

Flexible and
Autonomous
Manufacturing Systems
for Custom-Designed
Products



EU-Brasil Cooperation Workshop

César Toscano – European Coordinator
Mauro Rosa – Brazilian Coordinator

Brussels, 25 November, 2019

This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



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

This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



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
- 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



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

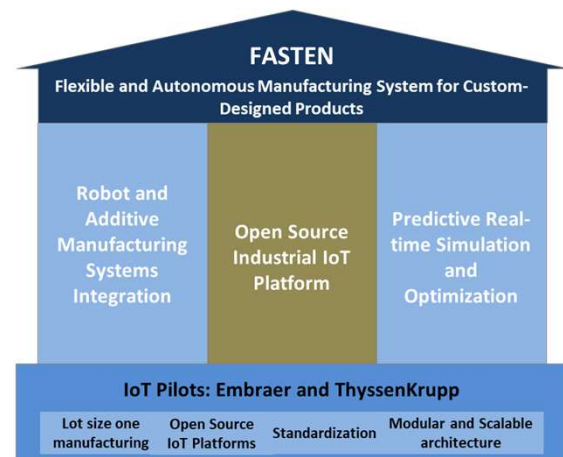
This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



3

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)



This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



4

The FASTEN Framework



Industrial Analytics Suite



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



Open Industrial IoT
Platform for custom-
designed products

full connectivity among
hardware and software
components

open source digitization
technologies

RAMI 4.0 compliant
reference architecture



Predictive and
Prescriptive Analytic
Tool

predict manufacturing
asset failures and
useful life time

off-the-shelf data
mining approaches



Holistic Simulator-
Optimizer Tool

solid understanding of the
system's behaviour and its
sensitivity to different
parameters

optimizes manufacturing
system design

better insights on near-
future plan



Real-time Monitoring
and Performance
Management Tool

real-time assessment
of KPIs

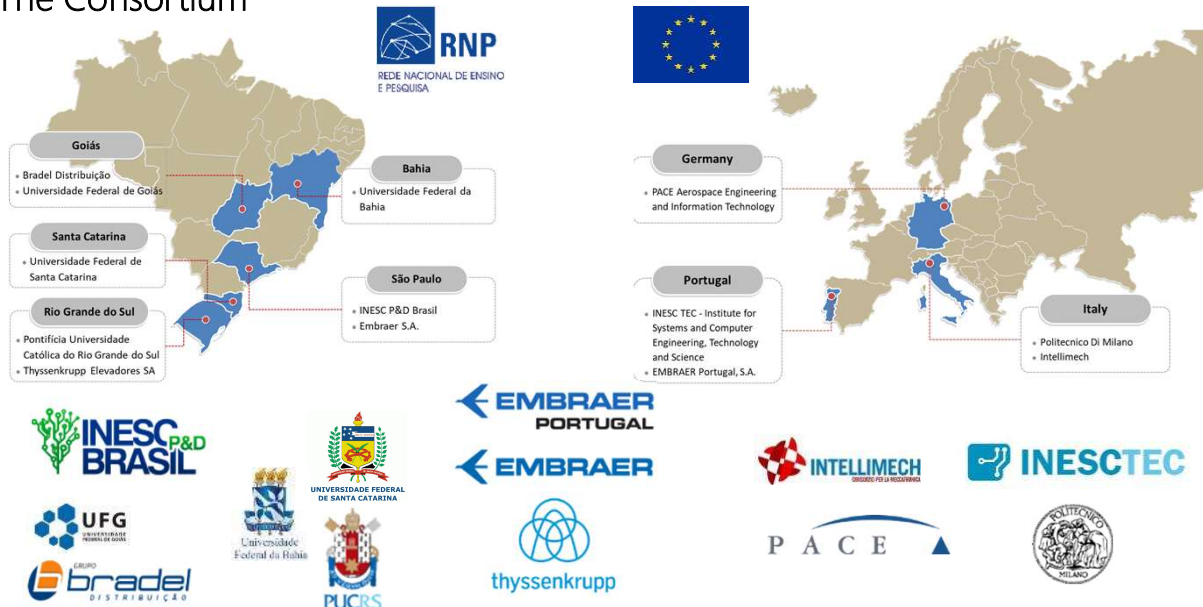
real-time data
visualization in
dashboard

