

FAPS

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Institute for Factory Automation
and Production Systems

Friedrich-Alexander University Erlangen-Nuremberg

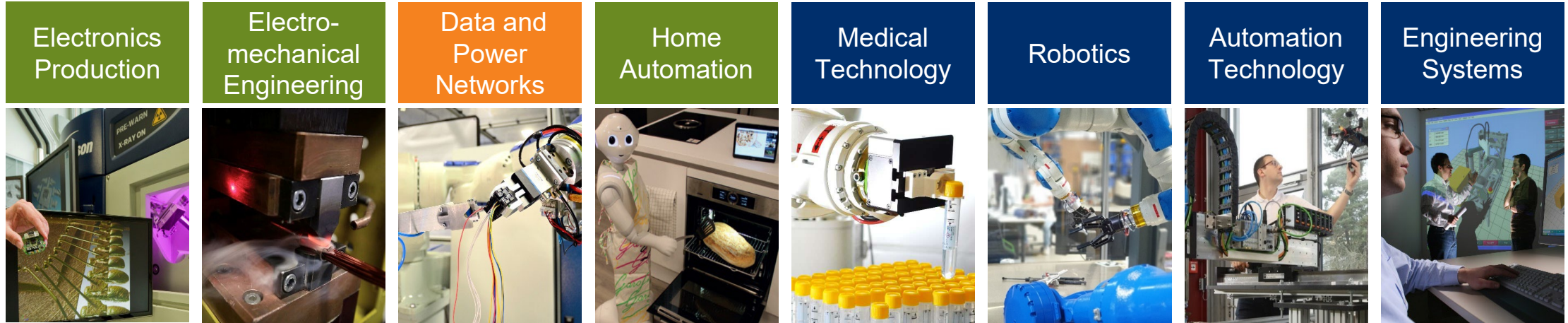


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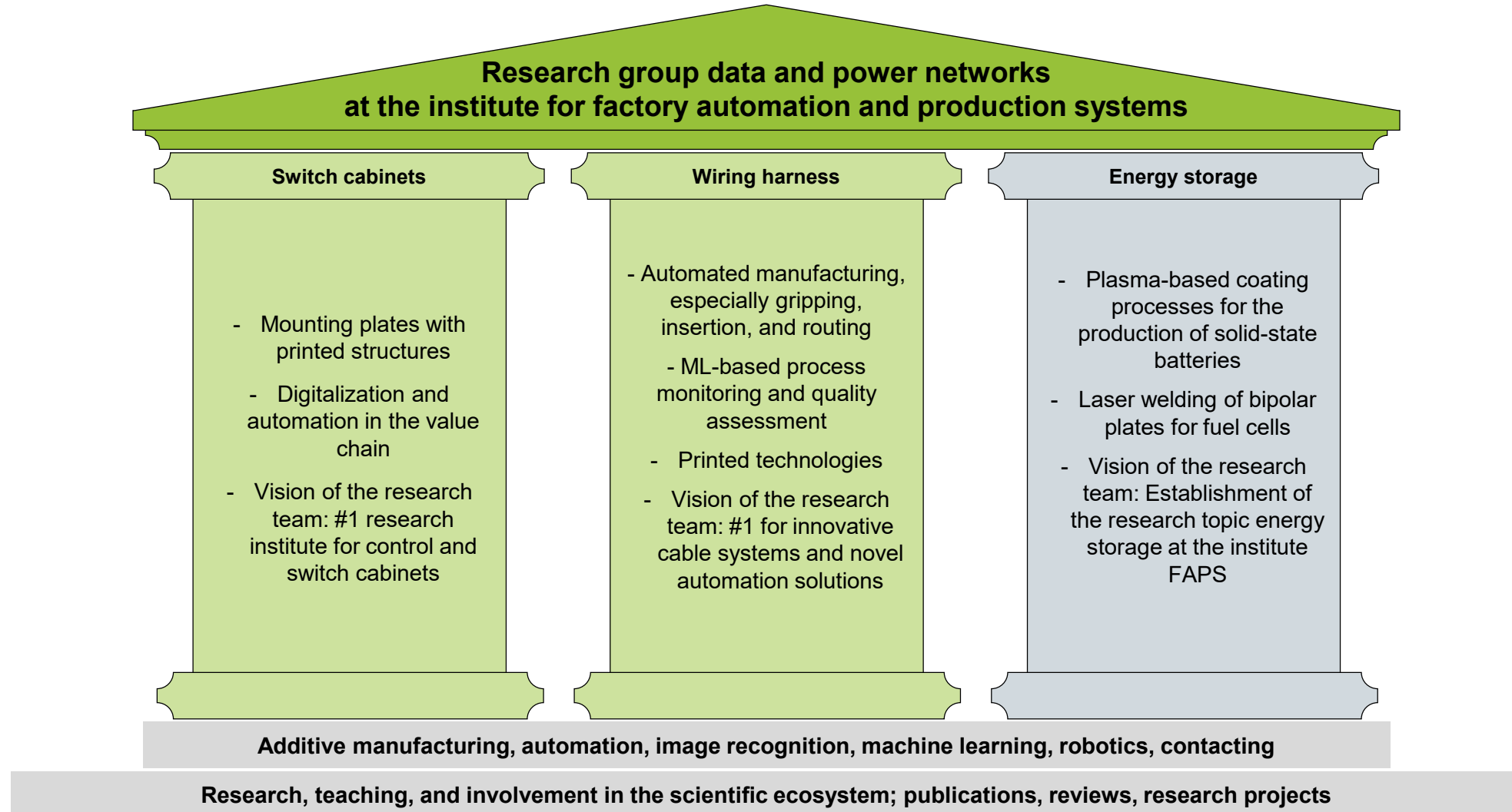
Presentation of the research sector data and power networks

