PROSPECT
Proactive Safety for Pedestrians and Cyclists

PROSPECT motivation

Accidents involving Vulnerable Road Users (VRU) are still a very significant issue for road safety. According to the World Health Organization, ***pedestrian and cyclist accidents account for more than 25% of all road traffic fatalities worldwide***. Autonomous Emergency Braking (AEB) Systems have the potential to improve safety for these VRU groups.

The PROSPECT project (Proactive Safety for Pedestrians and Cyclists) aims to improve significantly the effectiveness of active VRU safety systems compared to those currently on the market by expanding both ***the scope of scenarios addressed and improving the overall system performance***. This is realised with advanced sensor processing and a more precise situation analysis, accompanied by novel intervention strategies including both braking and evasive steering manoeuvres. All these envisaged concepts will be implemented in several vehicle prototypes. Special emphasis is put on balancing system performance in critical scenarios and avoiding undesired system activations.

The introduction of a new generation safety system in the market will enhance VRU road safety in 2020-2025, ***contributing to the 'Vision Zero' objective of no fatalities or serious injuries in road traffic*** set out in the Transport White Paper. Furthermore, the test methodologies and tools developed within the project shall be ***considered for the New Car Assessment Programme (Euro NCAP)*** future roadmaps, supporting the European Commission goal of halving road fatalities in the 2011-2020 timeframe.

Read about what we plan to do in PROSPECT and experience our current achievements!

In this issue:

PROSPECT
Proactive Safety for Pedestrians and Cyclists

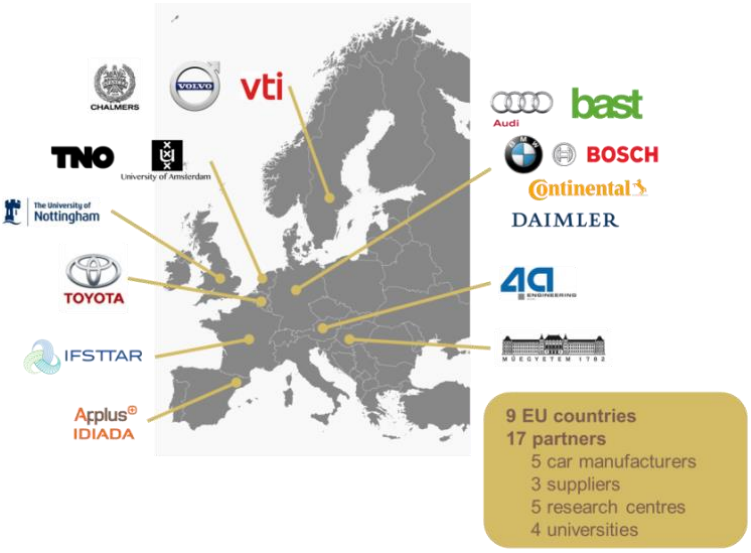
Newsletter 1, July 2017

Meet Project partners

Welcome to the first edition of the PROSPECT Newsletter, published after the first successful project review at Brussels.

PROSPECT is ***a collaborative research project involving most of the relevant partners from the automotive industry*** (including important active safety vehicle manufacturers and tier-1 suppliers) as well as academia and independent test labs, funded by the European Commission in the Horizon 2020 research programme under grant agreement No. 634149. The project was launched in May 2015 and will end in October 2018. The Consortium consists of 17 partners from 9 different European countries.

In this newsletter the ***car manufacturers of PROSPECT project are presented***.



Audi Aktiengeselldchaft, Germany	Audi	***AUDI*** is one of the world's leading automotive premium brands, and builds high quality, technologically progressive cars. We place our customers' wishes at the very heart of our unceasing quest. This philosophy is reflected in our brand claim "Vorsprung durch Technik" ("progress through technology").
Bayerische Motoren Werke Aktiengesellschaft (BMW), Germany	BMW	***The BMW Group*** is one of the most successful German manufacturers of automobiles and motorcycles and ranks among Germany's largest industrial companies. The brands BMW, MINI and Rolls-Royce are three of the strongest premium brands in the automotive industry today.
Daimler AG, Germany	DAIMLER	***Daimler*** with its divisions Mercedes-Benz Cars, Daimler Trucks, Mercedes-Benz Vans, Daimler Buses and Daimler Financial Services, the Daimler Group is one of the biggest producers of premium cars and the world's biggest manufacturer of commercial vehicles with a global reach.
Toyota Motor Europe, Belgium	TOYOTA	***Toyota´s R&D Group*** has been regularly involved in European Commission research in the vehicle safety area, were was developing test and assessment protocols for selected integrated safety systems with pre-crash sensing, focusing on AEB car-to-car technology and AEB car-to-pedestrian.
Volvo Personvagnar AB, Sweden	VOLVO	***Volvo Car Corporation*** has developed into one of the most well-known brands in the automotive industry. VCC has 40 years experiences in collecting field data and develop requirement and test methods in the active safety area.

