Scania’s truck Simulator and its contribution to simulator-based design: Simulator architecture, uses, and processes.

Experience tomorrow today

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We enhance driver performance by offering an HMI that is best in class and supports safe, efficient and pleasurable driving.
With creativity, expert knowledge and the driver in focus, RCDI design the driver vehicle interaction in Scania trucks and buses.
RCDI Group Structure

• Long Term Research Team
  – Product implementation about 8 years
• Medium Term Research Team
  – Product implementation about 3 years
• Immediate Deliveries Team
  – Current vehicles
• Simulation Team
Vision and Mission

Vision
• To be a world leading experience center where new ideas are created and tested.

Mission
• We work with the customer to deliver high quality virtual and mixed reality experiences and assessment services that support the development of products which include a human machine interaction. We do this with integrity and cross disciplinary knowledge, focusing on the customer values.
RCDI Workflow

PLANNING
- Project kickoff
- Vision Seminar
- Long Term Planning
- Benchmarking
- Technology Review

CONTEXT
- Driver workshops
- Relevant Research
- Work Domain Analysis
- Problem Identification
- Observations

USER NEEDS
- Personas
- Concept Generation: Ergo Hour
- Concept Selection
- Concept Delivery
- Wireframes

DEVELOPMENT
- Work Domain Analysis
- Concept Generation: initial
- Scenario Development
- Concept Development
- Software Integration
- Test Setup
- Data Collection

TESTING
- Data Analysis
- Hardware Integration

INTEGRATION
- Concept Generation: Ergo Hour
- Test Design
- Software Integration
- Demonstration Day: External
- Demonstration Day: Internal

DEMONSTRATION
- Project Film
- Demonstration Day: External

ViP Workshop - 27th April, 2016
Currently, the Simulator Team provides simulation support for research projects and product development for short and long time horizons.

The simulator team capabilities can be easily exported to support other groups within Scania.
Displays
Head Up Display
Fully Configurable Cluster
3D Audio
Seat Vibrators
Steering wheel Vibrators
Steering wheel LEDs
Steering Wheel Display
Windshield LEDs
2ndary Display (Tablet)
Digital Mirrors
Physical Mirrors (2016)

Input
Steering wheel
Steering wheel buttons
Foot pedals
Levers
Touchless gesture
Tablet
Eye gaze
Measurement Metrics

- Standard Questionnaires
  - Workload
  - Acceptance
  - Trust
  - Awareness

- Eye tracker
  - Heat maps
  - Eyes on vs. off road

- Driving performance
  - Speed, Distances, Steering wheel...

- Physiological Measures (2016)
  - Heart rate (and Variability)
  - Galvanic Skin response
  - Respiration Rate
  - EMG
Highly Autonomous Truck Cab

- **Goal:** Create a prototype cab that support supervision and control of a highly autonomous truck

- **Technology:**
  - 3D Audio
  - Head Up Display
  - Tablet for touch input
  - Fully Configurable Cluster

- **Simulator Role**
  - Integrate hardware and software
  - Create 5 driving scenarios (3 highway, 2 forest)
  - Conduct multiple rounds of full scale testing
  - Create story boards
  - Recruit drivers
  - Deliver raw data results
MODAS project dissemination

The blog was accessed 1710 times from 61 countries and incurred 3632 page views.
The project results were featured on SVT and in other Swedish and International press.
We do an excellent job with the resources available.

Traditionally, simulator developed has been ad-hoc on a project-by-project basis.

We are now taking a more strategic way forward.
Process

- Separation of Simulator from projects
- Projects order testing via internal (Scania) test process
- A contact person from Simulator team assigned to each project
- Sim Team includes System Developers and Interaction Designers (test leaders)
- Long term strategic development of Test and Simulation capabilities
Control room
Simulator architecture, Hardware

• Cluster of Windows PCs
• Arduino(s)
  – Leds, vibrators
• Real truck hardware (CAN, resistance)
  – Some connected to Arduino
  – Some connected to Baldor
Simulator architecture, Software

- Visir – From VipForge
- Kernel – From VipForge
  - Scenarios, plugins developed by us
- Truck Dynamics – Developed by us
- MMDE – Developed by us
Truck Dynamics and MMDE
MultiModalDisplayEngine

• Interface to Instrument clusters (ICL) and Media units (AUS)
• TCP/XML server for Flash applications
• Webserver HTML/JSON
• Websocketserver JSON
• Arduinos
Monitoring

• Inspector/Remote control
  – Web applications for monitoring and controlling simulator

• vMix Video
  – Web-cameras with IR-filter removed
Remote Control

- Start / Change scenario
- Send signals
  - Cruise control
  - Play / Pause
- Start events
- View position on map
Inspector

- View state
  - Own position
  - Actor position
  - Events
  - Button presses
- Teleporting
From now and into the future

Plans and needs
Upcoming needs

• Complicated road network for large city
• Fast iteration of scenario
  – Roads
  – Objects
  – Events
  – For non-programmers to create scenarios
Upcoming needs

• More capable AI for pedestrians, cyclists, roundabouts, traffic-lights

• Light-weight simulator (VR/Desktop)
  – Possible to deploy to desktop
  – Possible for non-programmers to help with scenario creation
  – Use scenario both in VR/Desktop and truck
Current VR simulator

• Unity game engine
• Easy to change
  – Parameters for AI
  – Add/remove/change objects
  – Add/remove/change actors
• Oculus Rift
Upcoming needs

• Improved graphic fidelity
  – Night scenario (city), lots of lights and moving objects
  – Integrate real-world maps (OSM, 3d-scanned terrain)

• Fewer applications for fewer fault sources
Upcoming needs

• Aggregated logging / monitoring
  – Simulator data
  – Text (typically from events)
  – Video
  – Physiological data
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