Newsletter No. 2, Feb. 2017

ReCaM

Rapid Reconfiguration of Flexible Production Systems

Welcome to the second issue of the ReCaM newsletter!

This issue provides you an overview of the last six months of the ReCaM project. The demonstrations in Robert Bosch GmbH are introduced together with the prospective potentials of three exemplary exploitable results that are being developed. It follows a special focus on the system architecture. An introduction to three of our Consortium partners closes this issue.

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In this issue:

Latest news and events of ReCaM!

ReCaM visited Graz, Austria

On December 1st, 2016, the project ReCaM was invited by the Styrian Business Promotion Agency along with 7 other H2020-projects to be presented to representatives of industry, academia and politics. The workshop was entitled "A journey into European factories of the future: The best Horizon 2020-projects are visiting Graz". Each of the projects was described in a separate presentation and visitors could get in contact with the coordinators of the projects during two round-table sessions in the afternoon.

ReCaM and EFFRA

The "EFFRA Factories of the Future Conference" was held in Brussels in order to connect different H2020 projects and to give a platform to discuss different approaches within H2020-projects. ReCaM was part of the FoF-pitch-sessions, which were focused on the exploitation of the future results.

Do you know?

*The ReCaM project is composed of 8 different Work Packages (WPs). The **WP2 "System and module architecture"** will be completed in January 2017. Furthermore, the first prototype SW are almost ready.*

The Consortium partners

The ReCaM Consortium is composed of nine partners from industrial end users, technology providers and research institutions.

BOSCH Invented for life · CESA · DGH ingeniería industrial · cosberg innovaction · NXT CONTROL · ENGINSOFT · TAMPERE UNIVERSITY OF TECHNOLOGY · POLITECNICO MILANO 1863 · tecnalia Inspiring Business

Face to face meeting: Leobersdorf, Austria

The semi-annual face-to-face meeting of the ReCaM partners took place at Leobersdorf in Austria, on November 29th - 30th 2016.
All partners met in order to discuss the current state of the project as well as the upcoming challenges.
Based on the architecture defined in the last meeting in Tampere, the next steps towards the implementation were discussed. Therefore, the main topics were realising the communication and organising the collaborative development of the future prototypes. The meeting as well as the social event were organised by our partner NXT, who is having their site nearby.

Upcoming!

Face to face meeting in Renningen

In the next ReCaM meeting, the consortium will evaluate and discuss the first software prototypes and the first application of the ReCaM system. This meeting is being organised by BOSCH and will be held in Germany, Renningen on April 3rd - 4th 2017. The theme of this meeting focuses on achieved results to be presented during Mid Term Review meeting, and the next activities.

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Applied ReCaM: demonstrators

Section focus:

ReCaM demonstrators within Bosch:

- The Bosch Homburg environment
- Bosch Lab environment

The Bosch Homburg environment

The intention of the industrial use case within Bosch is to reduce the assembly time required for the production of industrial hydraulic valves (Fig.1) in the Bosch production site in Homburg, Germany.

The challenge is to face a wide variety of product families and variants as well as highly varying lot sizes. This shall be achieved by using the ReCaM system to reduce the production reconfiguration effort and to plan the necessary reconfiguration steps together with the production tasks itself. The solution approach is to have different production modules providing the appropriate capabilities such as "screwing", "pressing" or "riveting".

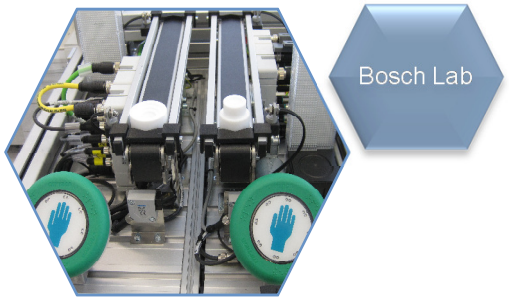
Fig. 1

By using intelligent and versatile modules, the required modules can be reduced in terms of total quantity and variety.

The system will be aggrandised by a worker guidance, which will support the worker during the reconfiguration tasks as well as the production itself. During the year 2017 a workbench will be developed, which will serve as a foundation for the modules. In parallel the first modules realising the most important capabilities will be developed.

The Bosch Lab environment

The goal of ReCaM is to reach **TRL7**, which means having the system in the production at a producing site. As evaluating different states of the software, which might not be mature from the beginning, is a challenging task within a production site, an additional demonstrator is being used within the Bosch lab to evaluate each result through small iterations.



In a smaller and controlled environment, the ReCaM architecture will be evaluated without having the typical restrictions of being in production. The knowledge gained in this process will be used for increasing the maturity of the implementation by reducing the risk of directly bringing the concepts to the main production use cases. The Lab demonstrator, consists of different modules, each of them providing a certain set of capabilities, like "feed" or "pick-and-place". With these modules, a variety of exemplified products represented by a stack of discs can be produced (Fig.2). The modular resources can be rearranged and are executed by the first implementation of the block *Production Execution & Control*.

