Something about Japan

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[2] Yamakita Lab, Tokyo Institute of Technology, Japan

November 30, 2005

About myself

Studies in Computer Science (1996-2001)

main focus:

- complexity theory / efficient algorithms (I. Wegener)
- evolutionary strategies, genetic programming (H.-G. Beyer, W. Banzhaf, H.-P. Schwefel)

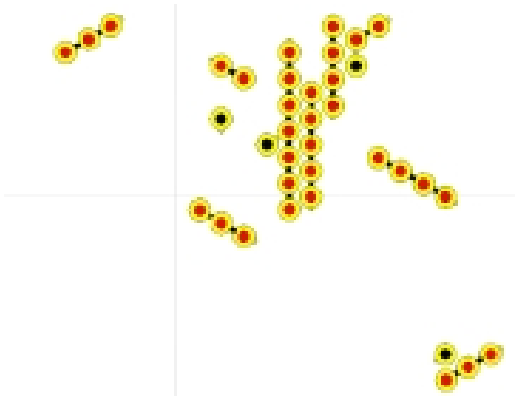
About myself

Studies in Computer Science (1996-2001)

- in cooperation with Keno Albrecht
- diploma thesis project
- distributed evolution of chess playing programs
- GECCO 2002; Focus (Germany) **40**, 2001

About myself

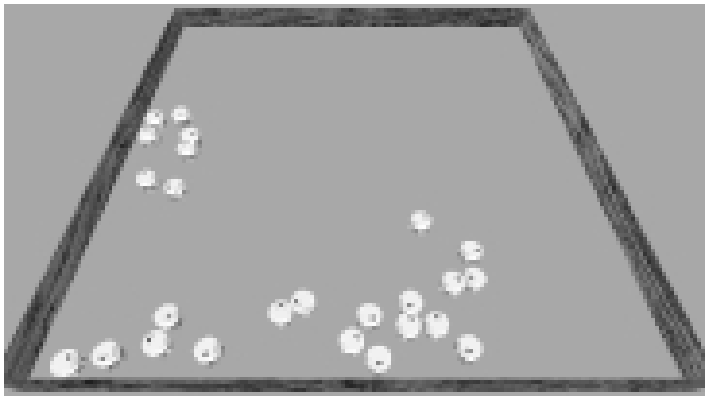
Doctoral Studies in IRIDIA (2002-2005)



- in cooperation with Halva, Vito, Erol, ...
- pattern formation
- probabilistic behaviors
- IEEE Int. Conf. SMC (2002, without me), technical report

About myself

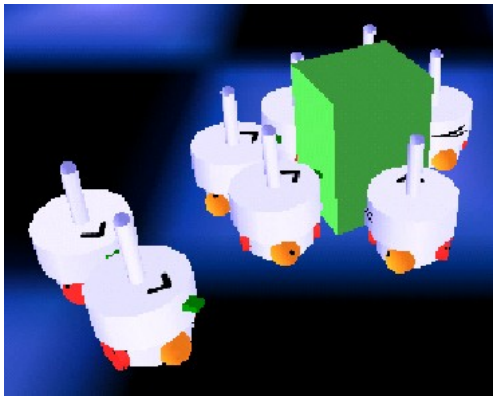
Doctoral Studies in IRIDIA (2002-2005)



- in cooperation with Vito, Halva and Erol
- aggregation
- evolution of neural networks
- ECAL 2003, Autonomous Robots **17**, 2004

About myself

Doctoral Studies in IRIDIA (2002-2005)



- cooperative transport
- focus on the evolution of self-assembling behaviors
- neural networks
- EA 2003, ANTS 2004, PPSN 2004

About myself

Doctoral Studies in IRIDIA (2002-2005)

- cooperative transport
- hand-coded controller
- pre-connected robots
- preliminary studies on integration with self-assembly
- 2006 IEEE Int. Conf. Robotics and Automation (submitted)

About myself

Doctoral Studies in IRIDIA (2002-2005)

- self-assembly
- evolved neural network controller
- state-of-the-art (group size, reliability, speed)
- AMiRE 2005,
  IEEE Trans. Robot. (submitted)

About myself

Doctoral Studies in IRIDIA (2002-2005)

- in cooperation with Elio
- self-assembly as mechanism to solve a task
- simple transport task
- ACM Trans. Auton. Adapt. Syst.,
  2006 IEEE Int. Conf. Robotics and Automation (submitted)

About myself

Doctoral Studies in IRIDIA (2002-2005)

- transport by pre-connected robots
- evolved neural network controllers
- *blind* robots may contribute (on average)
- 2006 IEEE Int. Conf. Robotics and Automation (submitted)

About myself

Doctoral Studies in IRIDIA (2002-2005)

- in cooperation with Rehan
- functional self-assembly
- ECAL 2005

- in cooperation with Shervin
- prey retrieval
- Intelligent Autonomous Systems Conf. (IAS 2006)

Outline

Location

Map

Data

- 4 big islands
- 3000 small ones
- 73% mountainous
- 4 tectonic plates

Climate

Map

Data

- late June - early July: rainy season
- **August** - October: typhoon season
- temperature: similar to Italy (south)
- outer islands: subtropical

Culture

- language
- crafts
- games
- onsen
- tea ceremony
- architecture
- gardens
- swords
- cuisine

Some pictures

Some pictures

Some pictures

Some pictures

Some pictures

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Some pictures

JSPS Postdoctoral Fellowship Programs

Overview

- Japan Society for the Promotion of Science (JSPS)
- founded in 1932
- linked with Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- budget: approx. 900 million EUR (2003)

JSPS Postdoctoral Fellowship Programs

Application

- application via host institute
- application via oversea nominating authorities
  - Belgium: FNRS, FWO
  - Denmark: DRC
  - France: CNRS
  - Italy: MIUR
  - Poland: PAN
  - UK: RS, BA
  - United Nation: UNU

JSPS Postdoctoral Fellowship Programs

Short-term

- 15 days - 11 month
- requirements: PhD (not older than 6 years), or expected to be issued within 2 years
- 6 recruitment phases (10 applicants each)
- start: anytime in fiscal year (April-March)

