RESEARCH AND DEVELOPMENT

Aiming to Improve the Business Value through Development of Advanced Technology

The OKI Group actively develops cutting-edge technologies with the aim of contributing to a safe, secure and comfortable "smart society" that is kind to both the environment and people, as an important theme for R&D. There are two important areas of technology for a smart society, which we classify as "smart sensing and awareness" and "smart network." We are further advancing the integration of OKI's traditional strengths of media processing technologies and optical broadband technologies with OKI's ability to build systems.

Furthermore, we are pouring effort into innovative development that will connect the fruits of research and development with new business value, aiming for the creation of new businesses.

01 Research and Development for OKI's Smart Society Vision

The IT foundation for a smart society is formed by organically connecting the technologies of "smart sensing and awareness" and "smart network." Our efforts in these technological areas include the following:

Smart Sensing and Awareness

OKI has newly developed radio sensing technology, whereby people's activities and contexts can be detected with high sensitivity from fluctuations in radio waves. When combined with awareness technology, such vital changes as heartbeats can even be recognized. With the arrival of the unprecedented aging society, this technology, together with image-sensing technologies, will contribute to the provision of safety and security. OKI is also developing data mining technology to find and utilize hidden "meaningful information" from among an expansive environment of diversified information and information on people's activities obtained from sensing.

Smart Network

OKI was the first in the world to develop a 920 MHz bandwidth wireless multi-hop network technology that can accommodate large-scale as well as small-scale systems, and offers enhanced efficiency in power consumption. This enables various sensors and equipment to be connected to networks, regardless of the environment. This technology is expected to be used in combination with awareness technology, and we envision its utilization in energy-saving applications at smart offices as well as in the disaster recovery field for remotely surveying the damage from earthquake, for example.

02 Research and Development Leveraging OKI's Strengths

OKI has strengths traditionally in media processing technologies and optical broadband technologies for audio and video, and is able to compete on a global level in these areas.

Aiming for Audio and Video Technologies that Provide Greater Comfort

Amid the rapid proliferation of smartphones, OKI is working to develop audio and video technologies that provide comfort, such as voice processing technologies that achieve clarity in reproduction even in noisy environments and video coding technologies that can operate even on devices with limited processing capabilities. Furthermore, we are also working to develop media processing systems that can integrate these technologies.

Aiming for Further Development of Broadband Networks

In order to realize further improvements in energy conservation, OKI is developing new optical broadband technology for next-generation optical access networks to realize virtual networks with more efficient bandwidth utilization.

03 Development of Basic Technologies for the Future

The accumulation of technologies that we develop will become the foundation that supports OKI's future businesses. In particular, when everything in society becomes interconnected as the society develops into a smart society, it enters an era where security affects the value of services. OKI is researching "quantum cryptography technologies" that will enable the realization of indecipherable encoding. We have succeeded in creating an entangled quantum state ("quantum entanglement" is a state in quantum mechanics) in a practical environment, and demonstrated the feasibility of this technology through transmission tests that used standard optical fibers, achieving successful transmissions over a distance of 140 kilometers. This success is regarded as a big achievement toward the technology's practical application.

TOPICS Development of Ultra-sensitive Human-detecting Sensor Technology Capable of Detecting Minute Movements, including Human Breathing

OKI developed a human-detecting sensor technology capable of distinguishing between large movements (for example, a person walking about a room) to minute movements like breathing. This technology can detect even the minute movements of otherwise motionless persons, making it suitable for use in various applications, including advance warnings of health problems. OKI is seeking to apply this technology to areas ranging from security to the monitoring of elderly or people requiring long-term care.

Pyroelectric infrared human-sensing sensors[1] have been widely used in the security, monitoring, energy conservation, and other fields but it has been less successful in detecting people who are motionless. Focusing on microwave sensors[2] that rely on the Doppler effect to penetrate and circumvent obstructions and allow detection and response to minute movements, such as breathing and heartbeats, OKI has pursued research on highly sensitive methods for detecting human presence and behavior.

However, microwave sensors have also suffered from certain shortcomings. When a single sensor is used to provide wide coverage over the typical room-sized space, in addition to actual motion inside the area being monitored, movements of air-conditioning equipment in the same area and movements of people or vehicles outside the space are also detected. OKI explored the differences in fluctuations caused by the movement of physical bodies, studying a statistical method to extract human movement with high precision while disregarding the effects of objects moving in the surroundings. As a result, OKI developed a technology capable of detecting motionless humans based on minute movements, such as breathing, at levels of high precision, and this technology can distinguish in real-time between resting and moving states.

[1] **Pyroelectric infrared human-detecting sensors:** Sensors that use pyroelectricity to detect temperature fluctuations from infrared radiation emitted from humans and other targets.
[2] **Microwave sensors:** Active sensors that use microwaves in the 10.5 GHz and 24 GHz frequency bands.
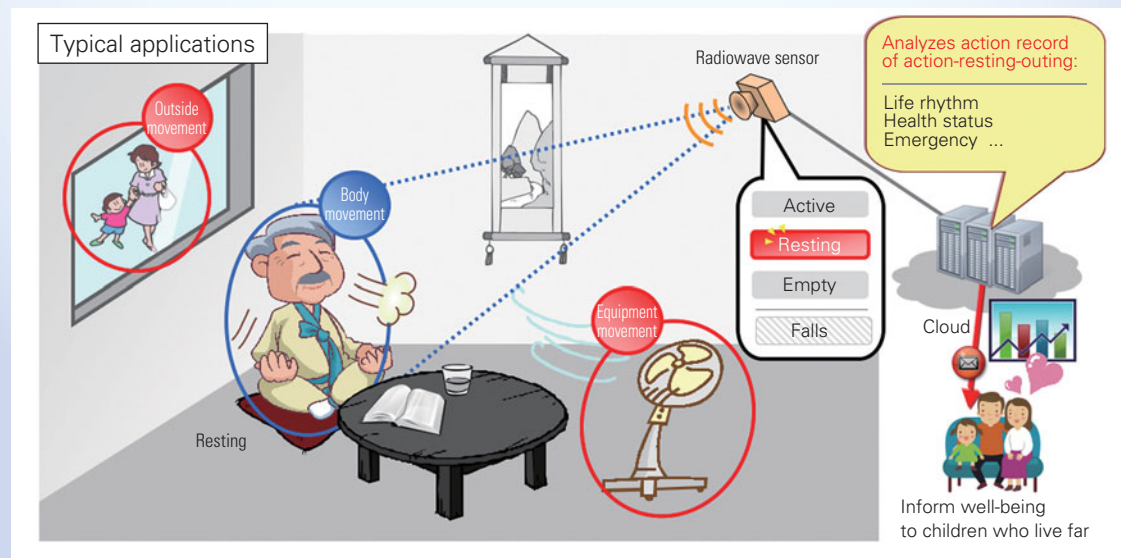
Comment from the Technical Engineer

Detecting minute movements as small as breathing from a remote sensor requires the highly precise separating out of unnecessary signals, called "noise," created by the environment and other sources. Determining if a signal is relevant or noise requires a great effort to accumulate a large volume of data and highly sophisticated analytic literacy to understand the connection between the large amount of the collected data and physical phenomena. In order to flexibly handle such elusive targets and become a research group with highly analytical skills, we always strive to acquire knowledge and skills through a friendly competition.