AIST Technology to Drive the Robot Revolution

Serving as a Bridge for the Robot Revolution

Industrial revolution through robots

In 1980, considered the first year that industrial robots were widely deployed, the size of the market for them was around 76 billion yen. Over the next 10 years the industry grew rapidly into a 600 billion yen market. In the quarter century since 1990, however, the scale of the industry has hardly changed–it has only gone through ups and downs in line with the general economic climate. In this time, exports have increased, largely due to the fact that the high value of the yen drove Japanese manufacturers to relocate production abroad, and in the past 15 years the unit price of robots has fallen by half.

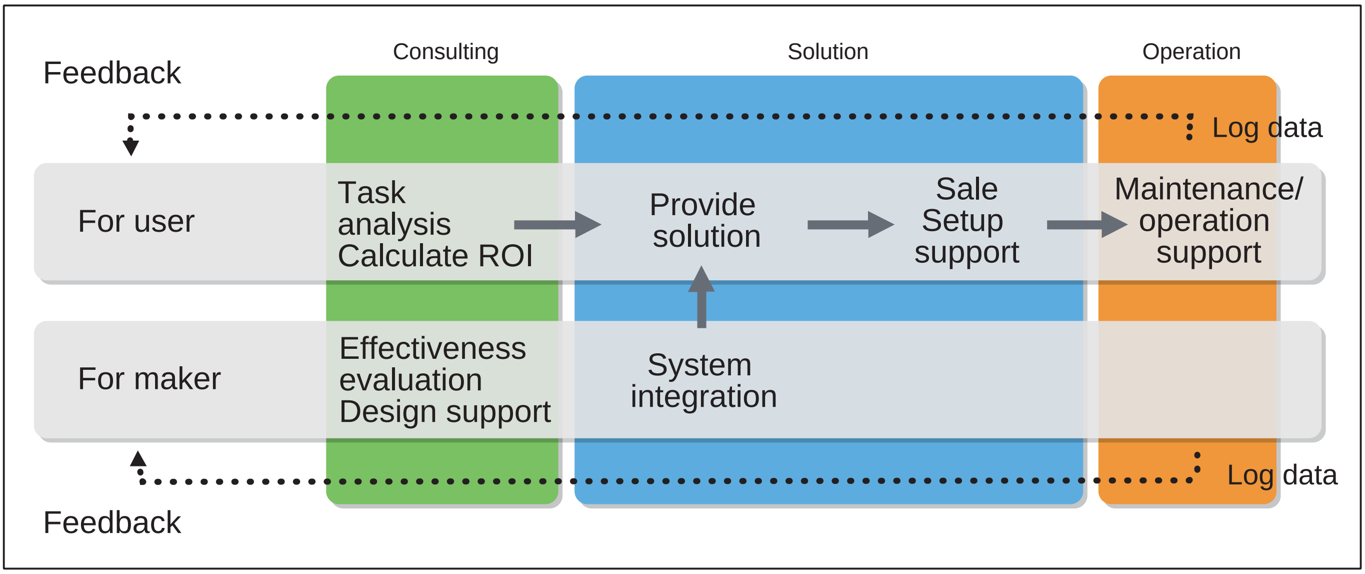
Statistics show that apart from the industrial robot manufacturers themselves, much of the investment to develop industrial robots in the 1990s was made by the R&D arms of light electrical appliance manufacturers. Since about the time of Expo 2005 in Aichi, though, major industrial corporations such as Toyota and Panasonic began making serious investments aimed at commercialization too, forming development teams of around 100 people to serve their companies' needs. The scale of private-sector investment in industrial robot development in recent years has been about 20 to 30 billion yen per year. In the U.S. a number of startup companies attracting billions of yen in investments have been launched, some of which made the news recently when bought out by Google.

At the same time, Japan is facing rapid changes in its social structure. With a falling birth rate and rapidly aging population, it is estimated that over the 20 years from 2005 Japan's workforce will have fallen by 5 million, while its population of elderly (people aged 65 and over) will have risen by 10 million. In view of these social conditions, it is entirely natural that Prime Minister Shinzo Abe has made the realization of a new robot-driven industrial revolution one of the pillars of his economic growth strategy.

How to realize a robot-driven industrial revolution

The question is: How can a robot-driven industrial revolution be realized?

According to a 2012 survey by the Ministry of Economy, Trade and Industry, when conventional robots are excluded, the market for industrial robots, including robot technology products (machinery and equipment utilizing robot technology, automated driving systems, etc.) is stuck at around 200 billion yen. The main reason is that robot technology is not providing solutions that can ignite an industrial revolution. It is not particularly that each industrial sector is wanting to use robots.



PDCA cycle for realizing robot solutions

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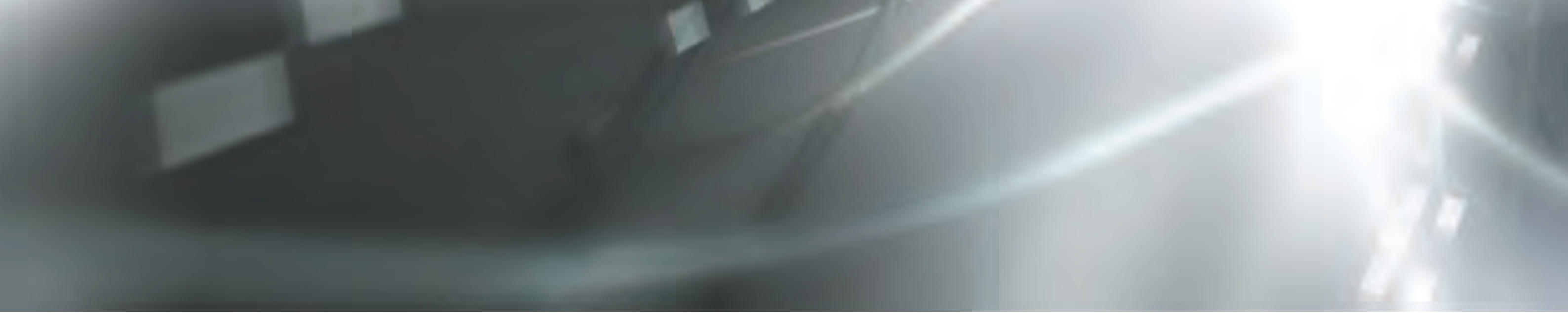

What is needed are solutions to the range of issues they are facing, such as low productivity, extreme work environments, and labor shortages. A lot of development in robots has been done up to now in collaboration with users, but this approach is not enough.

