



**JARVIS**

# **DRIVING HUMAN-ROBOT COLLABORATION: CO-HAND**

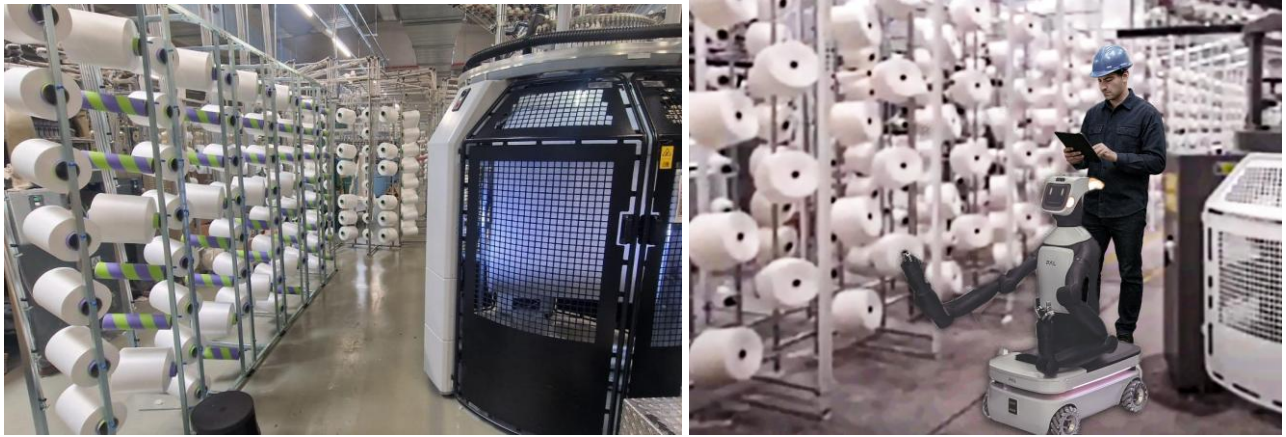


**Funded by  
the European Union**

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## CO-HAND – Collaborative Handling of Yarn Cones in Dynamic Textile Environments

CO-HAND develops a human-aware mobile manipulator that collaborates directly with textile workers, intuitively assisting them in physically demanding cone-handling tasks while ensuring safe, efficient and ergonomic human-robot interaction.

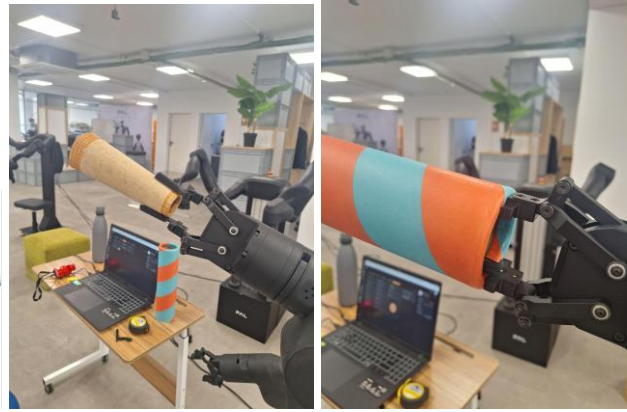
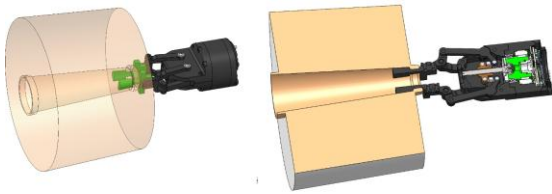


*Figure 1. End user setting; CETRIKO textile manufacturer*

CO-HAND is strongly aligned with the JARVIS framework, particularly Challenge 2 on agile collaborative robotics for logistics. The project advances JARVIS's vision of human-centric, AI-driven Human-Robot Collaboration by deploying a mobile manipulator that works intuitively alongside operators in a real textile manufacturing environment. The project integrates the JARVIS tool directly into PAL Robotics' TIAGo Pro, combining perception, manipulation, and multimodal interaction into a cohesive system for textile logistics.

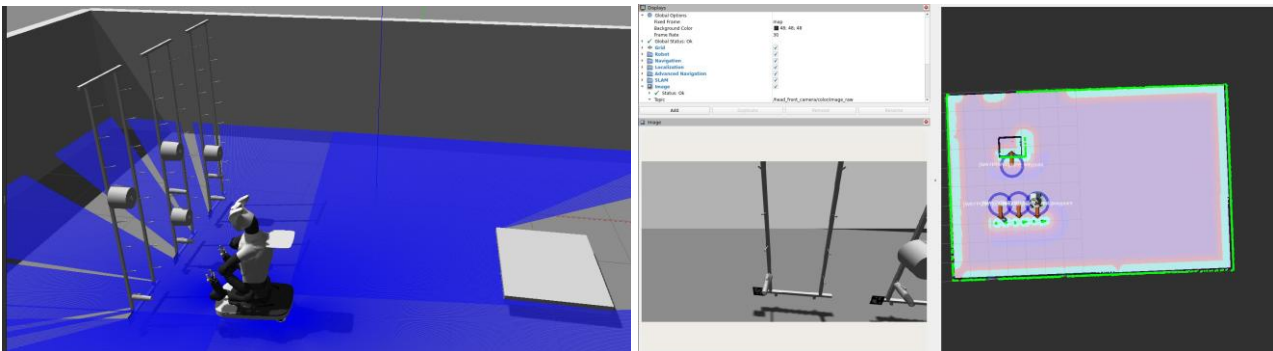
Concretely, the JARVIS tool "object detection and pose estimation" is used for cone detection, classification and pose estimation, enabling precise target generation for manipulation tasks. These outputs are integrated into a ROS2-based pipeline and linked to task planning and motion execution. The integration process has been actively supported by JARVIS mentoring, particularly in adapting trained models, resolving middleware compatibility issues, and ensuring smooth communication between components.

