UNIVERSITY TRANSPORTATION CENTER

RESEARCH BRIEF

PROJECT TITLE: **Decentralized Autonomous Electric Mobility-on-Demand Services for Individuals with Physical and Cognitive Disabilities**

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INSTITUTION: UNIVERSITY OF IDAHO

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SPONSORS: THE PACIFIC NORTHWEST TRANSPORTATION CONSORTIUM, UI

Background

The urban transportation system has already started to undergo a substantial upheaval, gradually migrating towards being more smart, autonomous and electric. With more than 10 million self-driving vehicles expected to be on the road by 2020, the vision of government agencies (such as USDoT), service giants (such as Google and Uber), and even automakers (such as Tesla, GM, Daimler and BMW) is to further inject more electrification, wireless connectivity, automation, and coordinated optimization on city roads. By 2025, it is expected that vehicle ownership will significantly decline, as individuals will further depend on the concept of autonomous electric mobility-on-demand (AEMoD) services. With customers being no longer required to pick-up nor drop-off vehicles, no hassle/delays/cost for parking, no/low vehicle insurance and maintenance costs, environmentally-friendliness, and full in-vehicle work/leisure times, these AEMoD systems will significantly prevail in attracting millions of subscribers across the world and in providing on-demand and hassle-free mobility.

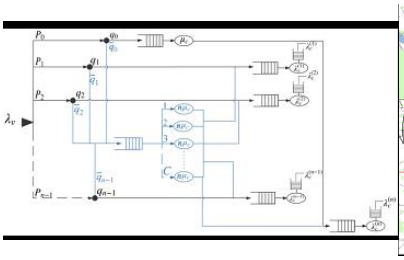
Though being interesting for the wider population, AEMoD will improve the mobility of individuals with physical or cognitive disabilities and their access to safe, reliable, independent, and disability-convenient mobility services. Imagine the achievable boosts in levels of comfort and independence of individuals, incapable of driving for physical or cognitive reasons, when simply pressing some buttons on an app to have a disability-friendly autonomous electric vehicle transporting them door-to-door, in a timely manner, and without any driving responsibilities nor dedicated parking needs.

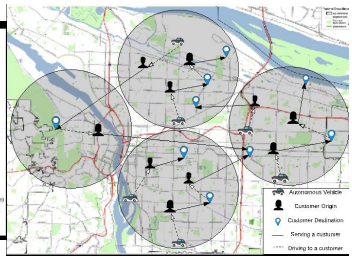
Research Project

To cope with the large volumes of demand on such services in general, and especially for customers with disabilities, this project proposes a new decentralized dispatching and charging framework for AEMoD services, which divides cities into small zones as depicted in Figure 1. Zone sizes will be chosen small enough for the allocated vehicles to customers to reach their positions within bounded delays. Each zone will be managed by a fog controller, which will can efficiently collect information about customer demands, vehicle state-of-charge, and their disability-friendliness in its zone. Given this information, it will make optimized dispatching and charging decisions for these vehicles in a timely manner. The proposed framework will leverage both the IoT and fog computing/analytics/control technologies to provide fast AEMoD services to the targeted city customers. To achieve this goal, this project aims to fulfill two main objectives:

1. Develop rigorous mathematical models to formulate, analyze and solve the IoT and fog enabled joint AEMoD dispatching and charging problems to satisfy different system, battery-level, user-conditions and quality of experience criteria.

2. Conduct a needs assessment with individuals with disabilities to identify the features that guarantee the suitability of the proposed solutions for their needs and maximize their acceptance of such solutions.





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