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New Year's Greetings

President Hiroyuki YOSHIKAWA

The fall of the Berlin Wall remains vivid in our memories, and we still remember our expectations at the time for the realization of world peace. And yet, our hopes were totally let down during this turbulent time. As we witnessed the collapse of the wall, we also anticipated that all mankind would be able to join together and face the growing global environmental challenges. With this increasing momentum, the Earth Summit was held in Rio de Janeiro three years after the historical event. This led us to share the concept of sustainable development as well as the need to solve poverty. In time, we have undertaken a process towards human solidarity aiming to realize the concept.

However, we started to recognise that the hope was premature. The international world order has fallen into a state of confusion which we have never experienced in our history. This chaotic situation must be resolved at the earliest possible moment. The question is how we as researchers of science and technology can contribute to the resolution of this problem.

The utilization of science and technology to counter terrorism has been raised as an urgent issue at some academies in the world. The most pressing goal for Japan should be to minimize the suffering of civilians caused by terrorist attacks. All the scientists in Japan, irrespective of differing viewpoints, must recognize their responsibility to achieve this goal.

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Besides this urgent and essential mission, we must define our long-term goal even in the midst of the turmoil. I believe this goal is the “expansion of the concept of sustainable development”. Our development activities are tolerated only on the condition that the opportunities to fulfill human needs are equally guaranteed to the future and present generations. In short, the concept of development originally involves a relationship between the present and future generations. However, by applying this condition to equality among people today, the scope of this concept would be expanded further. In other words, the development in any area of the globe should not reduce the people’s opportunities of those of other areas.

This principle should be a fundamental condition of the original concept of sustainable development. In fact, the Kyoto Protocol for preventing global warming was actually adopted according to this concept. Nevertheless, there are still many problems remaining, which require "expansion" or reconsideration on the meaning of sustainability. It can be considered that these problems are the underlying cause for the present breakdown of the order.

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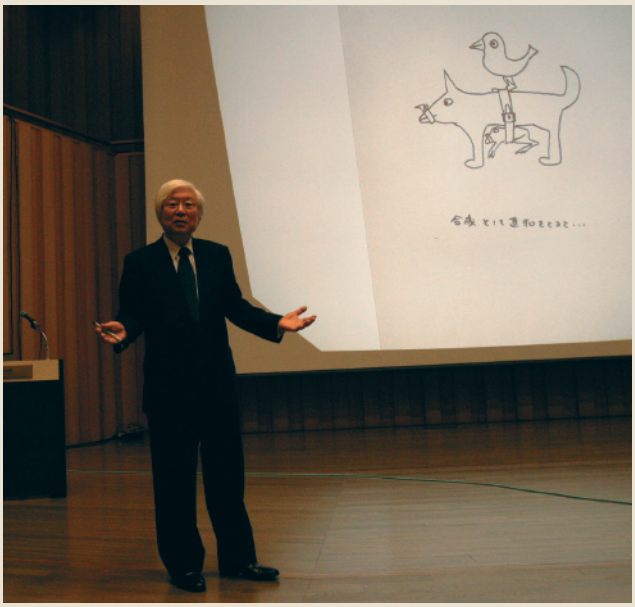
The challenges we are facing include the stable supply of food and clean water, treatment and prevention of diseases, securing of energy supplies and efficient utilization of resource. It is doubtful that there are universal perceptions and solidarity among us today to deal with such vital issues. Unfortunately it seems that we have no reliable vision or action plan towards the resolution of these issues.



Among them, however, the fight against global warming seems to be very promising despite the numerous problems lying ahead. Each country plays a role in this effort based on the commonly shared prospects within the framework centered on the United Nations.

Scientists will find a significant meaning in this international cooperation on the problems of climate change including ozone depletion. That is, such international consensus has been reached on the basis of scientific knowledge. The importance of the consensus was that

It was not simply the application of conventional subject-specific research achievements, but the application of innovative knowledge stemming from a new realm of research and obtained by multidisciplinary cooperation. This observation offers a profound "suggestion" for the roles and responsibilities of scientists as well as the future direction of researches in science and technology.

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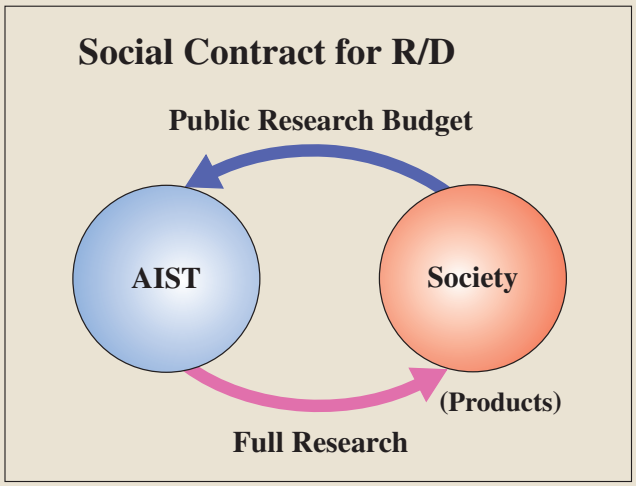
The immediate task at the National Institute of Advanced Industrial Science and Technology (AIST) is to respond to this suggestion through the research activities. Since the inauguration of AIST, we have been seeking measures to meet the expectations of people and return benefits to society through useful research achievements.



The research efforts at AIST include not only "Type- Ⅰ Basic Research", but also "Type- Ⅱ Basic Research" that combine scientific knowledge and add innovative knowledge, leading to product development that will be meaningful and beneficial to society. "Full Research", which comprehensively covers all these research aspects, is the basic principle of AIST activities, and each research unit is established and managed based on this principle.

The idea of "Full Research" comes from the philosophy that scientists must have an implicit "contract with society". I believe that this concept is now commonly shared by scientists and accepted by the public through AIST's workshops, 'Type- Ⅱ Basic Research Workshop' and 'Product Workshop based on Full Research', held during the past two years. We have succeeded in forming a link connecting AIST and industry to execute our "social contract". The next step is to determine the most critical issue to tackle.

I consider that AIST's mission is to deal with the issues involving the said hitherto untouched problems. In other words, we must clarify what to resolve through our "Full Research" for that goal. It is obvious that the resolutions of these global problems require society-wide action, but the linkage between AIST and industry must assume an integral part.

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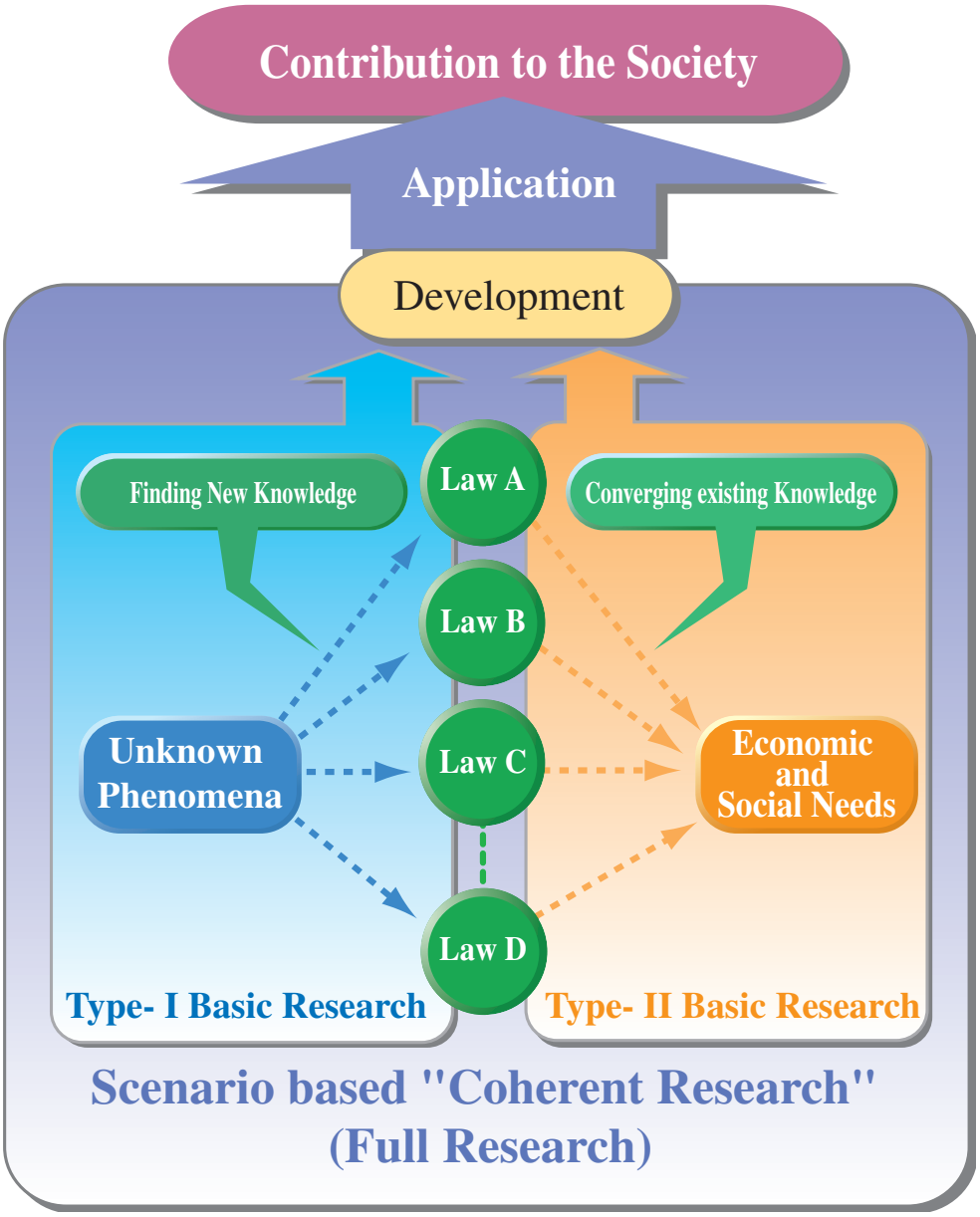
From this point of view and considering that the "Type- Ⅱ Basic Research" and product application have been thoroughly discussed as the essential components of "Full Research", the significance of "Type- Ⅰ Basic Research" emerges as a major part of our research activity. "Type- Ⅰ Basic Research", with its vast achievements, should be the starting point of the scenario that aims to explore the potential of "Full Research". At the beginning of 2004, I believe that our efforts will establish a scenario for the solution of global issues.



	Definition	Activities
Type -I Basic Research	Research to discover and establish universal scientific laws (rule, principle, theorem etc.) through observation, experiments and theoretical analysis of unknown phenomena	Discovery
Type- II Basic Research	Research to establish universal rules and/or knowledge by converging knowledge (rules, principles, theorems etc.) for a specific socio-economic requirement through observations, experiments and theoretical analysis of the phenomena	Convergence
Development	Research to appraise opportunity of technical and socio-economic commercialization of new materials, devices, products, systems, manufacturing processes and service based on the knowledge obtained through Type I and II Research activities	Commercialization

Feature

Ubiquitous Computing at AIST

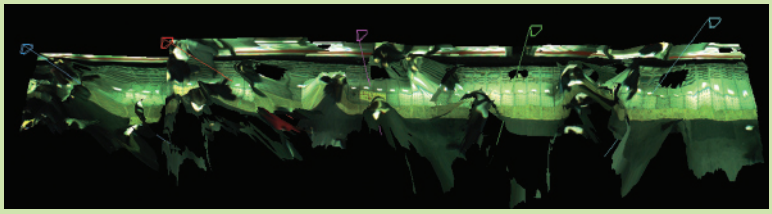
Increasing Convenience and Universality

Technology to Assist Humans

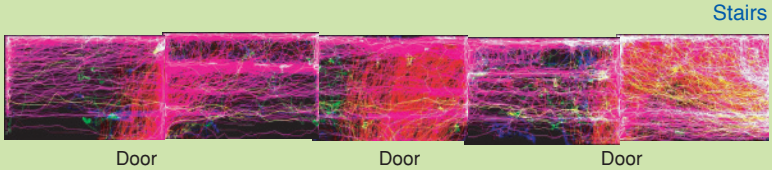
Technologies are progressing rapidly towards creating ubiquitous information societies where computers and networks exist universally.

The question is how people will use computers in such a vast information infrastructure. We hope that computers will be able to serve more directly as the "backbone" in people's life and become capable partners that provide unobtrusive, but firm support to us. They will be no longer mere tools which users need to take out of their bags or pockets or operate by using a mouse.

The computers will exert full potential in a variety of basic technologies that interface with people's activities. The application of these technologies will bring about the systems which enable hands-free control home appliances, ensure people's safety, gently assist the disabled, navigate directions, give guidance for working procedures, provide information as required, and so on. This feature article introduces AIST research projects on the technologies which support ubiquitous information societies, through the examples of practical application.



This is a momentary image of a train platform extracted from a series of 3D images shot at 12 frames/sec by five stereo cameras. As the subject's figure is captured three-dimensionally, the position, height and moving direction can be automatically calculated.



The paths of the passengers of ten trains (one train runs per hour, i.e. for ten hours) were recorded and color coded according to directions of paths. The diagram clearly represents the flows of the passengers getting off the trains and shows that most of the people use the stairs on the right hand side.

