Available online at www.sciencedirect.com

ScienceDirect

Transportation Research Procedia 5 (2015) 30 – 43

Transportation Research Procedia

www.elsevier.com/locate/procedia

SIDT Scientific Seminar 2013

Individual behavioural models for personal transit pre-trip planners

Agostino Nuzzolo [a], Umberto Crisalli [a] *, Antonio Comi [a], Luca Rosati [b]

[a] Department of Enterprise Engineering, Tor Vergata University of Rome, via del Politecnico 1, Rome 00133, Italy
[b] Department of Civil Engineering and Computer Science Engineering, Tor Vergata University of Rome, via del Politecnico 1, Rome 00133, Italy

Abstract

This paper presents the results of an in-progress research project aiming to define an advanced trip planner for transit networks. Starting from the description of user needs and logical architecture of the trip planner, the paper describes the module to support the user with pre-trip information based on his/her personal preferences. In particular the theoretical aspects of the individual, instead of user group (aggregate), path choice modelling used to support path choice set individuation, path utility calculation and user preference learning process are defined. The theoretical framework has been applied and tested through some experiments carried out on the public transport network of the metropolitan area of Rome.

Peer-review under responsibility of the Società Italiana dei Docenti di Trasporti (SIDT).

Keywords:
ATIS; transit trip planner; personalized advice; personalized pre-trip information; user preference learning process; incremental learning

1. Introduction

For many cities, making public transit more attractive, faster and more efficient is a key rule for increasing modal shift from private to public transport. Transit agencies continuously explore new ways to maintain existing passengers and to attract new ones. Providing static and real-time transit information using new strategies is becoming a priority in many transit agencies around the world. These strategies include the use of new technologies

* Corresponding author. Tel.: 39-06-72597053; fax: +39-06-72597053 .
E-mail address: crisalli@ing. uniroma2.it

2352-1465
Peer-review under responsibility of the Società Italiana dei Docenti di Trasporti (SIDT).
doi:10.1016/j.trpro.2015.01.015

such as internet and wireless mobile to disseminate traveller information on transit services to make them more user-friendly (TRB, 2003; Rizos, 2010).

In recent years, the evolution of Intelligent Transport Systems (ITS) has allowed the development of support systems that help transit agencies in the arduous tasks of planning and managing transit networks increasingly complex and integrated to satisfy the growing mobility needs of users. Today, transit users expect to have a quick and always available comprehensive information about multiple modes (including traffic information) coming in one place or from one source, and on a variety of media.

The more general example of traveller information systems, which can be defined under the umbrella of ITS, are the Advanced Travel Information Systems (ATIS) from which, the branch dedicated to transit are represented by the Advanced Transit Traveller Information Systems (ATTIS). An ATTIS is a specialised information system able to access, organize, summarize, process and display information to help users to plan their individual trips. It may cover a single mode of transport (e.g. bus) or many transport modes for an intermodal journey (e.g. car, bus, metro, rail, including different transit services operated by different transit companies). ATTIS overcome the historical function of route planners, which has traditionally covered just the "route", showing a path by which it is possible to travel between origin and destination at any time; in contrast ATTIS take also into account the transit timetable of services (scheduled, historical or real-time) that run over the network only at certain times, and so the time of travel is relevant when computing a trip.

Advisory tools, such as trip planners, can be considered part of ATTIS. They allow user to easily access to organized information in order to compare the different alternatives for a rational choice of the transport mode (Caulfield and O'Mahony, 2007). As the main reason which leads to reject transit as travel mode is the uncertainty about routes and timetable, transit trip planners have to provide accurate pre-trip information to reduce this uncertainty. The state-of-the-art presents many papers (Adbel-Aty, 2001; Kenyon and Lyons, 2003; Grotenhuis et al., 2007; Tang and Thakuriah 2011; Zhang et al., 2011) that demonstrate the added value of ITS (Intelligent Transport Systems) to improve transit ridership.

Trip planners usually refer to applications through which user can self-access the ATTIS using an user-friendly interface on computers or mobile phones connected to internet, which enable a path search engine for a given origin and destination able to find the best travel alternatives (paths) on transport networks including their relevant information, such as travel time, monetary cost, estimated departure and arrival time, service characteristics, alerts, disruptions. Path search may be optimised on different criteria (e.g. fastest, shortest, least changes, cheapest) and may be constrained to a certain time (e.g. a desired arrival time at destination or a desired departure time from the origin) or to avoid certain waypoints.

ATTIS and relative traveller tools mainly depend on two important characteristics (Levinson, 2003; Toledo and Beinhaker, 2006): data used as the inputs to the computation (static or real-time) and time in which the user receives information, i.e. pre-trip and/or en-route (TRB, 2003; Rizos, 2010).

Static traveller information systems are based on information about the transit network, such as distances, commercial speeds, classification of road facility types and scheduled timetable of all transit services that are defined as planned and that do not consider fluctuations due to unplanned events. An evolution of static information is represented by the updating of such information with the historical one derived from a historical database that represents past traffic conditions. Even if the use of historical information captures the average prevailing transit performances and operations, it does not capture the fluctuations in demand and supply generated by unexpected events.

Real-time traveller information systems allow us to overcome the above limits, as they are based on real-time estimates of current travel times. These estimates are based on traffic information collected by different sources, such as AVL (Automatic Vehicle Location), FPD (Floating Passenger Data), and in the new era of social media by crowdsourcing, too. In contrast with static information, the data analysis is done in real-time, which sets higher computational requirements on models and algorithms for path search. In fact, the real-time computation is more elaborate and involves not only estimation of current conditions but also the use of these estimates as inputs to methods that predict short-term future traffic conditions and non recurrent congestion. In such cases the accuracy of ATTIS strongly depends on the reliability of forecasting methods (Ben-Elia et al., 2013). The information provided at this level captures the effect of time-varying demand and supply due to planned (e.g. maintenance work) and unexpected events (e.g. incidents or disruptions). The generation of information may use statistical or data-based