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TELEMATICS APPLICATIONS AND THEIR INFLUENCE ON THE HUMAN FACTOR

Summary. Safety is the exemption from accidents and losses on human lives. It also deals with property protection, regulation, management and transport technology development. Human factor often caused a lot of accident because of his/her failure. One of the most frequent faults of drivers is a wrong decision in a critical situation. The decision process is very complicated since the driver has to evaluate the arisen situation correctly within fractions of a second. The implementation of telematics systems into vehicle equipment reduces its energy consumption, bad environmental impacts, increases safety etc. Total operating costs reduction of road vehicles, simplification of vehicle control and reduction of driver's overload by information is largely stressed. Our article deals with the analysis of human factor and exploration of its demonstrations in the context of telematic applications.

TELEMATIK-ANWENDUNGEN UND IHRE AUSWIRKUNGEN AUF DEN MENSCHLICHEN FAKTOR

Inhalt. Die Sicherheit wird von Unfällen und menschlichen Verlusten freizustellen. Es geht auch um den Schutz von Eigentum, Regulation, Verwaltung und Entwicklung von Technologien im Verkehrsbereich. Eine der häufigsten Fahrfehler ist eine falsche Entscheidung in einer Krisensituation. Entscheidungsprozess ist sehr kompliziert, weil im Bruchteil einer Sekunde Fahrer die Verkehrssituation richtig muss zu bewerten. Die Einführung von Telematik-Systemen in den Fahrzeugeinrichtungen reduziert ihren Energieverbrauch, verbessert die Umwelt, die Sicherheit erhöht und dergleichen. Die Reduzierung der gesamten Fahrzeugs Betriebskosten, Barriere Freiheit, Reduzierung des Stausees und andere ist in dem Fahrerinformationssystem erhoben. In diesem Artikel, wir möchten auf die menschliche Faktor Analyse und Prüfung ihrer Reden im Rahmen der Telematik-Anwendungen zu konzentrieren.

1. INTRODUCTION

The movement of vehicles in space and time which takes place on road communications constitutes a human – vehicle – environment system. Every human being has his/her specific characteristics that has to be considered when this being becomes an active element of road transport – a driver. These characteristics affect the quality of movement of the vehicle as well as the traffic safety. It is only under these conditions when we are able to protect the driver through reasonable utilisation of

transport vehicles, raise him into a qualitatively better driver and determine his behaviour while violating traffic regulations.

A majority of accidents are caused by the fact that someone misses something in a critical point in time. According to IT experts, there are approx. three million bits of information attacking the human mind every second. The human brain, however, is only able to process 16 in a second. The actual reception is dependent on the attention. Psychologists say that a healthy and relaxed person is able to receive up to 6 impulses in 1/10 second but this number drops to around 2-3 while driving. Speed and traffic situation complexity is also important. Psychologists consider concentration and prescience as the most important factor in driving. It is essential that the driver appropriately filters the relevant impulses and rejects the irrelevant ones, e.g. pedestrians on the sidewalk or billboards. In contrast to other means of transport, the participants in the road traffic are now always experienced professionals. The prevailing groups are skilled amateurs but also these can be overloaded in heavy traffic, including „new „phenomenon on Slovak roads – jams [5].

As is apparent form the traffic accidents, more than 95% of accidents are caused by human error, neglecting driver's responsibilities, incorrect assessment of situation and his/her abilities etc. Apart from basic elements, a driver and a vehicle, there is also another element, which is the environment. This term is very wide and in principle, it may include natural impacts (not influenceable by humans or influenceable to a small extent, e.g. climate) but also technical aspects or organizational measures, which are a result of human activity.

The above indicates that operational measures, mainly in the field of organization, regulation and traffic control, are an inseparable part of the traffic/transport system and is a condition to effective utilisation of transport vehicles, transport routes and provision of steady, safe and efficient traffic.

2. TELEMATIC APPLICATIONS SND HUMAN FACTOR

Currently, high intensity of traffic on road communications puts high demands on drivers. Their overload is obvious from the accident rate, which, against various measures, is still very high. An improvement in this field may be achieved through the implementation of new technical enablers into vehicles and increasing traffic awareness. An important approach is the implementation of the intelligent transport systems (ITS).

ITS (transport telematics) integrates information and telecommunication support of the transport process. The impact of such ITS technologies and whether these are only positive remains a question.

At present, there is not enough scientifically acquired knowledge in Europe that would cover this issue from all points of view, such as needs of various groups of drivers (professionals, elderly drivers, new drivers, impaired drivers), education and training for ITS systems, impact on mental load and attention, or acceptance of these systems in the context of different psycho-physiological characteristics. The research of ITS therefore has to integrate arts (psychology, sociology), ergonomy (science of understanding interactions between human and the system that attempts to achieve satisfaction of the person and performance of the system) but also engineering sciences (cybernetics, industrial design, artificial intelligence). There should be a serious interdisciplinary scientific research of the human-machine interface (HMI) that would enable full utilization of all options provided by the new information and communication technologies leading to increased traffic safety and improving mobility.

