Abstract:

This work describes an approach to determine the current travel times on freeways based on the detection and re-identification of Bluetooth devices onboard of vehicles using stationary roadside Bluetooth detection technology. It also aims at using this information for the traffic state determination of a whole freeway network with the goal of a fast and reliable dynamic net control in incident situations. Based on a four year experience in a Bluetooth detector test bed in Northern Bavaria, Germany, and after the evaluation of hundreds of millions of single detections, the technology as well as the developed algorithms for validation and evaluation of the data show their feasibility in practical use, especially in areas with a low density of stationary detectors like inductive loops. The data-driven part of the approach is divided into three subsequent steps. These steps are the determination of travel times, the data filtering and validation of plausible travel times and the automatic incident detection. The determination of travel time is based on the time stamp of the detection of a Bluetooth device with the shortest estimated distance to the position of the Bluetooth detector. For the data filtering the “Time Dependent Comparison to Neighbor Values Filter” will be applied. This filter allows for a fast and reliable differentiation between unrealistic (due to stops, detours, back and return trips etc.) and plausible travel time values for a certain segment of the freeway and is
based on a method to validate if the determined travel time is in a plausibility threshold corridor defined by the values of the previous and the next neighboring travel times. The outcome is a detailed travel time information for the whole freeway network which is used for an automatic incident detection, which was developed and calibrated within this research project. This includes the detection of the start of an incident as well as the end of an incident. The result is continuous information about the prevailing travel times and a fast and reliable traffic state information for all segments, which allows for a dynamic large-scale re-routing in the Bavarian freeway network in case of congestions or other disturbances of the traffic flow.

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