CURRENT CONDITION IN THE TRANSPORT TELEMATICS

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Abstract. *The term "telematics", which originated more than ten years ago, stands for integration of technologies and solutions from the field of telecommunication, automation and computer science. Telematics is the combination of words "tele" (transfer at some distance, remote access) and "automatics" (work without human involvement), i.e. the field involved in performing work from the distance using telecommunication "methods". New technical solution allow to treat telematics not only as a tools associated with a particular process, but as a tool for affecting the entire economic sectors and areas of life.*

Keywords

Telematics, Intelligent Transport Systems, ITS services.

1. Introduction

Introduction of modern systems of intelligent transport management and supervision assistance becomes increasingly necessary for effective development of transport and efficient traffic maintenance, apart from transport infrastructure development issues.
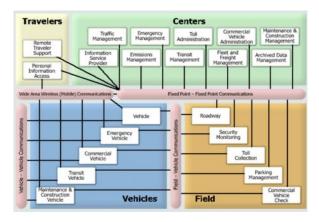

Fig. 1: Physical architecture of ITS. Source: USA National ITS Architecture ver. 6.1.

USA National ITS Architecture (Fig. 1) in a complex manner formulates the division between the various components of the system. Generalizing the principle of interaction it could be said that in a way telematics connects travelers, means of transport and the transport infrastructure throughout information and telecommunication technologies.

Of course modern highly sophisticated electronics and computer science will not replace a solid transport infrastructure, but as a dedicated "software" allow to reduce expenditure on transport solutions and better use of the existing transport network and technical resources, more intensive utilization of the existing infrastructure and vehicles, increasing effectiveness and competitiveness in the field of transport, enabling effective cooperation of all partners of the transport sector (organizers, users, manufacturers, beneficiaries) and among all increasing traffic safety. So now the transport systems telematics becomes a fact. A lot of attention is paid worldwide to development of transport telematic systems (called also intelligent transport systems).
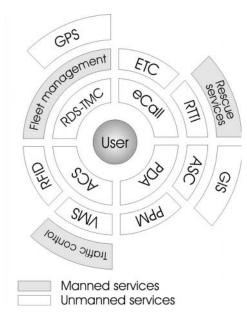

Fig. 2: Manned and unmanned ITS system components. Source: own preparation.

The goal of future transport is creating transport systems less and less depend on "individual" decisions but increasingly coordinated from the decision-making level. However, this part of transport, which will remain dependent on an individual (a driver, pilot, shipmaster), to increasingly large extent will be supported by the current information about real-time traffic situation.

In the sense of teleinformation technologies application and use in transport systems management the telematics equally applies to all transport branches, i.e. road, rail, sea and air transport. However, beyond the most popular in the world road transportation, each of the other sectors has a very restrictive systems and solutions. Telematic solutions facilitate integration of various modes of transport, contributing to establishment of intermodal structures based on information exchange. Telematic applications are used to supply and process a set of information appropriate to specific application and users needs, and this is carried out automatically or at request.

2. Physical Architecture of Telematics

Telematics is a set of systems (Fig. 1), which react appropriately to changing conditions, for example on a road. Fundamental in their operation is linked in a decision-making system and online collaboration. A significant increase in new technical solutions allow complex automation and control of technological processes. Only now a demand for national or international transport management systems, which are favorable in economic terms, acceptable in environmental terms, and which would substantially increase the transport safety, has clearly increased. New solutions are sought, which using state-of-the-art ICT, and such systems may be broken down into:

- technical transport equipment (sensors and various detectors),
- technical communication equipment (transmitters, receivers for communication with/between vehicles),
- technical vehicles equipment (receivers, transmitters, automatic vehicle's location, electronic identification, automatic driving systems),
- dispatcher systems (combining various information processing technologies).

3. Possibilities of Telematic Systems Divide

Development of telematics systems has reached a stage, in which should be stop the systems' definition in terms of which function they perform, because right now telematic systems application may be divided into a large number of systems:

- communication network,
- integrated transport supervision and management,
- traffic control,
- monitoring (of vehicle and/or driver),
- weather monitoring,
- monitoring of traffic rules observance,
- dynamic navigation and guidance,
- information acquisition and distribution for traffic participants (including travelers),
- anti-collision systems,
- remote measurements of traffic volume, pavement state, vehicles weight,
- management of vehicles fleet and transported goods,
- transport logistics,
- "intelligence" of means of transport,
- automatic speed control,
- safety and rescue systems,
- dynamic road sharing,
- ensuring right of way for privileged/emergency means of transport,
- parking places management,
- settlements management,
- electronic toll collection,
- application of automatic means of transport,
- dynamic connection searching.

A new look at continuously developed systems can be gained at a time when there is no distribution but the grouping of these systems with superior systems, based on the final effects of their actions that this action will be linked to the influence of a particular field of transport.
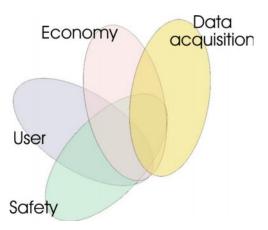
Fig. 3: Main division on fields of telematics' influences. Source: own preparation.

