[TECHNOLOGY CENTRE] CARTIF

HORIZON-CL4-2026-05-DIGITAL-EMERGING-03: *Next-Generation Agile and Intelligent Robotics Platforms for Industrial and Service Applications*

1. General context of the topic

This topic aims to foster the development of **agile, modular, and intelligent robotic platforms** capable of operating safely, efficiently, and collaboratively with humans in complex industrial and service environments. The goal is to enable **next-generation robotic systems** with improved adaptability, autonomy, and interoperability. These systems should combine advanced materials, non-rigid structures, and innovative actuation and sensing technologies to achieve flexible manipulation, enhanced perception, and seamless integration into real-world applications.

The topic also emphasizes **human-centric design**, interoperability through digital frameworks, and close collaboration with end-users to ensure scalability and real-world deployment. Projects are encouraged to integrate advanced sensors (vision, touch, proximity) and communication architectures, leveraging multi-agent and AI-based frameworks for adaptive perception and reasoning.

2. Potential contributions from CARTIF

CARTIF can contribute valuable expertise in the following areas:

a) Socio-bio-cooperative control for robotics

- Application of **socio-bio-cooperative algorithms** for robot control using **haptic feedback and human physiological signals** to enhance natural and safe **human-robot interaction** (HRI).
- Development of adaptive control loops that integrate human emotional and physical states for improved robot responsiveness and cooperation.

b) Experience in robotic applications and integration

- CARTIF has strong experience in **designing and deploying robotic solutions** across diverse domains including **healthcare, automotive, manufacturing, security, and cultural heritage**.
- Contribution to **end-user integration and testing** in industrial, healthcare, and service environments to validate performance and user acceptance.

c) Middleware and interoperability frameworks

- Development of a **ROS2–FIWARE middleware** architecture for **modular, interoperable robotic applications**, allowing flexible orchestration and communication between components.
- Ensuring compliance with **European digital frameworks** for robotics interoperability, security, and scalability.

d) AI and multi-agent management for robotic perception and reasoning

- Design of an **AI agent framework** for dynamic management of AI agents in robotic perception, planning, and decision-making.
- Implementation of multi-agent reasoning to support robot autonomy and adaptability in unpredictable environments.

3. Target industrial sectors

CARTIF's robotic expertise can be applied to several **strategic industrial and service sectors**, including:

- **Healthcare robotics**, focusing on assistive systems and rehabilitation.
- **Automotive and advanced manufacturing**, emphasizing flexible automation and collaborative robotics.
- **Security and cultural heritage**, supporting inspection, maintenance, and human-robot collaboration in complex settings.

4. Potential CARTIF roles

- **Technical leader** for socio-bio-cooperative control and human-robot interaction research.
- **Work package leader** for middleware and interoperability frameworks (ROS2–FIWARE).
- **Task leader** for development and validation of AI agent-based robotic perception and reasoning.
- **Integrator** with end-user partners in healthcare, industrial, and service applications to ensure real-world deployment and evaluation.