



**THEME [ICT-2011.2.1]
[Cognitive Systems and Robotics]**

Grant agreement for: Coordination and support action¹

Annex I - "Description of Work"

Project acronym: RoCKIn

Project full title: " Robot Competitions Kick Innovation in Cognitive Systems and Robotics "

Grant agreement no: 601012

Version date:

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A1: Project summary

Project Number ¹	601012	Project Acronym ²	RoCKIn
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One form per project

General information

Project title ³	Robot Competitions Kick Innovation in Cognitive Systems and Robotics		
Starting date ⁴	02/01/2013		
Duration in months ⁵	36		
Call (part) identifier ⁶	FP7-ICT-2011-9		
Activity code(s) most relevant to your topic ⁷	ICT-2011.2.1: Cognitive Systems and Robotics		

Abstract ⁹

Robot competitions have proved to be an effective instrument to foster scientific research and push the state of the art in a field. Teams participating in a competition must identify best practice solutions covering a wide range of functionalities and integrate them into practical systems. These systems have to work in the real world, outside of the usual laboratory conditions. The competition experience helps to transfer the applied methods and tools to successful and high-impact real-world applications. Other effects of robot competitions are that young students are attracted to science and engineering disciplines, and that the relevance of robotics research is demonstrated to citizens. However, some limitations can emerge as competitions mature: the effort required to enter the competition grows and may present a barrier for the participation of new teams; a gap between benchmarking complete systems in competitions and benchmarking subsystems in research may develop and limit the usefulness of the competition results to industry.

The goal of RoCKIn is to speed up the progress towards smarter robots through scientific competitions. Two challenges have been selected for the competitions due to their high relevance and impact on Europe's societal and industrial needs: domestic service robots (RoCKIn@Home) and innovative robot applications in industry (RoCKIn@Work). Both challenges have been inspired by activities in the RoboCup community, but RoCKIn improves and extends them by introducing new and prevailing research topics, like natural interaction with humans or networking mobile robots with sensors in ambient environments, in addition to specifying concrete benchmark criteria for assessing progress.

The RoCKIn project

- designs open domain testbeds for competitions targeting the two challenges and usable by researchers worldwide,
- develops methods for benchmarking through competitions that allow to assess both particular subsystems as well as the integrated system,
- organizes two robot competition events, each of them based on the two challenges and testbeds,
- organizes camps open to student participants, so as to help new teams getting involved in the competitions, and
- executes dissemination activities to target stakeholders in industry and academia, as well as the general public.

A2: List of Beneficiaries

Project Number ¹	601012	Project Acronym ²	RoCKIn
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List of Beneficiaries

No	Name	Short name	Country	Project entry month ¹⁰	Project exit month
1	ASSOCIACAO DO INSTITUTO SUPERIOR TECNICO PARA A INVESTIGACAO E DESENVOLVIMENTO	IST-ID	Portugal	1	36
2	UNIVERSITA DEGLI STUDI DI ROMA LA SAPIENZA	UNIROMA1	Italy	1	36
3	Hochschule Bonn-Rhein-Sieg	BRSU	Germany	1	36
4	KUKA Laboratories GmbH	KUKA	Germany	1	36
5	POLITECNICO DI MILANO	POLIMI	Italy	1	36
6	SECURITY CHALLENGE LIMITED	SecurityChallenge	United Kingdom	1	36

A3: Budget Breakdown

Project Number ¹	601012	Project Acronym ²	RoCKIn
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One Form per Project

Participant number in this project ¹¹	Participant short name	Ind. costs ¹³	Estimated eligible costs (whole duration of the project)				Requested EU contribution
			Coordination / Support (A)	Management (B)	Other (C)	Total A+B+C	
1	IST-ID	T	311,672.00	27,600.00	52,800.00	392,072.00	361,514.00
2	UNIROMA1	T	358,096.00	0.00	0.00	358,096.00	323,538.00
3	BRSU	T	314,160.00	0.00	4,800.00	318,960.00	284,406.00
4	KUKA	A	359,722.00	0.00	3,400.00	363,122.00	273,617.00
5	POLIMI	A	280,135.00	0.00	45,300.00	325,435.00	228,980.00
6	SecurityChallenge	T	244,320.00	0.00	13,200.00	257,520.00	229,622.00
Total			1,868,105.00	27,600.00	119,500.00	2,015,205.00	1,701,677.00

Note that the budget mentioned in this table is the total budget requested by the Beneficiary and associated Third Parties.

*** The following funding schemes are distinguished**

Collaborative Project (if a distinction is made in the call please state which type of Collaborative project is referred to: (i) Small of medium-scale focused research project, (ii) Large-scale integrating project, (iii) Project targeted to special groups such as SMEs and other smaller actors), Network of Excellence, Coordination Action, Support Action.

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project, and it cannot be changed. The project number **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

2. Project acronym

Use the project acronym as indicated in the submitted proposal. It cannot be changed, unless agreed during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a detailed justification on a separate note.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Activity code

Select the activity code from the drop-down menu.

8. Free keywords

Use the free keywords from your original proposal; changes and additions are possible.

9. Abstract

10. The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

11. The number allocated by the Consortium to the participant for this project.

12. Include the funding % for RTD/Innovation – either 50% or 75%

13. Indirect cost model

A: Actual Costs

S: Actual Costs Simplified Method

T: Transitional Flat rate

F :Flat Rate

Workplan Tables

Project number

601012

Project title

RoCKIn—Robot Competitions Kick Innovation in Cognitive Systems and Robotics

Call (part) identifier

FP7-ICT-2011-9

Funding scheme

Coordination and support action

WT1

List of work packages

Project Number ¹	601012	Project Acronym ²	RoCKIn
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LIST OF WORK PACKAGES (WP)

WP Number ⁵³	WP Title	Type of activity ⁵⁴	Lead beneficiary number ⁵⁵	Person-months ⁵⁶	Start month ⁵⁷	End month ⁵⁸
WP 1	Benchmarking Through Competitions	COORD	5	31.00	1	18
WP 2	Competition Design and Testbed Development	COORD	3	56.00	4	30
WP 3	Dissemination to Stakeholder Communities	COORD	4	23.00	4	36
WP 4	Dissemination and Awareness to the Citizens	COORD	6	38.00	1	36
WP 5	Competition Build-Up and Support	COORD	2	38.00	7	30
WP 6	Scientific Coordination and Competition Execution	COORD	1	32.00	1	36
WP 7	Project Management	MGT	1	7.00	1	36
				Total	225.00	

WT2: List of Deliverables

Project Number ¹	601012	Project Acronym ²	RoCKIn
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List of Deliverables - to be submitted for review to EC

Deliverable Number ⁶¹	Deliverable Title	WP number ⁵³	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D1.1	Specification of general features of scenarios and robots for benchmarking through competitions	1	3	15.00	R	PU	6
D1.2	General evaluation criteria, modules and metrics for benchmarking through competitions	1	5	16.00	R	PU	18
D2.1.1	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Home - v1	2	3	8.00	R	PU	9
D2.1.2	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Home - v2	2	3	8.00	R	PU	18
D2.1.3	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Home - v3	2	3	11.00	R	PU	30
D2.1.4	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Work - v1	2	4	5.00	R	PU	9
D2.1.5	Competition Design, Rule Book, and Scenario	2	4	5.00	R	PU	18

WT2: List of Deliverables

Deliverable Number ⁶¹	Deliverable Title	WP number ⁵³	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
	Construction for RoCKIn@Work - v2						
D2.1.6	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Work - v3	2	4	7.00	R	PU	30
D2.1.7	Description of Ground-truth System - v1	2	5	6.00	R	PU	18
D2.1.8	Description of Ground-truth System - v2	2	5	6.00	R	PU	30
D3.1	Report on progress of the competition and benchmark activities	3	6	11.50	R	PU	18
D3.2	Final report on progress of the competition and benchmark activities	3	6	11.50	R	PU	36
D4.1	Website	4	6	18.00	O	PU	3
D4.2	Report on Dissemination and Awareness to the Citizens - 1st Period	4	6	5.00	R	PU	9
D4.3	Report on Dissemination and Awareness to the Citizens - 2nd Period 2	4	6	7.00	R	PU	21
D4.4	Report on Dissemination and Awareness to the Citizens - 3rd Period	4	6	8.00	R	PU	36
D5.1	Introduction to RoCKIn Competitions	5	3	12.00	R	PU	9
D5.2	Report on RoCKIn Camp	5	2	13.00	R	PU	19

WT2: List of Deliverables

Deliverable Number ⁶¹	Deliverable Title	WP number ⁵³	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D5.3	Report on RoCKIn Field Exercise	5	2	13.00	R	PU	30
D6.1	2014 Competition Event	6	3	16.00	O	PU	17
D6.2	2015 Competition Event	6	1	16.00	O	PU	35
D7.1	Annual Administrative and Financial Project Report - Year 1	7	1	2.00	R	PU	12
D7.2	Annual Administrative and Financial Project Report - Year 2	7	1	2.00	R	PU	24
D7.3	Annual Administrative and Financial Project Report - Year 3	7	1	3.00	R	PU	36
Total				225.00			

WT3: Work package description

Project Number ¹	601012	Project Acronym ²	RoCKIn
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One form per Work Package

Work package number ⁵³	WP1	Type of activity ⁵⁴	COORD
Work package title	Benchmarking Through Competitions		
Start month	1		
End month	18		
Lead beneficiary number ⁵⁵	5		

Objectives

- Definition of general environment features and required robot capabilities in the RoCKIn' scenarios. Robot capabilities will be collected and formalized in the form of a RoCKIn Functional Reference Platform
- Definition of general metrics, and criteria for benchmarking through competitions together with the modules and techniques for the benchmarking (e.g., software modules for data logging, requirements for ground-truth, etc.)

Description of work and role of partners

The objectives of WP1 will be reached through the execution of three tasks. The main results will be the specification of general criteria for benchmarking through competitions and the benchmarking guidelines for the definition of RoCKIn testbeds that will be accomplished in WP2. The tasks work will include inputs from all academic and industrial partners of the project. The leading partner is POLIMI, due to its experience in the design of benchmarks for robot systems, including the design and implementation of systems for the collection of ground truth.

Task 1.1: Specifications of General Scenario Features for Benchmarking Through Competitions - TL: BRSU (IST-ID, UNIROMA1, POLIMI, KUKA) [4 (1,1,2,1) PM]

Starting from the RoCKIn selected challenges, Task 1.1 investigates the detailed scientific challenges that appear reachable in the short to medium term. These challenges are then analyzed in detail to identify tasks and subtasks, to be carried out within the corresponding competition, of reasonable general interest, not necessarily limited to RoCKIn's challenges in the target domains, and for which benchmarks can be defined. Based on this we can investigate how the solution quality is influenced by scenario features, and finally come up with a set of general scenario features, which will become the input for WP2 in the design of each corresponding competition. The competitions must balance well-defined, controllable task specifications with sufficient variability to ensure that the solution is of general interest to robotics and to avoid over-engineered solutions.

Task 1.2: Definition of Task Specifications for RoCKIn' Competitions and Specification of Required Robot Capabilities to Complete These Tasks - TL: POLIMI (IST-ID, BRSU) [4 (1,1) PM]

RoCKIn scenario features and specifications for competition tasks have a clear impact on the capabilities required to the competing robots. Such capabilities will be described in terms of functional specifications: task to be accomplished, environmental conditions under which task should be accomplished, condition to be met in order to verify that the task has been accomplished. Functional specifications will not be targeted at the implementation level, where differences among different systems and architectures are too large to allow meaningful definitions; they will, instead, be focused on the definition of higher-level functional building blocks and their interactions. A functional specification could identify a module for each high-level task defined in Task 1.1 as part of testbed scenarios. Different robots compliant with the specifications published by Task 1.2 will have a similar functional structure, thus opening the way to the compared evaluation of the contributions of single capabilities of such robots on the overall result of the robots in system-level competitions. Task 1.2 will produce these functional specifications in the form of a RoCKIn Functional Reference Platform composed of the functional modules that are relevant for the RoCKIn Testbed scenarios. An excellent starting point for the specification of the latter is the work done in other international efforts (e.g., BRICS and ROS) and in the description of solutions provided by participating teams in their Team Description Papers from past RoboCup competitions.

WT3: Work package description

Task 1.3: General Evaluation Criteria, Modules and Metrics for Benchmarking Through Competitions - TL: POLIMI (IST-ID, UNIROMA1, BRSU, KUKA) [9 (3,2,1,1) PM]

Task 1.3 is focused on the specification of a general framework for the benchmarking through competitions. This means to produce a well-specified set of criteria and metrics for benchmarking the performance of a robot (or a set of robots) in a competition (or one of its tasks and sub-tasks) such as RoCKIn competitions. Metrics for benchmarking and evaluation of competitors, will consider not only the full-fledged systems but also single sub-system functionalities. The RoCKIn Functional Reference Platform defined by Task 1.2 will be the reference framework for this. The module-level benchmarks defined by Task 1.3 will be designed in such a way that, while meaningful when taken in isolation, they can also be combined to yield an overall score for the competition. In particular, while integrated systems will be evaluated according to the usual scoring of competitions, individual modules will be scored along two directions: vertically, according to the contribution they provide to the success of an integrated system in a specific competition (e.g., as measured through the Shapley values), and horizontally, according to their generality and potential of reuse in different competitions (i.e., those implementing RoCKIn two challenges). Combining these scores leads to a multi-objective optimization problem that will be addressed using appropriate techniques (e.g., selecting the candidate on the Pareto frontier that is closest to the ideal solution). The scoring generated by RoCKIn benchmarks will result from the application of quantitative criteria. According to the aspect to be evaluated, these will take the form of absolute measurements (e.g., time needed to reach a given state), success in meeting pre-defined success criteria for competition tasks and subtasks, or comparisons – according to pre-defined criteria – with the baseline performance of reference modules. In order to make the benchmarks open-ended and dynamic, special attention will be given to the last category, in particular, by selecting as reference modules those that showed best performance in previous editions of the RoCKIn competitions. To this extent, the competition rules defined by Task 1.3 will include carefully designed provisions to set this mechanism in motion, ensuring that successful participants contribute to the competition with their module implementations. At the same time, this will be done without forcing them to share source code or endangering their Intellectual Property (an issue which is especially crucial for enterprises).

Measures of success

- a technically sound and complete list of general features of scenarios and robots for benchmarking through competitions including the description of the RoCKIn Functional Reference Platform
- a technically sound and complete list of general evaluation criteria, modules and metrics for benchmarking through competitions, useful outside RoCKIn competitions

Person-Months per Participant

Participant number ¹⁰	Participant short name ¹¹	Person-months per participant
1	IST-ID	5.00
2	UNIROMA1	3.00
3	BRSU	6.00
4	KUKA	2.00
5	POLIMI	15.00
Total		31.00

List of deliverables

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D1.1	Specification of general features of scenarios and robots for benchmarking through competitions	3	15.00	R	PU	6

WT3: Work package description

List of deliverables

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D1.2	General evaluation criteria, modules and metrics for benchmarking through competitions	5	16.00	R	PU	18
		Total	31.00			

Description of deliverables

D1.1) Specification of general features of scenarios and robots for benchmarking through competitions: Specification of general features of scenarios and robots for benchmarking through competitions including the description of the RoCKIn' Functional Reference Platform [month 6]

D1.2) General evaluation criteria, modules and metrics for benchmarking through competitions: Report with the description of general evaluation criteria, modules and metrics for benchmarking through competitions [month 18]

Schedule of relevant Milestones

Milestone number ⁵⁹	Milestone name	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments
MS3	Final Benchmarking Evaluation Criteria, Modules and Metrics	5	18	Detailed set of criteria, modules and metrics ready to be used in the 2014 competition event; accepted paper reporting to the academic and industrial communities on the general criteria.

WT3: Work package description

Project Number ¹	601012	Project Acronym ²	RoCKIn
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One form per Work Package

Work package number ⁵³	WP2	Type of activity ⁵⁴	COORD
Work package title	Competition Design and Testbed Development		
Start month	4		
End month	30		
Lead beneficiary number ⁵⁵	3		

Objectives

- Design a new scientific competition for the innovative robot applications in industry challenge (RoCKIn@Work)
- Reshape an existing scientific competition for the domestic service robots challenge, towards improved benchmarking and increased focus on applications meeting the demands of an ageing society (RoCKIn@Home)
- Specify, design and coordinate the development of a testbed for each of the selected competitions, replicable in research laboratories in Europe and worldwide
- Provide specifications and implementations of robot system features and software modules required for benchmarking and operating the testbeds

Description of work and role of partners

Task 2.1: Competition Design and Scenario Construction for Domestic Service Robotics - TL:BRSU (IST-ID, UNIROMA1, POLIMI) [12 (9,4,2) PM]

Domestic service robots are a long-pursued goal, but only highly dedicated systems focusing on very narrow tasks (like vacuum-cleaning or wiping) have so far made successful market appearances. Competitions for domestic service robots need to include challenges covering functionalities that bring robots closer to market relevance. Innovation in this application area can be fostered by reshaping existing scientific competitions such as RoboCup@Home to include more tests targeting applications in the health domain and providing support for the elderly. This requires putting more focus on the perception, semantic mapping, representation, and manipulation capabilities currently required for RoboCup@Home competitions. It will also include networking static sensors (e.g., cameras, RF-ID) with multiple heterogeneous mobile robots so as to provide a global view of the home state in different rooms, and extend the ability of the multi-robot team to address different task requirements (e.g., fetching objects required by a person retained in bed, supplying food to an handicapped person). Furthermore, the competitions need to improve on assessment and benchmarking procedures. During the task, the currently used set of tests in the RoboCup@Home competition will be analyzed with respect to application relevance and benchmarking ability. We will also conduct online interviews with a set of European research groups, who are active in domestic service robot research, but not yet participating in RoboCup@Home. Based on these analyses and results from WP1 we will suggest modifications to existing tests that will improve application relevance and benchmarking and drive the competitions to become more interesting for new teams from active research groups. The tests suggested will carefully balance detail and variability, both in task descriptions and scenario environments and objects. The competition design will involve the development and installation of a fully functional testbed in at least one of the partner sites (IST-ID). The leading partner is BRSU, due to its current and prior experience with RoboCup@Home league. POLIMI will participate to supervise the transfer of benchmarking features developed in WP1. UNIROMA1 will bring its academic expertise in networked robot systems and competitions. The competition design and test bed specifications will be revised and adapted each year depending on the experiences and feedback from participants, selected stakeholders and experts. The task will also provide any software needed for operating the testbed.

Task 2.2: Competition Design and Scenario Construction for Innovative Robotics in Industry - TL:KUKA (IST-ID, UNIROMA1, BRSU, POLIMI) [6 (2,1,6,2) PM]

With the advent of affordable, industrial-quality mobile manipulators (such as the KUKA youBot and KUKA omniBot, FESTO's Robotino or Aalborg University's Little Helper), the door has been opened to the development of innovative application of robotics in industry. However, the community still needs to develop a thorough understanding of the capabilities of mobile manipulators and how they can be used for new applications.

WT3: Work package description

This task will continue the development of a new competition, RoCKIn@Work, into a competition where the capabilities of these robots can be convincingly demonstrated in industry-like scenarios. At the same time, we will undertake an effort to increase the involvement of industry into the design and organization of the tests used in RoCKIn@Work. The scenarios will involve and combine aspects of manipulation, assembly, logistics, and cooperation by multiple robots networked with static sensors and other devices. A particular challenge is the design of competitions and benchmarks for assistive technology, i.e., where mobile manipulators assist human workers in performing complex or dangerous tasks. The definition of the tasks and the scenarios need to be driven by the needs of industry. Within this task, we will work closely with the major stakeholder communities of robotics in Europe and also include results developed in coordination actions like euRobotics and the requirements from industry concerning competitions. Thus, the scenarios comprising environments, objects therein, objects to be manipulated or to be interacted with, and the variability in all these aspects will be specified in close coordination with industry and influence the overall competition design. A permanent testbed will be built and installed in at least one partner site (BRSU). The leading partner is KUKA, due to its vast experience with industrial robotics. POLIMI will participate to supervise the transfer of benchmarking features developed in WP1, and to provide its expertise in ground truth collection. IST-ID, UNIROMA1 and BRSU will bring their academic expertise in networked robot systems and competitions. This task will also determine the concrete benchmarking infrastructure required for the competition and provide any software needed for operating the test bed. The competition design and testbed specifications will be revised and adapted each year depending on the experiences and feedback from participants, selected stakeholders and experts.

