Rise of the robots

Dr Reinhard Lafrenz, ECHORD Project Manager, describes the project's scope and how it will positively affect the EU's future use of industrial robots...

Europe has a very strong robotics industry, and there is significant world-class research potential and technological knowledge spread throughout the continent. Excellent research and development has been performed both by robot manufacturers and research institutes. However, finding common ground between manufacturers and the research community, especially when it comes to defining the future direction of robotics research, has proven difficult in the past. This has been one of the recurring themes on both sides, and a higher quality/level of co-operation is long overdue.

In a number of important areas, there has been a significant discrepancy between the state-of-the-art in robotics research and its practical application in products. Promoting direct contact between researchers (who usually write papers) and industrial engineers (who normally do not read papers) requires that results have to be put into an industrial perspective with realistic applications in mind. For this reason, it would be very advantageous to strengthen the European technology profile by creating new opportunities for know-how transfer between researchers and manufacturers. This should be done both for the developments in classical industrial robotics and also for the technologies that will be required in the future, for example, intelligent machines in 'cognitive factory' scenarios.

How can effective and efficient co-operation be achieved?

The project ECHORD (European Clearing House for Open Robotics Development), a European project within the 7th Framework Programme was established to provide a conclusive and comprehensive answer to this question.

ECHORD will make successful know-how transfers possible. It is truly open to those entrepreneurial research institutions or organisations willing to carry out challenging robotics development in co-operation with manufacturers, and willing to invest in research and technology development. Ultimately, it will give Europe the competitive edge it needs to be a winner in the global robotics marketplace.

It is the objective of ECHORD to provide incentives for both sides in order to systematically extend successful co-operation patterns that have been in place between those few privileged combinations of research and industry. This will include those manufacturers and research institutions or organisations that have not had preferred mutual access, and will enable partners with well established co-operations to invest more.

Experiments and participating

There are two key concepts for achieving the goals outlined above – the experiment and the structured dialogue.

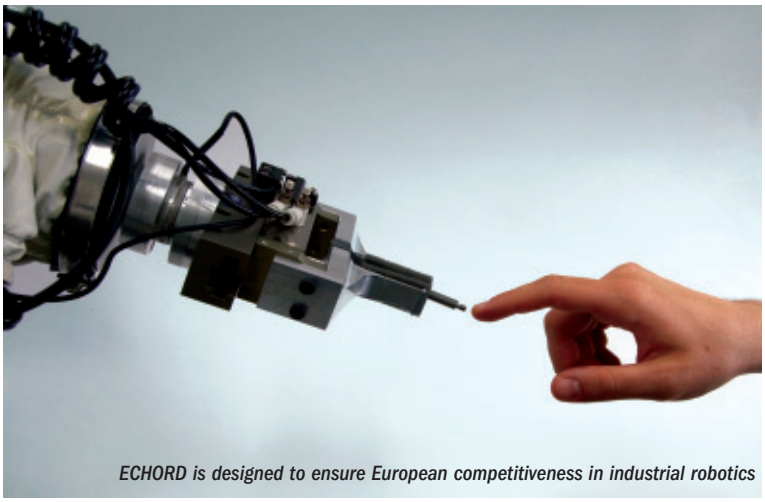
An experiment is a small-scale technical project carried out by a consortium of research institutes and possibly a manufacturer, and will last no longer than 12 to 18 months. The procedure for soliciting and granting proposals for experiments includes several open calls for experiment proposals. The proposals will be evaluated by independent experts from science and industry, ranked by an expert panel and then approved by the European Commission. Extensive discussions have revealed that it is very appealing to both sides to carry out joint, small-scale projects solving concrete problems, particularly if processes are simple and quick. To avoid confusion, these joint, small-scale projects are called experiments. The experiments will not only be simple and quick to propose and negotiate; in order to achieve the maximum level of application orientation, they will also use industry equipment provided by manufacturers.