Transformations-Hub Leitungssatz: 1. Trendausblick

The Institute for Factory Automation and Production Systems (FAPS) is researching the production and assembly of mechatronic products.



The research group data and power networks focuses on value chains of switch cabinets, automotive wiring harnesses, and energy storage.



Wiring and mechanical assembly, which account for almost 72% of the working time in the manufacture and assembly of control cabinets, offer great potential for optimization.

⚠ **Motivation:** Manual manufacturing of control cabinets

- Increase in the number, variety, and complexity of components installed in the control cabinet
- Labor-intensive, predominantly manual workshop production
- Data discontinuities, insufficient use of IT systems, and lack of economies of scale make economical production difficult

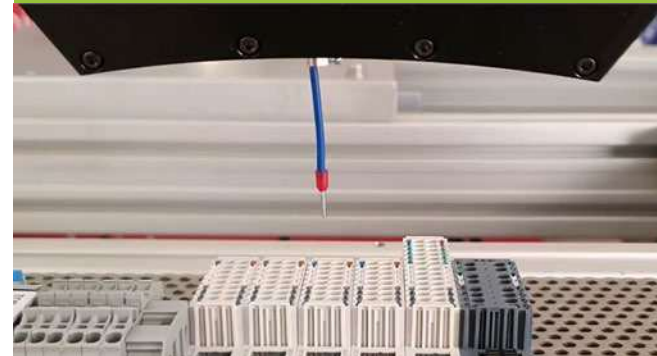
🎯 **Objective:** Increase efficiency in the manufacturing process

- Development of economical production solutions, especially for small and medium-sized enterprises
- Possibility of late individualization while guaranteeing faultlessness of the products
- Decrease of delivery time

💡 **Solution:** Automation and digital worker assistance

- Development of an assistance robot system for the automated insertion of prefabricated cables
- Conceptual design of a digital worker assistance system for the manual work steps of mechanical assembly and wiring

Automated insertion



Digital worker assistance



Further information:

Florian Hefner, Simon Schmidbauer, Jörg Franke, **Pose error correction of a robot end-effector using a 3D visual sensor for control cabinet wiring**, Procedia CIRP, Volume 93, 2020, Pages 1133-1138, ISSN 2212-8271, <https://doi.org/10.1016/j.procir.2020.04.088>.

