interactIVe

Accident avoidance by active intervention for Intelligent Vehicles

Integrated Collision Avoidance and vehicle path control for passenger cars and commercial vehicles - Development and evaluation results

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interactIVe Final Event

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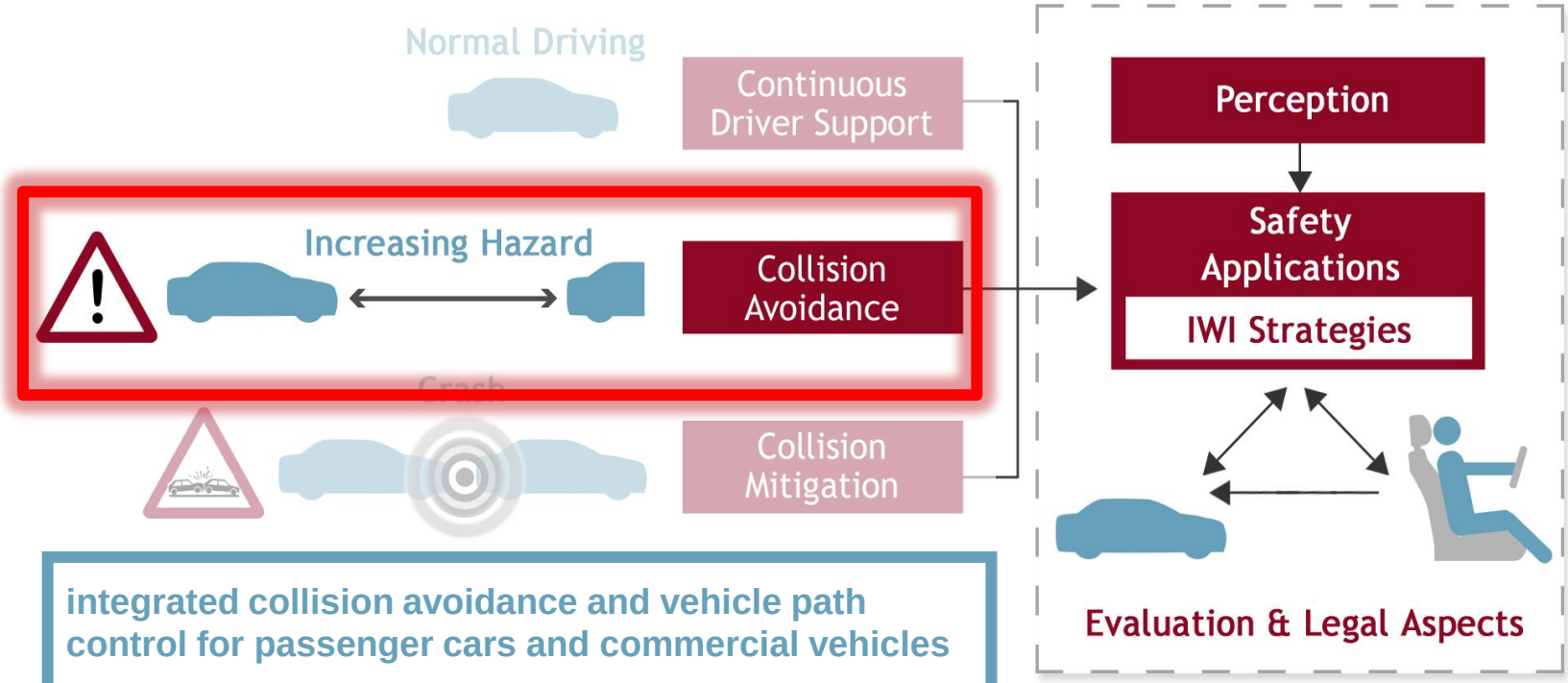
Contents

- Overview
- Challenges
- Demonstrator Vehicles
- Technical evaluations
- User-related evaluations
- Conclusions