Invisible guardians

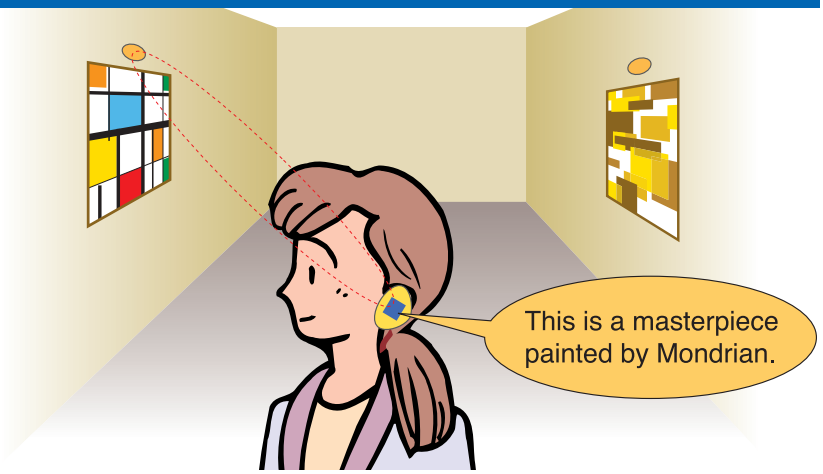
Tragic accidents at train stations are frequently reported. To prevent such accidents, AIST has developed a system to ensure people's safety in wider areas by installing many 3D sensors (ubiquitous stereo vision). By the use of 3D information, the system is able to select and track a target person in an extensive area with no blind spots and is unaffected by obstructive factors such as people's clothing, illumination, sunlight, shadows, background, congestion and so on. In practice, the research team successfully illustrates the paths of the people on the platform from the first train to the last train. Furthermore, it is possible to detect a critical condition before a passenger falls from the platform so that the technology can be applied to the system to warn and protect people who are in danger in public places. The system will realize the "ubiquitous information environment that ensures human security".

Reliable, low-key assistance for humans in everyday life

The elderly lady in the picture has a "My Button", an electronic universal pass. We aim at building an IT infrastructure which assists ordinary people carrying this device. With your schedule data stored in My Button, for instance, the station environment assists you to get the right ticket while automatically paying the right fare, to locate the right platform, and to take the right train. This is "Human Centered Ubiquitous Information Environment".

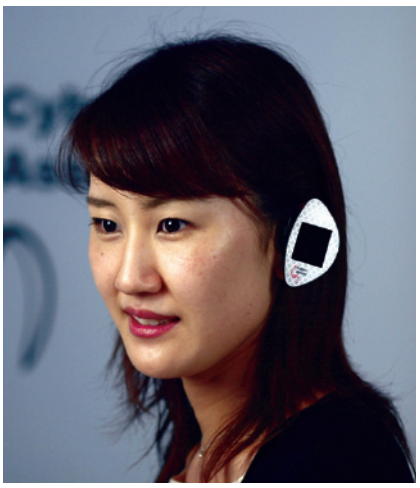
In good old days ↑
But recently··· ↓

Get the Information "I NEED HERE NOW"!



My Button Ver.1

"My Button" is a mobile terminal device that observes the user's natural, unconscious movements and provides information according to the user's various conditions, such as preferences, locations and so on. This is a small, light-weight and wearable terminal, which is integrated in the ubiquitous computing environment self-contained with a variety of devices (sensors, actuators, CPU and other computing resources). Needless to say, the system is designed to protect personal information from leakage. For My Button Ver.1, AIST has developed a terminal device, CoBIT, that plays audio information when the user looks at an object of interest. The system operates on a solar battery and is small and inexpensive. It will be commercially available priced at several hundred yen or less.

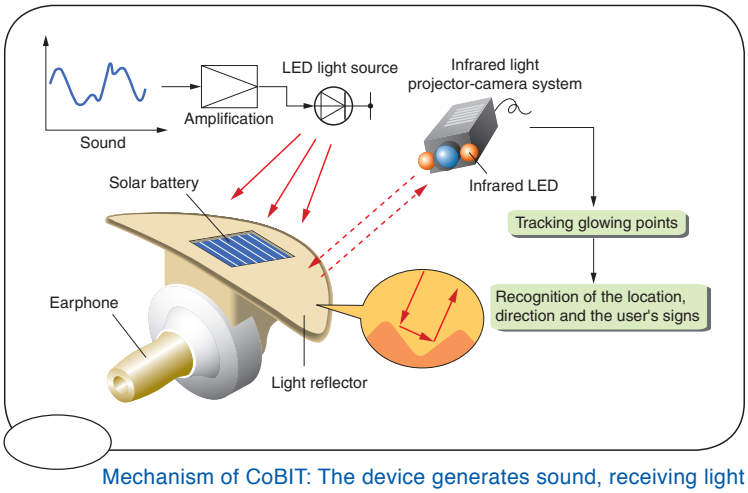


Mechanism of CoBIT

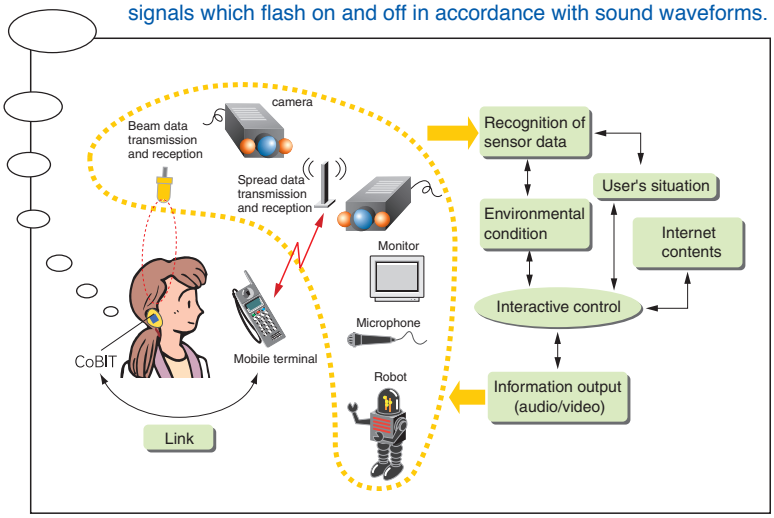
The electric current generated by a solar battery flows directly to the earphone. The device generates sound receiving light signals flashing on and off in accordance with the sound waveform. An infrared light projector-camera system makes only CoBIT visible as it is attached with a light reflector. It is possible to recognize the user's movement and signs, by analyzing the positions of these glowing points. This technology enables interaction between the user and the system. For example, in a museum, when CoBIT asks a user if more detailed explanation is necessary, the user can answer to the question by means of gestures. If the user says "No", the system suggests to move on to the next object.

Future information support system

CoBIT can transmit its identification number through a liquid crystal shutter fitted on a light reflector. The system instantly provides not only auditory information but also music, moving pictures and so on and meets the user's requirement on the spot. This function is operated based on various data such as the user's preference, schedule, previous actions and signals.



Mechanism of CoBIT: The device generates sound, receiving light signals which flash on and off in accordance with sound waveforms.



Future image: Information support systems that provide the most appropriate information based on the data of the user and the surrounding environment.

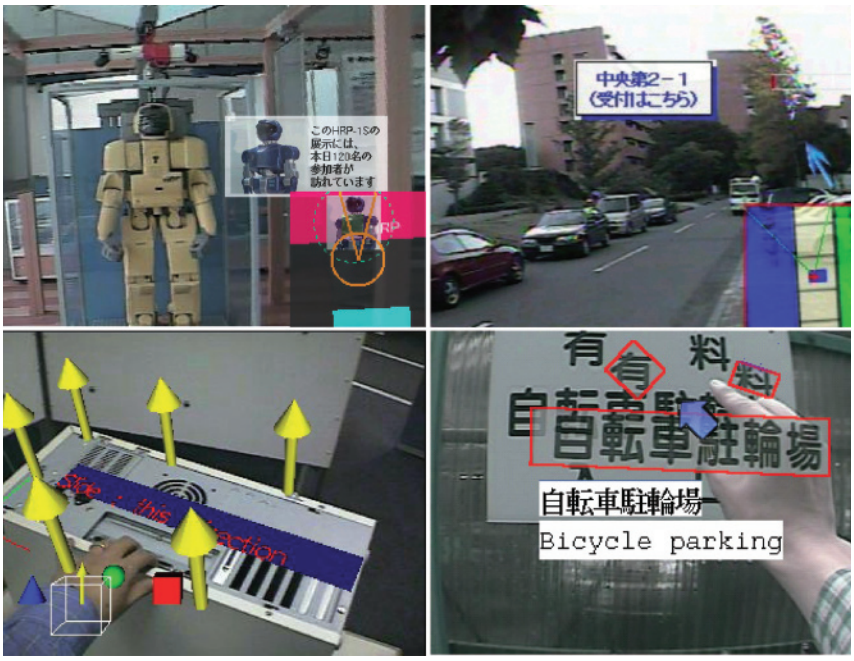
Weavy
Wearable Visual Interface

Interface between virtual and physical spaces

Dead Reckoning Navigational System using accelerometers, gyro-sensors and magnetometers is combined with image registration to estimate absolute position and direction, enabling such applications as “Event AR (Augmented Reality) Navigation”, “Outdoor AR Navigation” etc. to become feasible without building a sensor infrastructure. It is expected that this technology will be applicable to the development of a personal navigation system which can be utilized in various environments, not limited to museums. Furthermore, the system will contribute to realizing 3D AR manual with a function of tracking objects in three-dimensional way. Both hand-gesture recognition systems and Real World Character Recognition (RWOCR) eliminate the need for keyboards and mice for making simple and instant instructions. It is also an advantage that the user can intuitively operate the systems.

Interface for Next Generation Mobiles Phones?!

AIST aims for the creation of a smart, wearable system which provides necessary assistance to users. Analyzing the context of the user and the surrounding environment with mobile/wearable cameras and sensors, the system is able to offer the most appropriate service for the user. The development of Weavy, a wearable visual interface between virtual and physical spaces is in progress, applying recent technologies in the fields of computer vision, sensor fusion and Augmented Reality.



Augmented Reality (AR) Navigation

Above : The additional information is superimposed on a wearable display monitor based on the user's position and direction he is facing (Left: Event information in the building; Right: Guide sign) .
Below left : 3D Augmented Reality Manual
The set-up and disassembly procedures are three dimensionally shown on the wearable display monitor.
Below right : Real world character recognition
The automatically extracted character region selected by "picking up" motion (hand gestures) can be recognized and translated.

Wearable components of Weavy

Towards the development of “independable” and dependable interface systems

In order to create a highly autonomous and dependable sensing system with wider applications, it is required to build a framework to ensure the functionality in the space with no sensor infrastructure. If the infrastructure is available, they are expected to contribute to the provision of information with a higher degree of accuracy. For this purpose, AIST has been promoting a research to incorporate Weavy with CoBIT, as well as the ultrasonic 3D tag for the integrated system.

Remote Assistance by Wearable Information Devices

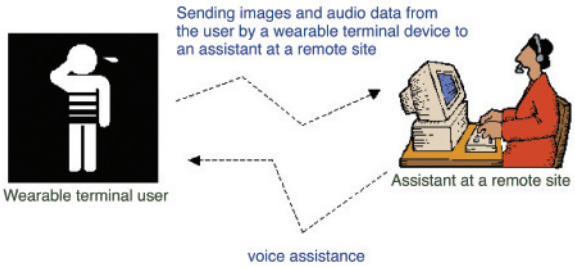
In Medical & Welfare Services

At emergency sites, it is essential to provide the necessary first aid and to be immediately ready for transferring patients to a hospital. Therefore, the doctors at the emergency center need to receive accurate information of the accident site and the patients' condition so that the severity of the damage can be assessed and appropriate instructions can be given to rescuers.

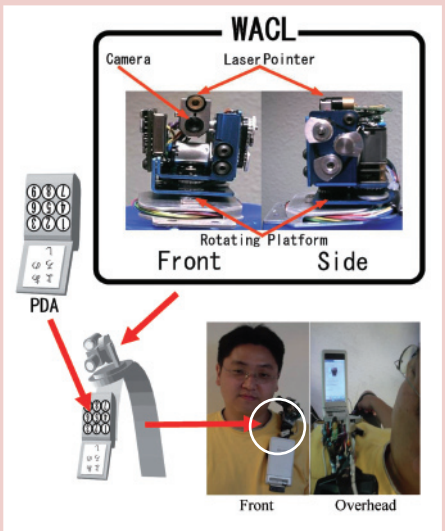
Visually impaired people sometimes may require assistance when they use an LCD monitor, a touch panel, check the indicator of a washing machine, choose frozen food, color and design of clothes, stockings etc., purchase something from a vending machine, read letters, and so on, even though it is difficult to promptly dispatch a human helper in these cases. In such cases where information assistance is required, a person who needs help will be able to receive appropriate information from a remote assistance provider wherever and whenever he/she may be.

