Co-simulation of Urban Air Mobility for Pedestrian Spaces by Integrating AIRSIM and Unreal Engine with SUMO

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Drones are projected to be an integrated part of urban transportation systems and a preferred method for freight delivery in cities. This would then require these autonomous systems to cohabit and share space with humans in city centers. However mixing other modes of transport (like cars and cyclists e.t.c.,) with pedestrians in urban designs are known to cause safety concerns as noted in Shared Spaces [1] studies. In such mixed traffic environments, walking people are required to behave more cautiously when crossing paths with cyclists or vehicles mainly due to the fear of collisions. Due to lesser traffic infrastructure (e.g., bicycle lanes or signals) and reduced rules, people have to primarily negotiate their right of way and cross only after ensuring that vehicles will not cross first. This is stressful for elderly individuals considering their declining physical ability, psychological fears and reduced decision making ability for quick and dynamic environments. While they are expected to look around for crossing cars before making a decision; adding drones would further increase the cognitive overhead to the navigation task. Furthermore, noise levels that would result [2] due to autonomous drones and subsequent distractions to pedestrians due to their flights has been relatively less explored from a safety perspective that is important in this regard. This paper focuses on first completing a survey on current methods of simulating a traffic environment for flying drone in pedestrian populated spaces. Furthermore as noise is an inhibitor to navigation route choices of pedestrians, this work will demonstrate a co-simulation framework on how the SUMO traffic simulation engine can be integrated with AIRSIM. This framework will focus on generating synthetic noise data to model pedestrian behavior with drones sharing space. While SUMO will be used to model the path and movement of vehicles near pedestrian spaces, AIRSIM generates data for synthetic noise and drone flights in the presence SUMO simulated vehicle routes. Lastly as the noise level from autonomous drones highly rely on the chosen flight path along with wind-speeds, 3D sensor data that is required for safety critical route planning and perception algorithms (like object detection) will also be simulated by interfacing Unreal Engine with the co-simulation framework. The key contributions of this co-simulation framework is on identifying how noise and 3D sensor data (Pointcloud and Camera images) of autonomous drone sensors can be synthetically generated to model and influence navigation behavior of nearby walking pedestrians . The potential benefits of agent based modeling [4] , safety critical perception [5] and Augmented reality(AR) [3] to

address the gaps in the above directions will be investigated. The results of this research and the co-simulation framework contributes to understanding how drone flights affect pedestrian navigation behavior in urban cities. This can then be used to devise methods to guiding pedestrians to navigate collectively when being projected with virtual walking paths using AR and drones [6].

References:

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Biography

Speaker Given Name

I am a postdoctoral researcher working at the institute of Informatics at TU Clausthal, Germany with the MEC Lab that focuses on mobility research. My key research focus is on how Augmented Reality (AR) influences navigation behavior in traffic environments like Shared spaces and its safety impacts.