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Optimizing urban freight deliveries: from designing and testing a prototype system to addressing real life challenges

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Abstract

In this article, we present efforts towards building a city-wide freight delivery rounds optimization system aimed at leveraging city traffic information to optimize professional vehicle rounds. This project, called SmartDeliveries, has been developed as part of the OptimodLyon project. We present the system's architecture and general objective. Then we present early evaluations which have led us to identify three main technical challenges to address, but also to quantify the potential productivity gains for its users: 18% in distance savings and 11% in time. This could lead, if the system were to be generalized at the scale of the city, to a reduction in as much as 5% in traffic, and to corresponding savings in emissions, which are the primary motivation of the project leaders. Finally we discuss the remaining challenges to address, from a technical as well as an organizational standpoint, to introduce real life implementation of the system.

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Keywords: round optimization; Intelligent Transportation Systems; city-wide optimization; city logistics.

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1. Introduction

1.1 Context

Traffic management in major cities faces well-known but major challenges. While mobility is directly tied to economic growth and prosperity, road networks are saturated. Costly attempts in the 1960's and 1970's to adapt European cities to massive car influx have yielded negative externalities, demonstrating the lack of sustainability of the approach. The current approaches in Intelligent Transportation Systems (ITS) favour, among others, to rely on better information processing from all the actors involved to develop alternate mobility patterns, for instance encouraging the use of public transports and cycling, or deferring rush hour travels.

OptimodLyon (http://optimodlyon.fr/en/) is a three year project supported by the French agency for the environment, in which eight industry partners, among which IBM, four academic institutions and the metropolitan authority of Lyon (called Urban Community of Lyon) work together to improve urban mobility through better collection, processing and distribution of mobility information. The flagship application of OptimodLyon is a real-time, predictive, multi-modal journey planner. This application lets travellers plan their journey through a combination of car, public transportation and bike sharing with the best available information. The expectation is to enable a reduction of 1% of the car modal share on the city, resulting in saving 25 kTe carbon of emissions per year and significant traffic improvements during rush hours, at a very reasonable cost compared to the amount of public works that are usually needed to obtain similar levels of decongestion.

1.2 Planned, professional urban mobility

Despite environmental concerns, there is a large portion of road traffic that will not lend itself easily to modal transfer. According to the (Academie des Technologies, 2009) report, 35% of road trips carry goods rather than people. If we account for the important portion of movements that involve moving both goods *and* persons to deliver a value added service (such as maintenance and construction visits, catering, sales visits…), an even larger portion of existing road traffic needs to be accounted for. We call this portion of the traffic we focus on "professional urban mobility" and we estimate (counting campaigns performed internally) that it covers at least 50% of daytime urban traffic. Most policies aimed at limiting private vehicle use affect almost equally professional urban mobility, which could impact economic activity negatively. Any policy aimed at limiting the negative externalities of urban car travel must therefore target this portion of the traffic properly.

Businesses are also acutely aware and affected by the cost of mobility and have direct incentives to rationalize it. For instance, fuel represents 18% of the total costs of a small freight operator employing 200 persons (undisclosed personal communication). Current estimates (CERB, 2007) consider that 20 minutes lost in urban traffic amount to about eight euros for such an operator, which represents, by-and-large, its gross financial margin for a half-day vehicle round. We can therefore consider there is a synergy of goals between public authorities and the private businesses in curbing congestion and optimizing trips. The shared objective of both public and private stakeholders is to tend towards the minimization of vehicle-kilometers and time spent on the road.

Our work stems from the observation that a large portion of professional mobility demand is actually *planned*. Somewhere, in the information system of the companies, the intent to move is known in advance, at a close informational distance from an internet connection. If the city can securely obtain this information and use it to improve its traffic forecast, providing in return relevant suggestions that can reduce the cost of mobility, both parties could benefit from this exchange of information.

1.3 Synergy between cities and freight operators

The expected gains of a cooperative data exchange for cities and road users are as follows:

- Freight trip planning data constitutes a new source of information for traffic regulation, providing an advance view of freight mobility, which represents a sizable portion of traffic.