●Development Stage

(Fiscal Year 2008–2010)

Kansai Science City and Surrounding Area

Development of a Healthcare Device & System for Ubiquitous Bioinstrumentation

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Life Sciences
IT
Environment
Nanotech Materials
Others

Framework for Project Promotion

Project Director……Kiyoshi Ninomiya (Adviser at Daikin Industries, Ltd.)
Chief Scientist……Kunihiro Chihara (Vice President at Nara Institute of Science and Technology)
Project Vice Director……Tadao Shioyama
Science and Technology Coordinator…Hiroshi Shibata, Tatsuo Minamitani, Shinichi Tanaka

Core Research Organizations

Osaka University, Nara Institute of Science and Technology,
Kyoto Prefectural University of Medecine,
Nara Medical University, Doshisha University

Major Participating Research Organizations

Industry…OMRON Corporation, SHIMADZU Corporation, MICRONIX Corporation, NITTA Corporation, TECNOS CO., Ltd., Rastec, ASIP Solutions, Inc., Biomarker Science CO., Ltd., Atomnics Laboratory Inc., Nippon Telegraph and Telephone West Corporation
Academia…Kyoto University, Osaka University, Nara Institute of Science and Technology, Tokyo Institute of Technology, Yokohama National University, Kyoto Prefectural University of Medicine, Nara Medical University, Doshisha University, Osaka Electro-Communication University, Kinki University, Kwansei Gakuin University
Government…Kyoto Preventive Medicine Research Center, Nara Engineering Center, National Institute of Information and Communications Technology

Aims of Project

ICT technologies and biomedical measurement technologies for home healthcare systems have been accumulated in the Kansai Science City area, responding to social needs and market demands related to an aging society and declining birthrate in Japan. This project seeks to develop the following three types of home healthcare systems to support people's wellness, based on accumulated technologies and integrated research in the fields of medical science, engineering, and information technology.

i) Home healthcare systems for monitoring of the fetus and mother during the early stages of pregnancy by living-body measurements.
ii) Home healthcare systems for the accurate measurement of voiding dysfunction that reflects daily life at home.
iii) Home healthcare systems that use scientific analysis to assess the progress of adult disease before the onset of sickness.

To realize these healthcare systems, we aim to develop real-time, pain-free, and non-invasive biomedical measuring devices. A secure network system will be developed to enable the sharing of biomedical information measured at home with medical institutions.

Contents of Project

1. Development of a monitoring system for pregnant women

There exists a nationwide lack of obstetricians and associated problems related to perinatal medicine in remote regions. Abnormalities during pregnancy commonly occur with little warning, meaning that even regular medical examinations in a clinic are insufficient in detecting the problem. A complicated pregnancy commonly leads to premature delivery, representing about 8% of total births. Many premature newborns enter the neonatal intensive care unit, requiring expensive medical treatment.
To date, we have developed general-purpose SoC (System on a Chip) technology for medical treatment and a specific sound-source separation technology for multiple sound sources. By using these technologies, this project will develop new devices for the home-based measurement of uterine contractions, pH value within the vagina, and the fetal heart beat. The project will also develop secure network systems that automatically transmit living-body data from home to a medical institution. If the medical institution receives information that indicates a problem, the information is passed on to the pregnant woman and her family doctor.

2. Development of a healthcare system for urogenital disease

More than 8 million elderly patients in Japan suffer voiding dysfunction. Because incontinence and frequent urination force patients to stay at home and may cause sleeping disorders, quality of life is significantly affected.
Existing urodynamic evaluations result in significant physical and mental stress. Moreover, a single urodynamic study conducted over a brief period in hospital may not lead to a conclusive diagnosis of the voiding dysfunction experienced during daily activities.
This project will develop a healthcare system to accurately diagnose voiding dysfunction with minimal patient stress. The system measures the urine flow rate using portable uroflowmetry, and measures detrusor pressure during the filling and voiding phases using a novel telemetric system based on a capsule within the bladder for 72 hours. The capsule will contain an MEMS pressure sensor and universal medical SoC technology that are under development as part of this project.

3. Development of a healthcare system for adult diseases

Because medical examinations only measure the current physical status, they do not enable predictions of future adult disease. This project will clarify a biomarker that indicates the potential of adult disease, and will develop a monoclonal antibody for detection based on proteomic analysis technology developed as part of the Area Program. A scientific diagnosis method for adult disease will subsequently be established.
This project aims to develop an easy method for assessing predictive signs of adult disease at home. The device utilizes a thin-film piezo-resonator type mass-sensor with ultra-high sensitivity. The monoclonal antibody is loaded on the mass-sensor to detect minute mass change by antigen-antibody reaction with the biomarker in a test sample.