IEEE ETFA 2018
2018 IEEE 23rd International Conference on Emerging Technologies and Factory Automation
September 4th - 7th, 2018, Torino, Italy

LEAN AUTOMATION

ROBO-PARTNER

THOMAS

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IoT and Industrial Robotics for human operator support: case studies and challenges

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Introduction

Human sensitivity required by operation

+

Flexible materials with unpredictable behavior

+

Multiple operators – Cooperative assembly

→

Human Operators are preferred

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Precision

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Repeatability

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Cycle Time

→ Robots are preferred

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Cycle Time

→ Robots are preferred

Challenge:

*"Integrating new forms of interaction between robots and workers - make the most out of the **synergy effect**"*

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Introduction

Collaborative Robots

DLR® lightweight

KUKA LBR iiwa ®

Baxter ® Rethink Robotics

ABB Yumi ®

UR5/UR10®

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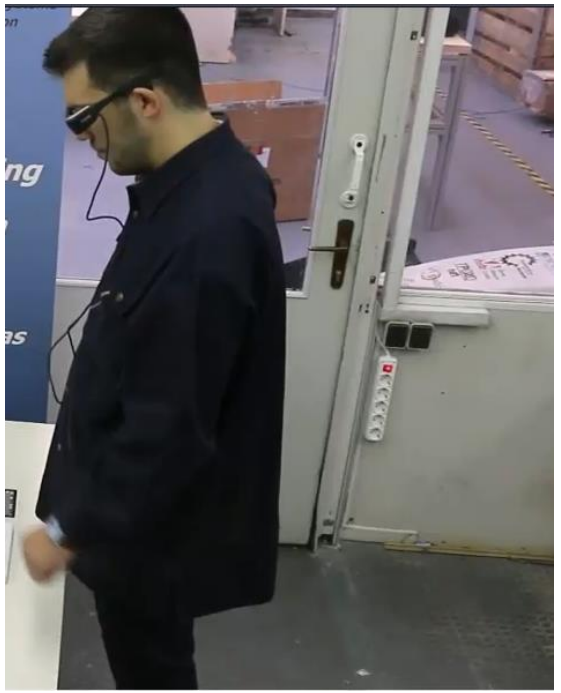
Industrial Robots

- High Payloads
- Majority of installed systems
- Not suitable for collaboration

Challenge



Closing the loop between humans and industrial robots

1. Safe cooperation
2. Coordination of tasks
3. Operator awareness

LIAA EU Project

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Fraunhofer IPA

DANISH TECHNOLOGICAL INSTITUTE

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LMS Laboratory for Manufacturing Systems & Automation University of Patras