Florian Hefner, Simon Schmidbauer, Jörg Franke, **Vision-based adjusting of a digital model to real-world conditions for wire insertion tasks**, Procedia CIRP, Volume 97, 2021, Pages 342-347, ISSN 2212-8271, <https://doi.org/10.1016/j.procir.2020.05.248>.



Development of an AI-based disassembly station for enabling a fully automated recycling process in the control cabinet industry.

⚠ Motivation: Enabling recycling in control cabinet industry

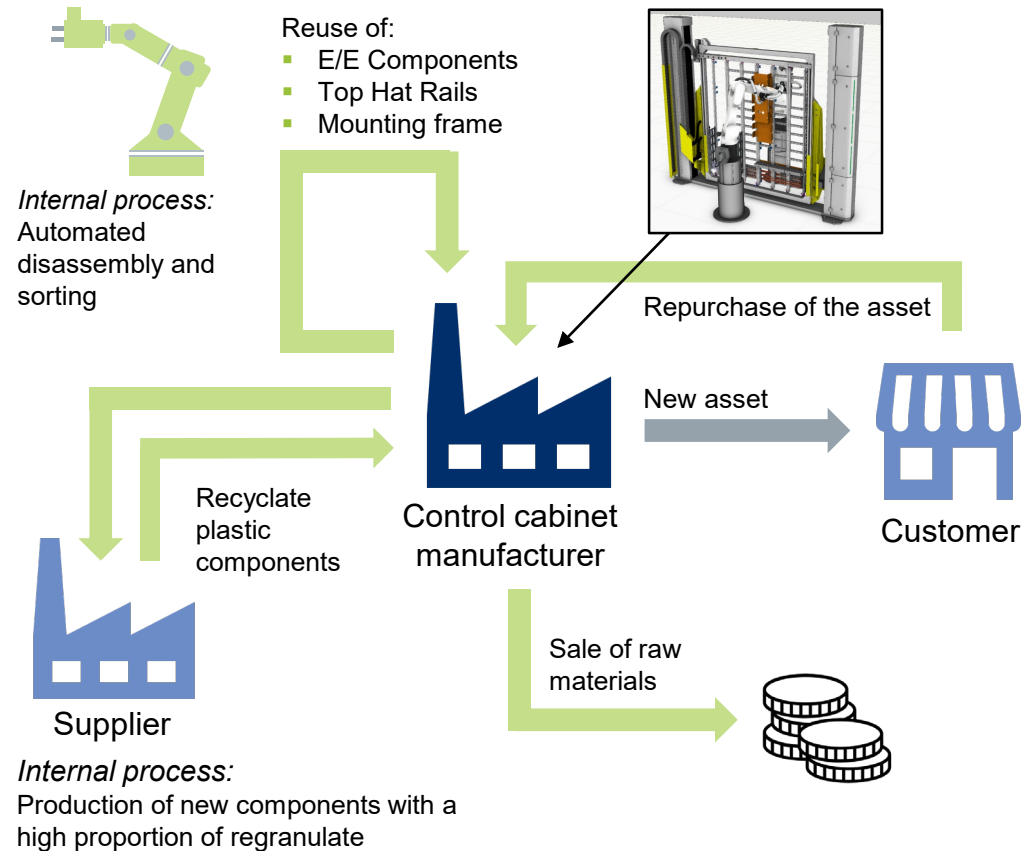
- Recycling share still low due to laborious and predominantly manual processes
- Reducing waste and enhancing a sustainable circular economy

🎯 Objective: Increase automation of recycling processes

- Development of an automated optical inspection system for detecting and determining recyclable components
- Creation of a fully automated disassembly station for enabling dismantle processes of entire control cabinets

💡 Solution: AI-based disassembling process

- Machine learning-based detection and classification of all subcomponents of a control cabinet
- Combination of AOI and intelligent robot system to enable effective recycling
- Increase the efficiency of recycling processes