Task 2.3: Specifications and Implementation of Modules for Benchmarking and Repository of Modules Implementations from Past Competitions - TL:POLIMI (IST-ID, UNIROMA1, BRSU, KUKA) [6 (2,1,2,1) PM]

This task complements Tasks 2.1 and 2.2 by providing specifications and implementation of the modules required for benchmarking. This includes the specification and implementation of additional hardware and software modules required for ground-truth gathering, be this related to the environment or to the robots. External ground-truth will be acquired with independent sensors and it will be related to video and audio recording of the scene, accurate models for the environment and for the objects within it, accurate positioning of all the relevant items, including the robots, during the whole execution of the challenge. At the specification level, we will provide general requirements in term of precision and accuracy for ground-truth, the modules implemented and used during the RoCKIn competitions will be targeted to the best possible accuracy and reproducibility. Additional data of interest for benchmarking and evaluation is related to all functional modules and all cognitive levels of a robot control architecture, including but not limited to goals, intentions, plans, paths, trajectories, poses of the robot, its manipulators, end effectors, and sensors (such as movable cams), and of perceived objects, and communication with external human or robotic agents as well as internal exchange of information. To this extent, where necessary and appropriate, implementation of modules that can be integrated easily by teams into their robot software architecture for the proper logging of data of interest with a given format and precision, all time stamped according to a global reference clock. This task is also in charge of the set up and acquisition of the ground-truth during the events where the RoCKIn competitions will be executed, where POLIMI will have a particular role, thus leading the Task. The other academic and industrial partners will bring on board their expertise in networked robot systems, industrial robots and competitions.

Measures of success

- complete design and realization of a competition implementing the domestic service robots challenge (RoCKIn@Home), including the corresponding testbed
- complete design and realization of a competition implementing the innovative robot applications in industry challenge (RoCKIn@Work), including the corresponding testbed

Person-Months per Participant

Participant number ¹⁰	Participant short name ¹¹	Person-months per participant
1	IST-ID	13.00
2	UNIROMA1	6.00
3	BRSU	20.00
4	KUKA	7.00

WT3: Work package description

Person-Months per Participant

Participant number ¹⁰	Participant short name ¹¹	Person-months per participant
5	POLIMI	10.00
	Total	56.00

List of deliverables

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D2.1.1	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Home - v1	3	8.00	R	PU	9
D2.1.2	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Home - v2	3	8.00	R	PU	18
D2.1.3	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Home - v3	3	11.00	R	PU	30
D2.1.4	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Work - v1	4	5.00	R	PU	9
D2.1.5	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Work - v2	4	5.00	R	PU	18
D2.1.6	Competition Design, Rule Book, and Scenario Construction for RoCKIn@Work - v3	4	7.00	R	PU	30
D2.1.7	Description of Ground-truth System - v1	5	6.00	R	PU	18
D2.1.8	Description of Ground-truth System - v2	5	6.00	R	PU	30
	Total		56.00			

Description of deliverables

D2.1.1) Competition Design, Rule Book, and Scenario Construction for RoCKIn@Home - v1: Competition Design, Rule Book, and Scenario Construction for Domestic Service Robotics (RoCKIn@Home) - version 1/3 Note:there will be periodic updates to this document, which includes design rationale, rule-book, scenario and object specs, a construction manual for the scenario, instruction for instrumentation of benchmarking, and operations manual for actual competitions. [month 9]

D2.1.2) Competition Design, Rule Book, and Scenario Construction for RoCKIn@Home - v2: Competition Design, Rule Book, and Scenario Construction for Domestic Service Robotics (RoCKIn@Home) - version 2/3 Note:there will be periodic updates to this document, which includes design rationale, rule-book, scenario and object specs, a construction manual for the scenario, instruction for instrumentation of benchmarking, and operations manual for actual competitions. [month 18]

D2.1.3) Competition Design, Rule Book, and Scenario Construction for RoCKIn@Home - v3: Competition Design, Rule Book, and Scenario Construction for Domestic Service Robotics (RoCKIn@Home) - version

WT3: Work package description

3/3 Note:there will be periodic updates to this document, which includes design rationale, rule-book, scenario and object specs, a construction manual for the scenario, instruction for instrumentation of benchmarking, and operations manual for actual competitions. [month 30]

D2.1.4) Competition Design, Rule Book, and Scenario Construction for RoCKIn@Work - v1: Competition Design, Rule Book, and Scenario Construction for Innovative robot applications in industry (RoCKIn'@Work) - version 1/3 Note:there will be periodic updates to this document, which includes design rationale, rule-book, scenario and object specs, a construction manual for the scenario, instruction for instrumentation of benchmarking, and operations manual for actual competitions. [month 9]

D2.1.5) Competition Design, Rule Book, and Scenario Construction for RoCKIn@Work - v2: Competition Design, Rule Book, and Scenario Construction for Innovative robot applications in industry (RoCKIn'@Work) - version 2/3 Note:there will be periodic updates to this document, which includes design rationale, rule-book, scenario and object specs, a construction manual for the scenario, instruction for instrumentation of benchmarking, and operations manual for actual competitions. [month 18]

D2.1.6) Competition Design, Rule Book, and Scenario Construction for RoCKIn@Work - v3: Competition Design, Rule Book, and Scenario Construction for Innovative robot applications in industry (RoCKIn'@Work) - version 3/3 Note:there will be periodic updates to this document, which includes design rationale, rule-book, scenario and object specs, a construction manual for the scenario, instruction for instrumentation of benchmarking, and operations manual for actual competitions. [month 30]

D2.1.7) Description of Ground-truth System - v1: Report with the description of ground-truth system to be used in the 2 competitions, including the follow up from the competitions - version 1/2 Note:there will be one update to this document, which includes the follow up from the first competition event. [month 18]

D2.1.8) Description of Ground-truth System - v2: Report with the description of ground-truth system to be used in the 2 competitions, including the follow up from the competitions - version 2/2 [month 30]

Schedule of relevant Milestones

Milestone number ⁵⁹	Milestone name	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments
MS1	First version of testbeds available	3	9	Main essential scenario features and involved objects, as well as robot capabilities requirements, defined and ready to be used in the 2014 competition event, including preliminary benchmarking items
MS4	Final version of testbeds available	3	30	All scenario features and involved objects, as well as robot capabilities requirements, defined and ready to be used in the final 2015 competition event, including benchmarking items

WT3: Work package description

Project Number ¹	601012	Project Acronym ²	RoCKIn
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One form per Work Package

Work package number ⁵³	WP3	Type of activity ⁵⁴	COORD
Work package title	Dissemination to Stakeholder Communities		
Start month	4		
End month	36		
Lead beneficiary number ⁵⁵	4		

Objectives

Bring together the RoCKIn Experts, as well as academia and industry stakeholders, public authorities and EC officials to

- evaluate the progress of the selected competitions (at the end of the competition events), their relevance for the advance of research, industry-academia collaboration in general and technology transfer and benchmarking in particular, and to provide inputs for the upcoming competition event, including measures to improve the benchmark definitions and the corresponding testbeds
- promote meetings between industry and researchers competing in the competition events to explore exploitation opportunities through technology transfer of the most successful solutions
- disseminate the results of RoCKIn competitions, benchmarking and testbed design to the scientific community

Description of work and role of partners

Task 3.1: Workshops on Progress Evaluation involving Academia, Industry and Public Authorities - TL: KUKA (IST-ID, UNIROMA1, BRSU, POLIMI, SC Ltd) [3 (2,1,2,1,3) PM]

At least 2 workshops, preferably directly after the main competition events, will be organized to join together a not too large set of important players in robotics from academia, industry, public authorities and EU officials, including the RoCKIn Experts Board. During the workshops, the participants will be informed and updated on the progress of the latest competition and benchmark activities. At these events, the participants will provide their feedback on the evolution of the project, and collaboratively discuss how to improve the implementation and dissemination of the benchmarking methods and the testbed implementations in further events. In the end of each workshop, RoCKIn Experts Board will elaborate a report with its resulting evaluation remarks and recommendations.

Task 3.2: Demonstrations to Industry and Exploration of Exploitation Opportunities - TL: KUKA (IST,BRSU) [3 (1,1) PM]

Demonstrations of some of the most successful solutions presented during RoCKIn competition events, as well as bi- and multi-lateral meetings between competing researchers and industry stakeholders will be promoted during industrial trade fairs, e.g., Hannover Messe, Automatica and/or during the annual European Robotics Forum workshops. All the demos and meetings will be hosted by KUKA in a limited area of its booth. Moreover, small forums/sessions will be organized during these events.

Task 3.3: Dissemination to the Scientific Community - TL: UNIROMA1 (IST-ID, BRSU, POLIMI) [3 (1,1,1,1) PM]

Academic workshops and invited sessions will be organized in major conferences in the fields of AI and robotics (e.g., ICRA, IROS, IJCAI, AAI, ECAI) to disseminate the results obtained during RoCKIn competitions, benchmarking and testbed design activities to the scientific community and to get community feedback on the research advances which are relevant for RoCKIn challenges. The number of these workshops is expected to be at least one per year and will be arranged according to the format allowed by the hosting event.

Measures of success

- positive evaluation of the RoCKIn Experts Board and stakeholders at each competition event meeting
- methods successful in RoCKIn competitions identified to be exploited through technology transfers by industrial stakeholders

WT3: Work package description

- major impact of scientific events organized in major sessions of AI and robotics conferences, e.g., expressed by number of participants and citations of proceedings
- number of accepted papers in conferences and number of publications in technical journals
- frequency of information requests and questions directed to the project office from industry
- number of publications and press articles mentioning RoCKIn or citing RoCKIn publications
- number of visits on the RoCKIn main website or of the websites describing the events.

Person-Months per Participant

Participant number ¹⁰	Participant short name ¹¹	Person-months per participant
1	IST-ID	4.00
2	UNIROMA1	4.00
3	BRSU	4.00
4	KUKA	6.00
5	POLIMI	2.00
6	SecurityChallenge	3.00
Total		23.00

List of deliverables

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D3.1	Report on progress of the competition and benchmark activities	6	11.50	R	PU	18
D3.2	Final report on progress of the competition and benchmark activities	6	11.50	R	PU	36
Total			23.00			

Description of deliverables

D3.1) Report on progress of the competition and benchmark activities: This is the first report produced by the Experts Board. RoCKIn experts will start producing their texts just after the 2014 competition event, and their contributions will be compiled by SecurityChallenge, under the coordination of IST-ID. The report will refer to competition as well as to benchmarking activities outcomes. [month 18]

D3.2) Final report on progress of the competition and benchmark activities: This is the second and final report produced by the Experts Board. RoCKIn experts will start producing their texts just after the 2015 competition event, and their contributions will be compiled by SecurityChallenge, under the coordination of IST-ID. The report will refer to competition as well as to benchmarking activities outcomes. [month 36]

Schedule of relevant Milestones

Milestone number ⁵⁹	Milestone name	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments
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WT3: Work package description

Project Number ¹	601012	Project Acronym ²	RoCKIn
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One form per Work Package

Work package number ⁵³	WP4	Type of activity ⁵⁴	COORD
Work package title	Dissemination and Awareness to the Citizens		
Start month	1		
End month	36		
Lead beneficiary number ⁵⁵	6		

Objectives

- ensure and coordinate the dissemination of the relevance of robot competitions to foster significant R&D developments in AI and robotics and their added value to Europe's societal challenges,
- promote S&T close to young high school students, and
- demonstrate the impact of robotics research to European citizens and public authorities.

Description of work and role of partners

This is clearly a WP where SecurityChallenge exerts a strong leadership role, given its expertise in dissemination and public relations activities. All the other academic partners will be involved so as to provide the information that will go into press releases and non-traditional media sites. A list of typical included tasks are:

- create and maintain RoCKIn's web page
- researching and tracking all robotics related blogs, websites, newsletters, pages (Facebook & others), forums, accounts and other web content
- join robotics related groups, forums, mailing lists wherever possible
- establish, develop and maintain a custom twitter account and news feed; using promotional strategies to attract and encourage sharing of information
- promote challenge program through concise messaging, 1 to 4 times per week (up to 50 LinkedIn groups)
- monitor news coverage and content related to robotics and build on this content to promote the challenge program
- research and approach potential media partners to maximize outreach; where appropriate draft, share and sign media partnership agreements
- monitor work of media partners
- perform extra promotional duties according to partnership agreements
- write and distribute fresh marketing messages every week, to reflect the stage of the competition; news coverage and feedback

Task 4.1 - Website Management - TL: SC Ltd (POLIMI) [17 (1) PM]

Security Challenge's experienced in-house web development team will design and program a website on a dedicated web-domain (www.rockinrobotchallenge.eu). We will create a visually appealing site that is integrated with our communications strategy. This website would include an attractive design, interactive tools (such as a forum) for participants, online registration in RoCKIn competition events, link to other challenges and competitions, and regular RoCKIn news updates. The website will regularly be updated with information of the project's on-going activities and results and contain information for different audiences, such as

- i) the general public (written without community specific expert language)
- ii) the media
- iii) industry stakeholders

iv) academic participants (written in the language of scientists and researchers, including the repository of past winning modules and resources collected by POLIMI).

Furthermore, the website will be the informational window for the project. It will provide online visitors to the site with all necessary background information, tools, project results and the corresponding contact data.

Task 4.2 – Public Relations and Community Engagement in Traditional Media - TL: SC Ltd (IST-ID, UNIROMA1, BRSU) [7 (1,1,1) PM]

WT3: Work package description

SecurityChallenge will act as press office, which will entail: proactively reaching out to offer comment on relevant stories / content; raising the profile for the RoCKIn competition project and demonstrating the need for innovation; creating opinion articles, which will be 500-word, thought-led opinion pieces.

This task will be dedicated to dissemination actions specific to the project i.e. dissemination of the project's reports and results, publicising the project's events, and more.

Task 4.3 - Public Relations in Blogs and Social Networks - TL: SC Ltd (IST-ID,UNIROMA1, BRSU) [7 (1,1,1) PM]
With extensive experience in grassroots marketing and community engagement, SecurityChallenge will use social media, such as Facebook, LinkedIn, Twitter and blogs as well as other platforms to reach out to the community. Dedicated groups on Facebook and LinkedIn will ensure a widespread discussion.

The consortium will also use its own media assets and resources to support the communications strategy:

- Using SecurityChallenge's online platform and forum that encompass several hundred thousands of innovators (IC Newsletter, Twitter accounts, Facebook and LinkedIn groups)
- Using SecurityChallenge's media partners, the outreach can be multiplied to more than 12 million people within the target audience
- Other partners to add their network outreach (e.g. universities, etc.)

Measures of success

- large number of visitors and feedback on the web site
- large awareness of RoCKIn in traditional media, blogs and social networks
- positive evolution of Europeans view of European robotics' research quality and impact in society

Person-Months per Participant

Participant number ¹⁰	Participant short name ¹¹	Person-months per participant
1	IST-ID	2.00
2	UNIROMA1	2.00
3	BRSU	2.00
5	POLIMI	1.00
6	SecurityChallenge	31.00
	Total	38.00

List of deliverables

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D4.1	Website	6	18.00	O	PU	3
D4.2	Report on Dissemination and Awareness to the Citizens - 1st Period	6	5.00	R	PU	9
D4.3	Report on Dissemination and Awareness to the Citizens - 2nd Period 2	6	7.00	R	PU	21
D4.4	Report on Dissemination and Awareness to the Citizens - 3rd Period	6	8.00	R	PU	36
	Total		38.00			

WT3: Work package description

Description of deliverables

D4.1) Website: This website would include an attractive design, interactive tools (such as a forum) for participants, online registration in RoCKIn' competition events, link to other challenges and competitions, and regular RoCKIn' news updates. The website will regularly be updated with information of the project's on-going activities and results and contain information for different audiences, such as i) the general public (written without community specific expert language) ii) the media iii) industry stakeholders iv) academic participants (written in the language of scientists and researchers, including the repository of past winning modules and resources collected by POLIMI). Furthermore, the website will be the informational window for the project. It will provide online visitors to the site with all necessary background information, tools, project results and the corresponding contact data. [month 3]

D4.2) Report on Dissemination and Awareness to the Citizens - 1st Period: [month 9]

D4.3) Report on Dissemination and Awareness to the Citizens - 2nd Period 2: [month 21]

D4.4) Report on Dissemination and Awareness to the Citizens - 3rd Period: [month 36]

Schedule of relevant Milestones

Milestone number ⁵⁹	Milestone name	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments

WT3: Work package description

Project Number ¹	601012	Project Acronym ²	RoCKIn
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One form per Work Package

Work package number ⁵³	WP5	Type of activity ⁵⁴	COORD
Work package title	Competition Build-Up and Support		
Start month	7		
End month	30		
Lead beneficiary number ⁵⁵	2		

Objectives

- organization of the activities that support both the preparation and the full exploitation of the testbeds, so as to adequately use them during the competitions
- support to team participation, including entering the competition, consolidating the team capabilities, sharing of knowledge and resources
- support the leveraging of the team capabilities, building on the experience gained in the first year of competition and on the resources developed by the community
- support the final stages of team development as well as the exploitation of the team capabilities in a real domain.

Description of work and role of partners

The main goal of this WP is the organization of the activities that support both the preparation and the full exploitation of the competition. A preparation activity will provide support to team participation, including entering the competition, consolidating the team capabilities, sharing of knowledge and resources. Exploitation after the competition will validate the best competing solutions in a real test environment with end user. This goal will be pursued by creating a community of teams to enter the competition and provide them with an introduction to the scientific challenges and the basics of the management of a team for each competition domain chosen by the project.

The consolidation activities in the second year of the project (RoCKIn Camp) will support the leveraging of the team capabilities, building on the preparation activity of the first year and on the resources developed by the community, both in terms of technical and scientific solutions and in terms of hardware/software components. The third year activities (RoCKIn Field Exercise) will support the final stages of team development as well as the exploitation of the team capabilities in a real domain. We refer to this activity as a field exercise to be held in a training facility in real homes with people and in a real industrial setting with workers, for the two competitions, respectively.

The activities are structured in three tasks:

Task 5.1: Introduction to RoCKIn Competitions - TL: BRSU (IST-ID, UNIROMA1, KUKA) [3 (2,6,1) PM]

This task aims at the introduction to the competition and includes a scouting phase to contact potential teams, with special attention to the research groups that have specific experience through EU projects in the domains of the competitions (supported by the activities in WP3). The key step of this task will be an event co-located with RoboCup 2013 (Eindhoven, Netherlands), where team representatives will be invited to learn about the competition challenges, team management and competition stages in the RoboCup teamwork area. UNIROMA1 will lead the task, supporting the overall event organization and management. IST-ID and BRSU will be involved in the activities concerning @Home and @Work challenges, respectively. KUKA will also be involved in @Work, as well as on the introduction to team management.

Task 5.2: RoCKIn Camp - TL: UNIROMA1 (IST-ID, BRSU, POLIMI) [6 (3,2,2) PM]

This task aims at consolidation of the team capabilities and it will consist of leveraging the use of available solutions and resources, namely how to handle using the developed testbeds, with the support of personnel contracted under WP2 related budget. This activity will be centred in the organization in an event, here and henceforth referred to as RoCKIn Camp (held in Rome). A Camp has the format of a summer school, but puts special emphasis on the hands-on experience of the participants, who are organized in small working

WT3: Work package description

groups focusing on the implementation of specific components and their performance evaluation through the benchmarks developed in WP2, as in a “living lab”.

UNIROMA1 will lead the task, supporting the overall event organization and management. IST-ID and BRSU will be involved in the activities concerning @Home and @Work competitions, respectively. POLIMI will coordinate ground-truth and data logging activities for benchmarking in the 2 testbeds during the Camps.

Task 5.3: RoCKIn Field Exercise - TL: UNIROMA1 (IST-ID, BRSU, KUKA, POLIMI) [6 (2,2,2,1) PM]

This task aims at the exploitation of the solutions developed by the teams in real scenario and supports the preparation for the final stage of the competition, as well as for the exploitation of the solutions developed in the competition (supported by the activities in WP3 for the dissemination to relevant industrial stakeholders). The format of the RoCKIn Field Exercise will be dependent on the choice of suitable locations, where the access to a real testbed with end-users will be arranged. UNIROMA1 will lead the task, supporting the overall event organization and management. IST-ID will be involved in the activities concerning @Home, BRSU and KUKA in the @Work and POLIMI in ground-truth and data logging for benchmarking activities.

