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The development of Intelligent Transport Systems

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Abstract

This article focuses on the development of intelligent transport systems from a historical perspective. It presents its main categories and application areas. The main feature of intelligent transport systems (also referred to as telematics) is the supply of services that include the activities of a road network administrator and operator, a transport service provider, carriers and a road transport participant. Intelligent Transport Systems (ITS) are one of the EU's priorities, as they aim at safer, greener and more efficient transport in the Member States.

Keywords: intelligent transport systems, telematics, advancement

Introduction

Intelligent Transport Systems (ITS) have the potential to revolutionize mobility, change everything from the way we move and communicate to the way we design transport legislation and regulate vehicles.

Main time periods of ITS development:

- ***Preparation*** *(1930-1980)*

In the first period of development of ITS the technology was not sufficiently developed and the construction of the new road communications was more attractive than the development of ITS. The first system was the electric traffic signals implemented in 1928. In 1939, the Automated Highway Systems (AHS) concept was introduced at the New York World Fair. However, the movement of ITS did not intervene until the 1960s, when the first computer-controlled traffic signals appeared in the US. From the late 1960s to 1970, the ERGS (Electronic Route Guidance Systems) was developed in the US. It used two-way communication of road vehicles to provide guidance on

route. [1] During the 1970s, a Comprehensive Automobile Traffic Control System (CACS) was developed. It used inductive loop antennas that were embedded in the roads as a digital communication link between equipped vehicles and infrastructure. At the

same time the ALI (Autofahrer Leit und Information System) project started in Germany, using induction loops to detect a vehicle with communication with the in-vehicle equipment. [10].

- ***Feasibility study*** *(1980-1992)*

The second phase of development is characterized by the explosion of development programs. The projects were implemented in Europe, Japan and the USA. In Europe, a pilot program called PROMETHEUS (Program for European Traffic with Efficiency and Unprecedented Safety) was introduced. It developed several ITS technologies between 1987 and 1994. VaMoRs vehicle was introduced in Munich in the 1980s [3]. In this prototype two cameras were used to track the roads. In the 1990s, the Daimler-Benz Group developed the VITA I1 test vehicle [7]. This vehicle contained 10 cameras and 60 processors to keep the vehicle at the center of the lane, keep the car at a safe distance from the car in front of it, change lanes and overtake other vehicles with avoiding collisions. The following projects were developed as part of the PROMETHEUS project, namely the ARGO project, which aim was to design, test and develop innovative solutions for future vehicles. This program was followed by company DRIVE (Dedicated Road Infrastructure for Vehicle Safety in Europe) to develop

and test the communication system, to do steering assistance and assist traffic management [5]. The Mobility 2000 Learning Team has created the foundations in the US for the creation of Intelligent Vehicle Highway Systems (IVHS), a forum to consolidate national ITS interests and promote ITS international collaboration. In 1994, USDOT (United States Department of Transportation) changed the name to ITS America (Intelligent Transportation Society of America). A key project, AHS (Automated Highway System), was implemented by the National Automated Highway System Consortium (NAHSC) created by the US Department of Transportation, General Motors, the University of California and other institutions [8]. In this project, various fully automated highway test vehicles have been demonstrated. In Japan in the 1980s, navigation system projects RACS (Road Automobile Communication System) and AMTICS (Advanced Mobile Traffic Information and Communication System) were implemented. In the 1990s it was possible to combine efforts with the Department of Post and Telecommunications to work on standardization projects in VICS (Vehicle Information and Communication System). The VICS terminal provides a locator for displaying vehicle coordinates on the screen map and allows communication with ground stations for route planning. Other projects are Advanced Road Transportation Systems (ARTS) by the Ministry of Construction, for the development of road traffic through road and vehicle integration with regards to the Advanced Safety Vehicle (ASV) to support research and development of vehicle safety technologies. In 1996, the Department of Construction and twenty-one major companies, such as Toyota, Nissan, Honda and Mitsubishi, created the Advanced Cruise-Assist Highway System Research Association and implemented various fully automated highway vehicles. [1]

