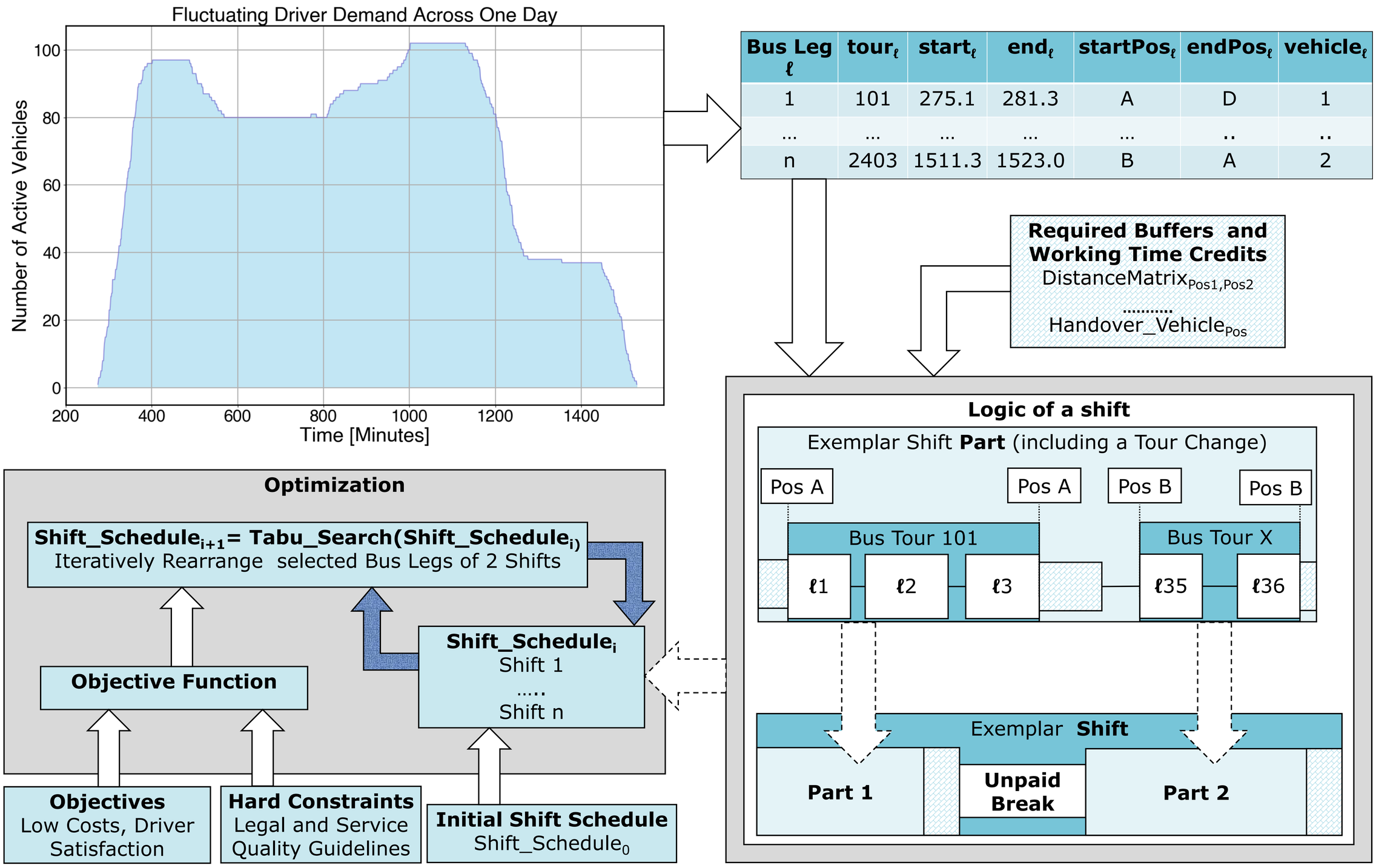
HSLU Hochschule Luzern

Technik & Architektur

Master-Thesis Business Engineering

Shift Schedule Optimization at Verkehrsbetriebe Luzern



The Simplified Bus Driver Scheduling Algorithm

Problem Description

Verkehrsbetriebe Luzern (VBL) is a key operator of Lucerne's public transportation system, offering bus services to commuters. Managing bus driver scheduling within a framework of legal and service quality guidelines is challenging. Inefficiencies in such schedules can lead to increased costs, reduced service quality, and driver dissatisfaction. This problem is a recognized operations research challenge, often referred to as Bus Driver Scheduling Problem (BDSP).

The BDSP is complex, entailing diverse route lengths and timings, fluctuating driver demand across different times, and the need for break rotations. Currently, VBL employs a manual, expertise-based approach for bus driver scheduling. This method faces challenges such as being time-intensive and less flexible, sometimes leading to suboptimal resource usage and driver satisfaction. Consequently, VBL is exploring new strategies for scheduling, aiming for a solution that better balances cost efficiency with driver well-being.

Methodology

The overall quality of a shift can be mathematically modelled as an objective function. The goal of optimization is to discover a shift schedule that achieves a lower score in this objective function, indicating a more efficient and satisfactory schedule. In this work, bus driver schedules are algorithmically generated and subsequently optimized using various objective functions. The Tabu Search metaheuristic is employed for optimization, a method recognized for its effectiveness in addressing large-scale BDSP.

Results

While the developed algorithm successfully optimized shift schedules, the resulting schedules were feasible but unsatisfactory for practice. The design of critical components, such as the objective function, was not sufficiently refined to surpass VBL's current scheduling. Also, there is a need to strike a balance between the speed of optimization and the quality of generated solutions, a difficult task.

By incorporating more expert knowledge into key aspects of the algorithm, one can speed up the optimization process and thus reduce the time required to find near-optimal solutions. This collaborative combination of algorithms with expert knowledge, could potentially improve today's bus driver scheduling process.

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