●Development Stage

IT

(Fiscal Year 2005–2007)

Tsukuba Science City Area

Development of a Ubiquitous Visual-Information Surveillance System for Safe and Secure Urban Living

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Core Research Organizations
University of Tsukuba, National Institute of Advanced Industrial Science and Technology (AIST), National Agriculture and Food Research Organization (NARO)

Major Participating Research Organizations
Industry···KDDI Corporation, Hitachi, Ltd., ADS Co., Ltd., and others
Academia···University of Tsukuba
Government···National Institute of Advanced Industrial Science and Technology (AIST), National Agriculture and Food Research Organization (NARO)

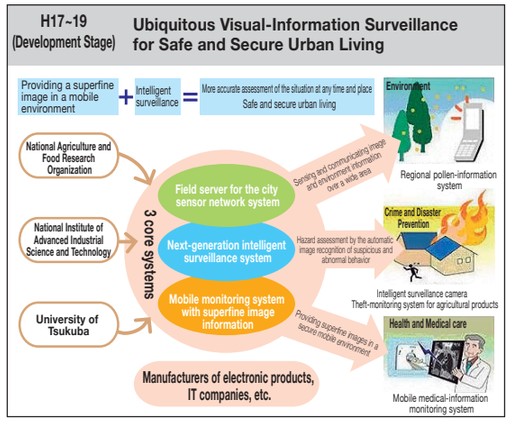
Overview of Project

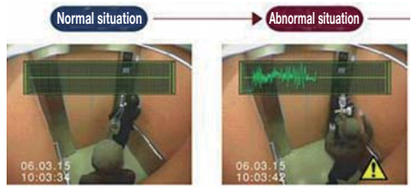
Today, safety and security are strongly demanded by the public in all aspects of life, including the prevention of crime and maintenance of good health. In this project, we extended a high-resolution image information system developed at the University of Tsukuba as part of the "Growing Stage" project, and intelligent recognition systems developed by the National Institute of Advanced Industrial Science and Technology (AIST) by incorporating the wide-area sensing systems developed by the National Agriculture and Food Research Organization (NARO). The objective was to encourage the implementation and commercialization of new, ubiquitous visual-information surveillance systems to ensure safe and secure urban living.

1. Mobile high-resolution image-information monitoring systems
   - The use of fluency information theory improved the quality of multimedia information provided via mobile systems.
   - We developed a mobile system for monitoring medical information and a radio system for assisting medical activities based on ambulance services; these innovations were proposed as a ubiquitous medical system.
2. Next-generation intelligent surveillance systems
   - Cubic higher-order local auto-correlation (CHLAC) technology for detecting unusual behavior was applied to actual products.
   - The reliability of a ubiquitous stereovision system consisting of a dual-eye camera was improved in actual environments, and the system was developed into a security product.
   - We developed a highly reliable recognition technology that uses non-linear identification algorithms and multi-viewpoint images.
3. Field server (FS) sensor network system
   - We proposed and demonstrated a system for preventing the illegal disposal of waste, consisting of FS and CHLAC with improved performance.
   - We developed a magnetically driven dual-eye camera system with "zoom" and "following" functions, and deployed the system with the aim of preventing the illegal disposal of waste, among other problems.

Main Results of City Area Program

1. Proposal of a ubiquitous medical support system
   The mobile equipment of the system is able to simultaneously display highly precise ultrasonic video and medical images, while also serving as a mobile phone. Uninterrupted images of the patient can be transmitted from the ambulance to the hospital, while strong security technology ensures the privacy of the patient. The system is a promising aid for medical services in the future.
2. Intelligent surveillance system created for the automatic detection of unusual behavior
   The technology developed for detecting unusual behavior, which uses the world-leading CHLAC technology, enables unusual behavior to be automatically detected in various fields. A camera system for monitoring the inside of an elevator (Hitachi Building Systems Co., Ltd; product name: Helios Watcher) is an example of the application of the technology. A system developed to prevent the illegal disposal of waste, which consists of FS and a monitor camera installed with CHLAC, is currently being tested to verify its performance.
3. Fluency information theory applied to various products
   Fluency DAC-IC has been built into various audiovisual systems such as CD and DVD players, and TV sets.