OPEL

UNIVERSAL ROBOTS

eon reality

VISUAL COMPONENTS

InSystems automation

LP Montagetechnik GmbH

penny

dresden elektronik

Fischer

SPINEA

TELNET Redes Inteligentes

http://www.project-leanautomation.eu

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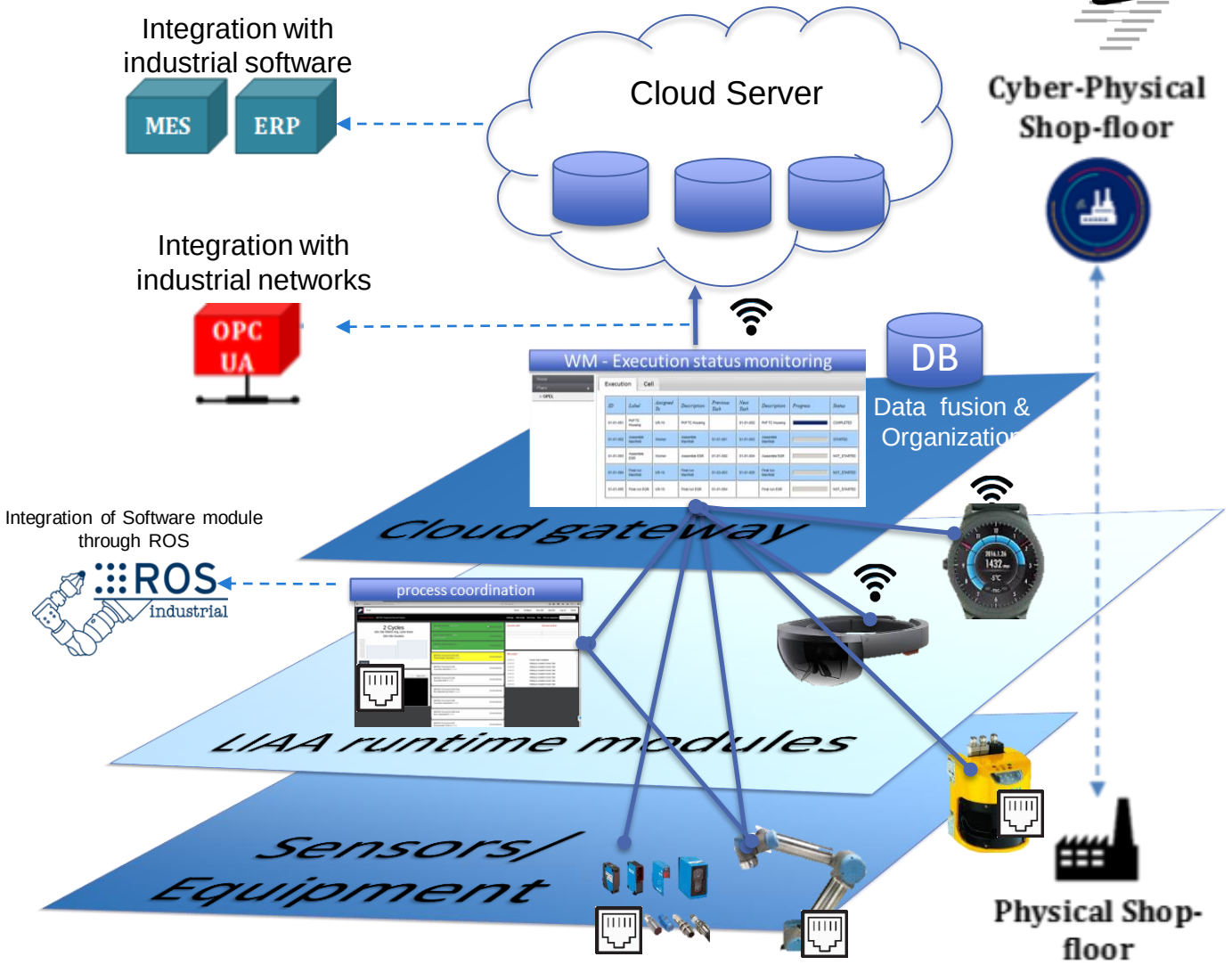
LIAA IoT application approach

- ✓ Cloud server for meaning full information storage
- ✓ data visualization
- ✓ Decision making

- ✓ Data collection
- ✓ Data fusion

- ✓ Process coordination
- ✓ High level and low level modules communication through ROS



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LIAA IoT application

World model

a. Data collection
b. Data fusion for cell and resources status
c. Safe exposure of production info to the cloud
d. Interface with MES, SCADA, ERP systems

LIAA runtime modules

1. LIAA framework
   a. Execution coordination
   b. Control robot
2. Augmented Reality Worker Instructions
   a. Teaching new processes
   b. Quality assurance
3. Human Position Perception
   a. Human activity recognition
   b. Sick S3000
4. Smart watch
   a. Wireless Execution Monitor and Control
   b. Mobile UI

