

INTELLIGENT TRANSPORT FROM THEORY TO PRACTICE

PhD. Doina Banciu * Doina.Banciu@ici.ro
math. Gabriela Rodica Hrin * office@ici.ro

* *National Institute for Research and Development in Informatics,
8-10, Maresal Averescu Avenue, Bucharest, Romania
phone: +4021 2241259/2240736, fax: +4021 2241030, Email: ici@ici.ro*

Abstract: U.S. Transport Department considers that the development of Intelligent Transport Systems is a new step in the evolution of the transport system. At European level, a well-defined regional strategy increases the security and efficiency of the transport system using Information and Communication Technology. This launched research framework supports this strategy. In Romania the development of the national Intelligent Transport Systems has been done by research and development projects. Based on the results obtained at international and European level concerning the Intelligent Transport Systems, Romanian specialists created Intelligent Transport Systems to support European integration.

„The integrated electronic system for e-business, transport optimization and vehicle monitoring in road transport area” - SOMCET-Net is a modern, integrated, intelligent support for vehicle monitoring and route optimization and an interactive tool for electronic commercial transaction (demands and offers) administration. The system uses open standards for positioning: GPS, GIS, GSM.

Keywords: Intelligent Transport System, freight road transport, information and communication technologies, vehicle monitoring and route optimization.

1 INTRODUCTION

eEurope+ Action Plan and eEurope 2005 Action Plan for the Information Society contain a special section dedicated to the improvement of Intelligent Transport System. The strategy for these Intelligent Transport Systems has been developed in U.S., Europe and other developed countries. Based on the international experiences and according to european documents, projects concerning Intelligent Transport Systems were launched at national level. A system dedicated to freight transport is presented below.

2 THEORETICAL ASPECTS

2.1 *Intelligent Transport System Definition*

Intelligent Transport Systems (ITS) are transport systems that use information and communication technologies, also control technologies to improve transport network operation.

Intelligent Transport Systems are the next step in the evolution of the transport system at national, European and international level [3].

Intelligent Transport Systems are a ”marriage” of the information and communication technologies with vehicles and transport networks and create an intelligent movement of freight and persons by providing a supplementary know-how for the travelers and operators [4].

The Intelligent Transport System is an assembly of subsystems based on advanced technologies from information, communication and electronics areas for transport processes management having as finality increasing the transport efficiency and security.

2.2 Transport system components

The main elements of the transport systems are: transport infrastructure; means of transport; means of transport drivers; transported objects (freight, persons), and transport logistics; agents involved in transport area; transport control centers; transit terminals; and transport documents.

The transport system can be structured in three types of systems (operational system, management system and information system) with complementary objectives that are structural, functional and informational integrated.

Taking into account the functional complexity and application area, the Intelligent Transport System can be structured as: advanced systems for traffic management; advanced systems for vehicle control; advanced systems for traveler information; advanced systems for public transport; systems for commercial vehicle operation; systems for emergency management; systems for electronic.

PRACTICAL RESULTS

“The integrated electronic system for e-business, transport optimization and vehicle monitoring in road transport area” - SOMCET-Net is an intelligent system developed in Romania.

2.3 General Characteristics of the System

„The integrated electronic system for e-business, transport optimization and vehicle monitoring in road transport area” - SOMCET-Net is a modern, integrated, intelligent support for vehicle monitoring and route optimization and an interactive tool for electronic commercial transaction (demands and offers) administration.

Characteristics:

- allows transport demands and offers registration and searching,
- supports the negotiation process and transport contact set up between the business partners,
- performs route optimization with route visualization on the digital map, location and real time survey of vehicles and vehicle characteristics.
- uses digital maps to represent the locations, maps which give characteristic descriptive information offering more visibility to the information.

2.4 System's structure

The system contains three integrated user oriented subsystems: a)Subsystem dedicated to economic transaction between the transport clients and the transport providers supporting the marketing, negotiation and contracting activities;b)Subsystem performing route optimization - a support for negotiation and contracting activities; c)Subsystem performing vehicle monitoring during road transport.

The system has also an “Administration” subsystem integrated with the others.

The classical communication means based on phone, mobile, fax or e-mail have been replaced with Internet communication and authorized access to the diversity of information managed by the SOMCET-Net information database and the geographical database.

SOMCET-Net system provides effective and efficient eServices that are able to support the development of a competitive knowledge-based economy in freight road transport area at European level. It contributes directly to the enhancement of European job productivity and overall competitiveness in this area.

The particular focus is concentrated on eServices for freight transport. The eServices are first of all directed to businesses. They are also used by citizens and other bodies (by citizens in moving by their own car and by government units from transport area in particular for dangerous freight transport monitoring).

