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ITEA 3 is a EUREKA strategic ICT cluster programme

Exploitable Results by Third Parties

17028 MOSIM

Project details

Project leader:	Dr. Thomas Bär
Email:	Thomas.baer@daimler.com
Website:	http://www.mosim.eu/

Name: MOSIM Framework		
Input(s):	Main feature(s)	Output(s):
▪ MMU ▪ 3D Scene incl. avatar	▪ Combination of heterogeneous motion synthesis approaches by utilizing motion model units	▪ Human simulation in chosen target engine
Unique Selling Proposition(s):	▪ The framework allows combining heterogeneous motion synthesis approaches by utilizing modular units referred as Motion Model Units (MMUs). These units can be realized in different programming languages and engines. The core framework utilizes Apache Thrift for communication and to automatically generate source code files for many programming languages.	
Integration constraint(s):	▪ See: https://github.com/Daimler/MOSIM_Core	
Intended user(s):	▪ Application developers or research engineers that have interest to generate human simulations based on existing motion model unit.	
Provider:	▪ Daimler – Open Source Code ▪ https://github.com/Daimler/MOSIM_Core	
Contact point:	▪ Dr. Thomas Bär – Thomas.baer@daimler.com	
Condition(s) for reuse:	▪ MIT Licence	
	Latest update: June 2021	

MOSIM

Involved Partner(s): Daimler Buses, DFKI

MOSIM-Framework for the utilization of heterogeneous digital human simulations

Type of Exploitable Result:

- Tool (available as open source software)

Description:

- Framework to embed heterogeneous digital human simulations based on Motion Model Units (MMUs)

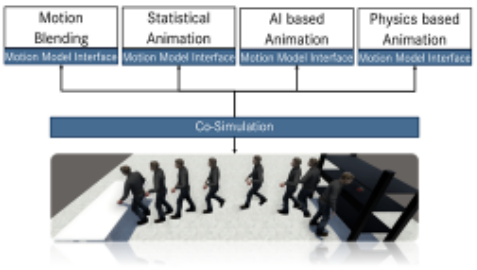
Target Industry:

- Main industries: Automotive
- Applicable across different manufacturing industries

Current Maturity (status of May 2021):

- Prototype

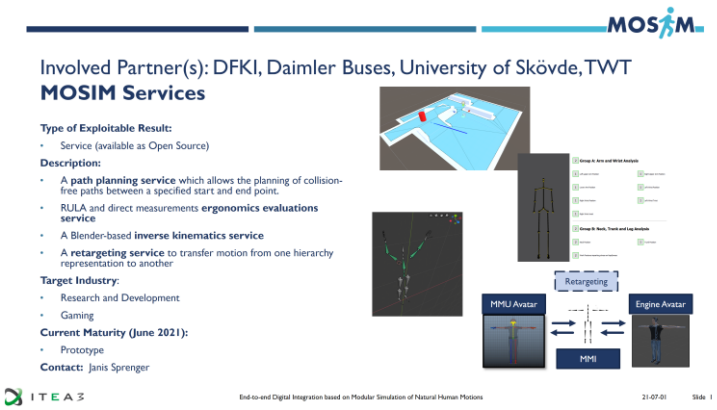
Contact: Thomas Bär, Klaus Fischer, Janis Sprenger



Name: MOSIM Services		
Input(s):	Main feature(s)	Output(s):
▪ Avatar Description ▪ Service related Properties ▪ MOSIM Framework	▪ Shared functionality for various functionality ▪ Extendible with generic services possible	▪ Service depending results

Unique Selling Proposition(s):	▪ Service based infrastructure for shared functionality within the MOSIM framework ▪ Specific service interfaces defined and implemented: Inverse Kinematics (IK), Path Planning, Scene Access, Skeleton Access, Posture Blending Service, Walk Point Selection Service, Coordinate System Mapper, Collision Detection Service ▪ Implementation can be exchanged ▪ Arbitrary services can be implemented with the generic service interface ▪ Services can run independently or integrated in target engine
Integration constraint(s):	▪ MOSIM Framework ▪ https://github.com/Daimler/MOSIM_Services
Intended user(s):	▪ MMU developers ▪ Behavior model ▪ Target engine
Provider:	▪ Daimler – Open Source Code ▪ https://github.com/Daimler/MOSIM_Services
Contact point:	▪ Janis Sprenger
Condition(s) for reuse:	▪ MIT License

