

Computing and Visualizing Taxi Cab Dynamics as Proxies for Autonomous Mobility on Demand Systems.

The Case of the Chicago Taxi Cab System

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Abstract. Despite the expansion of shared mobility-on-demand (MoD) systems as sustainable modes of urban transport, a growing debate among planners and urban scientists regarding what constitutes cost and how to compute it, divides opinions on the benefits that autonomous MoD systems may bring. We present a comprehensive definition of cost of traveling by MoD systems as the cost of the vehicle hours (VH), the vehicle-hours-traveled (VHT), the vehicle-hours-dispatched (VHD), and the vehicle-hours-parked (VHP) required to serve a pattern of trips. Next, we discuss an approach to estimate empty (dispatch) trips and idle periods from a user trip dataset. Finally, we model, compute, and visualize the relationship between the dynamics of VHP, VHT, and VHD using Chicago's taxi cab system as a case. Our results show that the total fleet of taxis in Chicago can decrease by 51% if all trips, currently served by conventional taxis, were served by autonomous ones.

Keywords: Mobility on Demand Systems, Taxi Cab Systems, Data-Driven Dynamic Modeling, Autonomous Vehicles, System Dynamics.