Sensors/ Equipment

1. Re-configurable Active Fixturing
2. Multi-Purpose hybrid gripper

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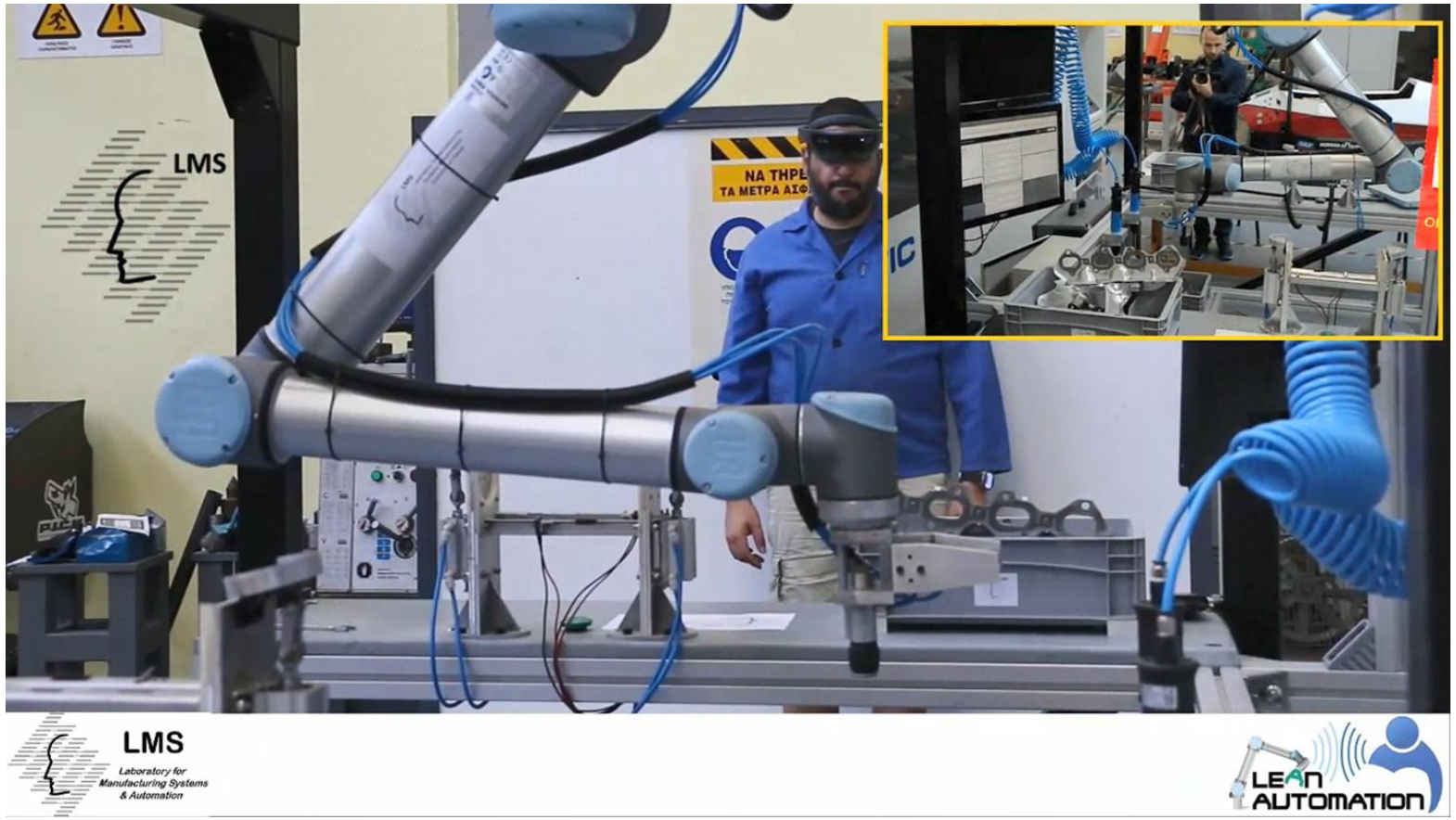
LIAA IoT Application



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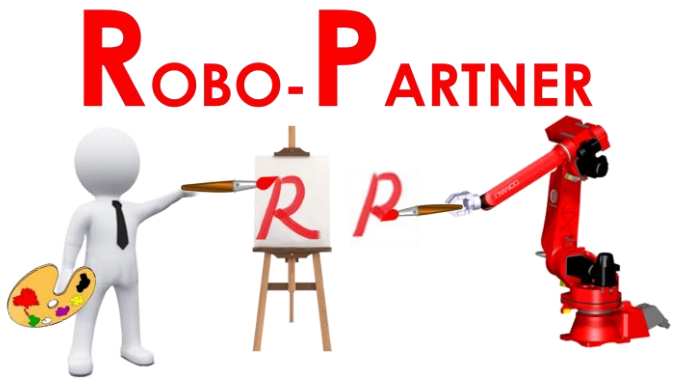

