DEVELOPING A TEST TOOL FOR ADVANCED ASSISTANCE SYSTEMS IN INTERSECTIONS, PEDESTRIAN AND VEHICLE DETECTION

D. GALLEGOS, F. LIESA & O. MUÑOZ

IDIADA
SUMMARY

✓ Introduction
✓ Accidents with pedestrians involved
✓ Nowadays pedestrian protection
✓ Technologies and advanced systems implemented in the vehicle
✓ Design of the installation
✓ Conclusions
The European Pedestrian Protection Legislation comprises tests divided into two phases. The first phase was implemented in October 2005 and the second phase of test comes into effect from 2010. The latter phase of tests is anticipated to be a lot more challenging than the former. In addition, legislation demands that these systems have to be installed as a standard in all vehicles, thus driving up the number of pedestrian protection systems in use.

Still under Development, Active and Passive Pedestrian Safety Systems are Likely to Demonstrate High Growth Rates

Unlike passive occupant protection systems, pedestrian protection systems, both active and passive, are still being developed. However, growing concerns for pedestrian safety and government legislation is likely to keep demand steady for these systems. Automobile manufacturers are working on various pedestrian safety solutions such as introducing energy absorption front end, installing deployment solutions (airbags, deploying bonnets or bumpers) or going for more active safety solutions such as driver warning systems and automatic systems.
Every year, in Europe, 6,000 people died as a consequence of a traffic accident, while they are pedestrians.

In Spain 2007, from the total number of victim in traffic accidents of 3,821, 589 were pedestrians,
- Representing un 15% of the victims outside the cities, in open roads.
- Representing un 40% of the victims inside the cities, being 302 pedestrians from 740 people died.

For instance, in Barcelona, in 2009, 16 pedestrians were died, with a total number of victims of 40.
ACCIDENTS WITH PEDESTRIANS

1. Pedestrian crossing from left
2. Pedestrian crossing from right
3. Pedestrian moving along the road
Other pedestrian situation
But nowadays, most of the systems applied to the vehicle to improve pedestrian protection are related to the passive safety.

In the Graphic it is showed the evolution of the punctuation in the pedestrian tests of the EuroNCAP, where an improvement of the pedestrian protection level can be seen.
Although the implementations in passive safety, there are new systems appeared recently that are focused on active safety.

**Upping**

**Airbag**

Source: CITROEN

Source: AUTOLIV
Results obtained by the cars with pedestrian protection advanced systems:

Maximum punctuation obtained in EuroNCAP tests in pedestrian protection area.

Source: EURONCAP
ADVANCED SYSTEMS

Advanced Driver Assistance Systems (ADAS)

Human Machine Interface (HMI)

I/O Elements

HMI Language

In-Vehicle Information Systems (IVIS)

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Technologies used in the development of new ADAS systems are:

- **Long Range Radar (LRR)**
- **Short Range Radar (LRR)**
- **Infrared-Radar (LIDAR Fixed)**
- **Infrared-Radar (LIDAR Scanner)**
- **Infrared Thermal Image (FIR)**
- **Infrared Vision (NIR)**
- **RGB-Video (Mono-Camera)**
- **RGB-Video (Stereo-Camera)**
ADAS SYSTEMS

1. Frontal detection
   - ACC (Adaptive Cruise Control)
   - ACC Stop&Go
   - Pre-Crash
   - Night Vision

2. Transversal detection
   - Intersection assistance
   - Pedestrian detection

3. Lateral Detection
   - LCA (Lane Change Assistance)
   - LDW (Lane Departure Warning)
   - Park Assist

4. Rear detection
   - Rear Collision Warning

5. Interior Detection
   - Driver drowsiness monitoring

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The installation

Concept

It represents an intersection scenario, to reproduce situations of pedestrian and vehicles crossing by the maximum realistic possible way.
Control

Scheme and equipments of the instalation

Control parameters

Target: to simulate different positions of the pedestrian and the vehicle in case of a possible crash with the test car.

Control algorithm in simulation mode

Free channels for future extensions

Light barrier

Controller

Engine

Pedestrian / vehicle movement

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The pedestrian

- Lower extremities movement.
- Synchronized with the longitudinal displacement.
- Detectable by any technology used in this kind of systems.
- "Crashable"; no damages in test vehicle are produced.
Operation

Synchronize of movements of the extremities with the use of poles
The vehicle

- Synchronized with the longitudinal displacement of the test car.
- Detectable by any technology used in this kind of systems.
- “Crashable”; no damages in test vehicle are produced in case of contact.
THE INSTALLATION

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### EVOLUTION

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<tr>
<th>Now in the market</th>
<th>First steps</th>
<th>In development</th>
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<tbody>
<tr>
<td>ESP; ABS</td>
<td>Night vision</td>
<td>Automatic emergency brake</td>
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<tr>
<td>Cruise control &amp; ACC</td>
<td>Blind spot monitoring</td>
<td>Intersection assistance</td>
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<tr>
<td>Speed limiter</td>
<td>ACC stop &amp; go</td>
<td>Pedestrian protection (PROTECTOR)</td>
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<tr>
<td>Speed alert</td>
<td>Lane change assist</td>
<td>V2V &amp; V2I</td>
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<td>Advanced front light</td>
<td>Lane keeping assist</td>
<td>Intelligent powertrain system (PEIT)</td>
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<td>Brake assist</td>
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<td>Rear vision</td>
<td>Adaptative suspension system</td>
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<td>Tire pressure monitoring</td>
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**Driver Assistance Systems**

**ADVANCED Driver Assistance Systems (ADAS)**

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DEVELOPING A TEST TOOL FOR ADVANCED ASSISTANCE SYSTEMS IN INTERSECTIONS
THE FINAL TARGET

Satellite to Vehicle (GPS)

Data process center

WLAN Hot Spot

Traffic management in real time

Vehicle Infrastructure

Vehicle Vehicle

THE FUTURE

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The innovation process in the automotive industry has active safety systems as one of the main lines of research, those systems which try to avoid that the accident happens. Specifically, inside active safety systems, advanced driver assistance systems (ADAS) are everyday with the appearance of new applications that need to develop new tools to test the performances of them, with the final target of doing a standardization.

The test tool designed follows the most dangerous situation appearing in an intersection, both situations with a vehicle and with a pedestrian in the intersection as a possible target and the installation has the possibility to test systems with misuse because all the target tools are totally crashed by the test cars.

Innovation in the target car and target pedestrian are focused in reproducing by the best way possible the appearance of each element as the system installed in the vehicle should see them with the different technologies that can be applied depending on the OEM.
THANK YOU VERY MUCH FOR YOUR ATTENTION
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