Results of the first period

The PROSPECT project has been running for two years now. During this time, PROSPECT team has identified challenges in bringing active Vulnerable Road Users safety to the next stage.

The consortium came up with a ***better understanding of accident data retrieved from naturalistic observation studies and novel HMI guidelines***. With these new key inputs a pro-active Autonomous Emergency Braking (AEB) system specification was defined, which builds the basis for the further system development.

The PROSPECT team is now finalising the ***integration of the various sensors and processing units in the demonstrator vehicles*** and preparing the first testing activities in realistic traffic scenarios including user acceptance tests.

This is a suitable time to present project key milestones that were achieved in the first half of the project.

Car-to-cyclist crashes in Europe and derivation of use cases as basis for test scenarios of next generation Advanced Driver Assistance System (ADAS):

In the first year of the project, PROSPECT team investigated ***crashes involving one passenger car and one cyclist in several European crash databases looking for all injury severity levels*** (slight, severe and fatal). These data sources included European statistics from Community Database on Accidents on the Roads in Europe (CARE), data on a national level from Germany, Sweden and Hungary, as well as detailed accident information from these three countries using The German In-Depth Accident Study (GIDAS), the Volvo Cars Cyclist Accident database and Hungarian in-depth accident data, respectively. The most frequent accident scenarios were studied and Use Cases were derived considering the key aspects of these crash situations (e.g. view orientation of the cyclist and the car driver's manoeuvre intention). The highest ranked of these Use Cases have subsequently been taken forward to form an appropriate basis for the development of Test Scenarios (see Fig.1).

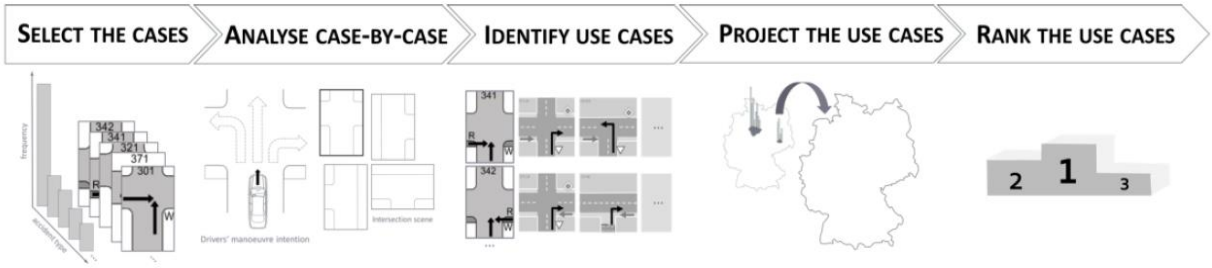


Fig. 1: The method for Use Case analysis in PROSPECT.

Latest information on car-to-cyclist crashes in Europe was compiled including details on the related crash configurations, driving directions, outcome in terms of injury severity, accident location, other environmental aspects and driver responsibilities. The majority of car-to-cyclist crashes occurred during daylight and in clear weather conditions. Car-to-cyclist crashes in which the vehicle was traveling straight and the cyclist is moving in line with the traffic were found to result in the greatest number of fatalities. If slightly and seriously injured cyclists were also considered, a different order of crash patterns arose, according to the three considered European countries. A total of 29 Use Cases were derived considering the group of seriously or fatally injured cyclists and 35 Use Cases were derived considering the group of slightly, seriously or fatally injured cyclists. Finally, regarding car-to-cyclist crashes, ***five Accident Scenarios were identified***: (I) "Car straight on, cyclist from nearside", (II) "Car straight on, cyclist from far side", (III) "Car turns", (IV) "Car and cyclist in longitudinal traffic" and (V) "Others". The highest ranked Use Case describes the collision between a car turning to the nearside and a cyclist riding on a bicycle lane against the usual driving direction (see Fig.2).

