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

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 can utilize a catalogue of developed technologies validated in the lab (TRL 4), building on results from previously funded EU projects related to collaborative assembly, and can apply them in a working solution for the gasket installation use-case at TRL7. 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 9 at the high-TRL partner facility 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.

Specification for use case

The solution will enable improved efficiency, operator ergonomics, and inclusiveness, decrease waste, and increase the longevity of refrigerator doors through enhanced stability of gasket installation quality.

Instruction handling and integration:

- Transformation of expert knowledge into structured Digital Work Instructions
- Integration with existing documentation systems (e.g., work instructions, checklists, safety procedures)
- Delivery of alerts and updates when instructions or process conditions change

Skill and context awareness:

- Consideration of operator qualifications (e.g., training, certification) when delivering guidance
- Adaptation of instruction detail based on operator experience level

Knowledge capturing and modelling:

- Extraction and formalisation of expert decision-making practices
- Linking operator actions with process conditions and outcomes

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Traceability and monitoring:

- Recording of actions taken and checks performed (e.g., process controls before/during manufacturing)
- Monitoring of compliance with required procedures

Development approach:

- Initial validation in a controlled lab environment (low TRL)
- Progressive integration and demonstration in an industrial pilot environment (TRL7)

Expected solution

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

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

Key Performance Indicators

Key Performance Indicators (KPIs) should clearly demonstrate the relevance and impact of the proposed solution. They must address at least two of the following dimensions: resource optimisation, Green Deal objectives, and social impact. All KPIs must be SMART (Specific, Measurable, Achievable, Relevant and Time-bound), ensuring they remain quantifiable throughout the project.

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