



CONVERGING



**Social industrial collaborative
environments integrating AI,
Big Data and Robotics for
smart manufacturing**

Vision

” The ambitious vision of CONVERGING is to develop a human–robot collaborative social–industrial environment by bringing together the advances of Big Data, AI, Robotics, and Social Sciences and Humanities for safer, more flexible, reconfigurable, and modular production environments. ”



Discover CONVERGING

The **CONVERGING project** aims to develop, deploy, validate and promote smart and reconfigurable production systems including multiple autonomous agents (collaborative robots, AGVs, humans) that are able to act in diverse production environments.

The diversifying factors will be a multi-level AI-based cognition system that takes advantage of the collective perception (Digital Pipeline) of the resources, enabling them to interact seamlessly coexist with humans under a “social industrial environment” that ensures trustful, safe and inclusive user experience.

The systems will have five key features:

1. **Perceive:** The ability to identify and understand processes, resources, and environments and their status through the use of Big Data, Real Time Integration & Communication Architecture, Digital Twins and Human in the Loop techniques.
2. **Reason:** Analyze the production system status and independently form plans using AI, Planning and Reconfiguration Algorithms as well as Resource Autonomy solutions.
3. **Adapt:** Automatically modify hardware and control systems to implement formulated plans using Robotics and Autonomous Systems, Smart Devices and Adaptable Mechatronics.
4. **Collaborate:** Work seamlessly with humans or other resources, creating a social industrial environment which exploits Smart Human Machine Collaboration, User experience assessment and User centric workplace design.
5. **Innovate:** Expand its capabilities and Openness via an Open Pilot Network as well as links to local and international innovation ecosystems.



CONVERGING: AI-Driven Reconfiguration & Human-Centric Smart Manufacturing

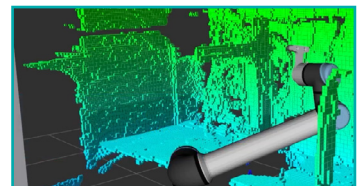
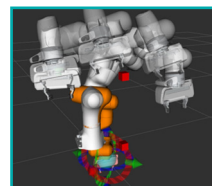
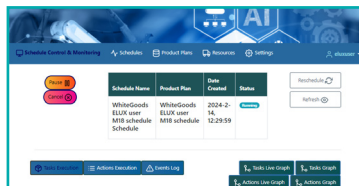
Transforming Industrial Workflows with AI and Robotics

CONVERGING is revolutionizing human-machine collaboration by integrating AI-driven reconfiguration, Big Data analytics, and cutting-edge robotics into next-generation smart manufacturing. The project enhances flexibility, efficiency, and safety in industrial environments by creating dynamic, adaptive, and human-centric production systems.

Key Technological Innovations

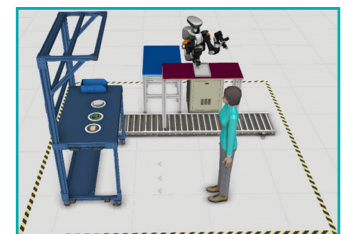
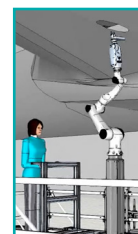
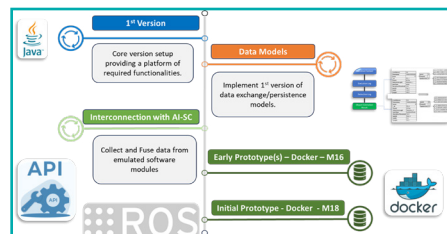
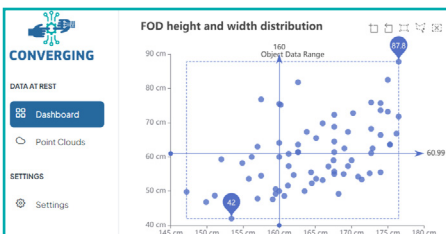
AI-Driven Reconfiguration & Autonomy

- **Dynamic Work Reorganization (DWR):** Uses AI to generate optimized task schedules for humans and robots, ensuring efficient production planning.
- **AI Station Controller (AISC):** Bridges decision-making with real-time execution, orchestrating robotic operations and coordinating production cells.
- **Collaborative Robot Control (CRC):** Enhances robot flexibility with collision avoidance, task-switching, and real-time process adaptation.
- **Perception & Autonomy (PAM):** Provides robots with advanced AI-driven perception for obstacle detection, process monitoring, and autonomous path planning.