JSPS Postdoctoral Fellowship Programs

Long-term

- 12 - 24 month
- requirements: PhD once fellowship starts (not older than 6 years)
- recruitment 1: September 2005; start: Apr-Sep 2006
- recruitment 2: May 2006; start: Sep-Nov 2006
- 200 fellowships each

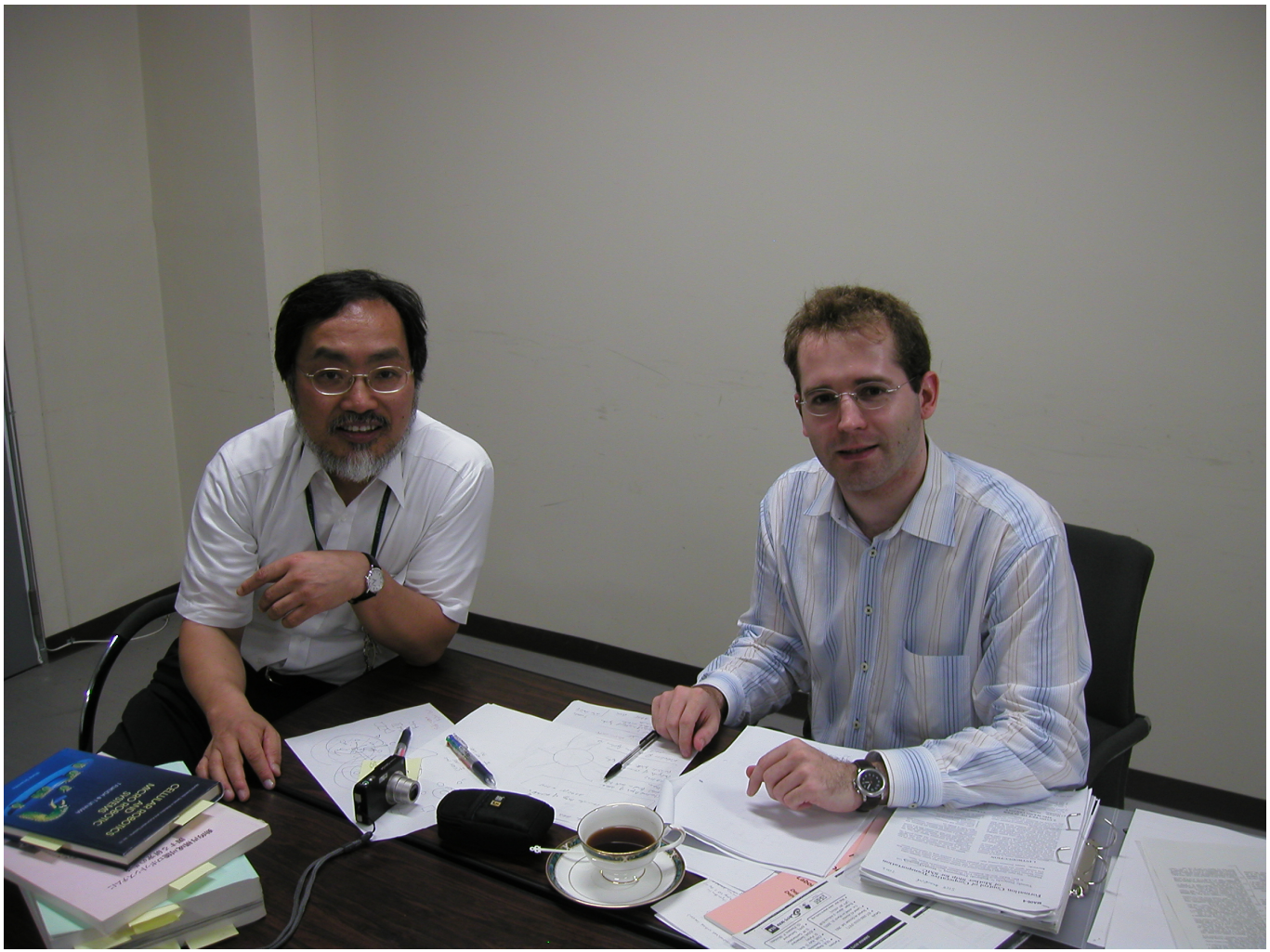