Measures of success

- attracting a significant number of participants, mainly from top research groups worldwide not usually involved in RoboCup and robot competitions
- clear progress of the competing teams along the 3 years of the project lifetime

Person-Months per Participant

Participant number ¹⁰	Participant short name ¹¹	Person-months per participant
1	IST-ID	7.00
2	UNIROMA1	18.00
3	BRSU	7.00
4	KUKA	3.00
5	POLIMI	3.00
Total		38.00

List of deliverables

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D5.1	Introduction to RoCKIn Competitions	3	12.00	R	PU	9
D5.2	Report on RoCKIn Camp	2	13.00	R	PU	19
D5.3	Report on RoCKIn Field Exercise	2	13.00	R	PU	30
Total			38.00			

Description of deliverables

D5.1) Introduction to RoCKIn Competitions: The report will provide a description of the activities carried out to support the participation in the RoCKIn' competitions during RoboCup 2013, in particular the organization, attendance and outcomes of the main event [month 9]

D5.2) Report on RoCKIn Camp: The report will provide a description of the activities carried out to support the consolidation of the team capabilities and component benchmarking, in particular the organization, attendance and outcomes of the main event [month 19]

WT3: Work package description

D5.3) Report on RoCKIn Field Exercise: The report will provide a description of the activities carried out to support the final stages of the preparation for the competition, in particular the organization, attendance and outcomes of the Field Exercises in each of the two competitions. [month 30]

Schedule of relevant Milestones

Milestone number ⁵⁹	Milestone name	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments
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WT3: Work package description

Project Number ¹	601012	Project Acronym ²	RoCKIn
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One form per Work Package

Work package number ⁵³	WP6	Type of activity ⁵⁴	COORD
Work package title	Scientific Coordination and Competition Execution		
Start month	1		
End month	36		
Lead beneficiary number ⁵⁵	1		

Objectives

- scientific coordination of the project, namely of the contributions of the other work packages to achieve the project goals and their expression through the 2 selected challenges (RoCKIn@Home and RoCKIn@Work)
- coordinate the organization of the 2 competition events (2014 and 2015)

Description of work and role of partners

This Work Package joins together the overall coordination of RoCKIn' activities: the scientific coordination of WPs activities and the execution of the competitions for the 2 selected challenges on domestic service robots (RoCKIn@Home competition) and innovative robot applications in industry (RoCKIn@Work competition), on 2 events: one in 2014, during the AUTOMATICA 2014 Fair, in Munich, and another in 2015, during the European Robotics Week, in Lisbon. The competitions are designed to enable team research progress through a division in tasks and sub-tasks of increasing complexity. For instance, in RoCKIn'@Work there will be initially basic navigation, manipulation and transportation tests for single robots, followed by competitive transportation tests (where robots try to achieve their goals in a factory without cooperating or coordinating) and cooperative transportation tests, involving 2 or more robots committed to transport an object together. Transportation and manipulation can also be done on posterior tasks in interaction with humans. In RoCKIn'@Home individual robots will also start by overcoming basic individual tasks, such as navigation through the house rooms, manipulating objects or recognizing faces, and then coordinate to handle house-keeping tasks simultaneously, some of them in natural interaction with humans. The use of static sensors, such as cameras and RF-ID, spread around the factory or the house, networked with the mobile robots, will help determining the overall state of the rooms, understanding human behaviour and taking more informed decisions.

Teams participating in the 2 RoCKIn competition events are expected to progress over the 3 years of project lifetime throughout these tasks, executed on the RoCKIn testbeds, while getting further expertise on how to handle the testbeds. Benchmarking criteria, competition rules and materials taught to the participants in the camps will naturally evolve over the project lifetime, which is the typical process in a scientific robot competition.

The 2 competition arenas will be built once and assembled in place at each competition event site by the subcontracted company, which will also handle participant registration and other logistics support. No registration fees are foreseen at this point.

IST-ID holds the main responsibility of organizing all the events, but logistics will be held by the subcontracted professional company (including preparation of the event, communication with all participants before and during the event regarding rules, regulations and event setup, registration and local arrangements). All the other partners (SecurityChallenge within the frame of WP4 activities) will participate, helping with organizational details, coordinating Technical Committees (formed by participant representatives) for rule discussion, fine-tuning and practical execution and helping with judging. POLIMI will be in charge of logging data from the competitions (e.g., through the ground-truth system) so as to evaluate the quality and applicability of the benchmarking criteria and to improve them for the following year event, in straight connection with WP1 activities.

Task 6.1: Scientific Coordination of Project Activities - TL: IST-ID [7 PM]

In RoCKIn, all different activities contribute to the overall goal of fostering robotics R&D progress towards smarter and dependable robots through competitions. This endeavour must be achieved under a consistent

WT3: Work package description

scientific view, which is based on the fulfilment of all steps of the loop of Figure 6, including some iterations for some of them, during the 3 years project lifetime. This task ensures that the activities in all RoCKIn WPs meet such requisites.

Activities will run according to the management structure and procedures detailed in Section B.2.1. IST-ID, as Project Coordinator, will monitor the evolution of the work in the different WPs to ensure their coherence and agreement with the project objectives, including the extensions of current challenges towards networked robot systems and cognition-based natural interaction with human users. It will work in straight connection with the Coordination Committee, which in turn will dialog with WP leader partners, so as to ensure that testbed design and construction on WP2 will follow the results of WP1 on general requirements of benchmarking criteria for Robotics. It will also ensure that the dissemination WPs 3 and 4 will have the important role of conveying the vision and the results of RoCKIn to the academic and industrial communities (namely through the Cooperation Board workshops), as well as the dissemination of relevance of robotics research in Europe to the citizens. In order for this to be effective, strong channels of communication between partners and between WPs must be established, so that information flows actively and frequently.

Task 6.2: Organization of 2014 Competition Event - TL: BRSU (IST-ID, UNIROMA1, KUKA, POLIMI) [4 (2, 2, 1, 3) PM]

The first competition event will take place in Munich, at the end of May 2014, during the AUTOMATICA 2014 Trade Fair, in Munich, Germany, and is expected to focus mainly on the basic tasks for individual robots of the 2 competitions. This is because most participants will be relatively inexperienced with robot competitions. Nevertheless, the teams (both experienced and new) will have attended the RoCKIn' Camp earlier that year, where they will have become familiar with handling the 2 testbeds technicalities. Therefore, initial steps in carrying out cooperative tasks by multiple robots are possible for this year.

Task 6.3: Organization of 2015 Competition Event - TL: IST-ID (UNIROMA1, BRSU, KUKA, POLIMI) [6 (3, 1, 1, 2) PM]

The second competition event will take place at the end of November / beginning of December, 2015, during the European Robotics Week (ERW) 2015, in Lisbon, Portugal, and is expected to display the full potential of the participating teams during RoCKIn lifetime. Teams will attend the RoCKIn Field Exercise earlier that year, where they will become familiar with the best-in-class teams in the 2 competitions, learning from their experiences and sharing best practices, hardware and software modules, when possible. Therefore, advances in carrying out cooperative tasks by multiple robots in interaction with humans, fully using the network of robots, sensors, and other devices, are foreseen in this final event.

Measures of success

- a significant number of participants is attracted, mainly from top research groups worldwide not usually involved in RoboCup and robot competitions (at least from 3 new groups);
- clear research progress of the competing teams along the 3 years of the project lifetime, including addressing research topics of increasing complexity, from individual to collective robots, and to natural interaction of the networked robot systems with humans
- large dissemination of robotics research quality in Europe to the citizens attending the events

Person-Months per Participant

Participant number ¹⁰	Participant short name ¹¹	Person-months per participant
1	IST-ID	15.00
2	UNIROMA1	5.00
3	BRSU	5.00
4	KUKA	2.00
5	POLIMI	5.00
	Total	32.00

WT3: Work package description

List of deliverables

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D6.1	2014 Competition Event	3	16.00	O	PU	17
D6.2	2015 Competition Event	1	16.00	O	PU	35
Total			32.00			

Description of deliverables

D6.1) 2014 Competition Event: Realization of the competition event #1 in Munich, during the AUTOMATICA 2014 Trade Fair, in May 2014, hosting the 2 competitions: RoCKIn@Home and RoCKIn@Work [month 17]

D6.2) 2015 Competition Event: Realization of the competition event #2 in Lisbon, during the ERW 2015, in November/December 2015, hosting the 2 competitions: RoCKIn@Home and RoCKIn@Work [month 35]

Schedule of relevant Milestones

Milestone number ⁵⁹	Milestone name	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments
MS2	1st competition event (2014) takes place	3	17	
MS5	2nd competition event (2015) takes place	1	35	

WT3: Work package description

Project Number ¹	601012	Project Acronym ²	RoCKIn
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One form per Work Package

Work package number ⁵³	WP7	Type of activity ⁵⁴	MGT
Work package title	Project Management		
Start month	1		
End month	36		
Lead beneficiary number ⁵⁵	1		

Objectives

- Administrative and financial management of the project

Description of work and role of partners

This work package handles all administrative and financial activities that will ensure achieving the overall objectives of the project. This will be accomplished by decision-making procedures supported by the management structure depicted in Figure 4. A detailed description of the management procedures is provided in Section 2.

The coordination of project activities is primarily achieved through live meetings, electronic communication (telephone, e-mail, Skype, other teleconference mechanisms), a project web site and e-mail lists. Activities include the preparation and chairing of regular project meetings and technical meetings, keeping minutes and records, and communication to all partners via the project web site.

The work also includes the communication with the European Commission (EC), and the preparation of the regular management and progress reports, and compilation of cost statements.

The description of tasks is centred on the roles of the project coordinator partner, but all partners will have the duty to send their administrative and financial documents accurately and timely, respecting all the rules of the EC, to the coordinator, by his request. Moreover, all potential conflicts within the consortium will be resolved by the Coordinator, advised by the Coordination Committee.

Task 7.1: Administrative Management - TL: IST-ID [4 PM]

IST-ID will (using the mandatory contributions of the consortium members):

- prepare the Consortium Agreement of all partners during the contract preparation phase of the project, and will organize and discuss all project issues with the EC for the final contract;
- prepare, lead and coordinate the meetings of the Coordination Committee regarding administrative issues;
- ensure regular reporting to the EC, according to planned deliverables and milestones;
- keep informed, and inform the consortium of all relevant meetings, at the global level of the project and/or related to particular Work Packages;
- be responsible for the administrative contacts with the EC;
- act as focal point for contacts outside the consortium;
- represent the project in all workshops, conferences and other meetings of the project;
- resolve any problems with members of the consortium, concerning administrative issues.

Task 7.2: Financial Management and Accounting - TL: IST-ID [3 PM]

IST-ID will (using the mandatory contributions of the consortium members):

- keep track of all project finances, regarding budgets, cost claims and payments;
- prepare and submit periodic financial reports to the EC;
- ensure any required auditing to consortium partners;
- resolve any problems with members of the consortium, concerning financial issues.

Measures of success

- timely provision of administrative and financial reports to the EC

WT3: Work package description

Person-Months per Participant

Participant number ¹⁰	Participant short name ¹¹	Person-months per participant
1	IST-ID	7.00
	Total	7.00

List of deliverables

Deliverable Number ⁶¹	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D7.1	Annual Administrative and Financial Project Report - Year 1	1	2.00	R	PU	12
D7.2	Annual Administrative and Financial Project Report - Year 2	1	2.00	R	PU	24
D7.3	Annual Administrative and Financial Project Report - Year 3	1	3.00	R	PU	36
	Total		7.00			

Description of deliverables

D7.1) Annual Administrative and Financial Project Report - Year 1: [month 12]
 D7.2) Annual Administrative and Financial Project Report - Year 2: [month 24]
 D7.3) Annual Administrative and Financial Project Report - Year 3: [month 36]

Schedule of relevant Milestones

Milestone number ⁵⁹	Milestone name	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments
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WT4: List of Milestones

Project Number ¹	601012	Project Acronym ²	RoCKIn
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List and Schedule of Milestones

Milestone number ⁵⁹	Milestone name	WP number ⁵³	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments
MS1	First version of testbeds available	WP2	3	9	Main essential scenario features and involved objects, as well as robot capabilities requirements, defined and ready to be used in the 2014 competition event, including preliminary benchmarking items
MS2	1st competition event (2014) takes place	WP6	3	17	
MS3	Final Benchmarking Evaluation Criteria, Modules and Metrics	WP1	5	18	Detailed set of criteria, modules and metrics ready to be used in the 2014 competition event; accepted paper reporting to the academic and industrial communities on the general criteria.
MS4	Final version of testbeds available	WP2	3	30	All scenario features and involved objects, as well as robot capabilities requirements, defined and ready to be used in the final 2015 competition event, including benchmarking items
MS5	2nd competition event (2015) takes place	WP6	1	35	

WT5:

Tentative schedule of Project Reviews

Project Number ¹	601012	Project Acronym ²	RoCKIn
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Tentative schedule of Project Reviews

Review number ⁶⁵	Tentative timing	Planned venue of review	Comments, if any
RV 1	11	Milan, Italy	first period work evaluated, in particular the intermediate results from benchmarking evaluation criteria, modules and metrics, together with the first version of the testbeds (MS1)
RV 2	23	London, UK	second period work evaluated, in particular the first competition event (2014) (MS18), plus the final benchmarking evaluation criteria, modules and metrics (MS3)
RV 3	36	Lisbon, Portugal	final evaluation, including the final version of testbeds (MS4) and after the second competition event (2015) (MS5)

Project Effort by Beneficiary and Work Package

Project Number ¹	601012	Project Acronym ²	RoCKIn
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Indicative efforts (man-months) per Beneficiary per Work Package

Beneficiary number and short-name	WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	Total per Beneficiary
1 - IST-ID	5.00	13.00	4.00	2.00	7.00	15.00	7.00	53.00
2 - UNIROMA1	3.00	6.00	4.00	2.00	18.00	5.00	0.00	38.00
3 - BRSU	6.00	20.00	4.00	2.00	7.00	5.00	0.00	44.00
4 - KUKA	2.00	7.00	6.00	0.00	3.00	2.00	0.00	20.00
5 - POLIMI	15.00	10.00	2.00	1.00	3.00	5.00	0.00	36.00
6 - SecurityChallenge	0.00	0.00	3.00	31.00	0.00	0.00	0.00	34.00
Total	31.00	56.00	23.00	38.00	38.00	32.00	7.00	225.00

Project Effort by Activity type per Beneficiary

Project Number ¹	601012	Project Acronym ²	RoCKIn
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Indicative efforts per Activity Type per Beneficiary

Activity type	Part. 1 IST-ID	Part. 2 UNIROMA	Part. 3 BRSU	Part. 4 KUKA	Part. 5 POLIMI	Part. 6 Securit	Total
3. Consortium Management activities							
WP 7	7.00	0.00	0.00	0.00	0.00	0.00	7.00
Total Management	7.00	0.00	0.00	0.00	0.00	0.00	7.00
Work Packages for Coordination activities							
WP 1	5.00	3.00	6.00	2.00	15.00	0.00	31.00
WP 2	13.00	6.00	20.00	7.00	10.00	0.00	56.00
WP 3	4.00	4.00	4.00	6.00	2.00	3.00	23.00
WP 4	2.00	2.00	2.00	0.00	1.00	31.00	38.00
WP 5	7.00	18.00	7.00	3.00	3.00	0.00	38.00
WP 6	15.00	5.00	5.00	2.00	5.00	0.00	32.00
Total Coordination	46.00	38.00	44.00	20.00	36.00	34.00	218.00
4. Other activities							
Total other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	53.00	38.00	44.00	20.00	36.00	34.00	225.00

WT8: Project Effort and costs

Project Number ¹	601012	Project Acronym ²	RoCKIn
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Project efforts and costs

Beneficiary number	Beneficiary short name	Estimated eligible costs (whole duration of the project)						Requested EU contribution (€)
		Effort (PM)	Personnel costs (€)	Subcontracting (€)	Other Direct costs (€)	Indirect costs OR lump sum, flat-rate or scale-of-unit (€)	Total costs	
1	IST-ID	53.00	174,900.00	110,000.00	60,160.00	47,012.00	392,072.00	361,514.00
2	UNIROMA1	38.00	190,000.00	39,100.00	75,830.00	53,166.00	358,096.00	323,538.00
3	BRSU	44.00	243,800.00	0.00	22,000.00	53,160.00	318,960.00	284,406.00
4	KUKA	20.00	231,140.00	0.00	24,800.00	107,182.00	363,122.00	273,617.00
5	POLIMI	36.00	162,000.00	0.00	52,000.00	111,435.00	325,435.00	228,980.00
6	SecurityCh	34.00	170,000.00	0.00	44,600.00	42,920.00	257,520.00	229,622.00
Total		225.00	1,171,840.00	149,100.00	279,390.00	414,875.00	2,015,205.00	1,701,677.00

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It cannot be changed unless agreed so during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

53. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

54. Type of activity

For all FP7 projects each work package must relate to one (and only one) of the following possible types of activity (only if applicable for the chosen funding scheme – must correspond to the GPF Form Ax.v):

- **RTD/INNO** = Research and technological development including scientific coordination - applicable for Collaborative Projects and Networks of Excellence
- **DEM** = Demonstration - applicable for collaborative projects and Research for the Benefit of Specific Groups
- **MGT** = Management of the consortium - applicable for all funding schemes
- **OTHER** = Other specific activities, applicable for all funding schemes
- **COORD** = Coordination activities – applicable only for CAs
- **SUPP** = Support activities – applicable only for SAs

55. Lead beneficiary number

Number of the beneficiary leading the work in this work package.

56. Person-months per work package

The total number of person-months allocated to each work package.

57. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

58. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

59. Milestone number

Milestone number: MS1, MS2, ..., MSn

60. Delivery date for Milestone

Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

61. Deliverable number

Deliverable numbers in order of delivery dates: D1 – Dn

62. Nature

Please indicate the nature of the deliverable using one of the following codes

R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

63. Dissemination level

Please indicate the dissemination level using one of the following codes:

- **PU** = Public
- **PP** = Restricted to other programme participants (including the Commission Services)
- **RE** = Restricted to a group specified by the consortium (including the Commission Services)
- **CO** = Confidential, only for members of the consortium (including the Commission Services)

- **Restreint UE** = Classified with the classification level "Restreint UE" according to Commission Decision 2001/844 and amendments
- **Confidentiel UE** = Classified with the mention of the classification level "Confidentiel UE" according to Commission Decision 2001/844 and amendments
- **Secret UE** = Classified with the mention of the classification level "Secret UE" according to Commission Decision 2001/844 and amendments

64. Delivery date for Deliverable

Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date

65. Review number

Review number: RV1, RV2, ..., RVn

66. Tentative timing of reviews

Month after which the review will take place. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

67. Person-months per Deliverable

The total number of person-month allocated to each deliverable.

PART B

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Glossary

CA: Coordination Action
EC: European Commission
ERF: European Robotics Forum
ERW: European Robotics Week
EU: European Union
PR: Public Relations
R&D: Research and Development
S&T: Science and Technology

B1. Concept and objectives, progress beyond state-of-the-art, S/T methodology and work plan

B 1.1 Concept and project objective(s)

Robot competitions have proved to be an effective instrument to foster scientific research and push the state of the art in a field. Teams participating in a competition must identify best practice solutions covering a wide range of functionalities and integrate them into practical systems. These systems have to work in the real world, outside of the usual laboratory conditions. The competition experience helps to transfer the applied methods and tools to successful and high-impact real-world applications. Other effects of robot competitions are that young students are attracted to science and engineering disciplines, and that the relevance of robotics research is demonstrated to citizens. However, some limitations can emerge as competitions mature: the effort required to enter the competition grows and may present a barrier for the participation of new teams; a gap between benchmarking complete systems in competitions and benchmarking subsystems in research may grow and limit the usefulness of the competition results to industry.

The goal of RoCKIn is to speed up the progress towards smarter robots through scientific competitions. Two challenges have been selected for the competitions due to their high relevance and impact on Europe's societal and industrial needs: domestic service robots (RoCKIn@Home) and innovative robot applications in industry (RoCKIn@Work).

- **RoCKIn@Work: Innovative robot applications in industry (*towards modern factories where networked robot systems interact naturally and work together with human workers performing industrial tasks*):**



Robots that assist and work interactively with humans in the factory, that are able to comprehend both the environment and complex tasks, and that can flexibly cooperate with other robots. RoCKIn targets industrial needs, such as those identified in existing or future roadmaps (e.g., EUROPE's Strategic Research Agenda for Robotics in Europe). The solutions proposed,

developed, and evaluated by research teams have a large potential to increase European competitiveness worldwide. Current industrial needs focus on autonomous mobile manipulators. RoCKIn takes up this challenge and enriches it with related and highly prevailing challenges, like the programming and configuration effort required to set up the robot such that it can autonomously perform tasks in the production process, or effective and efficient mechanisms to set up, control, and monitor the interaction, cooperation, or collaboration of many robots/devices with each other and with humans. The relevant benchmarking aspects considered include developing suitable benchmarks for assessing productivity. Furthermore, RoCKIn stresses the importance of physics-based simulation in order to reduce the overall application development time and to allow for new robot programming techniques for lot-size 1 production scenarios.

- RoCKIn@Home: Domestic service robots (towards having homes populated by networked robot systems that perform house-keeping and other domestic tasks in natural interaction with humans):** Homes where a wide range of robotic devices, from a single robot companion to networks of sensors, actuators and mobile robots, are integrated to help people to perform a wide diversity of tasks, including the provision of support to impaired and/or elderly people. This is a very important application area for Europe (2012 is the year of Active Aging, see <http://europa.eu/ey2012/>), with huge market potential, as most European countries are faced with the problems of ageing societies. Technology is appealing to most citizens, as long as it provides real improvement in the quality of life and entertainment at home. RoCKIn@Home also presents challenging benchmark problems in human-robot natural interaction and mixed-initiative cooperation.