In the figure on page 4 the first step is to analyze a particular work task to assess how investment in robots or other equipment can increase profitability. A solution is then provided. Then through the implementation of the solution at the premises of leading users, feedback is provided to the user and manufacturer based on detailed log data. Design support in terms of evaluating effectiveness and safety is provided to the manufacturer. It is necessary to rotate through this kind of PDCA cycle on a large scale in a short space of time.

AIST is pursuing R&D on fundamental technologies to realize this cycle, with the goal of conducting robot technology to the industrial world. This feature offers an outline of our various initiatives to achieve this goal.

Director,
Intelligent Systems Research Institute
Hirohisa HIRUKAWA

Mobility Robot Technology to Support Human Locomotion

Introduction

The special zone for mobility robot experiments in Tsukuba-city was launched in June 2011, as a testing ground for personal mobility devices equipped with robot technology, as a means of transport to address the needs of a low-carbon and aging society. We have been utilizing this zone to run driving verification tests on public thoroughfares (sidewalks), including wide-area autonomous driving tests of personal mobility devices and a verification test of mobility robot sharing between AIST and Tsukuba railway station. Through these tests, we are doing R&D on various kinds of technologies relating to information infrastructure support-type navigation.

"Marcus" wheelchair with autonomous traveling capability

We are developing a wheelchair-type

Fig.1 "Marcus" wheelchair with autonomous traveling capability
Attached with sensors for creating 3D environmental maps on the upper rear of the chair

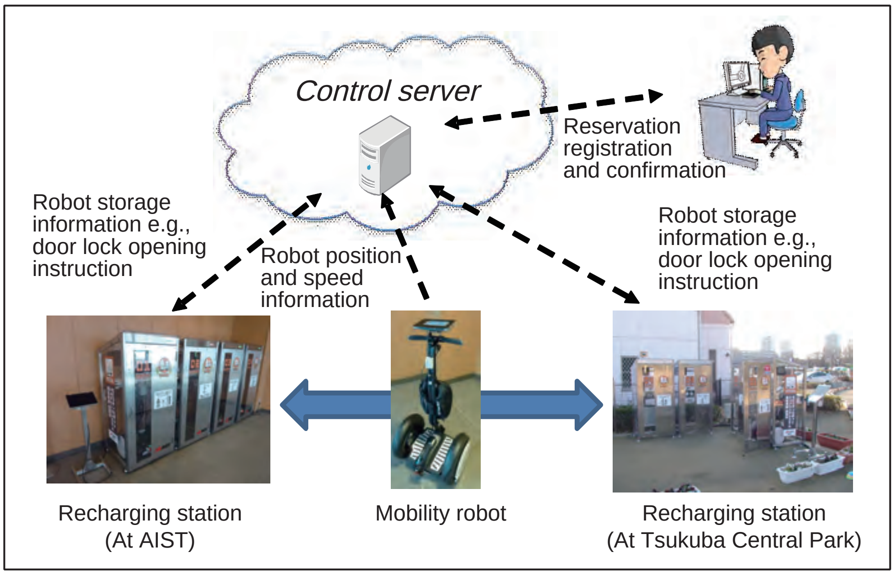

Fig.2 Mobility robot sharing system
Communication with a control server enables movement control and automated mobility robot hire

robot called “Marcus” that enables long-distance autonomous travel both indoors and outdoors. Utilizing environmental data collected using laser range sensors and omni-directional cameras attached to the robot, we created 3D environmental maps of a wide area, covering the central downtown district of Tsukuba City. We used these maps as the basis and developed a self-driving technology for long distances (a few kilometers or more), suitable for both indoor and outdoor transport. It is a highly versatile technology, enabling autonomous movement even in indoor environments where GPS cannot be used, and necessitating absolutely no modifications to the surrounding environment. Furthermore, it includes an avoidance function–whenever it detects a person or other obstacle ahead it automatically changes the trajectory of travel on a real-time basis. Research and development on this device, aimed at use by elderly people for movement in downtown areas in the future, is continuing.

Mobility robot smart sharing

We developed a sharing system using standing type personal mobility robots attached with GPS and various other sensors, and information display devices, by linking together a reservation system, movement control system, and recharging stations. This fully automated system, which allows individuals to borrow and return an electric personal mobility device in public spaces, is the first trial of its kind in the world. Currently, we are collecting, storing, and analyzing various kinds of data on the operation of the sharing system, which is being used mainly by AIST employees for work-related transport in the area between the recharging stations located at AIST and Tsukuba Central Park close to Tsukuba railway station. The system even features a means for issuing warnings if the device deviates from the regular course of travel or in the event of dangerous operation such as emergency stop. There are plans to expand the sharing system to enable travel between multiple locations by the end of FY2014, when additional recharging stations are installed at Kenkyu-gakuen Station and Tsukuba City Hall.

In addition to fully testing the operation system and examining the commercial feasibility of mobility robot sharing, we hope to demonstrate a model case study of a locomotion support service utilizing an information infrastructure.