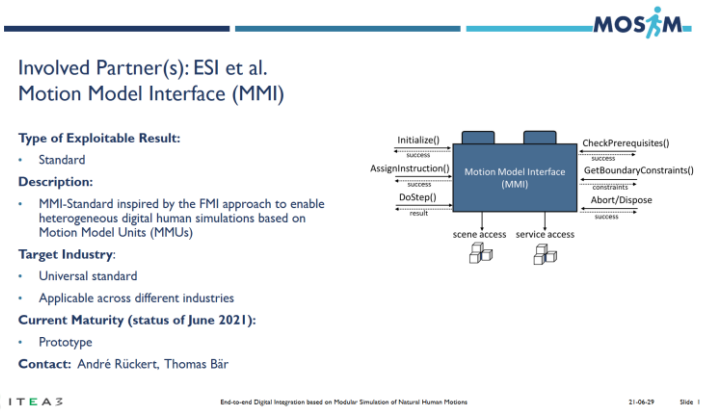
Latest update: June 2021



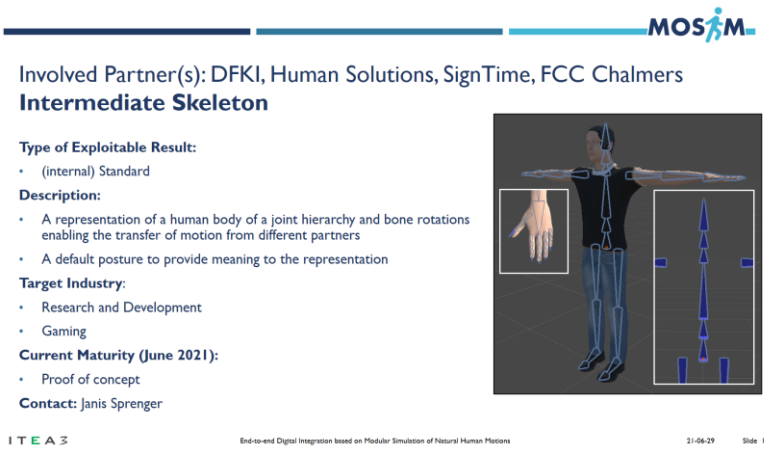
Name: MMI-Interface		
Input(s):	Main feature(s)	Output(s):
▪ MOSIM Framework ▪ Scene constraints	▪ Standard driven by Standardization Organization ▪ Focus on industrial use and defined interface description ▪ Use of MOSIM services	▪ Standardized Interface Description

Unique Selling Proposition(s):	▪ Standardized MMI Interface for the use if MMU's ▪ Use of heterogeneous motion synthesis ▪ Use of different programming languages
Integration constraint(s):	▪ MOSIM Framework ▪ https://github.com/Daimler/MOSIM_Core
Intended user(s):	▪ MMU developers
Provider:	▪ Daimler – Open Source Code ▪ https://github.com/Daimler/MOSIM_Core
Contact point:	▪ André Rückert
Condition(s) for reuse:	▪ MIT License ▪ Standardization Org License (under discussion)

Latest update: June 2021



Name: Intermediate Skeleton		
Input(s):	Main feature(s)	Output(s):
▪ Anthropometric scaling	▪ Skeletal definition to exchange motion information between multiple simulation modules	▪ Access to skeletal information ▪ Exchange format for motion transfer
Unique Selling Proposition(s):	▪ Well defined skeletal definition of a humanoid actor ▪ All participants of the framework must agree on the specific definition ▪ Shared definition can be extended in the future (e.g. for more accurate human representation, for non-humanoid characters, etc.) ▪ Can be used in combination with the retargeting service and the retargeting configurator to allow fast, reliable, and adjustable retargeting from and to the intermediate skeleton	
Integration constraint(s):	▪ Skeleton Definition (Skeleton Configurator: https://github.com/Daimler/MOSIM_Tools) ▪ Retargeting Service: https://github.com/Daimler/MOSIM_Services ▪ MOSIM Framework ▪ Documentation (https://github.com/Daimler/MOSIM_Core/wiki)	
Intended user(s):	▪ MMU Developers ▪ Service Developers ▪ Target Engine Developers	
Provider:	▪ Daimler – Open Source Code ▪ https://github.com/Daimler/MOSIM_Core	
Contact point:	▪ Janis Sprenger	
Condition(s) for reuse:	▪ MIT License	
	Latest update: June 2021	



