H2020 – The EU framework programme for Research and Innovation (2014-2020)

Robotics projects resulting from H2020 – LEIT ICT-25&26&35-2016

Project Summaries

December 2016

Results of the Call for Proposals: H2020 – LEIT ICT 25&26&35-2016

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Project summaries may be edited for space reasons. First-named participant is the Co-ordinator and funding amounts are approximate.
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Robotics in Workprogramme 2016 – LEIT ICT 25 2016

H2020-ICT-25-2016: Advanced robot capabilities research and take-up Opening date: 20th October 2015 Deadline: 12th April 2015	**Funding Scheme / Funding rate**	**Budget (M€)**
a. Research & Innovation Actions addressing generic advances and technical capabilities: Open, generic forward-looking research into novel technical advances in robotics – open to all robotics-related research topics and disciplines. Proposals are expected to address technical topics which cut across application domains and which can be developed further with a view to achieving high future impact on markets or societal sectors in Europe. **b. Research & Innovation Actions** addressing generic advances and technical capabilities: Technology research and development to achieve step changes in the capabilities of the following high priority RAS technologies: systems development, human-robot interaction, mechatronics, perception, navigation and cognition. Step changes are sought through either a multiplicative improvement in technical capability, for example achieving a difference in order of magnitude in the number of everyday objects a robot can recognise or handle, or a categorical advance, for example moving from rigid to intuitive human-robot interfaces. c. **Innovation Actions** driven by end users: Improving the deployment prospects of RAS through end user-driven application developments in domains and application areas with significant market potential. Proposals are expected to address system development beyond TRL 5. d. **Innovation Actions** driven by end users: Filling technology or regulatory gaps through end user-driven innovation actions, where the gap represents a challenging market entry barrier. Proposals are expected to address a gap in either technical capability or system ability. The targeted gap and the required steps to tackle the gap must be clearly identified in the proposal.	a. Small contributions/100% b. Small contributions/100% c. Small contributions/70% d. Small contributions/70%	a. and b. 15 c. and d. 15

An.Dy

Title: Advancing Anticipatory Behaviors in Dyadic Human-Robot Collaboration
Funding scheme: Research & Innovation action (25) **Project number:** 731540
Duration: 48 months **Maximum grant awarded: €** 3,950,025.00

Summary:
Recent technological progress in robot physical interaction permitted robots to actively and safely share with human a common workspace. Thanks to these technologies, Europe nowadays leads the robotic market in the niche of safety certified robots by endowing them with the ability to react to unintentional contacts. ANDY leverages these technologies and strengthens the European leadership by endowing robots with the ability to control physical collaboration through intentional interaction. These advances necessitate progresses along three main directions: measuring, modelling and helping humans engaged in intentional collaborative physical tasks. First, ANDY will innovate the way of measuring human whole-body motions developing the ANDYSUIT, a wearable force and motion tracking technology. Second, ANDY will develop the ANDYMODEL, a technology to learn cognitive models of human behaviour in collaborative tasks. Third, ANDY will propose the ANDYCONTROL, an innovative technology for helping humans through predictive physical collaboration. ANDY will accelerate take-up and deployment by validating its progresses in realistic scenarios. In the first validation scenario the robot is identified with an industrial collaborative robot (i.e. robot=cobot) which adapts its ergonomy to individual workers. In the second validation scenario the robot is identified with an assistive exoskeleton (i.e. robot=exoskeleton) optimizing human comfort and reducing physical stress. In the third validation scenario the robot is identified with a humanoid (i.e. robot=humanoid) offering assistance to a human while maintaining the balance of both.

Participants:

FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA	IT
INSTITUT NATIONAL DE RECHERCHE ENINFORMATIQUE ET AUTOMATIQUE	FR
INSTITUT JOZEF STEFAN	SI
DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	DE
XSENS TECHNOLOGIES B.V.	NL
IMK AUTOMOTIVE GMBH	DE
OTTO BOCK HEALTHCARE GMBH	DE
AnyBody Technology A/S	DK

BADGER

Title: RoBot for Autonomous unDerGround trenchless opERations, mapping and navigation
Funding scheme: Research and Innovation action (25) **Project number:** 731968
Duration: 36 months **Maximum grant awarded: €** 3,698,003.50

Summary:
The goal of the proposed project is the design and development of the BADGER autonomous underground robotic system that can drill, manoeuvre, localise, map and navigate in the underground space, and which will be equipped with tools for constructing horizontal and vertical networks of stable bores and pipelines. The proposed robotic system will enable the execution of tasks that cut across different application domains of high societal and economic impact including trenchless constructions, cabling and pipe installations, geotechnical investigations, large-scale irrigation installations, search and rescue operations, remote science and exploration, and defence applications. For this purpose, BADGER will deliver a highly innovative robotic system by integrating research into all required novel technical advances. BADGER will integrate innovative mechatronic concepts with robust industrial drilling tools to yield advanced manoeuvrability and motion capability; will integrate perception, localisation and mapping techniques in order to sense map and interpret the surrounding underground environment; the system will merge collected underground data with legacy digital maps to plan and track the motion of the robot with respect to physical landmarks. The robotic system actions and reactions will be governed by the cognition component which makes decisions on task execution, path planning and motion planning. Finally, the robotic system will be capable to manage and intelligently combine the massive data gathered during underground operation so as to continuously improve its perception and cognition abilities whilst also providing human users the means to store, process and analyse this data, thus enabling the efficient off-line planning and on-line remote monitoring and control of the overall operation process.

