Robust Control Strategy for Minimising Energy Consumption of Electric Buses using Cooperative ITS Technology

The introduction of high capacity electric buses to public transport substantially reduces transportation externalities such as noise and harmful emissions. One of the main drawbacks of electric buses is limited range. It can be extended thanks to on-route opportunity charging. We propose a complementary approach based on Driving Assistance Systems (DASs). Specifically, we combine Green Light Optimal Speed Advisory (GLOSA) and Green Light Optimal Dwell Time Advisory (GLODTA) to reduce energy consumption of an electric bus. The former optimises velocity of the bus, while the latter optimises battery-charging time at a bus stop so that the use of charging infrastructure is optimised without affecting service level of the bus. The proposed algorithm is robust to changes of traffic signal settings and the PT traffic. That is, thanks to continues access to Signal Phase and Timing (SPaT) from signal controllers as well as to information about charging requests from other buses the algorithm adapts its approach to the difficulty of the underlying optimisation problem. We also identify the best positions to place recharging stations. The heuristic rules developed in this study are applied to a Bus Rapid Transit (BRT) system. We assume that bus dwell times at bus stops as well as traffic signal timings are known by our system. Provided example shows how adopting speed and dwell time strategies help achieving efficient BRT operations, i.e. energy consumption is reduced and scheduling constraints are satisfied.