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論 文 要 旨

THESIS SUMMARY

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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

Ridesharing transportation is a travel mode that travelers share their private journey so that more than one person can travel in a single car. It has become an alternative to environmentally friendly travel for their personal trip as it can reduce the resource consumption, air pollution, and traffic congestion by increasing the utilization of the vehicle. In present, the system that facilitates the matching process of travelers so that travelers can find their ridesharing partner(s) in real-time, so-called dynamic ridesharing system (DRS), has been developed even in commercial scale. Even though the DRS has become broadly known, but the lack of user preference consideration in the ridesharing trip arrangement has caused the decrease of ridesharing travelers. This dissertation aims to investigate the characteristics of ridesharing transportation when travelers can rideshare with a consideration of their preference. To gear up for the development of the autonomous vehicle, ridesharing formed among passengers is focused. To achieve the aim, this dissertation develops the ridesharing transportation including the matching method that can take traveler's preference into account, analyzes the consequences and effects of traveler's preference consideration to the ridesharing transportation, and investigates the evolution and long-term characteristics of the considering ridesharing transportation. In chapter one, the background and considering problems of ridesharing transportation are justified together with the explanation of aim and objectives.

Chapter two reviews and summarizes the development of ridesharing transportation, present commercial DRS, and the existing ridesharing-related studies. The studies regarding the matching model and user preference toward ridesharing are specifically reviewed. The existing matching models can be categorized into two types. One is the social optimization (SO)-based model which assigns the matching to travelers in order to optimize the considering social costs. Another one is a so-called behavior-based model which aims to maximize user's utility by modeling user's behavior. Based on the literature, the former one has been extensively developed but without much attention on user preference. On the other hand, the latter one has recently been developed but not in comprehensive aspects.

In chapter three, user preference represented by the discomfort has been incorporated into the simple SO-based ridesharing model as one of the social costs in order to investigate the effects of user preference consideration to the system's efficiency. The considering SO-based model is formulated as an optimal vehicle routing problem using the mixed-integer quadratic programming based on the time-space network concept. The consideration of each social cost factor (i.e., users' discomfort, total travel cost of users, and operation costs of vehicles) is modeled to be adjustable. By using the developed model, vehicles are optimally assigned the route and schedule. In other words, users' itinerary and partner(s) are automatically assigned which optimizes the social costs at the designated level. The tradeoff between users' discomfort and system's efficiency is investigated.

The behavior-based model is developed in chapters four to six. The user's behavior on travel mode and partner choices decisions are considered by assuming that users rationally make these decisions by maximizing individual (expected) utility. Firstly, in chapter four, the user equilibrium model of travel mode choice between ridesharing and solo riding is formulated as a static model regardless of partner choice. The user equilibrium, its characteristics, and travel mode share are analyzed using the graphical representation.

In chapter five, considering the ridesharing between two passengers, the static partner choice is formulated as a one-to-one passenger matching problem regardless of travel

mode choice where all users are willing to use ridesharing system. To model the partner choice of rational users where they are trying to find the most desirable partner, this matching problem is formulated by modifying the stable roommate problem. The result of this matching problem is so-called stable matching. The model's characteristics and effectiveness in terms of system and individual success rates are investigated through numerical experiments. In addition, the stable matching is confirmed to be effective by evaluating with the matching formed by users themselves in the field experiments.

In chapter six, users' rational behavior on both travel mode and partner choices decisions are modeled in dynamics aspects which can represent the consequences of users' decision in within-day context to their learning process in day-to-day context and vice versa. Besides that, the model can tackle the effect of one user's behavior to others' behavior as well as the entire system's performance. The long-term characteristics of the behavior-based DRS are discussed straightforwardly from the developed model and quantified through the numerical experiments. The effects of social factors and user's learning behavior to the long-term DRS adoption are investigated together with the long-term performance of DRS.

Finally, in Chapter seven, the contributions of this research are summarized. The developed models and the investigations are useful for designing and assessing the management policies of ridesharing system, and valuable for implementing the ridesharing system as desire. The possible future research directions are also discussed.