



Dual-arm robots for skilled manufacturing operations

13/3/2014

ERF 2014, Rovereto

Dr. Sotiris Makris, LMS

Laboratory for Manufacturing Systems and Automation

Director: Professor G. Chryssolouris

University of Patras

Speakers

- **Sotiris Makris**, LMS-University of Patras, Robots, Automation and Virtual Reality in Manufacturing
- **Gian Paolo Gerio**, COMAU, Performance Engineering
- **Dragoljub Surdilovic**, Fraunhofer IPK, Control systems engineering
- **Panagiota Tsarouchi**, LMS-University of Patras, Robots, Automation and Virtual Reality in Manufacturing
- **Iñaki Murtua**, TEKNIKER, Robotics Division
- **Valerie Auffray**, TECNALIA, Directora Tecnalia France
- **Klas Nilsson**, Lund University – LTH



Introduction, X-act project overview

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X-act project

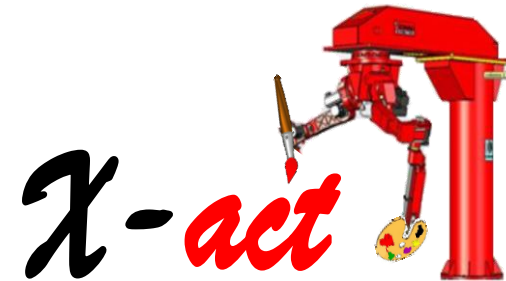
Grant Agreement No: 314355

START: October 2012

DURATION: 36 months

INVESTMENT: 4.9 Million Euro
(65% EU support)

Research has received funding
from the European Union's 7th
Framework Programme
(FP7/2007-2013) under grant
agreement n° 314355



LMS

Project
Manager



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Research Alliance



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 **Fraunhofer**
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X-act Objectives

X-act proposes the enhancement of **Dual arm robots** for cooperative use with **human operators**, by means of:

- **Dual arm robots enhancement modules** involving sensors, visual servoing and flexible tools to enable dexterous operation
- **Motion planning algorithms** for synchronizing the motion of the dual arms combined - execution of bimanual operations
- **Dual arm robot instructions libraries** to simplify programming, robot program to be incrementally and automatically created
- **Simulation modules** to realistically simulate the dual arm robot
- **Sensor guided programming** involving voice recognition, visual programming, force sensing
- **Highly intuitive interfaces for human-robot cooperation** during operation with control algorithms to regulate manipulation of parts
- **Fenceless human robot supervision system** adjust speed of the robots upon detection of humans automatically re-plan robot trajectory

X-act Objectives

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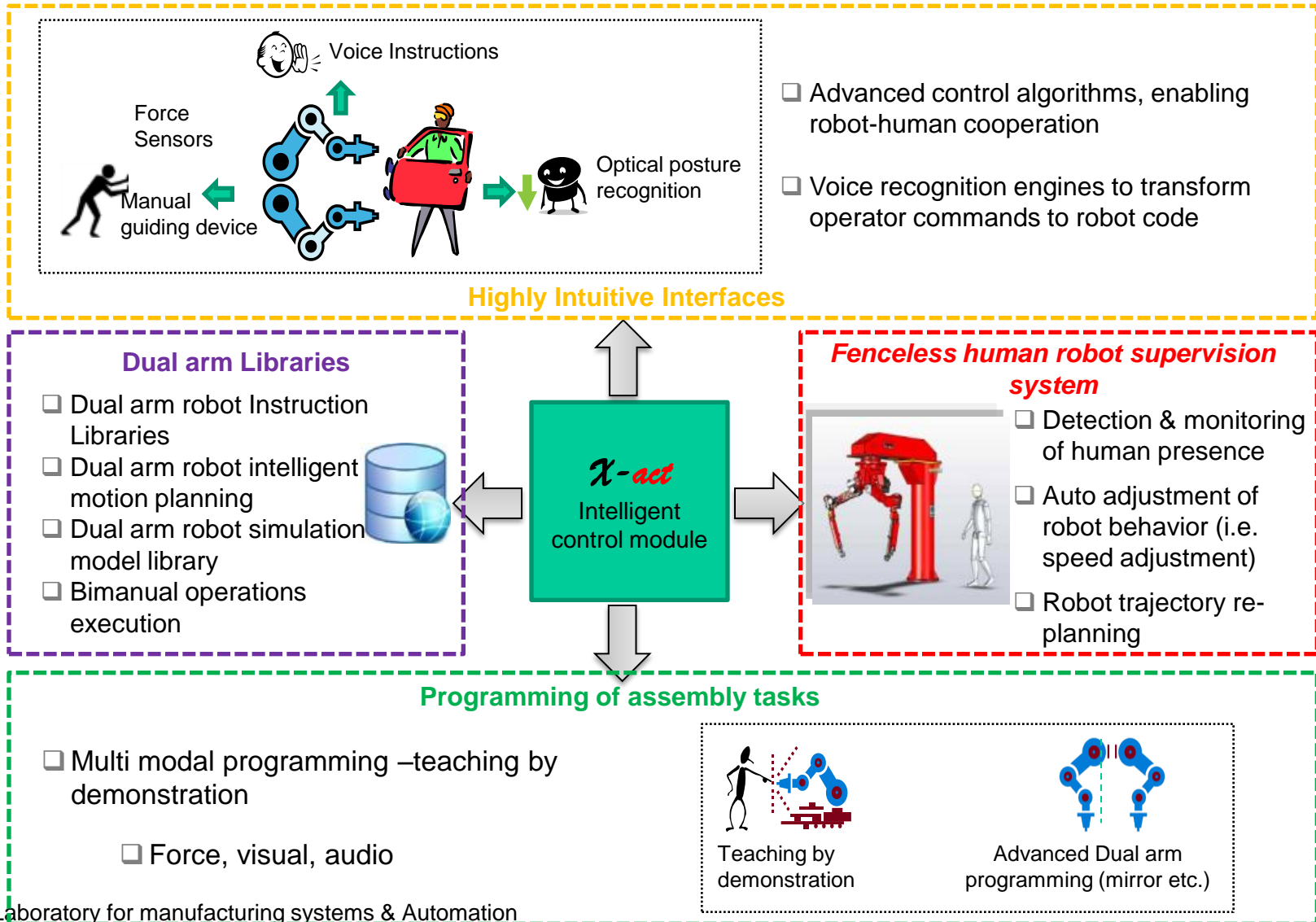
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Driven by the end users needs

