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TELEMATICS AS A MEANS OF ROAD SAFETY IMPROVEMENT

Abstract

The paper contains an analysis of telematic devices affecting road safety improvement. Telematic devices belonging to both road infrastructure and located in vehicles are presented. It can be stated that counteracting negative effects concerning road safety requires appropriate methods of minimising them. At present, significant results in the field of road safety improvement can also find considerable applications in transport telematics.

INTRODUCTION

For many years scientists have been seriously interested in the problems related to road safety. At present these issues are the focus of a considerable number of discussions concerning technical, medical, psychological and many other aspects of road safety. Today we can clearly state the fact that telematics is one of the basic components of road infrastructure which has a direct impact on traffic safety improvement. Because this area of knowledge relates to transport applications it is generally referred to as transport telematics. It includes integrated systems of measurement, telecommunications, computer science, information, automatics, their equipment and services carried out by them.

Transport telematics is a branch of knowledge about transport which integrates information and telecommunication technology in applications needed by organisations, traffic management and administration, stimulating technical and organisational activities ensuring quality of transport services, better efficiency and safety of these systems' functioning [6].

The main domain of telematic systems analysed from the point of view of road safety is both transport infrastructure and means of transport (vehicles). Thus, the "participants" of transport processes are mainly road end users. The use of telematics for the purpose of safety improvement focuses on infrastructure and vehicles, by means of which Intelligent Transport Systems (ITS) affect people's behaviours. Telematics indicates appropriate parameters to transport infrastructure, which, by collaborating with technically advanced means of transport, determine proper behaviour of traffic participants. It was found out that the role of telematic systems is to support traffic participants and enable them to make proper decisions [5].

1. BASIC COMPONENTS OF TRANSPORT TELEMATICS ANALYSED FROM THE POINT OF VIEW OF ROAD SAFETY – THE CASE OF INFRASTRUCTURE

While considering basic components of transport telematics concerning road infrastructure, we can distinguish [7]:
– variable message signs and boards,
– incident management systems,
– traffic measurement systems,
– traffic monitoring systems,
– meteorological services systems,
– emergency phone systems,
– parking space management and access control,
– automatic registration of traffic offences.

The tasks performed by particular sub-systems make up a whole which is a proper system of traffic control and supervision, prediction of dangerous situations, road incident management, road maintenance and carrying out other activities useful for the proper use of roads and road safety management [6].

Variable message signs and boards (VMS, LCS) serve the purpose of regulating and managing speed thanks to appropriate speed adjustments and limitations in particular traffic directions.

Road incident management system cooperates with many centres of accident identification and records information concerning particular incidents. The information in question includes: accident location, vehicles participating in it, effect on the traffic, predicted time of removing obstacles, etc.[7] The system provides also tools which enable preparing appropriate documents and diagrams comprising suggested rescue plans. The plans contain also information who should be informed and recommended LCS settings and changeable message boards. After selecting an appropriate plan, the system enables automatic implementation of recommended settings and tracking operations of particular devices so that in the case of not executing the recommended settings, an alarm addressed to appropriate services can be generated [3].

Traffic measurement systems serve the purpose of collecting data on traffic intensity via induction loops and axle-load scales. The task of induction loops is to:
– transfer in real time the data concerning road traffic intensity,
– inform the operator about possible jams or crowded roads,
– monitor average driving speeds,
– classify vehicles driving in the traffic.

The task of the axle-load scales is monitoring all lanes through:
– vehicle speed,
– axle load,
– axle base (wheel base),
– vehicle length,
– overload per axle, or axle group,
– maximum permissible load on vehicle,
– classification of vehicles according to the number of axles and axle base,
– date and hour of driving.

Traffic monitoring systems are mainly based on video detectors. Thanks to the use of camera it is possible to calculate the vehicle's driving time between two measurement points. The use of measurement stations with video detectors provides the road administrator with continuous information for traffic analysis and undertaking appropriate actions related to

transport policy on the site where they were situated. Video detection cameras are installed to detect and record undesirable incidents, such as:
– stopped vehicles,
– vehicles exceeding permissible speed,
– vehicles driving against the direction of traffic,
– accidents,
– traffic jams.

Meteorological services system monitors and transfers to the users basic parameters, such as:
– air temperature,
– land surface temperature,
– surface temperature for each traffic lane,
– wind speed,
– air humidity,
– road surface condition,
– visibility,
– rain or snow falls.

Alarm communication system includes alarm units which have a direct connection with the Traffic Management Centre and conversation records.

Parking space management and access control – mainly serve the purpose of providing automatic access to parking spaces by:

enabling control of parking fee payments,

ensuring complete registration of arrivals at and departures from a car park and in this way counteracting any abuse of the system.

Automatic registration of road offences which allows us to:
– successively register traffic offences with the help of the police,
– facilitate detection of traffic offences.

Automatic registration of traffic offences is possible thanks to digital cameras intended for registration of driving on red lights. Usually the cameras are high definition ones. They are located in a weather-proof housing and installed on the crossroads. Statistics prove that after such a system has been installed, drivers' behaviour changes considerably.

This registration is also accomplished by digital colour camera intended for use in traffic offence registration systems, such as exceeding the speed, driving on red lights (also through railway crossings). The camera takes a picture of the highest quality which can be used as evidence in courts.

The central point of an intelligent transport system is the control room. The computer which integrates sub-system activities ensures information flow among them. The system comprises also a number of devices, such as:
– working stations,
– monitors,
– large-size screens,
– telephones,
– faxes,
– means of wireless communication.