Participants:

UNIVERSIDAD CARLOS III DE MADRID	ES
UNIVERSITY OF GLASGOW	UK
ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS	EL
IDS GEORADAR SRL	IT
SINGULARLOGIC ANONYMI ETAIREIA PLIROFORIAKON SYSTIMATON KAI EFARMOGON PLIROFORIKIS	EL
TRACTO TECHNIK GMBH & CO KG	DE
ROBOTNIK AUTOMATION SLL	ES

Co4Robots

Title: Achieving Complex Collaborative Missions via Decentralized Control and Coordination of Interacting Robots
Funding scheme: Research and Innovation action (25) **Project number:** 731869
Duration: 36 months **Maximum grant awarded: €** 3,820,956.25

Summary:
Imagine a scenario where multiple robots have been deployed to provide services such as object handling/transportation, or pickup and delivery operations. In such a context, different robots with varying capabilities must be coordinated in order to achieve various multi-tasking procedures. Thus, the effective supervision and coordination of the overall heterogeneous system mandates a decentralized framework that integrates high-level task-planning, low-level motion control and robust, real-time sensing of the robots' dynamic environment. Current practice is at a great deal based on offline, centralized planning and related tasks are usually fulfilled in a predefined manner: this does not utilize the capabilities of the system to operate efficiently in a dynamic environment. In most cases, sudden changes in the environment, the type of tasks, and the need for coordination, would cause the system to halt, ask for human intervention and restart. Despite the fact that public facilities are in some degree pre-structured, the need for a framework for decentralized, real-time, automated task (re)-planning is evident in a twofold manner: (i) it will pave the way to an improved use of resources and a faster accomplishment of tasks inside public facilities and workspaces with high social activity; (ii) it will make an important contribution towards the vision of more flexible multi-robot applications in both professional or domestic environments, also in view of the "Industry 4.0" vision and the general need to deploy such systems in everyday life scenarios. Within Co4Robots our goal is to build a systematic methodology to accomplish complex specifications given to a team of potentially heterogeneous robots; control schemes appropriate for the mobility and manipulation capabilities of the considered robots; perceptual capabilities that enable robots to localize themselves and estimate the state of the dynamic environment; and their systematic integration approach.

Participants:

KUNGLIGA TEKNISKA HOEGSKOLAN	SE
ROBERT BOSCH GMBH	DE
NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA	EL
PAL ROBOTICS SL	ES
FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	EL
GOETEBORGS UNIVERSITET	SE

CYBERLEGs Plus Plus

Title: The CYBERnetic LowEr-Limb CoGnitive Ortho-prosthesis Plus Plus
Funding scheme: Innovation action (25) **Project number:** 731931
Duration: 48 months **Maximum grant awarded: €** 4,285,200.00

Summary:
The global goal of the CYBERLEGs Plus Plus project is to validate the technical and economic viability of the powered robotic ortho-prosthesis developed within the framework of the FP7-ICT-CYBERLEGs project as a means to enhance/restore the mobility of transfemoral amputees and to enable them to perform locomotion tasks such as ground-level walking, walking up and down slopes, climbing/descending stairs, standing up, sitting down and turning in scenarios of real life. Restored mobility will allow amputees to perform physical activity thus counteracting physical decline and improving the overall health status and quality of life. This consortium will pursue the achievement of the global goal by addressing four specific innovation objectives. 1) Further developments of the existing CYBERLEGs hardware modules, namely the 2-degree-of-freedom active transfemoral prosthesis, the active wearable orthotic device, and the wearable sensory apparatus. 2) Further developments of the existing multi-layered CYBERLEGs control system, to enhance its reliable use in real-life scenarios. 3) Carrying out two multi-centre clinical studies that validate the therapeutic potentialities and the economic viability of a robotic ortho-prosthesis which restores the amputees' locomotion abilities in scenarios of activities of daily living. 4) Implementation of a 3-phase strategy to foster the start of the market exploitation within the time frame of the CLs++ project. This project focuses on the demonstration in an operational environment (TRL=7) from both the technical and economic viability view point of a modular robotics technology for healthcare, with the ultimate goal of fostering its market exploitation. The project involves players from academia, end users, as well as robotics and healthcare industry.

Participants:

SCUOLA SUPERIORE DI STUDI UNIVERSITARI E DI PERFEZIONAMENTO SANT'ANNA	IT
UNIVERSITE CATHOLIQUE DE LOUVAIN	BE
VRIJE UNIVERSITEIT BRUSSEL	BE
UNIVERZA V LJUBLJANI	SI
FONDAZIONE DON CARLO GNOCCHI ONLUS	IT
Össur hf	IS
IUVO SRL	IT

HEPHAESTUS

Title: Highly automatEd PHysical Achievements and PerformancES using cable roboTs Unique Systems
Funding scheme: Innovation action (25) **Project number:** 732513
Duration: 42 months **Maximum grant awarded: €** 3,984,542.50

Summary:
The project addresses novel concepts for introducing Robotics and Autonomous Systems in the Construction Sector where, at this moment, the presence is minor. Specifically, the Hephaestus project focuses on highly risked and critical construction tasks such as prefab wall installation. In that sense, the Hephaestus has been conceived as a solution for accomplishing multiple tasks on vertical or inclined planes of the built and outdoor environment. For that purpose, the Hephaestus is mainly based on a cable-driven robot and a modular end effector kit. This modular kit can host several tools and devices and therefore we can say it is multifunctional. Among the functionalities, the research project will achieve tasks such as 3D laser scanning of the building structure and the posterior installation of the prefab wall. But we can foresee some other performances such as the cleaning and maintenance of the curtain wall, repair of cracks and painting. The apparatus of the Hephaestus is lean, compatible with other handling systems, highly versatile and its reachability is very broad. Moreover, the controlling system would offer and easy and fast calibration. For achieving this goal, matrix based design methods will be used. It basically consists on decomposing a complex solution, such as the Hephaestus, into interdependent subsystems that can be feasible to solve. Certainly, the integration and adaptation of several technologies into the Hephaestus will be carried out with a systematic approach that will facilitate the election, adjustment and development of suitable tools. This project envisages continuous techno-economical assessment, which includes several tests in real conditions where prototypes of the cable-robot and the modular end effector kit will be demonstrated. As an output of the research, the well balanced consortium and its interdisciplinary expertise will offer a realistic solution to cover primordial needs of the Built Environment and Construction sector.

