



EUROPEAN ROBOTICS FORUM, 22/03/2017

Teaching by Demonstration for Industrial Applications

Introduction

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Organizers:

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Teaching by Demonstration for Industrial Applications

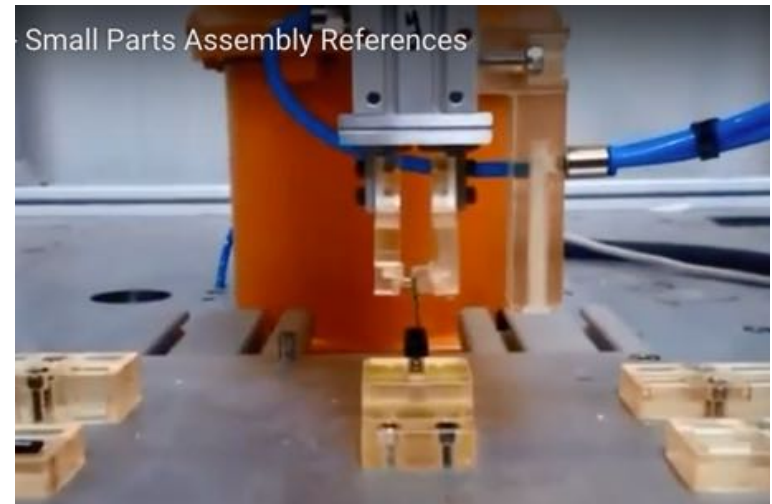
- ❖ How to design solutions to reduce required time and experience/skill of programmer

Challenges:

- complex materials,
- precise grasping requirements,
- part variations,
- operations requiring high precision (snap fits),
- operations requiring special motions (twist insertions),
- wear and tear of the assembly equipment...

➤ Learning from Demonstration:

- Equipping robots with skills to autonomously achieve tasks, **without manually programming** a desired behavior.
- Deriving robot controllers from observing humans with the aim of **adapting to novel cases** with minimum expertise.
 - Recording and mapping from human motions, teleoperation, kinesthetic teaching



Teaching by Demonstration for Industrial Applications

Speakers

1. Yasemin Bekiroglu, ABB Corporate Research, Sweden
2. Jose Medina and Aude Billard, EPFL, Switzerland
3. Guilherme Maeda and Jan Peters, TU Darmstadt, Germany
4. Carl Henrik Ek, Bristol University, UK
5. Jacek Malec and Elin Anna Topp, Lund University, Sweden
6. Naresh Marturi, KUKA, UK,
7. Dimitrios Tzovaras, Information Technologies Institute, Greece
8. Daniel Braun, KUKA, Germany
9. Paolo Rocco, Politecnico di Milano, Italy
10. Zoe Doulgeri, Aristotle University, Greece
11. Joseph McIntyre, TecNALIA, Spain

Connecting researchers from different backgrounds such as perception, motor control, planning, control, learning, design ...

Teaching by Demonstration for Industrial Applications

Discussion topics

What are the core problems in this area? (identifying industrial priorities)

How do we deal with force demonstration, i.e., teaching forces

Can you really not teach something completely new?

How to model/obtain bad examples to teach, considering safety?

Visual Observation vs. pHRI: What's good and what's bad about each?

What is the right level of human involvement/role (supervisor, cooperative, active or passive agent)

Demands from Machine Learning in robotics, e.g. data size?

Sensor developments sufficient to convey information?

What research methods could usefully/rapidly be transferred to industry?

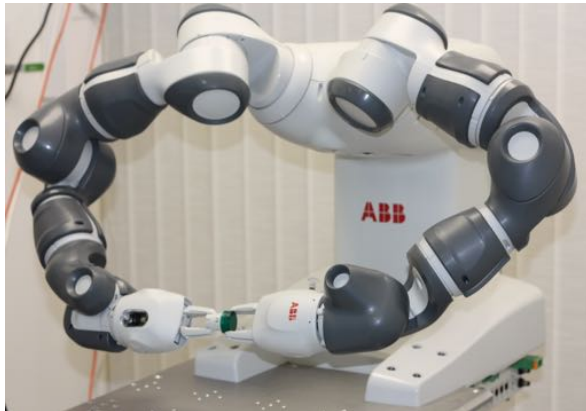
What are the most important next applications to target?

