R3COP

Resilient Reasoning Robotic Co-operating Systems

EXECUTIVE *summary*

R3-COP will provide European industry with new leading-edge methodology and technologies to enable production of advanced robust and safe cognitive, reasoning autonomous and co-operative robotic systems in different application domains at reduced cost in terms of time and money. It will not only establish an environment for their design, development, assessment and validation but also develop a high-performance and fault-tolerant processing platform.

CONTRIBUTION *to SRA*

R3-COP meets two basic objectives of the ARTEMIS SRA: to overcome the fragmentation of the embedded systems sector especially with respect to autonomous and robotic systems, and to facilitate the paradigm shift from design by decomposition to design by composition. This is expected to be achieved by developing:

1) a reference architecture with means for tailoring it for specific applications. It will be substantiated in a number of domain-specific platforms and demonstrators, including cross-domain cooperating systems.

2) a fault-tolerant high-performance processing platform, based on a multi-core architecture, as well as innovative system components for the robust perception of the environment including sensor fusion, and for reasoning and reliable action control.

Additionally, R3-COP is compliant with the European Robotics SRA.

MARKET INNOVATION *& impact*

Safe and robust autonomous systems are one of the key tangible manifestations of embedded systems simply because the application domains are so diverse, from rescue to entertainment. Such systems increasingly share space, and even cooperate closely, with humans, so an urgent need exists to assert and guarantee their dependability, especially safety and robustness. R3-COP facilitates the accelerated uptake of next generations of autonomous systems and robotics providing appropriate and efficient solutions for fast deployment of the innovations.

R3-COP will contribute to widespread comparative assessment of robot performance for different tasks and technologies. Enhanced engineering solutions will enable new market opportunities through technologies for increased productivity and efficiency. R3-COP accelerates mass market commercialisation and new applications and services. R3-COP will provide companies not yet active in the market of autonomous systems due to high development costs or deficiencies in system robustness with appropriate means to enter the market.

RELEVANCE & CONTRIBUTIONS *to Call 2009 Objectives*

The common architectural approach (framework), the development of a high performance extendable processing platform and of innovative system components for advanced perception and sensing, together with the methodologies for advanced validation and

verification as prerequisite for certification will meet the objectives of the ARTEMIS Call 2009:

> Reduce the cost of system design from 2005 levels by 15% by 2013 (expected to be at least 20% while enabling faster time-to-market).
> Achieve 15% reduction in development cycles, especially in sectors requiring qualification or certification by 2013.
> Manage a complexity increase of 25% with 10% less effort by 2013, by composition of domain/ application-specific systems from a knowledge base of components, methods and tools (embedded HW, sensors, perception).
> Reduce re-validation and re-certification effort and time by 15% by 2013.
> Achieve cross-sectoral reusability by developing and implementing a rather generic framework and platform with domain-specific instantiation, and use of multi-purpose computing platform.

The R3-COP approach fully meets the industrial priorities as well, especially composability, architectural dependability, certification support, cross-domain and domain-independent architecture and connectivity, European reference tool platform, multi-core energy efficient hardware platform and model-driven processes.
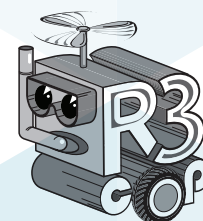
R&D INNOVATION *and technical excellence*

The project aims to overcome fragmentation in the robotic sector by creating a cross-domain platform of methods and tools for the design, development and validation of resilient and usable real-world autonomous systems. These systems will be able to reason, learn and cooperate in different application domains such as surveillance (indoor, land, air, sea) and rescue, agriculture (field and greenhouse), people care, home environments and transport. R3-Cop will advance autonomous systems two-fold: technology and methodology. **Technology:** a fault-tolerant high-performance processing platform (multi-core architecture), and innovative system components for robust perception of the environment including sensor fusion, and for reasoning and reliable action control. **Methodology:** a flexible framework to integrate components from various technology providers, and verification and testing means for autonomous systems with complex behaviour in realistic environments, including new test strategies and tools. The expected outcome is an industry-level computing environment and platform for resilient autonomous systems targeting various critical application domains, applied in a set of demonstrators covering ground-based, airborne and underwater domains.

PROJECT *partners*

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ARTEMIS