Monitoring camera detects an abnormal situation in an elevator

Program ended in FY 2007

●Development Stage

Life Sciences

(Fiscal Year 2005–2007)

Shizuoka Central Area

Creation of a food science business for overcoming lifestyle-related diseases caused by physical/mental stress

Shizuoka Organization for Creation of Industries
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Core Research Organizations
University of Shizuoka, Shizuoka University, Tokai University, Shizuoka Industrial Research Institute of Shizuoka Prefecture

Major Participating Research Organizations
Industry···Fuji Nihon Seito Corporation, Nihon Preventive Medical Laboratory. Co., Ltd., Prima Meat Packers Ltd., etc.
Academia···University of Shizuoka, Shizuoka University, Tokai University
Government···Shizuoka Industrial Research Institute of Shizuoka Prefecture,
Shizuoka Prefectural Research Institute of Agriculture and Forestry, Shizuoka Swine & Poultry Experiment Station, and others

Overview of Project

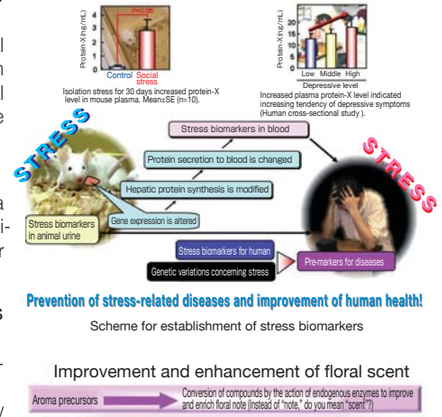
This project aims to develop a stress sensor and foods that reduce physical/mental stress and prevent lifestyle-related diseases.

Theme 1: Analysis and evaluation of the human living body and development of advanced functional technology
A possible "stress" gene was identified in the liver of a mouse under social stress; its product was also found in persons with stressful occupations, such as nurses. Multiple proteins in human blood were also identified as potential stress markers. We expect to develop biomarker kits for these candidate proteins.

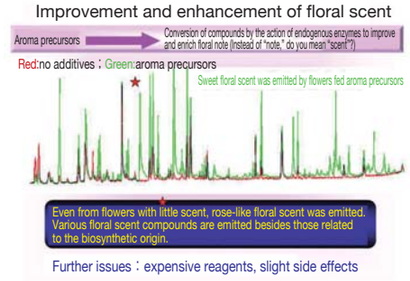
Theme 2: Non-invasive stress analysis by optical technology
We developed an ultra-weak light-emitting device that can measure stress via an analysis of human saliva. We developed a prototype equipped with analytical software and luminescence sensitivity that varies by a factor of 10 for different objects to be examined.

Theme 3: Development and marketing of advanced functional materials using enzymatic technologies
We determined the generation mechanism of a plant fragrance with an anti-stress effect.
As a result, the scent of a rose was generated in a cut flower without any natural scent.

Theme 4: Development of anti-stress foods and chemical materials, and analyses of the expression mechanism
The functionalities of marine products and farm products from Shizuoka Prefecture were proven by both animal experiments and human experiments using volunteers.
As a result, we have commercialized pet food, food materials, and a reagent, and have accumulated a large amount of prospective data for future commercialization

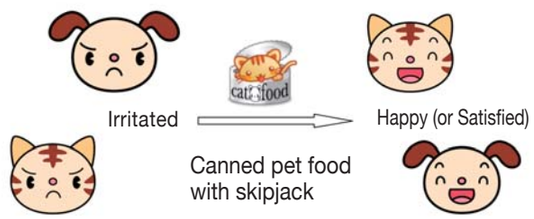


Scheme for establishment of stress biomarkers

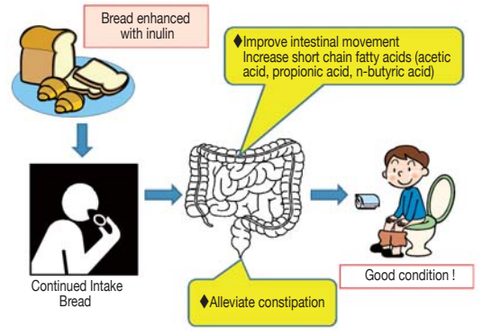


Main Results of City Area Program

Canned pet food made with skipjack-ovary oil has been commercialized and is proving successful.



