TEMPUS – SMART MULTIMODAL JOURNEY PLANNER FOR URBAN MOBILITY

Overview

Urban mobility is a central issue for political, environmental and economic stakeholders. Promoting the multimodality, that is to say the combined use of various transportation ways - including the car -, appears as one of the main answers to networks saturation in big cities.

As a fully multimodal routing system based on time-dependent travel times, TEMPUS (Multimodal Routing in Time-dependent Network for Traveler’s Information) gives travellers the best modal combination for one’s journey and therefore aims at optimising transport networks.

A prototype is under development by IFSTTAR (French Institute of Science and Technology for Transport, Development and Networks), OSLANDIA and CETE de Lyon. The benchmarking tool should be fully operational by 2013.

Background / objectives

Mobility in urban areas

The operational goal of the TEMPUS project (Multimodal Routing in Time-dependent Network for Traveler’s Information) is to increase the quality of the information given to urban network users through the development and implementation of a comprehensive multimodal trip planner. The main feature of a trip planner is to propose to users the best itinerary between a point A and a point B. TEMPUS is a fully multimodal routing system, based on time-dependent travel times, that allows a traveller to optimise his/her journey over a urban area. Such a system can help people make more rational mode and itinerary choices. Moreover it can contribute to a better dispatching of transport demand between the different modes and over the whole network. The potential benefits are both congestion reduction and a limitation of environmental emissions.

Since the travel time optimisation of one trip may be different from the travel time optimisation of all trips made within a day, TEMPUS deals with the issue of chained trips optimisation: for example if to go to work one leaves his/her car in a park-and-ride facility, he/she will not be able to use it if he/she wants to go to a meeting elsewhere afterwards – unless he/she goes back to the park-and-ride.

To achieve the fastest multimodal route, TEMPUS also integrates all modal interface times, such as the time needed to search and park a vehicle, which is barely taken into account by journey planners.

Moreover, in a multimodal context, it is particularly relevant to evaluate the uncertainty associated to a travel time. Indeed, inside a multimodal trip, transfers are critical points (e.g. arriving a few minutes late at a public transport stop may result in an important increase of the total travel time as the connection is missed). That is why one focus of this project is to evaluate the uncertainty level associated to each individual component of a multimodal trip. This raises some methodological issues that are undertaken within this project.
Approach / project description

TEMPUS description

The TEMPUS plateform is a Multimodal, dynamic and "door to door" information for planning and dynamic route guidance. The functional structure of TEMPUS is given figure 1.

Dynamic travel time estimations are embedded as well as specific methods for multi-modal route algorithms. TEMPUS can perform one-way trip optimisation, model turning movements on the road network, model intermodal transfers and sort solutions according to other criteria (cost, mode transfers).

Results / Evaluation

Technical description of the prototype

TEMPUS is an open source C++ framework built on a plugin-oriented architecture that enables users to develop their own algorithm of graph traversal. Part of the TEMPUS’ API is exposed in a language-agnostic way through a WPS server. A graphical interface that allows to easily build itinerary requests and configure TEMPUS plugins has been developed as a Python plugin for Quantum GIS. The main data structure in TEMPUS is the multi-modal graph (figure 1) that is composed of a road graph, public transportation graphs and other points of interest (like shared car or shared bike points, parking facilities), which are all linked to a particular edge of the road graph. Static data are stored in a PostGIS database. A set of scripts gives the ability to import into this database a wide range of data for road or public transportation stored in other formats (NavTeq shapefiles, OSM, GTFS). TEMPUS can then load data in memory from a TEMPUS schema in a PostGIS database. The in-memory structure maps the structure on disk and is built as Boost Graph Library (BGL) compliant graphs. A TEMPUS plugin is designed to serve a user request of itinerary planning and may return roadmaps of resulting itineraries. TEMPUS’ API, in addition to its C++ API, is exposed through the implementation of a web service that complies with the OGC’s Web Processing Service standard. Every newly created TEMPUS plugin is directly requestable through a WPS request, without the need for an additional compilation. TEMPUS is written in portable C++ and has been tested on GNU/Linux and Windows platforms. Platform-dependent code is only used for hot-pluggable plugins.

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