For more information:
http://www.robo-partner.eu

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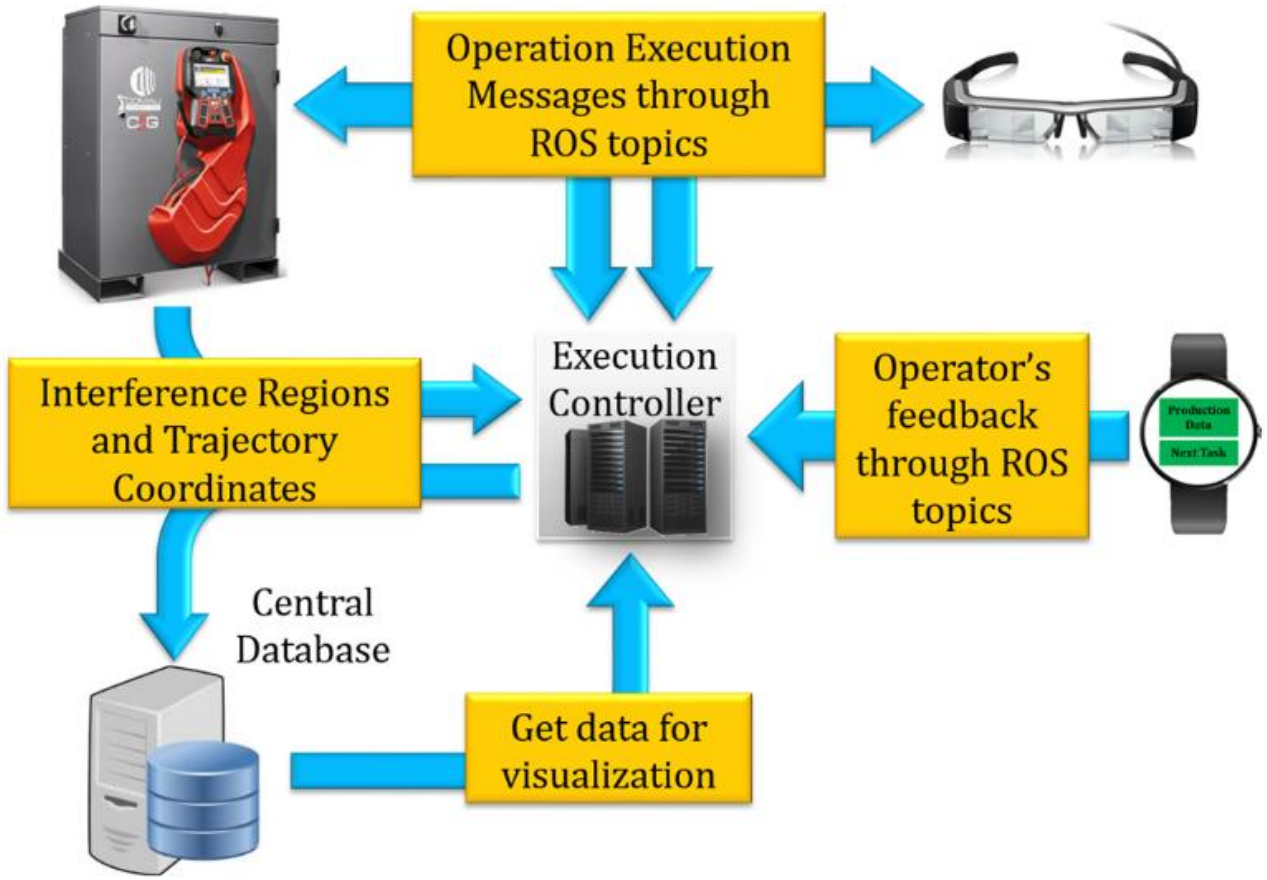
ROBO–PARTNER Architecture

Overview of the different systems and their connections

- **Usage of smartwatch** for operator's feedback to the execution system
- **Usage of AR glasses** for visualizing the necessary information to the operator
- **Usage of a central database** where all the data are stored
- **Execution controller** responsible for the message exchange and the data flow
- Information exchange through ROS topics and services – Usage of Rosbridge Server for the non-Ros applications (glasses, smartwatch)