Smart Mobility Research Group,
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Osamu MATSUMOTO

Robot Technology to Support Human Life

The need for personal care robots

As the costs of caring for the growing numbers of elderly people keep rising, much hope is being invested in robotic care devices.

It is estimated that in the 15 years from 2010 to 2025, the number of elderly people (aged 65 and over) in Japan will increase by approximately 7 million, and the proportion of elderly people in the total population will increase from 23 % to 30 %. From 2012 to 2014 alone, the increase in elderly people was more than 1 million people per year. At the same time the total number of care workers needed is predicted to grow to 2.4 million by 2025, an increase of 900,000 from 2010. Reports also indicate that some 70 % of care workers suffer from lower back pain, resulting in an employee turnover rate of around 20 % per year. In order to reduce the burden on care workers, the development of personal care robots to enhance the independence of elderly people is being tackled with urgency.

Initiatives to develop and deploy robotic care devices

Despite this, due to problems of marketability, safety, and practicality, the development and commercialization of care devices based on advanced robot technology is barely progressing. To overcome these problems, in FY2013 the “Project to Promote the Development and Introduction of Robotic Devices for Nursing Care”[1] was launched by the Ministry of Economy, Trade and Industry (METI). It is based on three key concepts:

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1) Identifying key areas based on real workplace needs (“needs oriented”); 2) Accelerating ease-of-use improvement and cost reduction by means of a stage gate process (“low cost”); and 3) Promoting full-scale deployment in the workplace (“mass adoption”). Through support for the development and adoption of robotic care devices in “key areas for the use of robot technology for nursing care” (Fig.1), as identified by METI and the Ministry of Health, Labour and Welfare, this project aims to enhance the independence of people requiring nursing care, to reduce the burden on care providers, and to create new markets for robotic care devices.

This project consists of two elements– a project to assist with the development of robotic care devices, involving more than 50 companies, and a project to formulate and evaluate standards by a consortium (“standards consortium”) made up of 10 organizations and centered around AIST. So far, the standards consortium has provided support by creating models of a “development concept sheet,” “safety concept checklist,” and “risk assessment sheet” to clarify the concepts needed for developing robotic care devices (how devices are used in practice, target users, and technical requirements), and by providing explanations to the development support companies. In addition, the consortium has created assessment standards that combine verification items and methods for the safety and performance levels that devices must satisfy for each key area. At the end of FY2013, assessments based on these standards were conducted at a stage gate conference.

Fig. 1 Key areas for the use of robotic care devices (as of FY2014)
Top: Mobility aid devices (wearable, non-wearable), outdoor mobility support devices
Middle: Excretion support devices, care facility monitoring devices
Bottom: Indoor mobility support devices, home care monitoring devices, bathing support devices

The standards consortium also develops methods and equipment for verifying the effectiveness of devices. Specifically, it is developing a humanoid robot and dynamic simulator (Fig.2) to simulate the behavior of care workers and care recipients, as well as a support system that involves recording the tasks performed at care facilities (including the conditions of use of robotic care devices). Furthermore, we are working to develop a highly reliable embedded CPU board to support modularization and conducting surveys and studies aimed at standardization of robotic care devices. We have also set up a public relations web site for the project (a portal site for robotic care devices),[2] on which we publish research results and information on the progress of our standards formulation efforts.

Safety verification of personal care robots

Assistive devices that are in direct contact with people and devices that move in living environments, such as robotic care devices, can cause great damage to people–if a device goes out of control in some way, for example. For this reason, the safety of robotic care devices and other kinds of personal care robots requires careful attention.

In December 2010 the Robot Safety Center was established as a base for conducting safety verification of personal care robots. The center is equipped with an assortment of testing equipment to verify the safety of personal care robots. Some examples include a system to check that robots do not malfunction under various temperature and humidity conditions (combined environment test system); a system to check that devices do not topple when the inclination of the driving surface changes (driving stability test system) (Fig.3); a system to check the potential for human harm by crashing the robotic device against a dummy (collision test system) (Fig.4); and a system to check that the electromagnetic radiation generated by a robot does not cause human harm or device malfunction (EMC test system).

Currently, the center is running a variety of tests on robotic care devices by companies involved in the robotic care device project mentioned above, but since July 2014 the Robot Safety Center is also conducting tests of other devices, on contract, through the Japan Automobile Research Institute (a non-profit foundation). More and more robot developers and manufacturers are expected to make use of the center's services in the coming years.

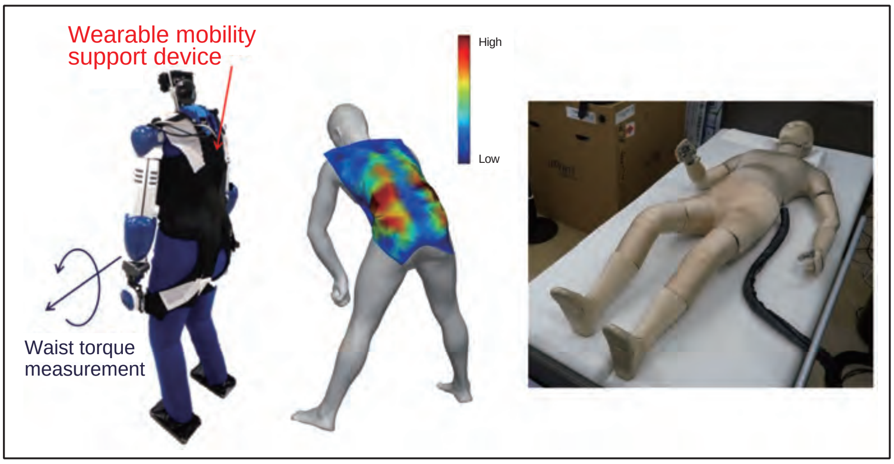

Fig.2 Simulated nursing care robot, simulator, and simulated elderly patient robot


Fig.3 Driving stability test system


Fig.4 Collision test system

International safety standards for personal care robots

While previously there were no standards applicable to personal care robots, on February 1, 2014 ISO 13482 (Robots and robotic devices - Safety requirements for personal care robots) was issued. This international safety standard covers three types of personal care robots–mobile servant robots, wearable physical assistant robots, and person carrier robots. The basic structure of these standards was proposed by Japan and the activities of the Robot Safety Center made a significant contribution to the standards. These standards are not yet defined quantitatively, but through its activities the Robot Safety Center is expected to produce more detailed quantitative data in the coming years.