Name: Basic Motion Model Units (MMUs)		
Input(s):	Main feature(s)	Output(s):
▪ Scene constraints ▪ MOSIM services (IK, path planning) ▪ MOSIM intermediate skeleton	▪ Utilization of various motion simulation techniques in different programming languages ▪ Communication through motion model interface (MMI) ▪ Simulation of specific human motions according to scene constraints ▪ Use of MOSIM services & skeleton	▪ Simulated human motion in intermediate skeleton format

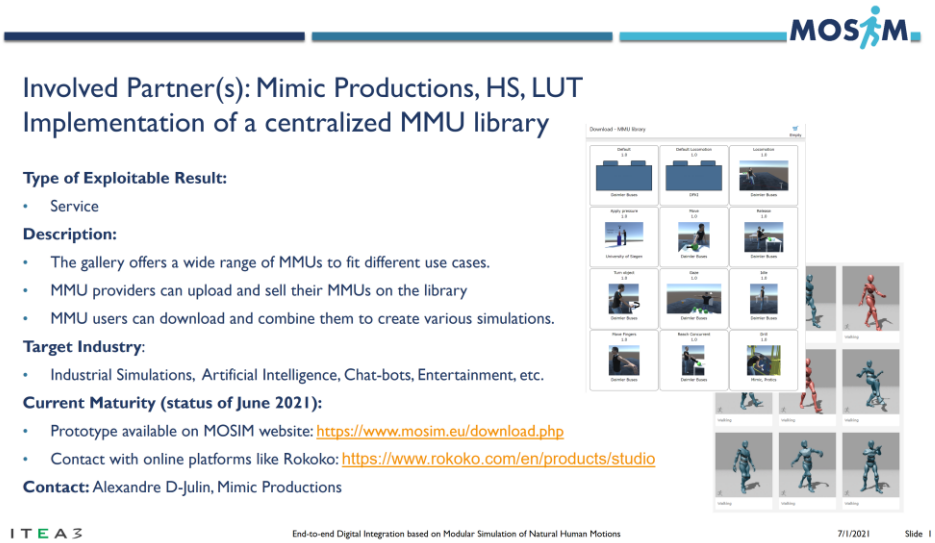
Unique Selling Proposition(s):	▪ Implementation does not require specific programming language and motion simulation technique. ▪ Output is modular and can be combined to complex motions within MOSIM framework.
Integration constraint(s):	▪ See: https://github.com/Daimler/MOSIM_Core
Intended user(s):	▪ Application developers or research engineers who have interest to generate individual human simulations for their use cases.
Provider:	▪ Daimler – Open Source Code ▪ https://github.com/Daimler/MOSIM_Core
Contact point:	▪ Dr. Hans-Joachim Wirsching – hjwirsching@human-solutions.com
Condition(s) for reuse:	▪ MIT License

Latest update: May 2021

Name: MMU library		
Input(s):	Main feature(s)	Output(s):
▪ MMU description ▪ MMU requirements and motion types	▪ Search for specific motion ▪ Preview the motion (image, video) ▪ Buy and download the MMU	▪ MMU package (zip Archive)

Unique Selling Proposition(s):	▪ The gallery offers a wide range of MMUs to fit different use cases. ▪ MMU providers can upload and sell their MMUs on the library ▪ MMU users can download and combine them to create various simulations.
Integration constraint(s):	▪ Local version available on the user's computer ▪ Online version available on the MOSIM website and 3rd-party web shops
Intended user(s):	▪ MMU providers who want to sell their own MMUs ▪ Everyone who wants to download and use MMUs within the MOSIM framework
Provider:	▪ MP Mimic Production GmbH (Library concept) ▪ MOSIM partners (Library development and MMU creation)
Contact point:	▪ Alexandre Donciu-Julin - a.djulin@mimicproductions.com
Condition(s) for reuse:	▪ Available online (MOSIM website, third-party webshops) See https://www.mosim.eu/download.php

