



Concurrent Operations Simulation in Virtual Reality

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Objective

- To develop a Virtual Reality training environment and laboratory for Production Assemblers with the aid of concurrent operations simulation





Definitions

- **Discrete-event simulation** – a simulation in which the state of a model changes at only a discrete, but possibly random, set of simulated time points (T. Schriber, 1997)
- **Virtual Reality** – a computer-generated three-dimensional environment, which can be interactively manipulated by the users (Barfield & Furness, 1995)





Assembly Line Simulation at Deere

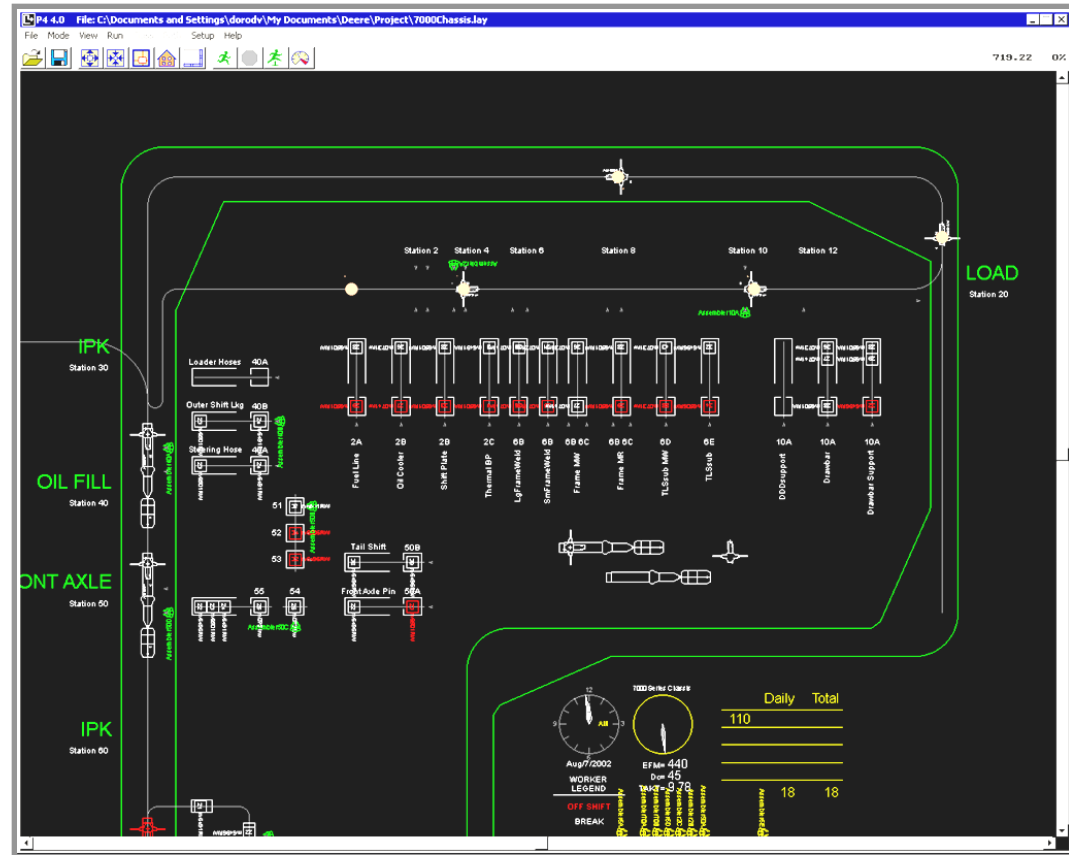
- ALiSS (**A**ssembly **L**ine **S**olution **S**et) is a discrete-event simulation model developed by Deere & Co., which relies on the following components for its functionality:
 - Wolverine's SLX (*Simulation Language with Extensibility*) for its simulation engine capabilities
 - Microsoft's Excel for the user interface
 - Wolverine's Proof Animation software for post-processed animation of the simulation results



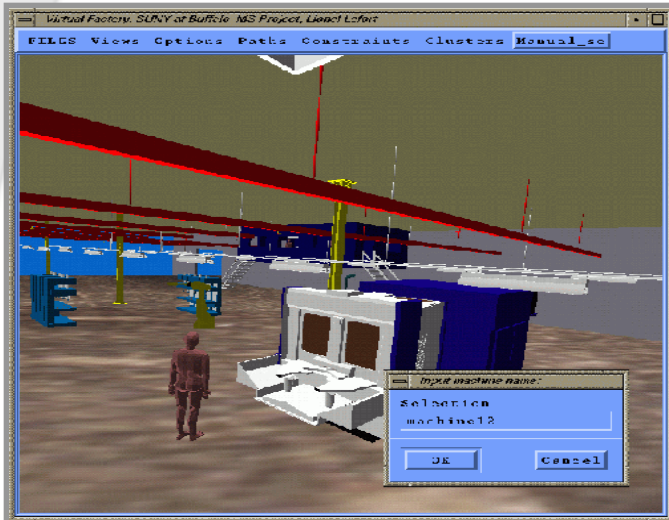


Why switch to VR?

- Limitations of the traditional simulation animation packages:
 - Two-dimensional, schematic layouts
 - Simple object geometry
 - Limited object interrogation
 - No direct human-model interaction



Current state of VR simulation



VR-Fact – virtual environment for modeling and designing factories and shop floors (Kesavadas and Ernznner, University of Buffalo).

VRFactory – an interface to a commercial discrete event simulation software (SLAM II) (Vance and Kelsick, Iowa State University).