References

[1] H. Hirukawa *et al.*: Robot Care Equipment Development and Introduction Program, 31st Annual Conference of the Robotics Society of Japan (2013).

[2] Robotic Devices for Nursing Care Project web site: http://robotcare.jp

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The Birth of "Mahoro": Turning to the Idea of a Multipurpose Two-armed Robot

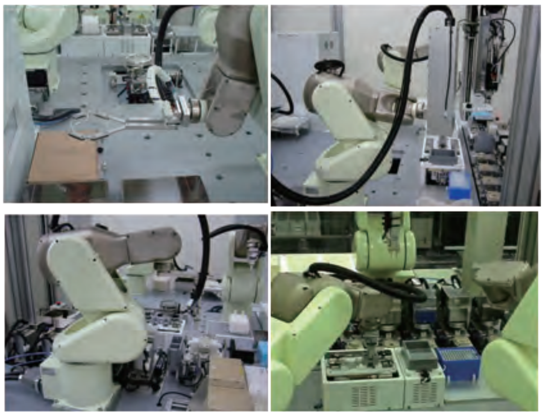

Fig.1 "One robot-one process" type benchwork robot

Fig.2 "Mahoro" multipurpose humanoid robot

The life sciences bottleneck

As new, innovative measurement technologies have emerged in the life sciences, the lab benchwork needed for research has expanded greatly, resulting in seemingly endless, laborious work. In view of the fact that the correctness and reproducibility of experiments depend on uncertainties such as the skill, spirit, personality, and concentration of the operator and tacit knowledge, a tremendous number of repeated trial and error processes are needed to reproduce experimental results satisfactorily. In addition, even if perfect procedural protocols are developed at great cost of money and time, it is not unheard of for work to vanish like mist when an operator changes. The fact that in many experiments little effort is made to make the technology visible and standardized is a major impediment when it comes to generalizing and industrializing research findings. On top of this, in biomedical experiments it is sometimes necessary to handle dangerous viruses.

In view of all this, here we present the story of "Mahoro," born to solve these kinds of problems and to facilitate a revolution in the life sciences and biotech industry.

The difficulties of benchwork robots

The development of the world's first benchwork robots was launched around 15 years ago, based on the vertical multi-axis robots that were already widely deployed in manufacturing industry (Fig. 1). However, "one robot-one process" production line type system suffered from a basic limitation–the need to rearrange robot hands and special jigs at each work step. On top of this, customizing peripheral devices such as dispensers, stirrers, and centrifuges that were not originally designed for use in automated processes required around five years for design, trial manufacture, and optimization, and another two years for teaching.

The robot system, completed at great expense of time and money, was a highly specialized automated line that was not amenable to the slightest change or correction of protocol–it was completely unable to adapt to the obsolescence of analysis and experiment methods, or to the incessant minor changes that tend to occur in work procedures.

From specialized lines to multipurpose robots

In view of the above issues, a conceptual transition occurred. Instead of "one robot-one process," peripheral devices would be used as they are, and all processes would be handled by a multipurpose, two-armed robot at a single benchwork.

When we presented this idea to Takeo Suzuki, then managing director of YASKAWA Electric Corporation in 2001, he arranged for us to pursue research in collaboration with Masahiro Ogawa (now CEO of Yaskawa America, Inc.), the person in charge of developing the two-handed robot, and his elite team. In the summer of 2012 we managed to complete a proof-of-concept of the world's first multipurpose two-armed robot (Fig. 2), and later through a full-scale collaborative research effort we gradually demonstrated that skilled experiment techniques can be visualized and tansfered and robots can surpass humans at many tasks.

Looking ahead to future projects, we have developed a business model together with companies and shared the concept and values of our "Mahoro" robot system with a wide range of entrepreneurs, engineers,

For inquiries about this article : Molecular Profiling Research Center for Drug Discovery http://www.molprof.jp/english/index.html and even salespeople. For AIST and the company to function as a single team, we sat together with university researchers and clinicians in meetings and study groups innumerable times. A lot of work in establishing a structure was also done to ensure genuine “open innovation,” for example by setting up a reference web site and establishing a group focused on robot utilization.

A robot that anyone can use

Within several years we hope to see a robot at work on the bench of every research lab. To help bring this about, we want to create a polished interface that allows even people without any special experience or knowledge to instruct the robot to perform sophisticated tasks. It is also necessary that the work procedures of researchers in all fields are quickly adapted, standardized, and accumulated.

Our hope is to help bring about environments that will liberate many researchers from the need for routine benchwork, so that they can devote themselves fully to work that only humans can do.

Related Information:
Advances in Lab Bench Work With “Mahoro,” a Multipurpose Humanoid Robot, AIST, Youtube (www.youtube.com/watch?v=l4W9d9ZVJyQ)

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Robot Technology to Support Manufacturing Industry

Introduction

In manufacturing industry, the use of robots for welding and machining processes is now relatively well advanced, but robotization of other processes, such as assembly, parts supply, and product inspection, is still quite undeveloped. At AIST, the Vision and Manipulation Research Group of the Intelligent Systems Research Institute is at the center of research efforts aimed at promoting robotization for such processes. Here, we offer an outline of some of our activities.