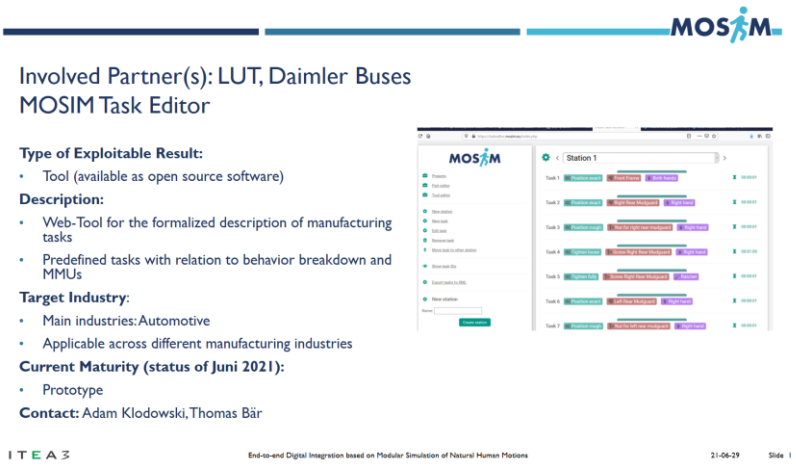
Latest update: June.2021



Name: Task Editor		
Input(s):	Main feature(s)	Output(s):
▪ Task list (high level description of worker tasks) ▪ Simulation scene ▪ User list ▪ Project list ▪ Tool list	▪ Simple task editing for human workers ▪ Organization of simulation projects ▪ User management and access rights for shared project data ▪ Multiuser collaboration of simulation project ▪ Web interface	▪ Direct integration to AJAN reasoning service ▪ XML and JSON standardized format output of tasks

Unique Selling Proposition(s):	▪ Based on industrial manufacturing workflow requirements ▪ Extendable for other use cases ▪ Support for multi-avatar environments and avatar interactions ▪ Automatic synchronization of scene elements with target engine ▪ Generating human simulation without need for programming
Integration constraint(s):	▪ Web server with database backend and PHP support ▪ Internet domain (if deployed on Internet) and HTTPS certificate for secure connection (if accessible outside local network)
Intended user(s):	▪ MOSIM framework end users
Provider:	▪ Lappeenranta University of Technology ▪ https://github.com/Lappeenranta-University-of-Technology/mosim-task-editor-server
Contact point:	▪ Adam Klodowski
Condition(s) for reuse:	▪ Apache2 license

Latest update: June 2021



Name: Reasoning Engine (AJAN)		
Input(s):	Main feature(s)	Output(s):

▪ Behavior Models (SPARQL-BTs)
▪ High-Level Tasks
▪ MOSIM Framework endpoints, like Scene-Access
	▪ Execution of MMU instructions
	  ○ based on High-Level Tasks
	  ○ based on internal behavior models
	▪ Domain-free, can be used separately from MOSIM
		▪ MMU Instructions
		▪ MOSIM Service calls to get dynamic paths, to get avatar transformation a.o.

Unique Selling Proposition(s):	▪ Domain-free multi-agent system web service for behavior modeling and execution of agents, based on SPARQL-BTs ▪ AJAN is fully integrated into the MOSIM infrastructure and is used for dynamic execution of available MMUs based on predefined tasks of the High-Level Task Editor ▪ Has a web editor for intuitive modeling of so-called MOSIM-breakdowns ▪ It can be easily extended (with the AJAN-Plug-In System) with additional AI methods like, Reinforcement Learning, Action Planning a.o.
Integration constraint(s):	▪ MOSIM context: MOSIM Framework, MMUs, High-Level Task Editor ▪ General: HTTP + RDF
Intended user(s):	▪ MOSIM users in general who want to run avatar tasks or model avatar behavior in detail or test MMU behavior ▪ Expert users who are skilled in modeling agents and thus in implementing autonomous system behavior ▪ Novices who have no prior knowledge of RDF and SPARQL but still want to model avatar behavior based on expert template
Provider:	▪ DFKI – Open Source Code ▪ AJAN-service: https://github.com/aantakli/AJAN-service ▪ AJAN-editor: https://github.com/aantakli/AJAN-editor ▪ AJAN-MOSIM-Unity: https://github.com/aantakli/AJAN-MOSIM-unity
Contact point:	▪ André Antakli
Condition(s) for reuse:	▪ AJAN-service: LGPL-2.1 License ▪ AJAN-editor: MIT License ▪ AJAN-MOSIM-Unity: MIT License

