IoT and Industrial Robotics: 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
Introduction

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- Flexible materials with unpredictable behavior
- Multiple operators – Cooperative assembly
- Precision
- Repeatability
- Cycle Time

Robots are preferred
Human Operators are preferred

Flexible materials with unpredictable behavior

Multiple operators – Cooperative assembly

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®
Introduction

Collaborative Robots

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Industrial Robots

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

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

Closing the loop between humans and industrial robots
LIAA – IoT application approach

✓ Cloud server for meaningful 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

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

LIAA runtime modules

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

World model

Sensors/Equipment

1. Data collection
2. Data fusion for cell and resources status
3. Safe exposure of production info to the cloud
4. Interface with MES, SCADA, ERP systems
LIAA – IoT application
ROBO–PARTNER

http://www.robo-partner.eu
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)
Human Robot Interaction
Manual guidance for part positioning
• **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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