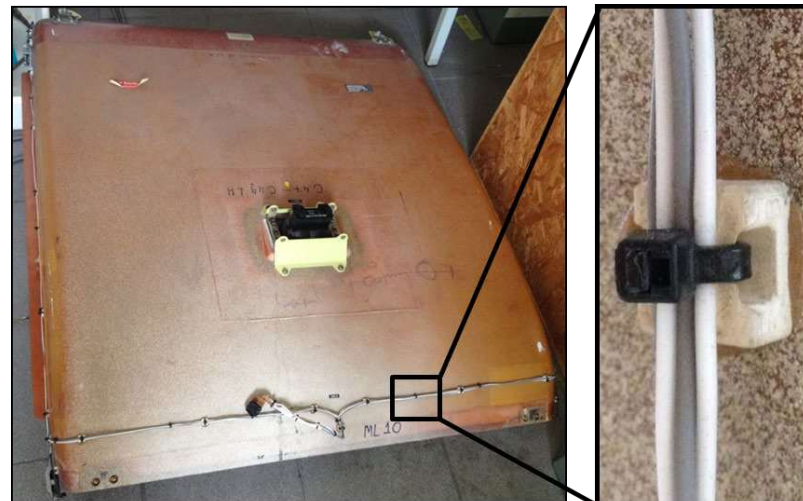
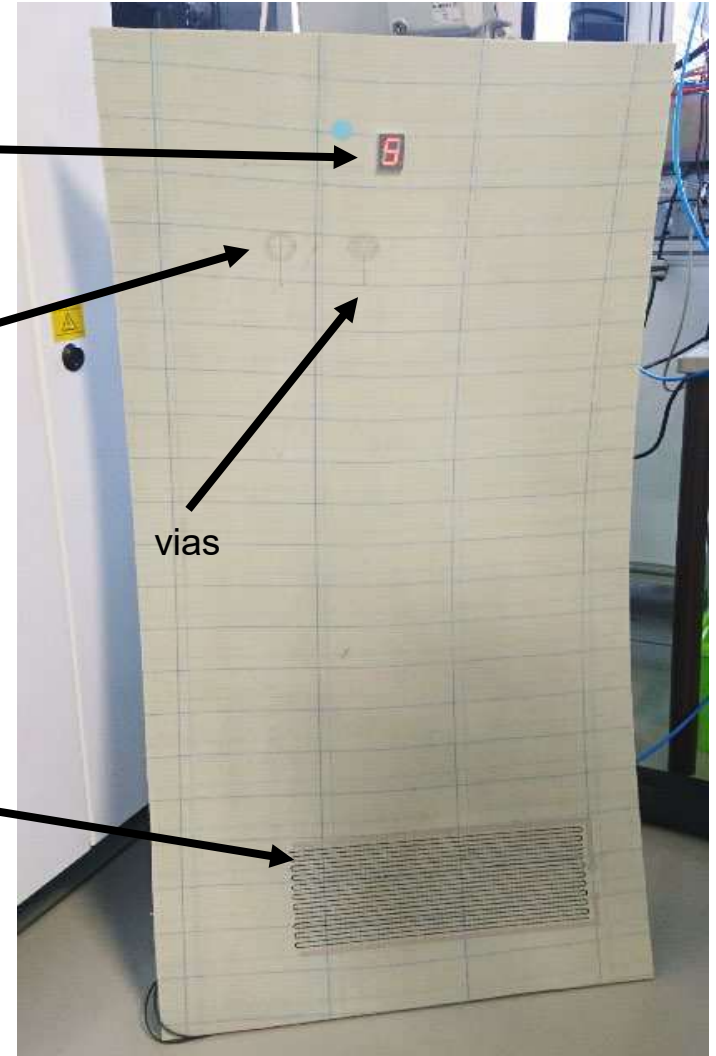
The initial motivation for the research on printed electronics within the aviation sector was the reduction of weight and manual processes through the reduction of cables.