Both challenges have been inspired by activities in the RoboCup community, but RoCKIn improves and extends them by introducing new and prevailing research topics, like natural interaction with humans or networking mobile robots with sensors in ambient environments, in addition to specifying concrete benchmark criteria for assessing progress.

The Objectives of RoCKIn are such that, after the project lifetime:

1. benchmarking methods and performance metrics that consider not only subsystems but the integrated system will be used in robot systems developed within the frame of the RoCKIn competitions by participating teams and in, at least, robot systems developed in one other running European project;
2. worldwide researchers in Robotics will use testbeds developed during RoCKIn to compare the success of their approaches when applied to a common research problem, as measured by the developed benchmarking criteria and metrics - with a special focus on approaches based on networked robot systems that display cognitive abilities when interacting with humans;
3. new teams from at least 3 reputed European research laboratories will participate in RoCKIn competitions;
4. the perception of European citizens and of industrial stakeholders about the value of Robotics research in Europe will increase, as measured by opinion poll methodologies.

These objectives underlie the execution of the following **Coordination Activities**:

1. organize robot competitions that address the 2 challenges: innovative robot applications in industry (RoCKIn@Work) and smarter domestic service robots (RoCKIn@Home) ;
2. organize 3 research and education camps on Robotics, mainly targetting the objectives of the two RoCKIn challenges, bringing new students and teachers from EU laboratories;

3. design and build 2 robot competition testbeds to address a threefold goal: i) serve as a benchmark for the RoCKIn competitions and, in general, for the autonomous robotics community; ii) foster the testing of novel approaches in the testbeds by academic and industrial researchers; and iii) build a showcase of Robotics R&D for the general public;
4. introduce new benchmarking challenges and methods to benchmark intelligent systems through competitions to push forward the state-of-the-art research through good experimental methodologies and performance evaluation in robotics;
5. endow the testbeds infrastructure with devices and scenarios that push the state of the art on cognitive and networked robot systems (i.e., systems that network multiple robots and other devices, e.g., sensors, actuators and humans to attain situational awareness and decision-making);
6. use competitions as a means of disseminating the value and impact of European R&D in robotics, both for citizens in general and relevant stakeholders, justifying the citizen's tax money investment in this area, and as a means of attracting young kids towards S&T areas. One important piece of the dissemination puzzle is RoCKIn website, described in detail in Section B.3.2.

Under Activity 1, two competition events events hosting RoCKIn'@Home and RoCKIn'@Work are organized during the project period, **targeting all four objectives**:

- RoCKIn 2014, in May 2014 (M17) during the AUTOMATICA Fair in Munich, Germany.
- RoCKIn 2015, in November 2015 (M35, close to the end of the project) as part of the European Robotics Week 2015.

In the RoboCup community, it is customary to revise and change the competition rules every year. While this is helpful in order to maximize progress and technology push, it makes it difficult to compare team results across multiple years and to assess the overall progress of the community. Due to its higher emphasis on benchmarking, the RoCKIn project makes a strong effort to develop improved measures of progress.

A first development is to reduce the number and importance of subjective evaluation vs objective evaluation in the competitions. In the current RoboCup@Home competition, which consist of three stages with several tests in each stage, some tests use completely objective measures, like the number of persons identified, the number of objects fetched, etc., while other tests apply subjective evaluations by competing team leaders or a jury of internal and external referees. Reducing this influence of subjective and possibly biased assessment will already make the competitions more attractive to additional research groups.

A second development is to revise the evaluation criteria of tests such that the overall measure combines elements measuring the quality of subsystems with elements measuring success in performing the overall task. Examples of subsystems include mapping and localization, navigation, object or person detection, identification, and pose estimation, grasping and manipulation capabilities. Examples of task performance elements include the number of items unloaded from a box or the number of items successfully retrieved and deposited in @Work, or the number of drinks served to people in @Home. Criteria for evaluating subsystems are usually not so difficult to find, but they may be difficult to measure, and technical infrastructure is often needed to do that. Task success criteria are also often well defined, and are usually easy to determine. The tricky part is how to combine all these into a single performance measure. The approach RoCKIn intends to follow is to use

performance assessment trees, which do the required aggregation in a tree structure. The advantage is that information on the performance on all subcomponents is retained while still providing an overall performance measure. The debate in the community is therefore expected to shift from the question of “which is the right measure?” to which is the “right weight of the measure?”. The results from the first few competitions should allow to adjust these weights to properly reflect the real influence of subcomponents on the overall performance. With this initiative, RoCKIn addresses the problem of subsystem vs total system benchmarking, and it may well pave the way for more scientifically grounded discussions on the relative importance of subsystem solutions and their contribution to overall system performance.

A third development is to apply more care in the design and revision of the competition rules such that performance can be better compared across years. Rule revision should actually start with an assessment of the performance of all teams on each of the elements of a test. If a test element, such as navigating from a defined start position to a target position, is robustly performed by almost all teams in the competition with similar efficiency, the scientific problem behind it is probably solved and a good engineering solution is available. Such elements can be removed from the competition --- or at least from the performance measure, because they do not contribute to differentiation of solution approaches. On the opposite, test elements which none or only a few teams can perform represent unsolved research challenges for which still no solution exists. Such elements need not be changed at all. Test elements in the middle are the ones that could or should see modification. These modifications should be such that the previous version of the test element is still retained in the test, but a version of it with an additional challenge is added to the test. As a simple example, take navigating through a door as a test element. A first door may be open; this test element then simply tests whether the robot’s navigation capability are precise enough to get through a narrow passage without collision. A second door may be “almost closed”; the robot cannot get through it without really opening it, but it need not manipulate any door handle. A third door may be really closed, i.e. the robot must actually deal with door knobs and handles. A fourth door may be closed and locked, i.e. the robot would have to be able to use a key for opening it. If a first version of the test used only open doors, and almost closed doors are added in the second version, then the performance assessment tree must be adapted. However, it still contains all the performance measures obtained in the first version (albeit possibly with less weight), which allows comparison of performance across multiple years.

A fourth development is to lower the entry barrier for teams interested in participating in the competition. This issue is addressed by setting up a repository for sharing data, performance evaluations, and code, including well-documented and complete solutions to challenge problems, which allow new teams to get a quick but non-optimal working system. Teams can then gradually improve such a system by gradually replacing subcomponents with better solutions, eventually even with changing the complete architecture. The development of these solutions per se is not part of RoCKIn; these solutions will be contributed by the teams maintained by several RoCKIn partners or by the community.

The aforementioned developments address several essential issues and barriers that currently still prevent many research groups to participate in competitions. By removing or lowering these barriers and by making the competitions much more attractive as an instrument for scientific evaluation of different approaches, the RoCKIn competitions could and should become an highly interesting instrument for fostering and measuring scientific progress, both for research groups as well as for European research projects. The progress in each of the aforementioned efforts can be soundly assessed and documented during project reviews.

Such developments ensure the fairness and repeatability required to benchmark results and provide sound evaluation criteria. Benchmarking handles the important issues of standardization and systematic accumulation of knowledge and skills developed in successive editions of a competition. Furthermore, it helps provide such material to new teams in an easily accessible manner, i.e., through a common infrastructure for competition repositories that can later be used, and make it a success case also for standardization, following examples such as Willow Garage's ROS (Robot Operating System). Progress is measured by the amount of success of the teams in addressing new rules each year and also by the success in building up competition repositories and standards across teams. **Criteria to measure this progress count the number of new rule challenges that have been successfully overcome by at least the top teams, as well as the number of newly available standards and repositories, benchmarks and component solutions.** Furthermore, we also provide online tools using which current and prospective participants can propose changes to the rules, and/or endorse existing proposals. **The number of such proposals also acts as a measurable way to verify the progress of RoCKIn.**

Underlying and supporting the achievement of all the objectives, annual research and education camps introduce, under Activity 2, the competition rules and technical details to new teams and are open events for the public as well;

- one introductory event will take place in 2013 during/after RoboCup2013 in Eindhoven, The Netherlands, so as to simultaneously enable members of potentially new teams to contact live with the current status of RoboCup@Home and RoboCup@Work competitions, and to get an introduction to the new RoCKIn competitions;
- two other summer school-like events - RoCKIn Camp and RoCKIn Field Exercise - will be held in 2014 and 2015, respectively, co-located with and immediately after that year's European Robotics Forum meeting.

Camps naturally target Objectives 2 and 3 above.

Immediately after the camps and competition events, and under Activity 6, annual workshops with relevant industry and services stakeholders will provide the means for fostering technology transfer, bringing together academia, industry, public authorities and EU officials to discuss the relevance of robot competitions for the advance of research, industry-academia collaboration in general and technology transfer and benchmarking factors in particular, to explore exploitation opportunities, and to provide inputs to improve the benchmarking scenarios and the corresponding testbeds. For the meetings taking place together with the annual competition events, where novel approaches are tested in RoCKIn@Home and RoCKIn@Work, **we have specifically invited selected (academic and industry) researchers from significant and RoCKIn-relevant EU projects as stakeholder representatives**, together with the RoCKIn Experts, who will compile reports on the annual progress of RoCKIn competitions and activities. **This is in line with part of Objective 4 above.**

The **remaining means to accomplish Objective 4**, still under Activity 6, concern dissemination activities and public relations (PR) of different types, through the project web page, traditional media, blogs, social networks, public events during robot competitions, and annual organization of European events (e.g., European Robotics Forum, European Robotics

Week, RoboCup German Open, Portugese Robotics Open, etc.). Here, the latest approaches to domestic service robots, and innovative industrial robots will be demonstrated, possibly together with other RoboCup competitions that further attract the general public, namely RoboCupSoccer and RoboCupJunior. The latter is not part of RoCKIn, but RoCKIn will take advantage of their co-location to further disseminate its goals and European robotics goals to a larger number of citizens.

In line with Objective 1, and under Activity 1, RoCKIn@Home and RoCKIn@Work extend the current RoboCup@Home and RoboCup@Work rules to include networked robot systems (i.e., spots for installing static sensors, networked with multiple mobile robots) designed to promote natural interaction with humans (e.g., the sensor network provides situational awareness and recognizes human gestures and behaviors, so as to provide information to the mobile robots to act appropriately).

Under Activity 3, two permanent testbeds, complex enough to remain unchanged for several years and modular enough to test not only for the end-goal but for the year-by-year progress of sub components, are designed to support the RoCKIn@Home and RoCKIn@Work education camps and competitions.

RoCKIn's emphasis on benchmarking pushes the current state of the art beyond RoboCup competitions by fostering reusability and inspect ability of the involved (sub)systems, thus making competition winning solutions attractive and suitable for industry. The benchmarking methods run under Activities 4 and 5, and consider both particular subsystems (e.g., guidance, localization, path planning, task planning, locomotion) and their integration, as well as challenges related to networked robot systems and natural interaction with humans based on cognitive methods. They address, but are not limited to, issues such as: public-domain functional specifications for a reference European platform; making the code, modules and components of competition winning teams public domain; tests for benchmarking; moulding the rules to enable benchmarking methods; evolution of the benchmarks with the state of the art; definition of a scoring mechanism that accounts for both system and subsystems performance. They are developed first for competitions in general, and then instantiated for the 2 selected competitions.

The **project milestones** are:

- **Milestone 1 (M09):** intermediate results from benchmarking evaluation criteria, modules and metrics available together with the first version of the testbeds, on time for the competitions
- **Milestone 2 (M17):** first competition event (2014) takes place
- **Milestone 3 (M18):** final benchmarking evaluation criteria, modules and metrics available for progress evaluation and camps + competitions usage
- **Milestone 4 (M30):** final version of the testbeds, ready to be used after the project lifetime.
- **Milestone 5 (M35):** second competition event (2015) takes place.

B 1.2 Progress beyond the state of the art

Robotics has come a long way from the intensive manipulator- and AGV (automatic guided vehicles)-based robotic automation systems of the 1970s, which displayed little intelligence,

to the service and industrial robots of today, which aim to act in largely unstructured scenarios populated with humans. Smarter robots should be dependable, should interact more naturally with humans, and should be part of the permanently evolving and rich ICT infrastructure currently available in modern public spaces and factories. Important steps have been made in this direction by researchers worldwide since then, and Europe has had a prominent role in this process.

Robot competitions (e.g., RoboCup, DARPA Grand Challenge, ELROB) have demonstrated the ability to bring advanced methods into practice, and have pushed the state of the art in providing integrated approaches to grand challenges. Participating researchers from all over the world, with different backgrounds, associate and compete to show their best solutions to address the same challenge. Scientific competitions, such as RoboCup, have well-established principles for research progress through annual rule updates and constraints removal, towards richer research challenges and more realistic robotic systems. Furthermore, competitions such as DARPA Grand Challenge provide very challenging experimental settings, with partially uncontrolled conditions. In this respect, they go far beyond the typical research laboratory scenarios, where the solution can be often demonstrated under constrained conditions not easily reproducible, thus making the tests not repeatable. In some cases, winning a competition has been a key step towards the transfer of the solution towards commercial and industrial enterprises, with a significant impact on our lives (e.g., Google driverless car, KIVA systems revolutionary automation systems, Quince robot used in search and rescue operations after the Fukushima earthquake in Japan, or Aldebaran Robotics' NAO humanoid commercial success).

Robotics needs now an impetus that brings existing appealing prototypes from research laboratories to actual products in the mass market. One of the driving forces for such a significant and long-awaited technology transfer to happen is to focus the research in robotics on integrated systems that address and solve grand challenges. Obviously, the goal is not simply to realize a robotic system engineered to solve that particular challenge, but to develop formal methods that enable systematic approaches to building better and smarter robots in a given class of applications, benchmarked against building blocks common to most grand challenges for robots.

From an European (and perhaps wider) perspective, some issues in robotics R&D are particularly important and their solution is urgent:

- a **regular and established process of technology transfer** of the results obtained in European projects to actual applications of industrial and commercial impact;
- a scientifically sound **specification of benchmarking challenges and methods**;
- a larger **blending of cognitive systems and robotics** concepts used to handle the challenges during competitions.

Though some of the current robot competitions, including RoboCup, have addressed some of these issues, they also have their drawbacks. Success requires too much effort on technological aspects of complex robotic systems. This has shown a number of critical problems, of which we name the most important:

- it is difficult for new participants to join an existing competition (barriers to entry), due to the high level of complexity in the competing systems;

- the competition is usually “one shot”, and thus it is usually difficult to directly compare results from different editions;
- the score is usually assigned to the integrated robotic system, making it difficult to evaluate the performance of single modules/subsystems (e.g., path planning and vision modules); it is undoubtedly a challenge to design a competition taking into account system level and subsystem level evaluation, so this is one of the key contributions of RoCKIn;
- the participants are generally required to provide complete robotic systems, thus discouraging small / low budget / specialized research groups from participation;
- the lack of an infrastructure to share solutions and software makes discrimination between scientific/technological breakthroughs and mere technical refinement difficult;
- the benchmarking and blending with cognitive systems aspects are not fully addressed.

RoCKIn aims at addressing the major European robotics R&D challenges by deploying competitions that act as benchmarks and whose rules avoid the currently known problems along four main directions:

- **promote** systematic methods for **technology transfer from robot competition** results and developments (through benchmarking - see WP1 - and contacts with industry - see WP3);
- **reduce the barriers for new teams to enter** robot competitions (through module re-use - see WP2 - and education camps - see WP5);
- allow **performance evaluation of both sub-system modules and the integrated robotic system, using scientifically sound benchmarking techniques** (see WP1);
- **extend the competition challenges to enable the inclusion of the cognitive systems dimension** (see WP2).

The focus on scientific benchmarking competitions requires a careful update of RoCKIn competitions with respect to their related current RoboCup competitions. Rules underline the competition setup, the scoring system, and (optionally) reference platform specifications. The current practice, task complexity and scenarios included in the rules are viewed as evolving and can change from year to year to accommodate new requirements. Therefore they explicitly include guidelines to ensure that such evolution will increase the scientific value of the competition and its appealing to the general audience.

The extension to the cognitive systems dimension results from promoting natural interaction of multiple robots with humans and networked devices in the rules, thus emphasizing the need to recur to knowledge acquisition and understanding through deliberation, learning, and a diversity of sensing information.

All the project participants have prior experience of involvement with robot competitions, namely RoboCup (IST-ID, UNIROMA1, BRSU, KUKA and POLIMI). SecurityChallenge has prior experience with the DARPA Grand Challenge.

The criteria for competitions progress evaluation, to be recommended for use by the Experts Board in their evaluation reports, are based on quantifying RoCKIn’s success in effectively addressing the aforementioned critical problems of competitions:

1. ability to reduce the barriers to entry of new participants (e.g., through the Education Camps) - aiming at having at least 3 new teams from reputed European robotics research Laboratories, along the lines of Objective 3 stated in Section B.1.1.;
2. ability to quantify team performance using a score that takes into account system level and subsystem level evaluation;
3. ability to evaluate subsystems only;
4. availability of an infrastructure to share solutions and software and its impact on cutting edge research groups (academic and industrial);
5. ability to compare results from different editions of the competitions, applying benchmarking methods and metrics to evaluate the progress on S&T challenges that are kept from year to year;
6. new published results on benchmarking and blending networked robot systems with cognitive systems.

RoCKIn also includes a substantial effort towards progress beyond the state of the art on the dissemination to and awareness of the citizens regarding the relevance of robotics in Europe. Along these lines, **criteria for evaluation of dissemination success** include the quantification of participation of new teams in competitions, impact on public awareness and media coverage, and RoCKIn website usage.

B 1.3 S/T Methodology and associated work plan

B 1.3.1 Overall strategy and general description

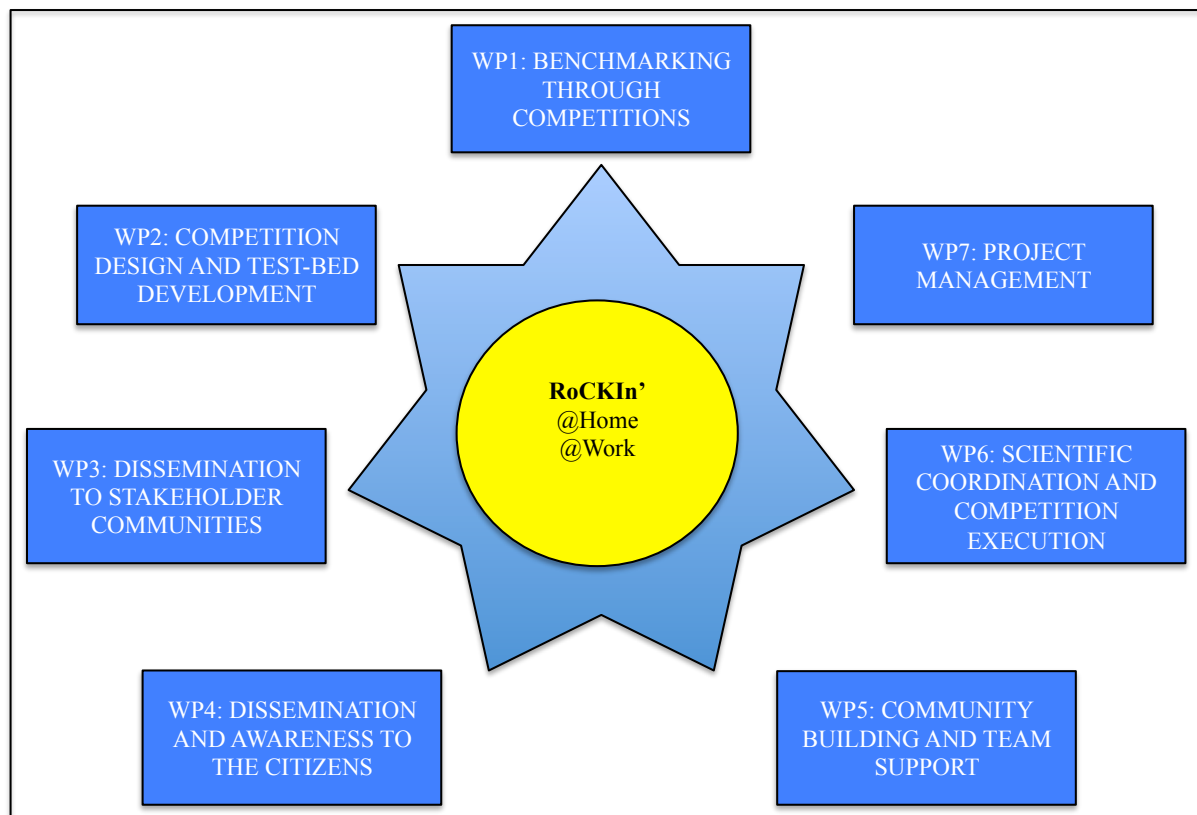


Figure 1 - General view of RoCKIn Work Packages.

The CA is organized into 7 work packages: WP1-WP6 are concerned with coordination activities and WP7 is the project management work package. **Figure 1** shows the 7 WPs represented at the tips of a star encircling the 2 RoCKIn challenges, to point out that all RoCKIn activities coalesce around the corresponding competitions (@Home and @Work).