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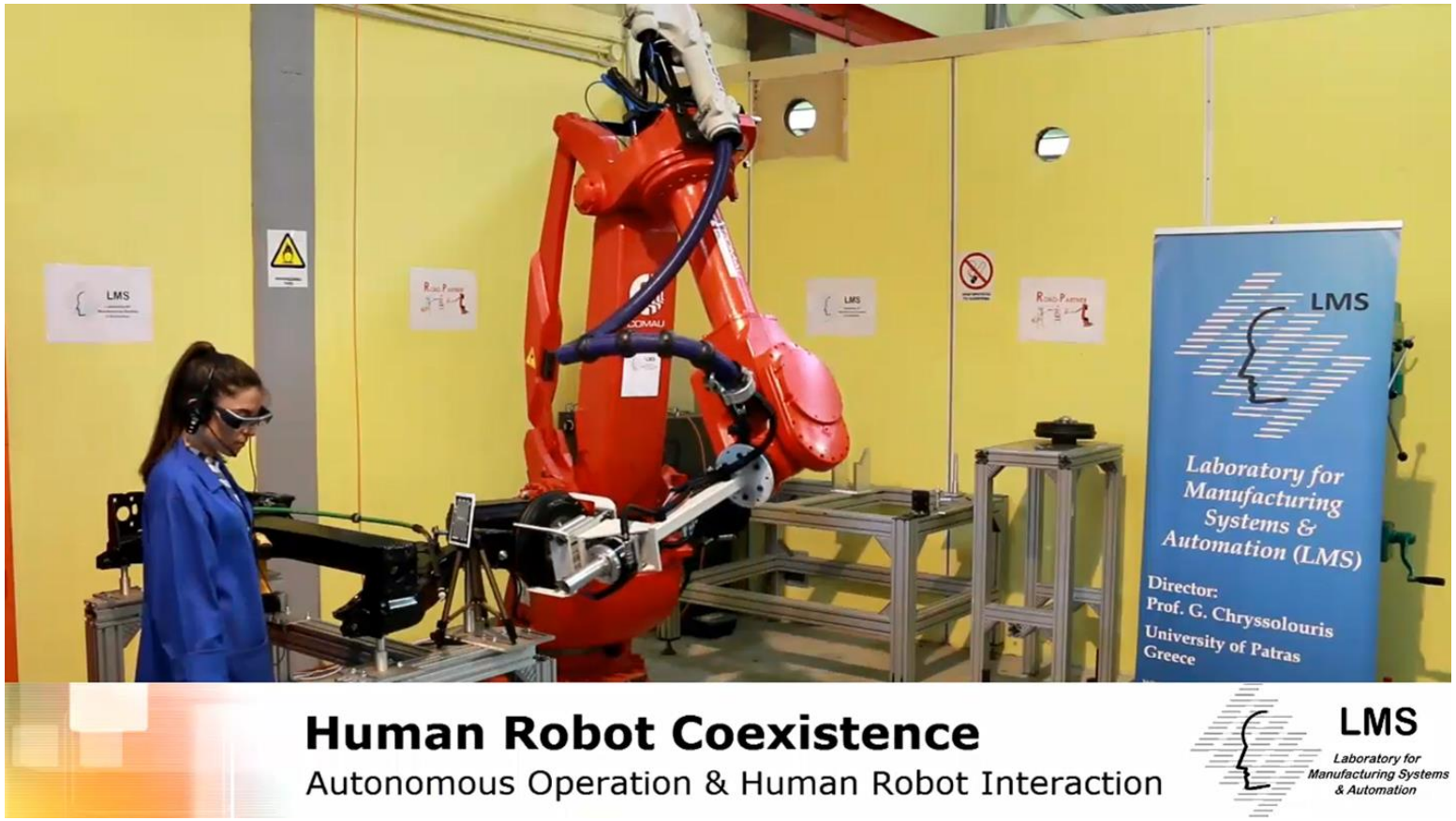
ROBO–PARTNER Application



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http://www.thomas-project.eu

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PSA GROUPE

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SICK
Sensor Intelligence.

