

Poster Abstract-USC-ISI.txt

From: Wei-Min Shen [shen@isi.edu]
Sent: Thursday, November 03, 2011 1:34 PM
To: Bruhn, Janine (contr-tto)
Cc: DARPA-BAA-12-02
Subject: Re: Phoenix ID Poster Abstracts due by noon EST-Friday, November 4th

Hi, Janine,

Here is our abstract:

Multi functional, Deployable, and Adaptive Robotic Systems for PHOENIX Missions

Dr. Wei-Min Shen
University of Southern California

To support the vision of PHOENIX, robotic systems and arms would be best if they are lightweight (for feasible deployment), flexible and adaptive (for performing various tasks using different tools), and robust to the launch and space environments. This poster presents a potential approach based on a modular and self-reconfigurable robotic system called SuperBot. It offers a solution for multifunction and adaptability and demonstrated that a robotic systems can plug-and-play and be reconfigured or/and self-reconfigured in situ to provide the needed form and function for a variety of tasks.

SuperBot modules can self-reconfigure into new robots that can change their logical or physical configurations and functions for new missions in new environments, and can self-heal damage and other unexpected changes. Each module is 128x64x64 cm³ in size, can move/manipulate as a Gimbal in 3DOF (pitch, yaw, and roll), and has six reconfigurable universal connectors, and contains on-board power, controller, sensors, actuators, and communicators. The modules can dynamically connect and disconnect among themselves to change configurations. They are designed to ultimately adapt their shape, size and configuration to accomplish complex tasks in dynamic and unforeseen environments. This research has produced many novel results, and some of them are still the state of the art, including rolling 1,100 meters in distance, climbing a 110 meter long real sand dune, ascending on a rope vertically up along a six floor building, and others.

The control of such multifunctional robots is challenging because their configurations, behaviors, and components are subject to changes. These include the dynamic topology of the modular network, the limited resource of individual modules, the difficulties in global synchronization, the preclusion of centralized decision makers, and the uncertainties in communication among modules. The poster will also show a biologically inspired control approach called "digital hormones" that is distributed, reliable, and capable of providing a unified solution for multifunction, self-reconfiguration, self-assembly, self-healing, locomotion, and manipulation. This control approach suggests a general representation for self-reconfigurable systems, and offers distributed solutions for "task negotiation," "topology-dependent behaviors," "synchronization," and detection and reaction to unexpected changes and failures.

Wei-Min

On Nov 3, 2011, at 8:37 AM, Bruhn, Janine (contr-tto) wrote:

> Greetings-
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> We have you/your organization registered as presenting a poster on November

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9th for the Phoenix "West Coast" Industry Day.

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> Just a reminder that these are due by noon EST tomorrow, November 4th.
Please send the abstracts to this e-mail address if you have not already done so.

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> If you have decided not to submit please let me know.

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> Thank you,
> Janine

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