JSPS Postdoctoral Fellowship Programs

Terms of Award

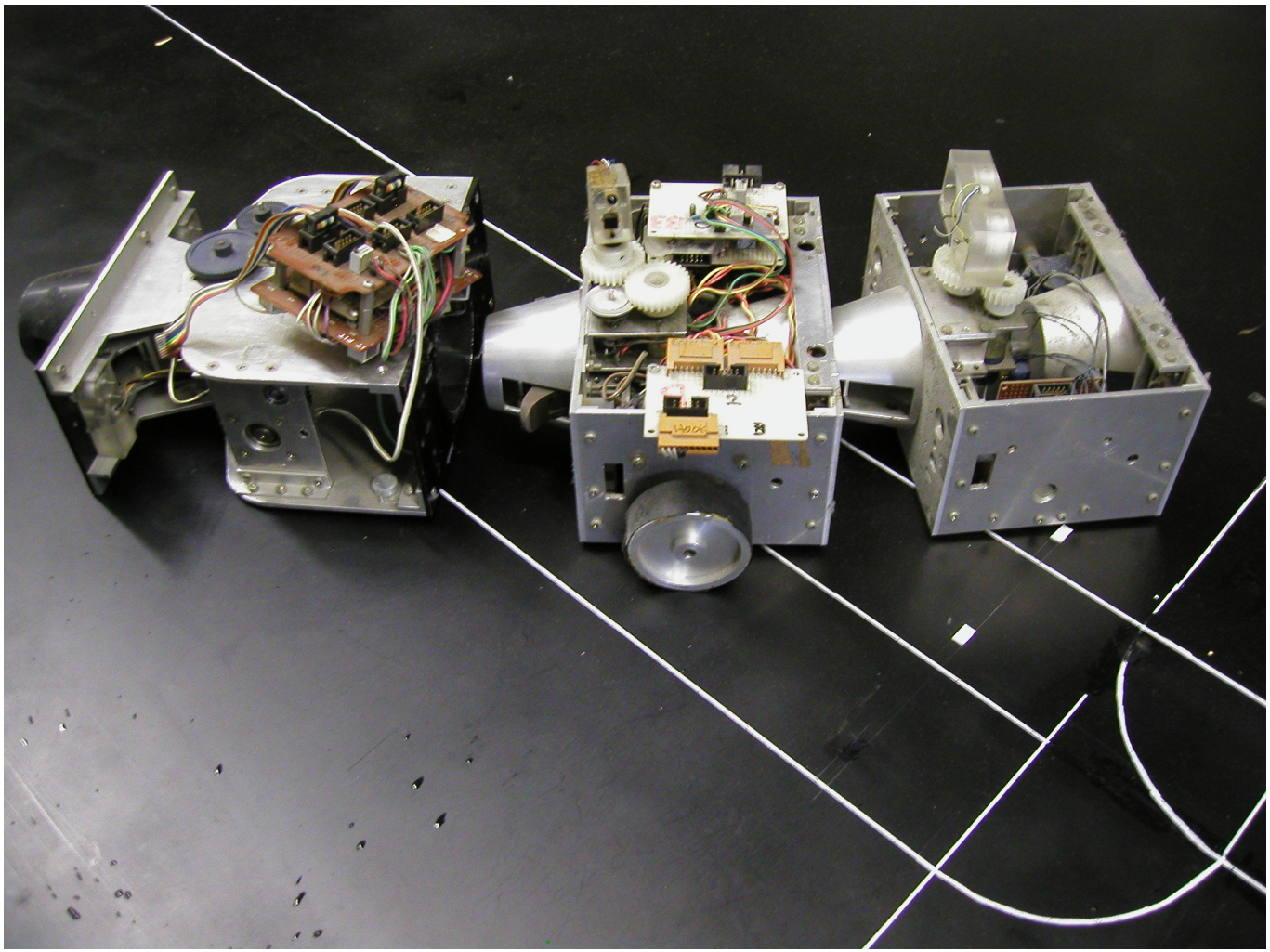
- monthly maintenance allowance: 2940 EUR
- research allowance: 600 - 1000 EUR (per month)
- settling-in allowance: 1500 EUR
- round-trip, domestic travel, insurances