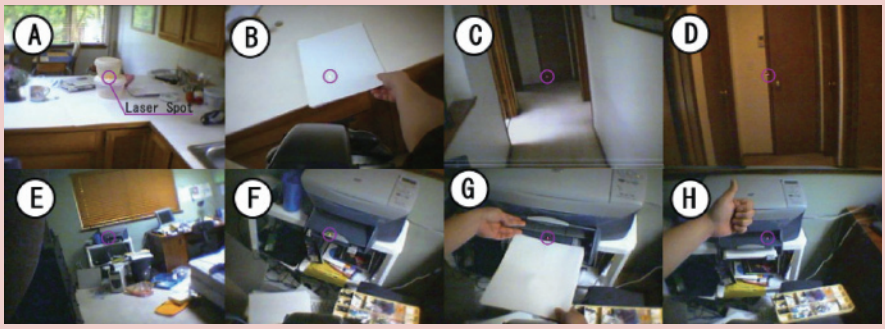
Furthermore, a unique shoulder-worn wearable robot (WACL) is now under development as an integral part of the Weavy system. The robot has an active camera with pan/tilt control and a laser pointer and is expected to play a major role in a wearable interface for remote collaboration systems. An instructor at a remote place observes pictures on a screen and gives directions for the next action directly to an operator wearing the robot, by spoken dialogue as well as a laser pointer.

A visually-impaired person chooses a drink following navigation by an assistant at a remote site, using an ear-phone type wearable camera system (with video camera, microphone and earphone).



AIST is working on the development of a smaller, lighter, wireless wearable device and the application of the current communication infrastructure. The research efforts also focus on data expression methods that facilitate the improvement of information quality (image, sound etc.) from the assistant's point of view.

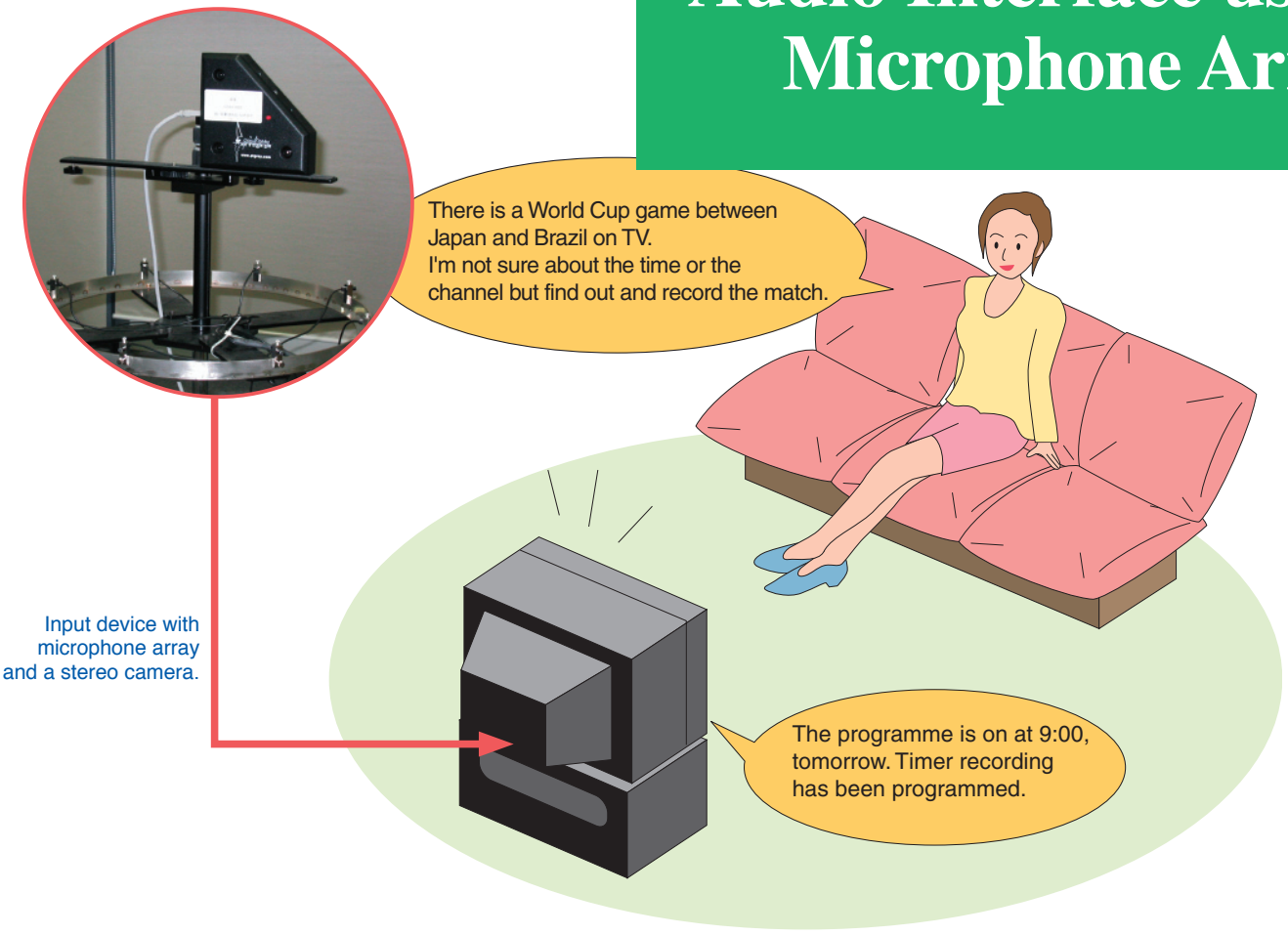




Assistance was provided to a person in an unfamiliar environment to feed paper to a printer in another room. It is possible to point directions/objects in the real place without being affected by the wearer's change in posture etc.

The device indicated with a white circle is the shoulder worn WACL (Wearable Active Camera with Laser Pointer) that is equipped with pan/tilt control and a laser pointer.

Audio Interface using Microphone Array



Audio interface

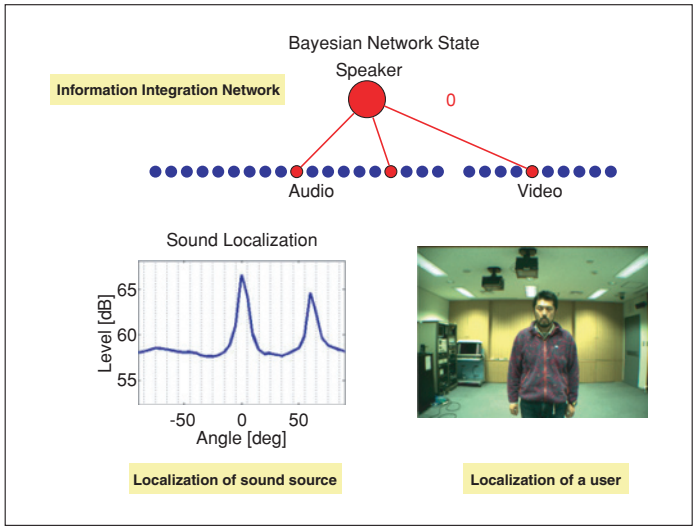
"There is a World Cup game between Japan and Brazil. I'm not sure about the time or the channel but find it out and record the match." This is an example of a rather complicated command based on conversational speech given to an information system. Speech recognition is often interfered in real environments with the background noise of electric appliances, such as TV sets. This study aims at the development of robust speech recognition system which understands free conversational speech uttered by a speaker 2-3 meters away from the system using microphone array.

Locating a speaker

For the accurate recognition of a speaker's voice under acoustic background noise, it is important to find out when and where the utterance was made. A microphone array is a system consisting of multiple microphones which can be used to detect the location and timing of a sound. Furthermore, by combining this acoustic information with visual data from a human tracking system, it is possible to specify when and where the speaker speaks.

Robust Speech Recognition

By identifying the location and timing of speech, the microphone array system will be able to separate the speaker's voice from other undesirable auditory noises. The technology called Adaptive Beamforming is applied to process sound signals. This technology separates the speaker's voice from ambient noise by adaptive directivity, focusing on the target sound source and reducing the sound coming from noise sources. Moreover, robust speech recognition is realized by the adaptation of acoustic model in speech recognition. Integration of these technologies will deliver a sound recognition system that achieves about a 90% recognition rate in the environment where the sound of television 2 meters away is at the same volume as the speaker's vocal level.



Estimation of the location and timing of speech based on sound and visual information.

Ultrasonic Sensors for Human Behavior Observation and Human Support

The ultrasonic transmitter and the inside of the sensor room (upper left)

Three types of ultrasonic transmitters have been developed: ultra small type (left; 11mm x 11mm x 20mm), small sized type (middle; 27mm x 20mm x 14mm) and long-lasting type, which runs on a mobile phone battery (right; 65mm x 44mm x 22mm). The long-lasting one can operate for up to 2 months without recharging. These transmitters are attached to the objects in the room, such as chairs, glasses and a remote controller of the television set.

Full view of the sensor room in which at least 300 ultrasonic sensors and more than 10 cameras are embedded

The upper right photograph is the living room for the foreign language learning assistance system. The figure below is the bedroom with care assistance system and physiological measurement functions for the elderly.

The living room for the foreign language learning assistance system and the enlarged figure of the sensors on the walls (dots arranged at intervals) and the cameras (right and left squares)

The bedroom with the care assistance systems and physiological measurement functions for elderly residents and the enlarged figure of the sensors installed on the ceiling (8 surrounding dots) and a camera (the square on the right bottom corner)

Distributed sensor environments

Sensors are usually used for observing people as well as environment. However, there is no single sensor that can acquire all the necessary information by itself. Visual sensors such as cameras fail to monitor objects behind obstacles. AIST has developed a distributed sensor environment, "Sensor Room," in which a number of sensors are embedded. More than 300 ultrasonic sensors and over dozen cameras are installed on the walls and the ceiling in the room, eliminating blind spots. The sensors measure and observe the positions of objects by small ultrasonic transmitters (ultrasonic 3D tags) attached with an accuracy of a few centimeters.

Many home electric appliances are controlled by built-in computers and sensors. But they are controlled individually and do not always comply with the conditions of the inhabitants. Our research efforts are focused on the development of the following technologies: 1) observing individual activities and the environment, 2) modeling human behaviors by the collected data, and 3) providing support for inhabitants based on their observed conditions and developed human models.

Human Supports utilizing the data obtained by Ultrasonic Sensors

The innovative "Language Education Assisting System" has been developed as an example of the applications of human support using our ultrasonic sensor system (patent pending). In this system, the user's behavior in the sensor room is observed by the ultrasonic sensors and the audio description of actions and gestures is provided in a foreign language. As the user's actions are described directly in the foreign language, the system is expected to be more effective than conventional passive language lessons based on text books. AIST is presently developing a new language teaching method and materials in cooperation with an English school.

Another project is in progress with a nursing home and a related company aiming at development of technologies for ensuring the nursing home residents' safety and for saving work and time of the staffs. These include the prediction and early detection of accidents as well as the identification of wandering elderly by use of numerous ultrasonic sensors installed in the rooms.

Ubiquitous Stereo Vision (USV)

Contact-free, position-free, human interface - Manipulation by actions

AIST develops technologies able to detect and identify multiple individuals, to perform real-time recognition of their intentions indicated by gestures. This is accomplished by using stereo cameras arranged at multiple points (ubiquitous computing environment) and a high-speed network system. The aim of this research is to realize a real-time human centered interface, by simply placing stereo cameras at suitable points in the environment. The system permits the user to be at any position or to perform natural movements, and requires no contact with any object in the environment. To implement the system, four stereo cameras are placed in the four top corners of an experimental room (4.5 m × 3.6 m). The objective of this research is to develop technology able to detect and identify a specific person from others who enter and leave the area, to recognize the person's actions, thus providing real time personalized interaction through specific gestures.

A variety of real world applications

Regarding daily-assistance in indoor environments, AIST has succeeded in the development of human interface with personalized identification abilities. The function of the system is effective at any place in the room and not limited to any particular space. The system enables the user to manipulate the electric appliances in an ordinary room by arm pointing gestures without any touching and special devices.

Furthermore, safety enhancement in public places such as on train platforms is another important area to which the technology can be applied.

Human interface with a personal identification function

The system captures and utilizes 3-D images of the human body to recognize the posture and arm pointing gestures of the users. The image closest to the full-face view is automatically selected for each individual and used for personal identification.

Real time, 3D integrated images via next generation cameras

The figure is a 3D view of a room constructed with 3D data sent by four network-linked stereo cameras and integrated at a rate of 12 frames per second. This is applied to the real time recognition of body postures and movements.

Infrastructure of Ubiq

"Grid" Technology and Network Transparency

Grid, as well as ubiquitous computing, is an important concept and technology which supports future information society. Our life is already surrounded by numerous computers. However, what we need is not really a computer, but functions provided by a computer network or an information service which enables the user to predict the future. This would be realised through the collection of data from the web sites, road information etc., building a database with necessary information and easy data retrieval. As far as these functions are available, the shape or the location of the computer does not really matter.

In order to meet this requirement, AIST is proceeding with research to establish the Grid technology that ensures a certain quality of service regardless of by whom, where or when the request is made.

Ubiquitous computing and Grid technology

Through ubiquitous computing, the optimal service is sought to be provided to the user in consideration of time, location and the environment.

Ubiquitous computing and grid technology have common characteristics in terms of the transparency of information systems (computer, storage, network, sensors etc.). The function to provide information services, regardless of place (ubiquitous computing) and the features to access the computing capabilities and database wherever situated globally are complementary to each other.

Ninf Project

With the aim towards the establishment of the grid technology, AIST is currently promoting the Ninf Project with the Grid Research Center as its hub of the research. The objective of this project is to provide a function that enables a user to access other computers when his/her computer goes down, even without any particular computer skill. This mechanism is called "Grid-enabled Remote Procedure Call (Grid RPC).