This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



5

The Consortium



This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



6

Embraer pilot - Adaptive Pick & Place Robot for Logistics

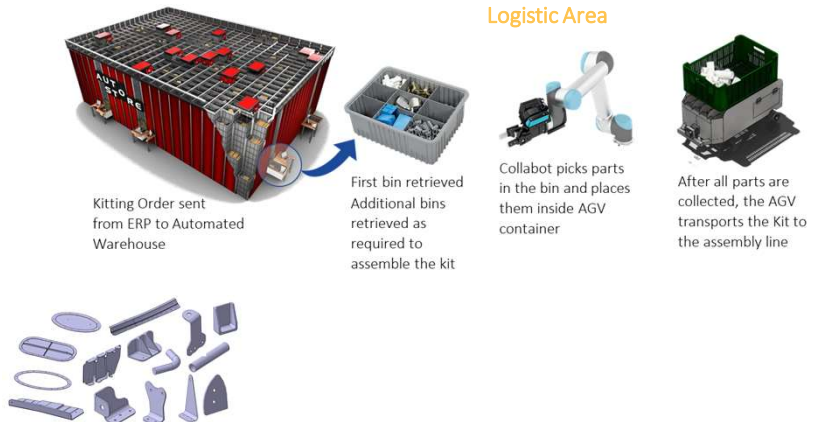
Adaptive Pick & Place Robot for Logistics

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!