Recognizing environments and objects

Versatile Volumetric Vision (VVV), a 3D vision system, is a software system that enables the highly precise, real-time execution of a series of processes–distance measurement, shape representation, object recognition, and motion tracking–applied to arbitrarily shaped objects under a variety of conditions.

For example, the system can detect objects made up of free curved surfaces, by making measurements of 3D information in an observed scene to determine features and then comparing them to geometric models (Fig. 1). It can also detect specific objects from a group of relatively featureless tubular objects by theoretically analyzing vector distributions of principal curvature (Fig. 2).

Grasping and motion planning

“graspPlugin for Choreonoid” whose framework is Choreonoid, a robot motion choreography software package, is capable of solving a wide range of planning problems, such as hand position planning for grasping

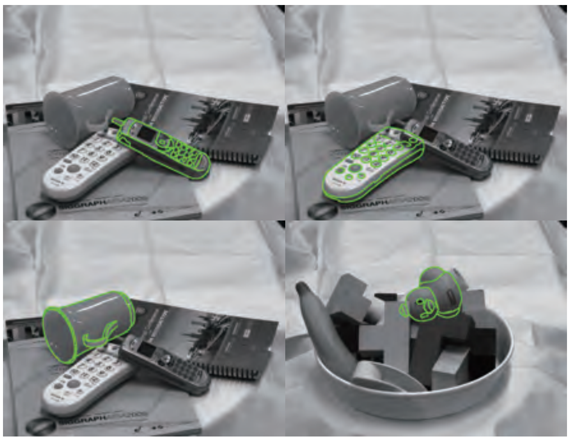

Fig.1 Detection of generic 3D objects

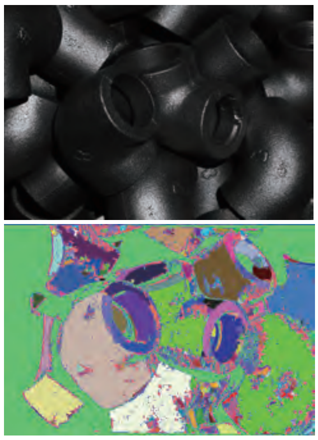

Fig. 2 Detection of tubular objects

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objects and planning of robot motion for grasping objects by hand.

The dual-arm robot in Fig. 3 plans "pick and place" motion, as needed, while passing an object from one hand to the other.

Force control technology

The ability to control the force and moment applied by the hand of a robot enables a variety of useful work to be performed by robots.

The humanoid robot in Fig. 4, for example, is able to tighten nuts, through the use of sensors fitted to the wrist of the robot that measure the 6 dimensional forces and moments. When a nut is tightened, information about the reflective force is used to fit the nut to the bolt at the correct position.

Fig.3 Robot motion planning, including grasping of objects

Through this process, the tightening of the nut is successfully achieved.

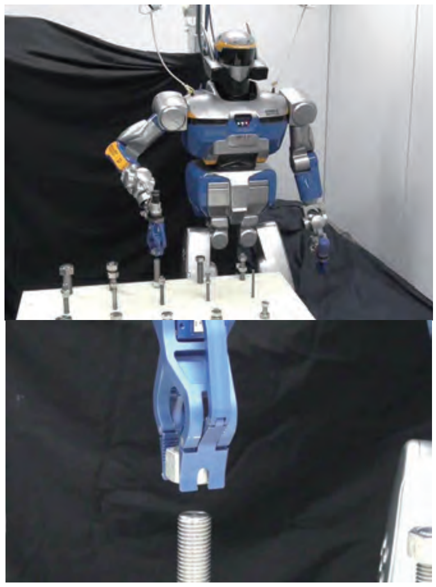

Fig. 4 Nut screwing operation with force control (Below is an enlarged view of the robot's right "hand")

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Kensuke HARADA

Robot Technology to Make Social Life Safer

Intelligent sensing technology

Sensing technology to serve as the "eyes of machines"

A new age in which the "eyes of machines" in the form of personal care robots, self-driving vehicles, and similar devices, will support us in many aspects of our lives is gradually emerging. Since humans live depending heavily on visual information, it is desirable that the machines we use to support us possess visual capabilities as good as or better than our own.

As illustrated in the figure, we are working on R&D to develop a variety of technologies to provide a foundation for realizing the "eyes of machines," and to serve as a bridge between the developed technologies and our society.

