SHERLOCK

UNLOCKING POTENTIALS

NEWSLETTER 1

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Human robot collaboration (HRC) has evolved to address the need for flexible production, presenting however drawbacks such as inability to cover all applications, low performance and quality of collaboration and complexity. Industrial adoption of HRC is constrained by:

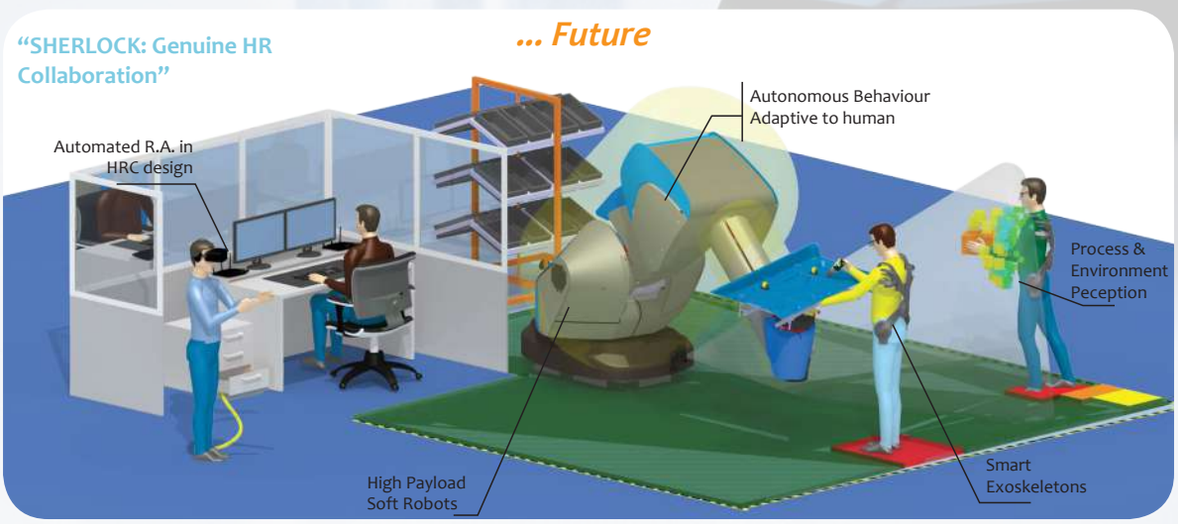
- Diversified needs for robotics by the production tasks. Robot arms are not able to cover all applications scenarios (rigidity, adaptability, payload, working envelope etc.).
- Low performance of collaborative operations. In the scenarios demonstrated so far, humans can perform tasks faster when working on their own as are robots when they function independently.

This is due to:

  - Complexity of safety systems that create more separation: Resolution, response time and robustness in uncertain conditions cannot be handled by existing safety/ sensing/perception and hardware/software.
  - Inefficient design of the system as HRC hazards are not systematically evaluated in the design process
  - People are not used to work cooperatively with robots as they would with other humans. Workers need to develop familiarity and trust in robots through intuitive interaction and accurate anticipation of robot actions/ intentions.

- Lack of cognition for autonomy: the robot cannot adjust its behaviour to shape its operation around the human behaviour.
- Programming of the robots is not user friendly, requiring programming skills knowledge and is detached from the method of interacting with it during execution.

The aim of SHERLOCK Project is to introduce the latest safe robotic technologies including high payload collaborative arms, exoskeletons and mobile manipulators in diverse production environments, enhancing them with smart mechatronics and AI based cognition to create efficient HRC stations that are designed to be safe and guarantee the acceptance and wellbeing of operators. The following illustration provides an overview of how SHERLOCK conceptualizes the status of HRC in the factories of the future.

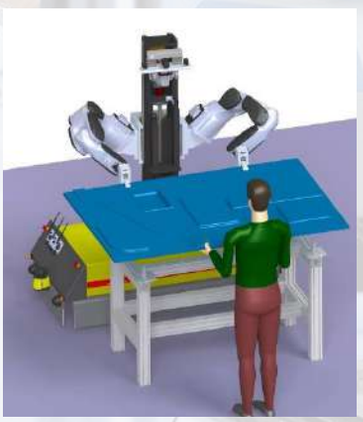


Concept

Human needs and market demands keep changing in a high rate and manufacturers must adapt by offering a large variety of higher quality products, faster than their competitors. The automation systems of the third industrial revolution that target mass production cannot handle this required flexibility. Human operators continue to constitute an important element of flexible production, and the fusion of different hardware and software technologies under the Industry 4.0 paradigm allow to combine the benefits of both human and automation systems, in a safe way.