This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



7

Embraer pilot - Adaptive Pick & Place Robot for Logistics

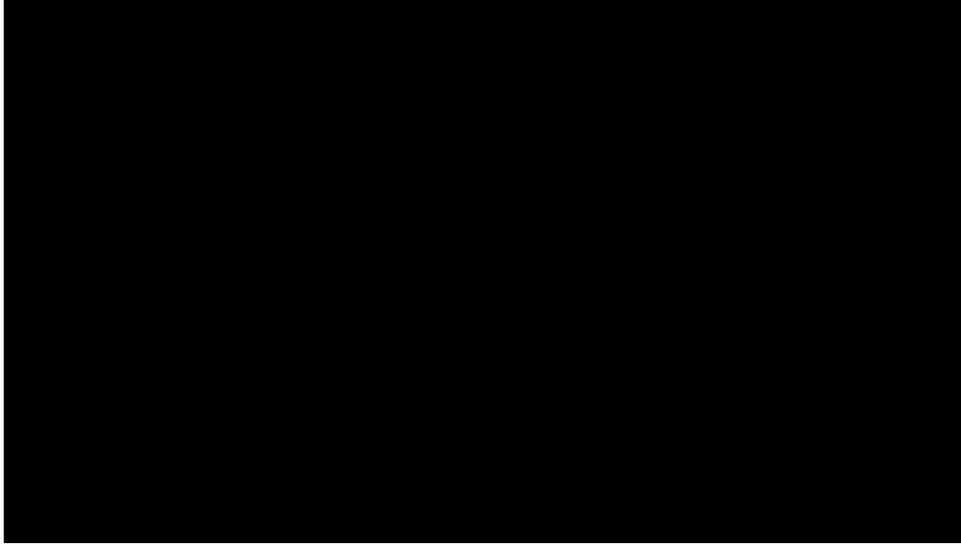


This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



8

Embraer pilot - Adaptive Pick & Place Robot for Logistics



This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



FASTEN

9

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**



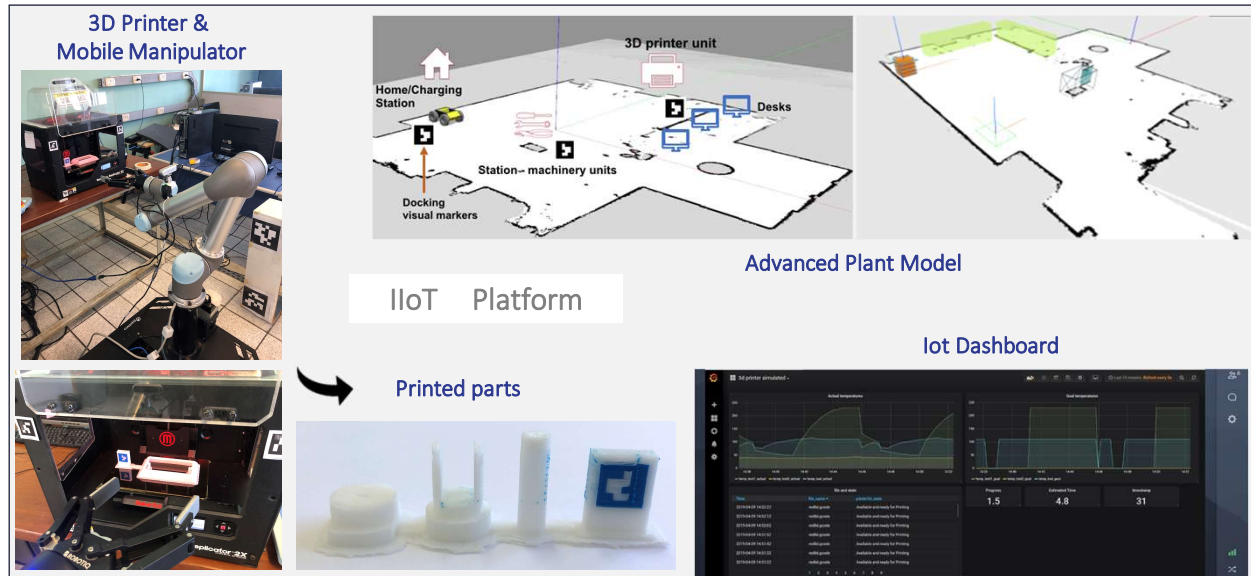
This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



FASTEN

11

ThyssenKrupp pilot - Smart Robotic Additive Manufacturing Unit



This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



12

Embraer Pilot - Wing Assembly Line Enhanced Decision and Management

Wing Assembly Line Simulation & Optimisation

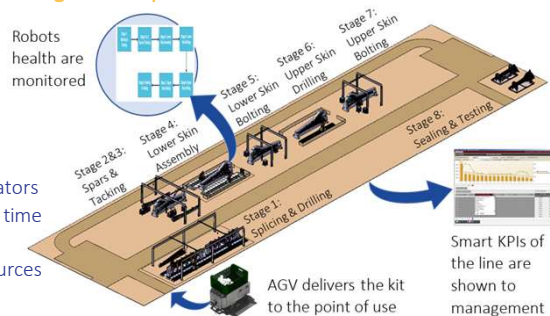
Enhance assembly line productivity by improving adaptability and flexibility in decision-making for disruption management and production of new products.
Enable the use of holistic optimization and simulation tools to create dashboards with event monitoring and analysis to support the decision-making.

- 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

Wing Assembly Line



This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



13

Embraer Pilot - Wing Assembly Line Enhanced Decision and Management



This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



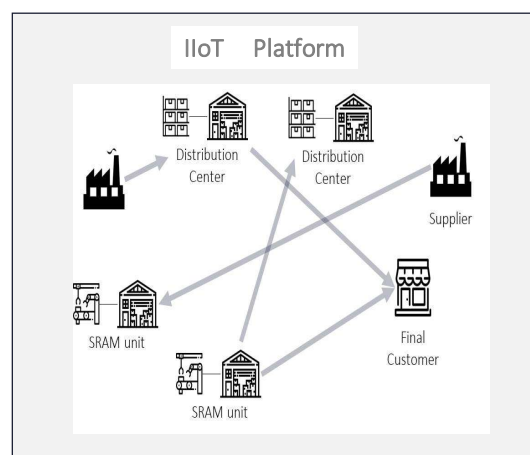
16

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.



This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



17

ThyssenKrupp Pilot – Network of Smart Robotic Additive Manufacturing Units



This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



18

Flexible and
Autonomous
Manufacturing Systems
for Custom-Designed
Products



FASTEN



Thank you
Questions?

www.fastenmanufacturing.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme and from Brazilian Ministry of Science, Technology and Innovation through Rede Nacional de Pesquisa under the Grant Agreement 777096.



FASTEN