The consistent intake of bread enhanced with inulin led to improved bowel movements and cured constipation.



●Development Stage

IT

(Fiscal Year 2005–2007)

Toyohashi Area

Development and Application of a Smart Sensing System

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TEL: +81-532-44-1121

Core Research Organizations
Toyohashi University of Technology, etc.

Major Participating Research Organizations
Industry···Advance Food Technology Co., Ltd., Alpha Project Co., Ltd., Japan Operator Co., Ltd., etc.
Academia···Toyohashi University of Technology, Tokyo University of Agriculture and Technology
Government···National Food Research Institute, National Institute of Livestock and Grassland Science

Overview of Project

The City Area Program, involving joint industry–university research, began in 2002. The purpose of this research was to develop a smart sensing system with two components: a high-quality sensing device with the ability to discriminate different types of information, and an information-processing system integrated into a smart sensing system that enables large-scale information processing. The smart sensing system has been developed in regional industry sectors (precision agriculture, medicine, welfare, environment, automobiles, etc.) as an experimental field, and has achieved various successes at different stages of development, including the release of new products, development of prototype products, establishment of university-based venture companies, technology transfer, and patent applications. In the Development Stage, the most promising achievement will be selected and extended via additional research to create new intellectual property. We would also like to optimize the smart sensing system for applications in agriculture, which is a prominent industry in the Toyohashi area. This project will stimulate local industry and reinforce the network established between academia and industry. Eventually, we will develop an innovation system that is sustainable in local areas. To achieve these aims, the project is divided into two sub-themes that will be initiated in collaboration with private companies.

Subproject (1) Development and application of a smart sensing system for supporting industry

Subproject (2) Development and application of a smart sensing system for combining IT and agricultur

Main Results of City Area Program

1. “Development of a Detector for Metal Contaminants in Food using a High-Tc SQUIDs Magnetometer (FINE METAL DETECTOR)”
   This device was developed as part of a collaboration between Prof. Saburo Tanaka, professor of ecological engineering at Toyohashi University of Technology, and Advance Food Technology.
   The device detects the extremely weak magnetism of magnetized samples in a magnetically shielded box, and is able to stably detect magnetism without being affected by aluminum packing, water, salt, or temperature. The device is low-cost, and is price-competitive. The main use of the device is in detecting metal contaminants in food, absorbent cotton, plastic, and liquid.

2. “Development of a device for the non-destructive measurement of the sugar content and ripeness of fruit (OISHIKA)”
   This device was developed as part of a collaboration between Prof. Shigeki Nakauchi, professor of information and computer science at Toyohashi University of Technology, and Chiyoda Electronics.
   This device uses NIR spectroscopy to non-destructively measure the sugar content and hardness of fruit. It is also able to predict the timing of harvest and peak ripeness. This device will ensure the accurate timing of cultivation and enable accurate delivery management for farmers. Another use of this device is to ensure peak ripeness in supermarkets, department stores, fruit shops, fine dining restaurants, wedding centers, gift shops, and cake shops. It is considered that the device will assist in the provision of high-quality fruit.