An important function in this system is the information providing to the drivers and passengers in the vehicles, which allows for a more effective utilization of road network. Information on direction, routes and driver services are fed directly into the vehicle. Information on transport congestions as well as information regarding dynamic navigation en-route is dependent on the communication link between the vehicle and main office. This information can be transmitted anytime as a continuous traffic monitoring. The knowledge of intensity provides realistic and immediate picture of traffic situation. It delivers accurate and current information to other participants of the transport process about traffic intensity at individual sections, announcements on accidents, dynamic route information that can be supplemented with other type of information, e.g. parking options, recommendations to

detours, hotels etc. The question is how much information is a driver able to evaluate in order to react optimally. The goal of mobile systems for dynamic direction finding is:

- to navigate drivers and to recommend a place for joining a lane according to current traffic intensities and average speed of traffic flow;
- to reduce the length of queues;
- to eliminate aggressive behaviour of drivers;
- to reduce negative externalities through optimal en-route navigation.

3. ANALYSIS OF TRAFFIC ACCIDENT RATE

Efficient transport services are crucial from perspective of the competitiveness of European industry. Transport contributes greatly to its growth, but also creates negative externalities, which are, for instance, estimated for 1.1% of the European GDP [9]. Overload of the roads constantly increases and deprive the GDP of more than 1%. In the field of safety on the roads, Europe in the White Paper on transport policy has specified itself an ambitious aim of decreasing the death of people to 50% till 2010 death of 50% compared to 2001. In the meantime, safety has increased significantly, but the situation is still not satisfactory [10].

The Slovak Republic as a full member of the European Union respects the recommendations of the European Commission in the sphere of road safety and is trying to accomplish them. Slovak Republic has not succeeded in meeting the obligations despite a great effort to prepare legislative and technical conditions for achieving the goal to reduce consequences of road accidents in 2010 which was to reduce the death toll by half and which was adopted when entering the European Union. (see p.1.) The development of transport in all its sectors is linked with the integration to the advanced countries and with developing of the society. Year by year in the road transport is increasing the number of vehicles on the roads as well as new drivers and with this situation is associated a lot of negative effects. The number of road accidents and their consequences increases in the consequence to lack of conditions for the realization of transport education, low discipline, aggressive driving, violation of fundamental duties and low legal awareness of drivers and other participants of road traffic [7, 8].

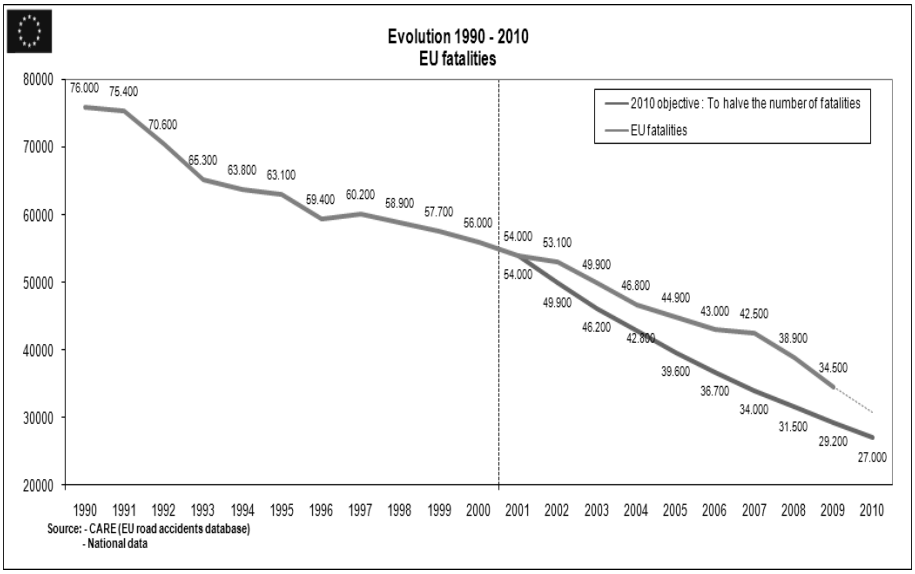

Fig. 1. The development of road accident rate in the European Union
Bild. 1. Die Entwicklung von Unfallrichtwert in die Europäische Union

Traffic accident rate as a serious social problem requires a comprehensive and effective solution that shows features of a coordinated and aimed procedure by all stakeholders and institutions with a broad public support [1, 6].

