in Electric Vehicles Ride-Sharing System

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Abstract

Electric vehicles (EVs) play an important role in the automobile market in recent years. And carsharing system is increasingly attracting people's attention. It’s a sustainable and innovative solution to solve transportation issues. Ride-sharing is a car (EVs) service which a person can use a third-party software to arrange a ride. Electric vehicles ride-sharing plays a prime role in shared service because of its environment friendly attributes. Especially, EVs ride-sharing systems offer a high level of travel experience because they provide users with fast and convenient service. In addition, users who participate in the EVs ride-sharing system would share rides to save time and money, and reduce environmental impacts. User matching mechanism is one of the important research issues in EVs ride-sharing system. The current user matching mechanism in EVs ride-sharing system is mainly in the perspective of one single subject, such as the government or rental operators. However, in reality, the EVs ride-sharing mechanism needs to be optimized with multi perspective. We will establish a multi-objective dynamic user matching mechanism in the context of the shared service model in Beijing City. In this mechanism, we consider multi objectives and utilize time windows as constraints which represent customers’ preference. So as to further improve the EVs ride-sharing services and enhance the operational efficiency of shared services model.

Keywords: ride-sharing system; goal-driven approach; user matching mechanism; multi-objective

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1. Introduction

With the world development and the rapid growth of the population, private car quantity is getting more and more. Meanwhile, traffic problems and environmental pollution have become severe issues for the sustainable development of today’s world [1]. In the last few decades, a lot of efforts have been made to find an alternative way of urban transport. Carsharing is the best solution, which is recognized ecological and innovative type transportation pattern. Carsharing is a model of electric vehicles rental where people rent EVs for short periods of time, often by the hour. There are mainly two kinds of carsharing service models: time-sharing and ride-sharing. Their common purpose is to increase the utilization rate of vehicle and replace of traditional fuel vehicle, and further to reduce vehicle usage and improve the environment pollution. However, there are some differences on the demand type and management issues, Table 1 shows the differences.

Table 1. The differences between time-sharing and ride-sharing.

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Demand Type</th>
<th>Management Issues</th>
</tr>
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<tbody>
<tr>
<td>Time-sharing</td>
<td>Transport demand</td>
<td>Imbalance; Dynamic pricing; Location problem</td>
</tr>
<tr>
<td>Ride-sharing</td>
<td>Travel demand</td>
<td>The user matching; Path optimization</td>
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</table>

Ride-sharing is a form of commercial taxi-like service. The vehicles (EVs) are operated by independent company, and users can book service through a matchmaking application platform [2]. In China, ride-sharing service is often referred to as “car pool” or “free ride”, users which have the same itinerary and time arrangement will be arranged in the same EVs. And thus effectively to increase the usage rate of electric vehicles’ seats, thanks in large part to improve the operation efficiency of urban traffic, indirectly reduce traffic congestion, fuel consumption and pollution. In addition, ride-sharing service can make the passengers jointly bear the cost of the EVs. The demand for this kind of service model has a great increase in recent years with the popularity of car travel service software such as DiDi Travel; more and more car owners begin to join the shared services. Participants would share rides to save time and money and, secondarily, to reduce environmental impacts [3]. Fig.1 shows the operation process of ride-sharing service.

Fig.1. The operation process of ride-sharing service.
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