Demo: MAMBA: A Platform for Personalised Multimodal Trip Planning

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***Abstract*—In recent years, multimodal transportation has become a challenging approach to route planning. Most existing planning systems usually rely on data sourced from different organisations, enabling the user to select a limited number of routing strategies. As part of the MAMBA project, developed in Luxembourg until 2017, we have been interested in the potential benefits of multimodal mobility systems. A key factor has been integrated into our studies: the need for a personalised experience at user level, whether when selecting the means of transport or describing user habits (e.g. route style, environment). In this context, we have developed a platform for planning personalised multimodal trips, broken down into the three main modules presented in this demonstration. More importantly, this platform has been developed to facilitate the daily mobility of people in Luxembourg, and considers datasets and characteristics that are specific to this region, which has an exceptionally high volume of daily commuting between Luxembourg and neighbouring countries.**

I. Overview

As shown in Figure 1, the platform we propose is broken down into three main components. At the centre, a multimodal route planner considers multiple data sources and offers users several travel options. This service, which is publicly available online, is directly connected to two other modules. One is a simulation scenario, realised via VISUM, which makes it possible to estimate realistic traffic demand or to generate different scenarios on the fly. The other is a mobile application that allows users to anonymously estimate different aspects of their daily mobility and to personalise the route planner interface. These modules are described in the following sections.

II. Web-based Itinerary Planner for Luxembourg

The web interface is based on OpenTripPlanner, an open-source platform for multimodal journey planning. As illustrated in Figure 2, users can choose between numerous parameters, making it possible to generate a set of routes between several points in the Luxembourgish network. Modes of transport can be grouped, resulting in multiple routes whose efficiency may differ. For example, an off-peak journey will favour the exclusive use of the car, while at rush hour, users may be better travelling by car for part of the journey before changing to another means of transport (e.g. Luxembourg bikesharing system, Veloh).

The system considers four main modes of transport: (i) cars, where the user can choose between different types of routes and schedules; (ii) the bus system, which considers real schedules and a maximum walking distance; (iii) personal bikes, where the user can choose between different types of path; and (iv) the Veloh bike-sharing service, which considers available stations in real-time. It should be noted that the system also considers other parameters when calculating routes, such as the availability of parking spaces.

This platform is available online[1] and offers a set of features that differ significantly from those offered by conventional planning systems, such as the Analyst described in Figure 4(b).

A. Travel time estimation

Although live road traffic states can be retrieved from existing APIs (e.g. Google Maps API), we have chosen to link the OpenTripPlanner to a traffic model. This gives us the opportunity to explore several scenarios on the fly and also to

[1] http://otp.mamba-project.lu

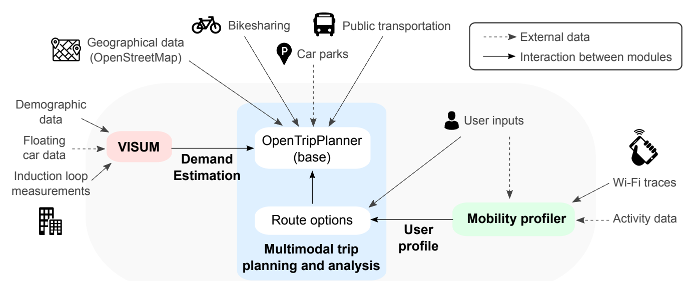


Fig. 1. Overview

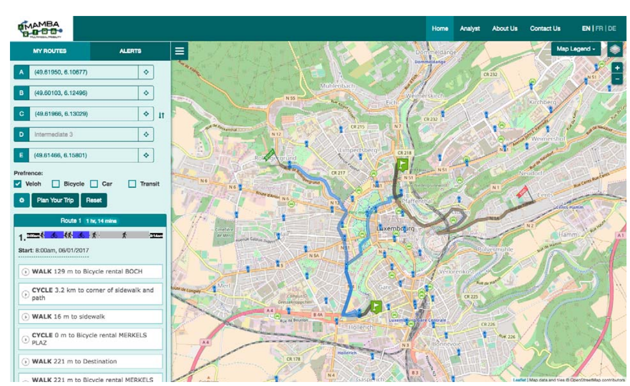


Fig. 2. Web-based Itinerary Planner

evaluate the ability of the system to react to certain situations that in reality are unlikely to arise.