Participants:

FUNDACION TECNALIA RESEARCH & INNOVATION	ES
TECHNISCHE UNIVERSITAET MUENCHEN	DE
FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	DE
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	FR
CEMVI CATENA ELEVACION MANUTENCION VICINAY SA	ES
NLINK AS	NO
FOCCHI SPA	IT
ACCIONA INFRAESTRUCTURAS S.A.	ES
R2M SOLUTION LTD	UK

REFILLS

Title: Robotics Enabling Fully-Integrated Logistics Lines for Supermarkets
Funding scheme: Research & Innovation action (25) **Project number:** 731590
Duration: 42 months **Maximum grant awarded: €** 3,692,850.00

Summary:
While online grocery stores are expanding, supermarkets continue to provide customers with the sensory experience of choosing goods while walking between display shelves. Therefore, retail and logistics companies are concerned with making the shopping experience more comfortable and exciting while, at the same time, using technology to reduce costs and improve efficiency. The REFILLS project aims at developing robotic systems able to address the in-store logistics needs of the retail market. Three scenarios building on top of each other are considered. In the 1st scenario, mobile robots inspect shelves and generate semantic environment maps for layout identification and store monitoring. The 2nd scenario employs robot arms for autonomous sorting of articles in the backroom and for assisting human clerks with shelf refilling in the shop. In the 3rd scenario, the autonomy of the robot is strengthened, resulting in a robotic clerk capable of manipulating articles varying in shape, surface, fragility, stiffness and weight, and refill shelves without human intervention. These scenarios trigger a number of research and technology challenges that are tackled within REFILLS. Information on the supermarket articles is exploited to create powerful knowledge bases, which are used by the robots to identify shelves, recognize missing or misplaced articles, handling them and navigate the shop. Reasoning allows robots to cope with changing task requirements and contexts, and perception guided reactive control makes them robust to execution errors and uncertainty. A modular approach is adopted for the design of cost-efficient robotic units. The work plan will generate exploitable results through three integration and evaluation phases. A final demonstration will take place at a real retail store. In sum, REFILLS is committed to generating wide impact in the retail market domain and beyond through the development of efficient logistics solutions for professional use in supermarkets.

Participants:

C.R.E.A.T.E. CONSORZIO DI RICERCA PER L'ENERGIA L AUTOMAZIONE E LE TECNOLOGIE DELL'ELETTROMAGNETISMO	IT
DM-DROGERIE MARKT GMBH+CO. KG	DE
INTEL ISRAEL (74) LTD	IL
KUKA ROBOTER GMBH	DE
SECONDA UNIVERSITÀ DEGLI STUDI DI NAPOLI	IT
SWISSLOG AG	CH
UNIVERSITAET BREMEN	DE

ROPOD

Title: Ultra-flat, ultra-flexible, cost-effective robotic pods for handling legacy in logistics
Funding scheme: Innovation action (25) **Project number:** 731848
Duration: 36 months **Maximum grant awarded: €** 3,494,825.00

Summary:
The market for automatically guided vehicles in logistic applications is growing rather slowly in spite of the market potential that has been forecasted. There are markets and applications, which literally cry for automation by AGVs not only for economic, but also for social reasons: hospitals and care facilities. Irrespective of the burning needs there are major barriers, however, which prevent such automation. Two of them are cost and legacy in existing logistic solutions. Today's hospital logistic robots are bulky, heavy, and with a price of 50+ KEUR for a single vehicle they are very expensive. At the same time these AGVs are often highly specialized and can only deal with few containers or supply carts. In a typical logistic environment there are however, dozens of different containers and such carts. In a nutshell there is a bad need for AGVs, which are low-cost and can deal with a great variety of legacy. The general objective of this project is to develop and implement a disruptive concept for AGVs that lowers the still existing barrier in logistics by offering
* cost-effective, automated or semi-automated indoor transportation of goods,
* while coping with existing legacy in terms of size, shape, and weight of goods and containers,
* without imposing disruptive changes in existing logistic solutions, such as rebuilding entire warehouses or switching to new containers or storage technology.
We will put an equal emphasis on cost-effective as well as on human-friendly automation of logistic tasks. While cost-effectiveness shall be achieved by preferably using and adapting technology designed for mass-markets, human friendliness shall be achieved by equipping the AGVs with a (semi-)autonomous shared control mode, in which the robot serves as a force amplifier for the human user and thereby reduces the physical strain on the user.