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INTRASOFT INTERNATIONAL

roboception

DH ingeniería mantenimiento industrial

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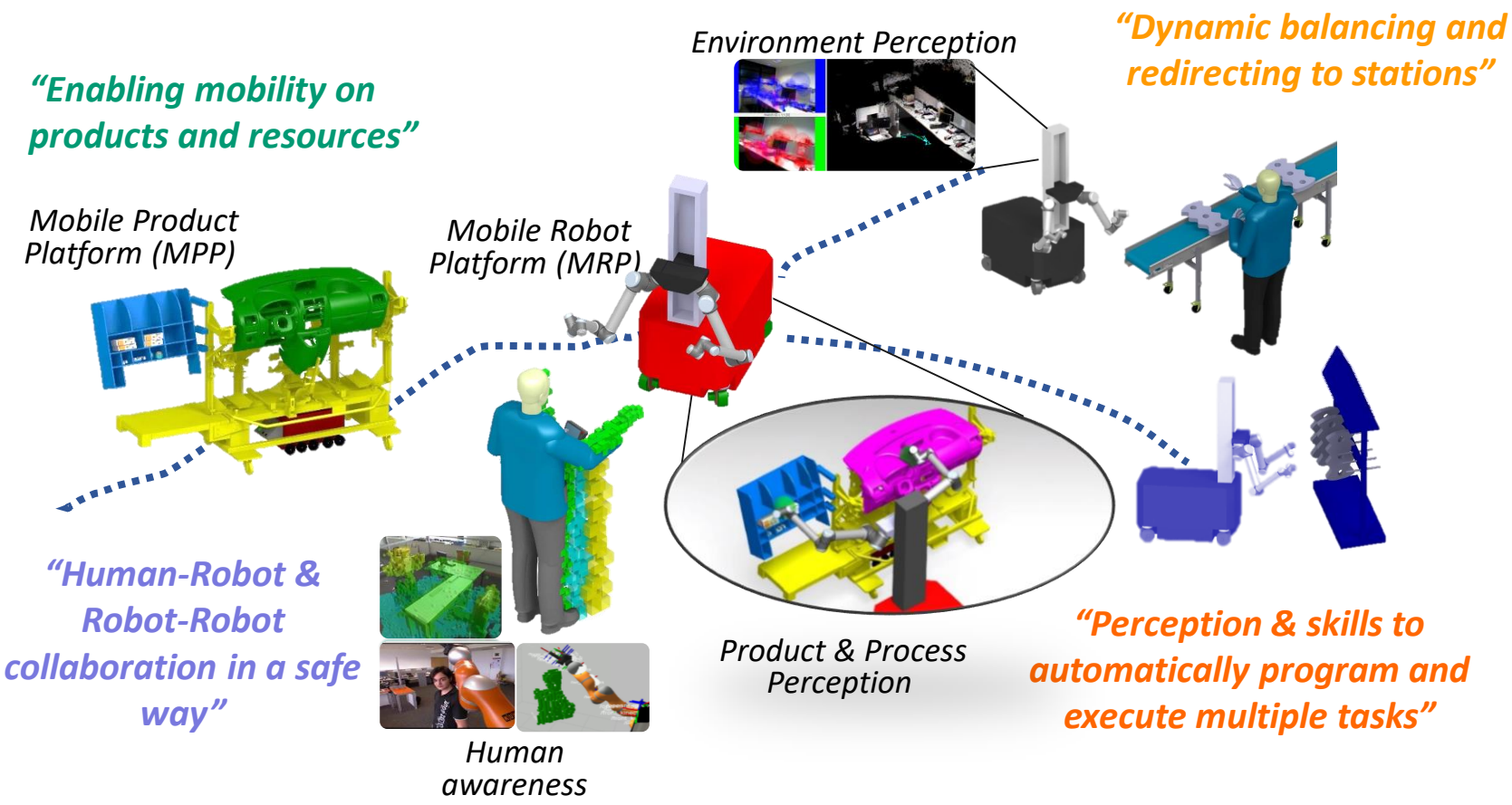
THOMAS Concept



