

## Worldwide R&D

# Area of Intelligent Systems, Division of Systems Science, Department of Systems Innovation, Graduate School of Engineering Science, Osaka University

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When the laboratory was first established in 1997, we conducted research on micro-hands and mobile manipulation robots focusing on parallel mechanisms and the mechanisms and control of arms, as well as their industrial applications. After later getting more personnel in the laboratory, we expanded our studies on mobile manipulation of humanoid robots, human interface, and information processing. Beginning in 2001, our laboratory was selected to head the Grant-in-Aid for Creative Scientific Research Project entitled "Initiative of Systems and Human Science for a Safe, Secure, and Reliable Society," and we are now engaged in research aimed at establishing a new academic field for engineering and humanities. In addition, we have been working on many R&D projects, primarily within a large national project framework involving close cooperation with participating businesses. We have received research aid from the Micromachine Center for a study on micro-hands, which has greatly advanced research on automated handling. Currently, we are participating in METT's IMS Project, the Project for Destruction of Abandoned Chemical Weapons under the Prime Minister's Office, and the NEDO Project for Developing Next-Generation Robots and are implementing commissioned and joint research with related businesses.

The current organization of the laboratory includes one each of a professor, associate professor, research associate, post-doctoral fellow, and technical official; two secretaries; four doctor course students (three of whom work for a living); thirteen master course students; and eight bachelor course students with whom we are conducting research and development focusing on robot hardware. We are implementing a robot system by studying the mechanisms and processing functions of humans and other organisms in order to coordinate information processing and the functions of these mechanisms in robots through studies of new sensors, mechanisms, and control techniques. We are also establishing a basic policy for education and research in an effort to propose a system to achieve the coexistence of humans and robots in order to build a safe and secure society. Through these educational studies, we hope to contribute to society with robotics by addressing the difficult problems facing the world today.



Fig. 1 Two-finger micro-hand still under development

Our current research focuses on nano- and micro-robotics and monitoring and support systems for assuring safety and security. The former field of research involves manipulation of micro-objects using a two-finger micro-hand developed together with the National Institute of Advanced Industrial Science and Technology, automated focusing and handling of objects in motion using visual information, evaluating operability of interface devices in the manipulation of micro-objects, handling and processing cells and tissue, measuring micro-forces, and the like. In the area of safety and security, a basic concept of merging system science with human science is employed in tracking humans with a moving camera to understand human behavior, providing humanoid robots to assist wheelchair users in movement and manipulation, evaluating humans' sense of security in response to robots, and conducting research on applications for humanoid robots.

In addition, we are working on a haptic interface for reproducing soft objects, integrated control of information and objects using RFID, improvements in the accuracy of a parallel mechanism, development of a limb mechanism for a robot having arms and legs, and applications for these robots in rescue operations. The limb mechanism was selected as one theme in NEDO's Project for Achieving a Practical Next-Generation Robot (Project to Support Prototype Development). We plan to perform a demonstration at next year's World Expo in Aichi.

In the future, we hope to continue concentrating our efforts on education about and research on robots that can be integrated into society. Since we apply great importance to our collaboration with the Micromachine Center and everyone in the industry, we hope that you will continue to provide us with this support.

Arai Laboratory Homepage:

<http://www-arailab.sys.es.osaka-u.ac.jp>

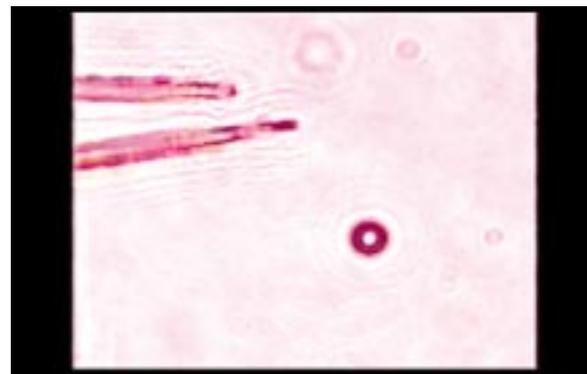


Fig. 2 Automated handling using automated focusing and object recognition functions (the object is a glass particle 2 μm in diameter)

## MICROMACHINE No. 48

**MICROMACHINE** is published quarterly by Micromachine Center (MMC) to promote the international exchange of information related to micromachines, R&D and other technical topics, and is circulated free of charge. Please send your comments about **MICROMACHINE** to the publisher :

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Date of Issue : August 23, 2004

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