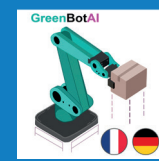


# Project Results Summary: GreenBotAI



## What results were achieved?

The Franco-German GreenBotAI project – Frugal and Adaptive AI for Flexible Industrial Robotics – developed integrated vision, force-torque control, and AI algorithms for real-time robot guidance, directly transferable to practical applications. These algorithms enable industrial users to quickly implement on-the-fly bin picking, tracking, assembly, and quality control tasks without deep robotics expertise. Modular machine learning models were designed and evaluated in custom-built simulation environments using synthetic data, delivering robust AI-driven 2D and 3D tracking combined with force-torque control that dynamically compensates for uncertainties in robotic assembly. Real-time communication via the User Datagram Protocol (UDP) and a modular architecture ensure seamless data exchange and adaptability across a wide range of robotic systems.



*To address the often-underestimated challenges of real-time, flexible robot-assisted force-torque control, we offer a new software solution with ForceAdapt. For quality control, new software modules were implemented into the Xeidana® software framework. Together, these solutions enable more cost-effective and sustainable production.*

**Prof. Ruth Otto / Rico Löser**  
Professor in Robotics and Automation Technology at Munich University of Applied Sciences / Consortium Management GreenBotAI and PhD Candidate Fraunhofer IWU

Supported by:



on the basis of a decision by the German Bundestag



## What is the benefit for the industry?

The GreenBotAI tools accelerate digital transformation and adaptive automation in high-variability sectors such as e-mobility, electronics, and recycling. They enable automation and quality assurance of dynamic production lines without stop-and-go operations, saving cycle time and eliminating the need for indexing systems. Using compressed, real-time AI models reduces the need for additional hardware and complex programming. Energy consumption can be cut by over 25 percent in continuous (no-stop) grasping applications, lowering operational costs and environmental impact.

## What are further plans after the project ends?

GreenBotAI solutions will continue to be implemented and validated in industries such as motor block screwing for mowing equipment, cable assembly, and robotic inspection. Their use will be extended to additional robot manufacturers beyond UR, FANUC, COMAU, and KUKA. The focus lies on balancing improved reliability and flexibility with further data reduction to develop cost-effective models. The system will be enhanced with behavior-based AI and integrated automated inspection for flexible disassembly, aiming for cost reduction and greater ease of use. Simulating forces and moments will shorten commissioning, stabilize processes, and maximize optimization across industries.

### 4 Partners

#### Germany:

Fraunhofer Institute for Machine Tools and Forming Technology (IWU)  
(German consortium leader)  
Hochschule München (Department of Applied Sciences and Mechatronics)

#### France:

INBOLT SAS (French consortium leader)  
Arts et Métiers (ENSAM LISPEN)

### Duration

March 2022 – August 2025

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