Natural human-robot cooperation in dynamic environments

Fact Sheet

Project Information

<table>
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<tr>
<th>NIFTi</th>
<th>Funded under</th>
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<tbody>
<tr>
<td>Grant agreement ID: 247870</td>
<td>FP7-ICT</td>
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<td>Closed project</td>
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<th>Overall budget</th>
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<td>€ 8 578 321</td>
<td>DEUTSCHES FORSCHUNGSZENTRUM FUR KUNSTLICHE INTELLIGENZ GMBH</td>
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<tr>
<td>EU contribution</td>
<td>Germany</td>
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Project description

Cognitive Systems and Robotics
Working together to assess real-life urban disaster sites

NIFTi investigates how natural behavior in human-robot cooperation can arise. The project operationalizes natural cooperation as balancing operational and cooperation demands in a cognitive architecture (CA), to minimize human cognitive task load and optimize joint work flow. The CA combines projections with cognitive user models and plans to predict why changes in human behavior (due to attention, task load) may occur. The CA uses these predictions to anticipate how it should adapt acting and communication to align with the human. NIFTi focuses on cooperation in the
USAR (urban search and rescue) domain, to restrict what actions, forms of communication and user aspects need to be taken into account.

NIFTi puts the human factor into cognitive architectures. NIFTi investigates how natural behavior in human-robot cooperation can arise. NIFTi operationalizes natural cooperation as balancing operational and cooperation demands in a cognitive architecture (CA), to minimize human cognitive task load and optimize joint work flow.

NIFTi designs CAs by closely coupling cognitive user models to how the architecture understands the environment, how it performs actions, how it communicates. The architecture acquires maps which combine perceptual- and conceptual information. These maps capture where what is in the environment, and project this to how acting is affected. The CA combines projections with cognitive user models and plans to predict why changes in human behavior (due to attention, task load) may occur. The CA uses these predictions to anticipate how it should adapt acting and communication to align with the human. The CA bases planning and execution in a cognitive control model. Control uses attention, characteristics of agent morphology, and skill acquisition, to guide autonomous action execution in a cooperative context. The CA achieves balance by actively interconnecting content across modules. Content in modules is not isolated. In the NIFTi CA design, controllers interconnect content across modules, percolating content changes throughout the CA. Changes guide processing in a module; interconnectivity ensures behavior changes coherently system-wide. Controllers are learnt off- and online, using reinforcement learning and statistical (relational) learning.

Adapting to a human thus permeates the entire architecture. NIFTi focuses on cooperation in the USAR domain, to restrict what actions, forms of communication, and user aspects need to be taken into account. USAR end users join NIFTi to yearly evaluate its approach in real settings, using an integrated CA on a new robot with adaptive active/passive locomotion to jointly explore a disaster area.

### Fields of science

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### Programme(s)

### Topic(s)

### Call for proposal
Funding Scheme

CP - Collaborative project (generic)

Coordinator Contact

Krujff GEERT-JAN (Dr.)

Coordinator

DEUTSCHES FORSCHUNGSZENTRUM FUR KUNSTLICHE INTELLIGENZ GMBH

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Trippstadter Strasse 122
67663 Kaiserslautern
Germany

Activity type
Research Organisations

EU contribution
€ 1 509 322

Website
Contact the organisation

Administrative Contact
Walter OLTHOFF (Dr.)

Participants (8)

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH

Switzerland

EU contribution
€ 984 100

Address
Raemistrasse 101
8092 Zuerich

Activity type
Higher or Secondary Education Establishments

Website
Contact the organisation

Administrative Contact
Roland Siegwart (Prof.)
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€ 968 092

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2595 DA Den Haag

Activity type
Research Organisations

Website
Contact the organisation

Administrative Contact
Ger Luijten (Mr)

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