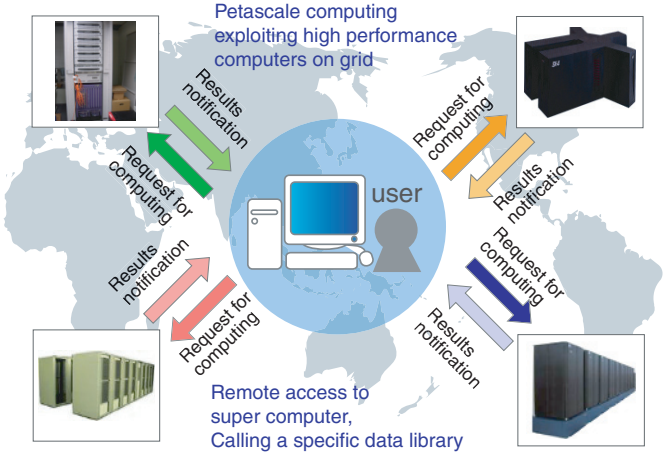
Furthermore, by exploiting the local storage of computers distributed over the world-wide network, AIST focuses on the development of Grid Data Farm (Gfarm), the grid software to create a virtual computer with high capacity data storage architecture and peta-scale data intensive computing system. Users can retrieve the required data, accessing the virtual mass storage wherever they are. In order to utilize this system from all over the world, it is required to use the high-speed network efficiently. AIST achieved high speed data transfer at 741Mbps between Japan and the U. S. in November 2002.

Standards for integration of single function sensors

Grid technology has been developed based on general purpose computing systems. However, in ubiquitous computing societies, it is necessary to integrate a large number of single function sensors. This requires the standardization of interfaces and protocols to communicate between devices in a cooperation with an international standardization organization, such as Global Grid Forum (GGF). AIST is involved in the standardization activities and promotional events organized by GGF. The Institute has set up Grid Consortium Japan and been active in technology exchanges with industrial and academic sectors.

Large file

High speed data transfer at 741 Mbps was achieved between Japan and the U.S.



Grid-enabled Remote Procedure Call (Grid RPC)

Users can call computers on the world wide network.

uitous Computing

Multi-agent Architecture CONSORTS for Ubiquitous Computing Environment

A variety of research projects on ubiquitous computing are ongoing all over the world. There are, however, few examples that provide a total formulation of architecture to integrate the entire layers from communication network to end users. For ubiquitous information societies, we find it essential to build a multiagent architecture that allows several kinds of agents to function individually in ubiquitous computing environment. This is the fundamental concept of the research project to design and implement "CONSORTS." The key concepts are as follows.

A prototype system of CONSORTS has been implemented for museum scenario where several kinds of users visit a museum and the CONSORTS service agents navigate the users and provide suitable information to them (Fig.1). The system uses FIPA-ACL based communication protocols and consists of spatio-temporal reasoner, personal agents, CONSORTS service agents, and device wrapper agents.

1. Grounding

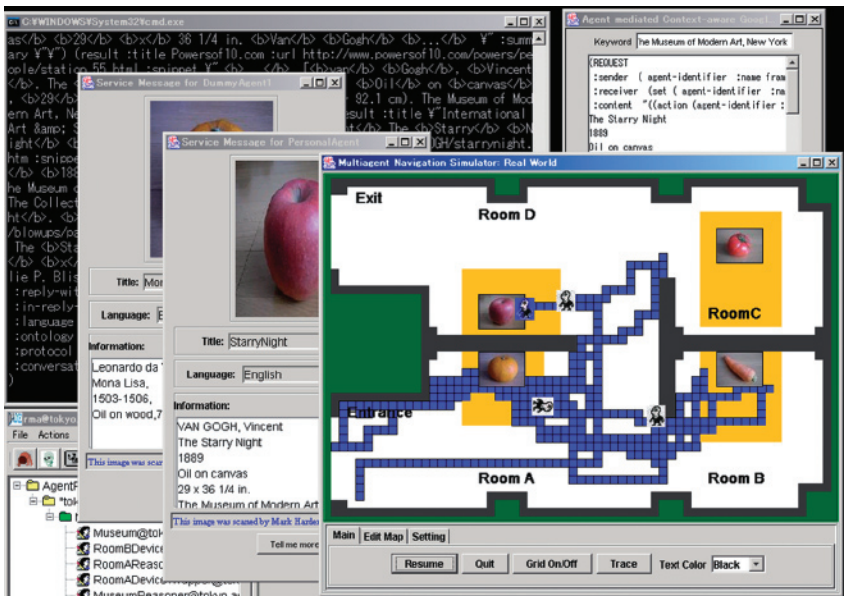
Information that is highly abstract "object" should be grounded in the real physical world by using sensory information.

2. Service Coordination

Physical and computational resources should be structured as agent framework where we can flexibly access information services.

3. Mass User Support

To support users as mass in order to realize innovative services that coordinate users' preference and plans. One of the service image is dynamic resource allocation, that is, coordination among users' behaviors in traffic system or appointment system for public services by spatio-temporal resource allocation.



CONSORTS Application Image – Museum Scenario.

What is "Ubiquitous Computing Society"?

The term "ubiquitous computing society" is often used in every day life. However, to publish this leaflet, researchers at AIST held a debate over the definition of this expression.

Various topics were brought up: the importance of using small devices, the necessity to solve problems locally and the involvement of high-speed computing, high-speed networks, virtual reality and pattern recognition technology in realizing the "ubiquitous computing society".

We reached the conclusion that all these technologies are essential elements for this purpose. This leaflet is intended to introduce the new technologies for ubiquitous computing societies, offered by the AIST's research units specialized in the information field.

For ordinary people who must face "information society" with little knowledge of information technology, it is significant to acquire the "lighter, more compact" devices and related technologies. At the same time, "massive" computing power is required to develop the smart identification technology. A truly "transparent information society" will be achieved only when these technological factors are integrated harmoniously.

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●Get the Information "I NEED HERE NOW"!
Takuichi Nishimura

●Multi-agent Architecture CONSORTS for Ubiquitous Computing Environment
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AIST RESEARCH HOT LINE

UPDATES FROM THE CUTTING EDGE

(Oct.— Dec. 2003)

The abstracts of the recent research information appeared on the Vol.3 No.10-No.12 of "AIST Today" are introduced and classified by research area. For inquiry about the full article, please contact the author directly.

Life Science & Technology

Escherichia coli Can Be Transformed by a Lipofection Method

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AIST Today Vol. 3, No.10 (2003) 15

Transformation of *Escherichia coli* is a basic technique for genetic engineering. We applied a liposome-mediated lipofection method to transform electro-competent *E.coli* cells which have little natural competence of foreign DNA without electroporation treatment, and have obtained transformants with plasmids by this simple and quick treatment. This method to transform *E.coli* with cation liposome is so simple that it can be used for the routine transformation works.

Transformation Efficency of *E.coli* by the lipofection method

Plasmid DNA	Size	selection antibiotics	Transformation efficiency Transformants/μg plasmid
pHSG397	2227bp	chloramphenicol	1.0×10^5
pUC19	2686bp	ampicillin	2.0×10^5
pBR322	4361bp	ampicillin	2.3×10^4
		tetracycline	2.7×10^4
pET32a	5900bp	ampicillin	3.0×10^4

Computational Detection of Golgi Membrane Spanning Region in Glycosyltransferase

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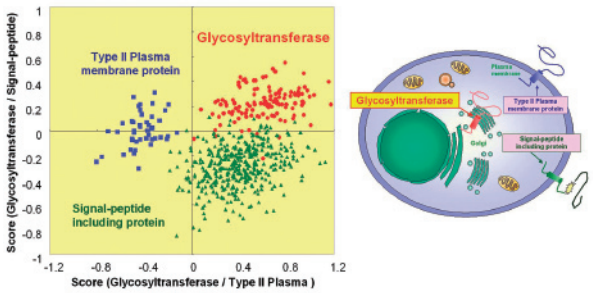
AIST Today Vol. 3, No.10 (2003) 16

An original computational detection system was developed to predict golgi membrane spanning region in glycosyltransferase. In order to discriminate glycosyltransferase from other proteins whose topology is similar to them, the character of golgi membrane spanning region was extracted by comparison with the type II protein localized in plasma membrane and the protein with signal-peptide. We succeeded to detect golgi membrane spanning region characterized in glycosyltransferase, by combining hydropathy alignment and PSSM of amino acid propensity with more than 95% of accuracy in self-consistency test. In the project aiming at discovering glycosyltransferase comprehensively from Genome ORF, this algorithm is playing an impotant role as detection system of glycosyltransferase transmembrane region.



Score distribution of glycosyltransferases and the proteins whose topology is similar to them

Overseas Reforestation by Means of Root Formation Promoters:Reforestation in Thailand

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AIST Today Vol. 3, No.10 (2003) 17

In 2002, many countries suffered serious damage due to floods and droughts. We believe that these natural disasters are caused by global warming. The absorption by trees of carbon dioxide that has been discharged into the atmosphere — the major cause of global warming — is an extremely important method for reliably fixing carbon dioxide. The numbers and areas of the world's forests therefore should be increased by reforestation in order to counter global warming.

Tokai Global Greening Co. (TGG), an AIST venture company, has contracted with the Forest Industry Organization (FIO) of the Ministry of Agriculture and Cooperatives, Thailand to use root formation promoters (RFPs) for cooperative reforestation. The first reforestation project was begun in April 2003.

4-Chloroindole-3-acetic acid, 5,6-dichloroindole-3-acetic acid and their derivatives (RFPs), which our group and TGG have developed, were very effective for promoting root formation by teak cuttings when aqueous solutions of these promoters were sprayed on their leaves. These RFPs therefore are being used to mass-produce the teak saplings for reforestation (Photo).

Mass production of teak saplings by using RFPs

Discovery of microRNAs and their Targets in Mammalian Cells

This article was removed, since it included the information reported to be inadequate by the surveillance committee.

(4/3/2006)

A Probabilistic Superposing of Protein Structures

Tsuyoshi KATO
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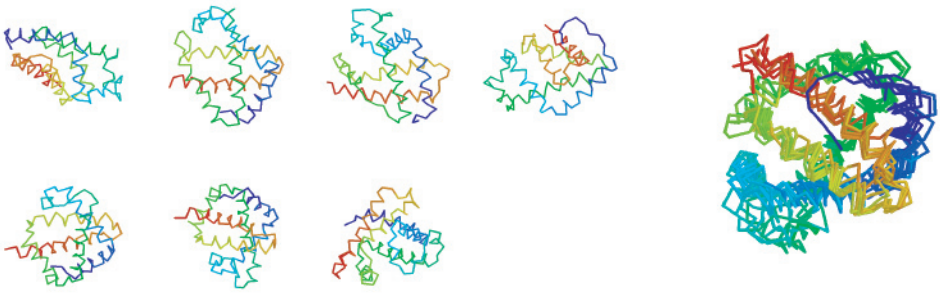
AIST Today Vol. 3, No.11 (2003) 9

It is not easy to compare protein structures, as they tend to be translated and rotated in arbitrary ways. A set of proteins have to be superposed correctly to measure meaningful similarities among them. Therefore, it is a key to estimate the direction and location of each structure correctly. We focused on the probabilistic modeling for representing structures by employing the hidden Markov model which is one of the successful probabilistic models, and developed a novel algorithm for estimating the direction and location by maximum likelihood. We also adopted our algorithm for seven protein structures, and achieved almost perfect superposition, as illustrated in the figure.



Superposition of protein structures. Using seven protein structures shown in the left figure, our estimation algorithm found the almost optimal rotation and translation and the common shape, as shown in the right figure

Yeast Expression System at Low Temperature

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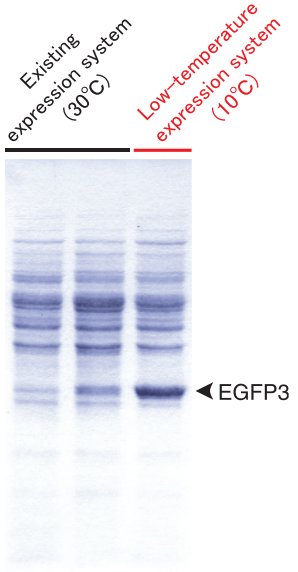
AIST Today Vol. 3, No.12 (2003) 21

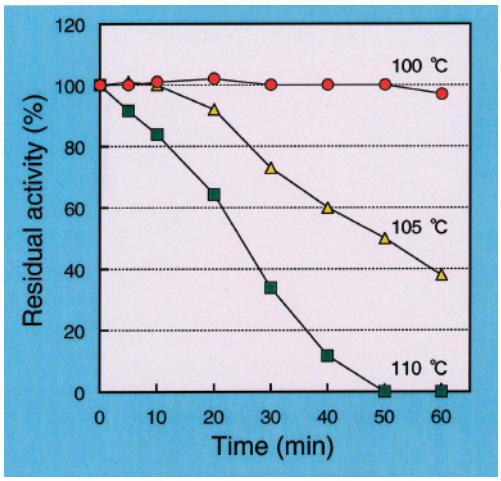
We have developed a novel expression system in yeast, *Saccharomyces cerevisiae*, at low temperature. In the expression system, target proteins can be produced only by lowering a culture temperature. A production yield of a protein in the expression system was higher than that in the existing expression systems in yeast at moderate temperature. Several proteins that were expressed as insoluble forms in *Escherichia coli* could be produced in functional and soluble forms in our expression system. Our expression system will greatly contribute to proteomics study and large-scale production of pharmaceutical and industrial proteins.



