

Robotic UBIquitous COgnitive Networks

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A team of researchers from UCD's Clarity Centre for SensorWeb Technology, Ireland, is leading the newly EU-funded project RUBICON (Robotic UBIquitous COgnitive Network). The project will develop a self-sustaining, adaptive robotic ecology consisting of mobile robotic devices, sensors, effectors and appliances cooperating to perform complex tasks such as supporting an older person to live independently. These components will encourage and teach one another in order to achieve their goals more efficiently and to adapt to changing requirements and user's needs. This will reduce the need for pre-programming and human supervision, and so will make these systems much cheaper and simpler to deploy in a variety of applications, for different homes and users.

RUBICON is a joint effort of 9 partners from industry, research and the health sector, from 5 countries all over Europe and comprising about 400 person months at a cost of 3.3 million. The project commenced in April 2011 and its planned duration is three years. Rubicon will demonstrate the real-world value of its technology in two application environments: a research facility for testing assisted living and independent ageing applications, and a robotic transport system in a hospital.

Rubicon's researchers believe that self-learning robotic ecologies will reduce the complexity, extend the type of applications that can be considered, and enhance the individual values of the devices involved by enabling new services that cannot be performed by any device by itself. Consider for instance the case of an automatic vacuum cleaner avoiding cleaning when any of the inhabitants are home after receiving information from the home alarm system, or the case of a robot monitoring a wireless sensor before seeking and informing the user that the stove was left on in the kitchen.

Current approaches strictly rely on models of the environment and of the activities of the user they try to assist. However, they lack the ability to proactively and smoothly adapt to evolving situations, especially when these involve subtle changes in user's habits and preferences. These limitations make such systems difficult to deploy in real world applications, as they are tailored to the specific environments, applications and users, and they can soon become unmanageably complex and expensive.

RUBICON will tackle these problems by developing self-sustaining learning solutions yielding cheaper, adaptive and efficient configuration and coordination of robotic ecologies.

To achieve its aims, the consortium will use a unique combination of expertise in cognitive robotics, robot and agent control systems, wireless sensor networks and machine learning to integrate planning and distributed control solutions with statistical and computational (neuroscience) methods. Each node of the ecology will contribute to a shared collective knowledge and memory while engaging in collaborative learning with the other nodes by interacting through remote synapses, mimicking those linking neurons in biological nervous systems. Bio-inspired, novelty detection and habituation mechanisms will make the collective memory capable of self-improvement and self-configuration.

By contributing to the development of novel technologies that combine communication with control and learning for robotic ecologies, the potential impact of RUBICON includes:

- Rubicon will simplify the deployment of robotic ecologies by enabling applications to evolve to learning systems which improve their performance over time and autonomously adapt to modifications in their environment.
- Rubicon ecologies will improve the quality of service offered by these systems in common settings such as AAL, without the need for extensive human involvement. The ability to discriminate and to learn about the environment in which they are active will open further domains of application and improve the quality of service which can be delivered with robotic ecologies.
- RUBICON ecologies will adapt to changes in the resources available, including replacement/updates of robots, added/removed sensing/acting devices and appliances. This will offer improved fault tolerance, but also the potential for enhanced performance on the fly.

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Links to Project and Partners

- Rubicon Web Site <http://www.fp7rubicon.eu>
- University College Dublin, National University of Ireland, <http://www.ucd.ie>, <http://www.clarity-centre.org>
- Consiglio Nazionale delle Ricerche, <http://www.isti.cnr.it/>
- Orebro University, <http://www.oru.se/>, <http://www.oru.se/aass>
- Fundación Tecnalia Research & Innovation, <http://www.tecnalia.com>
- Robotnik Automation SLL, <http://www.robotnik.es/>
- University of Ulster, <http://www.ulster.ac.uk/>, <http://isrc.ulster.ac.uk/>
- University of Pisa, <http://www.unipi.it/>
- Pintal LTD, <http://www.pintail.eu>
- Fondazione Stella Maris, <http://www.pintail.com>

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