Integrating business, education & research: The KNOW-FACT Knowledge Alliance

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http://www.lms.mech.upatras.gr/

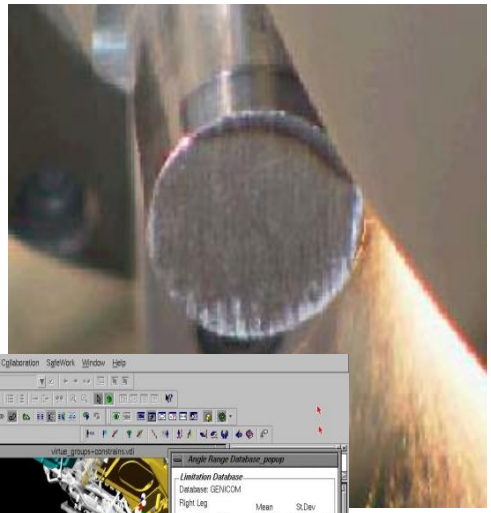
Organization profile

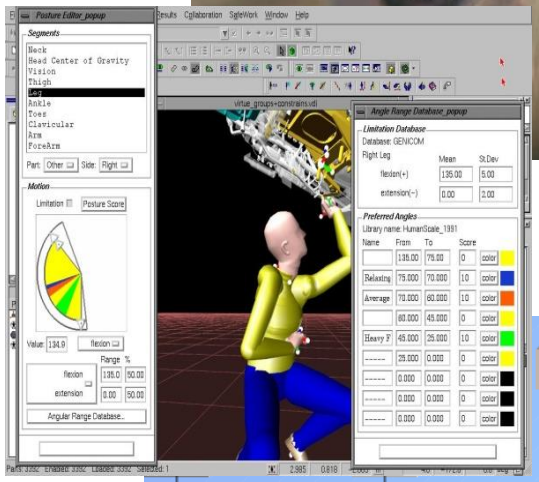
LMS is oriented on research and development in cutting edge scientific and technological fields.

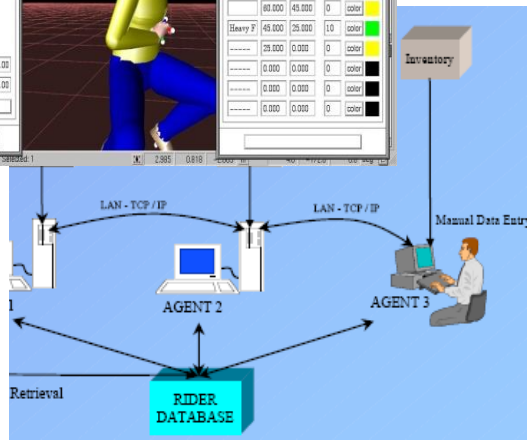
LMS is involved in a number of research projects funded by the CEU and European industrial partners. Particular emphasis is given to the co-operation with the European industry as well as with a number of "hi-tech" firms.

LMS is organized in three different groups:

1. **Manufacturing Processes Modelling and Energy Efficiency**
2. **Robotics, Automation and Virtual Reality in Manufacturing**
3. **Manufacturing Systems**