Participants:

Hochschule Bonn-Rhein-Sieg	DE
KATHOLIEKE UNIVERSITEIT LEUVEN	BE
TECHNISCHE UNIVERSITEIT EINDHOVEN	NL
AGAPLESION FRANKFURTER DIAKONIE KLINIKEN GEMEINNUTZIGE GMBH	DE
SPECIAAL MACHINEFABRIEK KETELS VOF	NL
LOCOMOTEC GMBH	DE

VERSATILE

Title: Innovative robotic applications for highly reconfigurable production lines
Funding scheme: Innovation action (25) **Project number:** 731330
Duration: 36 months **Maximum grant awarded:** € 3,479,631.75

Summary:
The recent trends of mass customization of products and lean approaches impacts production by a drastic reduction of production lot sizes. However, traditional automation and robotics fail to be competitive in such a context since all individual product variant would require a complete automation project. In addition, keeping up with the introduction of robots outside of the traditional sectors require to automate much more complex manual tasks, where again traditional robotics automation fails to provide a good ratio of cost vs robustness, mainly due to the rigidity of existing production equipment in terms of programming and tools The overall objective of the project is to provide a bridge for transferring, demonstrating and validating the latest R&D results in robotics towards different industrial environments proving their applicability and effectiveness. More specifically, VERSATILE will apply dual arm robots in executing complex tasks that are traditionally assigned to humans due to their manipulation requirements. By providing the tools to quickly setup, program and operate innovative robotic systems the end user will have robotic cells flexible enough to automatically adapt to the high number of products variants. In this context the project will focus on advancing the TRL level of the latest developments in the areas of: 1) Perception for Operation in semi-structured environment 2) Easy Programming framework to improve the re-configurability/ programmability of the robotic systems 3) Mobile dual-arm robotics manipulation capabilities 4) Open frameworks for the 'Plug and Produce' based coordination of these resources This will be investigated in three industry driven use cases including both static and mobile dual arm robots. The project will focus on three main applications: a) Automotive: assembly of vehicle dashboards at PSA b) Aerospace: assembly of aircraft wing parts at AIRBUS c) Consumer goods: handling and packaging of shaver handles at BIC.

Participants:

FUNDACION TECNALIA RESEARCH & INNOVATION	ES
PEUGEOT CITROEN AUTOMOBILES S.A.	FR
AIRBUS OPERATIONS SL	ES
VIOLEX BIC ABEE ANONIMOS BIOMICHANIKI KAI EMPORIKI ETAIRIA	EL
COMAU SPA	IT
DGH ROBOTICA, AUTOMATIZACION Y MANTENIMIENTO INDUSTRIAL SA	ES
INTERMODALICS BVBA	BE
PANEPISTIMIO PATRON	EL
UNIVERSITE DE MONTPELLIER	FR

Robotics in Workprogramme 2016 – LEIT ICT 26 2016

H2020-ICT-26-2016: System abilities, development and pilot installations Opening date: 20th October 2015 Deadline: 12th April 2015	**Funding Scheme / Funding rate**	**Budget (M€)**
a. Research & Innovation Actions on system abilities: Research & Innovation Actions will focus on advancing the state of the art in the level of smart robotics system abilities. The focus is on the technical challenges; research actions will address cross cutting technology issues that will make a significant contribution to the needs of applications and domains with the highest impact on markets. Proposals are expected to address at least one or a combination of the following prioritised abilities: robot dependability, social interaction ability and cognitive ability. **b. Research & Innovation Actions** on multiple-actor systems: This action focuses on developing advanced multiple-actor systems utilising actors which can operate individually, as members of a team and within a network of other assets in semi-structured, unstructured, dynamic or harsh environments. The system operates through the interaction of diverse independent actors and needs to be robust against errors or the inaction of any specific actor. Proposed multiple-actor systems are expected to demonstrate autonomy over an extended time scale and clearly identify service level gains (compared with current systems) in the application area chosen by the proposal. Systems must be built around identified end user needs and performance should be measured using relevant end user metrics. **c. Innovation Actions** on systems development technology: The action will address the open development and dissemination of integrated sets of tool chains and building-block applications which support the construction of complex robotics systems. This will result in a European-level ecosystem of development tools using commonly agreed ways of describing robot systems and system building blocks and their interaction. The ecosystem should be flexible and able to accommodate a diverse range of end application requirements in a broad range of different domains. Proposals must aim at developing such an ecosystem, provide mechanisms for its dissemination and stimulate community engagement in its development and	a. Small contributions/100% b. Small & Large contributions/100% c. Large contributions/70% d. Large contributions/70%	a. and b. 24 c. and d. 18

	subsequent deployment. Key to the success of this action will be support for modularity, composability, re-usability, ease of use and the adoption of existing and emerging standards within both the system and its components. The action is also expected to build on existing systems and structures. The action may involve financial support to third parties in line with the conditions set out in Part K of the General Annexes. The consortium will define the selection process of additional users and suppliers for which financial support will be granted (typically in the order of EUR 50.000 – 250.000 per party). Minimum 50% of the EU funding requested by the proposal should be allocated to the purpose of financial support to third parties.		
d.	**Innovation Actions** on pilot installations for robot testing: The action will develop and deploy access mechanisms and supporting infrastructure for single-site pilot installations outside the laboratory for robot testing, based on the needs of end users. Proposals will build on an installation supported through existing EU, regional, national or commercial funding to develop a European accessible facility prioritised against emerging market domains and application areas. In order to ensure real-world conditions, these pilot installations will be based on existing infrastructures such as farms, hospitals / care homes, mines, nuclear sites, undersea sites, collapsed buildings etc. The proposed access mechanisms and infrastructure should provide a low access threshold for SMEs, public bodies and research organisations. Proposals are expected to provide a support infrastructure including as a minimum: instrumentation of the site; simulation support to allow off-site testing; access to the end user and local site experts, and metrics relating to the functional goals of the end user. The proposal should also address safety certification processes, the development of appropriate performance evaluation measures and application-specific benchmarks. The proposal should identify application-relevant standards and, where relevant, the types of human interaction expected, including the level of social interaction. The action may involve financial support to third parties in line with the conditions set out in Part K of the General Annexes. The consortium will define the selection process of additional users and suppliers running the experiments to access the installation for which financial support will be granted (typically in the order of EUR 50.000 –		