Effective production of EGFP3 in yeast at low temperature

Development of Extremely Thermostable DNA Ligase for Genetic Diagnosis

The ligase chain reaction (LCR) is a DNA amplification technique which can be used to detect trace levels of known nucleic acid sequences. Use of a thermostable DNA ligase allows the LCR reaction to be cycled easily in conventional thermocyclers. We have developed an extremely thermostable DNA ligase (*Ape* ligase) from a hyperthermophilic archaeon *Aeropyrum pernix* K1. The new ligase remained stable for ~1 h at 100 ºC, and the half-life was about 1 h even at 105 ºC. It will provide enhanced product yields and shorter diagnostic times in the LCR reaction.



High thermostability of the Ape ligase we have developed

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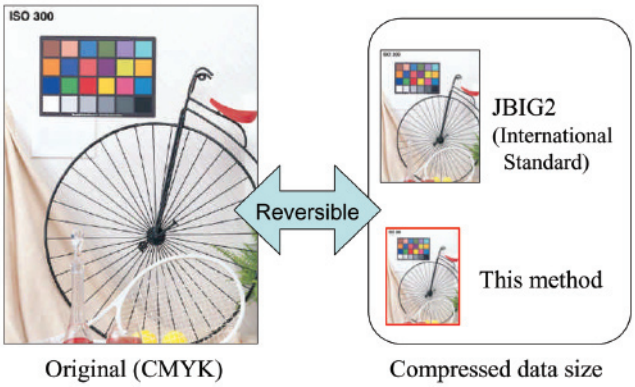
AIST Today Vol. 3, No.12 (2003) 22

Information and Communication Technology

Lossless Bi-level Image Compression Method Adopted in the International Standard (ISO/IEC 14492 Amd2)

The bi-level image compression method developed by AIST was adopted into the international standard JBIG2 as "ISO/IEC 14492 AMD2." AIST method achieved a compression efficiency that was about 23% better than JBIG2, owing to optimizing the parameters by the genetic algorithm.

The spread of the international standards accepted here will not only promote the cost reduction based on digital printing and publication, but also substantially contribute to the development of digital printing machine industry, to accelerate the expansion of markets for new generation publications, such as on-demand publishing and eBook.



Lossless bi-level image compression method, whose compression efficiency is more than 20% higher (or, in some cases, more than 30% higher) than that of the current international standards, JBIG2

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AIST Today Vol. 3, No.10 (2003) 7-9

Multiagent Architecture CONSORTS for Ubiquitous Computing Environment

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AIST Today Vol. 3, No.10 (2003) 10

Ubiquitous computing is expected to realize an environment, where anyone can get benefit of information services anywhere and anytime, and to become a complex system consisting of enormous numbers of software agents working parallel in a distributed manner.

To provide various information services in such ubiquitous computing environment, we are designing and implementing multiagent architecture CONSORTS that is a middleware to organize several kinds of information services with linking digital information and real physical world.

Multiagent is an approach to describe, implement, and analyze systems as emergent phenomena through interactions among agents that have their own behavior algorithms.

One of the key concepts of CONSORTS is 'semantic grounding' that grounds objects in digital world to real physical world. Another key concept is 'service coordination', by which we can flexibly access information services through service composition.

The application images in CONSORTS cover wider areas discussed in other approaches in ubiquitous computing. For instance, it includes 1) social resource allocation: coordination among users' behaviors in traffic system or appointment system for public services by spatio-temporal resource allocation, and 2) information circulation with semantic formalization by ontology that is general dictionary of concepts in the sense of information science.

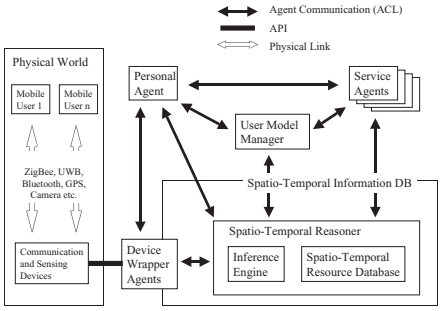

Fig.1 CONSORTS architecture (Version 1)

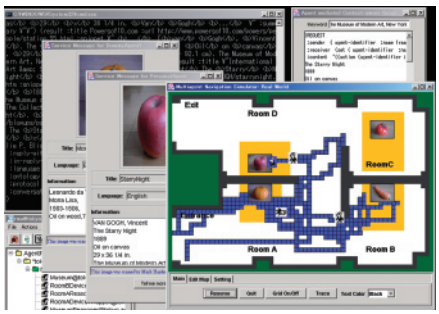

Fig.2 Demonstration image of museum scenario

System Verification using Formal Method

- A new verification method of information processing systems -

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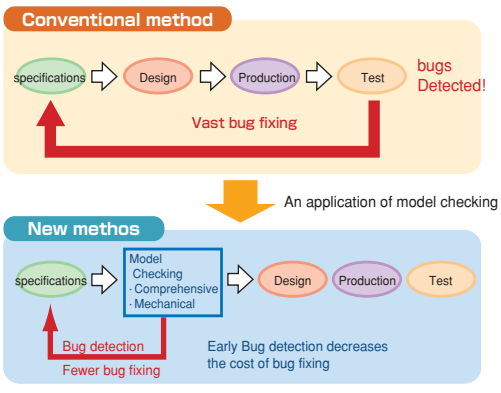
AIST Today Vol. 3, No.10 (2003) 11

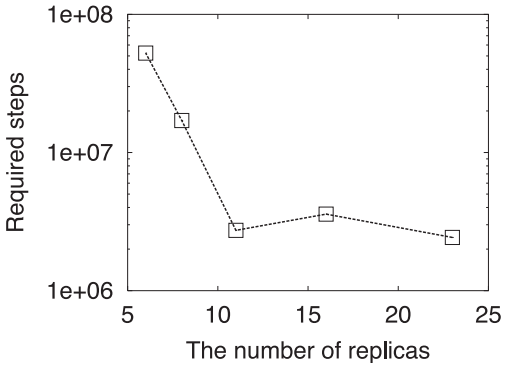
We are developing techniques of system verifications using formal methods in the designing phase of software development in industry. As a case study, we applied a model checking technique to specifications of an embedded system under development in a company. Model checking was proceeded in parallel with the designing process in the company and was completed in a reasonably short term. As a result of this collaboration, we could successfully detect six unknown bugs. Consequently our technique could contribute to improve the quality of the developing system and to cut down its developing cost. Thus this case study shows that an application of model checking technique to software specifications is feasible and effective.



Comparing a conventional method and a new method

Replica-Exchange Molecular Dynamics Toolkit

We have developed a toolkit to generate replica-exchange method programs suitable for solving the multiple-minima problem. The toolkit was designed as an object-oriented framework containing ofa set of C++ abstract classes whose subclasses enable one to incorporate an arbitrary force field implementation, and to use various functionalities. The efficiency of the toolkit was evaluated by generating new variants of simulation programs which implements the CHARMM force filed. It was shown that the toolkit not only reduces the total computational cost but parallelizes the simulation at an efficiency that was relatively linear with the number of CPUs.



Number of required conformations to decrease the error of heat capacity to less than 0.01 kcal/mol · K is shown as a function of the number of replicas

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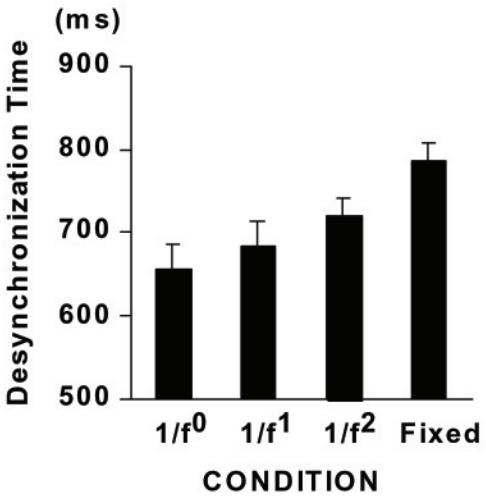
AIST Today Vol. 3, No.11 (2003) 10

The Effect of $1/f^n$ Fluctuation in Inter-stimulus Intervals on the Elicitation of a GO/NO-GO Response

We studied the relationship between a $1/f^n$ fluctuation in the inter-stimulus interval (ISI) and the elicitation of a magnetoencephalographic (MEG) GO/NO-GO response. The ISI times of the tone pulses were given by three types of fluctuation, $1/f^0$, $1/f^1$, and $1/f^2$, and with a fixed interval. The RMS values of the mismatch field (MMF) ($F(3/24)=10.94$: $p=0.0001$) and the duration time of beta band desynchronization (BBD) of the left occipital area sensors (CH75/76) for the NO-GO response ($F(3/24)=6.43$: $p=0.0024$) were significantly increased correlated with the fluctuation exponent. The temporal ordering within the stimulus was reflected in the activity of the BBD.



Relationship between the exponent of fluctuation and the desynchronization time in the beta band of the left occipital area channel CH75/76 for the NO-GO response. Each point is the mean with SE bar for 9 normal adults

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Multicolor Laser Pulse Synthesis with Attosecond Accuracy

- way to an optical function generator -

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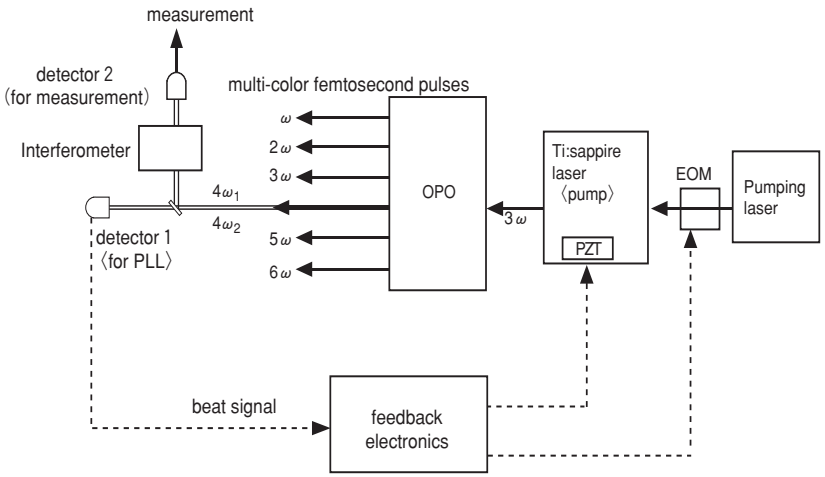
AIST Today Vol. 3, No.11 (2003) 15

We have controlled the optical phase (carrier-envelope-offset phase) relation between different-color femtosecond pulses that were generated by an optical parametric oscillator. The fluctuation of the cavity length difference between two laser oscillators causes the optical phase fluctuation. The cavity length fluctuates about 10 nm within a short time generally. It was reduced into attometer (1 attometer: 10^{-18} m) region when the optical-phase-difference signal among multicolor femtosecond pulses was fed back to the cavity-length (figure). This feedback system suppressed the cavity-length fluctuation about ten orders of magnitude. By using this technique, we have generated phase-coherent multicolor femtosecond pulses. An optical parametric oscillator system generated six subharmonic femtosecond pulses in visible and infrared region with attosecond stability.



Schematic of the experimental setup

Automatic Alignment of Multiple Optical Devices

Masahiro MURAKAWA
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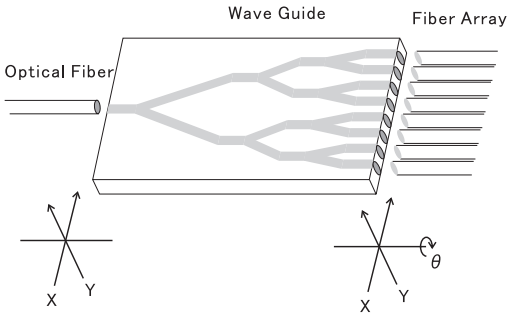
AIST Today Vol. 3, No.11 (2003) 16

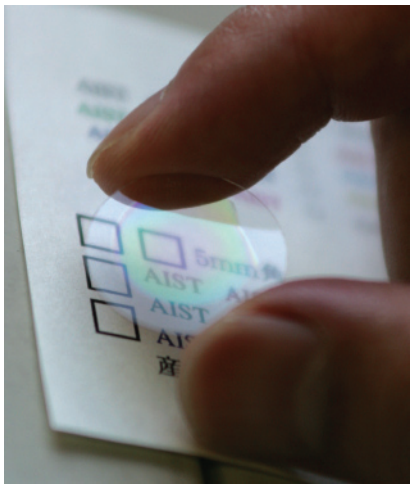
We have developed, in collaboration with the Nano Control Co., Ltd., a system for automatic alignment (precision positioning) between multiple optical devices based on a genetic algorithm for the artificial intelligence,and succeeded in connecting wave guides with optical fiber arrays in a shortspan of time through the simultaneous alignment of input and output sides. Through the application of the present technology, it may be expected that the massive production of functional optical devices at lower cost will berealized, and the spread of the optical networks will be accelerated. Its application areas include not only the precision alignment of optical devices, but also that for optical instruments, micro-fabrication and nano-technology.