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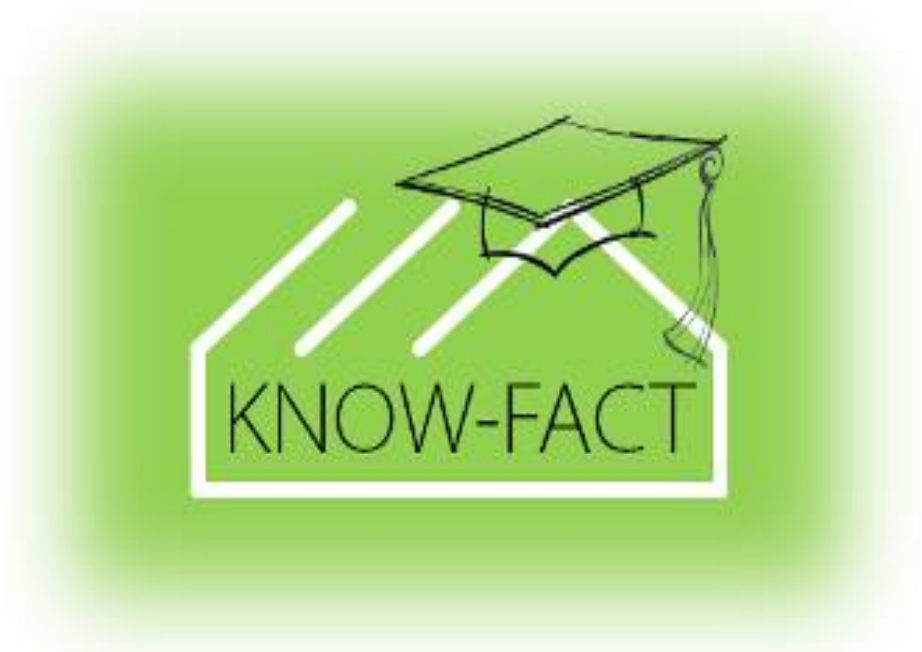

http://www.knowfact-project.eu/

A Knowledge Partnership for the definition and launch of the European *Teaching Factory* paradigm in manufacturing education

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Background

- Manufacturing is a subject that cannot be handled efficiently, only inside a classroom.
- The development of educational curricula has not kept pace with the growing complexity of industry, technology and economy.
- Research outcomes of educational institutions are typically presented to the scientific community without having been directly accessible to industry. Within this context, industry may not either comprehend or adapt to the technological advances in a direct way.

Thus, the promotion of a novel approach to manufacturing education that would integrate education, research and innovation, emerges as a key challenge

Background

The concept of the **Teaching Factory** has its origins in the medical sciences discipline and specifically in the paradigm of the teaching hospitals.

Aiming to become a new paradigm in engineering education and training, the **Teaching Factory** initiative will have a hybrid mission:

- Industrial training and education for university students
- Take-up of research results and training for industry engineers & blue-collar workers

Partnership

Project Coordinator

Laboratory for Manufacturing Systems & Automation

Director: Prof. George Chryssolouris

University of Patras, Greece

FESTO

VOLVO

POLITECNICO DI MILANO

TECHNISCHE UNIVERSITÄT DARMSTADT

tecnalia

CASP S.A.