●Development Stage

Others

(Fiscal Year 2005–2007)

Southern Okayama Area

Development of an active microreactor for a progressive micro-reaction process

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Core Research Organization
Okayama University

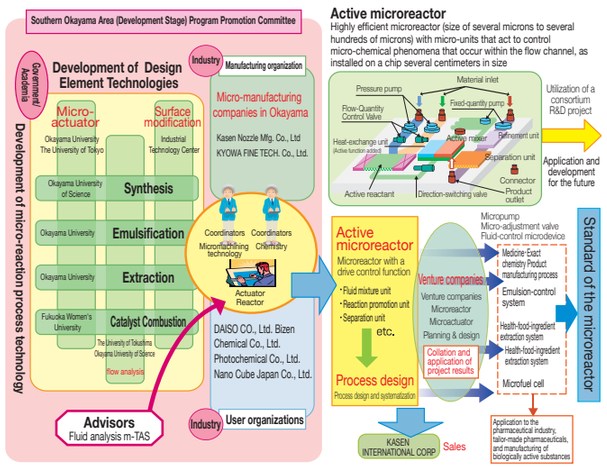
Major Participating Research Organizations
Industry···DAISO CO., Ltd., Photochemical Co., Ltd., Bizen Chemical Co., LTD., and others
Academia···Okayama University, Okayama University of Science, Fukuoka Women's University, and others
Government···Industrial Technology Center of Okayama Prefecture

Overview of Project

We aimed to achieve a highly effective material process with the microreactor and promoted the research and development which organically worked together the design factor technology of the microreactor and the microreaction process technology.

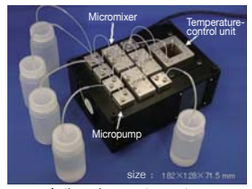
1. Development of design element technology
   We focused on the importance of “flow” and “mixing” in the chemical process. The following were developed as design element technology to solve problems in the microreaction process.
   · Development of an active device
   Development of device technologies with drive control function and incorporation into a microreactor
   · Development of fluid analysis technology in a microchannel
   Establishment of a microchannel design technique based on fluid analysis
   · Development of surface modification technology for a microchannel
   Reduction in flow resistance within the reactor channel by surface modification, reaction with the substrate, and prevention of melting of the substrate element.

2. Development of microreaction process technology
   A fundamental reaction process involving synthesis, emulsification, extraction, and combustion was referred to in employing the design technologies described above, and a microreactor based on precise micromachining technology was developed by a local company. We also proposed a micro-reaction process with the aim of applying it to the manufacturing of a specific product.
   · micro-synthesis reaction process: Manufacturing of non-natural amino acids and optically active lactone
   · micro-emulsification process: Manufacturing of emulsion preparation and macromolecule microcapsule
   · micro-extraction process: Manufacturing of EPA and DHA high-purity products
   · micro-catalytic combustion process: Development of a highly effective micro-catalytic combustion system for fuel cells.

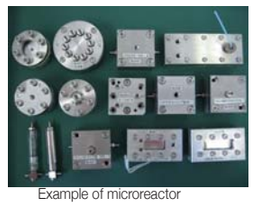


Main Results of City Area Program

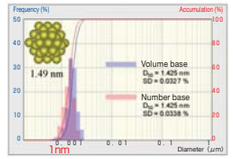
1. Development of various active devices and systems for use in the synthesis, emulsification, extraction, and combustion process
   We designed various devices for use in microreactors and microreactor systems, including a micro-synthesis reaction system composed of a micromixer with a magnetic particle for an active microreactor, a droplet-generation device for the generation of micro-emulsion, a micro-extraction valve for the generation of slug flow during the extraction process, an active separation system for use in the separation process, and a microcatalyst burner apparatus.



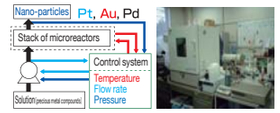
Active microreactor system


Example of microreactor

2. Development of a nano-particle mass-production business
   Nano Cube Japan Co., Ltd., newly established independently in Okayama Prefecture spin off from the collaborating company involved in this project, utilized the microreactor that used special reaction ground to assemble a minute duct and minute air space (tens of microns in size) in three dimensions, and succeeded in the continuous preparation of a precious-metal nano-particle (1.5 nm in size) for the first time world-wide. This technology is currently being commercialized.



