SYNCHRONIZING PUBLIC TRANSPORT CO-MODALITY NETWORKS FOR CITY LOGISTICS

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Introduction

• Public transport is widely considered as an ideal to travel around.
• City logistics focuses on improving the efficiency of urban freight transportation while reducing congestion, emission and noise.

Public transport co-modality aims to combine city logistics with urban public transport to ensure a more efficient and sustainable urban transportation system. Most public transport systems operate service that has some common characteristics such as pre-determined vehicle cycle, fixed route and limited capacity. Based on these characteristics, how to make packages delivery plan to synchronize freight flows and transit networks becomes a significant challenge in public transport co-modality.

Co-modality Solution

Assuming that design decisions on the infrastructure are already made and thus a network is already implemented within an urban area. In this network, the bus plays the role of transit for both passengers and express packages at the same time. At bus stops, smart containers used for temporary storage of packages make it possible to exchange packages between bus and bus stop automatically with no disturbance to the movements of passengers.

The bus stop area is divided into two areas: passenger area and freight area. All packages are stored in the physical internet containers which is designed to achieve autonomous loading/unloading.

Objective

This paper considers conceptual and mathematical models in which passengers and express parcels are handled in the same bus network. The problem aims to combine logistics couriers and bus network to respond to a number of packages transport requests in an urban area without any delays, while minimizing the total service time.

Passenger and Freight Sync

Freight on Transit: Fixed route and frequency

Constraints

Objective

To minimize the total freight delivery time

\[
\min \sum_{r \in R} \left( \sum_{l \in L} y_{r,l}^d \cdot a_{l,r}^d - \lambda(r) \right)
\]

Conclusion

An efficient memory-based solution approach is proposed and validated. The effect of the density of freight bus stops on the packages delivery efficiency of the bus network is examined. Numerical studies are conducted to illustrate the analytical observations and provide further insights.