Industrial pilot cases demonstration and system validation



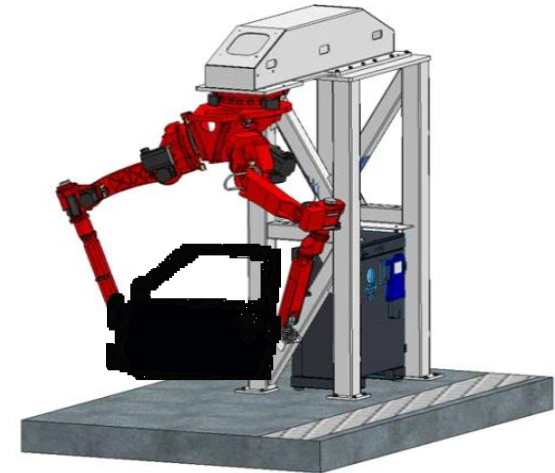
X-act Architecture



Dual Arm Robot Enhancement

Objectives

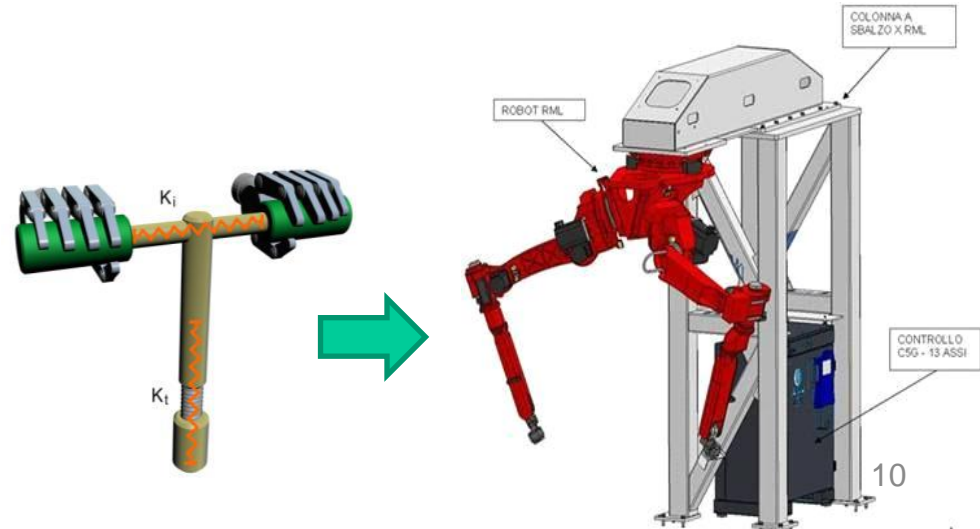
- ✓ Analysis of use cases – required functionality
- ✓ **Design of sensorial systems** and other hardware enhancements for the **dual arm robots**
- ✓ **Prototype** development of the selected enhancements
- ✓ **Installation** of the enhancement on the robot and **integration** with existing programming and control infrastructure