Alignment of optical fiber-wave guide-fiber array

Development of a Transparent Photovoltaic Cell

Transparent pn junctions based on oxide semiconductors have been investigated for transparent solar cells. While most conventional solar cells absorb visible and infrared light to generate electricity, the new photovoltaic cell is designed to simultaneously transmit visible light and convert ultraviolet radiation into electricity. Our innovative photovoltaic cells have the potential of controlling infrared radiation. The infrared radiation carries heat so this device can be developed into a functional window that controls the heat flow into a house. The prototype cell fabricated by the pulsed laser deposition technique is 0.1 square centimeters. AIST plans to develop a larger cell with these features so that conventional glass windows can be replaced by solar sheets of these cells.



A developed transparent photovoltaic cell

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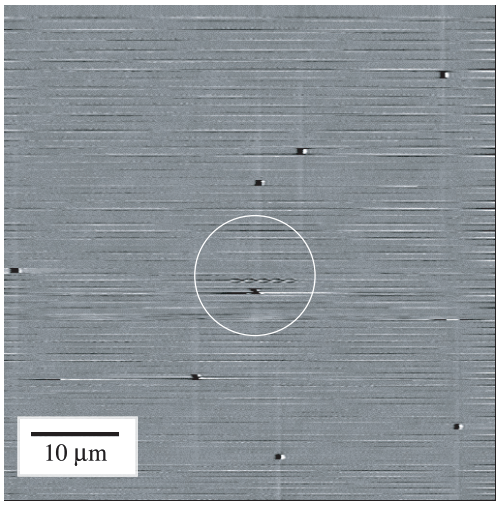
AIST Today Vol. 3, No.12 (2003) 15

Development of Complex Equipment Combined with an Optical Drive Tester and Atomic Force Microscope

AIST and Seiko Instruments Inc. have developed optical master disk evaluation equipment for an ultra-high density 100 GB optical ROM disk. An optical disk drive tester and atomic force microscope (AFM) were combined.

The evaluation process is the following; the entire master disk is scanned by an optical pickup. The defective pits are found and their positions are recorded. The pits located within the AFM scanning area and their topographies are observed on a nanometer scale. We will improve the equipment for more precise measurement and apply this process to master disk production.



AFM image of randomly recorded pits on the optical disk surface

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AIST Today Vol. 3, No.12 (2003) 16

Development of Environment-Friendly Ferroelectric Films

- Toward top performance ferroelectric memory and piezoelectric microdevices -

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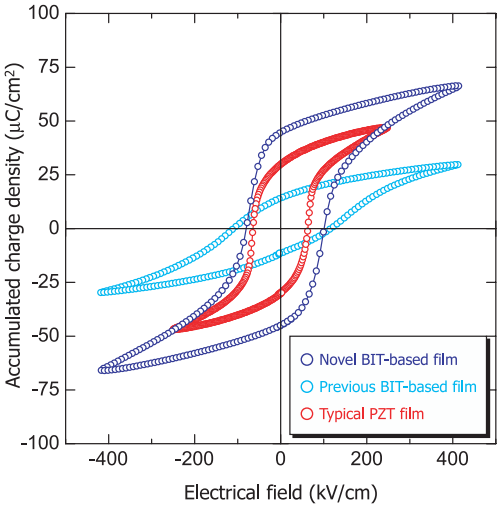
AIST Today Vol. 3, No.12 (2003) 20

Novel synthesis technology for ferroelectric thin films on silicon has been developed. The film ensures both lead-free, environment-friendly composition and superior performance to lead-containing films that are strongly demanded for the replacement of lead-based materials. We have focused on the base material of $Bi_4Ti_3O_{12}$ (BIT) layer-structured crystal that has been attracting vast interest particularly in non-volatile ferroelectric memory field. To BIT, we have applied our novel design concept of film synthesis with optimization of atomic arrangement of underlying substrate beneath the film and modification of growth rate of atomic planes in BIT structure by Bi-site substitution and succeeded for the first time in revealing ideal ferroelectric property of perfect BIT single crystal.



Superior ferroelectric property in novel BIT-based films

Development of ab initio Molecular Simulation System

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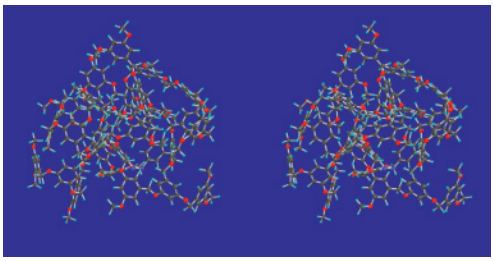
AIST Today Vol. 3, No.12 (2003) 23

The ab initio molecular simulation system was developed, in which non-empirical methods such as the molecular orbital theory are used to evaluate a force field. Because no *a priori* informations are needed such as chemical bondings and/or atomic partial charges, it can cover most of the chemical systems. The simulation program is parallelized by using the grid technology, which enables us to run simulations using several remote computers in a unified manner.



Stereogram of aryl ether dendrimer obtained from the REXMC simulation

Development of a High-speed and High-density Interposer for Three Dimensional LSI System

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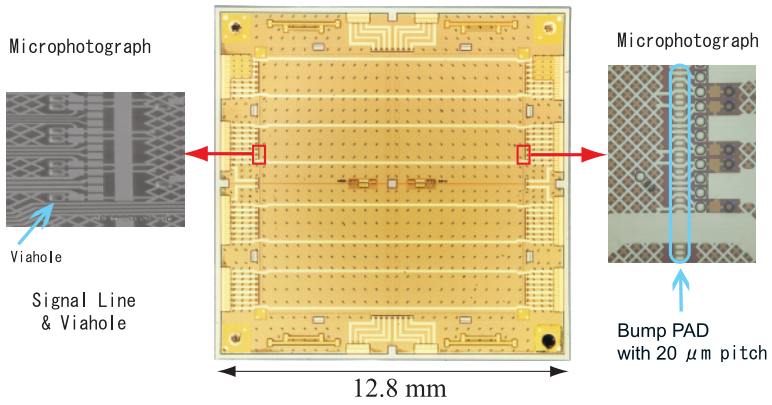
AIST Today Vol. 3, No.12 (2003)4-6

For the packaging of multi-layer three dimensional LSI systems, chip-to-chip and chip-to-board interposers are essential. We have developed a new fabrication technology of a fine wiring structure using positive photosensitive polyimide. Its features are as follows:

1. The driving power and delay at the LSI I/O terminals can be drastically reduced. The transfer clock of 10GHz has been attained.
2. Minimum line width of 7.5μm has been achieved which is about 15% of the conventional printed circuit board.
3. The lower production cost can be attained due to the lithography technology developed.
4. The pitch length between adjacent bumps can be as small as 20μm.

(URL http://unit.aist.go.jp/nano-ele/hd-interc/index.html)



Photograph of fabricated interposer

Environmental Science & Technology

Chemical Recycling of Waste from Electric-Electronic Appliances

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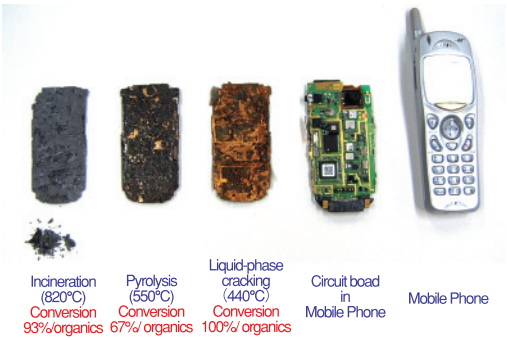
AIST Today Vol. 3, No.12 (2003) 17

We proposed new chemical recycling with dehalogenation of plastics in electric-electronic appliances by liquid-phase cracking at 400-440 ºC using hydrogen donor solvent, such as tetralin. In our process, halogen content in the gaseous and liquid products decreased to less than 2ppm by alkali carbonate catalyst use. Bromine in the solid product was fixed as alkali salts and also can be separated from metal by conventional washing with water. This indicates resins, halogen and metal can be separated almost completely and reused for fuel, chemical and material use respectively. Pyrolysis and incineration in Fig. can not recovered plastics effectively and environmentally.



Chemical recycling of mobile phone

Development of an Atmospheric Dispersion Model for Exposure and Risk Assessment – ADMER ver.1.0

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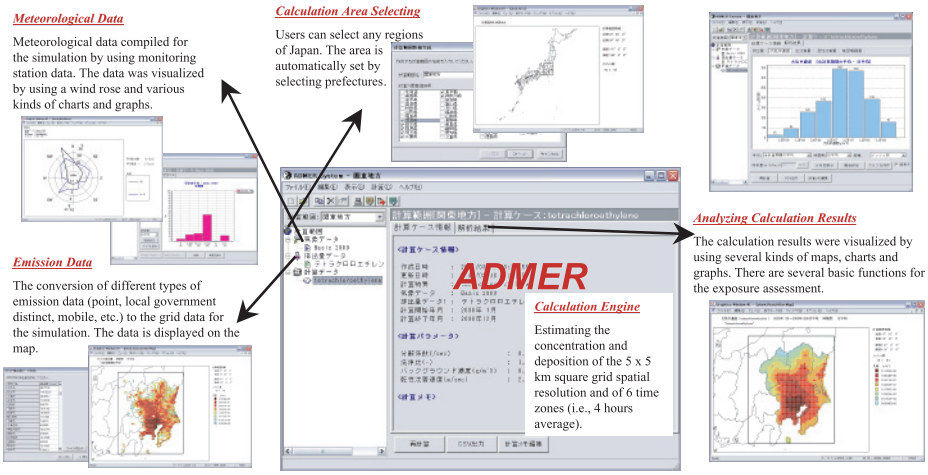
AIST Today Vol. 3, No.10 (2003) 18

An ADMER (Atmospheric Dispersion Model for Exposure and Risk Assessment), which estimates atmospheric concentrations and the depositions of chemicals, has been developed. The ADMER includes some useful functions for calculations and for exposure and risk assessment, used for compiling meteorological data and making up gridded emission data for the simulation, and for analyzing calculated results visually using several kind of maps, charts and graphs, and estimating the size and location of populations exposed to chemicals. The ADMER will be useful for those risk assessments in which spatiotemporal distributions must be considered.



The capture of the user interface and major functions in the ADMER ver.1.0

Water-Solubilization of Waste Paper by using Hot Compressed Water

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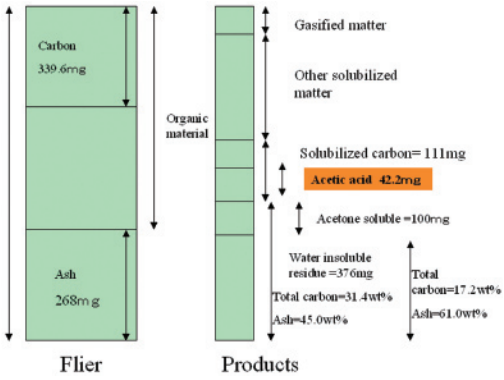
AIST Today Vol. 3, No.11 (2003) 14

Various kinds of waste paper with different ash content were solubilized by hot compressed water (HCW) in mini-batch reactor. When the operating conditions of reaction temperature and time were varied, it was found formic, acetic and lactic acids were mainly produced. Waste paper with higher calcium carbonate content was favorable in producing much more amount of organic acids. When a flier, 26.8wt% ash content and 10wt calcium carbonate content, was treated under the condition of 275°C and 30min, the conversion rate of water-solubilized carbon of about 33wt% and acetic acid of 42mg/g-waste paper were obtained.



Typical mass balance for HCW treatment of flier

Green Sutaibable Chemistry with Supercritical Carbon Dioxide Solvent

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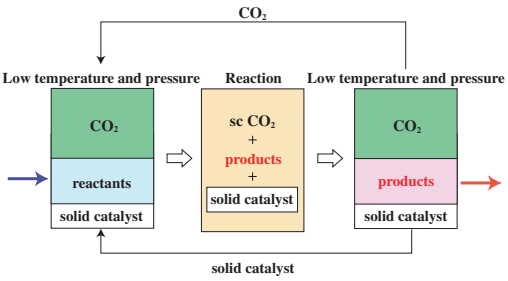
AIST Today Vol. 3, No.11 (2003) 4-6

Organic reactions with solid catalysts under supercritical carbon dioxide are green sustainable because: i) high reaction rates due to increased solubility of reactant gases in supercritical fluid, thereby eliminating mass transfer resistance; ii) easy separation of catalysts and products, iii) eliminating the use of organic solvents. Catalytic ring hydrogenation of phenol to KA oil (the mixture of cyclohexanol and cyclohexanone) was demonstrated with the green chemical process. A charcoal-supported rhodium catalyst was highly active for the ring hydrogenation of phenol to KA oil at 328 K under supercritical carbon dioxide, while gas reactions at > 453 K palladium is reported to be a suitable catalyst for this reaction.



Multi-phase catalytic reaction system with supercritical carbon dioxide

Energy Science & Technology

Successfully Test of Fault Current Limiter by Series-parallel Resonant LC Circuit

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AIST Today Vol. 3, No.10 (2003) 19

The Fault Current Limiter (FCL) is new instrument for reduction of fault current, and many kinds of FCL are investigated.

Desired properties of FCL are maintenance-free and non mechanical drive or external control.