Three sensing technologies

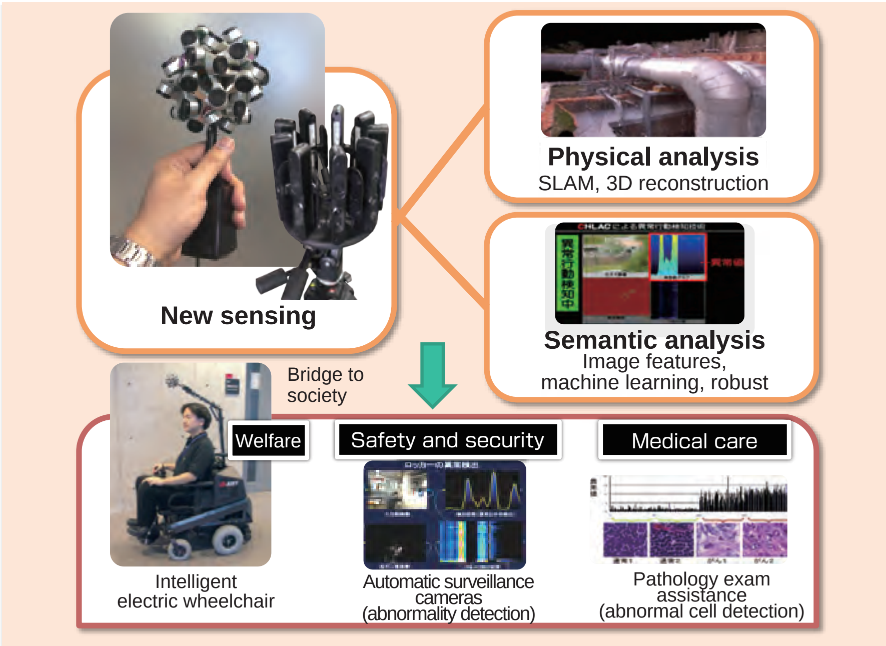
Sensing technologies can be roughly classified into three types. The first type of technology is equivalent to the "eye" of humans. The overall system performance is largely determined by whether or not information can be accurately captured. We are developing and assessing the performance of new sensing systems that defy conventional common sense, like an omnidirectional stereo camera system that simultaneously obtains color images in every direction and distance information by means of 36 "eyes." As an example we are doing research aimed at applying this technology to ensure the safety of electric wheelchairs that are required to move in and around living spaces together with pedestrians–spaces that are far more complex than the roadways that regular motor vehicles travel on.[1]

The second type is a "physical" data analysis technology. This includes reconstruction of 3D information from data captured in 2D, like that of ordinary camera images, integration of multiple captured 3D data sets obtained using lasers, and measurement of various kinds of quantities

and characteristics using these data. This is a fundamental technology that is becoming essential in a wide variety of settings–it is utilized, for example, to detect obstructions to electric wheelchairs like those mentioned above, as well as to serve as the “eyes” of industrial robots.

The third technology is a “semantic” data analysis technology. A typical example of this is Higher Order Local Autocorrelation (HLAC), a technique invented by AIST, and the applied technologies associated with this.[2] Applying thie technology, we developed a system for automatically detecting “abnormalities.” It is difficult to define “abnormality,” but by combining HLAC with machine learning techniques, the system learned to understand “normality.” By then defining the deviation from “normality” as the “degree of abnormality” it was possible to implement automatic detection of abnormal activity from surveillance camera images[3][4] and automatic detection of abnormal cells from pathology exam images.

These three types of technology and their combination represent a technological foundation that gives machines the power to see. Looking ahead, we hope to advance the technologies further and utilize our findings to facilitate safer, more secure social life.



Development of intelligent sensing to address social needs

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Yutaka SATOH

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Robot technology for infrastructure maintenance

Urgent measures to counter infrastructure deterioration

Infrastructure means the equipment and facilities that serve as the foundation for our personal lives and industries. Social infrastructure covers a wide range of things, including roads, rivers and dams, seaports and airports, water supplies and sewerage systems, and electricity and gas supplies. Since the peak of social infrastructure construction in Japan occurred in the period of rapid economic growth of the 1960s and 70s, over the next 20 years the proportion of this infrastructure that will be more than 50 years old will accelerate rapidly.[1] To address the deterioration of this social infrastructure, however, a number of problems have to be faced–a decline in infrastructure function, the financial difficulty of maintenance and renewal, and a serious lack of labor and technology.

Sensing and robot technologies offer promise for their potential to address the problem of maintaining social infrastructure. In December 2013 the Ministry of Economy, Trade and Industry and the Ministry of Land, Infrastructure and Transport designated

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bridges, tunnels, and the underwater parts of rivers and dams as “key areas for the development and deployment of robots for social infrastructure.” In FY2014 the ministries launched an R&D project and field verification project. The R&D project is being carried out under contract to the New Energy and Industrial Technology Development Organization (NEDO). Here, we present a description of our efforts to develop a robot for maintenance of bridges and the underwater parts of rivers and dams.

Inspection in difficult environments

There are approximately 700,000 bridges in all of Japan (defined as roadway bridges 2 m or longer). Of these, 68 % are managed by the local government. Guidelines for periodic bridge inspections for maintenance were revised in June 2014 to the effect that all bridges should be visually inspected in close proximity every five years, thereby placing a great burden on local governments and inspection services. In view of this problem, we are pursuing R&D together with Kawada Technologies, Inc. and other companies to create a bridge inspection system that utilizes multicopters (Fig. 1). In this development our aim is to facilitate comprehensive and uniform periodic inspections, by means of a multicopter system with a wired power supply, that flies under bridges to capture detailed images of the parts requiring inspection.

Japan also has some 30,000 river administration facilities at rivers and dams. One problem is scouring of river banks and bridge piers (sand is washed away by flowing water). Together with Q.I., Inc. and others we are engaged in an R&D project to develop a reconfigurable robot system for underwater surveys (Fig.2). This system is principally designed for surveys of dam facilities and deposits, surveys of scour in flowing rivers, and it enables modular configurations suited to the environment and inspection targets. Its key feature is that it enables a wide range of multipurpose surveys.

Like this, robots can make sensors access remote inspection points, and robot technology is an indispensable technology for the inspection of structures that are difficult for people to access.

The problem of infrastructure deterioration is similarly evident with industrial infrastructure, such as oil refineries, chemical plants, ironworks, and electric power plants. In light of this, we are also trying to develop robot systems to support maintenance of industrial infrastructure in more complex environments.