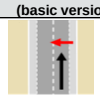
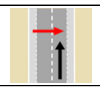
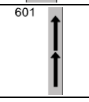
Accident type	UTYP Pictogram	PROSPECT pictogram (basic version)
(I) Car straight on, cyclist from near-side		
(II) Car straight on, cyclist from far-side		
(III) Car turns		
(IV) Car and cyclist in longitudinal traffic		
(V) Others		

Fig. 2: Car-to-cyclist accident scenarios.

Naturalistic Observations to investigate conflicts between drivers and VRUs:

In parallel to macro statistical and in-depth accident analysis, the PROSPECT consortium investigated ***interactions between vehicles and VRUs in real traffic situations to better understand critical situations*** and to identify factors that lead to conflicts. As a result, VRU and vehicle modelling will be more effective, allowing safety systems to react earlier, without necessarily increasing false alarm/activation rates.

Accident studies highlighted the most relevant use cases for car-to-cyclist and car-to-pedestrian accident scenarios, and further naturalistic observations provided information that could not

be inferred from accident databases regarding these use cases, such as trajectories and kinematic ***data*** (speed, acceleration, Time to Collision (TTC) or Post Encroachment Time (PET)) throughout the conflict evolution. Data was also collected on ***VRU's behaviors which forecast their intent in the near future*** (i.e. positional data, gestures). Finally, naturalistic observations were used to look for correctly managed situations by the road users that could provoke false alarms/activations in existing perception systems.

Two kinds of naturalistic observations were undertaken in three countries:

(1) A first data set (France and Hungary) was collected from ***on-site observations by infrastructure-mounted cameras***.
(2) A second data set was collected ***by cars equipped with sensors and cameras*** (Hungary and Spain) to observe interactions with surrounding VRUs.

More than 2,000 hours of videos were recorded in Lyon, Barcelona and Budapest and allowed for extracting 602 conflicts (see Fig.3 example).

Only situations of ***conflict with close proximity between road users both in space and time*** were analysed. This important criterion qualified an encounter as a conflict. Low speed conflicts were excluded. Several hundred conflicts were collected, each classified according to the prevailing use cases and annotated using a common evaluation grid. Different categories of parameters were investigated to describe: ***environmental conditions*** (light, precipitation, road surface, traffic density, etc.), ***infrastructure*** (layout, dedicated lanes, speed limit, etc.), ***VRU characteristics*** (type, equipment, etc.), ***encounter*** (visibility, right of way, yielding, conflict management, estimated impact point, etc.), ***intent*** (head/torso orientation, gesture, flashing indicator), ***kinematics and trajectories***.

Start and end timestamps were recorded for time dependent parameters such as yielding, head movements, etc. Finally, variants of use cases were obtained to describe potential conflict evolutions and determinant factors of these evolutions.

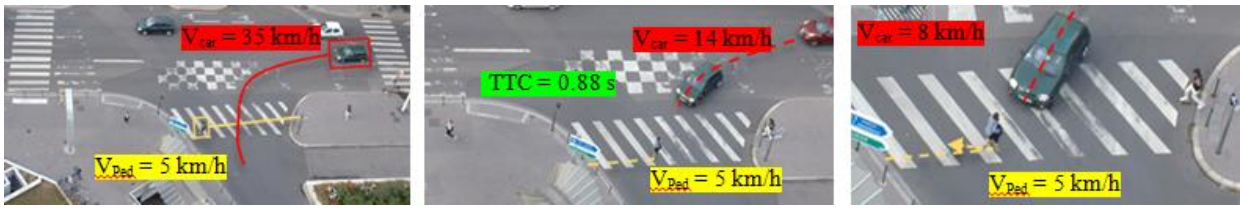


Fig. 3: Example of a conflict from naturalistic observations.

Technical and Advisory Board meeting at BASt

On the 17th, 18th and 19th of October 2016, BASt hosted the 4th PROSPECT General Assembly meeting, including the first Advisory Board meeting of the project and a session on accident Use Cases (see Fig.4).

The PROSPECT Advisory Board consists of senior automotive ***experts from areas such as Vulnerable Road Users safety, active safety, accident research and vehicle protection systems***. During the practical session the Advisory Board assisted the consortium to assess the potential impact of the project and refine future activities based on presented project findings and results. Following a fruitful discussion, it was clear from the Board that PROSPECT is quite exceptional among the various projects of Transport Research Safety and will significantly improve the effectiveness of active VRU safety systems compared to those currently on the market.

