NADS Engineering Capabilities

ANDREW VEIT

NATIONAL ADVANCED DRIVING SIMULATOR (NADS)

THE UNIVERSITY OF IOWA

APRIL 2018
Driving Excellence: Transforming the Future

Our Mission:
Improving safety by researching the connection between drivers, motor vehicles, and road users
Our Capabilities

Development
- Hardware Engineering / Instrumentation
- Software Engineering
- Integration with 3rd Party Devices / Software
- Vehicle Dynamics
- Automated Vehicle Models
- Driver Behavior Models

Human Subject Studies
- Experimental Design / Test Plan
- IRB / Subject Recruitment / Handling
- Data Collection using Simulators, Instrumented Vehicles, Naturalistic Data Recorders
- Dosing/Drug Protocols
- Data Reduction / Analysis
- Report Writing
NADS-1 Projector and IG Upgrade

• (16) 1920 x 1200 LED Projectors
• Replaced 8 Barco Sim6 projectors installed in 2005
• Mounting system designed and installed in-house
• Image Generator (IG) software developed in-house
  • Rendering
  • Warping and Blending
  • Projector control/admin
  • IG node control
NADS-1 Projector and IG Upgrade
Development of a new cab for NADS-1
Development of a new cab for NADS-1

- Interior representative of modern vehicles
- CAN bus integration
- Fully programmable infotainment system
Emulation of OEM Infotainment Systems
Vehicle infotainment system

- Touchscreen interface to replace (but mimic) OEM Toyota Entune (2015) system. Fully-integrated OEM physical keys (steering wheel buttons, etc)
- Built entirely in HTML/Javascript (Node JS)
- Beyond being controlled by the driver, also controllable by simulator operators, researchers, and/or programmatic triggers
- GPS positioning/mapping created leveraging overhead map infrastructure
- All interactions (touch + physical) logged and broadcast in real time to researchers

Graphic design, multimedia, web design + programming
1. Interaction telemetry is collected in real time. Touch events and positions are recorded and relayed to the onboard infotainment controller.

2. The infotainment controller collates interaction telemetry into a greater system state context, which is broadcast over a cellular link.

3. Remote observers see a live “mirror” of the system state through a standard web browser.

Touch points are expressed visually as fingerprint target icons, which ripple and dissipate as the driver removes their finger.
Instrument Cluster - Infotainment System

**TESLA MODEL 3**

- Approximation of pre-production Tesla OEM system, built to operate with NADS simulators, and instrumented vehicles
- miniSim-compatible
NADS-1 Cab Scope

• New 2015 Camry purchased ‘off the lot’
• Disassembly and fabrication
  • Flex-plate/airbag assemblies for dome interface
  • Structural Reinforcements for Vibration Actuators
  • Power Entry and Equipment Rackspace
• Instrumentation
  • UEI Ethernet DAQ (www.ueidaq.com)
  • CANbus
  • Active Steering and Brake loaders (E2M, www.e2mtechnologies.eu)
  • Audio PC, amplifiers, speakers, tactile transducers
  • Chiller for cab air conditioning (dome is air-conditioned)
  • Custom Infotainment Interface
  • OLED display in gage cluster replaces OEM display
  • Cab controls work normally (ignition, gage cluster, climate control, driver controls, etc)
Cab Test Fit in Dome

Front Equipment Bay

Cab Ride Height Set During Fabrication
NADS miniSim™

- Portable, small footprint
- Off-the shelf parts. Single PC.
- Cost Effective, Reliable
- Multiple configurations
  - Quarter Cab
  - Simplified Cab
  - Desktop
- Tool for collaboration across institutions/industry/agencies
- Scenarios/software compatible with NADS-1, NADS-2 simulators
- Growing network of users
- Software actively being improved
  - Distributed simulation
  - Automated vehicle models
  - Multi-site studies
University of Kansas miniSim™

• Cab donated by OEM
  • Used simulator buck, all instrumentation removed

• Section cab to fit doorways

• Instrumentation
  • Commercial USB A/D and DIO boards
  • No CANbus interface
  • Active Steering (www.simxperience.com), Passive Brake
  • LCD Gage Cluster
  • Cab Controls: fan, windows, mirrors, ignition, lights, turn signals, horn, gear select
  • Audio PC, amplifiers, speakers, tactile transducers
University of Kansas miniSim™

Cab Modified to Fit Doorways  Cab Instrumentation  Rack Mount Equipment  Custom Instrument Model
Simulator for Neurology Research

Yale

The National Advanced Driving Simulator

The University of Iowa
Yale miniSim™

- 2008 Mazda 6 Donor
- Fits through 36in [900mm] doorway
- 166° Horizontal Field of View
- 3 DLP Projectors
- 3rd party warping and blending
- Rear screen with 3 viewports for mirrors
Yale miniSim™ cont...

Cab Integration

All Connections in Passenger Wheel Well

Clean Projector and Alignment Camera Installation
Simulator for New Product Development and Demonstration

Heavy Truck
Truck miniSim™

• New Cab
• Custom Monitor Stand and frame
• Instrumentation
  • Commercial USB A/D and DIO boards
  • No CANbus interface
  • Active Steering (www.simxperience.com)
  • Passive Brake
  • Passive Gear Shift (x/y lever location)
  • OEM Air brakes
  • Custom clutch loader mechanism
  • LCD Gage Cluster
  • Cab Controls: fan, windows, mirrors, ignition, lights, turn signals, horn, gear select, radio
  • Audio PC, amplifiers, speakers, tactile transducers
Truck miniSim™

Metal Fabrication