ALiSS – VR Coupling

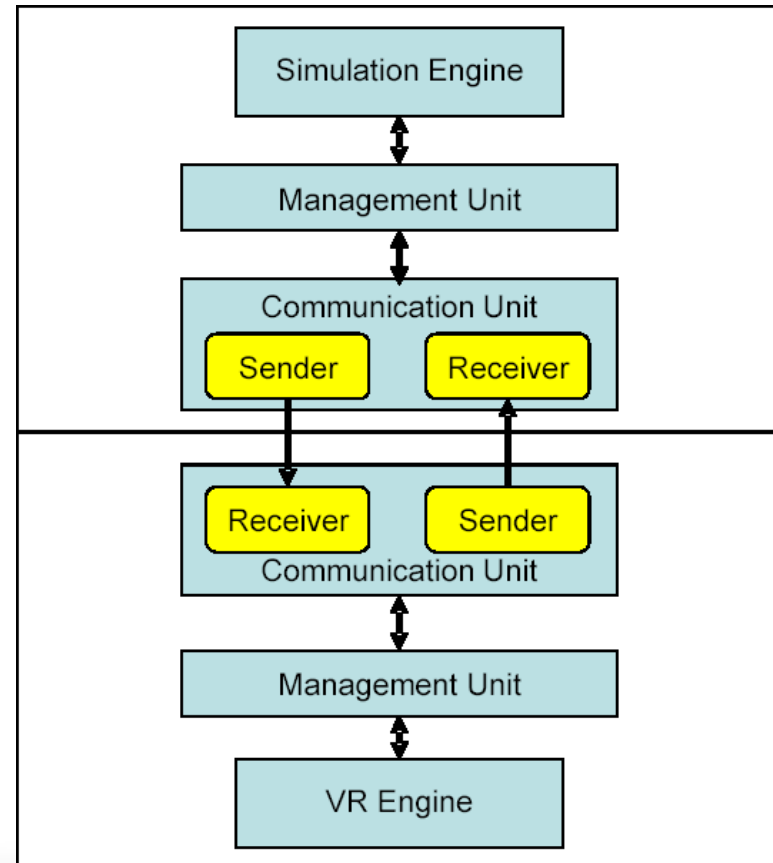
- A new, independent SLX module has been developed and integrated into the ALiSS existing code.
- The new module selects relevant information from ALiSS and communicates it to the VR application:
 - assemblers starting/ending tasks
 - parts arriving/leaving work stations
 - status of assemblers, parts, and vehicles





Concurrent simulation

- Synchronization is vital to fluent interaction between commercial DES and VR
- Number of discrete events and the amount of information passed varies significantly
- Self-adapting buffer size is used





Application Features

- Real-time generation of simulation results
- Ability to modify an assembler's behavior
- Comprehensive simulation status information
- Complete control over simulation flow





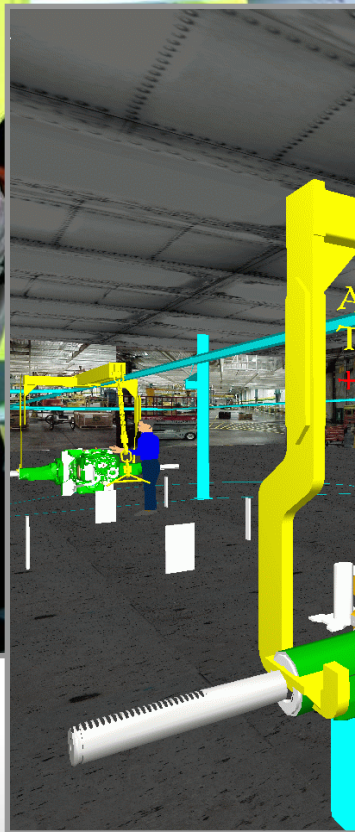
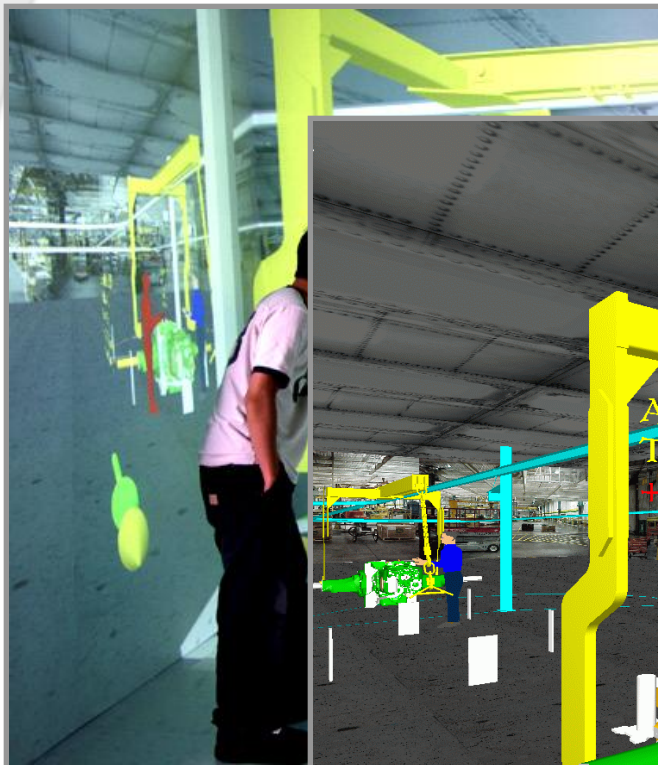
Testing

- A tractor assembly line was chosen to test the concurrent link between an ALiSS simulation and the immersive VR environment.
- The focus of the analysis is on a single station, where transaxle and frame are assembled to form the tractor chassis.

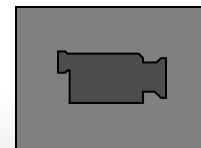




Developed application



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Acknowledgements

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www.vrac.iastate.edu



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