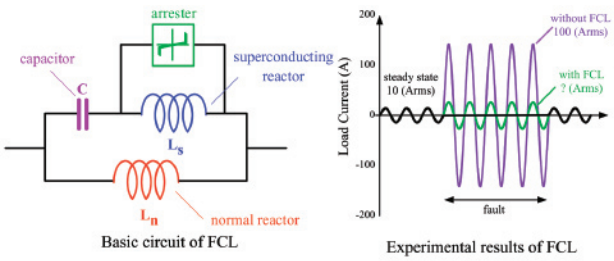
We have been studying about series-parallel resonant LC circuit type FCL.

Merits of this FCL are S/N transition is not needed and quick recovery from over current state to normal state.

We theoretically and experimentally investigate about series-parallel resonant LC circuit type FCL.

Experimental results show that …

- Fault current was successfully limited during fault.
- Anytime fault occurred or how long it was, this FCL was effective.
- FCL system returned to steady state within 1/4 cycle.
- The peak of load current was about double of threshold current I_0.



Basic circuit of FCL

◆ Steady State = Series Resonance
voltage of L_s is low
arrester is OPEN

Experimental results of FCL

◆ Over Current State = Parallel Resonance
◆ voltage of L_s is high
arrester is SHORT

Visualization of Oxide-Ion Conduction Path

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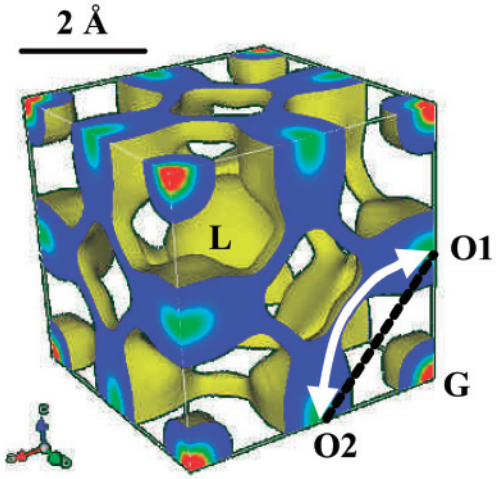
AIST Today Vol. 3, No.12 (2003) 19

We have analyzed the nuclear density distribution in the perovskite-type fast oxide-ion conductor, $(La_{0.8}Sr_{0.2})(Ga_{0.8}Mg_{0.15}Co_{0.05})O_{3-\delta}$ (LSGMC), to investigate the detailed distribution and conduction path of oxide ions. The nuclear density distribution was obtained by a combined technique including a Rietveld refinement and a maximum-entropy method (MEM)-based pattern fitting of neutron diffraction data measured at elevated temperatures. The oxide ions existed over wide regions perpendicular to the B-site cation (= $Ga_{0.8}Mg_{0.15}Co_{0.05}$) - oxide ion bonds, and showed arc-shape conduction path away from the B-site cations. This result agreed with the oxide ion conduction path so far predicted from the molecular dynamics (MD) calculation.



Visualized oxide-ion (O^{2-}) conduction path and distribution of O^{2-}. L and G refer to the La- and Ga-site, respectively. The conduction path of O^{2-} between two stable positions (O1, O2) is depicted as a curved solid arrow

Nanotechnology and Materials Science & Technology

Preparation of Highly Fluorescent Composite Nanocrystals by a Microfluidic Reactor

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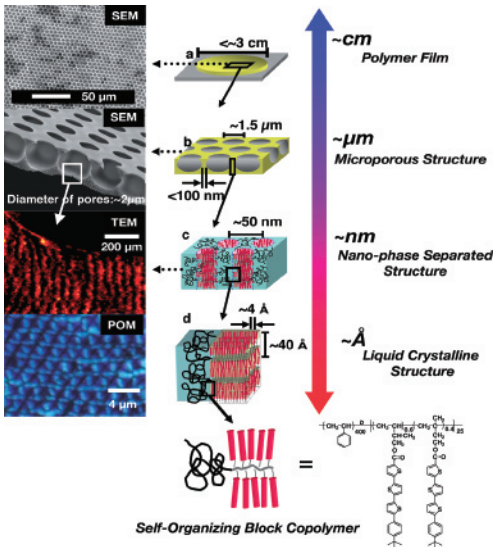
AIST Today Vol. 3, No.10 (2003) 13

A Micro-reactor is a continuous flow reactor, which can control reaction temperature and time precisely. We utilized this reactor to prepare a composite particle of ZnS coated CdSe nanocrystals to alter the photoluminescence properties of the nanocrystals. By the coating reaction, the luminescence intensity was improved significantly, and the PL wavelength became large with a coating of second order of reaction time. The precise control of reaction time and temperature by the micro-reactor was considered to be effective to modify the fluorescence intensity without any degradation of particle size distribution. Furthermore, the ZnS coated CdSe nanocrystals were successfully surface-treated and dispersed into water. This hydrophilic Q-dot can be applicable for a novel fluorescence tag for biological detection and analysis.

Photoluminescence from water-soluble ZnS/CdSe nanocrystals prepared by a Microfluidic reactor

Development of Polymer Thin Films with Hierarchical Structures

We have developed a new strategy for constructing highly ordered hierarchical structures by combining individual self-organizing components over multiple length scales. The specifically designed block copolymer formed organized structures on three-different length scales by combining of a liquid crystalline phase, a phase-separated nanodomain structure and microporous structure, ranging from angstroms to micrometers. The materials prepared by this strategy and modified by further fabrication are expected to have a wide range of applications in molecular optical or electronic devices, photonic band-gap materials, and sensors.



A hierarchical structure within a designed block copolymer thin film

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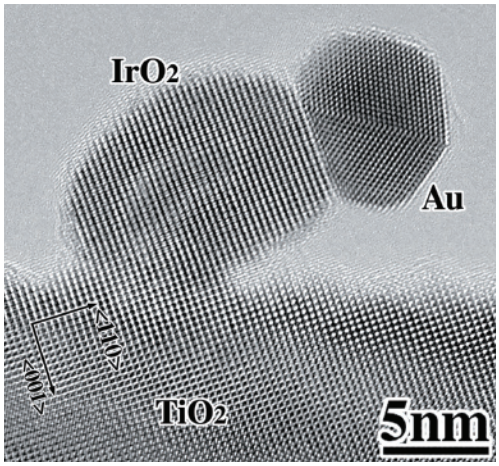
AIST Today Vol. 3, No.11 (2003) 12

TEM Observation of Complex of Nano-Particle

- Investigation of nano-interfaces -

In order to clarify the synergetic effect of the combination of Au with Ir on the catalytic performance for the oxidative decomposition of dioxins, as a model catalyst, Au and Ir were co-deposited on the single crystal of rutile TiO_2 by deposition-precipitation method. Analyses by means of analytical transmission electron microscope revealed that pillars of IrO_2 on each of which one Au nanoparticles was attached grew on the TiO_2 substrate. This pillar appeared to be formed by self-organization of Au, Ir, and oxygen.



HRTEM image of an Au-Ir deposited on TiO_2

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AIST Today Vol. 3, No.12 (2003) 18

Mechanical Engineering and Manufacturing Technology

Development of Continuous 100% Ozone Generator

- A key technology to the continuous 100% ozone supply process -

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AIST Today Vol. 3, No.10 (2003) 21

In order to bring out the maximum advantages of ozone for applications to the advanced industries, we have developed a continuous 100% ozone generator. The generator consists of four liquid ozone vessels and each vessel repeats the cooling down, accumulation of liquid ozone, ozone gas supply, and evacuation of residual ozone modes. By computer-controlling the modes of the vessels so as to keep the generator ready for continuous ozone supply, 100% ozone of maximum flow rate of 60 sccm at maximum pressure of 2,000 Pa can be supplied within ±1.1 % flow stability through at least 1 week without stopping.

Continuous 100% ozone generator

Standards and Measurement Technology

Development of Optical Frequency Synthesizer

- Fine control of optical frequency and phase -

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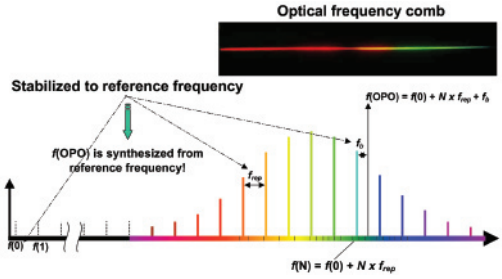
AIST Today Vol. 3, No.10 (2003) 12

The National Metrology Institute of Japan (NMIJ) at the National Institute of Advanced Industrial Science and Technology (AIST) is investigating a continuous-wave optical frequency synthesizer by using a femtosecond mode-locked laser and a continuous-wave optical parametric oscillator (OPO). The frequency of the optical output is synthesized from an accurate microwave frequency generated by an atomic clock.

We succeeded in phase locking an OPO to an optical frequency comb generated by a femtosecond mode-locked laser in the 830 nm region. We expect this synthesizer to become an important tool for optical frequency measurement, accurate spectroscopy, high-density wavelength division multiplexing and optical frequency standardization.



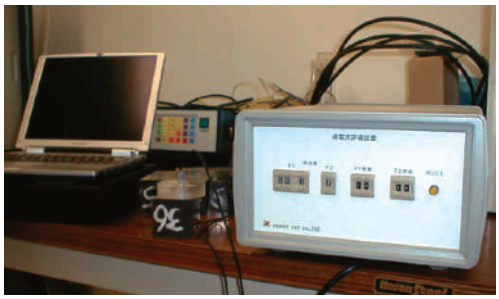
The scheme employed for phase locking the OPO to the optical comb

Material Characterization of Cast Iron by Means of Eddy Current Testing

Eddy current testing was applied for quantitative evaluation of matrix structure and hardness of ductile cast iron.

The correlation coefficient(R) between Brinell hardness and eddy current signal of 50kHz was as high as 0.92 for many kinds of specimens, and 0.96 for the selected specimens having similar chemical composition and graphite shape.

The photograph shows the eddy current tester(right), detecting coil on a cast iron specimen and display panel to show measured and calculated result (using a PC).



Eddy current hardness tester for Cast iron

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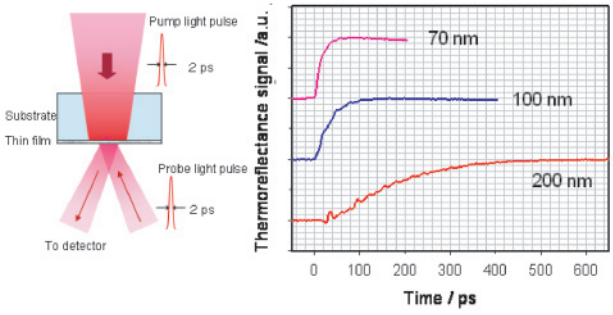
AIST Today Vol. 3, No.10 (2003) 20

Thermophysical Property Measurements of Submicrometer thin Films using a Picosecond Thermoreflectance Technique

Reliable thermophysical properties of submicrometer thin films are necessary for thermal design of advanced devices such as high density optical disks or highly integrated semiconductor devices. In order to measure thermal diffusivities of thin films thinner than 1 micrometer, a picosecond thermoreflectance measurement system has been developed. A film face of a transparent substrate side is heated by picosecond laser pulses and the temperature change on the front face opposite to the heated area is probed by the reflected intensity of other picosecond laser pulses. The heat diffusion across the thin film can be observed directly by this method. The thermal diffusivity of the thin film is calculated from the heat diffusion time across the thin film and the thickness.



Picosecond thermoreflectance signals of molybdenum thin films deposited on glass substrates

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AIST Today Vol. 3, No.11 (2003) 13

Evaluation of Measurement Uncertainty

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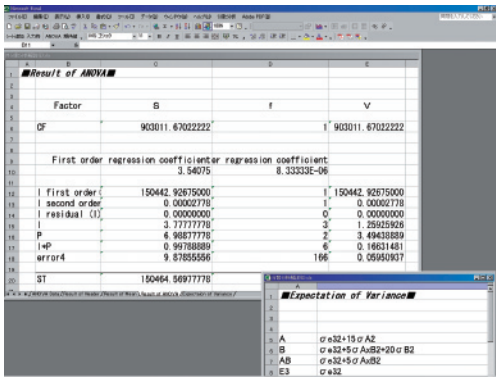
AIST Today Vol. 3, No.12
(2003) 24

We have developed new computer programs for evaluation of uncertainty in measurement. One of the programs is to perform the analysis of variances (ANOVA) in which the expression for expectation of each variance can be symbolically generated. This software is expected to greatly reduce labor required in uncertainty evaluations.

The other program is to evaluate the uncertainty of gear tooth profile measurement using Monte Carlo simulation. We formulated a geometrical model for a gear measurement machine, and constructed a "virtual-machine" in a computer. The uncertainty of gear tooth profile measurement is calculated from the geometrical errors of the virtual-machine. This program can be applied to most of the gear measurement machines.