In parallel, PAL has developed a custom adaptive gripper specifically designed for yarn cone handling, enabling reliable manipulation in narrow, semi-structured environments and complementing JARVIS perception capabilities. This tight integration of JARVIS software with custom hardware significantly enhances system performance.



*Figure 2. Custom gripper for yarn cone handling*

The project follows an iterative, user-in-the-loop approach, progressing from simulation to real-world validation. A digital twin environment has been used to develop and test navigation, perception, and manipulation workflows, including an optimized two-stage detection strategy to balance speed and precision. In parallel, on-site data collection and YOLO model training have been carried out at CETRIKO to ensure robustness under real factory conditions such as dust, lighting variability, and clutter.



*Figure 3. Simulation status*

On the HRI side, the project has evolved significantly through mentoring cycles from basic task triggering to advanced “operational transparency and interaction redundancy.” The system now provides multimodal interaction (WebGUI, voice, and visual signals), allowing operators to monitor the robot’s perception in real time and interact through redundant control channels, improving usability and safety. This directly reflects JARVIS’s human-centric design principles.

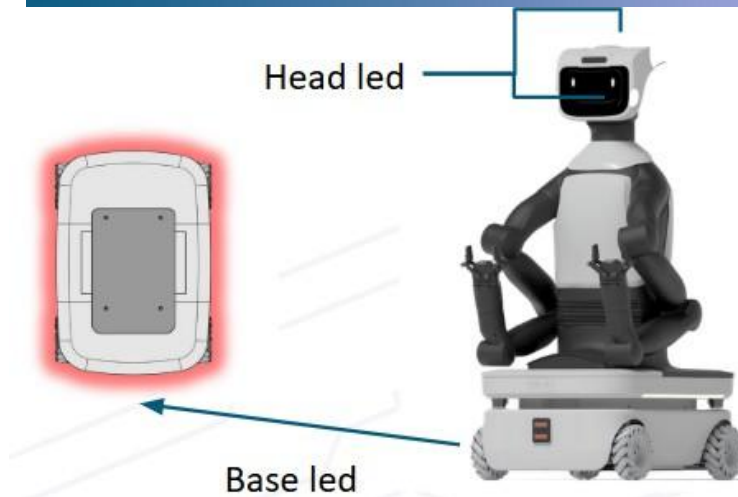


Figure 4. Visual signals and speech communication for human robot interaction

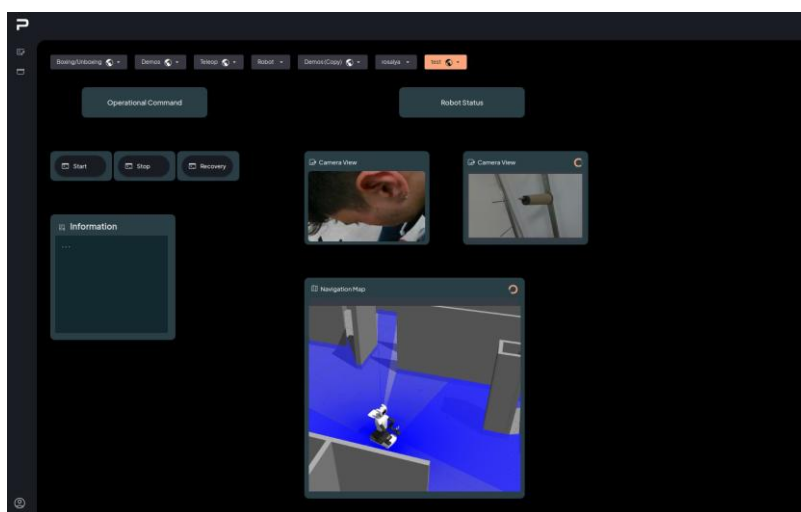


Figure 5. Initial WebGUI interface developed for operators

CO-HAND brings clear added value to JARVIS by demonstrating its technologies in a new, highly dynamic industrial domain. It validates JARVIS tools not only technically but also in terms of usability, robustness, and operator acceptance. Through real-world deployment, iterative testing, and continuous feedback loops, the project will contribute to improving the scalability, interoperability, and practical relevance of the JARVIS framework.

JARVIS provided access to the perception tool, guidance on its integration and mentoring support, which helps streamline development, benchmarking, and alignment with common standards. This has accelerated the integration of perception while ensuring interoperability within a broader multi-agent and modular framework. JARVIS also offered a platform to showcase our project results through its communication channels and community networking which increases the exposure of CO-HAND beyond the consortium.