Flexible and Autonomous Manufacturing Systems for Custom-Designed Products

EU-Brasil Cooperation Workshop

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Agenda

• Goals, Vision and Mission

• The FASTEN Framework

• The Consortium

• Embraer Pilot - Adaptive Pick & Place Robot for Logistics

• ThyssenKrupp Pilot - Smart Robotic Additive Manufacturing Unit

• Embraer Pilot - Wing Assembly Line Enhanced Decision and Management

• ThyssenKrupp Pilot – Network of Smart Robotic Additive Manufacturing Units

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Goals, Vision and Mission

- Make use of the rich potential of the Internet of Things (IoT) in real-world scenarios, by demonstrating technologies and tools developed so far

  **Key enabler** of the full adoption of IoT technologies in digital manufacturing businesses, engaging end-users, and demonstrating such technologies on **both sides of the Atlantic**

  Develop, demonstrate, validate, and disseminate an integrated and modular framework for efficiently producing highly customized products

- Target IoT use cases enabling the production of customised outputs, combining the low unit costs of mass production processes with the flexibility of individual customisation

The FASTEN Framework

- **Basis for supporting Smart Manufacturing** by enabling
  - lot size one manufacturing
  - decision-making for real time actions
  - integration of robotic and additive manufacturing technologies
  - higher levels of connectivity (e.g. FIWARE, OPC-UA)
  - advanced integrated control and online planning
  - real time simulation and optimization, combining machine-learning with simulation-optimization approaches

- Follows the relevant **standards** (RAMI 4.0, IEC 62890 life cycle value stream, ISA-95, ISA-88, OPC-UA, ROS)
The FASTEN Framework

Flexible and scalable robotic and additive manufacturing system
- Intelligent handling of custom objects
- Navigation in dynamic environments
- Integration of additive and robotic technologies
- Fast and efficient reconfiguration

Industrial Analytics Suite

- Open Industrial IoT Platform for custom-designed products
- Predictive and Prescriptive Analytic Tool
- Holistic Simulator-Optimizer Tool
- Real-time Monitoring and Performance Management Tool

- Full connectivity among hardware and software components
- Open source digitization technologies
- RAMI 4.0 compliant reference architecture
- Real-time data visualization in dashboard
- Solid understanding of the system’s behaviour and its sensitivity to different parameters
- Optimizes manufacturing system design
- Better insights on near-future plan

The Consortium

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Embraer pilot - Adaptive Pick & Place Robot for Logistics

Adaptive Pick & Place Robot for Logistics

**Increase efficiency** in **manual manufacturing operations** that require high adaptability and flexibility with an **IoT** based platform to monitor and coordinate a collaborative robot to perform **pick and place activities**

- Automate the Kit Assembling activity
- Use a Pick & Place Collaborative Robot
- Parts are recognized and handled without the need to program each one individually
- Transport the kit to the Assembly Line

80% of warehouse are small parts, different sizes, forms, weight, light reflexion, consistency, ...

... and new parts coming in!

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Embraer pilot - Adaptive Pick & Place Robot for Logistics

ThyssenKrupp pilot - Smart Robotic Additive Manufacturing Unit

First Objective: to develop Smart Robotic Additive Manufacturing Unit - Around 70% of elevators in services portfolio are outdated or they are produced by other manufacturers, which demands one-of-a-kind spare parts.

Develop a Smart Robotic Additive Manufacturing Unit composed of 3D printers and a Mobile Manipulator Robot, aiming to provide flexibility, scalability and agility to cope with spare parts demand.
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ThyssenKrupp pilot - Smart Robotic Additive Manufacturing Unit

3D Printer & Mobile Manipulator

Advanced Plant Model

Iot Dashboard

Printed parts

Embraer Pilot - Wing Assembly Line Enhanced Decision and Management

Wing Assembly Line Simulation & Optimisation

Enhance assembly line productivity by improving adaptability and flexibility in decision-making for disruption management and production of new products. Enable the use of holistic optimization and simulation tools to create dashboards with event monitoring and analysis to support the decision-making.

- Build a Digital Model of the Wing Assembly Line
- Assess the optimal layout for the Line through simulation and optimization models.
- Assess the adaptability of the Line to new products, derivatives, new mixes of product and new demands
- Select best date for performing a maintenance intervention (drilling robot)

Wing Assembly Line:

- semi-automated complex process composed by Drilling Robots and operators
- different products under different tasks, different sequences and time intervals
- susceptible to wastes, such as downtime caused by unpredicted resources failures; parts and operators unavailability; escapes in quality of product

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ThyssenKrupp pilot – Network of Smart Robotic Additive Manufacturing Units

Looking for a Smart Robotic Additive Manufacturing Unit Available over Brazilian cities in order to mitigate lead-times and costs.

TSK supply chain manager uses a computer or smartphones to access the IIOT FASTEN platform and perform the network configuration.

The optimization model developed runs itself in order to decide the best Smart Robotic Additive Manufacturing Unit available.
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Thank you Questions?

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