Experiments can be different for joint enabling technology development, application development or feasibility demonstration. Experiments, therefore, serve multiple purposes: they will bring people together, build up excellence and showcase potential applications.

Structured dialogue

The second key concept is the structured dialogue. It consists of a sequence of systematic exchanges between the robotics community and ECHORD about expected future trends in robotics.

The structured dialogue is an iterative process of successive information gathering and consensus finding between all parties. This approach is well suited to the structurally diverse and interdisciplinary field of robotics, with many potentially interesting directions. Based on a collection of ideas gathered in polls, web consultations and expert meetings, an initial set of ideas will be profiled, redistributed with specific questions for discussion (filtered through an economic, scientific, technology perspective) and then summarised in a white paper of



ECHORD is designed to ensure European competitiveness in industrial robotics

working hypotheses. The final version will then be presented to the public so that there is a benefit for the whole community, which can then be used for extracting emerging research fields as well as applications.

Technology areas for experiments

The set of research topics and subjects that may eventually lead to the creation of new products in the field of robotics is virtually unlimited. To be in line with industry's needs and to build on previous roadmapping work in various European projects, ECHORD has adopted the strategic research agenda (SRA), as compiled by EUROP, the European Robotics Technology Platform (www.robotics-platform.eu). Nevertheless, manufacturers have repeatedly emphasised their intentions to diversify into new areas. Therefore, ECHORD will be open to additional suggestions for research areas – to be worked out in the structured dialogue.

Three scenarios for likely future robot use have been defined to outline the scope of research work to be performed in the experiments. These scenarios make it possible for all stakeholders to get a clear picture of if and how their proposed work and envisaged results can be embedded into a coherent vision of robotic applications. Thus, they describe the application context from an exterior view. They represent comprehensive sets of challenges in an illustrative way, so that robotics experts can easily relate their own research to them.

The first scenario of ECHORD is the human-robot co-worker. In this scenario, the traditional idea of a robot performing pre-programmed action will change drastically, in that a robot co-worker interacts with a human towards achieving a common goal.

The second scenario is the hyper-flexible cells scenario. This scenario envisages not only one or more highly dexterous and co-operative robots, but also the hardware and software integration of the robots with an automatic warehouse system, along with the other devices present in the cell.

The third scenario is the cognitive factory. This future scenario will embrace both the first and the second scenario, and take the classic concept of the flexible manufacturing systems to a new level. Cognitive factories will, to a large extent, configure themselves and be fault-tolerant. They will contain autonomous robots jointly participating in the production process with their human counterparts.

For breaking down the application-driven scenarios, four research foci have been identified. They were chosen to encompass the relevant aspects of all scenarios.

The first research focus is on human-robot interfacing and safety. Here, the main goal of the experiments is to show that safe, human-robot co-operation is possible, taking all kinds of sensor failures and inconsistencies into account.

The second research focus is on robot hands and complex manipulation. Here, the experiments will have to show the improvement of laboratory set-ups towards practical usability, as well as promising breakthroughs in the areas of sensors and sensor-guided manipulation.

The third research focus is on mobile manipulators and co-operation. Here, mobile manipulators will have to solve concrete problems in dynamically changing environments with moving obstacles and interaction with humans.

The fourth research focus is on networked robots. Here, two areas are possible. One is networked industrial robots, where the expectation is to use demonstrators that can only be built in collaboration between industry and academia. This would call for industry providing the controller architecture, and academia contributing knowledge in advanced real-time networking technologies, as well as service-oriented architectures. The second area focuses on more loosely coupled systems, where we/ECHORD anticipate experiments with mobile robots that will establish new showcases, for example, in the area of search and rescue with robots, new applications of robots in urban areas, and robot systems for monitoring tasks.

In summary, the aim of the new project ECHORD is to reinforce and ensure European competitiveness in industrial robotics, and to create a solid base for the next technology steps towards new emerging markets of service robotics.

More information about experiments and participation can be found on our website.

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