Of course, all of these areas are in contact with at least one other area, but almost always their range includes many of them, because the components could belong to many areas.

3.1 Safety

Term Safety contained any type of protection of users and surveillance of cargo. These include systems located in the immediate vicinity of the driver, such as anti collision and warning systems (analysis of the nearest surroundings), indirect systems like variable message sings, and others.

Car manufacturers develop systems increasing drivers' comfort, reducing loads and increasing cars' safety. Typical examples may include:

- intelligent management of car speed (help drivers to keep a safe distance from the preceding car),

- keeping the car in the traffic lane centre,

- warning against a possibility of accident – drivers are warned against obstacles existing in front of the vehicle, or possibly next to the vehicle,

- accident preventing (direct intervention in vehicle driving to avoid a collision with an obstacle – a change in speed, possibly direction),

- improvement in vision – there are systems tested based on using cameras and displaying the observed situation on a screen placed within driver's sight,

- monitoring car's and driver's status,

- intervention in driving – basically the point is to have a combination of a number of systems mentioned above (automatic driving, speed changing, preventing possible collisions, keeping the vehicle in the traffic lane centre).

The interest in such systems has been permanently increasing and car manufacturers have been trying to implement them gradually.

Applications in monitoring and in law enforcement offer substantial increase in safety in road transport. Frequent reasons of serious accidents include speeding or non-adjustment of speed. Automatic system of vehicle speed control could use a transmitter, which would provide the approaching vehicles information about the speed limit. Such vehicles could be equipped with onboard system connected with the brake system and thereby the vehicle's speed could be reduced to the speed limit. Automatic control of maximum vehicles' speed could substantially reduce the number and seriousness of accidents. The system described could result in reduction of exhaust emission and in increasing the traffic flow.

3.2 Economy

Term Economy related to systems focused on economic aspects of cargo and passenger freight, it could be mentioned a systems for fleet management and for the other side the traffic control systems in cities. A special part in the Economy field are payments (toll payments, parking places, common ticket for public means of transport and other services – e-Purse).

Telematic applications in this field can:

- improve communication between dispatchers, operators and drivers as well as terminal operators,

- improve terminals administration and facilitate transfers between various modes of transport,

- monitor vehicles safety,

- monitor location and traffic of individual vehicles, possibly monitor goods.

The information about the location of cars, where they move, and detailed information about their whole journey may be helpful at determination of the best route and at determination of logistic strategy. This may cause that goods transport will be more effective and the number of traveled kilometers necessary to reach the target will decrease. Apart from that, the possibility to follow the movement of individual vehicles and individual containers to a large extent may increase the safety of valuable or hazardous goods transport.

With increasing transport concentration in cities, also requirements related to its management become more demanding. Recently attempts are made to resolve problems related to construction of urban traffic administration and management systems in a comprehensive way. Basically, the point is to achieve a new approach aimed at support of development of new transport systems generations, effective from the point of

view of economics and leading to better utilization of city roads network. These systems will help road administrators in cities and in such a way, that they will: prefer public transport, support pedestrian and bicycle traffic, reduce adverse environmental impact of transport, increase safety, reduce transport in sensitive areas and resolve traffic jams. Systems, which enable free movements to emergency vehicles (fire brigades, ambulances, and police), are a special subject.

The road network management becomes increasingly important measure to achieve safe, effective, reliable and environmentally friendly transport. The application of telematics means:

- using appropriate control, monitoring and directing systems,

- providing drivers recommendations and information, before and during journeys,

- examining, developing and using new applications to improve the level of services for road users.

The following may be the main examples:

- local and regional transport management centers,

- devices collecting motorway tolls,

- transport monitoring and its strategic management via informing drivers,

- servicing emergency notifications from phones situated along roads and motorways,

- monitoring transport results of the transport network.

Local management centers will collect information on the transport network using monitoring of crossroads and byways. The information will be stored in a database, which will contain a current picture of conditions existing in the entire monitored network. The data acquired this way will be used at determination of relevant strategy for traffic management and will directly inform road users by text messages displayed on boards situated along roads. Local centers will transfer (or sell) the information obtained further on to regional centers, which – using various communication means – will provide necessary information about the road situation to drivers, both before and during a journey.

Collection of payments for motorway use in the form of toll is very inconvenient today, reduces motorways effectiveness and is frequently criticized. Because of that other methods are sought, so as to preserve the principle to make payments appropriately to the degree of motorways use. Equipping vehicles with a GPS receiver and registration of their traffic is one of solutions. Unfortunately, the cost of such system is very high and its

enforcement is debatable. Equipping each car with appropriate electronic identifier, which will enable automatic vehicle's identification and registration during passing a toll collection point seems to be a better solution.

Other points of the road network, for example large crossroads, byways, etc. may be also equipped with readers (identifiers). Traffic intensity and the time of travel between neighboring measurement points could be measured this way. The information obtained may be useful for providers of services to drivers. A possibility to watch stolen cars could be a major improvement in the case of such system.

3.3 Users

Term User cover the systems use by final (or initial) users of transport chain such like dynamic information systems, localization systems.