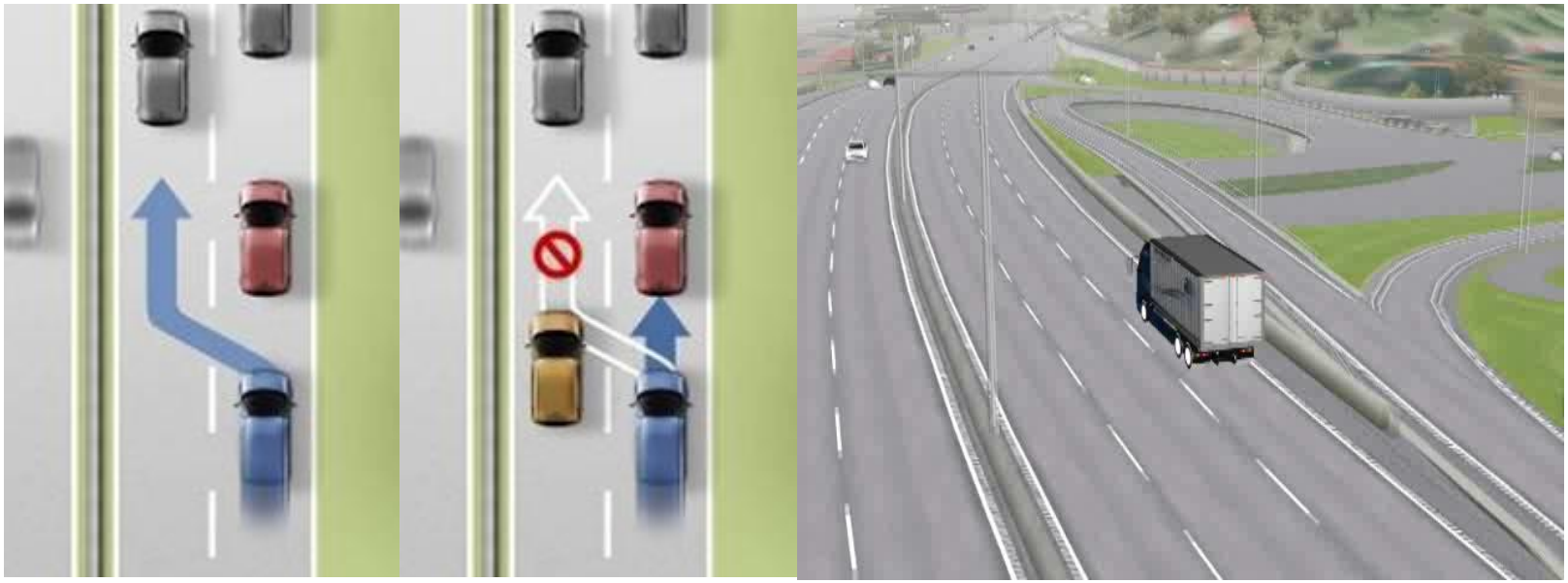
Role within interactIVe



integrated collision avoidance and vehicle path control for passenger cars and commercial vehicles

VOLVO Ford VOLVO CHALMERS DELPHI ΕΠΙΣΕΥ ICCS

Challenges



- interactIVe integrated Collision avoidance manoeuvre depending on traffic situation.
  - Evaluate a collision free trajectory or path in changing traffic scenarios.
  - Different configurations and load conditions for commercial vehicles needs to be taken into account
  - simulation models and simulation environment

Challenges (2)

- In order to cope with **avoidance manoeuvres by steering** a number of challenges is added: for example:
- How to decide and describe the best path to follow in order to avoid ” lateral threat; with boundary conditions by the vehicle itself and environment - like road curvature and width ?
- How to judge the risk of collision with oncoming (or objects from behind) given
    1. sensor limitations, sensor maturity (accuracy / delays) and
    2. long enough prediction horizon - in order to avoid unrealistic steering torque demands.
- Calculate the risk for passing the **road edge** is new and not done before, the sensor part is an obvious more difficult, - specially compared to lane tracking

demonstrator vehicles

SECONDS

INCA

EMIC

BMW Enhanced dynamic pass predictor

Fiat Continuous support with focus on haptic HMI solutions

Volvo car Collision avoidance, continuous support and SafeCruise

Ford Collision avoidance, continuous haptic support and automated driving

Volvo truck Collision avoidance and run-off road prevention by braking and steering, stability considerations for heavy vehicles

VW Collision mitigation with focus on cost-efficient sensors and algorithm approach

Conti Emergency steering assistance with focus on radar/vision combination

Functions implemented

- **Run-off Road Prevention**
- **Lane Change Collision Avoidance/Side Impact Avoidance**
- **Oncoming Vehicle Collision Avoidance/Mitigation**
- **Rear End Collision Avoidance**

Final Evaluation

Ford VCC VTEC

Ford
Technical tests
- Lommel
- Test cases: 7
- Number of test runs: 147

User-related test
- Aachen
- Driving with the function on a test track
- Number of test persons: 25

VCC
Technical tests
- Hällered
- Test cases: 6
- Number of test runs: 106

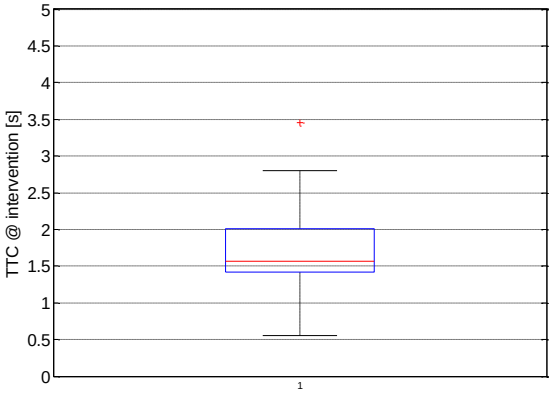
User-related test
- Hällered
- Driving with the function on a test track
- Number of test persons: 10