Latest update: <18.06.2021>

Involved Partner(s): DFKI
Reasoning Engine (AJAN) for Breakdownexecution

Type of Exploitable Result:

- Service (available as Open Source)

Description:

- Multi Agent System for the graphical modeling and execution of system behavior.
- AJAN is a Web service that follows the Linked Data paradigm.
- The behavior model used for the BDI Agent Plan is based on RDF/SPARQL Behavior Trees. AJAN provides an interface to use other AI methods for behavioral modeling.

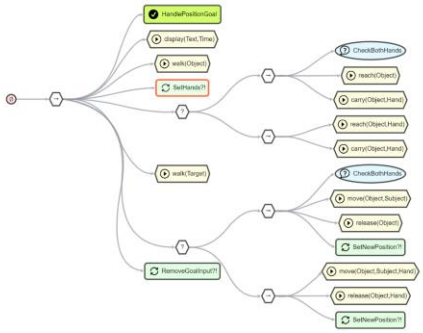
Target Industry:

- Can be used for orchestration and control of linked data domains
- Can be used for the modeling and execution of behaviors of autonomous entities such as simulated pedestrians, workers and robots

Current Maturity (status of June 2021):

- Prototype

Contact: Andre Antakli, DFKI



Name: Module add-on for human centric process validations (IC.IDO)		
Input(s):	Main feature(s)	Output(s):
▪ Geometrical scene + constrains ▪ Process data ▪ MOSIM services ▪ MOSIM intermediate skeleton	▪ Simulation of specific human motions according to scene constraints ▪ Use of MOSIM services & skeleton ▪ Easy adaption of scenario parameters and start of a new simulation / virtual tryout environment	▪ Validated and optimized worker process sequences ▪ Ergonomics estimation

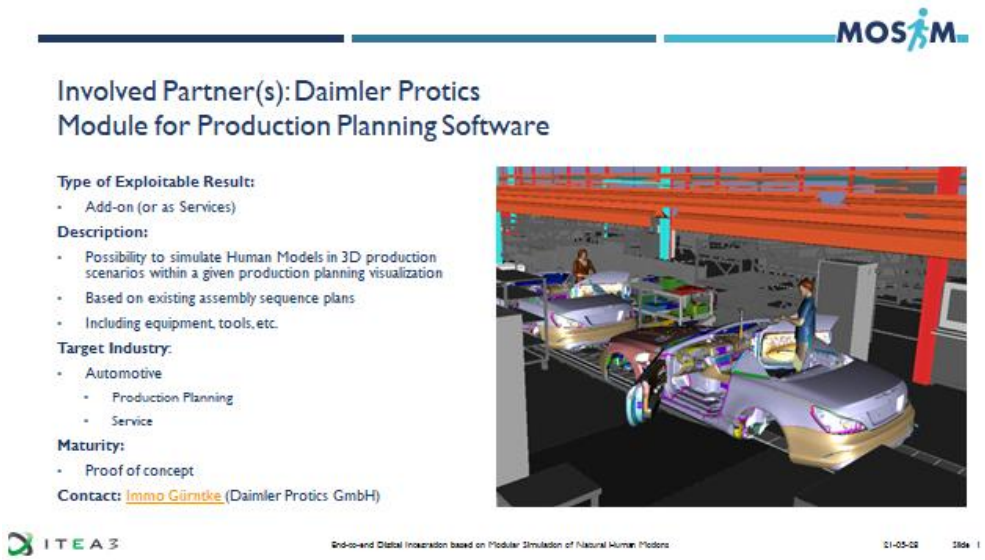
Unique Selling Proposition(s):	▪ Integration in production planning process ▪ Data usage of production planning system ▪ Realistic motion simulation
Integration constraint(s):	▪ MOSIM outcome stability/robustness (MMU availability, behavior modelling) ▪ 3D production input availability ▪ Availability of a human body model (RAMSIS support) ▪ Transfer of meta data out of source systems as simulation parameters
Intended user(s):	▪ Production Planning Engineers ▪ Final assembly line workers (blue color people)
Provider:	▪ ESI Software Germany GmbH
Contact point:	▪ André Rückert – andre.rueckert@esi-group.com
Condition(s) for reuse:	▪ IC.IDO proprietary license

