MMAssist II: Assistance in production in the context of human machine cooperation

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Abstract—MMAssist II is a national Austrian flagship project for research, development and establishment of assistance systems which could be used as a tool box for different applications. Besides a fundamental understanding of demands for such assistance units also a demonstration in industrial near production settings including an extensive evaluation is part of the project. Therefore, a mighty consortium of 9 scientific partners and 16 Industrial partners was formed.

I. INTRODUCTION

Initial situation: Austrian production companies manufacture goods of high quality and have a staff of well-trained employees. However, companies currently face technological and societal challenges to which they have to react to in order to continually provide competitive goods on an international level. These challenges include the demand of customers for individualized products, which leads to smaller lot sizes and faster production cycles. At the same time, production machines are more and more connected and equipped with sensors. This leads to an increased information density and more complexity for the workers, which induces a higher workload and stress. Furthermore, Austria is experiencing a demographic change. As Austrian citizens get older, they stay longer in employment. All of these trends, as well as the goal to keep up the high quality of produced goods, lead to an increased need of optimized assistance for the worker in the factory.

II. THE PROJECT MMASIST II

A. Key Facts

MMAssist II was launched in May 2017 and will run until April 2020. The project involves 25 different partners from research and industry, which are key players for research and manufacturing in Austria [1], [2], [3]. The partners expertise covers the whole manufacturing value chain from basic research to industrial manufacturing of high tech products and services. This consortium was set up to have all necessary competences without any overlap in research, and besides technical capacities there is also social-economic knowledge available. The industrial partners cover a wide range of different technical branches and provide real use cases to demonstrate the results in a production near environment.

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Project- Facts	
FFG Number:	858623
Titel:	Assistenzsysteme in der Produktion im Kontext Mensch – Maschine Kooperation
Acronym:	MMAssist II (www.mmassist.at)
Coordination:	PROFACTOR GmbH/ University Salzburg
Start:	01.05.2017
Duration:	36 months
Funding:	3 912 568 €
Total Costs:	6 131 405 €
Partner:	25 (10 scientific Partner, 15 Company partner)

Fig. 1. Key facts of the MMASIST II project

B. Objectives

The goal of the project partners in MMAssist II is to explore assistance systems for employees in production environments and to develop these systems. This is necessary to overcome future technical and socio-technical challenges for production, by setting new paradigms of industrial assistance.

Challenges for future Production processes	
Technical	Sozio-Technisch
Small lot sizes	Stress and work pressure
Common Setup and multiple machine operation	Physische Anstrengung
Physical effort	Knowledge Management
Flexible Assistant systems	High diversity of employees

Fig. 2. Challenges for Future production processes

OBJECTIVE 1: Exploration of modular, reusable assistance systems The project partners will develop assistance systems that can be used not only for the specific individual cases, but are applicable in different contexts and for different applications. The purpose is to establish a general approach for implementing assistance systems for employees in manufacturing companies.

OBJECTIVE 2: Context oriented detection of assistance needs Methods are developed, to enable the identification of the assistance needs of people in the vicinity of the machines from machine point of view. The purpose is to explore intelligent assistance systems, which offer targeted assistance only if it is needed.

OBJECTIVE 3: Improve the work and assistance experience

rience As a major goal, the project partners will implement assistance systems that increase positive factors of work and assistance experience while they are used, and reduce negative factors. Thus, it will be achieved that the systems are accepted by users and contribute to an improvement of their daily work.

OBJECTIVE 4: Applicability in real production environments The project partner aims to use the implemented assistance systems application at the industrial partners production facilities and to evaluate in terms of productivity, acceptance through the staff and ergonomics. This evaluation should prove that the assistance systems are also usable in real production environments and beyond the project.

Fig. 3. Basic technologies available for MMAssist.II Assistance Units

III. BASIC TECHNOLOGIES

In the MMAssist.II project, nine scientific partners from Austria provide different basic technologies for various Assistance Units. Either these technologies are ready for implementation or they were developed ready for use. Most challenging problem are the interfaces between this basic technologies and the software framework. Main basic technologies are:

Object recognition, Event recognition and scene Interpretation by Technical University Vienna [4]: A system to generate hypotheses on the current state and events happening in human robot collaborative scenarios (HRC) is being developed. The software modules will be based on existing approaches and software libraries for object modelling and object pose recognition, concepts to describe events in HRC scenes, and fusion of data streams including action recognition, robot states and object recognition.

Mixed Reality methods by Evolaris [5]: Focus of this work is to develop methods to augment visual information using Head Mounted Displays (HMDs) and modes for the user to interaction with the HMD (data input). A major challenge is given through the requirement of selecting appropriate information given the current context and individual needs of the user.

Visualization of complex data by Fraunhofer Austria [6]: The main focus is developing approaches to enable real-time visualization of large amount of data, e.g. complex CAD models, on thin clients (data glasses). Moreover, a model-based tracking approach based on CAD data is developed,

to facilitate position-stable augmentation of data in industrial environments.

Interaction for robot-based Assembly processes by PROFACTOR [7]: Within this technology package, concepts to enable intuitive interaction in HRC scenarios will be developed. Major challenges include the implementation of flexible models to enable fast adaptation of process knowledge and adaptation of the human-robot interaction (user specific needs), avoiding explicit programming.

Acoustic Interaction by Joanneum research [8]: The main goal is to develop speech-interfaces to enable intuitive interaction with assistance systems in an industrial setting. In order to maximize user friendliness, the interfaces are not restricted to a collection of commands and can cope with different dialects and languages. Acoustic feedback is used to inform the user about the states of the assistance system.

Iterative Interaction Design by AIT [9] and PLUS [10]: The goal is to implement a Research through Design (RtD) based process, where prototypes for current and present interaction models/modes are developed by potential end-users. This generated, valuable feedback serves as input to an iterative development process for assistance system interaction design.

IV. FIRST RESULTS

As the project has started in Mai 2017, the work performed in the first 6 months was focused on requirements and finding a set of basic technologies as described in chapter IV. Also a more detailed definition of the use cases and the Assistance Units, which will be implemented, was done. This led to 3 different Use Cases with 7 Assistance Units in total.

- **Service and maintenance (USE CASE 1)**
 - Notification of maintenance protocols (Unit 1)
 - Communication with Experts (Unit 2)
- **Setup and multi machine service (USE CASE 2)**
 - Guiding through setup process (Unit 3)
 - Multi machine service (Unit 4)
- **Assembly (USE CASE 3)**
 - Notification of Assembly instructions (Unit 5)
 - Part delivery (Unit 6)
 - Assembly instructions review (Unit 7)

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