Reference

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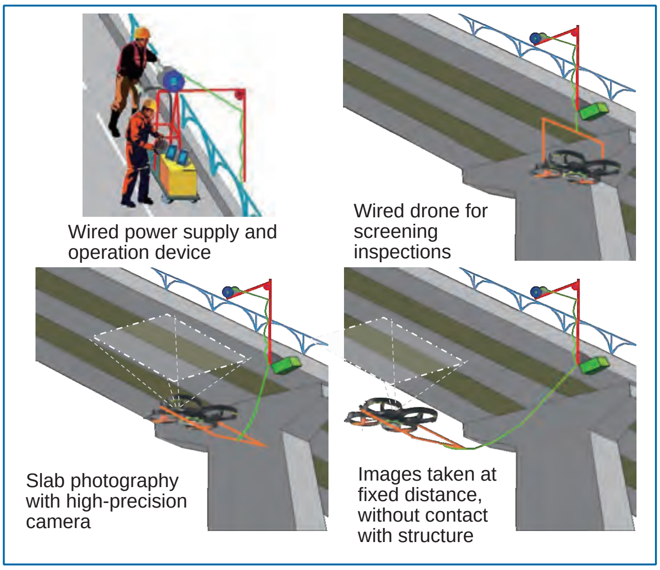


Fig.1 Images of bridge inspection system

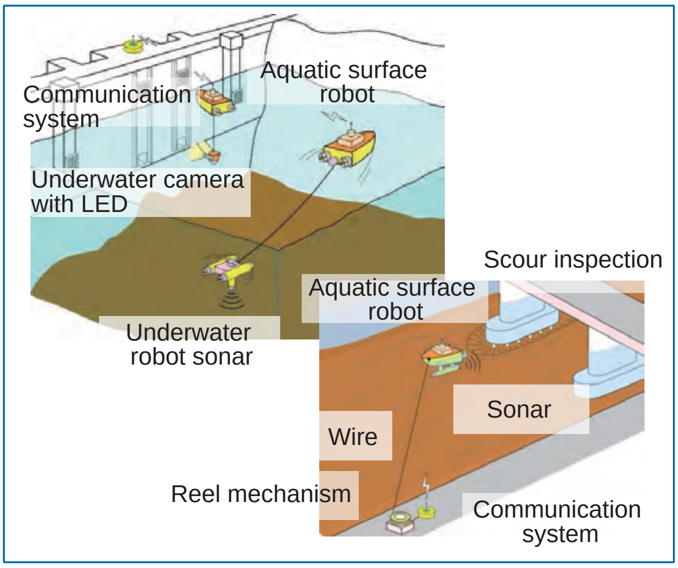


Fig. 2 Images of system for examination of dam facilities and deposits, and scour

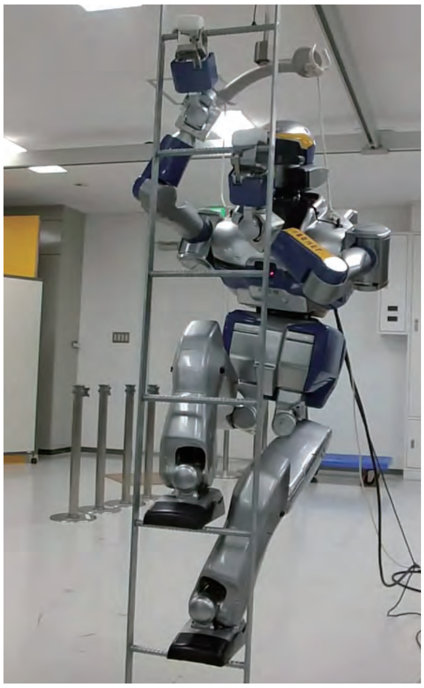
Robots Designed to Work in Extreme Environments

Disaster-response humanoids

There is a need for robots that can replace humans for evaluating and working at dangerous disaster sites. Although crawler robots the mobile Quince and PackBot are being actively deployed at the Fukushima Daiichi Nuclear Power Plant, facilities such as this were designed assuming that all work would be done by humans. Since the widths of passageways and stairs were designed for humans, the movement of robots is not easy, and there are many places where robots cannot move, such as vertical ladders, which are only accessible by humans. Thus, humanoid robots, shaped similarly to humans, are considered a promising solution for working effectively in such environments.

To realize humanoid robots capable of working at the scene of disasters, we are engaged in R&D to equip such robots with the ability for highly dependable movement, by combining three essential functions: 1) An environment recognition function that enables accurate recognition of surrounding conditions when the robot first arrives at the site; 2) A multipoint contact motion planning function for planning the motion needed to execute movement and tasks, whereby the robot makes contact with the environment not only with its “toes” but also with “fingers” and various other parts of the body; and 3) A whole-body motion control function that enables motion plans to be adaptively changed in the course of operation when uncertainties exist, for example when measurement errors occur.

We hope our efforts will hasten the day when human workers will be freed from the need to work in extreme and dangerous environments.



A humanoid robot climbing a fully vertical ladder using its two hands and two feet

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Robots for conducting surveys at disaster sites

In disaster response management, it is important to start by assessing conditions at the site of the emergency. Due to the severity of the environment or the danger posed by possible secondary disasters, however, it is often difficult for people to access the site. For these reasons, robots suitable for the particular environment and site conditions are used.

In the case of nuclear decommissioning at the Fukushima Daiichi Nuclear Power Plant, as assessment of conditions inside the building progressed, it became necessary to conduct a survey of high places with complicated piping. For this purpose, we worked in collaboration with Honda R&D Co., Ltd. to develop a high-access survey robot[1] (See figure). The robot was first deployed in March 2013 and it has so far been used to capture images and measure radiation levels at high places in reactors No. 2 and 3. In this development project, careful study to increase dependability and devise response measures, taking into account both the operation and return of the robot, was vital in improving the usability and safety of the robot.

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Robot technology is also used for disaster responses to volcanic eruptions and mudflows. Currently, we are developing a "complex terrestrial/aerial robot system for disaster surveys," designed for operation in integrated form, making use of the advantages and characteristics of terrestrial mobile robots and aerial flying robots. We are working on this in collaboration with Hitachi, Ltd., under contract to the New Energy and Industrial Technology Development Organization (NEDO).

