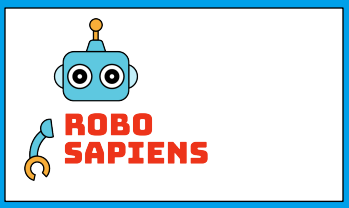

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RoboSAPIENS

In the development of tomorrow's robots, there is an anticipation for rapid and unforeseen adaptability in system structure or environment, ensuring trustworthy collaboration with humans by changing behavior while maintaining or enhancing performance and safety.

Call: HORIZON-CL4-2023-DIGITAL-EMERGING-01
Duration: 1 January 2024 > 31 December 2027
Project ID: 101133807

OBJECTIVES

The main objective of the RoboSAPIENS project is to advance the field of robotic self-adaptation and empower robots with open-ended autonomous software adaptations, allowing them to dynamically respond to unforeseen changes in system structure or environment while maintaining trustworthy collaboration with humans.

Specific Objectives:

Enable Open-Ended Adaptation
- Develop control software for robotic open-ended self-adaptation, specifically addressing unprecedented changes in system structure and environmental conditions,including human interactions.

Enhance Safety Assurance
Advance safety engineering techniques to ensure not only pre-adaptation but also during and post-adaptation safety, incorporating trustworthiness checkers and self-evaluation schemes.

Reduce Task Uncertainty with Deep Learning
Utilize Deep Learning techniques to actively reduce task uncertainty in robotic self-adaptation, ensuring more reliable and reproducible adaptations, with a focus on addressing uncertainties inherent in DL models.

Assure Trustworthiness
Develop and apply formal methods to assure the trustworthiness of systems using both Deep Learning and computational architectures for robotic self-adaptation, incorporating verification tools and techniques.

EXPECTED IMPACT

IMPACT 1:
RoboSAPIENS will develop the underlying technologies which enable robots to fully autonomously adapt their controllers and configuration settings to accommodate for unknown changes, such as, physical changes in the robots themselves, changes in the robot's mission or changes in their collaborating environment, while ensuring safety.

IMPACT 2:
RoboSAPIENS will apply forefront virtual design and analysis techniques such as DTs and co-simulation to extensively and automatically explore and validate adaptations to the robot environments.

IMPACT 3:
RoboSAPIENS will apply DT concepts to the MAPE-K framework in order to establish trustworthiness.

IMPACT 4:
RoboSAPIENS will elaborate the MAPE-K-loop for adaptive controllers in robotic applications, and reconcile it with stringent safety requirements. The generation of the adapted controller settings will largely rely on DL and DT techniques.

IMPACT 5:
The deployment of results created in Impact 4 onto robotic platforms will require balanced cloud and edge computation.

IMPACT 6:
As central part in the autonomous adaptation procedure, the RoboSAPIENS project will largely rely on DL techniques to be able to generate new settings from older experiences.

IMPACT 7:
Automated design methods and techniques will take a central place in the RoboSAPIENS project and aims to improve the overall reception of autonomous adaptation in robotic systems among certification authorities as well as insurance companies.

IMPACT 8:
Augmented self-awareness and environment awareness is a mandatory precondition to apply successful self-adaptation. RoboSAPIENS will deeply rely on available sensor data as input to the robotic DT. Automated (virtual and real) tests will be deployed to evaluate a safe operation of the robot after adaptation.

On a societal level, RoboSAPIENS strives to positively impact education by disseminating knowledge essential for engineering and maintaining Digital Twins (DTs) with self-adaptive loops. Societal benefits extend to the redefinition of production line roles, improved scalability and adaptability of robots, reduced accidents in supply chain operations, creation of high-quality jobs, and lower costs in safety engineering and certification