SARAFun: Smart Assembly Robot with Advanced Functionalities



Enable a non-expert user to integrate a new bi-manual assembly task on a robot in less than a day.

- teaching an industrial robot an assembly task with minimum knowledge and effort required from the user.
- sensory and reasoning abilities required to plan and execute an assembly task.



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of technology



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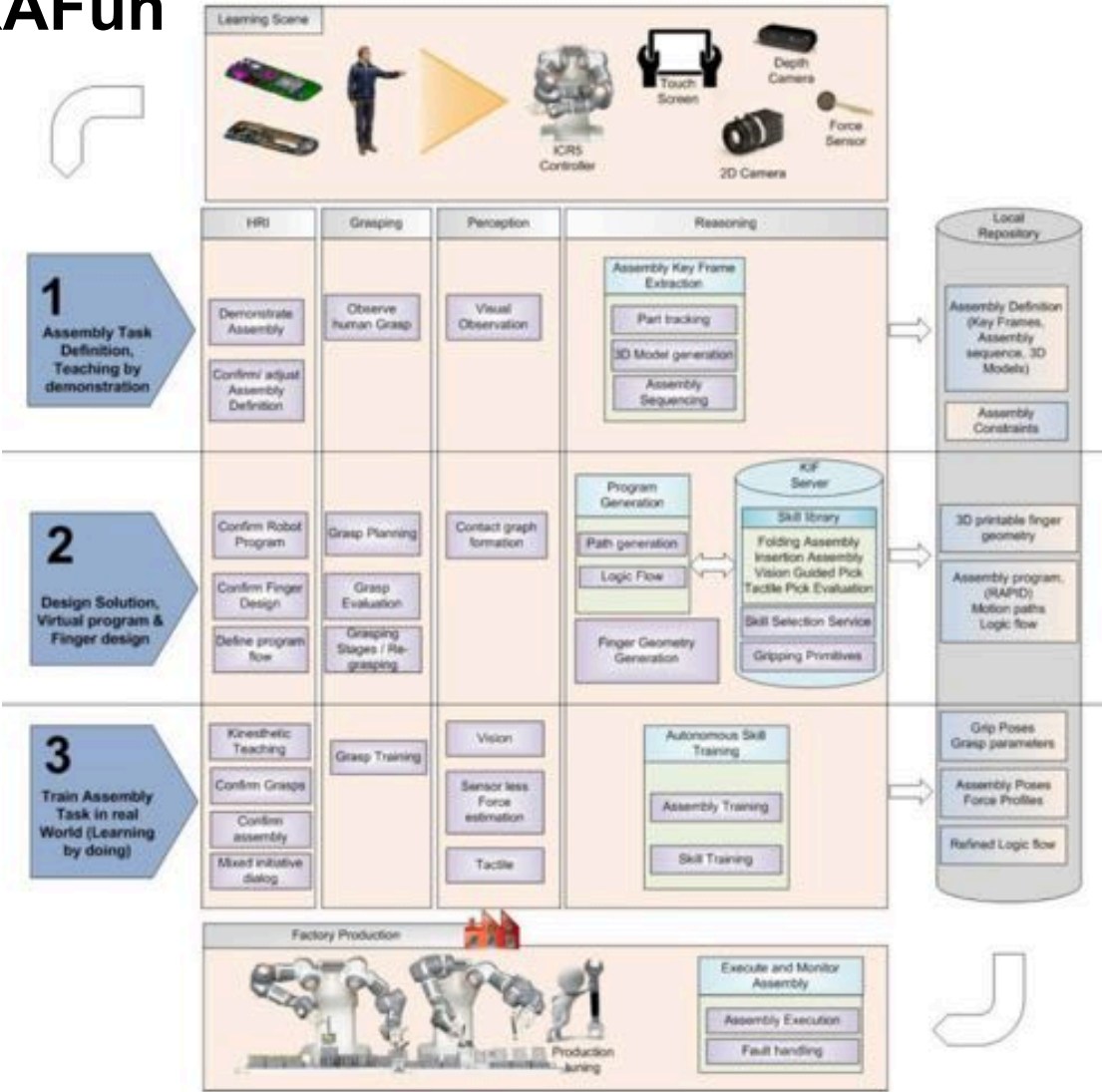
Centre for Research and
Technology Hellas