The implemented traffic model is composed of four interconnected sub-components: Demand Modelling, Departure Time Choice, Demand Estimation and Travel Time Prediction. While the demand has been created from scratches, the interaction with the transportation network has been modelled through PTV VISUM. Thanks to the newly created Luxembourguish open-data portal[2], an origin-destination trip table for the morning commute has been estimated by coupling the well-established Four-Step demand model [1] and a departure time choice model [2]. In addition, a Matlab package for calibrating the demand using PTV Visum as traffic simulation model has been developed. This package allows performing the calibration of the demand using different models (e.g. [3]. Once that both the network and the demand have been properly adjusted, PTV VISUM is used to estimate the travel time for each road segment, for both private and public transport. These travel times are combined with historical observations in order to provide real time travel time estimation. The system is depicted in Figure 3.

B. Mobility Profiler

The last piece of our platform is an open-source mobility profiler developed for Android[3], whose first version was presented at *SenSys'16* [4]. This personal mobility assistant allows a user to keep track of his or her daily mobility. It uses privacy-friendly data and methods, obtained thanks to the combination of Wi-Fi traces and activity detection, made available independent of any personal information. In addition to monitor easily-accessible information such as number of steps and user preferences, the application also collects anonymised Wi-Fi access points and creates a graph database, allowing to identify distinct places and mobility behaviours. Exploring graph properties leads to the generation of interesting metrics, such as the number of visited locations, their type (e.g. urban, rural), the level of physical activity, etc. The interested reader can refer to [5] where we compare mobility and graph theory metrics.

In addition to being a personal mobility assistant, this application can directly connect the user to a mobile version of the OpenTripPlanner (see illustrations in Figure 4).

III. Use-Case & Demo

The demonstration presented during the conference will cover the three aspects discussed above. In particular, it will demonstrate how the route planner can respond to different traffic demands while respecting the preferences imposed by the user. In this context, a showcase scenario will be presented, allowing the audience to discover the challenges of mobility in Luxembourg, and showing the characteristics and datasets used by our platform. In addition, future challenges and possible perspectives will be discussed (i.e. implementing new datasets and services, considering other urban areas).

[2] https://data.public.lu

[3] https://github.com/mamba-project/mobility-profiler

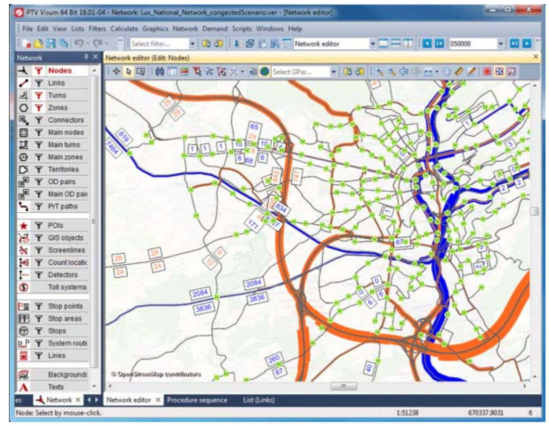
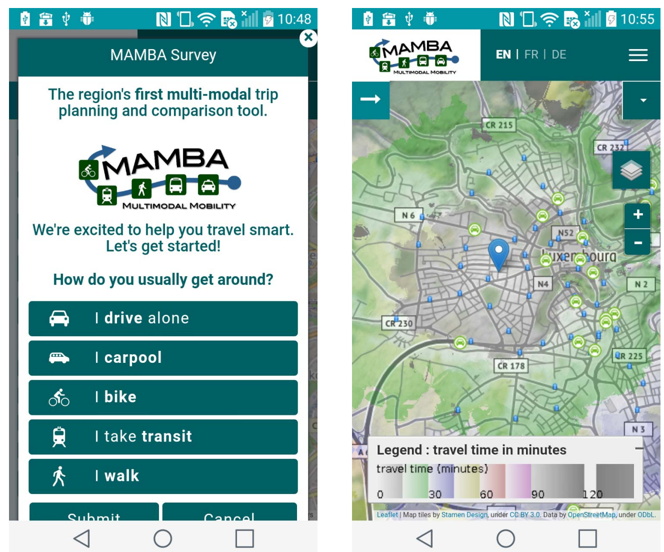


Fig. 3. The multimodal network of Luxembourg Implemented in VISUM



(a) OTP (b) Analyst

Fig. 4. Mobility Profiler

Acknowledgment

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