Pt nano-particle Particle diameter distribution



Continuous liquid-phase synthesis system for single nano-particles

●Development Stage

(Fiscal Year 2005–2007)

Life Sciences Nanotech Materials

Kumamoto Area

Development of a Next-generation Living Body Information-Processing Chip for Recording Human Movement and Physiological Data

Kumamoto Technology and Industry Foundation
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TEL: +81-96-286-3300

Core Research Organizations

Kumamoto University, Kumamoto Technology and Industry Foundation

Major Participating Research Organizations

Industry…DIGITEX LAB. Co., Ltd., K.T. System Company, YASKAWA INFORMATION SYSTEMS Corporation, and others
Academia…Kumamoto University, Kumamoto National College of Technology
Government…Kumamoto Technology and Industry Foundation, Japanese Red Cross Kumamoto Health Care Center, Kumamoto City Hospital, and others

Overview of Project

Progressive Development of the City Area Program—from "animal experiments" to "human"

Research undertaken in the Kumamoto Area marks an important shift from "animal experiments" to the "human" with an ambitious theme that aims to develop an advanced "Next-generation Living Body Information-Processing Chip" that will enable the collection of data on body motion and physiological functioning without any burden on the wearer of the chip.

This project aims to develop a small, multifunctional sensor chip that incorporates an acceleration sensor in addition to sensors that enable the measurement of an electrocardiogram, heart rate, blood pressure, etc., thereby enabling measurements of body movements and function.

In the future, we anticipate the development of a new health-support system that can remotely read medical data by combining the sensor technology with high-speed communication technology.

We also promote collaborations and exchanges with other regions in a wide range of topics, including human resource development, and accordingly contribute to the solution of engineering problems and stimulation of local industries via the integration of different research fields (e.g., nanotechnology/materials (engineering science) and life science (medical science)) in Kumamoto Prefecture.

Activity Monitoring and Evaluation System (A-MES)

1. Capturing Movements—Group for the Measurement & Development of Movement Information

The Kumamoto Technology and Industry Foundation has developed the Activity Monitoring and Evaluation System (A-MES) for quantitative and objective monitoring of the test subject's daily activities during rehabilitation. In its present stage of development, the system is capable of 24-hour monitoring to distinguish and evaluate three positions (standing, sitting, and lying) and two motions (walking and movement within a wheelchair). The next theme involves the development of an analytical and evaluation system that records the subject's motion information using acceleration sensors, and a home gateway for connecting the system to a networked medical service.

Other potential applications include rehabilitation, nursery care, physical fitness, and monitoring of unattended elderly persons.

2. Measuring Physiological Information—Physiology Information Measurement & Development Group

The Physiology Information Measurement & Development Group worked on the program that generates warning alarms. The group collected physiological-trait data for sleeping babies and various other parameters such as instantaneous/average heart rate, fluctuations in heart rate, respiratory rate, Po2, and body temperature. These data are compiled in a database, and the program is initiated if an abnormal measurement signal is detected relative to the values in the database.

This program enabled the development of the "Next-Generation Biological/Physiological Information-Measurement System," which incorporates a sensor capable of simultaneously measuring heart rate, respiratory rate, and body temperature. The device is easy to attach/detach, is highly portable, and has a low rate of false alarms.

How to monitor physiological data for an infant

Main Results of City Area Program

1. Development of A-MES (Activity Monitoring and Evaluation System)

We completed development of the prototype model II, an all-in-one design for a sensor-data logger, and the prototype model, a wireless sensor-data logger.

These devices enable 24-hour monitoring and evaluation of movements with the aid of dedicated analysis software.

We also plan to apply this technology to the development and evaluation of rehabilitation programs and care plans.

All-in-one design of an A-MES

2. Physiology Measurement System for Humans

We produced a prototype model of the physiology measurement system for newborn babies.

We also developed a sensor that senses the LSI for a transmitter–receiver system and information related to physiological functioning, as well as various devices for film materials, etc.

We also evaluated a system that equips the prototype model for newborn babies with these devices.

Furthermore, we succeeded in developing an RFID sensor tag for diapers.

The tag enables the simultaneous measurement of living body information at many points via uplink-telemetry and radio communication using the downlink–reception with ID cord identification.

Telemeter living-body information-measurement system used in the inspection