150.000 per party). Minimum 60% of the EU funding requested by the proposal should be allocated to the purpose of financial support to third parties. Third party support is expected to cover the development of end user solutions for use at the pilot installation as well as the development of related service-side support that would enable the deployment of the end user application. The Commission considers that Pilot installation proposals requesting a contribution from the EU of between EUR 7 and 10 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. At least one action will be supported within pilot installations for robot testing.		

Dreams4Cars

Title: Dream-like simulation abilities for automated cars
Funding scheme: Research and Innovation action (26) **Project number:** 731593
Duration: 36 months **Maximum grant awarded: €** 4,302,865.00

Summary:
Dreams4Cars takes inspiration from the Simulation Hypothesis of Cognition – notably in the sense of Hesslow – and in particular from the idea that thoughts are chains of simulated actions and simulated perceptions. The main objective of Dreams4Cars is to set up an offline simulation mechanism in which robots, by recombining aspects of real-world experience, can produce an emulated world, with which they can collectively interact to safely develop and improve their Perception-Action systems, in particular focusing on the analysis of rare events. The Perception Action systems trained by simulations in this way will then be used for sensorimotor control in real interactions. The application domain of Dream4Cars is automated driving, which – besides being a major economic sector for the EU – also poses the issue of developing systems capable of dealing with arbitrary and open-ended circumstances. Accidents are rare events and, to demonstrate that autonomous systems are safe enough (i.e. significantly safer than humans – which is not achieved today at high and full automation levels), extensive field operation tests would normally be required. The solution offered by Dreams4Cars, by focusing on variations of much more frequent near miss accidents, can develop safe behaviours for hypothetical/unexperienced situations. Hence Dream4Cars will contribute by solving both the problem of discovering critical situations and the problem of updating safely the software. Dreams4Cars will compare the driving agents evolved by the simulation technology to a baseline agent which will have the same State of the Art skills developed by the latest EU project in driving automation (AdaptIVe), hence concretely verifying the added value of the robotic technology (with target TRL 6).

Participants:

UNIVERSITA DEGLI STUDI DI TRENTO	IT
HOGSKOLAN I SKOVDE	SE
MIDDLESEX UNIVERSITY HIGHER EDUCATION CORPORATION	UK
THE UNIVERSITY OF SHEFFIELD	UK
DEUTSCHES FORSCHUNGSZENTRUM FUR KUNSTLICHE INTELLIGENZ GMBH	DE
HEICH CONSULT GMBH	DE
CENTRO RICERCHE FIAT SCPA	IT

ILIAD

Title: Intra-Logistics with Integrated Automatic Deployment: safe and scalable fleets in shared spaces
Funding scheme: Research & Innovation action (26) **Project number:** 732737
Duration: 48 months **Maximum grant awarded: €** 6,987,715.36

Summary:
Today, intra-logistic services have to respond quickly to changing market needs, unforeseeable trends and shorter product life cycles. These drivers pose new demands on intra-logistic systems to be highly flexible, rock-solid reliable, self-optimising, quickly deployable and safe yet efficient in environments shared with humans. ILIAD will enable the transition to automation of intra-logistic services with key stakeholders from the food distribution sector, where these challenges are particularly pressing. We will develop robotic solutions that can integrate with current warehouse facilities, extending the state of the art to achieve self-deploying fleets of heterogeneous robots in multiple-actor systems; life-long self-optimisation; manipulation from a mobile platform; efficient and safe operation in environments shared with humans; and efficient fleet management with formal guarantees. Scientifically, ILIAD pursues ambitious goals for complex cognitive systems in human environments beyond a specific use-case. We will overcome limitations in the state of the art in tracking and analysing humans; quantifying map quality and predicting future states depending on activity patterns inferred from long-term observations; planning of socially normative movements using learned human models; integration of task allocation, coordination and motion planning for heterogeneous robot fleets; and systematically studying human safety in mixed environments, providing a foundation for future safety standards. Our consortium is uniquely placed to tackle these challenges and to maximise exploitation beyond the project's duration. It includes partners with a proven track record in all key research areas, leading technology providers for intra-logistics, end users that are leading in their respective markets, and the National Centre for Food Manufacturing at partner UoL, facilitating access to realistic test sites. This mix of partners will ensure a very high impact of the project results.

Participants:

OREBRO UNIVERSITY	SE
UNIVERSITY OF LINCOLN	UK
UNIVERSITA DI PISA	IT
GOTTFRIED WILHELM LEIBNIZ UNIVERSITAET HANNOVER	DE
ROBERT BOSCH GMBH	DE
KOLLMORGEN AUTOMATION AB	SE
ACT OPERATIONS RESEARCH IT SRL	IT
Orkla Foods Sverige AB	SE
LOGISTIC ENGINEERING SERVICES LTD	UK

IMAGINE

Title: Robots Understanding Their Actions by Imagining Their Effects
Funding scheme: Research & Innovation action (26) **Project number:** 731761
Duration: 48 months **Maximum grant awarded: €** 3,797,050.00