Some Research labs

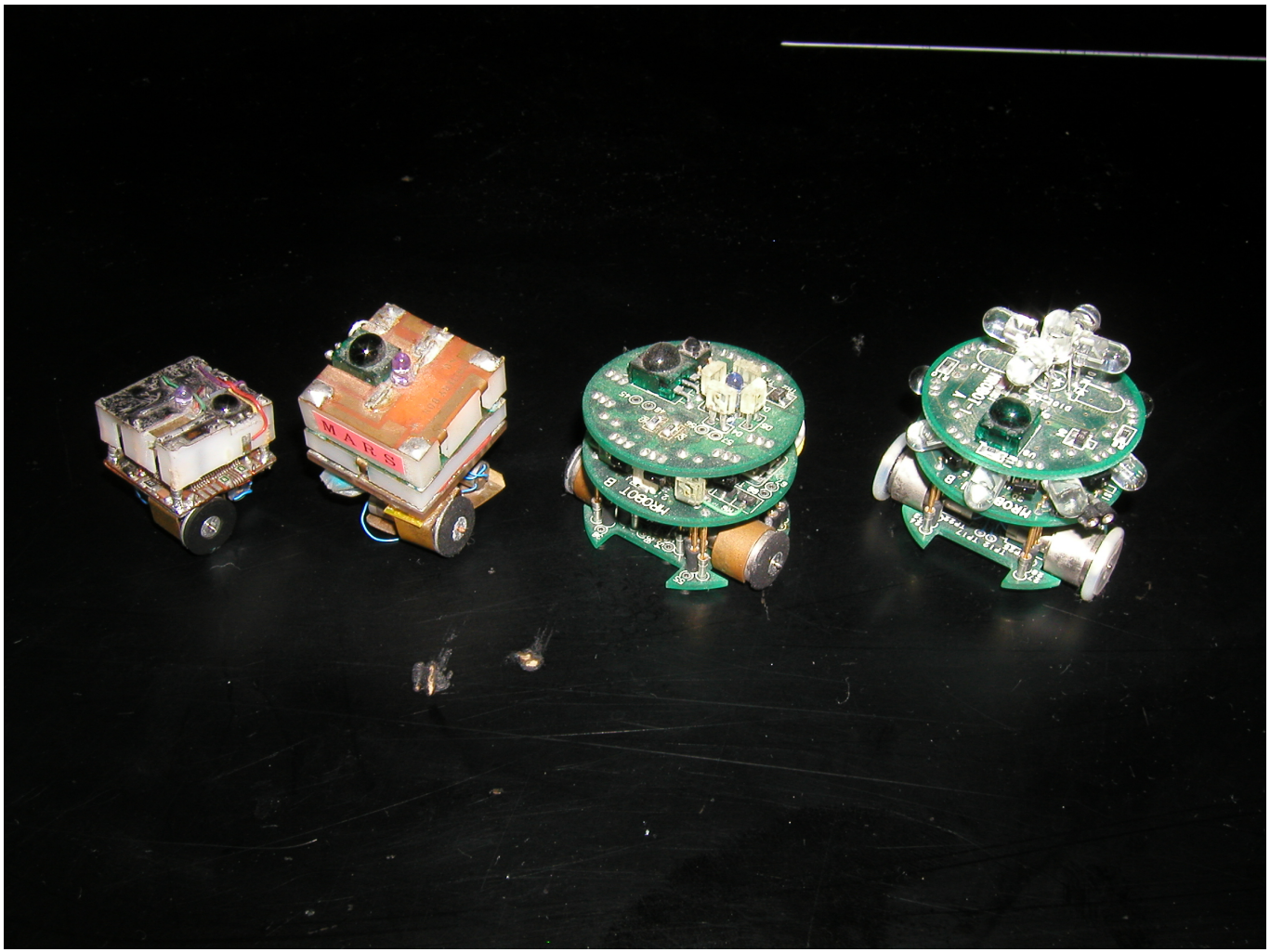
Fukuda Lab, Nagoya Univ., Nagoya



Fukuda Lab, Nagoya Univ., Nagoya



Fukuda Lab, Nagoya Univ., Nagoya



Fukuda Lab, Nagoya Univ., Nagoya

Kosuge-Wang Lab, Tohoku Univ., Sendai

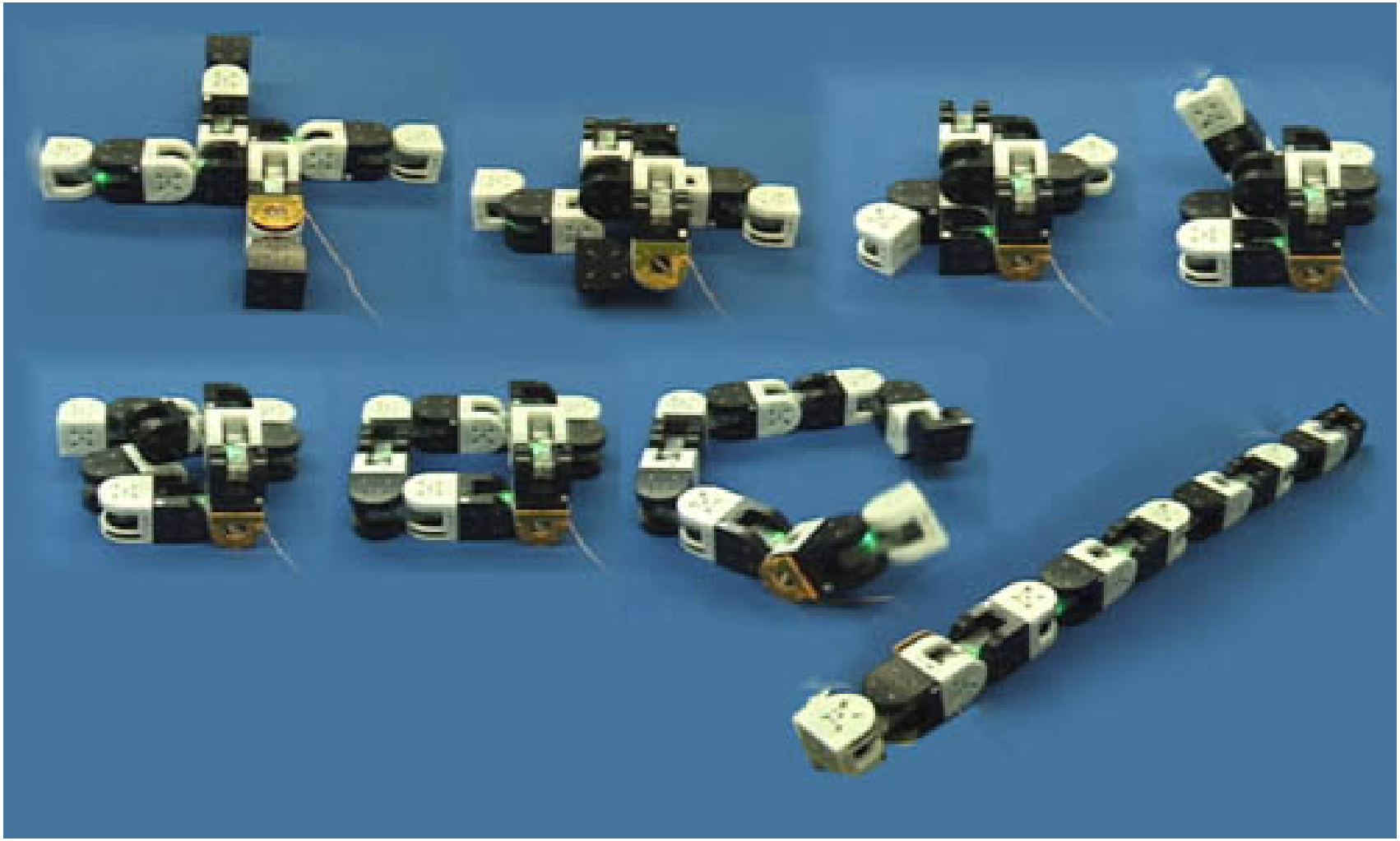
- group transport (to carry)
  - stigmergic communication
  - human-robot cooperation
- human-robot cooperation

