A Distributed ridehailing System in a CAVs Environment

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Abstract

With the growth in world population and rapid development in urbanization, the demand for transportation is continuously growing. To simultaneously satisfy this demand and ameliorate the negative impacts of transportation (e.g. road congestion and emissions), more sustainable forms of transportation need to be conceived. Over the last few years, with the advancement of technology and emerging smartphones, high-speed internet, and new communication equipment, on-demand shared mobility concept (e.g. ridehailing, ridesharing) as a sustainable form of transportation has gained extensive attention. Some benefits of shared mobility systems are decrease in traffic congestion and emissions, decline in parking space demand, and reduction in travel cost. Despite the benefits of on-demand shared mobility and ridehailing systems in particular, there are still some understudied challenges which avoid such systems to be widely adopted. Lack of scalability, computational complexity, privacy and security issues, system outage as a result of hardware/software failure are some main challenges of such systems. To resolve the issues of lack of scalability and high computational time in centralized systems, in this study a new distributed ridehailing system was developed which is based on vehicle to infrastructure (V2I) and infrastructure to infrastructure (I2I) communication. As the case study, the developed distributed system was applied on Downtown Toronto network which is considered a high congested network. The Results show that the proposed distributed system outperforms centralized ridehailing system and significantly reduces the computational time while the matching rate and passengers travel time (e.g. wait time, in-vehicle time) are close to centralized system.

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