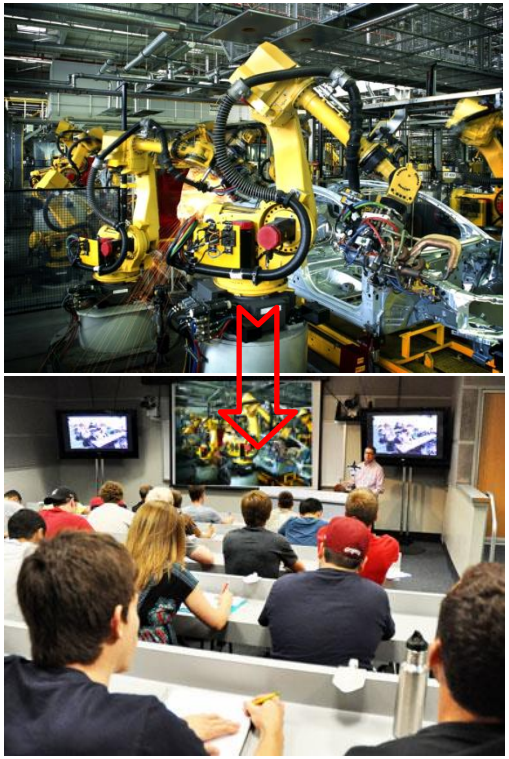
Objective and outputs

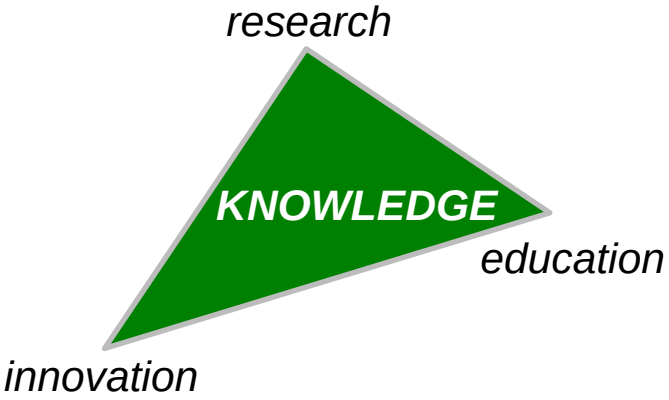
The KNOW-FACT **objective** has been to launch a University-Business cooperation to elaborate and validate the emerging concept of the Teaching Factory at a European level and identify its exploitation potential.

KNOW-FACT has delivered:

- A complete study for the conceptualization and implementation of the Teaching Factory initiative, including the
  - concept definition
  - layout and technological infrastructure specification
  - learning content definition
- Pilot runs for the validation of the underlying concepts and the delivery mechanisms
- An Extended Partnership of associated academic and industrial organizations to support follow-up and future implementation activities

Approach





The **Teaching Factory**
as a 2-ways
"learning channel"
communicating

… industrial practices to the classroom

… "new" knowledge to the factory

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Approach

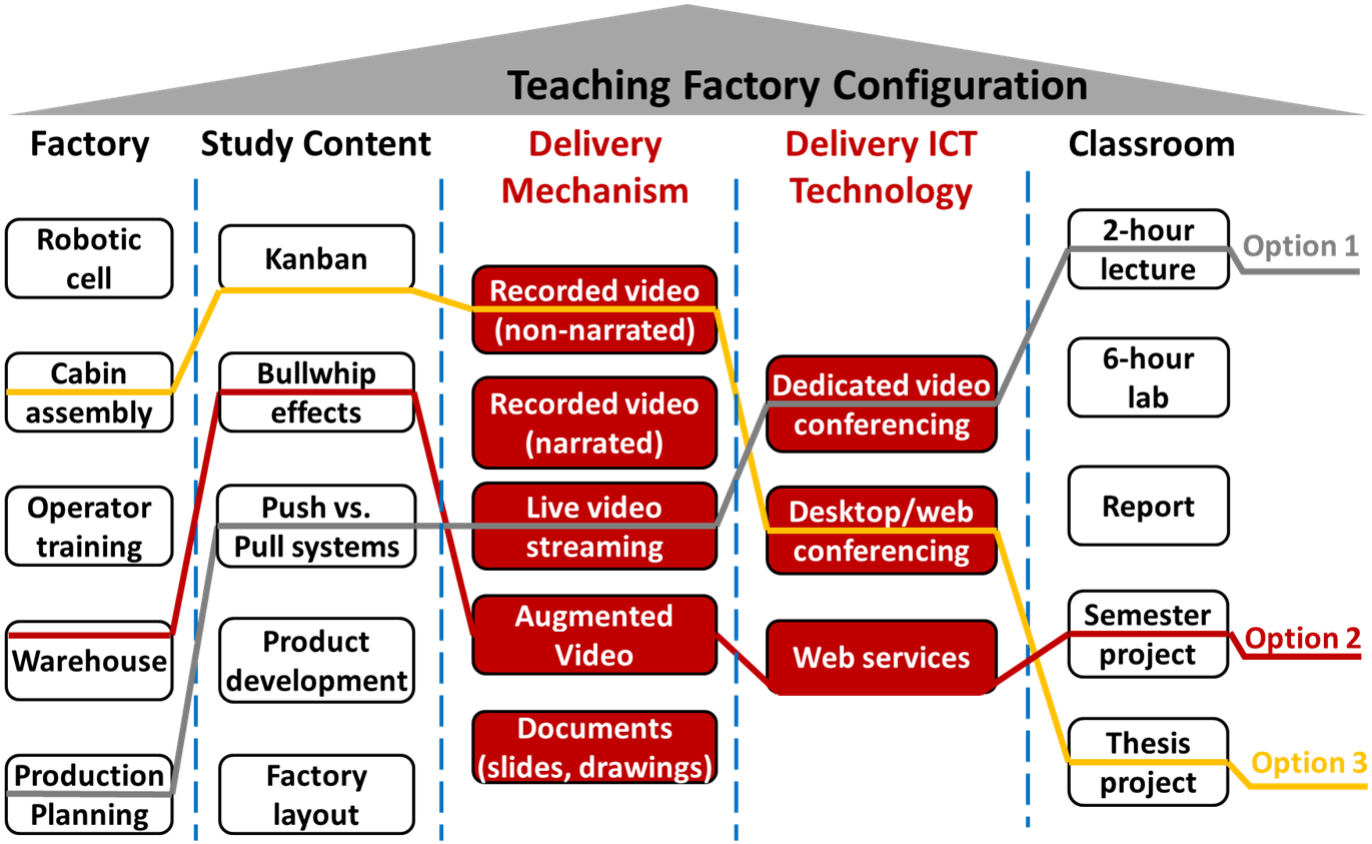
"Factory to Classroom"

