IoT and Industrial Robotics: case studies and challenges

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Introduction

Human sensitivity required by operation

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Flexible materials with unpredictable behavior

+

Multiple operators – Cooperative assembly

→

Human Operators are preferred

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Multiple operators – Cooperative assembly

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Precision

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Repeatability

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Cycle Time

→ Robots are preferred

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Precision

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Repeatability

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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**"*

Introduction

Collaborative Robots

DLR® lightweight

KUKA LBR iiwa ®

Baxter ® Rethink Robotics

ABB Yumi ®

UR5/UR10®

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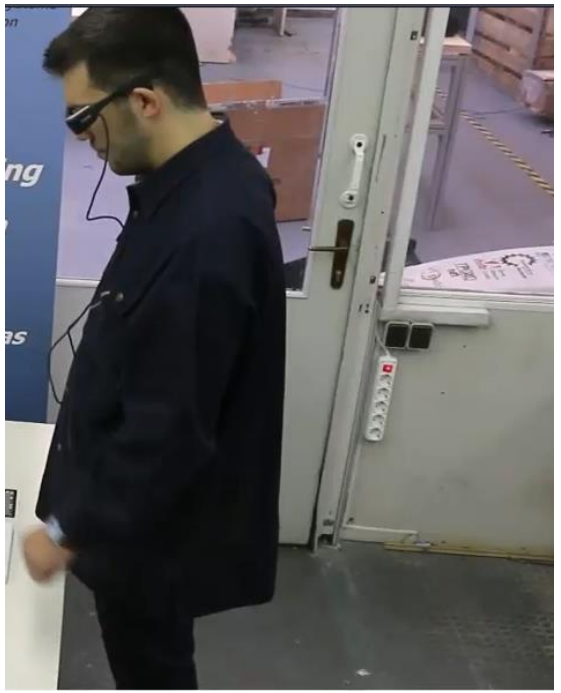
Industrial Robots

