Vulnerable Road User needs towards ITS

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ABSTRACT:

Due to fast development of new technologies in the field of Intelligent Transport Systems (ITS) a number of new research topics arise, especially in view of vulnerable road users (VRUs). As most developments in the ITS sector are primarily targeting motorised transport with focus on safety and ecological aspects of transport, there is still a lack of both research and development considering VRUs not only as passive element. The VRUITS project, funded by the EC, aims at actively integrating the "human" element into the ITS approach.

Goal of the EC co-funded project VRUITS (Vulnerable Road Users and ITS) is to assess societal impacts of selected ITS, and provide recommendations for policy and industry regarding already available and future ITS in order to improve the safety and mobility of VRUs. Main focus of the VRUITS approach is to provide evidence-based practices on how VRU safety and mobility can be integrated in Intelligent Transport Systems and on how HMI designs can be adapted to meet the needs of VRUs. In addition these recommendations are tested in field trials to further improve and adapt these applications to actual vulnerable road user needs.

Based on focus group discussions and expert interviews, critical scenario analysis and a comprehensive ITS mapping process the basic reaearch phase of the project focssued on:

1. Identification of critical situations for VRUs based on European accident data

2. Assessment of needs of VRUs towards ITS services and applications by integrating actual stakeholders in course of a qualitative research process

3. Identification and prioritisation of ITS which affect VRU safety as well as general mobility and comfort aspects

1 VUR needs and ITS

In order to integrate actual stakeholders into the research process and

assess current issues, needs and attitudes towards ITS representatives of different vulnerable road user groups have been involved in discussion rounds. In addition experts from tangent fields, infrastructure, traffic planning, ITS, policy, etc., were interviewed to gather insight in future developments, technology potential and issues in the fields of ITS and VRUs.

1.1 Focus Group Discussions with VRU groups

Based on a sample of overall 143 participants covering the following five VRU groups: adults, parents, adolescents, older road users, cyclists and PTWs (powered two-wheelers) from four partner countries (Spain, Finland, Austria, the Netherlands) 20 focus group discussions were conducted.

Based on the collected materials critical situations in traffic were identified to serve as a qualitative basis for the situations that could potentially be addressed by ITS solutions. These critical scenarios for VRUs are usually related to:

- High (car) speeds
- lack of respect of motorised traffic
- visibility/conspicuity
- Complexity and density of traffic
- Lack of communication between road users
- Weather conditions/maintenance of infrastructure

In general the participants of the different VRU groups discussed experiences on all levels of ITS including mobile applications, in-vehicle and infrastructure; with a high variety of known technologies (informing, intervening, warning) and high level of experiences among car drivers (BSD, ISA, GPS, Cruise Control, etc.). Actual experiences with various systems are generally very positive with hardly any statements regarding failing ITS.

One of the main goals of the discussion rounds was to identify the technology potential of ITS from the point of view of the different VRU groups. Most important benefits identified include:

- Increased visibility of VRUs (communication, warning, intervention)
- Increased overall traffic flow (automation)
- Economic (less fuel consumption) and ecological (less CO_2 emissions) aspects
- Increased comfort in traffic (information)

On the other hand participants were asked to identify potential hazards and

adverse effects of these emerging technologies on both the safety and general mobility of vulnerable road users. One of the main aspects identified by motorcyclists was loss of autonomy. Generally distraction (sounds, visuals, interaction), overreliance, or overconfidence technical reliability and potential negative effects on actual abilities (i.e.: decreasing spatial abilities/driving skills/reaction times) were mentioned in this regard.

1.2 Expert Interviews

In the course of 10 semi structured interviews with 10 European level experts from the fields of technology (including infrastructure, technology development and application), policy (structural aspects, legal issues, etc.) interest groups of vulnerable road users and infrastructure service providers additional qualitative input on both technological aspects as well as user-oriented aspects of ITS and traffic safety was gathered. Focus of discussion were VRU mobility needs, critical scenarios in traffic and technology potential of available and future technologies in the transport and mobility sector.

