

Title

Multicriteria route planning and delay prediction in public transportation networks

Abstract

Most Intelligent Transportation Systems do not integrate a multi-criteria route planning module with delay prediction in public transportation networks, which can negatively affect the efficiency, reliability and comfort of the system. Therefore, the dissertation examined the impact of such integration on the mentioned parameters.

The first part of the dissertation focuses on the delay prediction in the public transport network using real data from the MPK system in Wrocław. The prediction quality of six methods taken from the literature were presented and studied: the method of current delay propagation, historical travel time, artificial neural network, support vector machine, linear regression and Kalman filter. Then an additional proprietary hybrid method was proposed and studied.

The next part of the dissertation presents the problem of multi-criteria route planning in public transportation networks. Two graph models taken from the literature were presented: an event-based model and a time-dependent model. In order to test the hypothesis, a third model (station model) was proposed, which further reduces the number of nodes in the graph and allows integration of the search module with the prediction module. The research in this part was conducted using real data from the ZTM public transportation system in Silesia.

Finally, the impact of vehicle delay prediction on the quality of route planning in the public transportation network was studied by measuring parameters such as search time, initial processing time, memory requirements, probability of being late for a transfer and average waiting time at a stop.

The study showed that the integration of the multi-criteria connection search module with the vehicle delay prediction module in the public transportation network positively affects the reliability and comfort of the system with no impact on efficiency, which proves the hypothesis.

Keywords

route planning, delay prediction, public transportation network, multicriteria, intelligent transportation system, graphs, search algorithms, prediction algorithms