Summary:
Today's robots are good at executing programmed motions, but they do not understand their actions in the sense that they could automatically generalize them to novel situations or recover from failures. IMAGINE seeks to enable robots to understand the structure of their environment and how it is affected by its actions. "Understanding" here means the ability of the robot (a) to determine the applicability of an action along with parameters to achieve the desired effect, and (b) to discern to what extent an action succeeded, and to infer possible causes of failure and generate recovery actions. The core functional element is a generative model based on an association engine and a physics simulator. "Understanding" is given by the robot's ability to predict the effects of its actions, before and during their execution. This allows the robot to choose actions and parameters based on their simulated performance, and to monitor their progress by comparing observed to simulated behaviour. This scientific objective is pursued in the context of recycling of electromechanical appliances. Current recycling practices do not automate disassembly, which exposes humans to hazardous materials, encourages illegal disposal, and creates significant threats to environment and health, often in third countries. IMAGINE will develop a TRL-5 prototype that can autonomously disassemble prototypical classes of devices, generate and execute disassembly actions for unseen instances of similar devices, and recover from certain failures. For robotic disassembly, IMAGINE will develop a multi-functional gripper capable of multiple types of manipulation without tool changes. IMAGINE raises the ability level of robotic systems in core areas of the work programme, including adaptability, manipulation, perception, decisional autonomy, and cognitive ability. Since only one-third of EU e-waste is currently recovered, IMAGINE addresses an area of high economical and ecological impact.

Participants:

UNIVERSITAET INNSBRUCK	AU
GEORG-AUGUST-UNIVERSITAT GOTTINGENSTIFTUNG OFFENTLICHEN RECHTS	DE
KARLSRUHER INSTITUT FUER TECHNOLOGIE	DE
INSTITUT NATIONAL DES SCIENCES APPLIQUEES DE RENNES	FR
AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS	ES
BOGAZICI UNIVERSITESI	TR
ELECTROCYCLING GMBH	DE

MoveCare

Title: Multiple-actOrs Virtual Empathic CARgiver for the Elder
Funding scheme: Research and Innovation action (26) **Project number:** 732158
Duration: 36 months **Maximum grant awarded: €** 5,933,611.25

Summary:
MoveCare develops and field tests an innovative multi-actor platform that supports the independent living of the elder at home by monitoring, assist and promoting activities to counteract decline and social exclusion. It comprises 3 hierarchical layers: 1) A service layer provides monitoring and intervention. It endows objects of everyday use with advanced processing capabilities and integrates them in a distributed pervasive monitoring system to derive degradation indexes linked to decline. 2) A context-aware Virtual Caregiver, embodied into a service robot, is the core layer. It uses artificial intelligence and machine learning to propose to the elder a personalized mix of physical/cognitive/social activities as exergames. It evaluates the elder status, detects risky conditions, sends alerts and assists in critical tasks, in therapy and diet adherence. 3) The users' community strongly promotes socialization acting as a bridge towards the elders' ecosystem: other elders, clinicians, caregivers and family. Gamification glues together monitoring, lifestyle, activities and assistance inside a motivating and rewarding experience. Off-the-shelf components are assembled in a robust and reliable way to get a low-cost multi-actor IP-domotic platform that can be massively deployed at elders home. The use of software/hardware standards assures interoperability and makes MoveCare adaptable to utmost novel components. Full configurability, personalization, adaptation to elder needs applies to all components to maximize elder compliance, even when computer illiterate. On-field testing starting early in the project assures an implementation iterative approach involving all actors. MoveCare identifies functional and technical metrics to characterize and evaluate the system by means of improvement in its abilities as described by the Multi-Annual Roadmap. The metrics lead to the definition of an evaluation framework transferrable to other fields.

Participants:

UNIVERSITA DEGLI STUDI DI MILANO	IT
AB.ACUS SRL	IT
FONDAZIONE IRCCS CA' GRANDA - OSPEDALE MAGGIORE POLICLINICO	IT
FUNDACIO EURECAT	ES
JOICECARE AB	SE
SIGNALGENERIX LTD	CY
POLITECNICO DI MILANO	IT
SMART COM DOO INFORMACIJSKI IN KOMUNIKACIJSKI SISTEMI	SI
CONSEJERIA DE SANIDAD Y POLITICAS SOCIALES - JUNTA DE EXTREMADURA	ES
OREBRO UNIVERSITY	SE
UNIVERSITY OF PLYMOUTH	UK
UNIVERSIDAD DE MALAGA	ES
THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD	UK
KORIAN	FR

MULTIDRONE

Title: MULTIple DRONE platform for media production
Funding scheme: Research and Innovation action (26) **Project number:** 731667
Duration: 36 months **Maximum grant awarded: €** 5,306,536.25

Summary:
MULTIDRONE aims to develop an innovative, intelligent, multi-drone platform for media production to cover outdoor events, which are typically held over wide areas (at stadium/city level). The 4-10 drone team, to be managed by the production director and crew, will have: a) increased decisional autonomy, by minimizing production crew load and interventions and b) improved robustness, security and safety mechanisms (e.g., embedded flight regulation compliance, enhanced crowd avoidance, autonomous emergency landing, communications security), enabling it to carry out its mission even against adverse conditions or crew inaction and to handle emergencies. Such robustness is particularly important, as the drone team has to operate close to crowds and may face an unexpected course of events and/or environmental hazards. Therefore, it must be contextually aware and adaptive with improved perception of crowds, individual people and other hazards. As this multi-actor system will be heterogeneous, consisting of multiple drones and the production crew, serious human-in-the-loop issues will be addressed to avoid operator overload, with the goal of maximizing shooting creativity and productivity, whilst minimizing production costs. Overall, MULTIDRONE will boost research on multiple-actor systems by proposing novel multiple-actor functionalities and performance metrics. Furthermore, the overall multidrone system will be built to serve identified end user needs. Specifically, innovative, safe and fast multidrone audio-visual shooting will provide a novel multidrone cinematographic shooting genre and new media production techniques that will have a large impact on the financially important EU broadcasting/media industry. It will boost production creativity by allowing the creation of rich/novel media output formats, improving event coverage, adapting to event dynamics and offering rapid reaction speed to unexpected events.