Latest update: June 2021

Name: Module for Production Planning Software		
Input(s):	Main feature(s)	Output(s):
▪ Geometrical scene + constraints ▪ Process data	▪ Simulation of human body based on the scenario ▪ Easy adaption of scenario parameters and start of a new simumlation ▪ Fast simulation answer ▪ 1:1 visualization of simulation results in e.g. VR possible	▪ Simulated human body motion based on the scenario: location of parts, tools and carriers ▪ Ergonomics estimation

Unique Selling Proposition(s):	▪ Integration in production planning process ▪ Data usage of production planning system ▪ Realistic motion simulation
Integration constraint(s):	▪ 3D production planning SW tool decision ▪ Availability of a human body model ▪ Transfer of meta data out of source systems as simulation parameters
Intended user(s):	▪ Production Planning Engineers ▪ Ergonomics Specialist (Technician or Engineer)
Provider:	▪ Daimler Protics GmbH
Contact point:	▪ Immo Gürntke, Daimler Protics GmbH, immo.guerntke@daimler.com
Condition(s) for reuse:	▪ Daimler or rather Daimler Protics GmbH proprietary license license

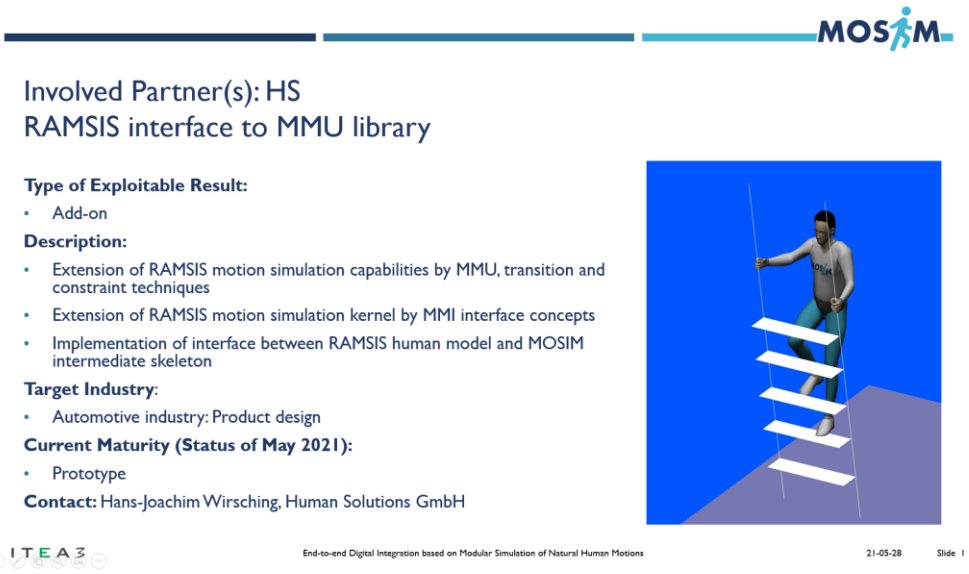
Latest update: June 2021



Name: RAMSIS Interface to MMU library		
Input(s):	Main feature(s)	Output(s):
▪ Geometrical scene constraints ▪ RAMSIS avatar ▪ Motion task	▪ Simulation of human motion based on motion capture data ▪ Consideration of scene constraints and avatar dimensions ▪ Extendable by additional motion data	▪ Simulated human motion in RAMSIS avatar format

Unique Selling Proposition(s):	▪ Seamless integration in RAMSIS simulation framework ▪ Customization by additional specific motion data ▪ Realistic motion simulation
Integration constraint(s):	▪ Available in ergonomic tool RAMSIS
Intended user(s):	▪ Ergonomic package engineers who intend to evaluate dynamic ergonomic aspects.
Provider:	▪ Human Solutions GmbH
Contact point:	▪ Dr. Hans-Joachim Wirsching – hjwirsching@human-solutions.com
Condition(s) for reuse:	▪ Human Solutions proprietary license