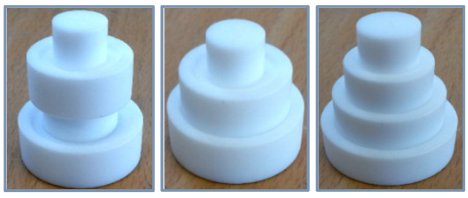


Fig. 2: Exemplified product set.

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Applied ReCaM: exploitable results

Section focus:

ReCaM exploitable results:

- Plug-and-produce technologies for highly adaptive production systems
- New mechanical solutions for reconfiguration of (semi)-automatic assembly process
- Eco-system for versatile production system

Plug-and-produce technologies for highly adaptive production systems

The ReCaM approach aims at enabling the connectivity in-between the different modules by using a systematic self-description and communication ability of the modules. Each module of the ReCaM system will be able to be connected and to communicate information like capabilities, parameters, and its actual availability. To enable this functionality a clever usage of different technologies regarding different disciplines (control technology, mechatronics, etc.) is required. Open standards will be used to enable other players to join the platform of interoperable production modules. It can be expected that no future customers will require the same solution as it might be realised at Bosch or CESA, but providing the applicable technology to achieve a higher versatility within the production can meet future customer requirements. This increases the potential of current and future markets and widens the field of both applications and customers simultaneously. Furthermore, smaller companies and different industries can participate by using the plug-and-produce technology to increase their versatility of their production.

*A **Mechatronic Object** is a module, which combines mechanical, electrical, electronical and software aspects as separate unit and provides a defined capability.*

New mechanical solutions for reconfiguration of (semi)-automatic assembly process

Mechanical tools integrated to software and controls architecture will guarantee a mechatronic system with high flexibility and fast reconfiguration in a semi-automatic production line. Typical customers could be manufacturing companies in the Automotive sectors as a well-known market with a low batch quantity and a high customisation level that typically requires flexible solutions. For future customers as for the consortium, the added values of using adaptive and flexible Mechatronic Objects are multiple. By the harmonization and the reconfiguration based design, the Mechatronic Objects assure high flexibility with low setup time and high potential for working on new products by reducing the time-to-market and by increasing the competitiveness of the company. Mechatronic Objects are proposed into the market as standard modules which can be selected directly from a catalogue.

Eco-system for versatile production system

The ReCaM approach is focused on versatile and highly adaptive production and assembly system. By using the software, an organisation could start providing a whole versatile system for future customers. It could consist of different partial systems like production resources and the software for the planning of the tasks. A partner within the consortium or an external company could be the provider of this products. By licencing the standards regarding communication and self-description, other organisations could enable their resources to be integrated in the eco-system of ReCaM-compliant resources. For a company running these versatile systems, the consequences are multiple. These companies can use the resources of several providers to have systems better fitting the requirements. Also, the wide applicability and therefore easy reusability of the modules within the production reduces the investment risk compared to a highly specified plant. Moreover, companies do have the chance of exploiting whole new business models based on an eco-system like leasing the modules, providing versatile production capacity to the outside or even training other companies to implement the standards within their own production-related resources. Small companies and SMEs can find access to production systems by providing specialised modules much easier than they could when special machinery would have been used.

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A closer look at the project: the WP2

Section focus:

The WP2 description: "System and module architecture"

- The main goal of WP2
- A modular systems architecture
- A closer look at the architecture

Applied ReCaM
- Demonstrators within BOSCH
- Exploitable results

A closer look at the project
- WP2: "System architecture"

Partners profiles
- COSBERG
- DGH
- TECNALIA

What is the main goal of WP2?

The ReCaM approach contains aspects of various disciplines to tackle the challenges of a truly versatile production system. Besides the mechanical parts enabling this versatility, there is a distinct need for a software system enabling the auto-reconfigurability, the production execution, and the capability-based description of both products and modules. In ReCaM, the main objective of WP2 is to derive a general architecture for a highly modular system approach consisting of collaborating and autonomous functional elements.

A modular architecture

The software system architecture is separated into blocks (Fig. 2). Each block is dedicated to a certain function and it contains a set of building blocks implementing the basic functionalities. The blocks are connected through a loosely coupled messaging based communication system. Also, at the shop floor a real-time capable solution is used, which supports the distributed control architecture.
The modularity of the architecture allows to have clear interfaces, a decentralised development and supports a component based deployment in heterogeneous industrial systems.

*A **Capability** is the inherent ability of a resource to perform activities ("milling", "drilling", etc.) required to change the properties of parts in order to produce a product.*

A closer look at the architecture

The Capability Management provides an ontology covering the field of production and assembly engineering.
The Resource Management describes the resources using the provided capabilities based on the capability-ontology.
The Product Management describes the products and their requirements to enable the planning of the production and reconfiguration tasks.
The Systems Engineering Platform defines a selection of resources and an optimised layout based on estimated production scenarios according to a selection of different KPIs.
The Production & Reconfiguration Planner schedules the production.
The Production Execution & Control is connected to the actual system for control purposes, and it detects the resources currently being in the system. It enables the communication between hardware-software and the statistics collection.