Safety issues identified in course of the expert interviews were very similar to those discussed by the different VRU groups:

- Visibility of VRUs

- Infrastructure design especially in view of actual space for VRUs in traffic

- Speed of motorised traffic

- Education, training and awareness of the different road user groups

- Lack of data on VRU specific accidents (single pedestrian, etc.) constitutes a significant barrier for ongoing developments of solutions specifically designed to address VRU safety.

In general the potential of ITS solutions to improve VRU safety and positively affect general mobility was assessed favourably. The potential of automation and direct support to reduce user errors, especially of novice drivers, older road users and children in traffic was identified as functions directly affecting

road safety. Traffic efficiency was another area were technological solutions could provide a source for improving traffic flow and fuel and CO_2 emissions overall improving traffic conditions. In view of motorised traffic, current systems are perceived to help compensate for distraction, fatigue etc. which are causing factors for high shares of VRU accidents. Overall ITS is seen as relevant technological factor to help improve independency of vulnerable road users by increasing comfort and decreasing uncertainty through information. A topic of potential future interest in the ITS sector was education and training via simulation and e-coaching solutions which could be especially relevant for motorised traffic, specifically for PTWs.

Beside these positive implications the interviewd experts also identified ITS hazards and current barriers to broad scale deployment. Main adverse effects were seen in distraction and risk assessment of ITS users, especially among car drivers. Attention to traffic and the corresponding requirements for HMI (human-machine interface) design will be important aspects not only for technological developments, but also for scientific evaluation. In addition there are still open questions when it comes to responsibility in case of system failure or misuse and privacy in connection with personalised data.

2 Critical scenarios in traffic

Based on available European accident data, most relevant critical scenarios for cyclists, pedestrians and PTWs were identified to serve as a basis for safety relevant situations to be potentially addressed by ITS solutions. The approach in the accident analysis started out by identifiying databases providing access to either in-depth and macro data on actual circumstances of accidents involving VRUs. In addition existing project results and already identified scenarios were taken into account to select most relevant scenarios from a VRU perspective.

All of the analised scenarios took both national databases, from Spain, Austria, the UK, Sweden and Finnland, and CARE data into account leading to more than one scenario per mode in certain cases.

2.1 Pedestrian scenarios

Analysis of CARE data showed that accidents were most likely to occur when the pedestrian was crossing the road mid-block, actually in distance from a

junction. In addition the reported accidents occurred in fine weather with dry road conditions. In view of time of day results suggested most accidents involving pedestrians to occur between 12pm and 6pm.

In regards to the actual location where pedestrian accidents occurred accident data suggests that most accidents occur in urban areas on roads with speed limits below 50km/h. The majority of accidents involved collisions with passenger car as collision partner, which was not only confirmed by CARE data, but also national accident databases.

Issues regarding not identifiable parameters include information on vehicle characteristics, vehicle speed pre-collision and pedestrian actions prior to collision.

2.2   Bicycle scenarios

Accident data from CARE involving bicyclists suggested that the most common scenario was a passenger car and a bicyclist heading in the same direction with the motorised vehicle turning into the cyclist's path. Results from national accident databases showed another picture suggesting that the most common scenario was a vehicle pulling out into the path of the on-coming cyclist at an intersection.

As seen with pedestrian accidents the majority occurred in fine dry weather during daylight hours. Another similarity to pedestrian accidents involve the actual location, with most accidents occurring in urban areas at relatively on roads with relatively low speed limits of 50km/h.

2.3   Motorcycle scenarios

In view of most common motorcycle accidents there was also a discrepancy between the national databases and CARE data. In the CARE database the most common scenario involved a PTW being hit by a vehicle with both vehicles initially heading in the same direction and the car then turning across the path of the PTW. In national databases the most frequently observed accident scenarios involved motorised vehicles pulling out from intersections into the path of the PTW. In both cases the vehicle most

commonly involved in the PTW accident was a passenger car. As with pedestrians and cyclists most accidents occurred within urban environments with again most commonly occurring on roads with low speed limits. Accidents mostly happened during the summer months, with fine and dry weather conditions during daylight hours.

