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A method to assess and plan applications of ITS technology in Public Transport services with reference to some possible case studies

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ABSTRACT

The paper deals with ITS (intelligent transport systems) for public transport (PT) services management, as key component of the wider "smart mobility" concept.

It is mainly a methodological contribution and describes the risks and motivations for which the introduction of ITS in PT could result (partially or completely) unsuccessful since some of the planned objectives are not achieved in terms of performance, cost savings and user/citizen benefits. This can be caused by an overestimation of the role and positive impacts of technology of some component and by poor user requirements analysis carried out in feasibility phase. In fact, functionalities of ITS should be defined according to the specific objectives of PT Operators or Authorities and adapted to the specific operational scenarios and organization contexts in which the system must work. It is further shown that ITS are generally made up by some subsystems and the overall performance is the result of interaction between them.

The paper firstly analyses the current technology scenario for urban mobility and transport, and underlines that the technology alone may be often insufficient to cope with transport services requirements; secondly, highlights the key role of the feasibility study and user requirements analysis for singling out the sub-systems making up the overall system and for the design of technical, functional and operational specifications for any ITS application. Finally, some relevant possible case studies in order to show composition of some ITS applications, encountered problems and how to cope them are described and discussed.

1. Introduction

In Public Transport (PT), ITS can play a primary role to guarantee a high level of performance and quality of transport services. Despite their potentials, in some cases, the introduction of intelligent transport systems (ITS) is (partially or completely) unsuccessful since some desired objectives have not been achieved in terms of performance, cost savings and user/citizen benefits. This is often caused by a poor engineering project overestimating the positive impacts of technology and by the insufficient user requirements analysis carried out in the feasibility phase. Though it seems obvious, it is not completely accepted or shared that the functionalities of ITS should be defined according to given objectives of the specific Transport Operator or Authority and tailored to the specific operational scenarios and organization contexts (role of the different actors, legacy systems, transport services characteristics, etc.) in which it must work. ITS improve the quality of PT service only when supported by a proper organisation and by an effective day-by-day operation (TCRP, 2006).

In fact, the operative and organizational scenarios for transport operations are different service by service, context by context, and they are also dependant on transport network and on the demand side which changes dynamically (day to day and within day). In fact, generally, when an ITS technology is applied to a wide range of transportation scenarios it does not guarantee by itself successful results in all of them. The application of technology, in general, requires a specific study, called feasible study since it analyses if and how a certain application can be realized and supported by an adequate organization and operation framework (as explained better in the following sections). This is particularly true in Public Transport (PT) applications characterized by different very dynamic in time and space factors. This may look obvious or trivial but there is not yet an adequate understanding in PT applications of the needed design process that should be

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developed before the procurement or the realization process. Each application has its own crucial concerns, and a proper skill and tools should be prepared, together with a list of indicators and critical working ranges, in order to measure and assess the successful of the system realization and operation.

The paper is based on the long experience earned in the last two decades on the ITS field for PT, especially but non only, in the European Community and its purpose is twofold: firstly, it analyses current technology scenarios for urban mobility and transport, underlying that technology alone may be often insufficient to cope with transport service requirements; secondly, it highlights the role of the feasibility study and user requirements analysis for any ITS application, not only for designing the related technical, functional and operational specifications but also for identifying the support conditions and the operation and organization dimensions.

Section 2 reports the glossary for some most used terms in this field.

In Section 3 we present the ITS scenario, the state-of-the-art market and the weakness (both at demand and at offer side) which can affect the implementation and the operation of ITS systems (CODE, 2000). At the end of this section we describe also how technologies are affected by operational issues and how these issues can impact on the achievements of the planned targets.

Section 4 analyses the needed requirements for designing applications for transportation systems and the role of the feasibility study; in Section 5 indicators for measuring system's performances are proposed both for technical tests as for contract management; finally, in Section 6 the conclusions are drawn.

Examples are concerned mostly on the AVM (automatic vehicles monitoring) system which can be considered the core component of managing and controlling PT services, guaranteeing the increase of reliability of services, the management of irregular cases with the provision of appropriate information to users and the availability of data on the weakness of operated services in order to tune the planning and to improve the effectiveness of service operation.

2. Glossary

In this section the meaning of some terms related to ITS applications with a particular focus on PT is reported.

2.1. AVM (automatic vehicle monitoring)

It is a means for automatically monitoring many quantities about a moving vehicle. This data, from one or more vehicles of PT, may then be collected, to monitor also the transport service.

2.2. BRT (Bus Rapid Trasport)

It is a bus-based mass transit system. A true BRT system generally has specialized design, services and infrastructure to improve system quality and remove the typical causes of delay. Sometimes described as a "surface subway", BRT aims to combine the capacity and speed of light rail or metro with the flexibility, lower cost and simplicity of a bus system

2.3. Evaluation criteria

A benchmark, standard, or yardstick against which accomplishment, conformance, performance, and suitability of an alternative, activity, product, or plan, as well as of risk-reward ratio is measured.

2.4. Failure

The condition or fact of not achieving the desired end or ends, or of being insufficient or falling short, or a cessation of proper functioning or performance, a decline in strength or effectiveness.

2.5. Feasibility study

A Feasibility study represents the first step for analysing and defining the objectives and the requirements of service and of agency or operator in the case of PT services, in order to designing the main relevant functionalities and performance to be required to the system. It provides a description of the product or service, accounting statements, details of the operations and management, needs and requirements. Moreover the organization framework, support conditions and the overall costs (investments, management and maintenance) are also aspects to be faced. Generally, feasibility studies precede technical development and project implementation.

A feasibility study evaluates the project's potential for success; therefore, perceived objectivity is an important factor.

2.6. ITS (intelligent transport system(s))

It refers to advanced ICT (information and communication technologies) applications which aim to provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks.

2.7. Scenario

It refers to an expected or actual situation or sequence of events, or processes or elements.

2.8. Smart mobility

Smart mobility aims at moving people and freight while enhancing economic, environmental and human resources by a convenient and safe multi-modal transport system, speed suitability, accessibility, management of the circulation network, and efficient use of land.

3. Its scenario

3.1. ITS framework For Urban Mobility Governance

All actions and services for mobility governance can be presently supported by a technological system, based on an ITS (intelligent transport systems) platform and devices (SUTP, 2005a, b; Ambrosino et al., 2013). Possible fields of PT (Public Transport) application are many and a reference list can be found also in Ambrosino et al. (2014).

All these systems are largely introduced and operating in metropolitan and urban contexts at different levels (Bělinová et al., 2010). Sometimes, an appropriate strategic view for the integration between planning and operations is lacking and there is also an unclear identification of objectives and targets to be achieved through mobility governance and ITS implementation.

Despite more than two decades of very extensive European Commission supported R&D initiatives in ITS (previously only 'Information Communication Technology in Transport") and in passenger transportation, there is no comparable repository of European reports and research results yet neither in terms of solutions nor in terms of the level of fulfilment of planned targets,