Demonstrator Vehicles

Agneta Sjögren, AB Volvo
interactIVe Final Event

20th-21st November 2013
Agenda

- **Overview of interactIVe demonstrator vehicles**
  - Commonalities
  - Ford
  - Fiat
  - BMW
  - Conti
  - Volvo VCC
  - Volvo truck
  - VW
- **interactIVe demo in Lommel**
Seven Demonstrator Vehicles

- **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

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Timeline - Development process – Use of demonstrators

- 2010: Accident Analysis
- 2011: Target Scenarios & Use Cases
- 2012: Requirements
- 2013: System Specification

- 2010: Architecture
- 2011: System Evaluation
- 2012: Integration & Verification
- 2013: Development & Implementation

November 2013: interactIVe Final Event
Demonstrator Vehicles: Common design elements

- In addition to common strategies
  - Common visual elements developed to indicate system status
  - Common haptic elements for warning and interventions
Demonstrator Vehicles: Common Functional Architecture

Perception Platform

- Vehicle State Filter
- Enhanced Vehicle Positioning
- ADASIS Horizon
- Road Edge Detection
- Lane Recognition
- Fronatl Near Range Perception
- Recognition of Unavoidable Crash Situation
- Relative Positioning to the Road of the Ego-Vehicle
- Assignment of Object-Lanes
- Vehicle Trajectory Calculation
- Surrounding Object Perception (stands for individual modules: FOP, SROP, MOC)

Application Platform

- Threat Assessment
- Warning Manager
- Intervention Manager
- X (VSP specific)

Input Manager

- Vehicle Data
- Camera (Front/Rear side)
- Radar (Front/Side/Rear side)
- Front Lidar
- Digital Map
- GPS
- Environment sensors
- V2X

Application Platform

- Low level/High-level Data Fusion
- Situation Analysis/Action planning
- Action

Vehicle bus

Feedback

Lateral Actuator

- X (demo specific)

HMI Channels

- X (demo specific)

Longitudinal Actuator

- X (demo specific)

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Ford Demonstrator

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INCA

EMIC

**SECONDS**

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Ford Demonstrator (Ford Focus)

- Full range ACC
- Curve Speed Control
- Speed Limit Control
- Curve Speed Warning
- Distance Alert
- Haptic Forward Collision Warning
- Autonomous Braking

Longitudinal

<table>
<thead>
<tr>
<th>Rear End-Collision Avoidance</th>
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<tbody>
<tr>
<td>Lane Centering Assist</td>
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<tr>
<td>Lane Keeping Assist /</td>
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<tr>
<td>Lane Departure Warning</td>
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<tr>
<td>Side Impact Avoidance</td>
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<tr>
<td>Lange Change Collision Avoidance</td>
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<tr>
<td>Rear End Collision Avoidance</td>
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<tr>
<td>Run-Off Road Prevention</td>
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</tbody>
</table>

Lateral
Ford Demonstrator - Sensors

- 76 GHz long range radar
- Three additional front radars
- Two cameras
- Ultrasonic sensors (left + right side)
- Two rear radars (24 GHz)
Ford Demonstrator - Actuators

- Steering system replaced and SW adapted to accept steering torque requests from AutoBox.
- Brake system interface adapted for request of individual wheel brake pressure.
Ford Demonstrator – IWI components

- Display
- Audio: Acoustic warning
- Haptic accelerator pedal
- Steering wheel
- Individually braked wheels
Ford Demonstrator - Architecture

Sensor layer
- Forward Camera 2
- L rear radar
- R rear radar
- Forward ESR
- Forward Camera 1
- Ultrasonic
- Vehicle HS

Perception layer
- Perception components
  - Enhanced vehicle positioning
  - Road edge detection
  - ADASIS horizon
  - Road data fusion
  - EVRP-ToRoad
  - Lane recognition
  - Assignment of objects – lanes
  - Vehicle trajectory calculation
  - Vehicle filter state
  - Road edge detection
  - Side/Rear object perception
  - Frontal object perception

Application layer
- Application components
  - Target selection
  - Threat assessment
  - Longitudinal controls
  - Lateral Controls
  - HMI manager
  - Mode Manager
  - Coordinator

IWI layer
- Sound / Display PC
  - Status icons when system is active
  - Text messages
  - Verbal messages
- Steering actuator
  - Steering actuator controller
  - Steering haptic warning
- Vehicle CAN
  - Brake actuator
  - Powertrain controller
  - Accelerator Pedal
  - Hazard lights

Evaluation data unit
interactIVe demo in Lommel
Enhanced pass prediction demo

- eDPP indicates road sections that are not safe for overtaking.

- Graphics in the instrument cluster in the cockpit (HUD and navigation display) presents the sections of not safe for overtaking.

- Additionally the driver receives info about traffic signs.
Collision mitigation for crossing traffic
Run off road demo
Collision Warning (static and/or moving vehicle) demo
Lane change intervention/On-side impact avoidance demo
Curve speed/speed limit demo
Rear end collision avoidance demo
Collision Warning and Avoidance crossing pedestrian demo
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Continuous support
Collision avoidance
cost-efficient system

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Demo in Lommel: Summary

- BMW: Enhanced dynamic pass predictor; Collision Warning static + moving vehicle + pedestrian, Side Impact Avoidance, Speed limit + curve speed warning
- Fiat: Side Impact avoidance; Collision Warning static & moving vehicle, curve speed- and speed warning
- Volvo car: Run-off road prevention, side impact avoidance, curve speed warning, collision avoidance rear-end
- Ford: Run-off road prevention side impact avoidance collision avoidance rear-end
- Volvo truck: Collision mitigation for crossing traffic
- Conti: Pedestrian collision avoidance rear end collision avoidance
Conclusions

Let’s try it!
Acknowledgements

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• We would like to thank all partners within interactIVe
Thank you.

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