The Use of ITS Technologies - Solutions for the Traffic Flow in Large Urban Areas and the Increase of the Public Transport Quality

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Abstract: - This is a sample of the format of your full paper. Use Word for Windows (Microsoft) (or equivalent Word Traffic congestion is one of the most burning problems of the authorities from the cities of our country. An effective solution in the cities of Western countries and the U.S., is the implementation of intelligent systems for traffic management. This encourages the use of public transport to the detriment of individual transport, in this way the traffic congestion is eliminated and decreases the amount of pollutant emissions. Such a system could be effective for major cities from Romania.

In this paper is presented a system of traffic management services using the facilities for automatic vehicle location (AVL) and data on the graphic of their travel in order to optimize their functioning. There are also presented efficient solutions, from the ITS sphere, possible to be implemented in urban public transport from our country.

Key-Words: - urban public transport, intelligent systems, traffic flow, ITS architecture, WAP.

1 Introduction

Intelligent Transportation System (ITS) represents the concentration of a variety of modern technologies from the IT & C services in the field of transport, in order to increase its safety and efficiency, to increase the level of confidence of users and to create a more pleasant environment without the need to modify the already existing physical transport infrastructure.

The wide field of technologies involved includes sensors and devices for signals control, modern communications surroundings and information terminals, and crosses disciplines such as transportation, engineering, telecommunications, computer science, finance, electronic commerce and automobiles manufacture.

ITS is a global phenomenon aimed to increase the benefits of both public transport as well as the privates ones. Intelligent Transport Systems help to minimize travel time, both for urban public transport users and also for the drivers which are using their personal cars. ITS also have a significant contribution to reduce pollution and helping to create comfortable conditions for travel.

2. ITS Architecture

Through the definitions given to the intelligent transport systems it can be noticed that in order to accomplish the functions required for these systems is necessary to integrate different kinds of systems into an unique system. Intelligent Transport Systems are integrated systems, of high complexity; this involves a specific approach in its design and development.

The complexity of Intelligent Transportation Systems generates the need for a definition and the accomplishment of an ITS Architectures. The complexity of the ITS systems can be viewed from different points of view:

- The ITS systems are integrated systems (and large systems with many subsystems and components). So that the integrated system, as a whole, must be more than the sum of the component elements;
- There are many cooperative relations between the many participants in such systems (the participant is understood as that economic entity, natural or legal person, that wishes to develop such systems - local authorities, infrastructure operators, who actually develop ITS systems - suppliers components, suppliers of infrastructure elements, who use the intelligent transport systems - passenger, freight carriers and who settle the ITS field - government, the European Union)
- Commercial interests of different kinds: public and commercial services;
- The existence of multidisciplinary activities: software, electronics, traffic engineering, communications, information technology etc

All these issues presented above make almost impossible the design and the development of intelligent transport systems without defining an ITS Architecture. This architecture should ensure both the definition of
specifications regarding the communication between ITS subsystems and also a common conception over these subsystems, without which it can’t be spoken about a consistent integration of the system that it contains.

The objectives of the definition and development of Intelligent Transport Systems Architecture can be grouped into two categories:
- to facilitate the understanding both of the problem and of its solutions;
- to be able to present the whole (intelligent transport system);
- to meet the aspirations of the participants in the development of such systems;
- to provide a stable basis for the design and the development of ITS systems, to meet the aspirations of those involved in developing such systems;

Given these objectives, ITS architecture can be defined as a level which describes the integrated system as a whole and offers the understanding of what the system can offer, through its functions and components.

ITS architecture is built on the participants aspirations (the user needs) in ITS development and is used to:
- Defining organizational elements;
- Establishment of programs for conducting the implementation of Intelligent Transport Systems;
- Definition of infrastructure specifications and systems components;
- Establishment of risk analysis development of such systems;
- Achieving cost / benefit analysis

3. ITS – Solutions in urban public transport
A flexible and quality urban public transport is difficult to conceive without the implementation of intelligent transport systems - ITS. The component elements of integrated intelligent transportation systems in the public urban transport, evaluated within the analysis performance of ITS are:

**Real-time information about urban public transport services** offered to citizens through Internet, mobile phone or other mobile devices via short message service (SMS), through wireless application protocol (WAP) or other services.

**Electronic display** installed in buses, trolley, trams and stations, which displays the remaining time until reaching the next stop, links with other means of public transport or waiting time until the arrival of the next means of transport.

**Electronic billboards**, on which is included information about routes, the price of travel tickets, travel schedules of the means of transportation, real-time information about traffic events, so one.

**Screens with lights** installed in vehicles of urban public transport, which displays the text information in real time from traffic control centers, audio devices, through which a voice announces the next stop.

![Fig. 1: ITS solutions applied in urban public transport](image)

**Vending machines for the sale of tickets**, installed in stations which can accept as a means of payment the credit card.


**Security and safety systems**, especially represented by video cameras installed in public transport means and in stations, to prevent acts of violence, robbery or destruction.

**Other information services for the passengers**, such as displaying the current location of the vehicle, the distance between stations, providing information on parking for those who use their own means of transport.