- ***Product development (1995-present)***

The previous phase was aimed at creating a technical background with high-level features for ITS. Around the mid-1990s, a uniform policy that dealt with IDS in a consistent and harmonious way was adopted. This has led to the current phase dealing with the creation of viable products. One example in Europe is the Chauffeur project, by Daimler-Benz and research institutes, the goal of which was the autonomous vehicle following human factor-driven vehicle. At the end of the 1990s in the US, ITS began to integrate to a greater extent. [1]

ITS consist of a wide range of equipment and tools to manage the transport network and provide services to road traffic participants. ITSs are based on fundamental principles of information, communication and integration. The main categories of intelligent transport systems are:

A. Advanced Traffic Management Systems (ATMS)

Advanced Traffic Management Systems (ATMS) are an essential part of intelligent transport systems that have been used to improve the quality of transport services and reduce traffic delays. The system works with a series of videos and road loops, message signal variables, network signals, and schedules of timers, including traffic control strategies from a central location.

The three main elements of ATMS are:
Collecting Data Team - monitors traffic conditions;
Support Systems - cameras, sensors, traffic lights and electronic displays;
Real-time traffic management systems - these systems use the information provided by the two previous elements that can change traffic lights, send messages to electronic displays, and control highway access.

B. Advanced Travelers Information Systems (ATIS)

The goal is to provide real-time traffic information to passengers. Traffic condition information of transport system has influenced drivers to make better use of the system, reducing congestion, optimizing traffic flow and reducing pollution. [6]

C. Commercial Vehicles Operation (CVO)

CVO systems use a variety of ITS technologies to increase the safety and efficiency of commercial vehicles that are useful for medium and large companies. [1]

D. Advanced Public Transportations Systems (APTS)

APTS systems use electronic technologies to improve the operation and efficiency of high-volume shipments such as buses and trains. [6]

E. Advanced Vehicles Control Systems (AVCS)

The AVCS common sensors, computers and control systems help and alert drivers or participate in driving. The main objectives of these systems are to increase road and motorway safety.

F. Advanced Rural Transports Systems (ARTS)

ARTS are designed to solve problems arising in rural areas (communities or areas with less than 50,000 inhabitants). [1]

The ITS application areas in road transport for individual, public and utility transport and transport infrastructure are:

- electronic toll - electronic payment for distance travelled on defined sections of highways, expressways and 1st class roads
- e'call
- automatic or manual activation of a call to 112 via mobile networks
- traffic information - traffic information centre - verified data for traffic information service providers and exchange of information with other TICs
- vehicle systems
- parking systems
- electronic travel fare
- cost and fleet management
- transport of dangerous goods
- traffic flow management
- automatic vehicle identification [9]

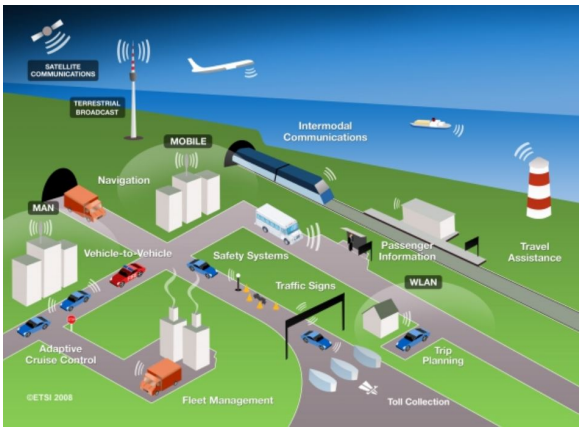

Figure 4 - ITS

Conclusion

Intelligent transport systems enable all stakeholders to be better informed, informed and more "intelligent" in making decisions. Today, ITSs are a very powerful tool, increasing the performance, efficiency and safety of the transport system. They also represent a major challenge for EU transport policies.

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