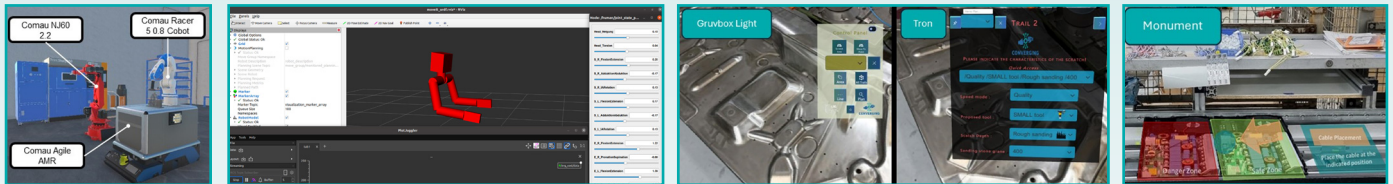
Big Data Pipeline for Smart Manufacturing

- **Data at Rest (DAR):** Ensures seamless data sharing through microservices and real-time analytics.
- **Data in Motion (DIM):** Enables instant data exchange between Human-Robot Collaboration (HRC) agents for synchronized operations.
- **AI Digital Twin (AIDT):** Creates virtual shop floor models to optimize processes, predict maintenance needs, and enhance production efficiency.



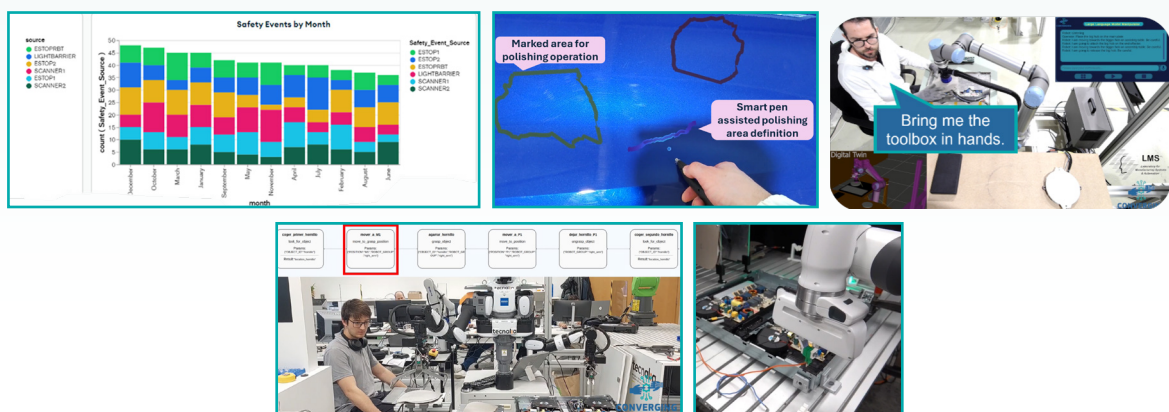
Human-Centric Industrial Environments

- **Operator Training (OTM):** Leverages AR, MR, and VR for immersive, personalized training experiences.
- **User Experience & Ergonomics (UXE):** Integrates human-centered models to enhance safety and efficiency in robot-assisted tasks
- **Multi-Actor Contextual Interfaces (MACI):** Provides dynamic, personalized human-machine interaction interfaces..



Smart Human-Robot Collaboration

- **Safety Assessment & Monitoring (SAM):** Implements AI-driven safety systems for real-time risk detection and accident prevention.
- **Multi-Actor Contextual Interfaces (MACI):** A next-generation communication module that enables seamless, bi-directional interaction between human operators and the CONVERGING system.
- **Teaching by Demonstration (TDM):** Enables robots to learn tasks from human demonstrations, reducing programming complexity.
- **Autonomous Robot Behavior Adjustment (ARBA):** Uses AI to refine robot behavior in real-time for adaptive, self-learning operations



Why Choose CONVERGING?

- **AI-Powered, Human-Centric Smart Manufacturing**
CONVERGING seamlessly blends Artificial Intelligence, Robotics, and Big Data with human expertise, ensuring a dynamic, efficient, and worker-friendly production environment.
- **Enhanced Human-Robot Collaboration for a Safer, Smarter Workplace**
With adaptive AI, intuitive interfaces, and real-time safety monitoring, CONVERGING minimizes risks, reduces learning curves, and ensures a seamless transition to collaborative robotics.
- **Next-Generation Digital Twins & Big Data Integration**
By leveraging real-time simulations, AI-driven insights, and advanced predictive analytics, CONVERGING optimizes production, minimizes downtime, and enables data-driven decision-making.
- **Immersive Training & Workforce Empowerment**
State-of-the-art AR, MR, and VR training modules provide personalized learning experiences, ensuring that workers adapt quickly and develop the skills needed for the factories of the future.
- **Scalable & Future-Proof Industry 4.0 Solution**
Built on an adaptive, modular architecture, CONVERGING ensures long-term flexibility, interoperability, and continuous innovation in smart manufacturing environments.

Partners

The EU-funded CONVERGING project brings together 16 high-profile partners from several EU and Asian countries consisting of 5 research organizations and eleven industrial partners.



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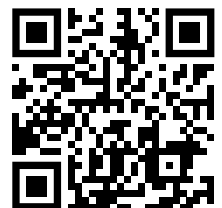
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