Wiring airplanes:

- Length of copper wires within the Airbus A320: ~100 km
- Mounting is done manually


Disadvantages:

- Weight and space consumption
- Enormous production effort





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In the research project “ProMil”, printed circuits were developed to support the assembly and maintenance processes in aircraft manufacturing.

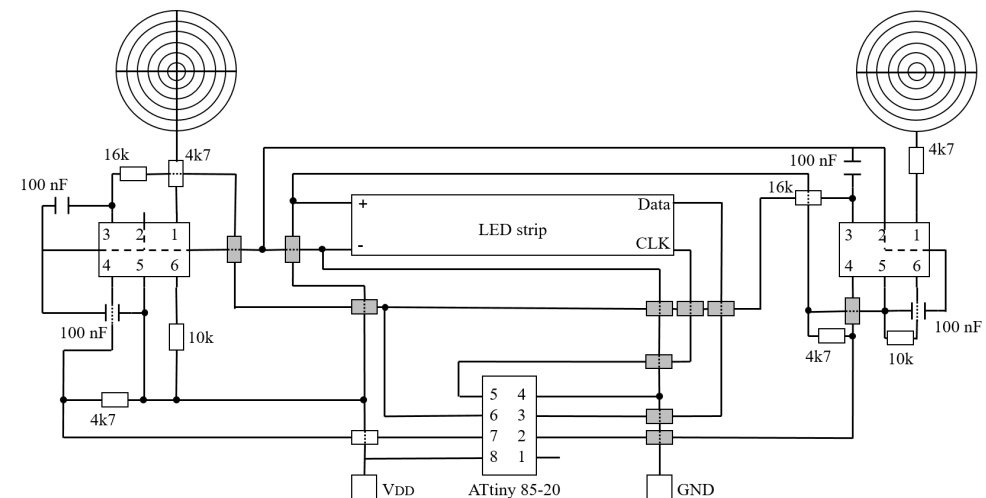
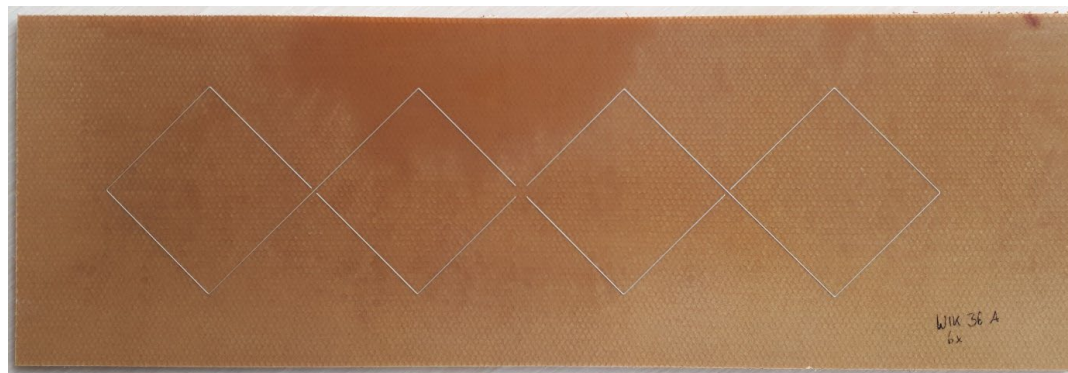
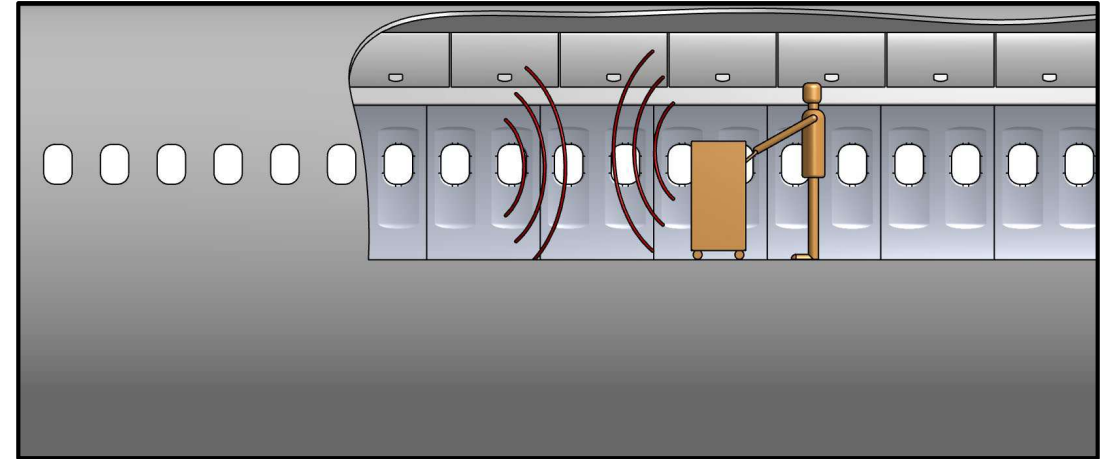
ProMil: Assembly and Maintenance Support through Function Integration

