Evaluation Framework for MOST Based Driver Assistance System Based on Virtual Prototypes

23rd April 2013

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Motivation

Advanced Driver Assistance Systems (ADAS)

- Continuously increasing number of ADAS in modern vehicles
- Driver assistance and comfort systems
- Driver safety systems
Motivation

Advanced Driver Assistance Systems (ADAS)

- ADAS use complex algorithms e.g. FFT or Hough Transformation
- Dedicated pre-processing nodes with optimized hardware
- For efficient information sharing communication network is the backbone
Motivation

Advanced Driver Assistance Systems (ADAS)

- Sensors, processing units and actuators distributed all over the vehicle
- ADAS interact with different electrical/electronic systems clusters
- ADAS have to share the inputs with electronic systems
- Challenge – efficient information sharing
- Communication network analysis with different scenarios
- Communication network optimization
Agenda

- Motivation
- Evaluation Framework
  - Concept
  - Scenario configuration
  - Data analysis and parameter optimization
  - Benefits
- Use Case Scenario 1: MOST based ADAS
  - Structure of the used framework
  - Distributed ADAS
  - Influence of the communication technology
- Use Case Scenario 2: Shared Packet Channel
  - Structure of the used virtual prototype
  - Evaluation
- Conclusion
Evaluation Framework

- Concept
  - Simulation based
  - Modularity and generic Approach
  - A number of basic modules in C++/SystemC - basic building blocks
  - Modules can be aggregated to build desired system scenarios
  - E.g. the ADAS use case scenario is assembled using 150 modules
Evaluation Framework

- Scenario configuration
  - Define the modules
  - Define the interconnections
  - System scenario can be changed during runtime
Evaluation Framework

- Data Analysis and Parameter Optimization
  - User defined data access points
  - Simultaneous data monitoring at different junctions
  - Data capturing, monitoring and comparing
  - Analysis of the modeled data
  - Parameter optimization
Evaluation Framework

- **Benefits**
  - Easy building of different scenarios
  - Functional and timing verification
  - Performance analysis
  - Parameter optimization
  - Easy integration of new applications using IP components
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Use Case Scenario 1: MOST Based ADAS

- Structure of the used framework
  - Approximately 150 module instances
  - Communication over Isochronous Channel
Use Case Scenario 1: MOST Based ADAS

- Distributed ADAS
  - Stereo Depth Map – SDM
  - Traffic Sign Recognition – TSR

- Modules in the processing chain:
  - Camera left and camera right
  - Preprocessing module (Hough transformation)
  - Stereo Depth Map calculation module
  - Circle Detection module
  - Speed Sign Classification module
  - Human Machine Interface - HMI
Use Case Scenario 1: MOST Based ADAS

- Influence of the communication technology
  SDM calculation requires
  - Synchronous images from camera left and camera right
  - Different channel types can result in varying transmission delays
  - Isochronous channel best suited
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Use Case Scenario 2: Shared Packet Channel

- Data access points
Use Case Scenario 2: Shared Packet Channel

- Detailed insight in the system behavior
- Analysis using standard tools Matlab GUI, Wireshark, OptoLyzer

![Graph showing network traffic analysis](image)
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Conclusion

- Advantages of the virtual prototype based framework
  - Different used case scenarios can be easily configured
  - Module as well as system performance can be analyzed
  - System can be optimized
  - Already existing tools can be coupled for the data analysis

- Advantages of MOST for ADAS
  - Different channels can be used simultaneously
  - For SDM isochronous channel is the most suitable channel
    1-to-n communication, stable average latency
  - Different protocols (MHP and TCP/IP) can be used over the shared packet channel
Thank you for your attention!