Direct benefices to businesses, citizens and government units are the following:

- Electronics open market development for road transport area;
- Intelligent commerce conditions ensuring;
- Increased human resources efficiency with direct impact on marketing activities, route planning and vehicle management.

2.5 *Specific objectives*

On short term, the system helps the Romanian agents involved in road transport to include eServices in their activity and to create the conditions for a rapid European integration. On long term the system can become a real time communication support between different agents from public and private sector involved in goods commercialization and freight transport between different countries from Europe.

The SOMCET-Net system contributes to the European Community policies regarding free movement of goods and services.

The European enlargement process is supported because the European relationships between public and private agents, from different European countries, can be electronically managed. The SOMCET-Net system contributes to the development of information society in principal in transport area.

SOMCET-Net system has as main objectives the following:

- Integration of road transport services specific to marketing, route planning and vehicle monitoring;
- Real time management of transport demands and offers;
- Improved conditions for road transport information integration;
- Improved vehicle and driver security;
- Minimized vehicle management risk;
- Assurance of just in time freight delivery;
- Development of a reliable communication system between agents involved in road transport area;
- Minimized communication time between agents involved in road transport area;
- System conformance with International and European standards in Electronics, Information Technology and Communication, and road transport area;
- Road transport cost optimization.

2.6 *System Description*

The system provides eServices to support the principal activities specific to transport chain:

- Marketing: transport market investigation through transport demands and transport offers registration and search. The system can manage **transport demands** that contain 1 - n types of goods for the following situation: a)to be transported by specifying departure and destination; b)loading date and place; c)unloading date and place; d)good characteristics; e)required transport services.

The system can administrate **transport offers** that contain 1-n types of means of transport for the next situation: a)by specifying departure and destination; b)loading date and place; c)unloading date and place; d)intermediary places between departure and destination; e)transport services and general characteristics of the goods.

- Negotiation and Contracting: for the dialog between the partners there is an e-mail service provided by the system.
- Route optimization: in order to establish the route this system provides three optimization models: “quick route”, “short route”, and “preferred route”; the elements that have to be specified to all the models are: “route planer”, “driving speed”, “fuel” and “day driving planner”.
- Vehicle transport survey in real time or from an indicated period of time or to a specified times can be performed using created mobile equipments installed on vehicle board used in freight road (international or national) transport.

The created mobile equipment contains the following components: positioning and Communication Device (DPPC); on board computer; sensor GPS; fuel sensors. The mobile equipment ensures: real time remote vehicle monitoring; vehicle parameter acquisition; message communication between vehicle driver and Management Center.

The monitored information consists of: a)GPS information: position (latitude, longitude), altitude, time (TIME GPS – hhmss), number of visible satellites, number of tracked satellites, dilution and precision factor, heading north, speed; b)GSM modem status; c)Vehicle fuel level, temperature, alarm, information messages, monitoring messages.

All the messages can be point-to-point, point-to-multipoint to communication between mobile device and the Management Center and multipoint-to-multipoint between the transport providers and vehicle fleets.

2.7 Technical Elements

The system is functional structured and modular developed in order to be open having a large flexibility.

The hardware and software components that have been developed implement effective, efficient and innovative solutions to increase the efficiency of freight road transport and to support the integration in European Information Society.

The SOMCET-Net system contains a Web-site that provides developed eServices, database server for information management, Geographical Information Server for geographic information management, communication tools for information changes between system components, between system and vehicles, between system and users, between System Monitoring Center and vehicles.

The system provides a new intelligent approach by integrating the principal activities specific to freight road transport into one electronic hardware and software system using a diversity of functional integrated technologies: GPS, GIS, GSM, SQL, ASP.Net, XML. It uses open standards for positioning (GPS technology - Global Positioning System) based on satellite information communication, for geographical information management (GIS) and Europe digital map and for data communication (GSM) between the mobile equipment installed on vehicle board and the System Monitoring Centre.

The English language is used for system development and interfaces to ensure a large usability.

During the system development process have been involved very good experts for analyses, system design, hardware design and development, database and software development, integration with standard tools: GPS, GIS, GSM, SQL.

SOMCET-Net system, based on Internet Communication, allows multiple access platform for businesses, citizens and government as workstation; personal computer

connected on Internet with operating system: Windows '95, Windows '98, Windows NT or Windows 2000 and Internet browser with version ≥ 5 .

SOMCET-Net system provides access to commercial and geographical information:

- from information point of view the system provides interoperability between transport clients and transport providers;
- from technical point of view, the system provides interoperability between database management systems, GPS, GIS and GSM.