Kosuge-Wang Lab, Tohoku Univ., Sendai

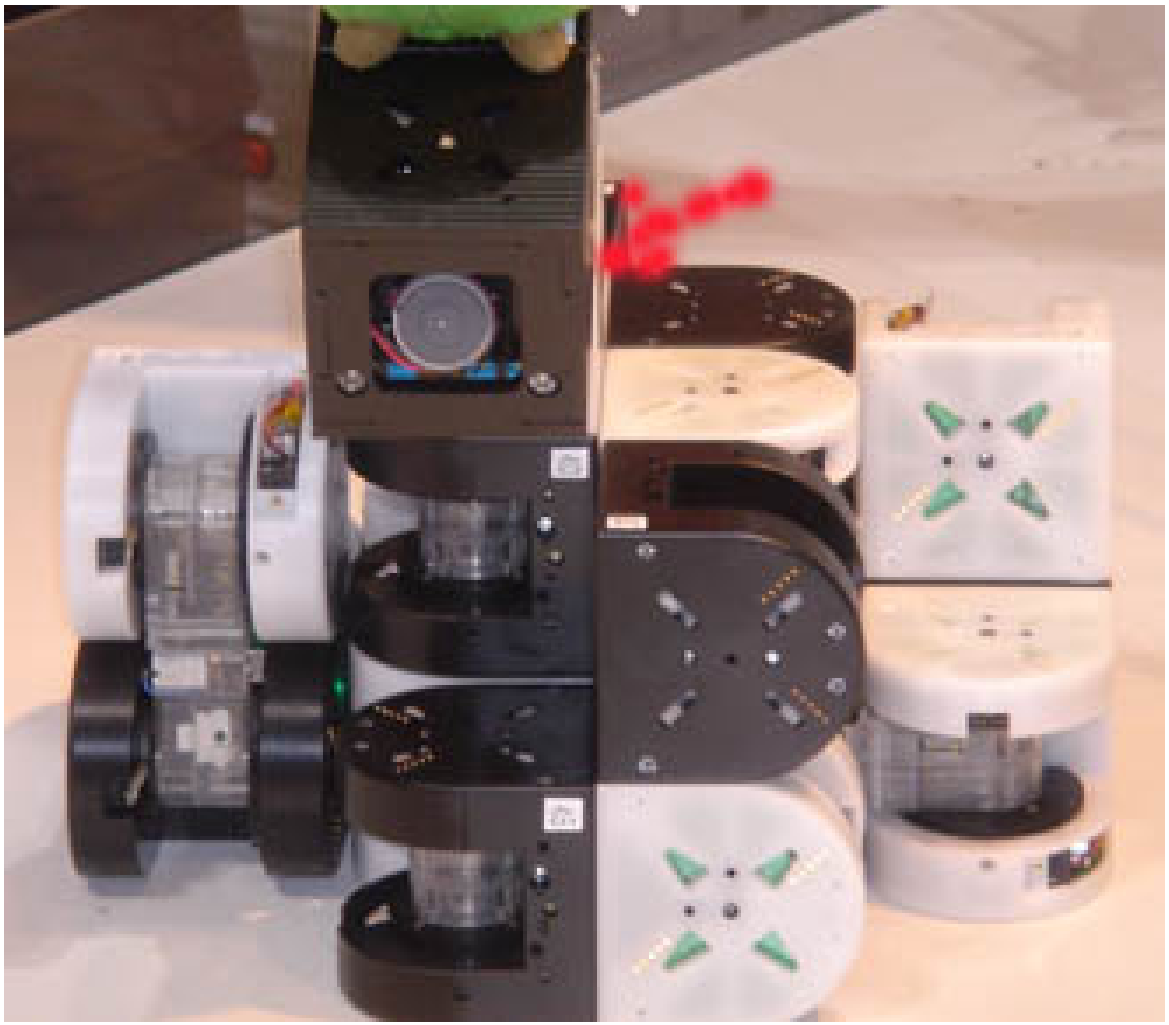
Matsutake

Murata Lab, Tokyo Tech, Tokyo

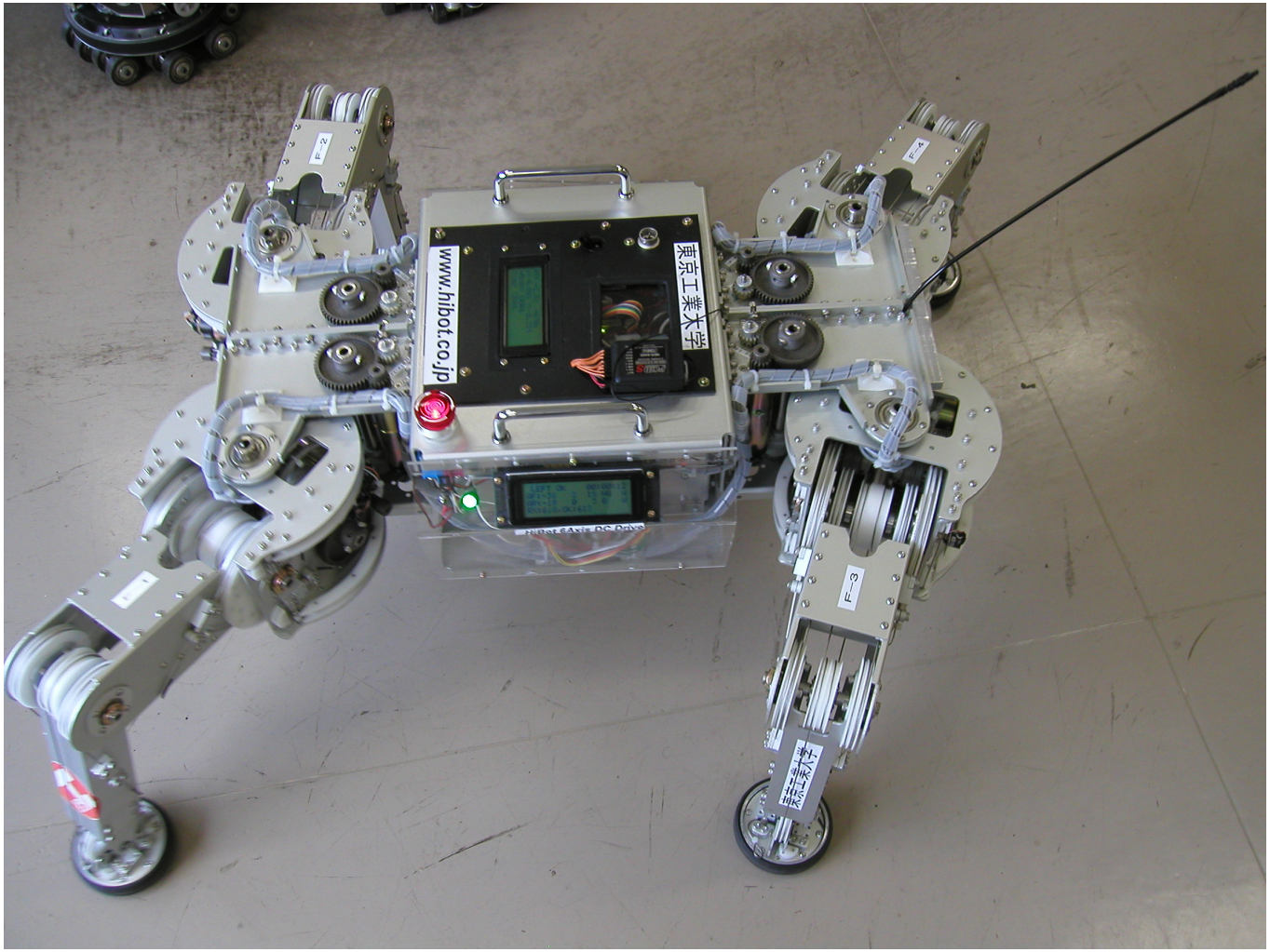
Murata Lab, Tokyo Tech, Tokyo



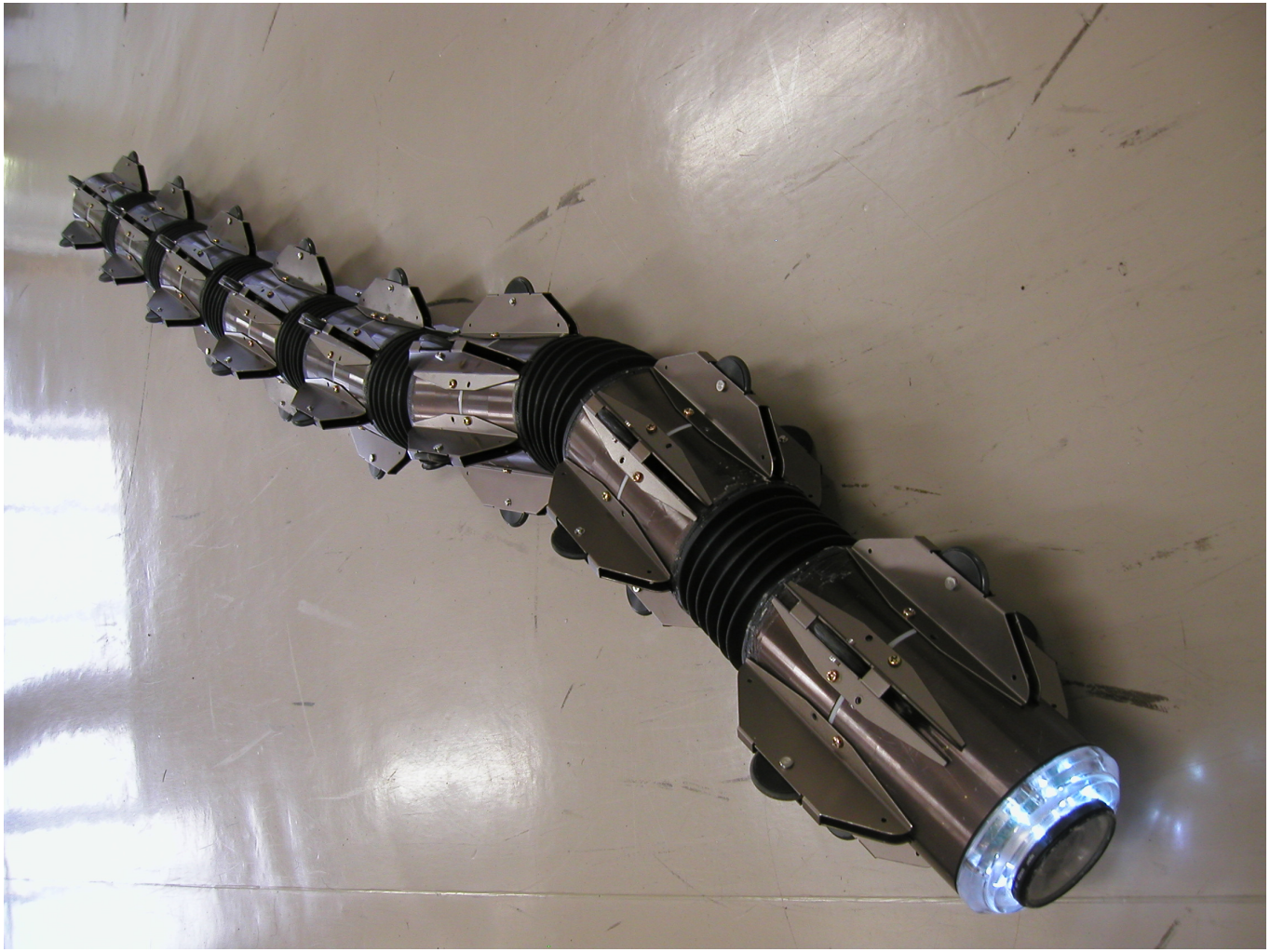
Murata Lab, Tokyo Tech, Tokyo



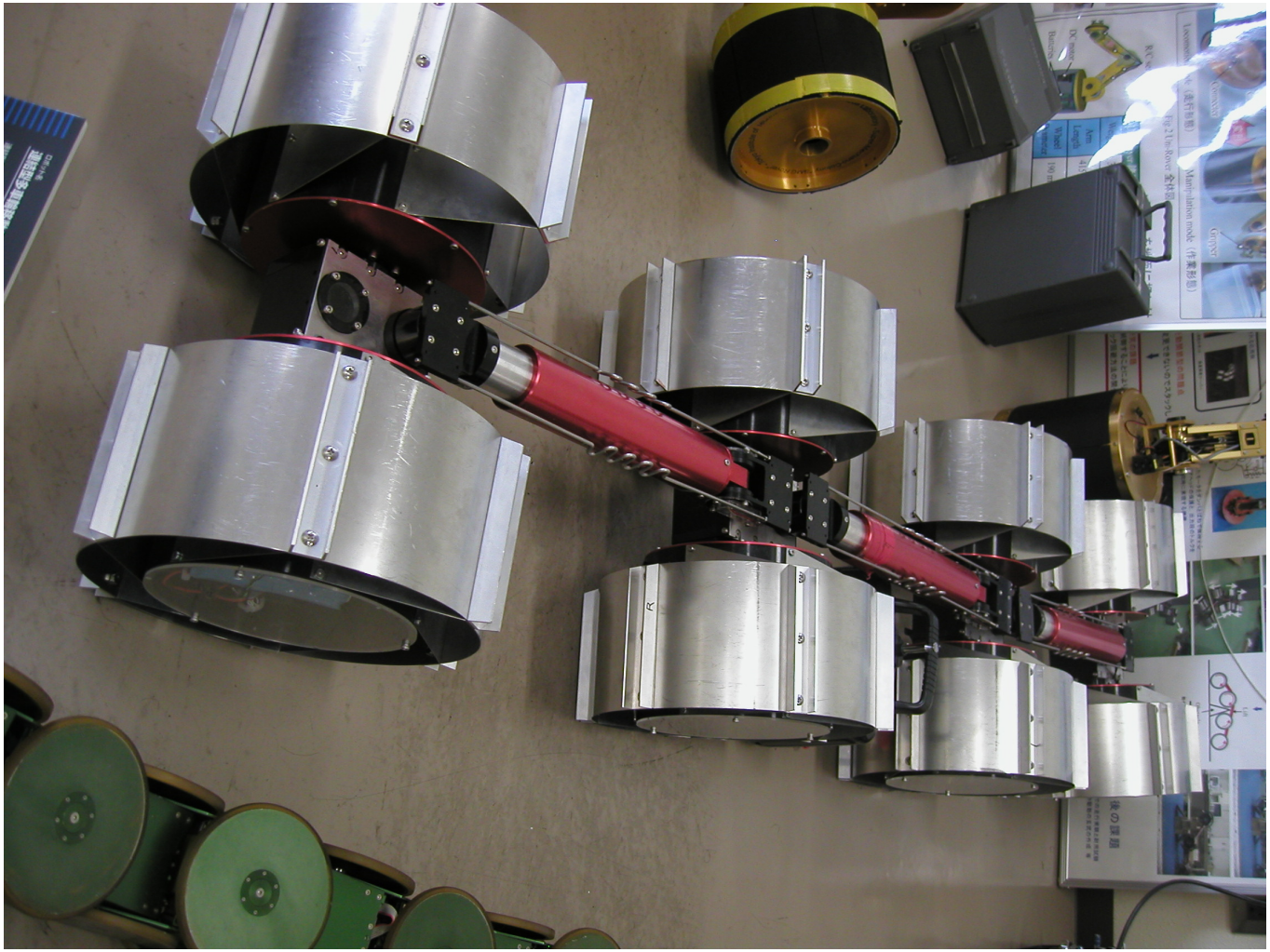
Hirose & Yoneda Lab, Tokyo Tech, Tokyo