- 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 Project

Fraunhofer IPA

DANISH TECHNOLOGICAL INSTITUTE

tecnalia Inspiring Business

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

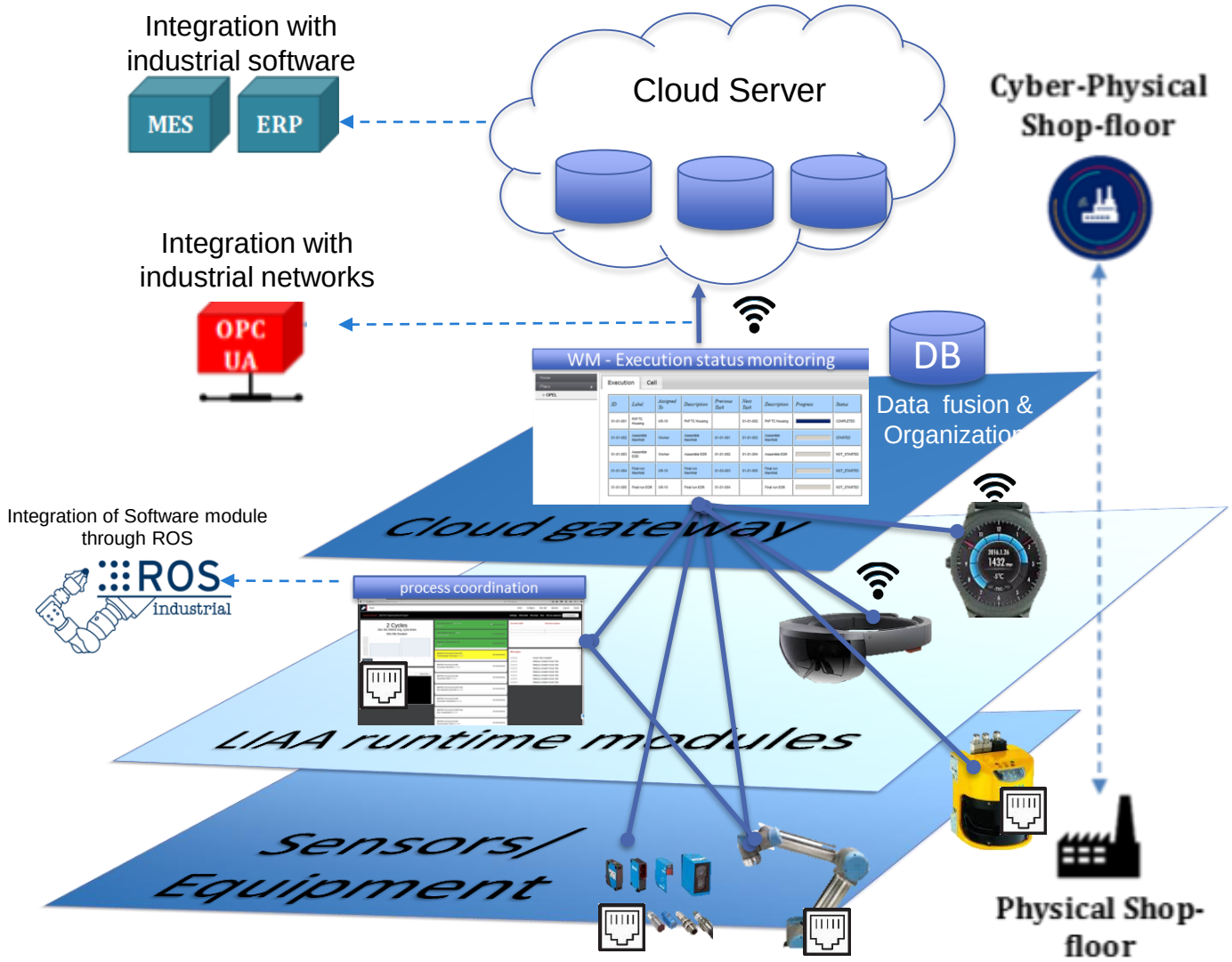
http://www.project-leanautomation.eu

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



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

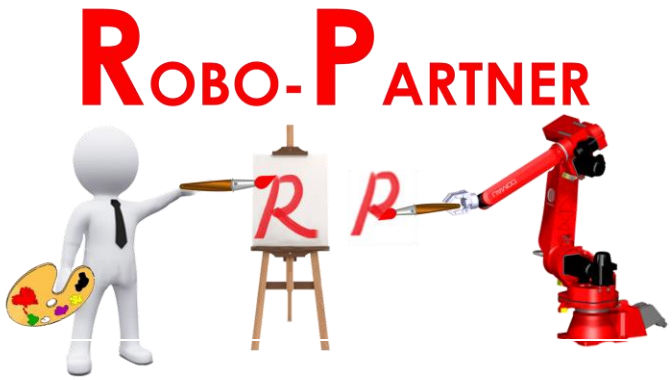
1. LIAA framework
   a. Execution coordination
   b. Control robot
2. Augmented Reality Worker Instructions
   a. Teaching new processes
   b. Quality assurance
3. Human Position Perception
   a. Human activity recognition
   b. Sick S3000
4. Smart watch
   a. Wireless Execution Monitor and Control
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

Sensors/ Equipment

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

LIAA – IoT application

ROBO–PARTNER



http://www.robo-partner.eu

TOFAŞ TÜRK OTOMOBİL FABRİKASI A.Ş.