Latest update: June 2021



Name: MOSIM Plugin for Unreal		
Input(s):	Main feature(s)	Output(s):
▪ Unreal Scene	▪ Conversion of the Unreal simulation into the format applied by MOSIM ▪ Coupling of the MMU's, services and the MOSIM register	▪ MOSIM generated motions fulfilled by the Unreal character in the Unreal scene

Unique Selling Proposition(s):	▪ Integration of MOSIM into Unreal ▪ Additional Game Engine extends the amount of possible users of MOSIM considerably
Integration constraint(s):	▪ Conversion of the Unreal simulation into the format applied by MOSIM ▪ Coupling of the MMU's, services and the MOSIM register
Intended user(s):	▪ Everyone who wants to use MOSIM with the Unreal Engine
Provider:	▪ TWT GmbH
Contact point:	▪ Caroline Handel
Condition(s) for reuse:	▪ MIT Licence

Latest update: June 2021

Name: Mevea integration to MOSIM framework		
Input(s):	Main feature(s)	Output(s):
▪ Task list for human avatars ▪ MMUs ▪ Services ▪ Human avatars	▪ Simulation of the human interacting with machines ▪ Testing sensors' digital twins with human models ▪ Evaluation of hazardous scenarios	▪ Human simulation in environment with machines that are digital twin of real machines ▪ Human – machine interaction ▪ Digital twins of sensors can interact with human avatars in the scene

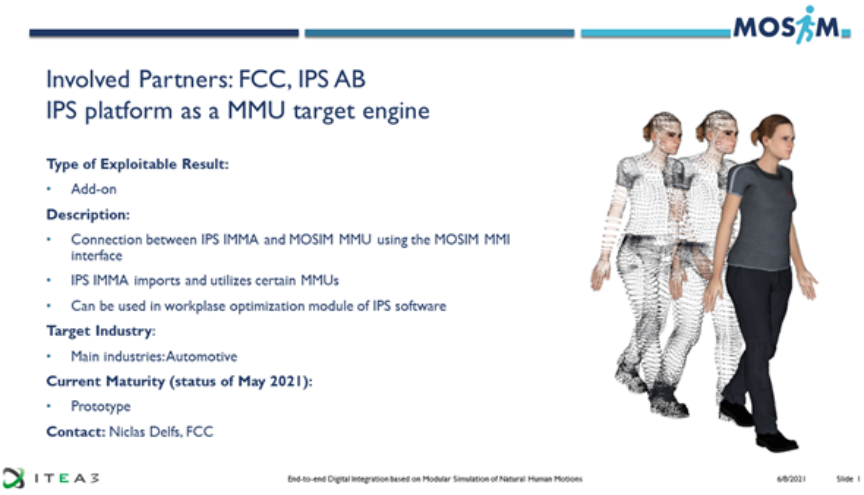
Unique Selling Proposition(s):	▪ State of the art real-time simulation of machines ▪ Digital twins of sensors modules ▪ Support for motion platforms and real controls ▪ Hardware in the loop integration ▪ Operator training (including scenarios with observers)
Integration constraint(s):	▪ Mevea software package ▪ Mosim framework ▪ Unity
Intended user(s):	▪ MOSIM framework end users who need also dynamics real-time multibody simulator
Provider:	▪ Mevea Oy
Contact point:	▪ Asko Rouvinen
Condition(s) for reuse:	▪ Commercial license

Latest update: June 2021

Name: IPS platform as a MMU target engine		
Input(s):	Main feature(s)	Output(s):
▪ MMU ▪ 3D geometry	▪ Use features from MMUs ▪ Possibility to blend MMUs with the algorith heavy IMMA motions	▪ Animation of MMU

Unique Selling Proposition(s):	▪ Make use of MMU library inside IPS IMMA
Integration constraint(s):	▪ License of IPS IMMA
Intended user(s):	▪ Simulation engineers in production
Provider:	▪ IPS AB
Contact point:	▪ Tobias Forsberg
Condition(s) for reuse:	▪ Perpetual or leasing license of IPS IMMA