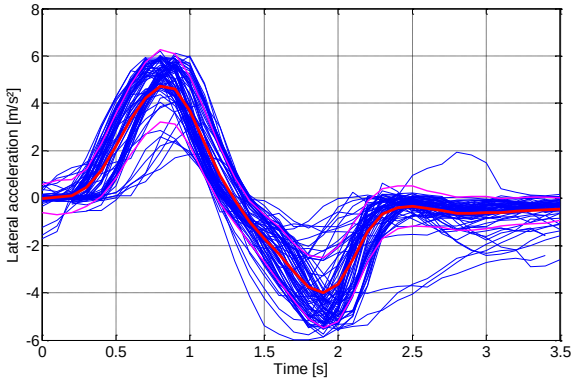
VTEC
Technical tests
- Hällered / E6 (public road)
- Test cases: 4
- Number of test runs: 27

User-related test
- Gothenburg
- Driving Simulator study
- Number of test persons: 31

Technical Tests – Example Results

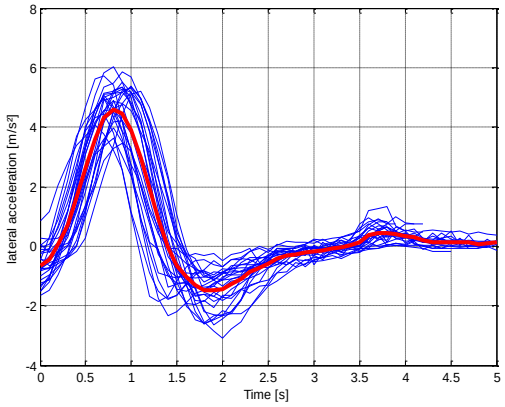
- Rear-end collision scenario:
  - Tests were performed for a passenger car and a truck
  - Function can either intervene by braking or steering
  - Intervention starts for both vehicle types approx. at the same time point
  - Strength of the intervention differs depending on the vehicle type – in particular for lateral interventions

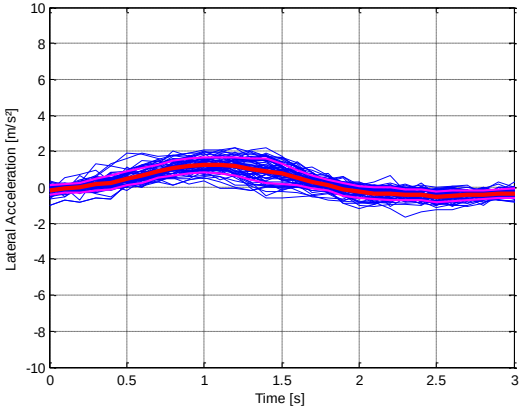




Technical Tests – Example Results

- Lane-change collision avoidance scenario:
  - Test were performed for passenger cars and a truck
  - Difficult to test → more standardization of the test is necessary!
  - Different approaches for the lateral intervention (strong vs. slight intervention)
  - Vehicle leaves its lane → trade off between false warning / intervention and prevention of accidents
  - A few missing intervention were detected due to a not correct detection of lane markings

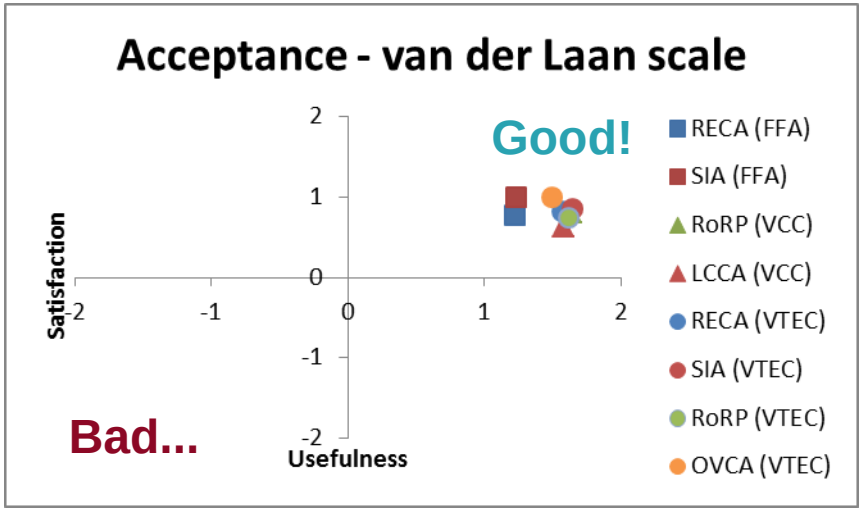




User-related evaluation results (example)

User perception of the functions

- High acceptance and usability
- Perceived advantage: Improve safety
- Users feel they should be aware and in control even with the support (trust)
- Almost all want to have the functions in their own vehicle



User reactions to the functions

- Emotional activation (arousal) is higher with the functions (VTEC)
- Reaction time is shorter with the functions.

Conclusion

- INCA functions implemented in three demonstrators
  - RECA seems to stand out in terms of reactions and subjective opinions this goes in line with findings regarding automatic steering interventions in rear end scenarios.
  - In general, acceptance is quite high and usability is average (prototype systems though, so this is expected)

- Demonstrator test drive in Lommel tomorrow
- More information in the exibition area and in technical presentations

Acknowledgments

- ” Perception” team
- ” IWI strategies” team
- ”Evaluation and legal aspects” team
- INCA partners:

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Thank you.

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SEVENTH FRAMEWORK
PROGRAMME

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