Dexterous Advanced Robot Programming

Objectives

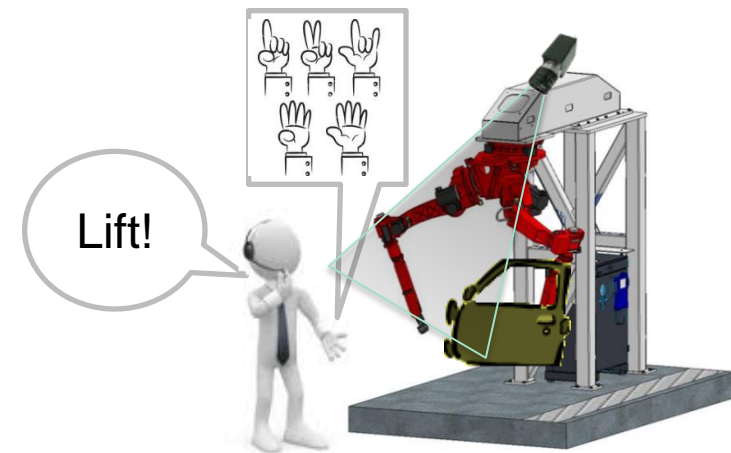
- ✓ Dual arm **robot instructions library**
- ✓ **Bi-manual** robot programming
- ✓ **Free space motion** dual arm-robot programming
- ✓ Dual arm **robot simulation modules**



Cognitive Human robot cooperation and safety

Objectives

- ✓ Development and implementation of **fenceless safety measures** to facilitate **human-robot collaboration**
- ✓ **X-act** intuitive interfaces for **human - robot cooperation**
- ✓ **X-act** **Fenceless** human robot **supervision system**
- ✓ **X-act** sensor guided programming



Industrial pilot cases demonstration and system validation

Objectives

- ✓ Demonstrate **X-act** developments
- Pilot cases
 - ✓ **Automotive** assembly
 - ✓ **Rework** of electrical appliances



Expected benefits of using the Dual-arm

- **Increase dexterity of robotic applications:**
 - Minimize the need for single grippers and jigs
 - Simplify tooling, 2 arms enable to use simpler grippers
- **Increased flexibility of manufacturing and assembly processes** by the enablement of robot to robot and human robot cooperation
- **Facilitate programming** thanks to the intuitive and sensor assisted programming interfaces
- Reduced floor space compared to using two single arms
- Higher workspace compared to two single arms

Project information

-Project website

<http://www.xact-project.eu>

- X-act Vision**
- Increase dexterity of robotic applications
 - Increased reconfigurability of manufacturing and assembly processes
 - Reduction of programming efforts for robot programming
 - Increased reliability/availability of the production system
 - Increased equipment reutilization



Find us:
<http://www.xact-project.eu/>

Contact us
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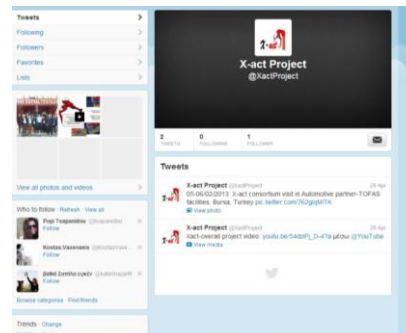
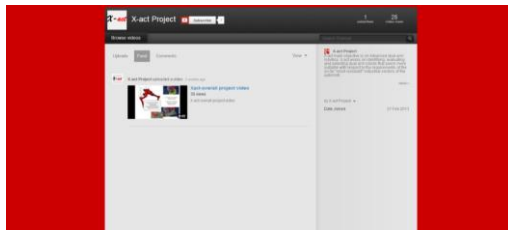
Expert cooperative robots for highly skilled operations for the factory of the future



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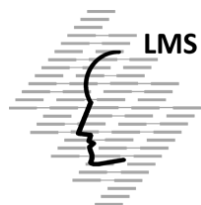


Following speakers

- Gian Paolo Gerio (COMAU Robotics): Dual arm robots - open control
- Dragoljub Surdilovic (Fraunhofer IPK): Dual arm robots programming
- Panagiota Tsarouchi (LMS-University of Patras): Dual arm robot for assembly tasks
- Iñaki Maurtua (TEKNIKER): Dual arm robots for disassembly
- Valerie Auffray (TECNALIA): Mobile dual arm application in aerospace
- Klas Nilsson (LTH - Lund University): Skilled dual arm robot tasks



Thank you



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