MathWorks

CLEMSON VIPR-GS

Digital Engineering Accelerates Off-Road Ground Vehicle Development

Project Goal
Develop an optimized digital engineering workflow to support **rapid design, verification, and validation for autonomous ground vehicle systems for all terrains** around existing platforms in collaboration with the VIPR-GS center researchers supporting the U.S. Army DEVCOM Ground Vehicle Systems Center.
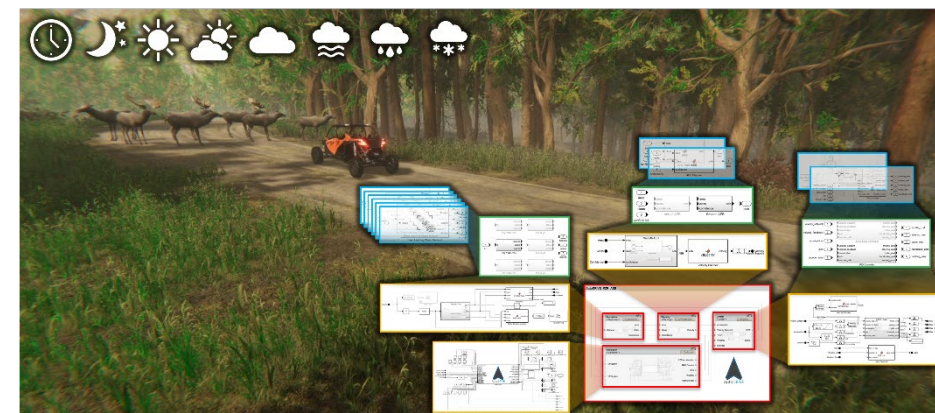
Components
MATLAB, Simulink, System Composer, Deep Learning Toolbox, Control System Toolbox, AutoDRIVE Simulator

Solution
- **An integrated digital thread that accelerates verification and validation was used** to develop and simulate complex systems for autonomous ground vehicles (emergency maneuvers, visual servoing, and deep learning–based object detection).
- Perception-enhanced control for variable conditions (e.g., weather, time of day) blends deep learning, a finite-state machine, and reactive control frameworks.
- The integrated connection of a modular open-source AutoDRIVE Simulator with System Composer empowers requirements modeling and verification in a model-based systems engineering framework.

"Working with MathWorks brought a more systems- and simulation-oriented approach to help manage the complexity of the project. The modular and hierarchical framework enabled by Simulink, coupled with the systematic approach enabled by System Composer, helped accelerate our work when developing and evaluating a solution in an extensive trade-space while allowing traceability across the digital thread."

Tanmay Vilas Samak, Ph.D. Candidate, ARMLab, CU-ICAR

Flexible Framework
Leveraging MOSA and System Composer helped create the extensible system needed for **future-proofing autonomy capabilities across vehicle platforms.**

Efficient Complexity Management
Automated exploration of models, parameters, and variants across levels of hierarchy—components, systems, and systems of systems with varying fidelity— **accelerated development.**

Systematic Validation
Further gains in efficiency came through a systematic approach that improved report generation, requirements traceability, and continuous verification and validation **across a digital thread.**

>> **Learn more about System Composer**