Participants:

UNIVERSITY OF BRISTOL	UK
THALES COMMUNICATIONS & SECURITY SAS	FR
ARISTOTELIO PANEPISTIMIO THESSALONIKIS	EL
UNIVERSIDAD DE SEVILLA	ES
DEUTSCHE WELLE	DE
RAI-RADIOTELEVISIONE ITALIANA SPA	IT
BRITISH BROADCASTING CORPORATION	UK
ALERION	FR
ASSOCIACAO DO INSTITUTO SUPERIOR TECNICO PARA A INVESTIGACAO E DESENVOLVIMENTO	PT

RobMoSys

Title: Composable Models and Software for Robotics Systems
Funding scheme: Innovation action (26) **Project number:** 732410
Duration: 48 months **Maximum grant awarded: €** 8,000,000.00

Summary:
RobMoSys will coordinate the whole community's best and consorted effort to build an open and sustainable, agile and multi-domain European robotics software ecosystem. RobMoSys envisions an integration approach built on-top-of, or rather around, the current code-centric robotic platforms, by means of the systematic application of model-driven methods and tools that explicitly focus on (system of-) system integration. As proven in many other engineering domains, model-driven approaches are the most suitable approach to manage integration that is intended to be "all-inclusive" with respect to technologies and stakeholder groups. RobMoSys will enable the management of the interfaces between different roles (robotics expert, domain expert, component supplier, system integrator, installation and deployment, operation) and separated concerns in an efficient and systematic way by making the step change to a set of fully model-driven methods and tools for engineering robotics systems. RobMoSys will drive the non-competitive part of building the eco-system aiming at turning community involvement into active support for an ecosystem of professional quality and scope. It will provide, based on broad involvement via two Open Calls, important concretizations for many of the common robot functionalities (sensing, planning, control in the broad sense). It will fulfil two complementary missions: (1) establish a common methodology enabling a composition-oriented approach to address complexity in robotics and face the integration burden caused by type diversity, target diversity and platform diversity; (2) stimulate and boost an ecosystem of methodology-based toolchains that supports the interaction of separated roles. RobMoSys is designed for widest inclusion - from the very beginning and throughout the overall course of the project - of the expertise and body of knowledge of the robotics community and of related relevant technology and application domains (Tier-1 concept).

Participants:

COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	FR
FACHHOCHSCHULE ULM	DE
KATHOLIEKE UNIVERSITEIT LEUVEN	BE
TECHNISCHE UNIVERSITAET MUENCHEN	DE
SIEMENS AKTIENGESELLSCHAFT	DE
PAL ROBOTICS SL	ES
COMAU SPA	IT
ECLIPSE FOUNDATION EUROPE GMBH	DE
EUNITED AISBL	BE

ROSIN

Title: ROS-Industrial quality-assured robot software components
Funding scheme: Innovation action (26) **Project number:** 732287
Duration: 48 months **Maximum grant awarded: €** 7,504,236.25

Summary:
ROSIN will create a step change in the availability of high-quality intelligent robot software components for the European industry. This is achieved by building on the existing open-source "Robot Operating System" (ROS) framework and leveraging its worldwide community. ROS and its subsidiary ROS-Industrial (European side led by TU Delft and Fraunhofer) is well-known, but its European industrial potential is underestimated. The two main critiques are (1) is the quality on par with industry, and (2) is there enough European industrial interest to justify investing in it? Partially, the answer is "yes and yes"; ample industrial installations are already operational. Partially however, the two questions hold each other in deadlock, because further quality improvement requires industrial investment and vice versa. ROSIN will resolve the deadlock and put Europe in a leading position. For software quality, ROSIN introduces a breakthrough innovation in automated code quality testing led by IT University Copenhagen, complemented with a full palette of quality assurance measures including novel model-in-the-loop continuous integration testing with ABB robots. Simultaneously, more ROS-Industrial tools and components will be created by making 50% of the ROSIN budget available to collaborating European industrial users and developers for so-called Focused Technical Projects. ROSIN maximizes budget efficacy by alleviating yet another deadlock; experience shows that industry will fund ROS-Industrial developments, but only after successful delivery. ROSIN provides pre-financing for developers which will be recovered into a future revolving fund to perpetuate the mechanism. Together with broad education activities (open for any EU party) led by Fachhochshule Aachen and community building activities led by Fraunhofer, ROSIN will let ROS-Industrial reach critical mass with further self-propelled growth resulting in a widely adopted, high-quality, open-source industrial standard.