Hirose & Yoneda Lab, Tokyo Tech, Tokyo



Hirose & Yoneda Lab, Tokyo Tech, Tokyo



Hirose & Yoneda Lab, Tokyo Tech, Tokyo

Takanishi Lab & Sugano Lab, Waseda Univ., Tokyo

- humanoid robots
- instrument playing robot
- speaking robot
- robot - animal interactions

My research environment

Yamakita Lab, Tokyo Tech, Tokyo

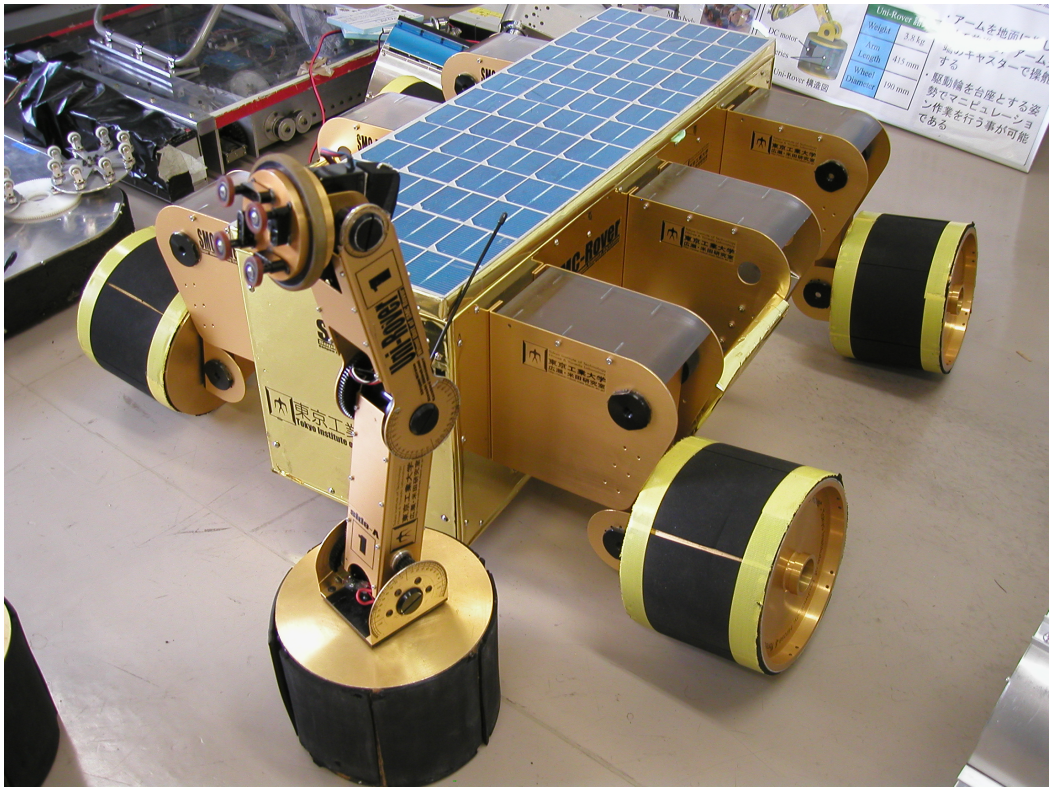
Yamakita Lab, Tokyo Tech, Tokyo

- control theory: posture control
  (bike, box with actuators inside, acrobat robot)
- Ionic Polymer-Metal Composite (IPMC) actuators
  (swimming snakes, walking bipeds)
- multi-robot systems (object transport, formation control)
- biology, etc.