There is a balance between standardized solutions offered by GPS - Global Positioning System, GIS - Geographic Information System, GSM - Global System for Mobile Communications technologies and customized solutions developed for SOMCET-Net administration and user oriented components, system interfaces, interfaces between software tools used in software development process based on the new ASP.Net technology that protects source software code, assures interoperability with other software tools as GIS for example, and is based on XML technology.

IIS (Internet Information Services) provided by Microsoft and SOMCET-Net administration software components enables data protection, security, trust, privacy and confidentiality of information.

2.8 System Operation

ICI (National Institute for Research and Development in Informatics) provides the Internet services offered by SOMCET-Net. The created mobile equipments have been installed on vehicles of some Romanian transport providers for monitoring freight road transport in Europe and in Romania. The users can survey, in real time, the geographical position of their vehicles anywhere.

- The system supports European transport because the used map is a digital map that covers European regions.
- The system user is the partnership created between transport clients and transport providers including also brokers.
- The system has a strong impact on improvement the quality of life of drivers, business development and transport efficiency increase.
- The SOMCET-Net system resources are administrated by "Administration" component. The system knowledge management is performed by search function based on dynamic criteria created by system users in conformance with access right.

In SOMCET-Net system operation cannot appear major risk. If there are some problems the operator of the Monitoring Center will be informed by alarm messages in conformance with the situation type.

For example, below there are presented two pages from system:



Fig. 1 Route Optimization

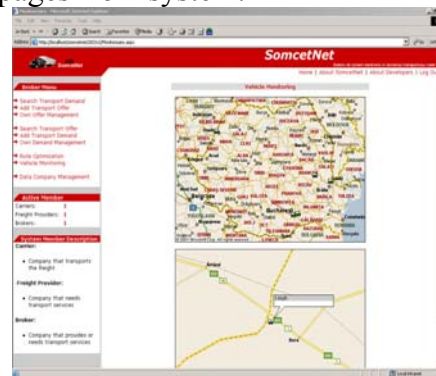


Fig. 2 Vehicle monitoring

3 CONCLUSIONS

This system represents a model of appliance of the eEurope+ Action Plan – Intelligent Transport Area. Regarding the future, it seems clear that the european integration will require the adoption of the new approach of the movement of citizens, goods, vehicles. In this perspective, there are three major motivations for future development of information society in transport area based on intelligent transport systems.

1. The key motivation is political frame. The political factors have to ensure a balance between the requirements and capabilities.
2. The second motivation is an efficient exploitation of the technological infrastructure for a mobile business in which the computer and communication are available to the users anywhere and any when. The developed intelligent environment supports the political frame by providing information and determines new requirement identification.
3. The third motivation is a result of information society technologies development that acts in the direction of changing of the agents, citizen, commerce, industry, government and society needs.

The SOMCET Net system is only an application. It will be developed according to the interaction level between political frame, technology and market is modified during the time.

REFERENCES

1. Anghel, Lucian; Alexandrescu, Corneliu Mihail; Banciu, Doina; Esanu, Adrian; Hrin, Gabriela Rodica; Mihai, George Dionisie. „Sisteme inteligente de transport - Ghid pentru utilizatori și dezvoltatori”. Bucuresti: Editura Tehnica, 2003. ISBN 973-31-2154-1
2. Kan, C., Miles, J.C., 2000, ”ITS Handbook 2000, Recommendations from the World Road Associations (PIARC)”, ISBN 1-58053-103-2
3. Perrett, K.E. , A. Stevens, 1996, ”Review of the potential benefits of Road Transport Telematics”, TRL Report 220
4. Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F., Lorensen, W., 1991, ”Object-Oriented Modeling and Design”, Prentice Hall, Englewood Cliffs, NJ
5. Saito, T. et al., 1997, ”Reduction of Traffic Accidents and Improvement of Road Traffic Produced by ITS Deployment”, Proceedings of the 4th ITS World Congress
6. Steve Mortensen, Michael Harris, Corey Hill, 2002, ”Mid-continent transportation symposium proceedings - Investigating ITS Concepts for the Dulles Corridor Rapid Transit Project”
7. US Department of Transportation - USDOT - Intelligent Transport Systems, <http://www.its.dot.gov/>
8. ERTICO – Working program for 2000, 2001 <http://www.ertico.com>
9. ITS Network <http://www.its-network.com/>
10. U.S. Organisation for Inteligente Transport, 2001 <http://www.itsa.org/>
11. The people transportation software company <http://www.trapsoft.com/index.html>
12. Sistemul universal mobil de telecomunicații: <http://www.umts-forum.org>
13. Software GIS: <http://www.esri.com>
14. Tehnologie GSM <http://www.gsmtech.co.uk>
15. Site-ul: <http://www.its.dot.gov> 2001
16. Studiu de piață privind administrarea traficului <http://www.janes.com/>