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Optimization of Bus Dispatching in Public Transportation Through a Heuristic Approach Based on Passenger Demand Forecasting

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Abstract

Bus dispatching strategies are fundamental for urban public transportation systems as they directly influence operational efficiency, allow adequate satisfaction of passenger demand, and optimize the use of available resources. This study develops a dynamic heuristic that integrates passenger demand forecasts, leveraging machine learning techniques within a discrete time horizon. Additionally, a mathematical model tailored to the specific conditions of traditional public transportation systems in medium-sized Colombian non-metropolitan cities is proposed, serving as a benchmark to evaluate the heuristic's performance. A case study conducted in the city of Montería (Colombia) demonstrates that implementing the proposed heuristic achieves operational utility levels comparable to those obtained by the mathematical optimization model, but at a significantly lower computational cost, which is reasonable for practical industry applications. Furthermore, the proposed approach provides adaptability and robustness, making it a particularly effective tool for medium- and small-scale transportation enterprises, enabling operational optimization and enhancing service efficiency.

Keywords
Demand Forecasting, Dispatch Optimization, Dynamic Heuristic, Transport Fleet Management, Urban Public Transport.