The competitions are actually the core activity of this CA, and they are the main motivation for the other activities: benchmarking features (for scenarios and robots), evaluation criteria, modules and metrics are an output of RoCKIn *per se*, but are also instrumental in designing adequate testbeds and competition rules. Teams must get background on Robotics and especially on the testbeds in order to use them efficiently during competitions. Dissemination (to citizens and relevant stakeholders - demonstrating their potential for technology transfer) is a key activity enabled by the competitions.

The main Work Packages and their relations are summarized as follows (check Part A for full descriptions):

- WP1 is dedicated to the definition of environment features and required robot capabilities in the RoCKIn scenarios, as well as of general metrics and criteria for benchmarking of competitions in general.

- WP2-WP5 cover the specific cross-cutting activities for each of the 2 selected challenges: competition design and testbed development; dissemination to stakeholder communities and regular citizens of project progress and obtained results, exploring exploitation opportunities with industry; community building and team support through research and education camps, respectively.
- WP6 covers the scientific coordination of the CA, ensuring consistency across the coordination activities, and the execution of the competitions (notably of the 3 annual competition events).

Risk assessment and contingency planning was studied for each of the work packages, and is summarized in the next tables.

WP1-specific risks	Probability	Impact	Contingency measures
A sound and complete list of general features of scenarios and robots (including the functional reference platform) for benchmarking is difficult to provide, given the high heterogeneity of robot competitions.	Medium	Low	Focus on RoCKIn competitions, which will likely provide a very rich set of lessons for more general competition classes.
A sound and complete list of general evaluation criteria, modules and metrics for benchmarking through competitions is difficult to provide, given the complexity of the benchmarking problem in robotics.	Low	Medium	Focus on specific evaluation criteria, modules and metrics for RoCKIn competitions, which will likely provide a very rich set of lessons for more general competition classes.

WP2-specific risks	Probability	Impact	Contingency measures
Budget and/or effort amount constraints prevent achieving all the desirable characteristics of each testbed, namely concerning scenario features and sensors.	Medium	High	Reduce the scope of what will be implemented during the project lifetime, though providing a full-fledged list of design specifications for future implementation; refer to resources available at the partners' labs.

WP3-specific risks	Probability	Impact	Contingency measures
Annual evaluation by stakeholders and RoCKIn	Low	Low	Thorough and fast implementation of the Experts' recommendations for the

Experts turns out to be not so positive.			following period/year.
Only a few methods identified are suitable for technology transfer.	Medium	Medium	Re-think whether the right challenges are addressed (what does industry want?) and whether the dissemination approach is right. Approach suitable industries directly and offer bilateral demonstrations and meetings to explore exploitation opportunities. Try attracting more industry stakeholders to competition events.
Scientific community not usually participating in robot competitions does not show interest in RoCKIn events in conferences and in general.	Low	Medium	Invest more on personal word-of-mouth and bi-lateral meetings with top researchers to explain them the technical soundness of the RoCKIn approach to robotics research and the potential impact of competitions on the development of smarter robots and scientific breakthroughs, illustrated by past and during-project-lifetime examples of success.
Costs for dissemination of results at major industry trade shows are too high.	Medium	Medium	Additional funds from industrial partners will be requested as in-kind contribution to the project.

WP4-specific risks	Probability	Impact	Contingency measures
Web page not attractive / low number of visitors.	Low	Medium	Thorough revision of the web page, following a meeting with and recommendations of RoCKIn's Coordination Committee.
Low awareness of the project in traditional and non-traditional media.	Low	Medium	Focus on a smaller number of publications, blogs and social network sites, with a larger number of visitors/readers, namely those more popular among general audiences, not just the ones related to popular science (where readers are already "convinced").

WP5-specific risks	Probability	Impact	Contingency measures
Students are attracted to the introductory camp, but show little interest in participating in RoCKIn competitions.	Medium	Medium	Invest more on personal word-of-mouth and bi-lateral meetings with research group coordinators in Europe and worldwide. This should explain the technical soundness of the RoCKIn approach to robotics research and education, and the potential impact of competitions on the development of smarter robots and scientific breakthroughs, illustrated by past and during-project-lifetime examples of success.

WP6-specific risks	Probability	Impact	Contingency measures
ERW events do not take place in 2015, or there is no adequate venue for the competition events within the major ones prepared for the ERW in that year	Low	Medium	RoCKIn will organize its own competition event week. As a last resort, the RoCKIn competition that year could be moved to another date. This could coincide with some European regional RoboCup event, such as the German Open, Portuguese Robotics Open or Mediterranean Open.
Costs of organizing a competition event exceed the expected ones (e.g., AUTOMATICA 2014 venue too expensive to rent).	Low	Medium	Charge registration fees to participants, only as high as required to ensure the financial viability of the event.

WP7-specific risks	Probability	Impact	Contingency measures
Contentions with one of the consortium partners.	Low	Medium	See Section B.2.

B 1.3.2 Timing of work packages and their components

Dependencies between Work Packages are depicted in **Figure 2**. The results from WP1 are instrumental in influencing the competition design and the testbeds development in WP2, which in turn provides relevant input for WP5, where testbed handling by potential

participating teams is taught. The outputs of both WP2 and WP5 are essential to ensure a successful execution of the competition events in WP6.

The dissemination to stakeholder communities (industry and academia) will be fed by the results obtained in WP1, WP2 and WP6, while the dissemination to citizens will result mainly from the competition events (WP6) and research and education camps, where some field tests will take place (WP5). Selected stakeholders and the RoCKIn experts have a prominent role in WP2 (where they provide inputs to the design and validation of the testbeds), WP3 (where they evaluate – during the competition events – the project progress, and provide advice for the next year), and WP5 (where they teach at the research and education camps).

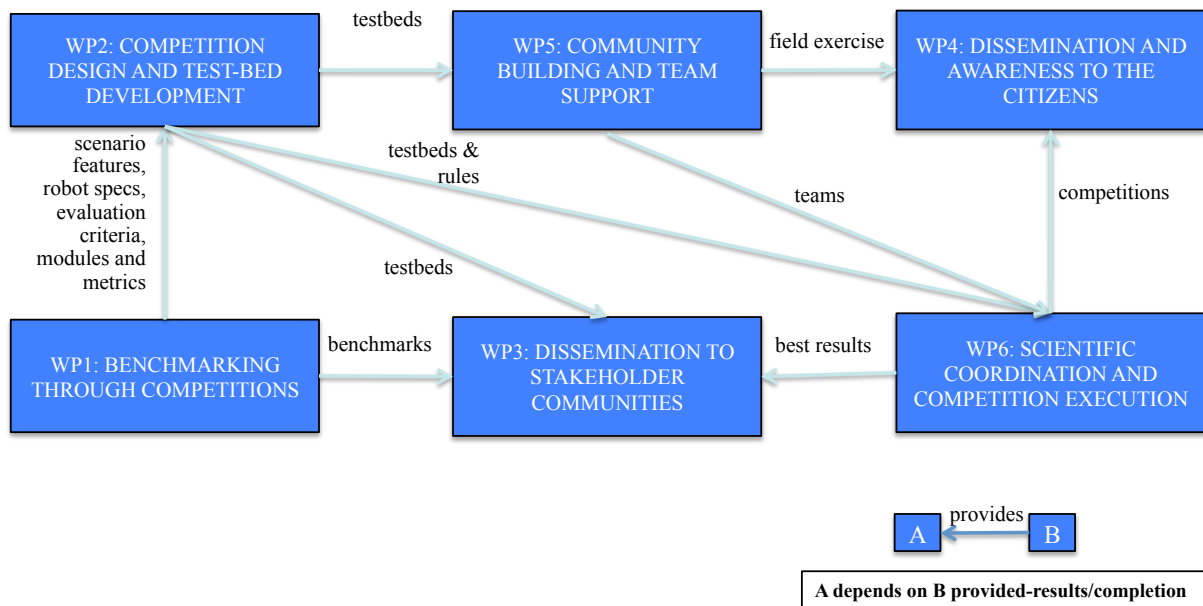


Figure 2 - Pert diagram with RoCKIn Work Packages dependencies.

The Gantt chart of Figure 3 depicts the project timeline for Work Packages and their tasks, including the milestones.

The following table summarizes the timeline of planned activities.

	2013				2014				2015			
	1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T
Local/Event	IST, Lisbon	ERF 2013 - Lyon, FR	RoboCup 2013 - Eindhoven, NL	ERW 2013	Rome, IT	ERF 2014	RoboCup 2014 - João Pessoa, Brazil	ERW 2015 - London, UK		ERF 2015	RoboCup 2015 - [Location TBD, possibly Asia / Oceania]	ERW 2015 - Lisbon
Project Meeting	KO Meeting		Progress Meeting		Progress Meeting			Progress Meeting		Progress Meeting		Final Meeting
Coordination Activity		Workshop			Workshop	Advisory + Expert Boards Meeting				Workshop	IROS 2015, Hamburg	Advisory + Expert Boards Meeting
Coordination Activity		ICRA 2013, Karlsruhe	Camps kickoff		RoCKIn Camp1	Competition Event (AUTOMATI CA 2014) - Munich				Field Exercise - Rome		Competition Event

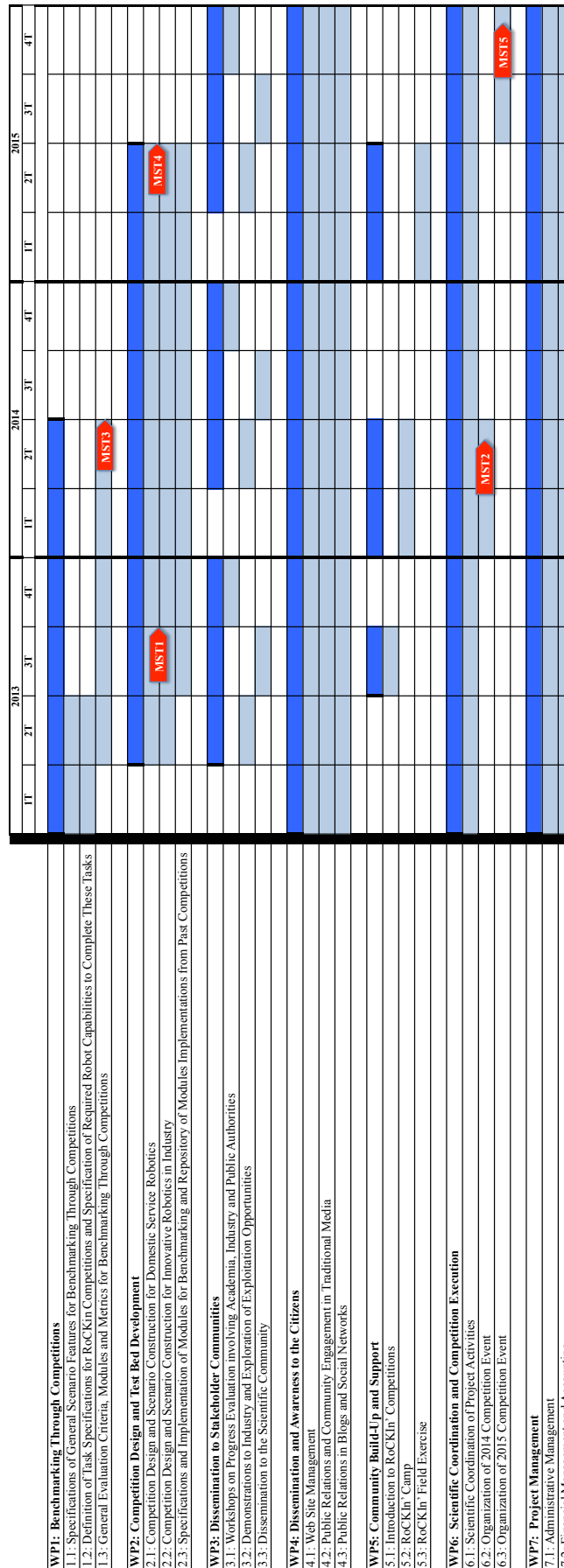


Figure 3 -RoCKIn Gantt Diagram, including milestones

B2. Implementation

B 2.1 Management structure and procedures

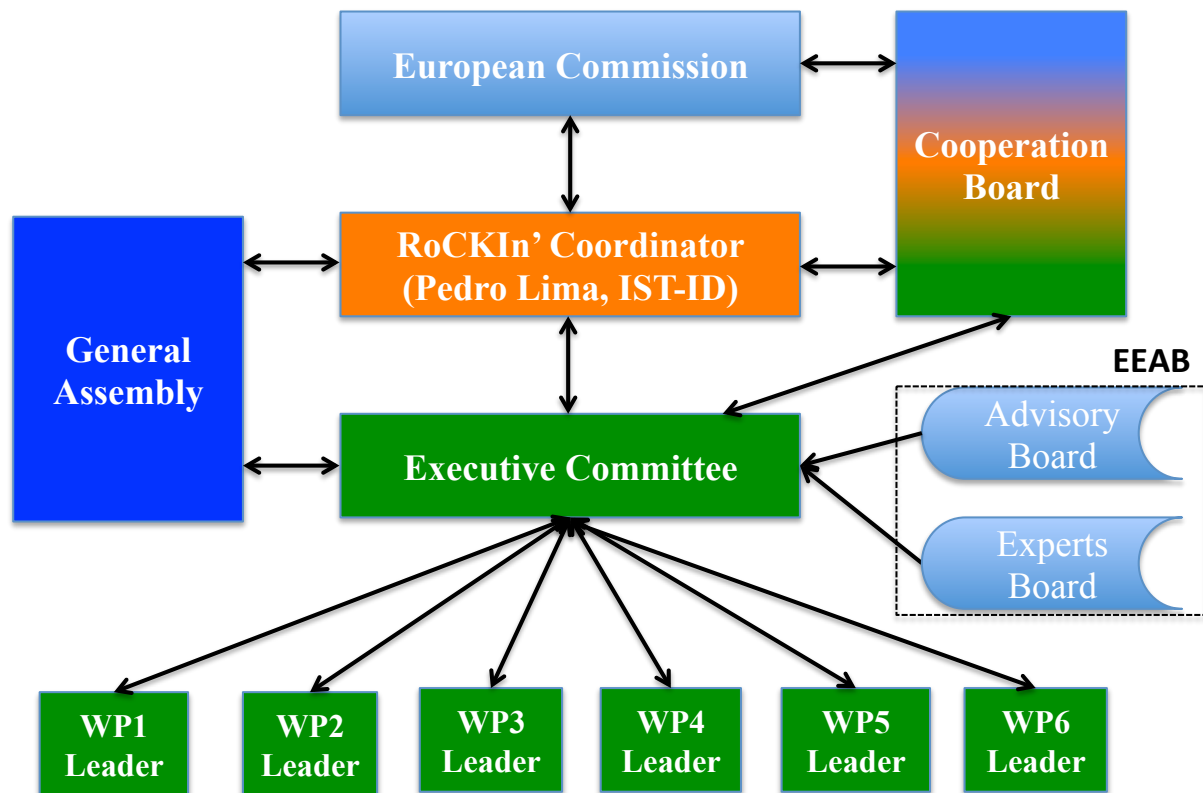


Figure 4 - RoCKIn management structure.

The management structure of RoCKIn has been kept simple, so as to be agile and effective¹.

The **Project Coordinator** is Pedro Lima, from IST-ID. He serves as the scientific, administrative and financial interface between the consortium and the European Commission (EC), through its Cognitive Systems and Robotics (CSR) unit. He is also part of the **Executive Committee**, composed of 1 senior representative per partner, who advise the Project Coordinator in his S&T decisions.

The **General Assembly** is the ultimate decision-making body of the CA.

The **Executive Committee** represents all partners of the project. It ensures the project performs work which is relevant and useful to the wider European robotics community. The Executive Committee shall be responsible for:

¹ The consortium body descriptions in this section are just indicative. In case of any inconsistency, the definitions in the Consortium Agreement prevail.

- supporting the project coordinator in fulfilling obligations towards the EC,
- monitoring the project progress and updating the work plan (if necessary),
- performing contingency planning.

The Executive Committee interfaces with the project **Work Package** leaders, designated by the WP leading partner. This ensures that the benchmarking, competition design and testbed development, dissemination (to stakeholder communities and to citizens in general), and research and education camps activities are handled consistently, following the project philosophy and principles, contributing for the organization of successful competition events, capable of attracting major research groups from Europe and the rest of the world, with large impact on technology transfer to industry and services, and on citizens' perception of the relevance of European robotics worldwide.

Two Boards, composed of experts in robot competitions and robotics, grouped in the **External Experts and Advisory Board (EEAB)**, advise and help evaluating the progress of RoCKIn:

- **Advisory Board** - composed of RoboCup members and non-RoboCup members, academic and industry people, advises on major decisions, research directions, relation with industry and other arising issues during the project lifetime
 - XiaoPing Chen, University of Science and Technology of China, China
 - Jon Agirre Ibarbia, Tecnalia, Spain
 - Adam Jacoff, NIST, USA
 - Bruno Siciliano, U. Naples, Italy
 - Bill Smart, Oregon State University, USA
 - Oskar von Stryk, Technical University of Darmstadt, Germany
 - Manuela Veloso, Carnegie-Mellon University, USA
- **Experts Board** - prepares evaluation reports after the 2 competition events, as described in the project text.
 - Alessandro Saffiotti, Örebro University, Sweden - RoCKIn@Home + RoCKIn@Work
 - Herman Bruyninckx, Katholieke Universiteit Leuven, Belgium, RoCKIn@Work
 - Tijn van der Zant, University of Groningen (UG), The Netherlands - RoCKIn@Home

A **Cooperation Board** is composed by

- a representative of the EU, that leads
- RoCKIn Coordinator (also representing IST-ID)
- 4 representatives of the other 5 RoCKIn partners (1 representative per partner, rotating over the 5 partners)

with the goal of increasing communication and cooperation with the other competition and benchmarking activities in EU-funded projects, as well as promoting participation of other project members in RoCKIn Camps and competition events. A workshop, gathering ad hoc Cooperation Boards from other related projects, is organised at least once a year, e.g., during the annual European Robotics Forum. During these workshops, RoCKIn progresses in benchmarking through competitions are presented to the other project representatives, and lessons taken from those projects' progresses on benchmarking and metrics are incorporated in RoCKIn benchmarking efforts.

The **Project Coordinator, Executive Committee and Work Package Leader** duties are listed in RoCKIn's Consortium Agreement.

The **decision making process** is defined in detail in the Consortium Agreement.

The partners in the consortium commit themselves to provide a **maximum level of transparency in terms of the available knowledge** for the purpose of an effective and efficient execution of the project. The precise details of management procedure in case of delays and defaulting parties are stated in the Consortium Agreement.

The coordinator further undertakes, together with the project management, a number of specific measures to assure maximum awareness of the available knowledge and foster communication in the consortium. These measures include setting up and maintaining a project webpage that includes a public section to communicate, for example, ongoing activities and project progress, a list of recent events and a private section to facilitate communication within the consortium.

Further details of handling **intellectual property** are fixed in the Consortium Agreement.

B 2.2 Beneficiaries

The **Association of Instituto Superior Técnico for Research and Development (IST-ID)** <<http://www.ist.utl.pt/en/>> coordinates the project.

IST, Instituto Superior Técnico, from Technical University of Lisbon, acts as a **third party** in this project and makes available some human resources to IST-ID, on the basis of a prior agreement. Under this agreement, members of IST's staff are made available to IST-ID and may participate in the research and development activities carried out by the latter and to be used at its management discretion. The following key personnel of IST-ID involved in this project are all members of the IST and are covered under said agreement.

Main tasks and role in the project

WP1: involvement in the benchmarking tasks

WP2: strong involvement in the design and construction of the domestic service robots testbed, of which it will be the final host

WP3: involvement in industrial and academic dissemination

WP4: responsible for providing content for most of the dissemination actions

WP5: active participation in the teaching and organization of the 3 Camps

WP6: responsible for the scientific coordination of the overall project, and the main responsible for organizing the competition events (including a subcontract for the logistics), handling the RoCKIn Experts budget to draft independent reports

WP7: project manager

Previous experience and competencies

The project team comes from the Intelligent Robots and Systems group at the Institute for Systems and Robotics of the Instituto Superior Técnico (ISR/IST). The research and development work carried out by the group approaches complex systems from a holistic standpoint, rather than focusing on some of the subsystems. The topic of cooperation (among agents and/or robots, among robots and humans) arises naturally from this viewpoint. Well-recognised expertise in organizing and participating in robot competitions qualifies IST-ID (through ISR/IST) to be the coordinator of RoCKIn. The topic has been one of the most important research areas of the involved research group, as proved by more than 50 publications resulting from the work in competitions, in scientific journals and conferences, in the last 10 years. Experience within RoboCup since 1998 is a good example of such expertise, though the group has also participated in other national and international competitions at the European level.

