Agenda

MAC Stuttgart, 11.4.2019

1. Future Mobility System - our vision
2. Mobility System - main Items
3. Challenge – handling of complexity
4. Mathworks tools – role and usage
5. Results – development status
6. Field of actions – our system engineering strategy
7. Summary
Future Mobility System – our vision

The ILO1 connects the central transport systems on the last and first mile
Mobility System – main items

Our objective - development of functions to increase performance and safety for the overall system.
Challenge – handling of complexity

The Mobility System is decentralized, unclear, unsynchronized and solutions are interest driven

Our company objective
• maximum development speed and high-performance creativity - with minimal developers

Our technical system objective
• Modularization and strong integration
• Automatization
• Requirement & Testing solutions in a reals and virtual world

Our human system objective
• Active part in systems working groups

Our organizational strategy
• Use and support of standards
• Build interfaces and bridges
• Discovering good and innovative system partners
Mobility System – handling of complexity

The understanding of the system is trained through a virtual environment

**Transport System**
- communication, powertrain, brakes, chassis, steering, sensors and situation perception, driving control, ...
- simulation of driving dynamics and AD-functions
- simulation of full mobility system

**Environment & all road user**
- road, buildings pole, reflectors, road user behavior, ...

**Infrastructure**
- communication, situation perception, and infrastructure / traffic light control sensors functions, ...
- simulation of vehicle control
- Infrastructure control
- Simulation of road user “control”

**Control Center**
- communication, Situation recording and mission control, ...
- Simulation of mission control
- simulation of traffic
Mobility System – Virtual World

The virtual use cases and analysis are controlled with Matlab Simulink

- **parametrisation**
  - full virtual environment
  - automated Emm! parametrization und Emm! simulation control
  - Emm! matlab-scripts

- **simulation**
  - vehicle model incl. Emm! controller and AD-functions

- **visualisation**
  - full item visualization / .mp4-Video
  - automated Emm! analysis
  - Emm! simulation analysis

- **interfaces**
  - integration with Simulink-blocks (C++, ROS, TCP-IP)
Mobility Subsystems - Real-Time function (HW&SW) testing

The system testing of real time functions testing are controlled with Matlab Simulink

parameterization

real-time simulation

visualization in unreal engine

automated Emm! parametrisation und Emm! simulation control

VDTB Blockset Matlab

HW, vehicle model and Emm! controller and functions

interfaces
integration with Simulink driver blocks (UDP, TCP-IP)
Mobility System – Integration testing

All real time control functions are based on Matlab Simulink

test execution

with real-time signal diagnostics

Visualisation of measurements

... in webinterface

simulative analysis offline

Correction steps
Results - ILO 1 in Singapore 1.19

Executed rides commissioned from the "Infrastructure" for greater safety and better traffic flow

- Development from scratch within 9 months
- Modularized architecture – e.g. execution with external AD-modules possible
- Conformity according to ISO 26262
- Constantly improved of system stability
- Ongoing improvement of functionality
Results – System Engineering capabilities

Emm! solutions offers engineering services with full coverage of system understanding.

- Requirements
- Release Management
- Integrationstest
- Automated Simulation and Testing
- Testing Signal & Communication
- Simulation SIL/HIL
- Testing Sensor functions
- Design SW
- Design Wiring
- Design Package, CAD
- Design of new functions
- PT Build EE
- Prototype build and certification
Field of actions – our system engineering strategy

Based of our todays status there are options for improvement

Our company objective
• maximum development speed and high-performance creativity - with minimal developers

Our technical system strategy
• Modularization and strong integration
  • increase completeness - with partners
  • flexible robust interface management

• Automatization
  • increase execution speed
  • extend flexibility
  • in conformance with standards (e.g. ISO 26262)

• Requirement & Testing solutions in a augmented world
  • extend perception capabilities
  • adapt machine learning
  • use data analytics
  • extend our requirement and testing management
Summary

A Future Mobility System (FMS) was described – system engineering capabilities are a key success factor.

Future Mobility System – how it works

Requirements and Testing – powerful tools are a must

Handling of complexity is a core competence
Thank you very much for your attention

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