

Abstract

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Using Transit Vehicles as Probes for Travel Time Estimation on Urban Roads

Obtaining the near real-time information of travel times is a critical element of most applications of Intelligent Transportation Systems (ITS). Instrumenting the roadway infrastructure with inductance loops, cameras and other sensors to obtain travel time data is very expensive leading to an increased data collection cost. The cost becomes even higher if the covered area is large. Hence, cost-efficient approaches for collecting travel time data are highly desirable. This research proposes two models to estimate travel time on urban roads in Greater Cairo using buses as probes. Travel time data were collected using GPS receivers installed on test vehicles and buses that travel along the same urban routes. The cost of GPS receivers is not very high compared to other instruments and hence can be used for large scale deployments of vehicle probe systems. The data were collected at different periods of the day for a comprehensive evaluation. The travel times of bus and automobile were compared in order to explore similarities and differences between the speed profiles. Statistical regression models were accordingly developed to relate automobile travel times/speeds to bus travel times/speeds. The models showed reasonable estimation accuracy taking into account the chaotic nature of traffic in Greater Cairo in addition to the natural variability of travel times. In the first model, average bus speed was used as the dependent variable while average automobile speed was used as the explanatory variable. In the second model, however, travel times were used instead of speeds. Finally, two linear regression models were developed and were found to be the most successful models in terms of their goodness of fit and predictive ability, which the R^2 is 65.9%, and 69.3% for the two models, respectively. The average estimation error of the model did not exceed 17.6% for each run. The developed models could be thought of as an initial step towards the development of a continuous system for collecting and disseminating traffic information to travelers using transit probes data. If such a system exists, it can be used to help traffic management centers in optimizing the performance of the network, especially during congestions. Further research is still necessary to refine the two models as much as possible.