Key personnel

Pedro Lima (Ph.D., Associate Professor at Instituto Superior Técnico, TU Lisbon) <<http://omni.isr.ist.utl.pt/~pal>> is the coordinator of RoCKIn, leveraging his almost 20-year experience organizing and participating in robot competitions (he chaired RoboCup 2004 in Lisbon), namely in RoboCupSoccer, and project coordination. He is the coordinator of the Intelligent Robots and Systems group at ISR/ IST, and his research interests include networked robot systems. Pedro Lima has a significant role in all WPs.

Luis Custódio (Ph.D., Assistant Professor at Instituto Superior Técnico, TU Lisbon) <<http://omni.isr.ist.utl.pt/~lmmc>> has an active participation in RoCKIn, especially WP1, WP2 and WP6, where his past experience organizing and participating in robot competitions (he was co-chair of RoboCup 2004 in Lisbon) are determinant. He is member of the Intelligent Robots and Systems group at ISR/ IST, and his research interests include emotion-based systems and artificial intelligence.

Sapienza Università di Roma (UNIROMA1) <http://www2.uniroma1.it/default_e.php> most prominent role in the project refers to the organization of research and education camps under WP5 and, in general to the support to new teams and community building, though it is involved in the other WPs as well.

Main tasks and role in the project

WP1: involvement in the benchmarking tasks

WP2: strong involvement in the design and construction of the domestic service robots testbed

WP3: responsible for organising workshops in major AI and robotics Conferences

WP4: provides content for most of the dissemination actions

WP5: main responsibility for the organization of the 3 Camps, including the travel support to teams and teachers (to be subcontracted).

WP6: involvement in competition events organization

Previous experience and competencies

The project team comes from Ro.Co.Co. Lab (Cognitive Cooperating Robots), and has an internationally established research expertise in the following research areas: (i) cognitive robotics knowledge representation and reasoning, (ii) coordination and cooperation in MAS and MRS, (iii) Robotic perception and SLAM (iv) human-robot interaction. The RoCoCo lab has developed robotic teams for soccer, as well as home rescue robots (SPQR) for the RoboCup scientific competitions. Moreover, it has organized several RoboCup events including Rescue Robotics Camps and Mediterranean Open.

Key personnel

Daniele Nardi (Ph.D., Full Professor at Sapienza Università di Roma) <<http://www.dis.uniroma1.it/~nardi/>> is currently President of RoboCup and coordinates UNIROMA1 participation in RoCKIn. He is particularly responsible by the dissemination in major academic events, benchmarking and Camps organization.

Luca Iocchi (Ph.D., Associate Professor at Sapienza Università di Roma) <<http://www.dis.uniroma1.it/~iocchi/>> is mainly involved in the design and construction of the domestic service robots testbed, based on his past experience with RoboCup@Home, and in Camps organization.

Bonn-Rhein-Sieg University of Applied Sciences (BRSU) <<http://www.fh-bonn-rhein-sieg.de/en/Home.html>> is the coordinator of WP2, on the design of the competitions and development of the 2 testbeds, and is involved in all work packages.

Main tasks and role in the project

WP1: involvement in the benchmarking tasks

WP2: responsible for the design and construction of the domestic service robots testbed and strong involvement in the design and construction of the innovative robots applications in industry testbed, of which BRSU will be the final host

WP3: involvement in industrial and academic dissemination

WP4: provides content for most of the dissemination actions

WP5: active participation in the three camps

WP6: involvement in the organization of competition events

Previous experience and competencies

BRSU contributes experience to BRICS mainly in the areas of architecture, middleware, and interfaces in robot software development and software engineering in robotics. The group has been active in RoboCup for many years, initially in the Middle-Size League, and since 2006 in the RoboCup@Home League, placing with its b-it-bots team constantly among the best three teams both in RoboCup and RoboCup German Open competitions in the past four years, and winning three titles. Group members have also repeatedly served on technical committees and organizing committees of competitions.

Key personnel

Gerhard K. Kraetzschmar <<http://www.kraetzschmar.de/gerhard/index.php>> represents the RoboCup@Home, RoboCupJunior, and Soccer Middle-Size Robot Leagues in the Board of Trustees of the RoboCup Federation, and serves as Vice President Europe since 2011. He is a EURON Board Member and a Member of the Education and Training Board of EURON. Gerhard has a leading role in BRICS, an IP funded by the EU, which develops technology and tools for model-driven software development in robotics. Therefore, his expertise is very relevant for RoCKIn, namely concerning benchmarking, competition design and testbed development. He is the Coordinator of BRSU participation in RoCKIn.

Dr. Björn Kahl, is a post-doctoral research associate in the Autonomous Systems Group in the department of Computer Science. He worked on Programming by Demonstration for assembly robots. His current research interest are in the field of machine learning, especially unsupervised learning from raw sensor data, logic-based knowledge representations and processing with uncertain data. With his interest in the evolution of complex (logical) theories he was a key participant in the FP6 project XPERO and a key designer of the XPERO architecture for robotic learning.

KUKA Laboratories GmbH (KUKA) <www.kuka-labs.com/en> was founded in 2010 in a strategic move within the KUKA group to focus the innovation activities of the company and to develop new products for the markets of the future. KUKA Laboratories GmbH is a spin-off and 100% subsidiary of KUKA Roboter GmbH, which is a member of the KUKA Aktiengesellschaft (Augsburg). Currently, KUKA robots are primarily used in the automotive and metal-working industries. Recently, a trend towards closer cooperation between humans and machines and towards integration of sensors can be observed resulting in a significant increase in the functionality of robots. KUKA is a key partner in the design of RoCKIn@Work and of the corresponding testbed development. KUKA leads the dissemination to stakeholder communities within WP3.

Main tasks and role in the project

WP1: involvement in the benchmarking tasks (industrial perspective)

WP2: responsible for the design and construction of innovative robot applications in industry test-bed

WP3: leader of dissemination to industry

WP5: participation in the Camps on RoCKIn@Work

WP6: participation in the Competition events on RoCKIn@Work

Previous experience and competencies

KUKA has a track record of successful co-operative research projects, both on a European and national level. KUKA is the coordinator of the European Robotics Coordination Action (euRobotics) which is actively driving the European Robotics Technology Platform (EUROP) and is known for its support of the academic community and a number of highly respected technology transfers. KUKA is also the coordinator of the FP7 projects BRICS (Best Practice in Robotics) and TAPAS (Robotics-enabled Logistics and Assistive Services for the Transformable Factory of the Future). KUKA was the proponent, together with BRSU, of the new RoboCup@Work league.

Profile of key personnel

Rainer Bischoff (Ph.D., Project Manager of Cooperative Research Projects) <<http://www.robotics-platform.eu/cms/index.php?idcatart=12&p=159>> is the Coordinator of KUKA participation in RoCKIn, with especially relevant roles in the dissemination to stakeholder communities, including the organization of workshops within major industrial fairs, within WP3 (lead by KUKA) and WP2 (RoCKIn@Work competition design and testbed development).

Developer (N.N.): KUKA is currently hiring more personnel for the development department, especially youBot development. One of these new developers will become responsible for the development work in WP2 and will give major contributions to all other WPs.

The **Politecnico di Milano (POLIMI)** <<http://www.english.polimi.it/>> AIRLab is presently one of the leading Italian research groups in AI and robotics and has a track record of previous participations in RoboCupSoccer and in the EU-funded CSA RAWSEEDS. This naturally lead to POLIMI having the role of WP1 coordinator and, in general, of responsible for benchmarking activities within RoCKIn.

Main tasks and role in the project

WP1: leader of benchmarking work in the project

WP2: involvement in the design of the testbeds

WP3: involvement in academic dissemination

WP4: web page on benchmarking; provides content for most of the dissemination actions

WP5: active participation in the 3 Camps

Previous experience and competencies

POLIMI has coordinated the FP6 RAWSEEDS project for the development of a benchmark toolkit for SLAM, collaborated on benchmarking with the FP7 RoSta Project, and participated actively to the EURON SIG on Good Experimental Methodologies and Benchmarking. Moreover, POLIMI participate to the IEEE Standards Association Working Groups on Map Data Representation and on Ontologies for Robotics and Automation, and to the Robotics and Law working group within the FP7 Coordination Action EuRobotics. Finally, POLIMI have been involved in Robocup since 1997, participating in rule and challenge definitions for 8 years. The group includes a philosopher of science working on epistemological and methodological issues of experiments and simulations.

Key personnel

Matteo Matteucci (Ph.D., Researcher at the Politecnico di Milano) <<http://www.dei.polimi.it/people/matteucci>> is deeply involved in the field of Robot Benchmarking. He has been the coordinator of the FP6 RAWSEEDS project for the development of a benchmark toolkit for SLAM, and an expert on benchmarking for the FP7 RoSta Project. He was also an active participant to the EURON SIG on Good Experimental Methodologies and Benchmarking (co-author of the Review guidelines produced by the SIG). Matteo is the reference person for POLIMI research unit. Leveraging on his previous experience in the RAWSEEDS project, he focuses on ground truth definition and ground truth gathering modules (WP1, T1.3 and 2.3).

Andrea Bonarini (Ph.D., Full Professor at the Politecnico di Milano) <<http://www.dei.polimi.it/people/bonarini>> is coordinating the AIRLab since 1984. He has developed several autonomous mobile robots for service, entertainment, teaching and space applications. He has been involved for 8 years in the definition of challenges (i.e., benchmark for specific soccer abilities) and objective evaluation of robot teams in RoboCup Middle Size League. Andrea mainly works on the definition of the testbeds (WP1) both in terms of general specifications (T 1.1 and 1.2) and in terms of rules (T2.1 T2.2), given his PAST experience in the RoboCup middle size league technical committee.

Francesco Amigoni (PhD, Associate Professor at the Politecnico di Milano) <<http://home.dei.polimi.it/amigoni/>> main research interests include: agents and multi-agent systems, mobile robotics, and the philosophical aspects of artificial intelligence. Francesco mainly works on the definition of general criteria and rules for benchmarking through competitions both at system level and sub-system level (WP1, T1.3). He also establishes a connection with the IEEE standardization committees he is involved in and the benchmarking activities of RoCKIn.

Viola Schiaffonati (PhD in Philosophy of Science 2004, Università degli Studi di Genova) is a temporary researcher at the Dipartimento di Elettronica e Informazione of the Politecnico di Milano. Her main research interests include: philosophical foundations of artificial intelligence, epistemological and methodological issues of experiments and simulations, formal approaches to the philosophy of science. Viola works jointly with Francesco Amigoni on the definition of benchmarking methodologies in the context of competitions, providing, with her philosophy background, a complementary vision with respect to the pure engineering one.

InnoCentive EMEA, trading as **Security Challenge Ltd UK**. *InnoCentive EMEA is the UK branch of U.S. based InnoCentive. All work performed in this project is exclusively performed in Europe by employees employed in the UK.*

InnoCentive <<http://www.innocentive.com/>> is the open innovation and crowdsourcing pioneer that enables organizations to solve their key problems by connecting them to diverse sources of innovation including employees, customers, partners, and the world's largest problem solving marketplace. Within RoCKIn, InnoCentive/SecurityChallenge is the leader of dissemination to stakeholder communities and citizens, including web design and press releases.

Main tasks and role in the project

WP3: organizing and executing workshops with industry stakeholders and RoCKIn Experts, including the payment of stakeholders and RoCKIn Experts travel

WP4: media outreach, including web development, social and traditional media outreach, as well as Public Relations activities

Previous experience and competencies

InnoCentive has recently finished the first phase of the European Security Challenge (ESC – grant agreement 261566), a challenge project for the European Commission's DG Enterprise. The project's main target includes the design of 3 challenge designs that fosters and promotes innovation in the field of security in the European Economic Area <<http://www.europeansecuritychallenge.com>>. Because of DARPA's extraordinary success with its Challenges, InnoCentive recruited the former DARPA Deputy Director, Lee Buchanan to help define civil competitions that build on the best aspects of this defense-focused challenge.

Key personnel

Siobhán Gibney Gomis, Senior Director of Operations (Marketing Director) is Senior Director of Operations at InnoCentive EMEA. She was previously Marketing Manager & HR Advisor. Prior to joining InnoCentive, she worked on communications, event-planning and publications at international think-tanks in Brussels and Canada. Siobhán is responsible for all outreach related tasks of the RoCKIn project. She was previously Assistant Editor of The Euros and has written for a number of other publications. Siobhán completed her BA (Hons) at Queen's University, Canada and holds an MSc from the London School of Economics and Political Science.

Gergely Eredics, Director of Finance (Project Manager) is the Director of Finance at InnoCentive EMEA. Previously he was responsible for the execution of different challenges. He conducts project management, support and administrative actions necessary for the execution of the project, as he has been deeply involved in InnoCentive's previous FP7 open innovation project, the European Security Challenge. Before joining InnoCentive, Gergely worked for the Hungarian Government for six years in various project management and political supporting roles, related to economy and business development, political PR and marketing. Gergely holds a Bachelor in Economics and a Masters in transport engineering.

Jay Stow, Ideation & Design Executive, InnoCentive GC (Marketing Expert), is closely involved in the institutional development of grand challenge programs, from conceptual exploration right through to detailed technical development, in his role as Exploration & Challenge Development Executive. He is also experienced in the facilitation of stakeholder workshops that aim towards challenge exploration, improvement and evaluation. Jay is also working on a number of projects aspiring to develop new models and mechanisms that further advance open innovation management strategies.

Web Experts (t.b.d.): InnoCentive has a team of web experts from both a design as well as web development background. Our web developers usually not only have a web but software development understanding, as they are heavily involved in all product developments of the company. Their background is usually a combination of computer science and development combined with a scientific discipline, ranging from bioengineering to banking. Our web and graphic designers are responsible for the graphical development of campaigns and website, but also influence all branding activities. They usually have different backgrounds ranging from pure web to fashion design.

A Table summarizing the effort, cost and tasks of each of the above researchers is included in the table of personnel in Section B.2.4.

B 2.3 Third Parties

IST-ID will allocate to the RoCKIn CA some human resources made available to it by Instituto Superior Técnico (IST), on the basis of prior agreement. Under this agreement, Instituto Superior Técnico makes available to IST-ID a number of members of its staff so that they may participate in the research and development activities carried out by the latter. The human resources are made available to IST-ID, as a proportion of their full time allocation, to be used at its management discretion and managed by IST-ID according to its own needs and organization. Since the prior agreement between IST and IST-ID leaves the assignment of the resources to the discretion of the management of IST-ID, they should not be considered as made available to participate only in this specific project. Therefore, in accordance with the regulations, the contribution of these resources by IST are eligible costs, should not to be considered as receipts of the project and will be invoiced by IST-ID in accordance with the cost model used.

These resources will be involved in all the tasks that IST-ID participates. Prof Pedro U. Lima and Prof Luís Custódio, that are professors at IST - "Instituto Superior Técnico", the Engineering School of the Technical University of Lisbon (UTL), and at the same time members of the IST-ID research teams. They will provide coordination, strategic consulting, technical support and technical development for the activities in the aforementioned tasks. Other researchers that are also with IST will also participate in the project, the exact tasks and responsibilities to be assigned during the development of the project.

B 2.4 Subcontracts

B 2.4.1 Subcontract for Competition Event Logistics (IST-ID)


A subcontract will be established by IST-ID (RoCKIn coordinator) with Dr. Bredenfeld UG, given the need to free the project partners of intensive logistic operations close to and during

the event dates, and to achieve a professional organization of those events. Dr. Bredenfeld UG is an experienced company in event-management and has organized the RoboCup GermanOpen events in recent years in Germany. Its CEO, Dr. Ansgar Bredenfeld, is a former researcher at IAIS Fraunhofer, Germany, and a past active RoboCup participant. **To the best of our knowledge, no other company is available with comparable experience in organizing robot competitions events.**

The subcontract provides RoCKIn@Home as well as RoCKIn@Work reference testbeds (to be used in the competition events only) for the 2 three-days competition events to be hold during the project lifetime: one in 2014, during AUTOMATICA 2014 in Munich, Germany, the other in November 2013, during the European Robotics Week, in Lisbon, Portugal. The arenas will be stored in Magdeburg and transported to the event locations.

The subcontractor will only build, as part of the testbeds used in the competition events, the environment structure, such as rooms and walls, plus some larger furniture items in @Home, after plans are devised and provided by the consortium in WP2. The objects in the environment (smaller decoration stuff, objects for manipulation) will be brought to the competitions by the partners hosting the permanent testbeds (built in WP2) - IST-ID (@Home) and BRSU (@Work). The ground truth system will be brought by POLIMI (who use it during the rest of the time) to the competition event testbeds.

The following is the budget sent by Dr. Bredenfeld UG, discriminating costs and stating payment conditions:

 Dr. Bredenfeld

Appendix I. Quotation project RoCKIn, September 6, 2012 (revised)

Cost estimates

Pos	Description	single cost	factor	cost
Costs related to each event				
Pos 1	estimated costs for construction of two arenas (transport, rental costs, build-up, dismantling, customs handling, travel costs)	20.000 €	2	40.000 €
Pos 2	local rental costs for team area set-up (100 people) (chairs, tables, infrastructure)	2.000 €	2	4.000 €
Pos 3	miscellaneous event costs	2.000 €	2	4.000 €
Overall project costs				
Pos 4	project coordination			45.000 €
Pos 5	assistance (student worker)			3.000 €
Pos 6	travel costs (1 approx. 10 travels for project meetings, preparation meetings at event sites, etc.)			9.000 €
Pos 7	Registration of participants (web-based infrastructure)			5.000 €
total cost:				110.000 €

VAT
The total costs do not include VAT. The Instituto Superior Tecnico - ID, Av. Rovisco Pais, 1, 1049-001 Lisbon, Portugal has to account for VAT due.

Payment scheme
10% of total costs will be charged after signing the subcontract
Pos 1 to 3 will be charged after each single event
Pos 4 to 7 will be charged every six month according to project progress

B 2.4.2 Subcontract for Travel and Subsistence Arrangements for Camp Participants (UNIROMA1)

Another subcontract will be established by UNIROMA in order to acquire the services for some of the tasks associated with the implementation of the camps that do not fall within its core activity, in particular those concerning the travel and subsistence arrangements of the attendees of the Camps. In this way UNIROMA1 can better focus the effort on the technical organization of these events. The subcontractor will be chosen according to Italian laws and the internal rules of the University.

RoCKIn Camp 2013

Total Budget Assigned: 19.19K€, Total cost participants 9.2K€ – **to be Subcontracted**

- Target audience: up to 16 students from EU institutions that are fully supported by RoCKIN
- Cost per student: travel 250€ + accommodation (5 nights) 250€ = 500€ + Management 15% = 75€

RoCKIn Camp 2014

Total Budget Assigned: 38.5K€, Total cost teams 16.1K€ – **to be Subcontracted**

- Target audience: up to 8 teams from EU institutions fully supported by RoCKIN
- Cost per team (costs are computed on 3 team members): travel 750€ + accommodation (7 nights) 1000€ = 1750€ + Management 15% = 262.5€

RoCKIn Camp 2015

Total Budget Assigned: 38.5KEuro, Total cost for teams 13.8K€ – **to be Subcontracted**

- Target audience: up to 8 teams from EU institutions that are fully supported by RoCKIn
- Cost per team (costs are computed on 3 team members): travel 750€ + accommodation (5 nights) 750€ = 1500€ + Management 15% = 225€

Total cost to be subcontracted 39.1K€ – to be Subcontracted

B 2.5 Consortium as a whole

This consortium is mostly composed of partners who have been involved in robot competitions for a significant number of years (15 or more, in the cases of IST-ID, UNIROMA1, BRSU and POLIMI) and/or had joint research work related to them in the past.

IST-ID, UNIROMA1, BRSU and POLIMI senior researchers have been active in RoboCup since 1998, and were or are involved in the Trustees and/or Executive Boards of the RoboCup Federation. Their level of past collaboration and common expertise managing and

participating in RoboCup ensures a high level of coordination and common understanding of the project's main needs concerning the preparation of research infrastructures (human and testbed resources), the organization of research and education camps and the organization of successful and dependable competition events. There are complementary interests in RoboCup leagues among these academic partners, while all of them were or are involved in RoboCupSoccer:

- IST-ID is currently the oldest RoboCupSoccer Middle Size League (MSL) team, has research work on Search and Rescue robots since 2000 and has recently participated in this league during the RoboCup GermanOpen 2012.
- UNIROMA1 has been very active in RoboCupSoccer Four Legged League (SONY AIBOs), then in the Standard Platform League (Aldebaran Robotics' NAOs), as well as in RoboCupRescue, for which it has organized several Education Camps. It was the Coordinator of the Italian Team who participated in RoboCupSoccer in 1998 and 1999, and one of the founding teams of RoboCup@Home.
- BRSU has a long tradition of participating in competitions and maintained a RoboCup middle-size league team until 2006. Since then BRSU is active in RoboCup@Home, helped to develop the league, and is currently one of the top teams in the league. BRSU also initiated the RoboCup@Work demonstration league, which has been held for the first times at RoboCup German Open 2012 and RoboCup 2012 in Mexico.
- POLIMI was an active participant in RoboCupSoccer MSL since its early days until 2009. Moreover, in 2012 POLIMI participated in the Virtual Robot competition within the RoboCup Rescue Simulation league.