2. BASIC COMPONENTS OF TRANSPORT TELEMATICS ANALYSED FROM THE POINT OF VIEW OF ROAD SAFETY – THE CASE OF TRANSPORT MEANS

Each year about 40 000 people die on the roads. In critical situations fractions of a second decide about whether a collision is going to happen or can be avoided. To prevent this, designers design and develop intelligent safety systems. In 2006, the European Commission promoted the "Intelligent car initiative". Its aim was to accelerate and develop more intelligent, safer and more ecological transport in Europe. Such an initiative will accelerate dissemination of intelligent car systems in the European and international market.

The tasks assigned to "intelligent cars" [2]:
- to help drivers prevent and avoid accidents or collisions,
- to minimise consequences resulting from accidents,
- to provide drivers with information about the current traffic, road works, etc.,
- to help drivers in finding the shortest route to their destination,
- to improve energy efficiency.

While considering particular components of transport telematics regarding road infrastructure, we distinguish [4]:
- ACC – Adaptive Cruise Control,
- LKAS – Lane Keeping Assist System,
- ADIS – Advanced Driver Information System,
- Active headlights – adaptive headlights,
- Lane change assistance – blind spot detector,
- E – CALL,
- Electronic braking system,
- ESP – Electronic Stability Program,
- GPS – Global Positioning System,
- Night Vision.

ACC – Adaptive Cruise Control is an intelligent speed control which helps the driver to maintain a safe distance from the vehicles ahead. When the driver crosses white lines, signals warn the driver that he swerved to the wrong side of the road. If the driver does not react, they guide the driver to the right track. Installed obstacle controls warn, among others, against dangers and obstacles around the vehicle; they also inform if some manoeuvres cannot be performed.

LKAS – Lane Keeping Assist System helps to keep the vehicle in the lane. LKAS identifies horizontal lines bordering the lane (lane markings) by processing information provided by a camera mounted behind the windshield. Then the system actively aids the driving wheel torque to keep the vehicle in the lane. When the vehicle approaches the lane's border line, a monotonous audio signal is produced. The LKAS system works only when the following conditions are fulfilled: the lines separating lanes are well visible, the road is the high speed motorway or a similar one without sharp bends, the driver must hold the driving wheel – if the system does not "feel" the driver, it will switch off, or if the indicator is not on and the force and speed with which the driver operates the driving wheel do not indicate that the driver attempts to change the lane.

ADIS – Advanced Driver Information System, the system of traffic information transmission. The aim of designers was to develop an infrastructure which supported by the in-vehicle electronics would be able to support the driver with the information regarding dangers, traffic conditions, etc.

Active headlights – adaptive headlights, the headlight beams are directed left, right, upwards or downwards. It depends on the turn of the driving wheel, actual braking or accelerating. This improves safety because gives more light around curves and over hills, and prevents the lights from beaming up during rapid acceleration and down during rapid braking.

Lane change assistant - blind spot detector- its functioning is similar to that of ACC. It detects the objects which are in the blind spot. If during the lane change manoeuvre another vehicle is in a position that is not covered by the car's mirror (blind spot), the system will cause a vibration of the driving wheel, a warning will be displayed in the mirror or an alert signal will be generated.

E CALL – automatic notification about an accident. If air bags are activated during the accident, then the system automatically notifies the administrator about the location of the collision site by sending, among others, GPS coordinates. This system can also be activated manually.

Electronic braking system – detects emergency braking from the way in which the brake pedal is pressed and automatically applies more force, which shortens the braking distance by ca. 5m. Moreover, the system switches the emergency lights on.

ESP – Electronic Stability Program – the system controlling a vehicle's stability. It prevents a vehicle's loss of traction (side skidding) and in this way steers the vehicle where the driver intends to go.

GPS – Global Positioning System – it is designed, among others, to locate vehicles. It guides a vehicle to the destination owing to maps and information supplied by satellites.

Night Vision – the system that increases visibility at night. The picture of the road registered by the radar system is displayed on the screen.

SUMMARY

Innovative solutions are widely implemented in all branches of transport. Changeable message boards, satellite navigation systems, internet, mobile phone networks are just some examples of the use of telematics in road transport.

Owing to the application of innovative telematic solutions, we can notice improvement in the safety of traffic participants. The aspects concerning [1]:

- higher traffic efficiency,
- collecting data concerning road traffic and current weather conditions,
- wider access of traffic users to collected information,
- navigation systems have been solved.

Telematics is a dynamically developing field of knowledge, therefore we can expect a further development of devices belonging to the infrastructure and vehicles and improvement of road safety. Intended effects of the described device activities require not only technical solutions but also changes in the attitudes of road users. These intelligent systems are not able to predict irresponsible behaviours of particular road users. Therefore, to be sure that the activities undertaken to improve road safety will bring expected results, we need involvement and compliance of all traffic participants.

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TELEMATYKA ŚRODKIEM POPRAWY BEZPIECZEŃSTWA RUCHU DROGOWEGO

Streszczenie

W referacie przedstawiona została analiza telematycznych środków wpływających na bezpieczeństwo ruchu drogowego. Przedstawiono analizę urzadzeń telematycznych należących zarówno do infrastruktury drogowej jak również tych znajdujących się w pojazdach. Stwierdzić można, że przeciwdziałanie negatywnych skutków dotyczących bezpieczeństwa ruchu drogowego wymaga odpowiednich sposobów ich zmniejszania. Obecnie znaczące rezultaty w obszarze poprawy bezpieczeństwa ruchu drogowego mają duże zastosowanie także w dziedzinie jaką jest telematyka transportu.

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