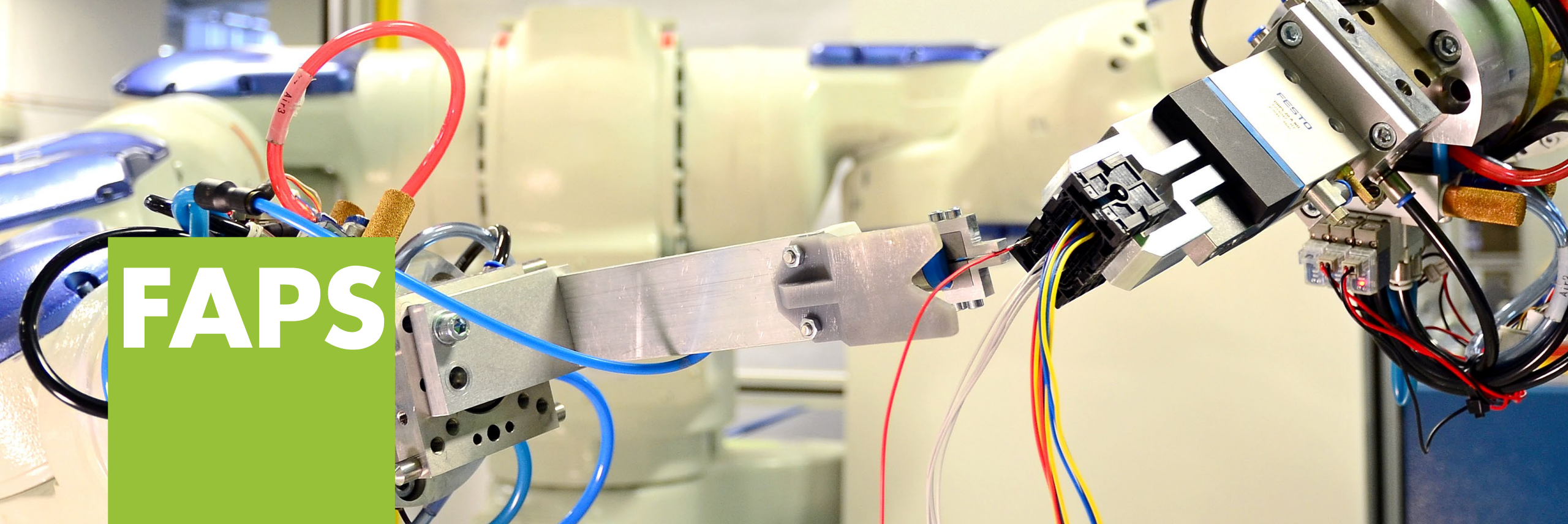
Aim:

- Tracking of assembly progress
- Detection of lining displacement
- Contactless data gathering through RFID

Solution:

- Printed distance sensors
- Printed RFID antenna
- Microcontroller and energy harvesting module





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THANK YOU