- **Students** in the classroom act as the **knowledge "receivers"**
- On the industry side, **engineers introduce and present real shop floor problems**
- **Student projects** are launched on the basis of the shop-floor problems

"Lab to factory"

- **Engineers** at an industrial site act as the **knowledge "receivers"**
- Academic facilities provide the **test-bed** for presenting and demonstrating **research results**.
- New **solutions to industrial problems** are investigated on the basis of these results.

Approach



Modular configuration of the factory-to-classroom knowledge communication

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Approach

Students watch an augmented video from a warehouse about how raw materials are handled

Engineers present, in a conference room, a welding operation, performed in real time at a robotic cell. Students are able to interact with the engineers from the classroom.

Asynchronous 1-to-1 session

Synchronous 1-to-many sessions

Multiple layouts of the factory-to-classroom knowledge communication channel

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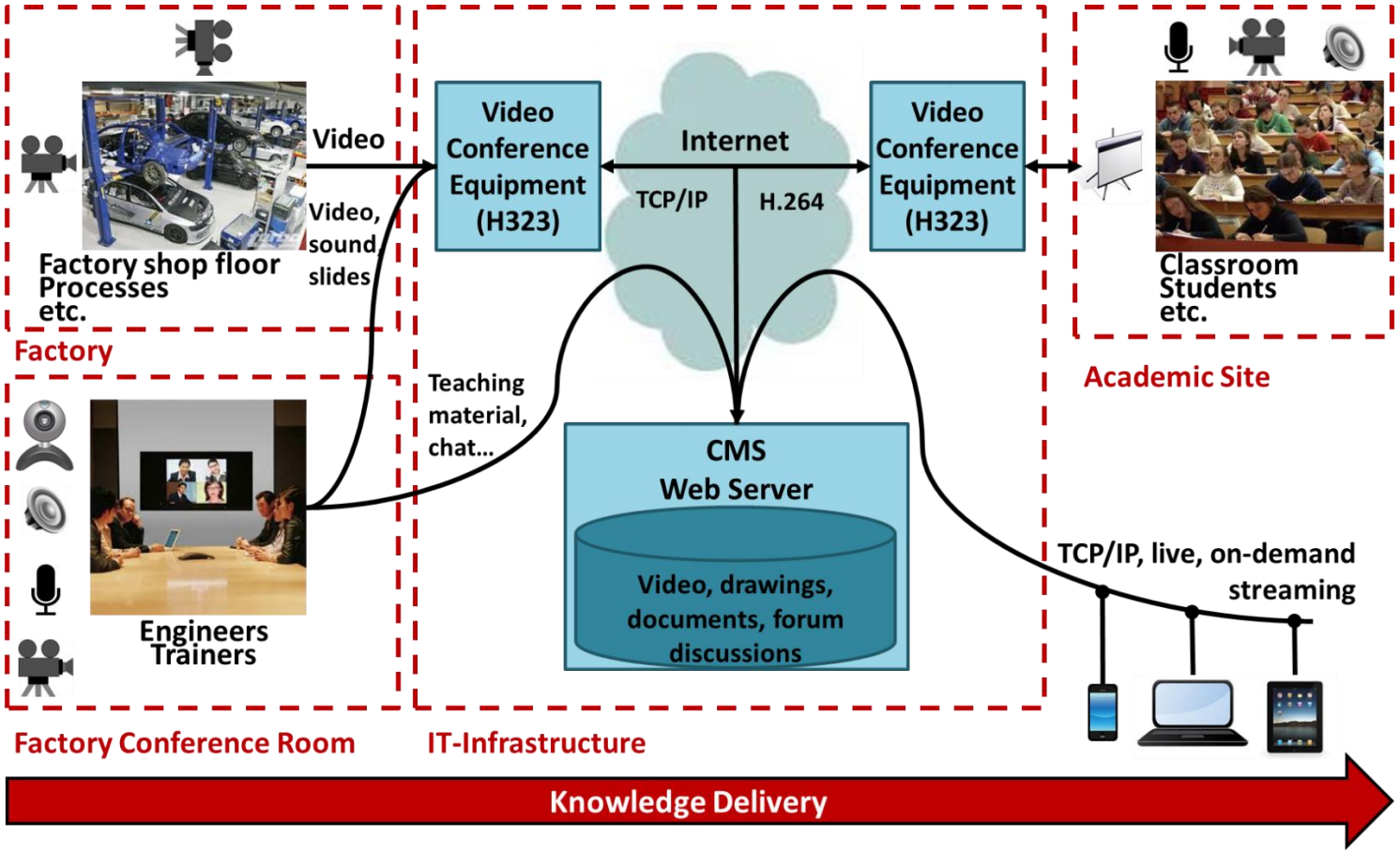
Approach



Generic ICT infrastructure for the factory-to-classroom knowledge communication

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Pilot project 1

Industry → *knowledge transfer* → **Academia**

Industrial problem:

- ***line balancing of a new production area***
- ***planning of material kitting area***

4 Volvo engineers
20 LMS students
6 weeks (2h session per week)

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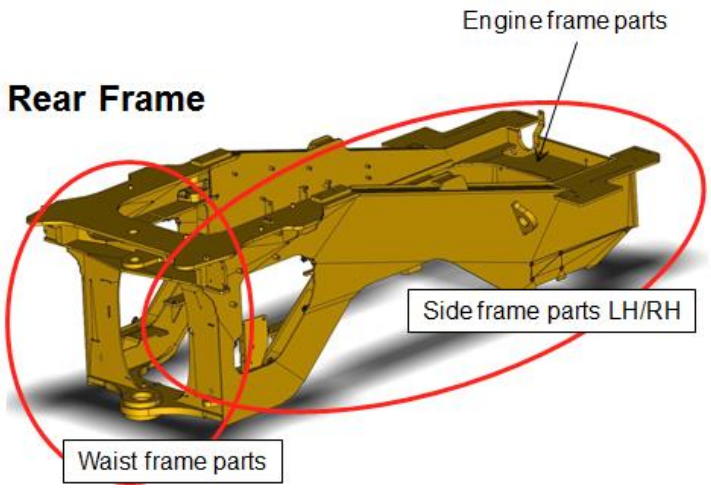
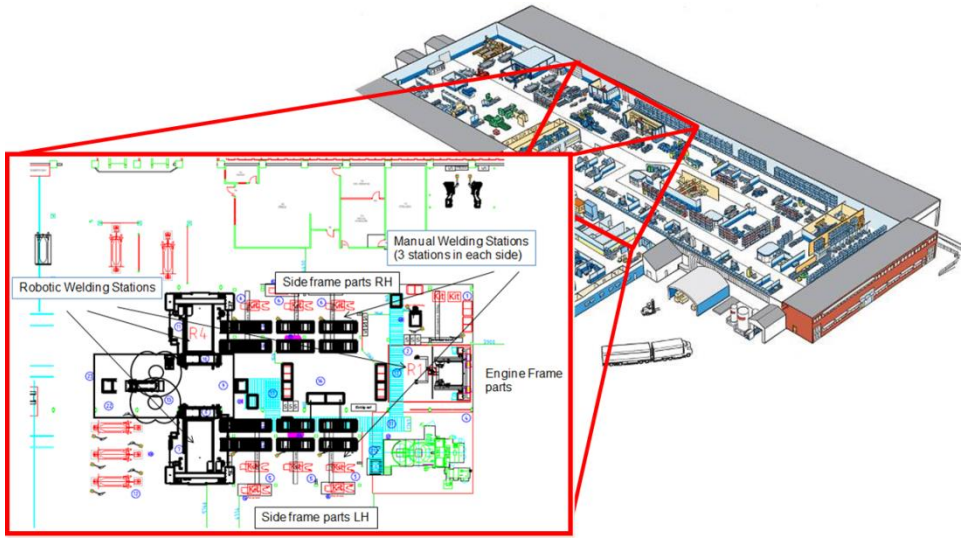
Pilot project 1

