

Nagasaki/Isahaya/Omura Area

Development of Non-invasive Sensing Technology for QOL Medical Diagnosis

The Nagasaki Prefectural Organization for Industry
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Project Promotion

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Major Participating Research Organizations

Industry... CHORYO CONTROL SYSTEM CO., LTD, AOR, LTD.,
J-system Ltd. Inc., NIHON RIKO MEDICAL CORPORATION LIMITED,
Mechatronics Co. Ltd., ArtLogic Inc., TERUMO CORPORATION
Academia... Nagasaki University, Nagasaki Institute of Applied Science
Government... Industrial Technology Center of Nagasaki,
National Hospital Organization Nagasaki Medical Center Of Neurology

Core Research Organizations

Nagasaki University, Nagasaki Institute of Applied Science,
Industrial Technology Center of Nagasaki

Aim of research and development

In Nagasaki Prefecture, there are many residential quarters that were in the solitary islands and the sparsely populated district, and even located on slope. Therefore, it was anticipated to improve medical services for the residents through telemedicine and development of medical care for medical care at home.

In this project, the area of investigation is set as "non-invasive technology for the QOL medical diagnosis". Medical diagnosis technology of Nagasaki University School of Medicine, the sensor technology of Faculty of Engineering Nagasaki University, the sensor technology of Industrial Technology Center of Nagasaki, and LSI design technology of Nagasaki Institute of Applied Science are integrated for application and development toward improvement of the field of medicine and welfare. This will be linked with research and development with enterprises in and out of the area to achieve a revolutionary non-invasive type and user-friendly medical diagnostic equipment that may be applied to home medical care and nursing.

* QOL medical diagnosis

Inspection and diagnosis without disturbing patients in respect of their quality of life (QOL:Quality Of Life).

* Non-invasive sensing technology

Inspection and diagnostic technique with no damage on patient's body by using laser light, microwave, and ultrasonic wave, etc. This will reduce physical and mental stress on patients in the event of collecting blood and palpation, etc.

Contents of research

1. Detection of abnormality in auscultatory sounds by digital processing

The sounds produced within the body (heart sounds, breath sounds, etc.) are captured by the stethoscope and processed by digital signal processing. We develop the advanced technology of auscultation which extracts features from the sounds, discriminates the normal and the abnormal sounds, classifies the abnormal sounds into several patterns, and provides the resulting information for diagnosis of lung sounds.

2. Measurement of blood component (blood glucose) with laser

With non-invasive and indirect method using laser light we develop the high precision measurement technology of the blood component such as blood glucose without blood sampling. This technology warrants reducing the patient's stress in daily life.

3. Detection of early-stage breast cancer by microwave

Using high contrast in electrical parameters (permittivity and conductivity) between normal tissue and a malignant tumor at microwave frequencies, we develop microwave mammographic technique not only to detect the location and shape of early-stage tumors but also to discriminate between their benignancy and malignancy

4. Measurement of urine flow by ultrasonic wave

The technology of a lightweight and flexible sensor pad with ultrasonic vibrators is developed. The sensor should be placed on the lower abdomen of the patient to automatically measure the amount of urine flow of the bladder on a constant basis. If the patient is unable to control the urine flow, the sensor automatically inform the patient in care and the caretaker of the condition.

The main study results

1. Detection of abnormality in auscultatory sounds by digital processing
The algorithm of automatic detection of abnormal lung sounds and the techniques of data processing and user interface were developed. Ultra-low power CMOS-LSI which has the function of wireless communication and high accuracy analog-to-digital conversion was also developed. This LSI can be used with various types of medical sensors as well as the stethoscope.
2. Measurement of blood component (blood glucose) with laser
The blood glucose weighing device of the technique and non-invasive and indirect that did the anti-optical path correction according to the expansion and the shrinkage of the blood vessel was developed. The developed detection method is applicable also in the quantitative measurements of the human tissue element other than the blood glucose.
3. Detection of early-stage breast cancer by microwave
We developed a measurement technique and an image reconstruction algorithm, which could experimentally demonstrate successful detection of a 1 cm simulated tumor embedded in microwave breast phantom. Application of the developed microwave tomographic imaging technique to other fields such as ground penetrating radar has begun.
4. Measurement of urine flow by ultrasonic wave
The measurement method is developed to almost accurately identify the shape of organs such as bladder in a limited space, as well as its measurement device. The system to control urine disorders and the ultrasonic sensor pad are also developed. For connection of human body and sound, the ultrasonic sensor and the film-type echo gel are also developed.



Multi-channel sensor pad

Equipment for image display and wave analysis

