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J.D. Quak *Intelligente transportsystemen.*
Literature survey, Report 96.3.LT.4727, Transport Technology, Logistic Engineering.

Since the last decades, road transport has increased immensely and this increase will probably continue. Traffic congestion is the result, and the problems due to this congestion are: traffic (un)safety, loss of time, energy consumption and personal frustrations. This has led to the development of intelligent transportation systems (ITS): information technologies implemented in vehicles, on roadways, or centrally, which should reduce the problems mentioned above.

At the moment, ITS is a hype all over the world. In the United States, Europe, Japan and Australia development started approximately in the mid-6'0s and was considerably accelerated since the mid-'80s. Large research programs and coordinating agencies were established.

A commonly used categorisation of ITS is a functional one, in which the first three categories are broad categories and the other three are targeted on specific users:

1. ATMS (Advanced Traffic Management Systems): monitoring and controlling traffic to improve traffic-distribution and traffic-flow, e.g. electronic message signs, central traffic-light control;
2. ATIS (Advanced Traveler Information Systems): provide individual travelers with information to enhance their traveling efficiency, e.g. route-guidance (in-vehicle digital maps and real-time traffic information);
3. AVCS (Advanced Vehicle Control Systems): assist or replace a driver in performing driving tasks, intended to enhance safety and traffic-flow, e.g. automatic distance keeping;
4. CVO (Commercial Vehicle Operations): targeted on commercial road transport (trucks), e.g. automatic vehicle location;
5. APTS (Advanced Public Transportation Systems): targeted on public transport, e.g. realtime traveler information in a bus;
6. ARTS (Advanced Rural Transportation Systems): targeted on transport in rural areas, e.g. automatic incident detection.

In the United States a national goal has been set for ITS. The matching plan is structured around 29 "user services": products and services to satisfy user needs. These user services have been grouped into 7 bundles and represent a more precise categorisation and definition of the exact possibilities of ITS. The 7 bundles are:

1. Travel and Transportation Management
2. Travel Demand Management
3. Advanced Public Transportation Operations
4. Electronic Payment
5. Commercial Vehicle Operations
6. Emergency Management
7. Advanced Vehicle Control and Safety Systems

In Europe there are two main ITS-programs:

- Prometheus, originally initiated by the European automotive industry, emphasizes on the vehicle-part of ITS. A number of study-programs are led by the automotive industry (industrial research) and some others are led by universities (basic research).
- Drive (I and II), established by the European Commission, emphasizes on the infrastructural part of ITS. Drive II builds on the results of Drive I, with lots of operational tests.

In Japan, the numerous projects are less well-coordinated; a lot of agencies, ministries and industries have their own system. Efforts are however being made for coordination.

Some representative ITS-projects are:

- United States: TravTek, SMART Corridor, PATH
- Europe: Ali-scout/Euro-scout, Rekeningrijden, VITA II
- Japan: VICS, UTMS
- Australia: SCATS, ANTTS

Many aspects are important in the development of ITS:

- *technological aspects*: especially compatibility (standardisation) and an appropriate system architecture are extremely necessary;
- *economical aspects*: who will pay for the high costs of construction, who will pay for use; another dilemma is: who will buy vehicle systems if there is no appropriate infrastructure, but who will build an infrastructure if there are no users;
- *organisational aspects*: public-private partnerships are necessary and beneficient, as well as international cooperation;
- *education*: a sufficient number of ITS-educated people is needed, otherwise the developed technology will not be very effective;
- *legal liability*: if the control of a vehicle is transferred to some kind of ITS, who will be responsible when an accident occurs;

- *social issues*: threat to privacy and individual freedom;
- *latent demand*: increasing road capacity by ITS can lead to an increase of trips being made.

Implementation of ITS take place in stages. Very roughly spoken, in the first stage traffic management systems and traveler information systems, and in a next stage also vehicle control systems will be commonly used. Fully automated vehicles on fully automated roads might be reality around 2030.

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