4. TELEMATICS APPLICATIONS IN THE SLOVAK REPUBLIC

The Slovak Republic faces lot of transport problems, which has not followed only from the uncompleted transport infrastructure, but they concern many areas of such as are for example transport safety, impact of transport on the environment or quality of service, which solution was not sufficiently secured in the past. In 2005, the Government of the Slovak republic accepted Transport Policy of the Slovak republic with the Resolution No. 445 till the year 2015, in which is defined by a global goal and several specific objectives that include concrete measures in the transport sector in Slovakia for collateral the sustainable development of mobility, long-term collateral continual-increasing transit needs of society in the required time and quality and with parallel reducing of negative effects on the environment. Draft action plan is couched in several areas, which are aimed at: [3]

- optimization of the use of the latest road data and data access,
- the synergy of combined applications and services in area of commercial transport,
- data security and protection of personal and commercial data,
- strengthen the effect of public authorities in the area of ITS,
- a framework for integration and coordination of programs,
- a framework for the promotion of diversity and acceptance of ITS.

The support program of the development of intelligent transport systems - National System of Traffic Information represents the comprehensive solutions of intelligent transport systems based on information and communication systems and technologies in road transport in Slovakia. It is oriented to the use of a united system surrounding for the collection, processing, sharing, distribution and use of transport information in concrete information, operate and telematics applications. In January 2009, it was adopted a resolution of the Government to the project of support the development of ITS-establishment of the National System of Transport Information (NSDI) by the end of 2013.

Establishment of the NSTI is needed to achieve a significant reduction in traffic accident rate. The main objective will be the ensuring the greatest temporal and territorial extent of road network passage and improve safety and traffic flow through a reliable, functional, efficient and safe road transport system. [4,11]

National system of traffic information: Complex system environment for collection, processing, sharing, publishing and distribution of traffic information and traffic data on:

- current traffic situation on the road network,
- the network of road communications, components and equipments and
- environment for administration and operation of applications and systems over the traffic information and traffic data in connection with uniform geographical model of road network.

Main goals are to:

- provide serviceability of road network.
- increase safety and continuity of road traffic and
- minimise negative impacts from road traffic.

The ensuring of the road network passage means to have continuously updated traffic information and traffic data of all phenomena or events that partially or fully limit passage or negotiability of the network in some areas or sections, directly or indirectly affect the safety or continuity of the road traffic. Economical benefits of the project are: [2]

- reduction of travel time of persons - 2016: 2,6 - 2026: 3,6 mil. hours per year).
- reduction of travel time of freight - 2016: 718 – 2026: 976 thous. ton.hour per year.
- reduction of accident rate (social costs) – 50% decrease of fatalities (in 15 years) or 14 mil. EUR:2016/17,2 mil. EUR:2026 per year.
- reduction of fuel consumption – aprox. 2,8 mil. EUR per year.
- reduction of air pollution (NOX, SO2, NMVOC, PM2.5) – 3,55 mil. EUR:2016, 3,67 mil. EUR:2019, 2,4 mil. EUR:2026.

- reduction of climate impacts – aprox. 200 thous. EUR per year.
- total benefits - 2016:59,9 mil. EUR – 2026: 90,5 mil. EUR.
- project is not generating financial revenues.

5. CONCLUSION

Effective transport of passengers and freight is becoming a serious problem of the whole society and it is required that state administration takes steps towards this issue. Ignoring these issues induces higher public expenditures for solving the consequences.

The new millennium is marked by globalization of economy and transport is undoubtedly an important part of this development. The main contribution of the implementation of ITS systems and services from the social point of view is the increase of transport safety.

The public sector should financially support such telematic applications, which will increase the comfort for the user of transport services, improve the traffic management and reduce the accident rate. Furthermore, the public sector should support the development of technologies for timely saving of lives and the reduction of consequences of serious injuries caused by accidents via technology that diminishes the negative externalities and adds to the increase of quality of public mass transport of passengers.

Negative externalities disrupt the effective share of resources. This brings about two contradictions: the society demands higher mobility but is ever less tolerant towards the increase of externalities. Efficient transport is therefore underlined by a proper calculation of costs. Lessons learnt show that investments into infrastructure only attract more cars, so external costs do not decrease and problems cannot be basically solved via new transport infrastructure. One of the positive ways of easing the impact of the problems is the application of ITS technologies that are a tight connection of information and communication technologies with vehicles and transport networks that move people and items, and thus help improving every part of the transport chain. Recently, the growth of road transport is an attendant phenomenon of development, which manifests in a significant growth of negative impact of transport on the environment, growth in congestion in conurbation and growth in traffic accidents, similar both in developed countries, and in conditions in the Slovak Republic.

Forthcoming Action Plan of ITS aims to:

- decrease transport congestion by 25% and increase the quality of travel,
- increase transport safety by 25% and thereby contribute to the overall European goal to reduce number of death by 50%,
- reducing CO2 emissions by 10%, mainly in urban areas.

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