UW CENTRE FOR PATTERN ANALYSIS AND MACHINE INTELLIGENCE

CPAMI SEMINAR SERIES

Design of Predictive and Fuzzy Control Strategies for Public Transport Systems

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Date: Wednesday, May 16, 2012

Time: 4 pm- 5 pm

Place: EIT-3142 **Refreshments will be served*

Abstract :

In the daily operation of a bus system, the movement of vehicles is affected by uncertain conditions as the day progresses, such as traffic congestion, unexpected delays, randomness in passenger demand, irregular vehicle dispatching times, and incidents. In a real-time setting, researchers have devoted significant effort to developing flexible control strategies, depending on the specific features of public transport systems.

In this work, a hybrid predictive control (HPC) strategy is formulated for the real-time optimization of a public transport system operation run using buses. For this problem, the hybrid predictive controller corresponds to the bus dispatcher, who dynamically provides the optimal control actions to the bus system to minimize users' total travel time. The HPC controller makes decisions based on two well-known real-time transit control actions, holding and stop-skipping. The resulting optimization problem of the HPC strategy at every event is Np-hard and needs an efficient algorithm to solve it in terms of computation time and accuracy. We chose an ad hoc implementation of a Genetic Algorithm that permits the proper management of the trade-off between these two aspects.

Additionally, a control scheme is formulated for the same public transport system, based on expert rules and fuzzy logic. That is, the control strategies aim at keeping regular headways between consecutive buses, with the objective of reducing the total waiting time of passengers. The proposed control systems rely on measures of the position of each bus, which are easy to obtain and implement by means of emerging automatic vehicle location devices through Global Positioning System (GPS) technology. The utilized strategies are holding, stop-skipping, and the integration of both. The parameters of the fuzzy controllers were tuned through a particle swarm optimization (PSO) algorithm. The methodology has great impact, and it is easy to implement due to its simplicity.

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