Unlike today's production stations, robots no longer need to be encaged in safety fences despite having the ability to lift high payloads. Instead they can be covered with soft skins containing several types of proximity and force sensors allowing them to receive input by the human and adjust their behaviour. Such robots are part of the SHERLOCK production station and are equipped with AI algorithms that adjust their operation while analyzing the status of ongoing tasks in their vicinity.

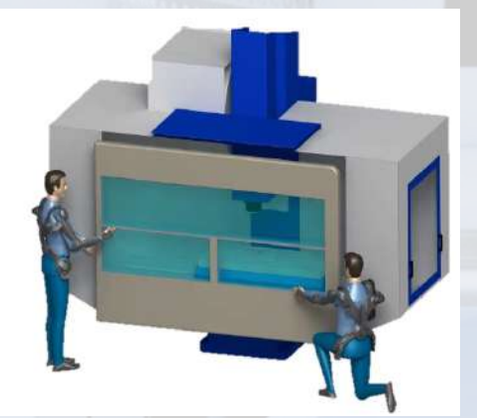
The robot uses distributed sensors (3D safe cameras, safetyMat etc.) to locate humans entering its vicinity and reasons about his/her intentions. Its motion is not hard coded in a program. Instead it uses a set of skills and parameterizes them for the specific task. During its motion, it is able to re-plan its trajectory upon detecting any obstacle or human and would only stop if the human is very close or in contact with it.
In close collaboration, the operator may assemble components while using his/her hands to place the heavy parts in a position/orientation that makes it more comfortable for him/her to work. The robot is fully compliant and supporting the part weight so that no strain is exerted on the operator. The operator is also equipped with smart devices such as AR glasses, smartwatches etc. to exchange information with the robot.



In another applications, operators have to handle very large components which although are not very heavy, require a well-coordinated motion between more than one operators to achieve a good positioning. In such cases the other operator is a SHERLOCK mobile dual arm robot which can move along the workshop while handling the part in cooperation and synchronization with the operator. The ability of the robot to relocate itself in the shopfloor makes it a very flexible production resource capable of being very often repurposed.

Nevertheless, robotic manipulators are not the only type of robotic device that can facilitate a manual task. Smart exoskeletons are also included in SHERLOCK station. They are wearable devices that can physically support operators in hanging large weights and repeatable operations.

The sensors on these devices can detect the motion and status of the operator and the exoskeleton adjusts its behaviour to create comfortable working conditions for the operator in real time.



Events

The SHERLOCK consortium is regularly meeting to materialize the project objectives. The project kick-off event was organized on 17-18 October 2018 at the OTIS Factory in Gien, France, and the 1st General Assembly held at VDL-IM premises in Helmond, Netherlands on 14 March 2019.

Kick-off meeting at UTRC-OTIS, France, 17-18 October 2018

The kick-off meeting of SHERLOCK was held at the premises of OTIS, an end user of SHERLOCK, for two days. The SHERLOCK consortium discussed with the plant managers and engineers the project concept and objectives as to confirm its strong industrial orientation. The partners had a first glance on the SHERLOCK use cases and planned the project activities for the first 6 months. Furthermore, they also visited the shop floor of OTIS and observed the operators working on the pilot case of SHERLOCK.

First GA at VDL-IM Netherlands, 14 March 2019

In order to collect further information on the project pilots, VDL hosted the second general assembly on March 2019. The particularities of the assembly of industrial modules were thoroughly analyzed and the onsite visit allowed the detailed documentation of requirements for the project demonstrator.

European Robotics Forum 2019 (ERF2019), 20-22 March 2019

The coordinator of SHERLOCK project, LMS, was present at European Robotics Forum (ERF) 2019, disseminating the SHERLOCK project during the 6th Hybrid Production System Workshop. ERF is the most influential meeting of the robotics community in Europe. LMS had the chance to present the concept and objectives of the SHERLOCK project. Around 900 attendees with diverse background participated the event, such as academic, industry, policy makers and media.

