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SysArch – part of EVO-MTI

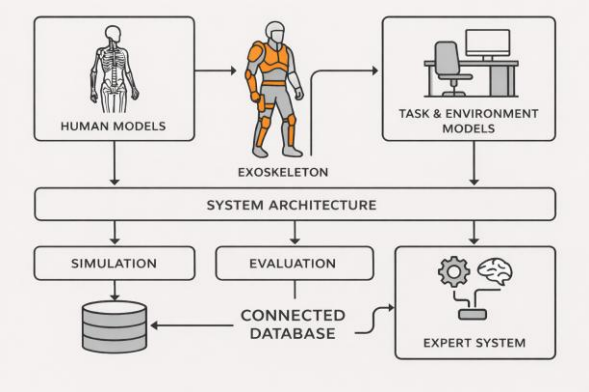
Development of a System Architecture for Traceable and Reproducible Benchmarking Across Experiment, Simulation and Evaluation

BACKGROUND

Assistive technologies are increasingly used in everyday and professional contexts, and exoskeletons are a key example. Depending on their design, they can reduce physical strain in demanding work or support people during rehabilitation. To be effective, these systems must fit the real support situation, including the user's physical condition, movement patterns, intended purpose, and practical constraints such as safety and workplace conditions. In the EVO-MTI project, a digital environment is being developed to support the design, evaluation, and optimization of human-machine systems, with a focus on the human in the performance flow, human-technology interaction, and components such as force-transmitting interfaces. To connect all of these elements consistently, a unified system architecture is needed that allows physical systems and virtual models to work together and enables the integration of diverse tools and data sources across the project.

FOCUS OF WORK

Within EVO-MTI, the key elements of the human–machine system are represented through a combination of physical and virtual models. Depending on the focus, these models describe the human through biomechanics and intention recognition, while the exoskeleton is captured via kinematics, dynamics, actuation behavior, and control strategies. Tasks and environments are represented using process descriptions, load profiles, and workplace constraints. As these models operate at different levels of abstraction, they generate diverse data ranging from raw sensor signals to simulation results and evaluation indicators. The absence of a unified system architecture leads to fragmented workflows, making the reuse of results, configuration comparison, and transfer from simulation to real systems difficult. A modular system architecture addresses this by providing standardized interfaces and data flows, enabling consistent integration, evaluation, and reuse across development stages and use cases.



KEY STATMENT

A unified system architecture will integrate all models, methods, and tools into a continuous digital workflow covering data acquisition, simulation, evaluation, and optimization. A central database and knowledge base will store measurement, simulation, and evaluation data consistently. Building on this, the expert system (ExpSys) will combine information across abstraction levels. This enables structured evaluation, comparison, and optimization of system configurations.

Funding
Dtec.bw – Zentrum für Digitalisierungs- und Technologieforschung der Bundeswehr

Funding ID
EVO-MTI - EU (NextGenerationEU)

Duration
01/2026 – 12/2026

Project Partner
Helmut-Schmidt-Universität |
Universität der Bundeswehr Hamburg

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