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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Robots are preferred

- Precision
- Repeatability
- Cycle Time
Human Operators are preferred

Human sensitivity required by operation

Flexible materials with unpredictable behavior

Multiple operators – Cooperative assembly

Precision

Repeatability

Cycle Time

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

DLR® lightweight
KUKA LBR iiwa®
Baxter® Rethink Robotics
ABB Yumi®
UR5/UR10®

Industrial Robots

• High Payloads
• Majority of installed systems
• Not suitable for collaboration
IOT AND INDUSTRIAL ROBOTICS FOR HUMAN OPERATOR SUPPORT: CASE STUDIES AND CHALLENGES

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

Closing the loop between humans and industrial robots
IOT AND INDUSTRIAL ROBOTICS FOR HUMAN OPERATOR SUPPORT: CASE STUDIES AND CHALLENGES

LIAA EU Project

http://www.project-leanautomation.eu
LIAA IoT application approach

- Cloud server for meaningful information storage
- Data visualization
- Decision making
- Data collection
- Data fusion
- Process coordination
- High level and low level modules communication through ROS
IOT AND INDUSTRIAL ROBOTICS FOR HUMAN OPERATOR SUPPORT: CASE STUDIES AND CHALLENGES

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

World model

LIAA runtime modules

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

Sensors/Equipment
LIAA IoT Application

Link to YouTube video
ROBO–PARTNER EU Project

For more information: http://www.robo-partner.eu
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)
ROBO–PARTNER Application

Human Robot Coexistence
Autonomous Operation & Human Robot Interaction

Link to YouTube video
THOMAS Concept

“Enabling mobility on products and resources”

Mobile Product Platform (MPP)

“Human-Robot & Robot-Robot collaboration in a safe way”

Mobile Robot Platform (MRP)

Environment Perception

“Dynamic balancing and redirecting to stations”

Product & Process Perception

“Perception & skills to automatically program and execute multiple tasks”

Human awareness
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

[Link to YouTube video]
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