Applications in this area on the one hand should provide as effective and as cheap as possible information, which is needed by user to be able to use the transport network in an effective and safe way, and on the other hand these applications should also provide other information services required by users, for which they are willing to pay.

The system using graphic equipment (utilizing maps) to display current traffic concentration on motorways may be used as an example. Transmitters are situated on entry roads to motorways and inform drivers about the situation on the motorway. Divers have then some time to decide about possible change of the route. Preliminary data is acquired by detectors situated on all motorways and on majority of main roads.

An interface for communication with the driver plays an important role in onboard information devices. To a large extent it may influence the comprehensibility of information provided, but it should be considered that in the event of inappropriate design it may deteriorate the traffic safety by excessive attracting driver's attention from vehicle driving. Because of that, attempts are made to develop necessary standards for such equipment. Radio data system is used to transmit acoustic messages – the channel designed for information about the road traffic (Radio Data System – Traffic Message Channel, RDS-TMC).

Studies have shown that a large part of traveled kilometers is lost due to erroneous navigation or ignoring the situation on roads. Therefore a lot of designers' attention is attracted by a possibility to build onboard systems, which could guide a driver along a selected route in real time or possibly provide him other information about the road traffic. The systems proposed belong to two categories:

- static (autonomous) systems providing information about the route and position based on "historic" data, using very detailed and accurate maps,

- dynamic systems, which navigate, guide and provide current traffic information in real time (information updated on a current basis). They enable taking into account changing conditions on roads, directly during journeys.

Now there exist navigation systems, based on the GPS system and on digital road network maps. An onboard system determines the optimum route to the target and guides drivers using acoustic (sound) instructions and a visual information. Available autonomous guidance systems could be supported by the real time traffic information through the RDS-TMC system which is working in most of the European countries. In that case the decision making system could propose a change of previous route because of the traffic accident that happened meantime and which have a significant influence on journey comfort.

The acquisition of full and current information on services provided by public transport is a fundamental step to increase attractiveness and convenience of public transport as an alternative to individual transport. At the same time this would enable traveling without major problems, waiting, loss of time etc. Automation with the use of telematic systems should support the entire process of traveling, starting from seats reservation and tickets buying up to providing the travelers comprehensive information about the current transport conditions. Information systems for travelers should, apart from general information about services, ensure also coordination between various modes of transport. The system informing travelers on stops about the time left to arrival of the next means of transport is an example of such systems. Equipping vehicles with a system enabling location of individual vehicles in individual line routes is an important part of the system. The data obtained may be also used for the dispatchers needs during traffic flow control.

The issue strongly related to above mentioned real time travel information is the use of "intelligent" electronic cards for paying for journeys. Such solution offers a number of advantages as compared with the traditional payment method. They comprise precise division of revenue between individual transport operators and between individual modes of transport, much better analysis of transport trends, and – based on them – better adaptation of services to travelers needs. Such systems enable introduction of various systems of payment for transport, taking into account time of day, the scope of services used, offering various concessions etc.

The group of other road users consists of pedestrians, cyclists, moto-cyclists as well as elderly and disabled persons. Telematic applications may increase their safety and help them as well as rise attractiveness of most environmentally friendly modes of transport – walking and riding a bicycle. The examples of systems for no motorized:

- detection of pedestrians and cyclists on pedestrian crossings and crossroads,

- information about public transport – the point is to have systems addressed primarily to blind people, enabling provision of necessary information, for example in public transport stops by means of acoustic messages.

3.4 Data Acquisition

Term Data acquisition mean any kind of devices and databases which collect, store and analyze information from diverse sources like: traffic monitoring, travel time monitoring, weather monitoring, environmental monitoring, cargo monitoring, traffic control centers, fleet management, electronic toll collection, services to rescue teams.

Today, the accuracy, timeliness and reliability of information are the most important features. Hence the information systems about cargo and information systems for drivers and travelers must work based on geographical information infrastructure. Information about the area may be acquired from various sources, depending on the needs:

- GIS – geographical information system (topographic maps),

- LIT – local system of information about the area.

Information about the area is used in transport telematics for the needs of navigation (land, sea, and air) and for the location of vehicles, persons or goods. Actions in real time apply primarily to crisis response services (accidents, natural disasters, fires, mugging and burglary cases, drugs flow, illegal immigration), i.e. police, army, rescue services, and environmental special services.

Electronic vehicles identification, on which a number of other uses depend, is another application belonging to this field. If each vehicle is equipped with unique electronic identifier, a number of applications could be substantially simplified. Basic vehicle databases (basic technical parameters, engine and body number, etc.), useful also for other purposes, e.g. searching and watching stolen vehicles, various statistical surveys etc. could be connected with electronic ID. Statistical applications are also indispensable for the evaluation of the existing network load, for active traffic management in the transport network etc.

4. Conclusion

The division established on Fig. 3 does not constitute the final solution, a various kind of approximation could be taking into account and the variable number of fields could be created. Up to date it can be create the new field which designation consist of two words: "information" and "entertainment", which allowed coining the "infotainment" term, which means "a material broadcast by electronic media, aimed at the same to inform and entertain".

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