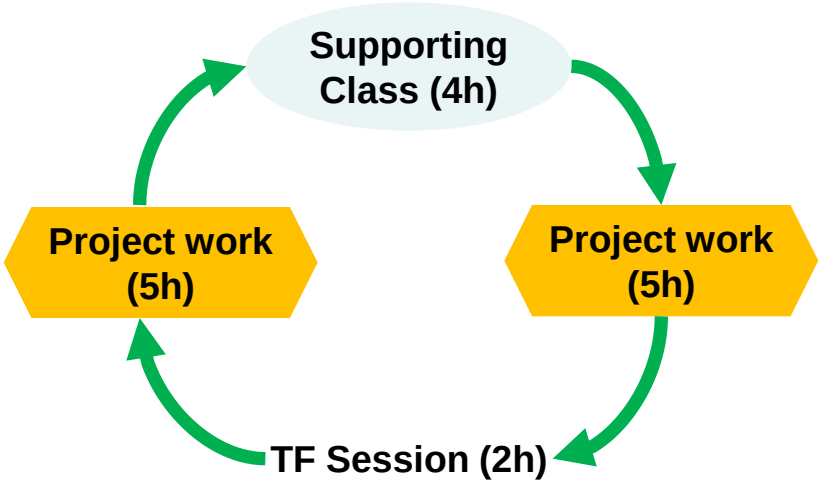
- Volvo Construction Equipment
- Material flow simulation project
- Use of DES (discrete event simulation) software to address the problem





Pilot project 1

Weekly cycle



Implementation plan

13.11.12	***Introduction to VCE production and problem definition***
20.11.12	***Discussion on problem***
27.11.12	***Initial theoretical approach***
04.12.12	***Evaluation of model design and approach***
11.12.12	***First draft results***
18.12.12	***Solution presentation***
15.01.13	***Follow-up on solution and discussion***

Pilot project 1

Overall experience - The business perspective:

- The pilot provided ideas and solutions that would not have been considered during the standard company processes of solving such problems.
- It was an opportunity to give a wider range of solution proposals, which consequently resulted in better decision support.
- The factory people had the chance to interact with a pool of students that had a new way of thinking and problem solving capacity.
- There were cases among the students where they approached the problem with real talent and out-of-the-box thinking.