These are the main ITS solutions, used in practice to modernize and streamline the system of urban public transport. Not always, the application of these solutions will lead to increased quality and efficiency of urban public transport. Thus, if these are implemented without a comprehensive analysis of actual traffic situations, it can have a negative impact upon the system. In general, ITS, according to the purpose for which it is used can be categorized: ITS for individual transport, ITS for commercial vehicles, ITS for infrastructure and ITS for urban public transport.
Starting from the generic architecture of intelligent transport systems and particularizing for the cases of a line of means of transportation, an ITS can be split into the following parts:

**The traffic management**

This system uses the services for automatic vehicle location and data on the graphic of its displacement, in order to optimize its exploitation. Data on the position of vehicles for transporting passengers are provided with precision by GPS devices. Also, on the computers installed in the vehicles are stored information relating to the chart of their journey. The driver of the vehicle has permanently information regarding the adherence to schedules travel and exchanges information in real time with the control point via a mobile terminal, especially when changes in the traffic conditions occurs.

**System priority over traffic signals**

When the computer on the board of the vehicle indicates deviations from the graphic of displacement, it generates alerts, and emits infrared signals to the traffic signals manager, requesting priority over traffic signals. Thus, based on some installed sensors before and after the road junction, is determined the vehicle position in the intersection and the traffic signals manager, where appropriate, he reduces the duration of the color red of the light traffic, or extends the duration of the color green.

**The information of passengers in real time**

Based on information received from GPS devices, updated in real time it can be achieved correct information of the travelers by displaying dynamic messaging in the vehicles and stations, and on the Internet before traveling.

Thus, the integration of traffic control systems, of management of public transport passenger, and of information makes possible:

- Settlement of public transport services by providing priority over the traffic signals
- Increased use of public transport to the detriment of the individual transport with effect on reducing the quantities of pollutant emissions;
- Allows drivers of vehicles to avoid congestion and to quickly find free parking places
- Allows travelers to compare information from different means of transport before traveling
- Provide information which allow passengers to change travel plans when incidents and interruptions occurs;
- Control access to urban area through various forms of charging the users.

4. The application of ITS solutions in the **concrete phases of travel**

ITS are useful during a journey from the planning phase until its end, as it can be seen in the following figure:

**Planning phase of the journey** – ITS role in this phase is to facilitate the access to primary information about travel, such as: where they are, where they are going, what ticket to buy, where to park when they get there. This information is provided, depending on the circumstances, through the Internet or wireless technology using SMS.

**Parking Phase** - This phase is very important if during the journey it is combined the means of public transportation with the personal means of transportation. Here ITS role is to guide traffic participants in finding optimal solutions to avoid the creation of congestion in congested areas. For this, ITS provides real-time via SMS, data on: parking, the number of seats open, the price of parking, near subway stations, so one. Drivers receive information on these devices installed on the board of the vehicles. For the parking payment, you can use portable devices that integrate Bluetooth technology.

**The waiting phase of the means of transportation**

During this phase, the information refers to: the place from where to purchase tickets, its prices, routes and travel conditions. The access is made through information points located in the stations, equipped with touch-screen links and adapted in order to be useful also for the people with special needs. ITS, in this phase also include vending machine for the release of tickets, where the payment can be made by card. There are either touch screen monitors or vending machines, which indicate the sequence of steps which should be followed in order to purchase tickets, namely selecting the type and number of tickets, select your destination or the distance corresponding to the display price,
including discounts for students, students, retired, the 
opportunity to cancel the transaction before paying, 
choose the mode of payment, and the delivery of the 
ticket and the change.

**The access phase in the means of transportation** – ITS 
acts in this stage especially over the technology 
verification and validation of tickets or travel cards. 
These technologies are represented by electronic devices 
installed in the means of transportation, able to identify 
the ticket validity, to display text messages, regarding 
the number of trips remaining, the expiring date of the 
tickets and so one.

**The transport phase** - ITS use is related to informing 
passengers inside the vehicle. Usually, it consists in the 
installation of monitors or electronic billboards, where 
are displayed in real-time, information received from the 
centers of traffic, regarding the situation on the 
respective route, the links for multimodal journeys, 
delays, so one. Independent of the traffic conditions, on 
the monitors runs news channels, music clips, thus 
enhancing the attractiveness of travel. Another use of 
ITS, at this level, relates to video surveillance systems 
installed in the vehicles, which helps to increase travel 
safety and a rapid identification of offenders.

**The connection phase with other means of 
transportation** - For multimodal urban public transport, 
the ITS role is to facilitate linkages. Very important is to 
inform passengers on the real-time traffic. To have this 
information, the vehicles are equipped with GPS 
devices, computing devices. The traffic controller has 
reception RDS devices (Radio Data System), display 
sites and aerial display. In principle, ITS solutions used 
here, coincide with those from the waiting phase of the 
means of transportation.

5. Conclusions

A systematic application of intelligent transport 
systems, significantly increases the attractiveness of 
urban public transport use, reduces negative impacts on 
the environment by reducing the quantities of pollutant 
emissions, and results in a significant savings of time for 
participants. These intelligent transportation systems 
require sustained financial efforts for implementation. 
Particular attention is given to all the details from the 
cost-benefit analysis. A high cost of implementation 
involves results as: comfort, minimum waiting time, 
eliminating congestion, reducing pollution, reducing the 
use of individual transport at the expense of the public 
one, reducing vehicle maintenance costs. But without an 
intelligent analysis, in particular of all the determinants 
factors, can lead to high costs of implementation and 
results may be below expectations. Note that it is not 
absolutely necessary to introduce ITS in every phase of 
the transport process. The action mechanisms depend on 
concrete situations and the problems from the cities. 
Personally, I consider that intelligent transport systems 
will be a huge step and absolutely essential for creating a 
reliable and modern urban transport system.

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