Combined AI and Data solutions for AUTOMATION

Challenge 4.4
Co-bot refrigerator door assembly solutions

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4.4 Co-bot refrigerator door assembly solutions

Challenge and Context: The development of new automation technologies for the manufacturing industry directly contributes to efficiency, safety, and human factors. Modular, reconfigurable, energy-efficient, and collaborative robots can enable industries to optimize their operations, reduce waste, lower their environmental impact, and improve human operator job attractiveness. The white goods factory of a partner is one area where collaborative robots can make a significant difference. This partner will provide a use case for their refrigerator production line, where refrigerator gaskets of different shapes and sizes are installed on refrigerator doors. Manual installation of the refrigerator gaskets poses ergonomic challenges, resulting in inefficiencies and potential product rejections. Partial (co-bot) automation of gasket installation, particularly flexible elastomer gaskets, presents unique challenges that require the integration of collaborative robotics and AI to optimize the installation process. This ensures precision, safety, and adaptability to the deformable nature of elastomers, as the co-bot must apply the right force on the flexible material without causing deformation. The partner seeks a co-bot solution to overcome these challenges while aligning with the Green Deal's focus on promoting worker well-being and safety.

Use Case and Expected Solution: Another partner has a catalogue of developed technologies validated in the lab (TRL 4), building on results from previously funded EU projects related to collaborative assembly. These technologies will be combined with 2D/3D video analysis technology blocks. The partner has several low-TRL playgrounds based on these technologies.

The solution enables to improve efficiency, operator ergonomics, and inclusiveness, and reduce waste. This will result in more efficient production processes, better utilization of machinery, and enhanced overall operational efficiency. The expected solution will advance the catalogue of technologies and apply them in a working solution for the gasket installation use-case at TRL6. This will enable to improve efficiency, operator ergonomics, and inclusiveness, and reduce waste. This will result in more efficient production processes, better utilization of machinery, and enhanced overall operational efficiency. It will be demonstrated at TRL 6 and will offer the means to be advanced to even higher TRL, including with all safety requirements for factory deployment.

The AID4SME solutions will foster a sustainable and inclusive digital transition that benefits both manufacturing companies and society at large.

Specifications for Use Case: The consortium partner will guide and mentor SMEs to further develop the technology bricks using their low-TRL playground and adapt these technologies for deployment in other industry sectors. For the “bring your own use-case” challenges, co-bot solutions will be demonstrated at TRL 5-6. This will enable improved efficiency, operator ergonomics, and inclusiveness, decrease waste, and increase the longevity of refrigerator doors through enhanced stability of gasket installation quality.

The selected third party is expected to contribute with the following:

1. Develop a co-bot-assisted gasket installation solution
2. Integrate AI-based perception and control systems to allow the co-bot to adapt to different gasket shapes and models.
3. Ensure compliance with safety and ergonomic standards, by reducing physical strain on human workers and improving workplace safety with co-bot working
4. Demonstrate human-robot collaboration capabilities, where the co-bot supports rather than replaces the human operator, ensuring intuitive interaction and task sharing.

The SMEs are expected to deliver:

1. **A functional prototype or demonstrator** of a semi-automated gasket installation system using a collaborative robot and AI.
2. **Technical documentation,** including system architecture, control algorithms, safety assessments, and integration plans.

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3. **Performance evaluation results,** showing improvements in precision, cycle time, safety, and operator workload compared to manual processes.
4. **A roadmap for scalability and industrial deployment,** including environmental and economic impact assessments in line with the Green Deal.
5. **Training and user manuals** to ensure the solution can be safely and efficiently used by operators with minimal retraining.

Key Performance Indicators:

- Demonstrate effective and flexible autonomous processes (% increase in assembly precision).
- Ensure the safety of workers in the vicinity.
- Improved efficiency: reduce the number of workers required at the production line (% increase in production line efficiency).
- Operator ergonomics: reduce operator/worker effort, as they will be able to focus on other tasks.
- Increase quality: robotized processes can more easily detect errors in production during the process itself (% reduction in installation errors).
- % reduction in waste due to assembly defects

To be noted, the list of KPIs provided in this section is not exhaustive but rather indicative. Additional KPIs will be studied and can be integrated to ensure quality outcomes.

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