Thesis Project Portfolio

REINFORCEMENT LEARNING BASED ROUTE AND STOP PLANNING FOR AN AUTONOMOUS VEHICLE SHUTTLE SERVICE IN AN URBAN CITY
&
ACCIDENT RISK LEVEL PREDICTION FOR INDIVIDUALS

(Technical Report)

ANALYZING THE CHANGING RELATIONSHIPS A SOCIETY FACES WITH THE ADOPTION OF AUTONOMOUS VEHICLES

(STS Research Report)

An Undergraduate Thesis

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Sociotechnical Synthesis

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My technical project focused on the route and stop planning for an autonomous vehicle shuttle service in an urban city. As public transportation is quite necessary in busy areas, an AV shuttle can attempt to bridge the gap between transportation services available and the mobility needs of city residents. Existing services such as metro or shuttle buses usually require a driver to run the vehicle along the same routes every day, which can become tedious or tiring. An autonomous vehicle can alleviate this issue, and bring a few other advantages. The technology can allow passengers to attend to other work when traveling, permit many kinds of people to drive (e.g., the elderly or disabled), and improve particularly long or overnight journeys. However, it is important to note other effects autonomous vehicles can have on society as well. My STS research focuses on the shifting relationships between the city residents and potential challenges the city itself must overcome with the adoption of autonomous vehicles.

My technical research includes the analysis of a mobility dataset containing information collected from user cellphone GPS data in Richmond. The project consisted of evaluating four main aspects of the city and its residents to plan the route and stops of an efficient autonomous vehicle shuttle service: the user's everyday routes, vehicle speeds, point of interest, and parking burdens. The everyday routes users take in the city were mapped to find the areas in which people traveled most popularly. The autonomous vehicle shuttle service should visit these areas during the times they are most frequently visited. Vehicle speeds were analyzed to separate car owners from public transportation (PT) users. If users traveled relatively fast from their home, they are more likely to have a car than those traveling slower who are either walking or biking to

a nearby PT stop. The autonomous vehicle shuttle service should have stops near the residences of PT users to benefit them the most. Points of interests were observed to determine the schools, restaurants and government buildings most popularly visited to the city residents. The autonomous vehicle shuttle service should visit the places that are most visited at the best time. Lastly, parking burdens around the city were observed to find the best areas the autonomous vehicle should travel to reduce parking woes the city residents face. My STS research specifically investigates the change in relationships between drivers and their cars, the shifts in perspective from a pedestrian point of view, and adjustments a city must overcome with the adoption of autonomous vehicles. As a driver shifts from using a manually driven car to an autonomous vehicle, the relationship with their car will change as well. Some notable differences include a feeling of privacy in their car as they will be able to take confidential calls or review documents during traveling. In contrast, they may sense a loss of control or autonomy as they will not be the sole regulator of the vehicle. From a pedestrian point of view, their trust in manually driven cars vs. autonomous vehicles will differ as well. In particular, a new method of communication must be instilled with AV's. Lastly, some changes a city must overcome with the adoption of AV's includes the difference in traffic patterns and varied parking configurations.

As mentioned before, autonomous vehicles have many advantages to bring to a city. In particular, the technical research focused on how they can be used as a shuttle service to fit the mobility needs of an urban city. However, it is important to note the negative side effects autonomous vehicles can bring to the city as well. The adoption of autonomous vehicles can bring shifts in relationship between the city residents that is worth noting. In addition, the city as a whole must face various challenges such as traffic and parking patterns that can be preemptively handled if considered earlier.

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