3   Prioritisation of ITS for VRUs

Based on available literature and accident scenarios and the results of the qualitative assessment of different VRU groups the most promising ITS solutions covering both safety and general mobility aspects were mapped. An initial set of 14 solutions aimed at pedestrians, 34 addressing cyclists, 28 motorcyclists, and 10 systems for motorised vehicles were identified as positively affecting VRU safety and mobility. In course of an expert workshop with stakeholders from different tangent fields the most relevant solutions were identified and considered for the impact assessment. Overall 20 systems were selected for the final inventory covering safety and mobility relevant functions for all considerd VRU groups.

For each VRU group different applications were identified as having a positive effect on VRUs.

For pedestrians these solutions focus on the following aspects in traffic:

- Car speeds (i.e.: speed cameras and ISA)

- Visibility and detection (i.e.: tags for kids, in-vehicle pedestrian detection tools, automatic detection of pedestrians)

- Generally improving comfort and mobility (mobile phone tracking for transport planners, countdown signals, special users)

For bicyclist the systems identified as having the highest potential to support safety and mobility were on the one hand solutions that are aimed at detectability and conspicuity of the cyclist in traffic:

- Intersection safety

- Blind spot detection

- Bicycle green wave & pre-green for bikes

- Automatic bicycle identification

And systems that provide information relevant to cyclist and therefore increase comfort and mobility:

- Safe route planner and critical black spots in traffic

- Information on bike sharing

- Public transport vehicles where bicycles are allowed

For motorcyclists most of the identified solutions are related to other motorised traffic and hence focussing on increase detectability and conspicuity:

- Intelligent speed warning for motorcyclists

- Rider monitoring, to warn in case to rider is unattentive

- Intersection safety

- Cooperative systems allowing communication between vehicles and between vehicles and infrastructure

The final inventory to be used in course of the adaptation and development process of an assessment methodology for ITS addressing VRUs is not only covering safety, but also comfort and general mobility.

4   Conclusions

The results of the first tasks of the VRUITS project provided insight not only into critical scenarios and accident data of VRUs, pedestrians, cyclists and PTWs, but also integrated actual stakeholder needs and attitudes towards ITS into the approach. By applying focus group discussions, expert interviews and workshop methods in course of the basic research phase an inventory of the most promising ITS solutions for vulnerable road users was established to serve as basis for the assessment methodology and controlled field trials.

In view of safety relevant systems these need to cover the different scenarios

for the different road user groups. For pedestrians the key scenarios consistent in all used databases were mid-block accidents, remote from a junction. In view of cyclists safety needs the most relevant scenarios to potentially be addressed by ITS were not consistent in all available data sources but especially junctions and intersections where 'give-way' is required were relevant. These findings regarding motorcyclists correspond to results found for bicyclists.

In this regard systems with the highest potential to provide support in critical scenarios in traffic are aiming at reducing both car speeds, by providing information and support to the car drivers and reduce the complexity of high density traffic situations, especially at intersections. In addition solutions that increase visibility and conspicuity of vulnerable road users were identified as highly relevant for avoiding potential accidents. By providing additional information in traffic, for routing, parking etc., both efficiency and comfort of vulnerable road user can be supported in turn increasing general mobility of the affected road users. On the other hand potential adverse effects negatively impacting traffic safety were identified and will be considered in course of the impact assessment. Distraction, technical reliability as well as still existing standardisation issues need to be tackeld in course of technical development.

5   References:

Bell, D., Risser, R., Morris, A., Hancox, G., García, A., Martín, O., Scholliers, J., Schirokoff, A., Penttinen, M., Johansson, C., Goede, M. de and González Luna, J., VRUITS: Improving the Safety and Mobility of Vulnerable Road Users Through ITS Applications, Deliverable D2.1, Technology potential of ITS addressing the needs of Vulnerable Road Users, Grant agreement n° 321586, 11 October 2013.

Website

http://vruits.eu/, accessed March 2014