SNS COLLEGE OF TECHNOLOGY
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DEPARTMENT OF MECHANICAL ENGINEERING

19MEZ404-Connected and Automated Vehicles

UNIT I CONNECTED VEHICLE (CV) TECHNOLOGY

Connected vehicle (CV) technology leads to a system in which vehicles can communicate with other vehicles, transportation infrastructure, and other devices with communication capabilities. With increases in data availability, there is a great need for algorithms to process and utilize the data to improve system efficiency and mobility. This study developed an adaptive navigation algorithm based on the data collection and communication functions in the CV based on user cost. To quantify the travel cost associated with different paths, a link cost function was developed to estimate both the link travel time and delay at the downstream intersection. An empirical intersection delay function was derived from stochastic queueing theory models. The developed function can support link cost estimation for interrupted traffic flow on local streets, which has been a limitation of previous navigation algorithms. On the basis of CV communication capabilities, a dynamic navigation algorithm as developed to suggest the optimal paths that dynamically minimize user cost. The developed navigation algorithms were implemented in a microscopic simulation model using VISSIM application programming interface (API) functions. Multiple experiments were conducted to test the CV navigation algorithms in a virtual traffic environment based on the urban street network in downtown Bellevue, Wash. Experiment results revealed that the CV navigation algorithms were effective at reducing user cost in comparison to the static navigation used by non-CVs. The benefits of adaptive navigation algorithms will increase with CV market penetration, and the maximum benefit will be achieved when the CV penetration rate reaches around 60 percent. In the studied network, the marginal benefit of using the dynamic system optimum navigation over dynamic user equilibrium navigation was negligible (e.g., around 1 percent) given traffic flow randomness. Further experiments showed that the developed CV

navigation algorithms can work effectively during non-recurrent congestion by properly balancing historical and real-time traffic information.