All academic partners have a strong track record of research in multi-robot systems and networked robot systems, expressed in research publications and R&D projects, some of them European (e.g., RAWSEEDS, URUS, BRICS). Their expertise ranges from benchmarking robot systems to cooperative perception, decision-theoretic planning, and robot middleware, to name but a few topics. A multi-disciplinary collaboration with areas contributing to the development of cognitive robot systems is also strong at all these institutions, namely at POLIMI (one of the team members has a PhD in Philosophy) and IST-ID (past and currently involved in multiple projects in collaboration with philosophers, biologists and neuro-scientists).

Besides the academic component, RoCKIn counts a very important industrial partner. KUKA has been involved with RoboCup since 2011, sponsoring the new @Work league with the youBot robot platform, and has been expressing great interest and commitment with this challenge, namely through strong collaboration with BRSU and the RoboCup Federation. Moreover, KUKA's principal investigator in the project is currently EUROP's Coordinator. This naturally provides complimentary views on robot competitions that facilitate the transfer of technology and their connection to real world problems of high scientific and technological relevance.

SecurityChallenge brings not only its main expertise in promotion to the media of scientific grand challenges (it has promoted scientific grand challenges outside and inside the robotics world, and that is their main business), but also some innovative ideas and expertise on the design of such competitions in order to make them appealing to relevant stakeholders and to disseminate the relevance of S&T to the great audiences. They are our key partner for

dissemination of RoCKIn competitions to industrial and service stakeholders and to the general public.

Furthermore, a significant record of previous research collaboration activities among the partners exists. Some examples:

- IST-ID and UNIROMA1 have exchanged students, published joint research work on coordination of robot team plans using Petri nets, and had a joint team on RoboCup 2007 Four-legged League League
- UNIROMA1 and POLIMI have been part of a joint Italian team that participated in the RoboCup Middle Size League between 1998 and 2000, including a 2nd place in 1999
- POLIMI and IST-ID have exchanged students on Robotics research, who participated in RoboCup teams
- BRSU and KUKA have been partners in EU-funded research projects, e.g., FP7 BRICS

The following table summarizes the competences required in the project vs RoCKIn partner competences in a matrix.

Partner Compet.	IST-ID	UNIROMA1	BRSU	KUKA	POLIMI	SecurityChallenge
Project Competences						
Experience with Participation in Competitions	√	√	√		√	
Experience Organizing Competitions	√	√	√	√	√	√
Robotics R&D, Education and Training	√	√	√	√	√	
Benchmarking			√	√	√	
S&T Dissemination to Citizens	√	√	√	√	√	√
Industrial Relevance and Dissemination to Industrial Stakeholders				√		√

B 2.6 Resources to be committed

Most of the resources to be committed to the CA concern the **2 testbeds** regarding both **human labour** and **equipment resources**.

As for **labour**, the following table lists the key (faculty, staff) personnel as well as other personnel that are involved per partner.

	Type of Personnel	Percentage of Dedication (%)	Tasks
IST-ID	Professor (Lima)	30%	Coordination, dissemination, testbed design, benchmarking, competition events, camps
	Professor (Custódio)	18%	testbed design, benchmarking, competition events
	1 Post-Doc	100%	RoCKIn@Home testbed design and development, competition events, benchmarking
UNIROMA1	Professor (Nardi)	36%	dissemination in major academic events, camps organization
	Professor (Iocchi)	20%	design and construction of the domestic service robots testbed, camps organization
	Temporary Researcher	50%	dissemination in major academic events, benchmarking and camps and competition events organization
BRSU	Professor (Kraetzschmar)	8%	Coordination, dissemination, testbed design, benchmarking, camps, competitions
	Post-Doc (Kahl)	8%	Benchmarking, camps, competitions
	Ph.D. Student 1 (Hochgeschwender)	42%	Testbed design, benchmarking, competitions, camps
	Ph.D. Student 2 (Hegger)	50%	Testbed design, benchmarking, competitions, camps
	Ph.D. Student 3 (Paulus)	14%	Testbed design, benchmarking, competitions, camps
KUKA	Project Manager (Bischoff)	8%	Coordination, dissemination, testbed design, benchmarking

	Developer (N.N.)	50%	Testbed design, preparing competitions and events
POLIMI	Professor (Bonarini)	18%	Definition of the testbeds specifications and rules; benchmarking, camps
	Professor (Amigoni)	21%	definition of general criteria and rules for benchmarking through competitions; camps; benchmarking
	Matteucci (Professor)	27%	POLIMI Reference person; benchmark definition, ground truth and gathering modules definition; camps.
	Researcher (Schiaffonati)	11%	definition of general criteria and rules for benchmarking through competitions; camps; benchmarking
	Temp. Researcher	31%	Set up of benchmarking tools during competitions and in the labs
SecurityChallenge	Marketing Director (Gomis)	20 %	Supervision, coordination of marketing and web development
	Project Manager (Eredics)	10%	Legal and financial control, reporting
	Web-design Expert	25%	Web site design development, maintenance, updates
	Marketing Expert (Stow)	40%	Dissemination

Significant labour effort is required to design and build the actual testbeds for the 2 selected challenges, and to endow them with adequate sensors and other devices, both for the competition and for the ground-truth determination.

The **funding requested for resources** concerns:

- materials for building the actual scenario (e.g., walls, floors, doors) plus objects (e.g., tables, chairs, furniture, stairs, rubble, factory items, fully functional kitchen) – **17 kEUR for the 2 testbeds** (13 KEUR for IST-ID/@Home, 4 KEUR for BRSU/@Work),
- one high-quality portable ground-truth vision sensor system that is regularly used in POLIMI lab and testbed installations but also transported to the competition event sites (it will remain property of POLIMI by the end of the project) – **30 kEUR** (POLIMI).

No funding is being requested for robot platforms and several sensors (vision, laser range finders, RF-ID, lower quality ground-truth systems) to be used in tests with the testbeds, since those are available from all project partners, providing heterogeneous networked robot solutions for the different challenges involved.

Available resources at the partners' facilities that are used in the testbeds and coordination activities are listed below:

IST-ID can provide: a 200 square meter mobile robot lab, including a stereo vision system with synchronized cameras for ground-truth measurements and a ZigBee wireless localization system that can be used locally for the domestic service robots testbed; several mobile robots



with vision systems and laser range finders for tests (e.g., perception, navigation, transportation) in both challenges; several MS Kinect 3D cameras; a network of more than 10 IP cameras and 3 quadcore servers covering 2 floors of ISR/IST building, which can be networked with other mobile robots in the list above and could become part of the domestic services robot testbed installation.

UNIROMA1 can provide a research laboratory with several kinds of mobile robots, and it also has an academic environment with facilities for hosting meetings, workshops and schools.

BRSU can provide a 100 square meter robot lab half of which is permanently modelled and



fully equipped as RoboCup@Home environment, with fully functional kitchen, living room, dining room, and lounge room; a 50 square meter robot lab currently being set up with a RoboCup@Work environment; a general-purpose service robot (Jenny) featuring a Care-O-bot-3 omnidirectional mobile base and build-up from Fraunhofer IPA, a KUKA LWR-4 lightweight arm, a Schunk 3-finger hand, plus a

plentitude of sensors; a general purpose service robot (Johnny) featuring a differential drive mobile base by Fraunhofer IAIS, a 5-DoF Katana arm, a parallel gripper, and several laser scanners and cameras as sensors; 2 youBot mobile manipulators from KUKA; and an academic environment with facilities for scientific meetings, summer schools, and research and/or education camps, including a set of 30 Apple MacBooks available for students and participants of summer schools or camps.

POLIMI can provide several (self-made) robot platforms and sensor systems; a camera network used to track robots in the environment with some marker on; a couple of SICK laser range finders on the floor could be used to track robots and people (legs) as well. The setup described in <http://www.springerlink.com/content/k924032g72818h53/>, developed during the RAWSEEDS project, can be used in RoCKIn but it is becoming obsolete and new, faster and more robust technology is now available.

The organization of **research and education camps** requires funds to support (per Camp)

- participation of 20 selected students from EU countries and Associated Member States,
- 5 invited lecturers for the RoCKIn Camp and Field Exercise,
- facility renting,
- social program,
- transportation of test-beds from labs to camp sites and assembly,
- logistics and organization.

in a **grand total of 96 KEUR**.

The consortium considers charging small registration fees to:

- other students interested in attending the camps, but not included in the selected set of (maximum 20) financially supported students, provided logistic conditions are ensured - raised money is used to support their accommodation, meals and social events;
- teams participating in the competition events, so as to foster their commitment - raised money is used to support a social event to gather all participants.

The invitation to Advisory Board members, including industry stakeholders, and to Experts Board members for expert meetings during competition events (including the payment for the written reports on the progress of the project and with recommendations for the next period) is estimated to cost **11 KEUR for travel** (assigned to and handled by SecurityChallenge) and **6 KEUR for the reports** (assigned to the Coordinator IST-ID). There are also **costs for preparing these meetings**, including renting rooms and video projectors, as well as preparing documentation, foreseen at **4 KEUR** (SecurityChallenge).

Costs of small **workshops with stakeholders, presence in industry events, and exploration of exploitation opportunities** are reduced to a minimum (included in the 4 KEUR above), taking advantage of our industrial partner's (KUKA) presence in such meetings with its own booths, where RoCKIn is promoted and advertised, and of the reduced costs of room renting and event organization in events such as the European Robotics Forum.

The costs of **the dissemination to citizens** also represent important slices of the requested funding, both in labor (mostly SecurityChallenge) and materials (for SecurityChallenge), including leaflets and a brochure of RoCKIn. The materials cost is estimated at **15 KEUR**.

It is relevant to underline RoCKIn's foreseen work on creating up-to-date messaging for the project that are shared via the website, grassroots marketing activities and traditional media connections. Cross-referencing between the websites, Facebook, LinkedIn, Twitter and other channels ensures engaging messaging for all stakeholders. All PR activities are promoted via the RoCKIn website, to ensure exposure and accessibility for the general public. SecurityChallenge's main role in the project is to create and maintain this dissemination infrastructure, whose labor costs are discriminated below.

- **Website:** the website requires approximately 2 PM of programming, testing, validation and bug fixing until completion. This includes the company in-house graphic designer working in close collaboration with the marketing and operations team as well as the web developer to ensure a highly positive association as well as branding. The latter implements all aspects of the web-design into the final web presence. The branding and project graphics are used for the website and for all communication relevant tasks of the initiative. The maintenance of the website contains the following items that need to be done (estimated to consume around 3 PM per year):
 - Regular updates of content. Each update will be checked for appropriate content, style and language.
 - Answering questions from citizens and contributors that arrive through the contact form on the website. This requires constant staffing of the website, in order to gather the required information for answering citizens' questions. By following up quickly on questions asked by citizens (less than 3 days in average), we ensure that citizens are engaged by a bidirectional communication process. These requests are answered by SecurityChallenge's staff (if possible) or directed to the respective partner, if expert robotic knowledge is required.
 - By providing a forum, we provide a base for exchange of information of interested citizens. The forum needs to be supervised to keep it clean from inappropriate comments.

Additionally, SecurityChallenge will respond to any other communication related questions that are submitted via email or phone to the offices (approximately 1 PM per year).

- **Grassroots Marketing:** to avoid replication of efforts and to maximise the impact of all activities, SecurityChallenge will conduct extensive research into existing online forums, groups and communities that match the profile of the challenge. A smart selection of channels and sub-channels is also crucial to ensure a reliable and serious communication with all stakeholders. During the submission phase, we post and share information with these groups several times weekly. Each release will be checked for appropriate language, style and content by our team (3 PM per year)
 - Reading through all relevant resources (online forums, blogs, groups, communities) we keep the overview over the hot topics and can react quickly.

Thorough communication with all other consortium members will help to secure a holistic style and integrated appearance of the project.

- Several times weekly, utilize custom created twitter feeds and Facebook pages to reach out to citizens, but also to create content and become part of topical discussion, demonstrating relevance and thought leadership.
 - Encourage interested, but ineligible parties to help spread the word through social media and through direct contacts.
 - Partner with topical blogs, newsletters and websites and monitor activities to eliminate negative associations and adjust messaging where needed.
 - Have established partnerships with various publishing groups that are actively engaged worldwide, which can be included in our outreach from the strategic development onwards.
- **Traditional Marketing and PR:** the company traditional challenge marketing and PR services are configured to the unique needs of the RoCKIn Challenge programme. This includes branding, reputation, communication and awareness building. (estimated to consume 2 PM in the first year, 3 PM in years 2 and 3). The PR activities are designed to:
 - Attract and engage solvers to this challenge programme and the specific challenges.
 - Drive public awareness around the strive for further development and interest in the space of robotics.
 - Create a brand for RoCKIn and the European Commission for a sustainable development for this challenge programme.

Press releases are typically generated, published to the website and homepage, and released via wire services (e.g., PR Newswire, Business Wire) throughout the course of the project.

A **Reserve Fund** of 25 KEUR has been allocated in the budget of the Coordinator so as to respond to possible requests of the EC for travel of some of RoCKIn partners to unplanned events of relevance for the dissemination of robotics in Europe through robot competitions. Whenever this may happen, required funds will be transferred by the Coordinator partner IST-ID to the partners requested to travel, up to the total amount of the reserve fund.

Travel is mainly associated to consortium meetings and coordinating activities events, summarized in the following table.

	2013				2014				2015			
	1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T
Project partner trips	5	6	4		5	5	4	5		5	4	5
Experts trips						3						3
AdBoard Members trips						5						5
Conference trips		4									4	
	TOTAL TRIPS EUROPE	TOTAL TRIPS ABROAD	COST w/o Conf (k€)	TOTAL COST (k€)								
Travel partners	40.00	8.00	96.00	108.05								
Travel stakeholders + experts	6.00	0.00	6.00	6.00								
Travel AdBoard	10.00	0.00	5.00	5.00								
TOTAL TRAVEL				119.05								

Assumed 1 person/partner for travel overseas and 2 person/partner for travel within Europe and 1 person/partner for travel to confs. Also assumed only 5 AdBoard members will make it per meeting.

Meetings filled red mean travel from people outside EU to EU or people from EU

Meetings filled green mean no travel costs with noted exceptions

"RC people" includes UNIROMA1, BRSU

The distribution of travel per partners is estimated to correspond to the following:

- **IST-ID:** 8 trips to project meetings and events, 2 of which overseas (16.16 KEUR)
- **UNIROMA1:** 6 trips to project meetings and events (16.00 KEUR)
- **BRSU:** 7 trips to project meetings and events (18.00 KEUR)
- **KUKA:** 9 trips to project meetings and events, 2 of which overseas (21.37 KEUR)
- **POLIMI:** 9 trips to project meetings and events, 2 of which overseas (22.00 KEUR)
- **SC Ltd:** 9 trips to project meetings and events, 2 of which overseas (14.52 KEUR)

The academic partners (IST-ID, UNIROMA1, BRSU and POLIMI) travel includes 2 trips to robotics research conferences each.

The summary, rationale and distribution per partners of the requested budget is summarized in the following table.

Resource	WP	Total Cost (K€)	Justification
Labour costs	all	1,172	PM * cost
@Home Test Bed Infrastructure	WP2	13	Material for building the actual scenario (walls, floors, doors) + objects (tables, chairs, furniture, stairs, rubble, factory items, fully functional kitchen ...) - to be assigned to BRSU (@Work) and IST (@Home). Ground-truth sensors (stereo cam systems) - to be assigned to POLIMI.
@Work Test Bed Infrastructure	WP2	3.99	
Ground Truth System	WP2	30	
Consumables	WP3	3.37	Consumables
Dissemination to Stakeholder Communities and Citizens	WP4	15	Leaflet and brochures cost only. SC Ltd PR in blog and intervention in social networks, press releases+Website is under SC Ltd labour
Research and Education Camps	WP5	59.83	2.5 camps (0.5 refers to the initial camp during RoboCup 2013, where only students will be invited and no lecturers, venue costs, ..., are incurred) --> Facility renting, social program, transportation of testbeds from labs to camp sites and assembly.
Organization of Experts Board evaluation meetings	WP6	4	Documentation, projector renting, (preparation by SC Ltd included in labour costs, 3 PM). Will take place during the 2 competition events
Partners Travel	all	108.05	Project Meetings and conferences
Experts and Advisory Board Members Travel	WP6	11	Reporting about activities and results of Workshops on Progress Evaluation, including recommendations for future steps, and on the test bed developments (3 experts, 2 reports - 2014 and 2015, payment per expert)
Experts budget for drafting independent reports	WP6	6	Reporting about activities and results of Workshops on Progress Evaluation, including recommendations for future steps, and on the test bed developments (3 experts, 2 reports - 2014 and 2015, payment per expert)
Reserve	WP6	25	Travel to unplanned events that may be requested by the EC. To be distributed by the Coordinator on a need basis, whenever the EC identifies such an event and the partners that should participate.
Flat Rate	N/A	102	7% of above costs
Logistics of Competition events (subcontract)	WP6	110	Competition infrastructure logistics for 2 competition events (subcontract to Dr. Ansgar Berenfeld company)
Travel + Subsistence for Camps	WP5	39.1	Travel + subsistence for camp participants
TOTAL		1,701.75	

B3. Impact

B 3.1 Strategic impact

RoCKIn aims at generating a substantial **impact**, with a European drive, on the following **key aspects of the innovation process**:

- **Technology transfer (impact on potential end-user applications)** aims to be achieved through the implementation of new concepts and methods in service and industrial robots, at home (or office, or hospitals) and at the factory scenarios, originally developed to implement Robotics grand challenges, by
 - a. defining challenges in collaboration with enterprise stakeholders, so as to make them closer to the industry and service market needs;
 - b. promoting visibility and dissemination of results (and tech transfer success stories) to enterprises.

Important characteristics that resulting products should display, namely requiring enterprise intervention, concern robustness (e.g., the robotics system should be able to operate without human intervention, except when tele-operation is required, for long time periods without major problems), repeatability (the robot should be able to execute the same task several times successfully under variable environmental conditions, even if not exactly the same way all the times), safety (the robot should not harm itself and/or humans surrounding and/or interacting with it) and adaptation to dynamic environments. The introduction of explicit benchmarking criteria in RoCKIn plays a determinant role on modifying this situation, leading to more standardized design and sound measurable evaluation criteria that industry can rely on when considering success stories in competitions. Building upon existing industry-academia collaborations (e.g., EURON, EUROP, European Robotics Coordination Action euRobotics) - see **Figure 5**, this project leads to a deeper intervention of industrial stakeholders in the competition development process, blending scientific and technological innovation and market requirements, and also in the transfer process of innovative ideas and technology to actual market scenarios.

- **Benchmarking (both scientific impact and impact on end-user applications)** efforts made in other European projects (e.g., RAWSEEDS, BRICS) are boosted by the experience of the consortium designing competition rules, where critical robot sub-systems and their integration methodologies are benchmarked using meaningful, internationally recognized and reproducible scenarios. The new (and extensions of existing) testbeds for the 2 selected challenges / competitions (domestic service robots / RoCKIn@Home, innovative robot applications in industry / RoCKIn@Work), push the state of the art in their domains. Furthermore, their specifications will be public domain, so as to easily replicate them in several European laboratories. **This is an asset that will last after the project lifetime, creating installations on several European research labs**, which have a large potential to become reference testbeds for benchmarking methods applied to these application scenarios.
- The **cognitive skills of robotic systems (scientific impact)**, already available in university-led European projects, are further expanded in RoCKIn competitions so as to produce human-friendly robots. The proposed extension of current rules in RoboCup@Home and RoboCup@Work to require research on multi-robot and networked robot systems, e.g., fusing information from cooperative sensors deployed in the competition scenario to help robot task execution, actively moving sensors around to improve overall perception and decentralized task execution, are pivotal in this effort.

APPLICATION SCENARIOS ▶	ROBOTIC WORKERS	ROBOTIC CO-WORKERS	LOGISTICS ROBOTS	ROBOTS FOR SURVEILLANCE & INTERVENTION	ROBOTS FOR EXPLORATION & INSPECTION	EDUTAINMENT ROBOTS
SECTORS ▼						
INDUSTRIAL	■	■	■			
PROFESSIONAL SERVICE	■	■	■	■	■	■
DOMESTIC SERVICE		■	■	■		■
SECURITY		■	■	■	■	
SPACE	■	■	■		■	

Figure 5 - Intersection between RoCKIn challenge areas and the vision of the Strategic Research Agenda for Robotics in Europe [reprinted from the “Robot Visions: to 2020 and Beyond” document by EUROP, July 2009].