Second GA at SOFITEC Sevilla - Spain, 18 July 2019

On July 18th , 2019 SHERLOCK organized its second General Assembly at the premises of SOFITEC in Sevilla (Spain), focused on the ongoing activities of SHERLOCK, planning the next steps until M12 of the project and analyzing the requirements for the mobile dual arm robotic resources that will be developed by the project to handle co-manipulation of large components.

Upcoming events: SHERLOCK will be represented in several events, such as the CIRP CMS 2019 conference, and invites all interested parties to follow its developments through the project social media.

Partners

Fidia S.p.A.

FIDIA S.p.A., established in Turin since 1974, designs, manufactures and sells Numerical Controls, High Speed Milling Systems and Flexible Manufacturing System for the production of complex parts and shapes mainly for the automotive, aerospace and energy sectors.
With three industrial sites in Italy, one Joint Venture in China and eight Subsidiaries overseas, the FIDIA Group employs approx. 330 people and reached 46,0MEuro of turnover in 2017, and 57.4MEuro in 2018.
The Company is focused on high-quality products and customizable machines being, since its creation, among the world leaders in the field of Numerical Controls for machining of complex surfaces as well as in the one for High-Speed Five Axis Milling Centres.
With respect to other machine tool builders, Fidia covers almost the complete product chain. In fact Fidia design and then produces or assembles: mechanical structure, rotative milling heads, rotative milling table, electronic drives (both digital control logic and power electronic switching boards), Numerical Control (casing, proprietary real-time board, proprietary control SW and GUI SW), tools and devices for compensating and calibrating the machine tools plus auxiliary SW tools such as anti-collision, machine monitoring and 3+2 CAD/CAM.
FIDIA invests every year a significant percentage of the turnover in research and development. The primary R&D activities, competences and experience on the project issues are:

- High speed milling machines: performance, reliability, maintainability and manufacturing process improvements
- CNC and SW tools: improve design performance and solution of all software solution as well as introduce new auxiliary SW
- Integration of new and not conventional production processes within the machine tool (WAAM, Laser Cladding, micro machining, Waterjet, EDM, Laser quenching, surface treatments, etc.)

Sofitec

SOFITEC is an international aerostructures manufacturer, specialized in the development of integrated solutions for composite, metallic and assembly projects. SOFITEC is a large company has been operating in the aerospace industry since 1999.
SOFITEC currently has annual revenue of about 25 M€ and employs about 277 professionals. The current facilities of 409.028 ft2, with over 59.055 ft2 of Composite plant, 32.291 ft2 of metallic plant and the same dimensions for assembly and 5.400 ft2 of inspection area.
The Composite plant is totally equipped with state-of-the-art technology in every productive process. It has almost 500.000 ft3 for lay up with new laser projectors, over 11.840 ft2 for raw material and kitting refrigerating store. Autoclaves, oven OAA, Composite CNC trimming, Painting facilities (6.458 ft2) sand sanding cabins (1.641 ft2). 3.300 ft2 of Composite material repairing area.
In such a highly competitive segment, the company stands out for its service vocation, efficiency and multi-technological capacity, due to its internal customer-supplier and “lean thinking” management philosophy.
SOFITEC offers service based on flexibility, competitiveness and quick response. Support clients throughout the process, putting forward innovative ideas, investments and new manufacturing integrated solutions in new industrial facilities with large production capacity.
The company has as its mission developing aerostructure comprehensive programs getting involved with excellence in quality & planning requirements for the aerospace industry worldwide.
SOFITEC works with the main OEM’s in the sector: Airbus, Embraer, Bombardier and TIER1’s such as Spirit Aerosystems and Premium AEROTEC, between others. 100% of SOFITEC turnover comes from aeronautical products and services. There are 4.968 different P/N manufactures.

UTRC

United Technologies Research Center (UTRC) delivers advanced technologies to the businesses of United Technologies Corporation (UTC) – a diversified company that provides a broad range of high technology products and services to the global aerospace and building systems industries. Founded in 1929, UTRC engages with UTC business units and external research organisations globally to pursue research and develop innovative technologies that meet and anticipate marketplace needs.