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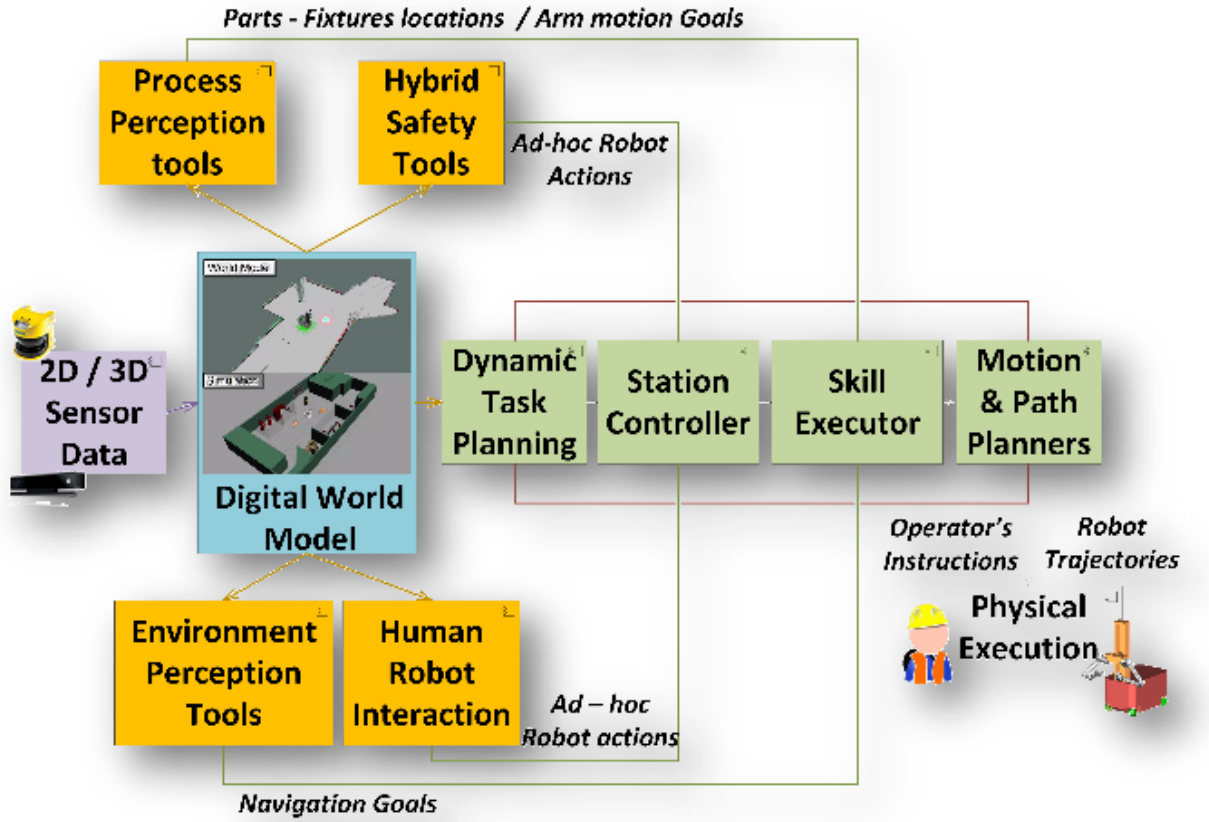
THOMAS Architecture

Overview of the different systems

- **Digital World Model** for multi sensor data acquisition, combination and representation
- **Hybrid safety** for closer human – mobile robot cooperation
- **Human Robot Interaction** through human behavior understanding
- **Enhance** environment and process **perception** combining 2D and 3D data inputs
- **Dynamic Task Planner** for on line work re-organization – task re assignment
- **Station Controller** responsible for the message exchange and the data flow



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This research has been partially supported by the research EU FP7 project "ROBO-PARTNER – Seamless Human-Robot Cooperation for Intelligent, Flexible and Safe Operations in the Assembly Factories of the Future" (Grant no. 608855) funded by the European Commission.

This research has been partially supported by the research EU FP7 project "LEAN AUTOMATION" (Grant no. 608604) funded by the European Commission.

This research has been partially supported by the research H2020 project "THOMAS – Mobile dual arm robotic workers with embedded cognition for hybrid and dynamically reconfigurable manufacturing systems" (Grant no. 723616) funded by the European Commission.

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Thank you for your kind attention!

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