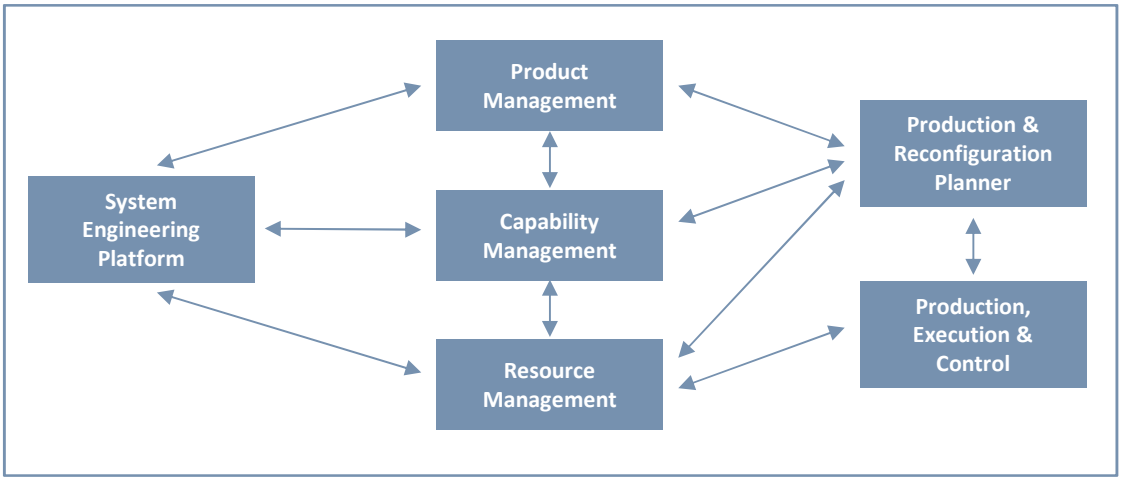

Fig. 2: The ReCaM system, software modules and their communication architecture.

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Consortium partners profiles

Section focus:

A brief description of three of our consortium partners

- COSBERG
- DGH
- TECNALIA

In our next newsletter we will introduce you with three other consortium partners.

Stay in touch!

Applied ReCaM

- Demonstrators within Bosch
- Exploitable results

A closer look at the project

- WP2: "System architecture"

Partners profiles

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Cosberg is an Italian company technology provider focusing in the realization of prototypes, "tailor-made solutions" but based on a long experience and on standardised modules for mechatronics. Since 1983, Cosberg becomes a leader company in mechatronics, robotics and special assembly solutions for the automation of assembly processes. Solutions are used in many industrial areas: Mechanical, Electrics, Automotive Components, Household Appliances Parts, Accessories for Furniture, Consumer Goods but also specific sectors such as Goldsmith segment and Electronics. Cosberg's aim is to supply machines to the highest level of reliability and productivity. The R&D team is also dedicated to the development of new equipment integrating the latest technologies. Key feature on project development is the analysis, study and design of mechatronic solutions. The engineering innovation and technologies, the continued investment in research and development have led Cosberg to become an international reality with headquarter in Terno d'Isola (Italy). Cosberg company Group counts 100 people employed, highly specialists in the design, mechanical, electrical and information technologies, and more than 50% of the production is exported worldwide.

DGH is a company located in the Technology Park at Boecillo (Valladolid) and it is specialised in Robotic and Automation Engineering and Industrial Maintenance. Since 1985, DGH has been a leader in introducing new technologies focusing in flexible manufacturing systems, flexible robotics cells, and knowledge and information management. Nowadays, DGH is present in 16 Spanish provinces and it has international operations in Portugal, France, and other countries, with a staff of more than 315 professionals. DGH's mission is to boost the competitiveness of customers by improving their access to the most innovative technology that can be applied to their production processes, and to offer comprehensive and customised solutions. DGH achieves the higher performance investment ratio provided by the customer and generates the more efficient internal management of the sector in Spain. To maintain the technological leadership, DGH is on a continuous process of creating and managing various innovation networks with partners in different industrial sectors such as automotive, energy, and aerospace.

Tecnalia is the first privately funded applied research and technological development centre in Spain and the fifth largest in Europe, employing around 1400 people with 214 Ph.D. holders. Tecnalia's mission is to transform technology into GDP and it is organised in six interconnected business divisions: Sustainable Construction, Energy and Environment, ICT-European software institute, Health and Technological services, and Industry and Transport. In particular, the Technology Area of Robotics develops advanced technologies in the areas of mechatronics design, control, manipulation, autonomous navigation, perception and learning. The Instrumentation & Smart Systems Area provides a large experience in implantation sensor in different devices for monitor, control and optimization purposes. Tecnalia has a wide range of experience in prototyping and control of new robots, professional service automation, in modern automation, and complex systems optimization. Tecnalia supports around 4050 companies thanks to the strong market orientation aiming at achieving the major impact in economic terms, through the innovation and the technological development.