UTRC's headquarters is in East Hartford, Connecticut (U.S.), with an office in Berkeley, California, and research and development centers in Shanghai, China and Cork, Ireland. United Technologies Research Centre Ireland, Ltd. (UTRC-I) was established in 2009, and conducts research into the next generation of energy and security systems for high-performance buildings, generating world-class technologies for UTC's commercial businesses worldwide. Its mission is to create a strategic technological development presence in European markets. In 2011, Europe accounted for 26% of UTC revenues and a significant share of its manufacturing and design activities.

UTRC-I has been actively involved in several EU-funded research projects (FP7 and H2020), mainly in the security, energy, and aerospace areas. In the SHERLOCK project, UTRC-I will lead the piloting activities, as well as hosting one of the project's industrial pilots. In particular, UTRC-I will contribute to formulating manufacturing challenges for the project, providing use cases, developing several modules of Human Robot Collaborative workstation and helping to validate them.

VDL

VDL Industrial Modules is a subsidiary within the VDL Group. VDL Group, headquartered in Eindhoven, the Netherlands, is an international industrial family business with 104 operating companies, spread throughout 20 countries, with 20.000+ employees. The combined annual turnover in 2018 was 5.991 billion euros. The VDL companies break down into four divisions: Subcontracting, Car Assembly, Buses and Coaches and Finished products. Today, VDL Group is a major player in the subcontracting and semi-finished products sectors, produces its own finished products such as suspension systems, is active in automotive factory automation, builds heat exchangers and container handling systems, and the family business owns VDL Nedcar in Born, the Netherlands' only large passenger car assembly factory, which carries out assembly line production of cars for third parties.

VDL Industrial Modules has the ambition to be a premium sub-contractor in the field of module- and system supply. VDL Industrial Modules wants to be recognized

as a solid partner for development and production of premium modules and systems. VDL Industrial Modules is a contract-developer / contract-manufacturing firm supplying technical parts, modules and systems to OEM's. Development, production and assembly are in-house competences therefor information exchange and sharing is effective and swift with all benefits for the customer. VDL Industrial Modules supplies small to mid-range series for various markets. In addition to this VDL Industrial Modules offers in-house application expertise in field of: "Energy Storage ; dosing & weighing; heating & cooling, precision frames & covering".

SHERLOCK CONSORTIUM

LMS Laboratory for Manufacturing Systems & Automation
Project Coordinator

COMAU

VDL

United Technologies Research Center

sofitec

FIDIA

PILZ THE SPIRIT OF SAFETY

GIZELIS ROBOTICS

INTRASOFT INTERNATIONAL

LIGHT & SHADOWS THINK BEYOND REALITY

tecnalia Inspiring Business

Fraunhofer IPK

Cranfield University

UCD DUBLIN

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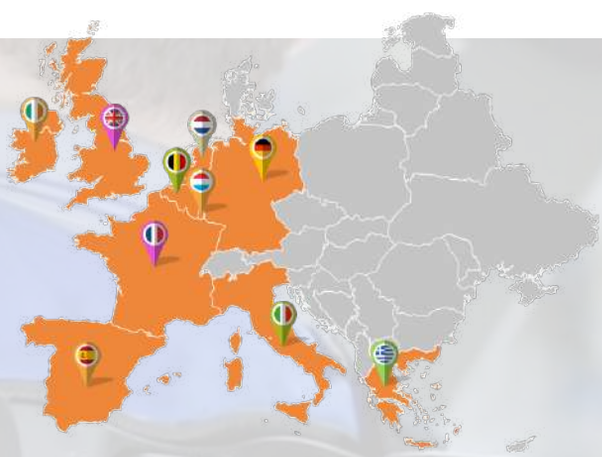

Contact us:

Project Coordinator
Laboratory for Manufacturing Systems and Automation (LMS)

sherlock@lms.mech.upatras.gr

Website: www.sherlock-project.eu

Social Media:

@sherlockh2020 | @sherlockh2020 | @SherlockH2020 | Sherlock H2020 Project

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