In particular, we learned more *about* ***legislation and political aspects of ADAS systems***, ***links to other projects and initiatives on traffic safety***. Moreover, we gained knowledge on how to approach relevant bodies and organisations like ***Euro NCAP, CLEPA, ACEA and ISO***, amongst others, with our results.

Fig. 4: First PROSPECT Advisory Board Meeting in conjunction with workshop session.

Fig. 5: Demonstration of Audi driving simulator.

The Use Cases session included a presentation and discussion about the Pedestrian and Cyclist Use Cases. In addition, first ideas for the project demonstrators were reviewed, including sensors, HMI, vehicle and functional setup. This session also included a demonstration of the mobile driving simulator by Audi.

Finally, ***the R&D projects SENIORS, XCycle, InDEV and SafetyCube, funded under the same H2020 topic***: MG-3.4-2014 "Traffic safety analysis and integrated approach towards the safety of vulnerable road users", presented their achievements on VRU safety. An open discussion occurred on future profitable collaboration and synergies among the projects which helped us to explore new promising tracks and identified room for improvements.

These days of profitable collaboration and intense work reinforced and sharpened our results. Ultimately, they assisted considerably in ensuring we received positive feedback from the first project review that took place in January 2017 in Brussels.

Past conferences

The PROSPECT partners have been intensively disseminating the project results obtained so far. For the whole presentations and publications, we invite you to check our website or to contact us directly!

- ***IEEE Intelligent Vehicles Symposium in Redondo Beach*** (USA), 11-14 June 2017;
- ***International Technical Conference on Enhanced Safety of Vehicles in Detroit*** (USA), 5-8 June 2017;
- ***Automobile in Barcelona*** (Spain), 11-12 May 2017;
- ***International Cycling Safety Conference in Bologna*** (Italy), 2-4 November 2016;
- ***Design and Architectures for Signal and Image Processing in Rennes*** (France), 12-14 October 2016.

PROSPECT Twitter Account
@PROSPECT_H2020
Follow us on Twitter for news, info and interesting content on #AEB #activesafety #ADAS #HMI #RoadSafety and more.

PROSPECT dissemination kit
Download public deliverables, project presentations, publications and dissemination kit from PROSPECT website:
www.prospect-project.eu/download/

Save the date! PROSPECT at upcoming events

You can meet members of the PROSPECT project at various events in the coming months. The following four events have already been confirmed. Stay tuned for future news and we look forward to seeing you there:

September 4-6: ***Euro Working Group on Transportation Meeting*** (Budapest, Hungary)

October 8-13: ***European Microwave Week*** (Nuremberg, Germany)

September 21-22: ***International Cycling Safety Conference*** (Davis, USA)

October 17-19: ***The Road Safety and Simulation conference*** (The Hague, The Netherlands)

Recently published papers

- I. Gohl, A. Schneider, J. Stoll, M. Wisch, V. Nitsch: ***Car-to-cyclist accidents from the drivers' point of view*** - International Cycling Safety Conference 2016, Bologna, Italy.
- D. R. Large, C. Harvey, G. Burnett, S. de Hair-Buijssen: ***Understanding the cues and characteristics that indicate and affect a cyclist's future path: A focus group study conducted in the UK and Netherlands*** - International Cycling Safety Conference 2016, Bologna, Italy.

- F. Meinl, M. Kunert, H. Blume: ***Hardware acceleration of maximum-likelihood angle estimation for automotive MIMO radars*** - Design and Architectures for Signal and Image Processing 2016, Rennes, France.
- A. Glász, J. Juhász: ***Car-pedestrian and Car-cyclist accidents in Hungary*** - Conference on Sustainable Urban Mobility 2016, Volos, Greece.

Available public documents

The first deliverables presenting a review of accident analysis for VRU and derived functional requirements for active systems have been finalised and uploaded to the PROSPECT project website.

- Deliverable D2.1 ***"Accident Analysis, Naturalistic Driving Studies and Project Implications."***
- Deliverable D2.2 ***"Specification of User Needs (drivers and VRUs) and Functional Requirements of Vehicle Safety Systems."***
- Deliverable D3.1 ***"The Addressed VRU Scenarios within PROSPECT and Associated Test Catalogue."***
- Deliverable D3.2 ***"Specification of the PROSPECT demonstrators."***

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Get in touch with PROSPECT experts and researchers

Are you representing an automotive supplier, vehicle manufacturer, standardisation body or other interested automotive association or organisation?

Want to know more? Visit our website or contact us!
Please contact us for any questions concerning this newsletter.

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