Pilot project 1

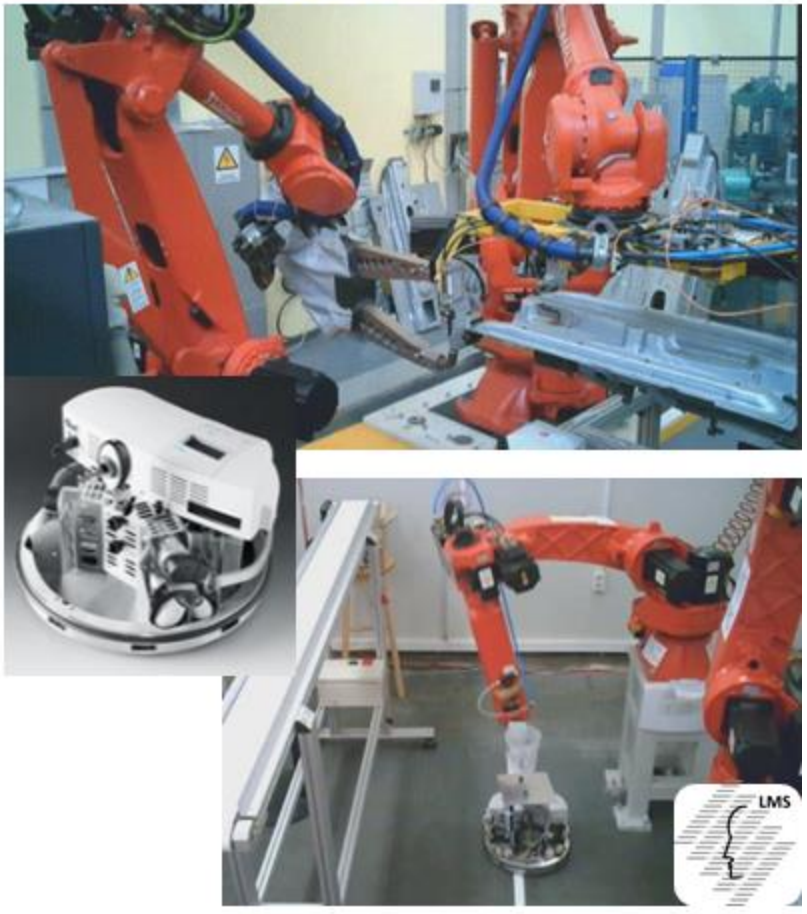
Overall experience - The academia perspective:

- New experience for both the students and the faculty.
- New learning approach and knowledge delivery mechanism that is not available in theoretical lectures or one-time labs.
- Gives the ability for the students to deepen their knowledge in certain topics and apply that in practice, while addressing real-life problems, and working in view of actual deadlines and industrial practice terms.
- Major impact on the learning process and the development of the young engineers, but also outside the academic environment.
- Promote the exciting character of manufacturing to the young people

Pilot project 2

knowledge transfer

Industry ← **Academia**



Industrial problem:

- ***new integration and control architecture for industrial robots***

5 FESTO engineers
7 LMS research engineers
3 weeks (1h session per week)

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Pilot project 2

General conclusions from the industrial perspective:

- The pilot demonstrated that there is clearly a potential in this approach
- The image/video quality was very good.
- Didactic content/approach is critical
  - *The didactic approach varies according to the teaching situation*
  - *The organization of the session (what to show, how to show it, etc.) should consider the didactic approach.*
- There is room for improvement regarding the use of technologies (e.g. ability to focus on specific parts of the didactic presentation)
- What content to transmit
  - The particular topic was successfully transmitted to FESTO because of their background and similar research interests.
  - In case of an SME it would require a different didactic approach.

Pilot project 2

General conclusions from the academic perspective:

- Get input/feedback from industry
- Bring in direct touch, researchers/students with industry
- Better industrial orientation in the academic research
- Facilitate the production innovation by offering new ways of thinking and demonstrating new solutions to companies (e.g. SMEs)

Thank you for your attention!

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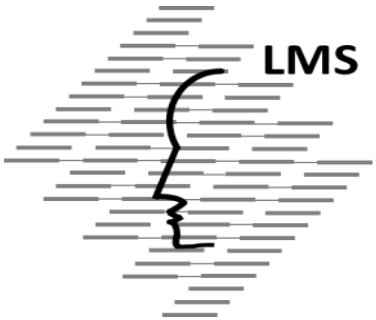

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