LMS Laboratory for Manufacturing Systems & Automation

COMAU ROBOTICS

Electrolux

pilz the spirit of safety

INTRASOFT INTERNATIONAL

CRF CENTRO RICERCHE FIAT

Fraunhofer

IK4 TEKNIKER Research Alliance

GIZELIS ROBOTICS

UNINOVA

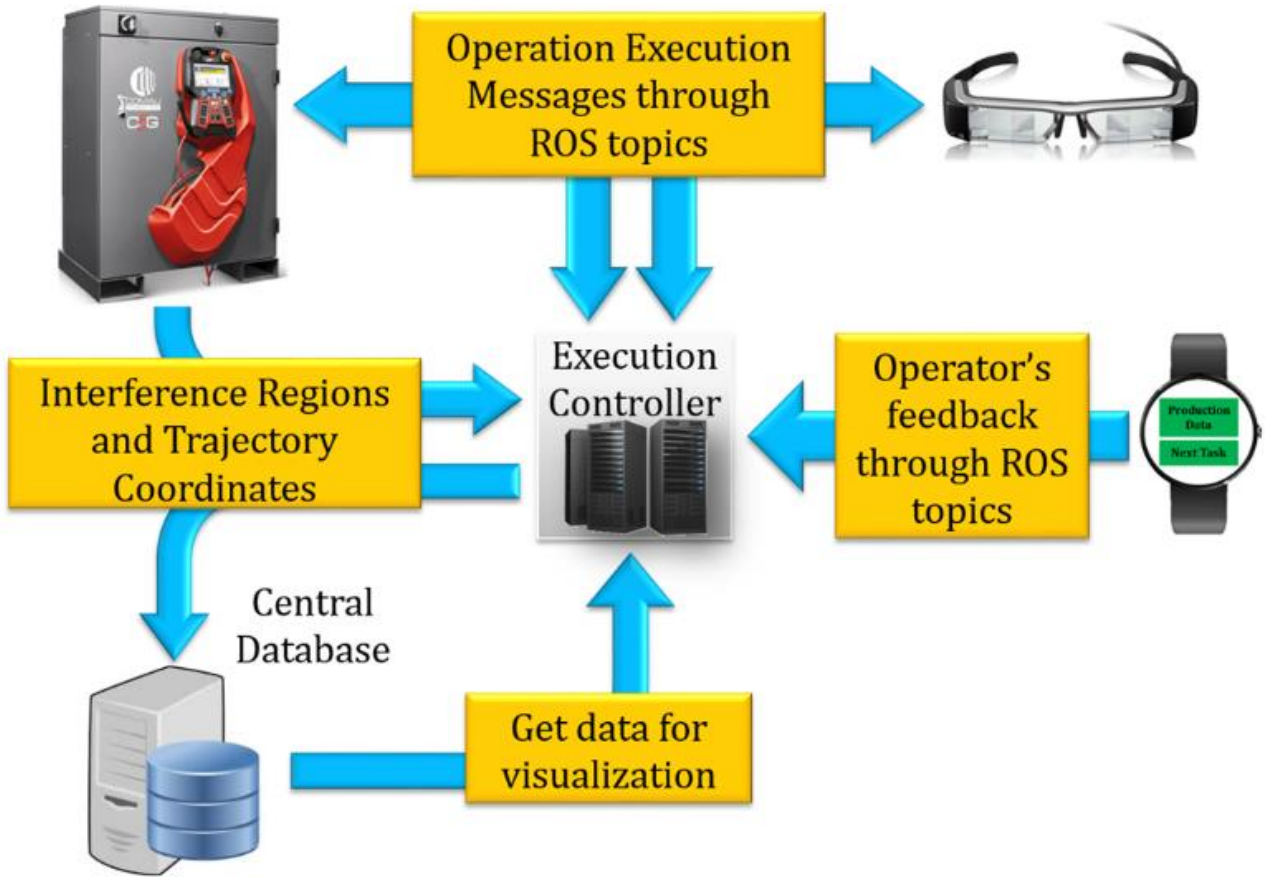
Jatorman

TRIMEK METROLOGICAL ENGINEERING

robosoft Advanced Robotics Solutions

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)



ROBO–PARTNER Application

Link to video

IoT and Robotics

- **Added value:**
  - Integrating humans in the manufacturing workflow
  - Ease of use/short learning curve through already existing/used IoT devices
  - Easier integration of heterogeneous devices/ sensors and control systems

- **Enablers:**
  - Cloud services that can be developed/ deployed locally
  - Middleware for brand agnostic applications (e.g. ROS)
  - Local information processing at low level contributing to higher level awareness (production cell/ system)

- **Platforms and systems:**
  - ROS/ ROS Industrial
  - IBM Watson
  - SAP

- **Obstacles:**
  - Real time/ Reliability requirements required by safety/ security requirements
  - Industrial devices coming from multiple vendors – difficulty to integrate seamlessly

Thank you for your kind attention!

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