RoCKIn’s integrated impact on S&T research and end-user applications is illustrated by the competitions / education camps / research / field evaluation / market loop diagram of **Figure 6**: prototypes developed for competitions and the tests and performance benchmarking they are subject to during competitions, push the state of the art frontiers, leading to teaching advanced education topics in the RoCKIn Camp (first full research and education camp) where new teams learn how to enter competitions. But competitions also have an impact on field exercises and user studies that start from developed prototypes and transfer them into market technology - this will be achieved during the RoCKIn Field Exercise (second research and education camp).

Robot competition events and their associated workshops and meetings provide excellent opportunities for inputs from academia, industry, public authorities and EU officials to improve the competition-based benchmarking scenarios and their corresponding testbeds. They also serve as opportunities for encouraging other EU-funded projects and EU researchers to send teams to the next research and education camp and competition event.

Another important moment for attracting other EU researchers and EU-funded projects to participate in RoCKIn competitions are the **Cooperation Board annual meetings**. RoCKIn representatives will show to the other project representatives how participation in RoCKIn competitions is a significant mean of benchmarking their project results, by applying those results to a common case application (home or work scenarios with RoCKIn rules).

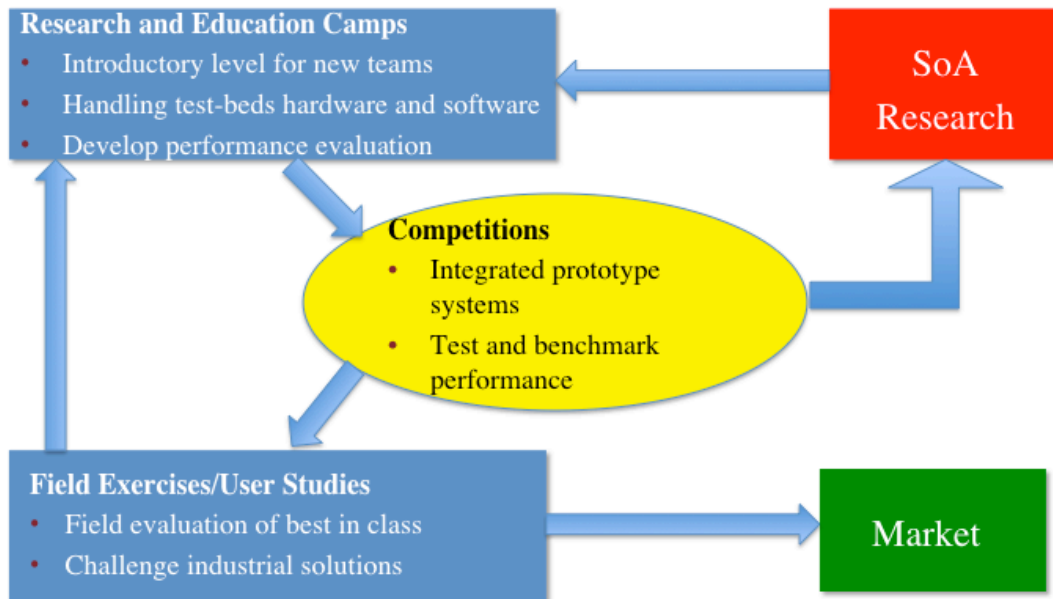


Figure 6 - The competitions / education camps / research / field evaluation / market loop diagram.

The strong link between RoCKIn and RoboCup significantly boosts the international dissemination to regular citizens and academia/industry stakeholders for the @Home and @Work challenges, with Europe heading such efforts. After the project lifetime, it is expected that the innovative rules, as well as the benchmarking methods, databases and metrics, introduced by RoCKIn in the @Home and @Work competitions will make their way to RoboCup@Home and RoboCup@Work leagues. **The consortium, namely its members currently more strongly linked to RoboCup (UNIROMA1, BRSU and IST-ID) commit to keep the RoCKIn branding associated to all such innovations introduced in RoboCup, advertising them in all future RoboCup booklets and web page (see next subsection).**

On the dissemination level, national and international impact of RoCKIn is supported by advertising RoCKIn on national and international blogs, discussion groups and media. In addition, information material is provided at national and regional levels of RoboCup in Europe (e.g. GermanOpen, Portuguese Robotics Open or Mediterranean Open), e.g. via flyers or emails to participants, or might even organizing demonstrations of RoCKIn competitions there.

RoCKIn therefore impacts different targeted communities in different ways, summarized here:

Target Community	RoCKIn Impact
Academia	<ul style="list-style-type: none"> • availability of tested and well-documented testbeds and benchmarks • experimental validation of state of the art research • availability of quantitative comparisons between different approaches • fostering novel approaches to research challenges by providing means to demonstrate its validity

	<ul style="list-style-type: none"> • involvement of EU young researchers
Industry	<ul style="list-style-type: none"> • new solutions arising from competitions (e.g., the Quince Robot at Fukushima, Kiva Systems' warehouse robots, Google driverless car, boat monitoring in Venice Grand Canal) • spin-off companies (current examples are Aldebaran Robotics, Kiva Systems and many smaller ones spread all over Europe) • possibility to assess for free the real-world performance of available research solutions, easing their incorporation into products
Citizens	<ul style="list-style-type: none"> • awareness and social perception of new technologies and Europe strengths on them • education (attractiveness of scientific and engineering disciplines) • entertainment

B 3.2 Plan for the use and dissemination of foreground

Dissemination of RoCKIn results is a key activity of the project. We have dedicated 2 different WPs to dissemination:

- **Dissemination to Stakeholder Communities:**
 - 2 meetings (1/competition event) involving Advisory Board members, including stakeholders (from academia, industry and public authorities, e.g., government officials, policy makers, as well as EC research officers) and RoCKIn Experts take place to evaluate the progress and impact of the results of the research infrastructure created by the project, namely those observed during actual RoCKIn competition events;
 - (at least 3) workshops/meetings on opportunities for exploitation of the results obtained in the competitions target industrial (producers and end-users) stakeholders over the project lifetime and take place in industry and service trade fairs, as well as in events such as the European Robotics Forum;
 - besides RoCKIn competition events, competition progress will possibly be demonstrated annually in some of the following events: RoboCup annual world event, RoboCup annual regional European events (e.g., German Open, Portuguese Robotics Open, Mediterranean Open), European Robotics Forum, European Robotics Week, major Robotics conferences taking place in Europe, e.g., ICRA, IROS, RSS;
 - novel results on benchmarking and testbed and other research infrastructure developments will be reported in major research conferences.
- **Dissemination and Awareness to the Citizens:**
 - extensive public relations activity target traditional media (e.g., major newspapers, radio and TVs), as well as in blogs and social networks, in creative ways that simultaneously disclose some of the interesting details of

Robotics research and simultaneously help teach and attract young students to S&T studies, and show the citizens the value of their tax money applied to research in these areas;

- competition events are open to the public and serve (as demonstrated by 15 years of RoboCup tradition) as a great display of S&T through robotics to the society;
- a comprehensive web site provides different views (academia, industry, citizens, media) of RoCKIn activities, being permanently updated with news and progress reports. Besides being the main hub for the challenge programme's communication activities and centre for exchange within the challenge community, the RoCKIn web site aims at being a reference site for robot competitions in Europe and worldwide, and includes the public domain specifications of the domestic service robots and innovative industrial robots testbeds, benchmarking specifications and criteria for robot competitions, and news on international scientific robot competitions.

Below we detail some of the most important activities concerning dissemination.

The Website (www.rockinrobotchallenge.eu)

In order to ensure a high visually appealing as well as technical advanced website for the overall programme, it contains the following components:

- A general information section that provides information about all involved participants as well as a description of the overall programme
- A description of the guidelines of participation, which is an essential part of the trust building process with the challenge participants
- A media hub that contains a user friendly collection of all relevant articles and messages created by the consortium
- An interactive forum that facilitates information exchange between participants and open discussions around the field and challenge topics – such forums play intensive roles in potential team building processes of participants (besides interaction on social sites such as LinkedIn or Facebook)
- Online registration tool and backend that allows participants to register with the project for news purposes but also for participants to register their participation in events and the challenges
- All achievements, results, success stories and general progress information are published on the website in order to provide a point of information to the general public about the programme
- General information about challenge initiatives in the field of robotics that are conducted by third parties from around the world in order to provide a central hub for robotics challenge driven innovation – this way we ensure to become a central point of information for stakeholders beyond this programme
- Link to a web page, shared with the EURATHLON Coordination Action, on benchmarking results achieved during the project(s) lifetime, in the form of open access repositories and databases.

In order to ensure the continuation of the website after the end of the project, we will:

- **During the project**
 - ensure, using Microsites, that the website is constructed such that updates can be inserted at the end of the project by a person knowledgeable in HTML.
- **At the end of the project**
 - publicise all final results and programme findings to the general public
 - ensure that the website can be transferred to one free host (e.g., the Coordinator's university servers) for continuing web support and updates after the end of the project
- **After the project** we will keep the website open for at least 2 years to the community by:
 - allowing the community full access to the forum in order to allow for self-management
 - allowing the community to add new information about other challenge programmes
 - allowing the community to add to the news section of the website
 - allow the Project Coordinator to continue updating the web content.

By opening the website to the general community and more importantly to the expert community that is already active on the website, we ensure a sustainable development towards a centre of open innovation initiatives as well as inducement challenges in the field of robotics.

Alternatively, the web platform can of course be used as a hub for succeeding challenge programmes by the European Commission in the field of robotics.

Branding and Marketing Plan

RoCKIn is branded as advancing questions and problems relevant for society. Outreach does not only happen amongst participants but addresses the general public. The media coverage is understandable by the lay person, showing that RoCKIn research aims at installing Europe at the top innovation whilst tackling the challenges that Europe is facing. Also, RoCKIn is branded as focussing on transfer of lab-proven technology to commercial technology.

RoCKIn is marketed and branded towards adult citizens as a competition that targets the important challenges of the future, such as the aging society (RoCKIn@Home) or the problems of Europe's technological competitiveness (RoCKIn@Work) and focuses on the transfer of technology from academia to industry. RoCKIn addresses adult lay persons by reaching out via LinkedIn and other more mature channels, such as expert and technology blogs. This outreach is tailored in language, style and content to adult users and focuses on the technological benefits and advances of EU funded robotics research in Europe while using lay language.

In addition to informing adult citizens about the importance of robotics in Europe, **RoCKIn also tailors its outreach specifically towards younger citizen to spark interest in the STEM (Science, Technology, Engineering, Math) areas.** These outreach activities use the grassroots level (Facebook, Twitter, Blogs), tailored in the language, style and content to young citizens and be attractive with a "cool" look and feel, with a focus on the attractiveness of robots and futuristic applications.



Figure 7 - RoboCup@Home in a supermarket - targeting end-users

Mobilizing Researchers Across Europe

The Coordination Action takes an active part in promoting the EU-funded robotics research programme, for example at the occasion of the European Robotics Forum, as referred before in Section B 2.4. **The project commits to participate in meetings and events as requested by the Commission and assigns a budget of 25,000.00 EUR for this purpose, which is part of the overall travel budget.**

This commitment also concerns **mobilizing researchers from top European groups (and other groups worldwide) who do not usually participate in competitions** due to several different reasons (for instance, difficulty to compete with an integrated system, low ratio of research publications vs. involved effort in developing and maintaining the robot and human teams, costs of transporting equipment when many robots are involved, lack of interest in robot systems engineering methods which do not scale to other applications in the same class) to get attracted by RoCKIn competitions through a significant number of factors:

- RoCKIn Camp teaches newcomers the details of how to develop robot systems to participate in the 2 RoCKIn competition events, including how to handle the testbed scenarios and technical aspects (interfacing sensors, hardware modules, software modules) - support of qualified technicians hired by the project is available;
- evaluation criteria, modules and metrics to benchmark the results in each of the competition testbeds aim to become standards that different researchers, competitors or not, will be able to use during and after the project lifetime, to achieve a sound evaluation of their approaches to standard well-defined robotics research problems;
- benchmarking applies both to the integrated system and also some of its sub-systems, and competitions award both types of approaches;
- software and hardware modules which become cases of success after some edition of a RoCKIn competition event will be available in a repository for other teams to use in future editions, provided Intellectual Property rights are not violated, especially

when enterprises are involved - leading to an exponential increase of standardization and increase of quality in the corresponding application domain, both for competition participants and other researchers.

Summary of Dissemination Activities

The following table summarizes RoCKIn main dissemination activities and the target groups they intend to reach.

RoCKIn Main Dissemination Activities	Target Group			
	Researchers/ Educators	Robotics Industries	End-Users	Public
Research and Education Camps				
Introductory event at RoboCup 2013	•	•		•
RoCKIn Camp	•	•		
RoCKIn Field Exercise	•	•	•	•
Reports				
Competition Design, Rule Book, and Scenario Construction for Domestic Service Robotics (RoCKIn@Home)	•			
Competition Design, Rule Book, and Scenario Construction for Innovative robot applications in industry (RoCKIn@Work)	•			
General evaluation criteria, modules and metrics for benchmarking through competitions	•	•		
Description of ground-truth system to be used in the 2 competitions	•	•		
Report on RoCKIn Field Exercise	•	•	•	
RoCKIn Final Report	•	•	•	
Competition Events				
2014	•	•	•	•
2015	•	•	•	•
Web site				
interactive tools (such as a forum) for participants	•	•		
online registration in RoCKIn competition events	•	•		
link to other challenges and competitions	•	•		•
regular RoCKIn news updates	•	•	•	•

Communication Materials				
leaflets	•	•	•	•
brochure	•	•	•	•
press releases	•	•	•	•
articles in social networks	•	•	•	•
Presence in Major Robotics Events				
Trade Fairs (AUTOMATICA, Hannover Messe)	•	•	•	•
Research conferences (ICRA, IROS, RSS, IJCAI, ECAI...)	•	•		
European Robotics Forum	•	•		

Relations with Other EU-funded Projects

RoCKIn also privileges interaction with related EC-funded running FP7 projects. The following table lists those with a higher potential for interaction, due to existence of common partners and shared objectives, plus projects which already ended but have a very strong relation with our CA. Other recently approved projects may also be of interest.

Period	Project	Funding	Common Partners	RoCKIn / project Expected Interaction
2012 - 2015	SMErobotics : the European Robotics Initiative for Strengthening the Competitiveness of SMEs in Manufacturing by integrating aspects of cognitive systems	EC, FP7	KUKA	The SMErobotics vision is to bring cognitive robots to the SME shop floors, with the benefit of long-term improvements in productivity. The industrial scenario is common to the one proposed for the RoCKIn@Work competition. The co-partnership of KUKA favors a synergic effect in both directions: (input) from SMERobotics for the RoCKIn@Work testbed definition, (output) in terms of dissemination of RoCKIn@Work testbed and benchmarking activities among the industrial

				partners of SMERobotics.
2010 – 2012	euRobotics: Coordination Action for Robotics in Europe	EU, FP7	KUKA	euRobotics aims to improve cooperation between industry and academia and enhance public perception of (European) robotics. To help the two communities to communicate more efficiently, the project develops a common terminology and a common perception of the state of the art. euRobotics also creates a high-level education and training initiative for both PhD students in robotics and R&D engineers in robotics companies. By the leading presence of KUKA in euRobotics, as well as of EURON's Coordinator as a RoCKIn Expert, RoCKIn interacts with the euRobotics project to reach most of European industrial and academic stakeholders.
2009 - 2013	BRICS: Best practices in robotics	EU, FP7	KUKA, BRSU	BRICS develops a design methodology which focuses on three fundamental major research and development issues, which is implemented in three highly interwoven lines of technical activities: identification of best practice in robotics hardware and software components; development of a tool chain that supports a rapid and flexible configuration of new robot platforms; cross-sectional

				<p>activities addressing robust autonomy, system openness, and harmonization and benchmarking. The work done by BRICS in the definition of best practices in robotics is a valuable input to the definition of the RoCKIn Reference Functional Platform and provides a great background to the definition of the testbeds.</p>
2007 - 2009	RoSta – Robot Standards and Reference Architectures	EU, FP7	BRSU	<p>The technological objectives of RoSta aimed at coordinating a set of actions initiating and preparing a set of standard defining activities on the following topics of advanced robotics: (i) creation of a glossary/ontology for mobile manipulation and service robots; (ii) specification of a reference architecture for mobile manipulation and service robots; (iii) specification of a middleware for mobile manipulation and service robots (iv) formulation of benchmarks (of components, methods, middleware and architectures) for mobile manipulation and service robots. The RoCKIn project takes into consideration RoSta results from (ii) when defining its RoCKIn Reference Functional Platform, (iii) when</p>

				establishing software modules for the testbeds and (iv) when studying the issues related to benchmarking through competitions.
2007 - 2010	ROBOTS AT HOME An open Platform for Home Robotics	EU, FP6	none	The objective of robots@home is to provide an open mobile platform for the massive introduction of robots into the homes of everyone. The innovations introduced were: (1) a scalable, affordable platform in response to the different application scenarios of the four industrial partners: domotics, security, food delivery, and elderly care; (2) an embedded perception system providing multi-modal sensor data for learning and mapping of the rooms and classifying the main items of furniture; (3) a safe and robust navigation method that finally sets the case for using the platform in homes everywhere. The system was tested in four homes and at a large furniture store (IKEA). Developers as well as lay persons showed the robot around, indicated rooms and furniture and then tested the capabilities by commanding to go to the refrigerator or dining table. RoCKIn looks also at the results from this project in the design and specification of the

				RoCKIn@Home testbed.
2006 - 2009	<p>RAWSEEDS</p> <p>Robotics advancement through Web-publishing of sensorial and elaborated extensive data sets</p>	EU, FP6	POLIMI	<p>The aim of the Rawseeds Project was to stimulate and support progress in autonomous robotics by providing a comprehensive, high-quality Benchmarking Toolkit for Simultaneous Localization and Mapping. RoCKIn leverages from POLIMI's experience in RAWSEEDS to develop a general benchmarking methodology to be used during robot competitions.</p>

B4. Ethical issues

The RoCKIn project involves minor ethical issues during experimentation and benchmarking, both at the permanent testbeds installed at partner sites as well as at the temporary testbeds installed for competitions and dissemination events, as follows:

- Experimentation and running competitions involve adult healthy volunteers.
- Experimentation and running competitions involve tracking the location or observation of people.

Explanation of the ethical issues:

- The RoCKIn@Home scenario involves the operation of service robots in domestic environments inhabited by humans. For realistic experimentation and benchmarking of certain capabilities, the presence of humans during the experiment is desirable or even necessary. Examples for such robot capabilities include
 - Avoiding collision or injuring humans moving in the environment shared by the robot.
 - Interacting with humans, e.g. in order to get commands for tasks to perform (“*go and get me a cup of tea*”), to inform humans about the outcome of tasks (“*I have put your shopping items into the refrigerator*”), to request help, decisions, or assistance (“*Do you want to have sugar in your tea?*”).
 - Recognizing people and being able to distinguish between several individuals sharing the environment (“*Bring a cup of tea to my wife*”).

The above list is non-exhaustive. Furthermore, benchmarking procedures may require recording location and posing data about the humans involved in an experiment, in order to later analyze and evaluate the quality of the robot-internal modules for functionalities such as estimating the pose of humans, recognizing gestures, estimating the emotional state of a human, etc.

- The RoCKIn@Work scenario initially foresees the optional presence of humans in the environment as dynamic obstacles. The safety of humans has to be guaranteed under all conditions. Later on, tests may be added that involve the cooperation between humans and robots at the work place, e.g. the robot getting parts and passing them to a human worker just in time.

Measures to handle ethical issues:

The situation for handling ethical issues is quite different for the permanent testbeds and for the competitions, and it also depends on the laws of the country where activities are carried out.

- The permanent testbeds (installed at IST-ID and BRSU laboratories) are used only by staff and students involved in the project, plus possible members of visiting research groups who want to use the permanent testbed installation at project partner

sites. All participants in experiments at these sites is recruited from the staff and students involved in the project. They are informed about the ethical issues, including those pertaining to the law in the testbed country locations, by the principal investigator (PI) of the site hosting the testbed and asked for their consent. Only if they give their consent, they can participate in the experiment. The consortium will provide a brief Consent Form, which will be used by the PI to keep a record about participants having given their consent.

- For competitions and field exercises, we follow a similar procedure. The Technical Committee of a competition event asks all members of the participating teams and anyone from the audience who is invited to take a role in the competition to sign a Consent Form, that shall contemplate the laws of the country where the event takes place.

The consent forms are collected and archived by the coordinator together with the repository of data collected in experiments involving ethical issues.

Whenever possible, we collect data such that the identity of the person cannot be concluded from the data, e.g. by using laser scanners or by recording only processed data like pose estimates instead of the video images. The Consent Form may, however, foresee an item where the signee can give her/his consent to use video images. Data that made publicly available is either in sufficiently anonymous form, or the consent of publishing video images of contestants has been acquired. In any case, the law of the country where these measures are taken will be followed.