Participants:

TECHNISCHE UNIVERSITEIT DELFT	NL
FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	DE
IT-UNIVERSITETET I KOBENHAVN	DK
FACHHOCHSCHULE AACHEN	DE
FUNDACION TECNALIA RESEARCH & INNOVATION	ES
ABB AB	SE
UNIVERSITAET ZUERICH	CH

SMARTsurg

Title: SMart weArable Robotic Teleoperated Surgery
Funding scheme: Research and Innovation action (26) **Project number:** 732515
Duration: 36 months **Maximum grant awarded:** € 3,990,206.25

Summary:
Robot-assisted minimally invasive surgery (RAMIS) offers many advantages when compared to traditional MIS, including improved vision, precision and dexterity. While the popularity of RAMIS is steadily increasing, the potential for improving patient outcomes and penetrating into many procedures is not fully realised, largely because of serious limitations in the current instrumentation, control and feedback to the surgeon. Specifically, restricted access, lack of force feedback, and use of rigid tools in confined spaces filled with organs pose challenges to full adoption. We aim to develop novel technology to overcome barriers to expansion of RAMIS to more procedures, focusing on real-world surgical scenarios of urology, vascular surgery, and soft tissue orthopaedic surgery. A team of highly experienced clinical, academic, and industrial partners will collaborate to develop: i) dexterous anthropomorphic instruments with minimal cognitive demand ii) a range of bespoke end-effectors with embedded surgical tools using additive manufacturing methods for rapid prototyping and testing utilizing a user-centred approach, iii) wearable multi-sensory master for tele-operation to optimise perception and action and iv) wearable smart glasses for augmented reality guidance of the surgeon based on real-time 3D reconstruction of the surgical field, utilising dynamic active constraints and restricting the instruments to safe regions. The demonstration platform will be based on commercial robotic manipulators enhanced with the SMARTsurg advanced hardware and software features. Testing will be performed on laboratory phantoms with surgeons to bring the technology closer to exploitation and to validate acceptance by clinicians. The study will benefit patients, surgeons and health providers, by promoting safety and ergonomics as well as reducing costs. Furthermore, there is a potential to improve complex remote handling procedures in other domains beyond RAMIS.

Participants:

UNIVERSITY OF THE WEST OF ENGLAND, BRISTOL	UK
ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS	EL
POLITECNICO DI MILANO	IT
NORTH BRISTOL NATIONAL HEALTH SERVICE TRUST	UK
UNIVERSITY OF BRISTOL	UK
ISTITUTO EUROPEO DI ONCOLOGIA SRL	IT
IDIOTIKO POLIIATRIO ORTHOPAIDIKIS CHIROURGIKIS ATHLITIKON KAKOSEON KAI APOKATASTASIS ETAIRIA PERIORISMENI EFTHINIS	EL
CYBERNETIX	FR
OPTINVENT	FR
HYPERTECH INNOVATIONS LIMITED	UK

Enabling responsible ICT-related research and innovation LEIT ICT-35

H2020-ICT-35-2016/2017: Enabling responsible ICT-related research and innovation Opening date: 20th October 2015 Deadline: 12th April 2016	**Funding Scheme / Funding rate**	**Budget (M€)**
• **Research and Innovation Actions** should take a fresh look on the relationship between information and communication technologies, on the one hand, and social phenomena, on the other hand. They should contribute to ongoing ICT-driven research and innovation by providing best practice in collaborative research between SSH and ICT communities. The projects are expected to have direct relevance to ongoing ICT-related research and innovation, in particular in the area of robotics, cyber-physical systems, internet of things, big data and cybersecurity. From this wide range of issues, proposals are expected to focus on one or both of the following clusters: • How can we avoid the traps of ICTs ending up in isolating humans behind their screen, or harnessing them in a passive role? In the forthcoming hyperconnected era, it is essential to acknowledge the dual human aspirations for relationships and for freedom, and the dynamic nature of the relationships between humans and artefacts. • What are the conditions for ICT-enabled innovations to generate interesting and rewarding jobs, and reduce the risk of excluding sections of society from the labour market? What economic models can ensure a fair sharing of the created added value?	a. Small contributions/100%	a. 7.0

REELER

Title: Responsible Ethical Learning with Robotics
Funding scheme: Research and Innovation action **Project number:** 731726
Duration: 36 months **Maximum grant awarded:** € 1,998,265.00

Summary:
Robots are the next ICT-related technology on the horizon ready to radically alter human societies. It is a major societal concern that up to 40% jobs may be replaced by robots over the next 20 years. Few empirical studies have been made in how roboticists' visions may differ from users/affected stakeholders' needs and concerns with these pervasive and radical changes. The REELER project aims at aligning the roboticists' visions of a future with robots with empirically-based knowledge of human needs and societal concerns. Based on extensive robotics/SSH-RRI collaboration, REELER will offer proactive steps towards ethical and responsible robots by suggesting radical changes in current robot design procedures. Moreover, REELER will formulate guidelines in the REELER Roadmap for distributed responsibility among roboticists, users/affected stakeholders and policy-makers by closing the current gap between these. At the core of these guidelines is the concept of collaborative learning which permeates all aspects of REELER and will guide future SSH-ICT research. The main outcome of REELER is the research-based roadmap presenting a) ethical guidelines for Human Proximity Levels, b) prescriptions for how to include the voice of new types of users and affected stakeholders through Mini-Publics and call forth roboticists' assumptions via sociodrama and c) an agent-based simulation tool for policymaking. The high level of multidisciplinarity (8 robot designers from the LEIT-ICT batch 23, anthropologists, psychologists, economists and philosophers) of the REELER research, will assure cooperation, comprehension and acceptance of SSH-research by the robotics research community. Integrating the recommendations of the REELER Roadmap for Responsible and Ethical Learning in Robotics in future robot design processes will ensure a European robotics community that take humans needs and societal concerns into account.

Participants:

AARHUS UNIVERSITET	DK
AB.ACUS SRL	IT
DE MONTFORT UNIVERSITY	UK
UNIVERSITAET HOHENHEIM	DE