World Academy of Science, Engineering and Technology
International Journal of Transport and Vehicle Engineering
Vol:17, No:08, 2023

A Hybrid Traffic Model for Smoothing Traffic Near Merges

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Abstract : Highway merges and unmarked junctions are key components in any urban road network, which can act as bottlenecks and create traffic disruption. Inefficient highway merges may trigger traffic instabilities such as stop-and-go waves, pose safety conditions and lead to longer journey times. These phenomena occur spontaneously if the average vehicle density exceeds a certain critical value. This study focuses on modeling the traffic using a microscopic traffic flow model. A hybrid traffic model, which combines human-driven and controlled vehicles is assumed. The controlled vehicles obey different driving policies when approaching the merge, or in the vicinity of other vehicles. We developed a co-simulation model in SUMO (Simulation of Urban Mobility), in which the human-driven cars are modeled using the IDM model, and the controlled cars are modeled using a dedicated controller. The scenario chosen for this study is a closed track with one merge and one exit, which could be later implemented using a scaled infrastructure on our lab setup. This will enable us to benchmark the results of this study obtained in simulation, to comparable results in similar conditions in the lab. The metrics chosen for the comparison of the performance of our algorithm on the overall traffic conditions include the average speed, wait time near the merge, and throughput after the merge, measured under different travel demand conditions (low, medium, and heavy traffic).

Keywords : highway merges,traffic modeling, SUMO, driving policy
Conference Title : ICCAV 2023 : International Conference on Connected and Autonomous Vehicles
Conference Location : Montreal, Canada
Conference Dates : August 03-04, 2023