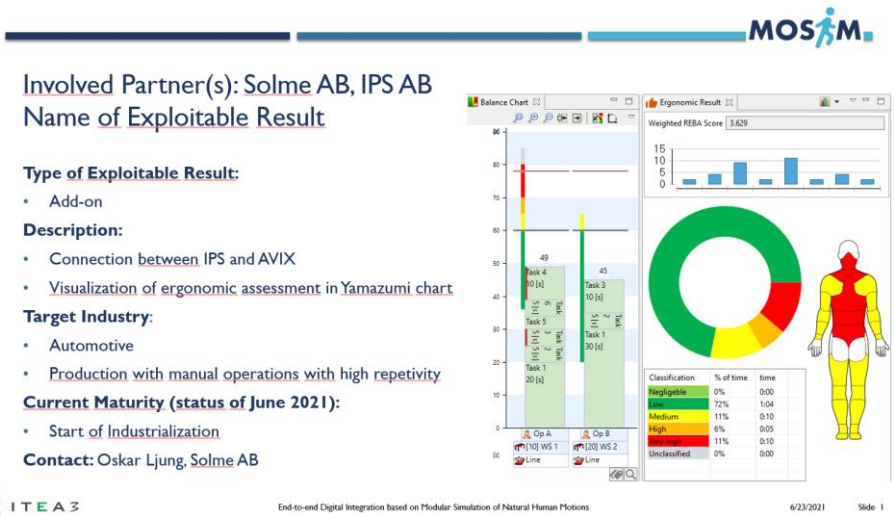
Latest update: June 2021



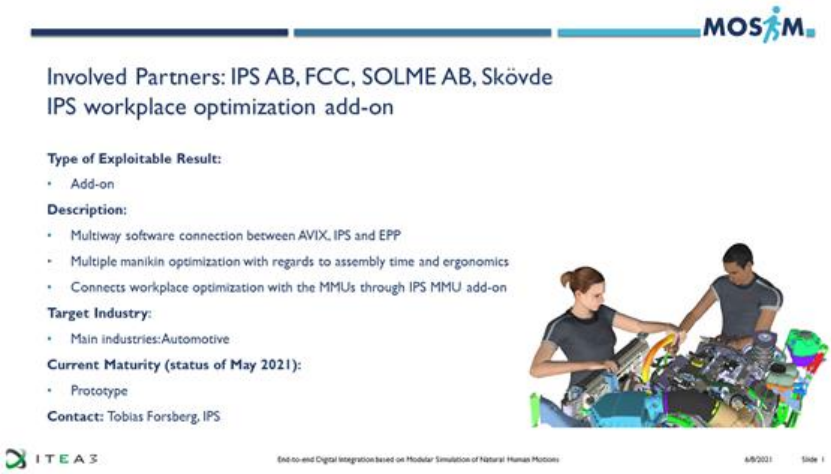
Name: Ergonomic Balancing		
Input(s):	Main feature(s)	Output(s):
▪ Production assembly structure in AVIX ▪ Ergonomic simulation from IPS	▪ Line balancing with time and ergonomic aspects ▪ Visualization of ergonomic load per manually activity in assembly	▪ Line optimization with increased capacity ▪ Improved ergonomic situation for operators

Unique Selling Proposition(s):	▪ Combines optimization of production capacity and ergonomic load for operators.
Integration constraint(s):	▪ Ergonomic simulation in IPS to calculate ergonomic load automatically. ▪ Or manually performed ergonomic assessment
Intended user(s):	▪ Production engineers, Process planners
Provider:	▪ Solme AB
Contact point:	▪ Oskar Ljung
Condition(s) for reuse:	▪ AVIX license

Latest update: June 2021



Name: IPS workplace optimization		
Input(s):	Main feature(s)	Output(s):
▪ 3D Geometry 3D geometry ▪ JSON file from Avix with instructions on the setup of bite-sized simulations	▪ Wizard to set up and adapt simulations wrt ergonomics ▪ Simulations possible to view and adapt ▪ Rebalancing in Avix based on times	▪ Videos of simulations ▪ Optimized simulations wrt ergonomics

Unique Selling Proposition(s):	▪ Setting up advanced ergonomically sound simulations, guided from start to finish ▪ Use EPP for finalized step of optimizing positions of surrounding geometries
Integration constraint(s):	▪ Avix software ▪ IPS IMMA software
Intended user(s):	▪ Simulation engineers within production ▪ Ergonomists
Provider:	▪ IPS AB
Contact point:	▪ Tobias Forsberg (tobias.forsberg@industrialpathsolutions.com)
Condition(s) for reuse:	▪ Perpetual license or leasing

Latest update: June 2021