Universität Bielefeld

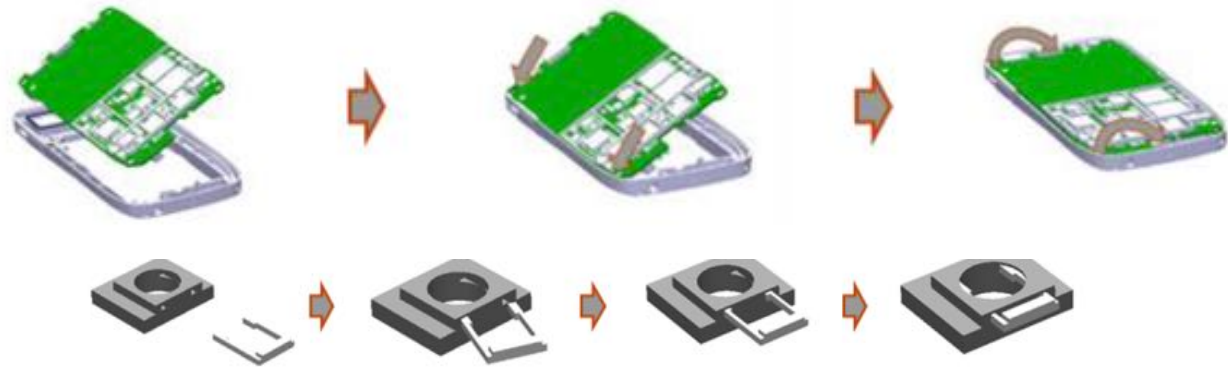
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Real Assembly Scenarios



Demonstration



extract key information



detection of parts

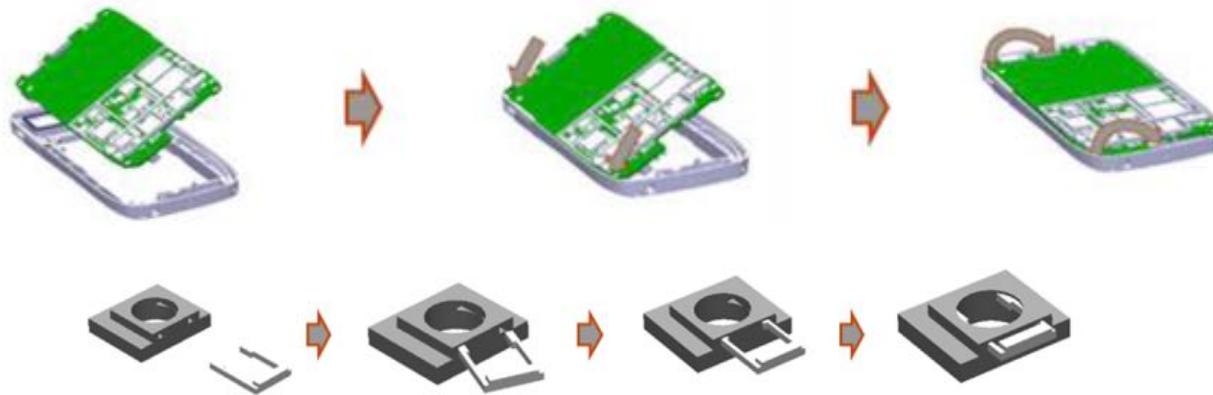


execution



SARAFun

- capable to learn the assembly of two parts by human demonstration
- enables teaching with advanced physical human-robot interaction
- planning grasps and optimize the finger design for industrial grippers
- improve and maintain grasp stability for industrial grippers
- multi-modal control assembly strategies under uncertainties



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Thank you!



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<http://h2020sarafun.eu/erf-2017-tbd-for-industrial-applications/>