Super-mechano systems (SMS)

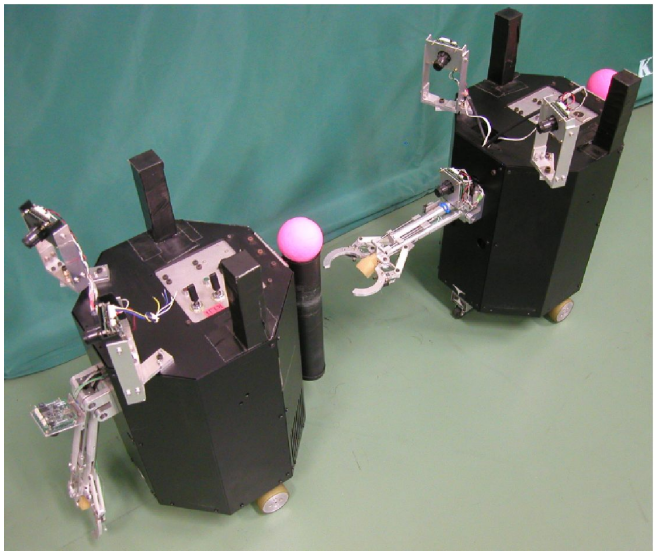
- COE research project at Tokyo Tech
- payed by MEXT (government)
- 17 professors
- about 10 robot systems (modular robots, and others)

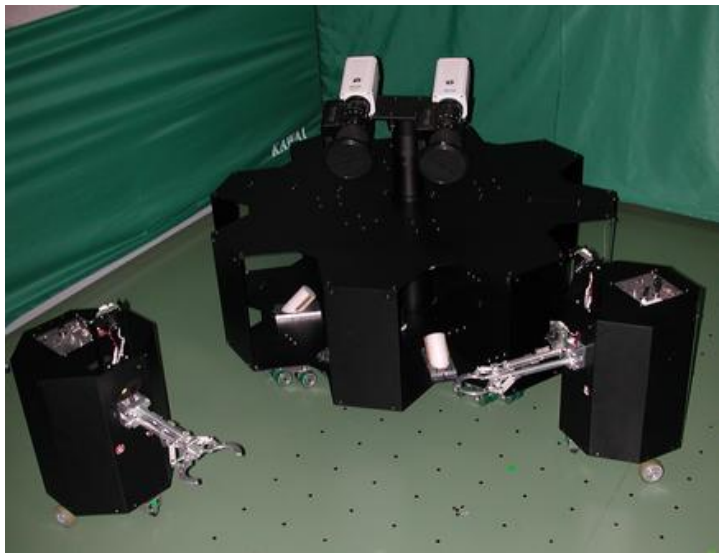
Super-mechano colony (SMC)



- parent-child system, planetary rover
- no sensors

Super-mechano colony (SMC)





- parent-child system, flat surfaces
- stereo vision system

Super-mechano colony (SMC)

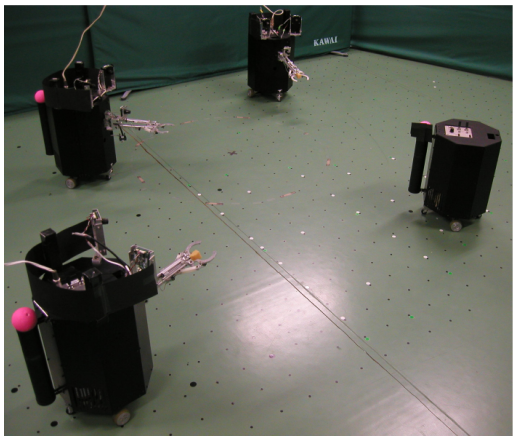
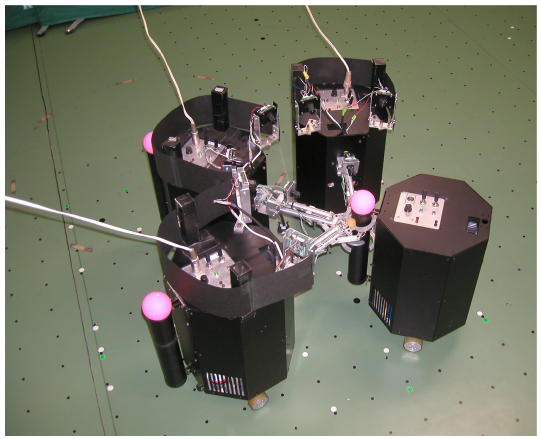
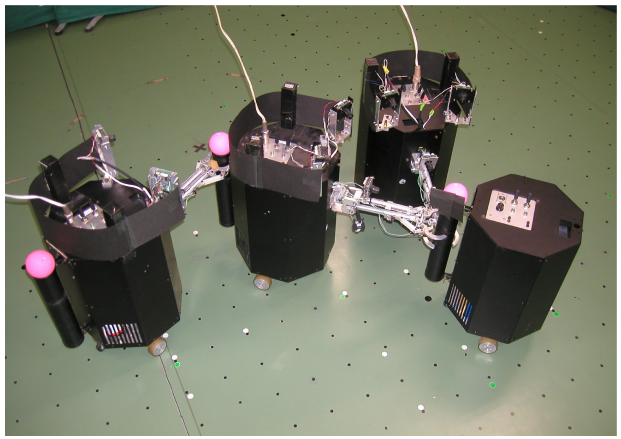
Aim of collaborative study

- transfer of neural-network based control from swarm-bot system
- approach: mimic functionality of source platform on target platform
- no need for major redesign of hardware and control

Results

- reliable self-assembly of two robots (150 degree range)
- lack of communication abilities
- preliminary studies with groups, focus:
  active pattern formation

Super-mechano colony (SMC)

- generated shape depends on type of stimuli
- Intelligent Autonomous Systems Conf. (IAS 2006)

Future Work

- PhD thesis and defense

Discussion