Looking ahead, we will continue striving to develop robust, highly dependable robot systems, capable of working effectively under extreme disaster conditions. We will also perform evaluations and formulate relevant standards to help in deciding on robot deployment.

Reference

[1] N. Yamanobe *et al.*: *Journal of the Japan Robotics Society*, 32-2, 145-147 (2014).

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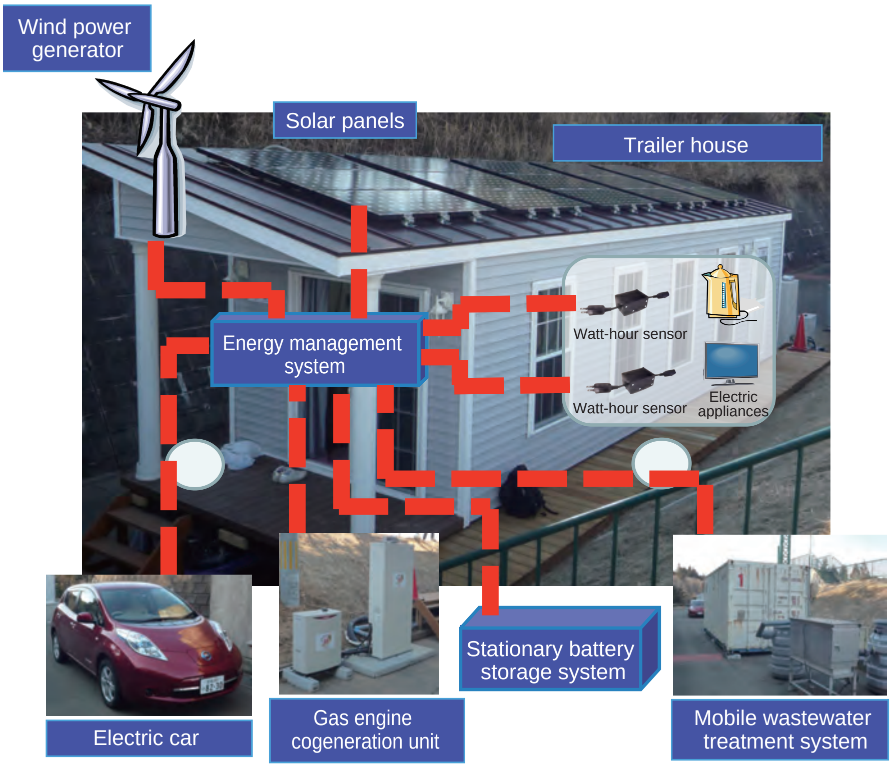
Appearance and specifications of high-access survey robot
Left: when used for high-access survey, Right: when transported or moved

Robot Technology to Create Value

Spreading the use of robots in society

Even if we create a car that can travel very fast, its performance can not be demonstrated if there are no roads. Similarly, even if high-performance robots are available, they cannot do much good if there is no way to get them used in society. It was an awareness of this problem that led to the launch of the Kesennuma Kizuna Project.[1]

When we first visited the disaster-affected areas following the Great East Japan Earthquake, we tried to identify problems that could be solved with technology. We realized, however, that this was putting the cart before the horse–that technology was essentially a secondary issue. The right approach is to start by clarifying "what kind of support is needed in the disaster area" and then creating



Trailer house and energy management technology

a means to get the necessary support adopted. Only after this would it be clear what technology was appropriate.

Conditions in the disaster area and the future of Japan's rapidly aging society

Local communities within the affected area were devastated by the disaster. Many of the elderly victims moved into temporary housing, but without any local community they had no motivation to go out. As a result, they tended to become reclusive, shut away in their homes. This in turn affected their health, leading to a rise in cases of a disease known as "disuse syndrome" (a disease caused by lack of activity). This situation in the disaster area struck me as a microcosm of a problem that is becoming more prominent in the wider Japanese community, so a solution to this problem could also be valuable for the country's aging society in the years ahead.

Robot technology needed for support

To prevent disuse syndrome it was necessary to create a sense of community to motivate people to get out of their homes. It was first necessary to create a social space in which community could be established, then to prepare and provide some kind of attraction to ensure that the community would be active and sustainable. At this point the required technology became clear. To provide a social space we needed a building. It was not possible to construct a building immediately, so we decided to bring in a "trailer house"–a mobile house fitted with wheels (See lower figure on page 15). In addition to a building, electricity and water supplies were also needed, of course. In the disaster area, the quickest option for this was a self-sufficient energy management system, with solar panels, a battery storage system, etc.

Robot introduced at a health and fitness event

The next step was to provide something to engage the interest and participation of the people. For this we brought in several robots connected to health. Rather than simply placing the robots in the trailer house, it was important to make effective use of them, as part of running health events and consultations allowing people to keep track of how much their health improved from day to day (See the figure above).

A social system linking governments and private sectors

The presence of engineers in a disaster area and the support provided through their knowledge can make a valuable contribution to the recovery of a community, but ultimately the locals have to run things on their own. So unless we leave them with a practical way to operate the adopted technology themselves, the community cannot be genuinely revived. What is needed is some kind of system in which governments or NPOs adopt technology from the private sector themselves and then develop appropriate government services.

Currently we are collaborating with Kesennuma City to start up a revival support system, the "Kesennuma City Good Life Creation Promotion Scheme," linking the government and private sectors, with the aim of tying together technology provided by private sectors to local government services. This will serve as a social system that can help ensure that robots and other kinds of technology make a valuable contribution to communities.

Reference
[1] *Ikirukizuna* web site: http://ikirukizuna.jp/

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