Example of ANOVA program output

Geological Survey and Geoscience

Geological Study of Fuji Volcano, Japan
- for evaluation of evolving volcano -

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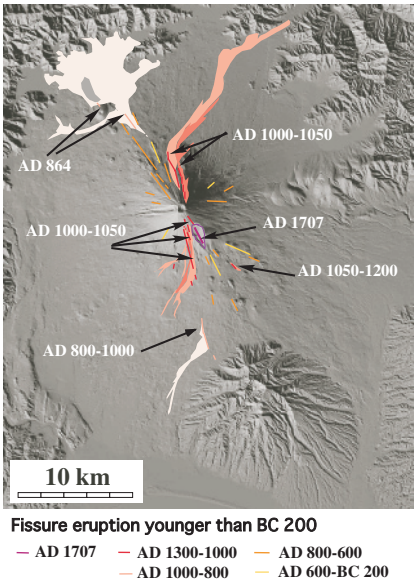
AIST Today Vol. 3, No.10
(2003) 14

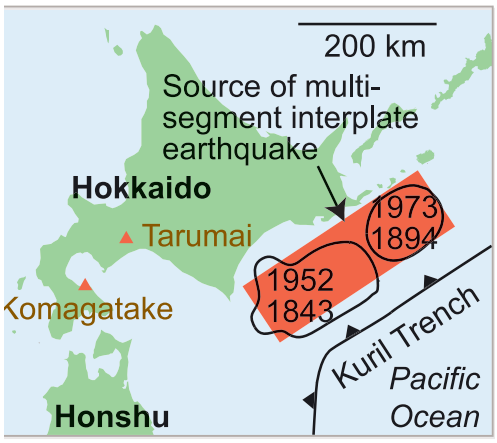
The mapping of Fuji volcano including trench surveys of more than 30 sites are carried out in Geoscience Institute, AIST. Evolution of Fuji volcano is investigated quantitatively with dating. For example, many historical fissure eruptions are discovered (Fig.). Moreover, time series diagrams of cumulative eruptive volume and fissure eruption sites younger than BC200 shows various time-dependant patters in response to changes of boundary conditions such as magma supply rate and stress field.



Distribution of fissure eruptions younger than BC200

Outsize Tsunamis Caused by Multi-Segment Inter-Plate Earthquakes along the Kuril Trench

Paleoseismological surveys combined with computer simulation of tsunamis disclosed for the first time that multi-segment inter-plate earthquakes along the Kuril trench off Hokkaido had generated greater tsunami than previously reported. Great earthquakes with magnitudes ~8 ruptured single segments (on rupture segments 100-200 km long) over the past two centuries. We use deposits of prehistoric tsunamis, extending kilometers inland, and dated volcanic ash to show that unusually large tsunamis occurred about every 500 years on average over the past 2,000-7,000 years, most recently ~350 years ago. Numerical simulations of these tsunamis are best explained by earthquakes that rupture multiple segments (~300 km) along the southern Kuril trench.



Sources of single-segment earthquakes with years of occurrence and newly-inferred multi-segment earthquakes about 350 years ago

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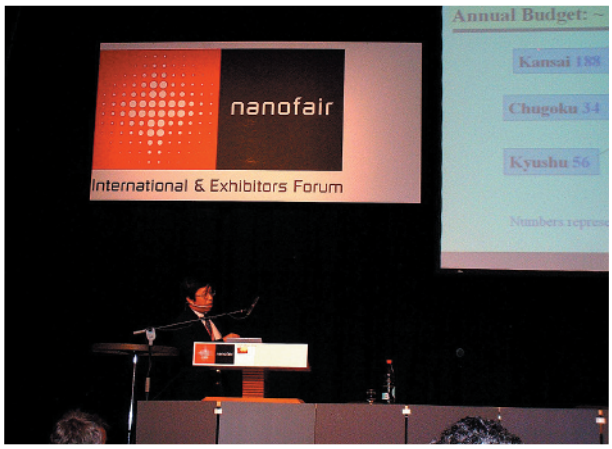
AIST Today Vol. 3, No.10 (2003) 4-6

AIST Participates in Nanofair 2003 in Switzerland

On September 9-11, 2003, Nanofair 2003, organized by the Ministry of Economy, Switzerland and "TOP NANO 21", was held in St.Gallen, a city in northeastern Switzerland. "TOP NANO 21" is a technology-oriented program of nanotechnology sponsored by the Swiss government. Nanofair 2003 was the first fair held in Europe that dealt with only nanotechnology. Exhibitors were nanotechnology-related venture companies, universities and institutes mainly from Switzerland, Germany and other European countries.



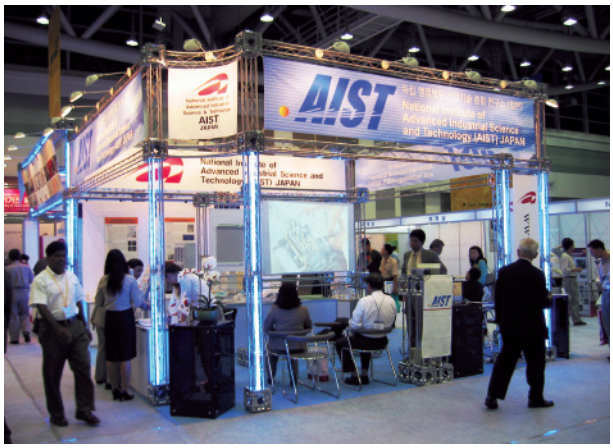
AIST, in collaboration with the New Energy and Industrial Technology Development Organization (NEDO), participated as an exhibitor. "Photocatalytic Technology", "Ozone Generator" and an overview of AIST and its technology licensing activities were presented at the exhibition booth. AIST's achievements were also included as a part of NEDO's projects. Dr. Hiroshi YOKOYAMA, Director of the Nanotechnology Research Institute of AIST made a presentation at the forum of the exhibition. He explained the nanotechnology strategy and activities at AIST and in Japan .

Although Nanofair 2003, which attracted 4,500 participants in three days, was rather small in scale, a fairly good number of people came to our AIST/NEDO booth. We believe we could promote AIST's name and activities in Europe. We greatly appreciate the Japan External Trade Organization (JETRO) Geneva and Zurich Offices for their help.

Daegu International Automatic Machinery & Tools Exhibition 2003

AIST had a booth on photocatalytic technology at the 4th Daegu International Automatic Machinery and Tools Exhibition 2003 (DAMEX), which was held from September 25th to 28th at the Daegu Exhibition Convention Center (EXCO) in Daegu, Korea.

The secretariat of DAMEX showed a strong



interest in AIST and its research achievements on photocatalytic technology exhibited at Hannover Messe in Germany in April this year, and invited AIST to participate in this trade show. The visitors of the booth eagerly listened to the explanation about the effects of photocatalysts and their possible application.

We received many inquiries about this technology transfer with a view for business development. We were impressed at the widespread interest in photocatalytic technology in Korea.

Vice President of Chinese Academy of Sciences (CAS) Visits AIST Tsukuba

On October 14, 2003, Prof. YANG Bailing, Vice President of the Chinese Academy of Sciences (CAS) along with Mr. QIU Huasheng, Director of the Division of Asian, African and Latin American Affairs, Bureau of International Cooperation, CAS visited AIST Tsukuba. CAS is the highest academic institution in China with over 100 affiliated institutes all over China. The Academy covers a wide range of research fields and is one of the national organizations equivalent to a ministry.

Prof. YANG, the vice president in charge of international cooperation, is a researcher specializing in chemical laser. He had tours of the Photonics Research Institute, which is very near to his expertise, Research Center for Advanced Carbon Materials and Research Center for Glycoscience. After the tours, he met Prof. Hiroyuki YOSHIKAWA, President of AIST.

They talked amicably about the future collaboration between both institutions. As CAS is now dynamically promoting a reorganization of its affiliated institutes, it was very impressive that they showed much interest on the way the former Agency of Industrial Science and Technology was reorganized into the new AIST.

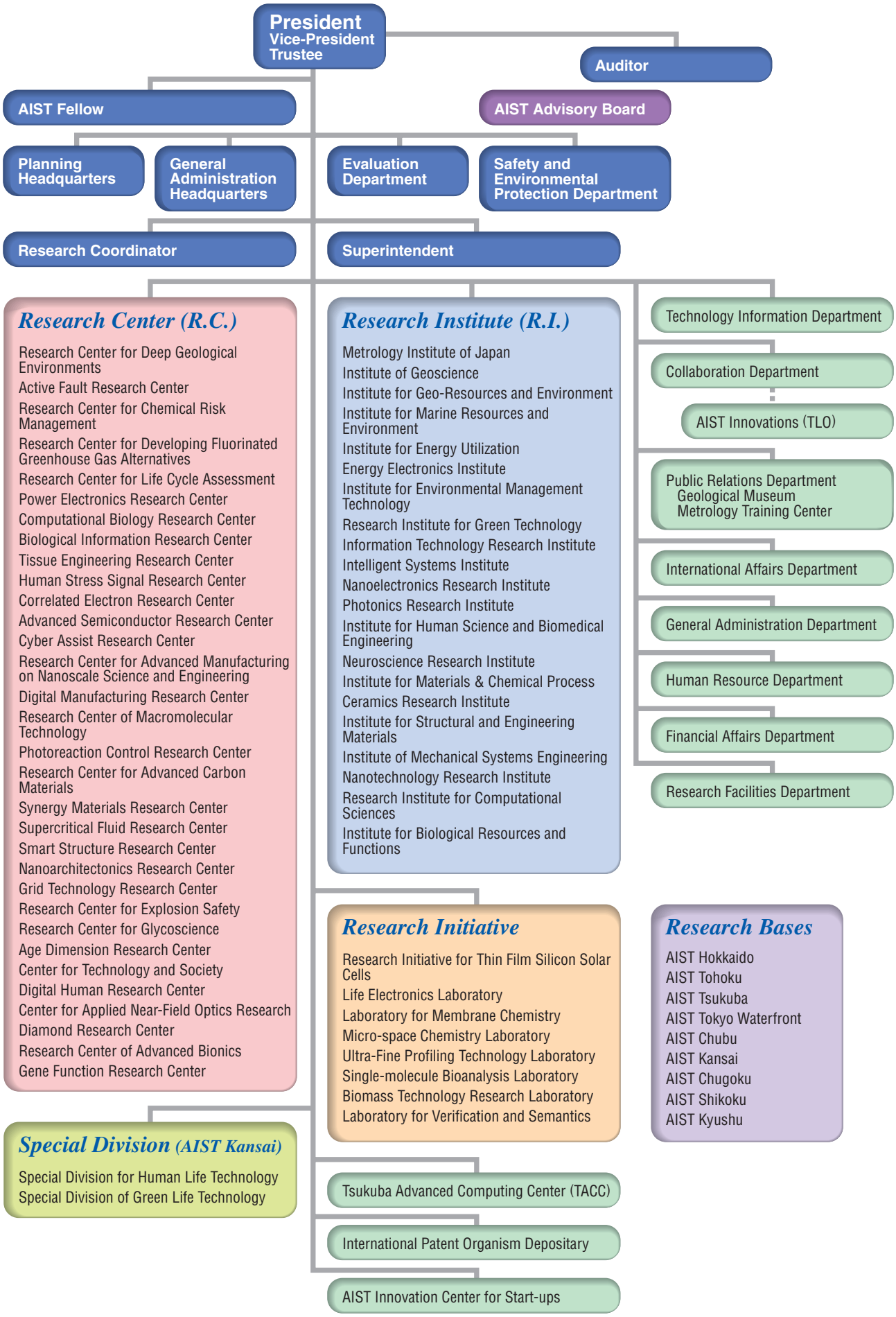
Delegation of Sweden University Presidents Visits AIST Tsukuba

On October 20, 2003, a 25-member delegation of Sweden university presidents visited AIST Tsukuba.

Following the introduction of AIST by Dr. Tatsuo Katsura, Trustee of AIST, Dr. Hiroyuki Yoshikawa, President of AIST, explained “Full Research” that AIST has been promoting. Dr. Junji Itoh, Director of Nanoelectronics Research Institute, introduced “Full Research” examples. On behalf of the delegation, Prof. Bo Sundqvist, the President of Uppsala University, addressed greeting and introduced Sweden. Afterwards, they had a discussion on research, education and budget.

They toured the Advanced Semiconductor Research Center, where they had an overview of the Millennium Research for Advanced Information Technology Project(MIRAI Project) by Dr. Hirose, Director of Advanced Research Center. They visited a super clean room, a world-class clean room for research.

AIST Organization Chart



Sep. 1. 2003

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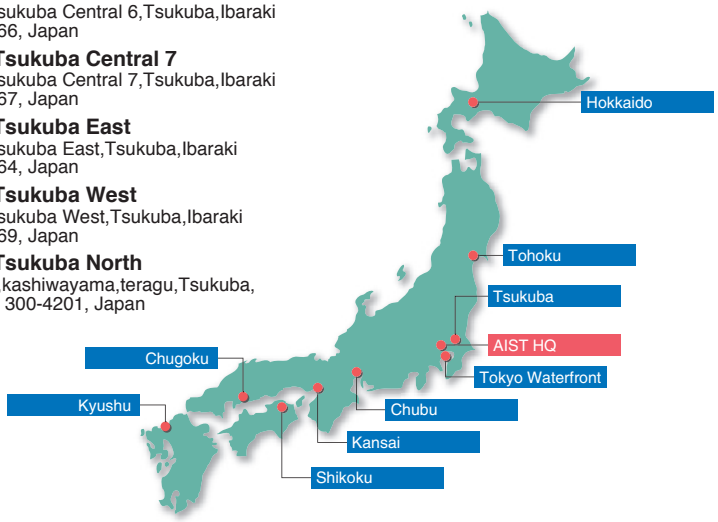

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