

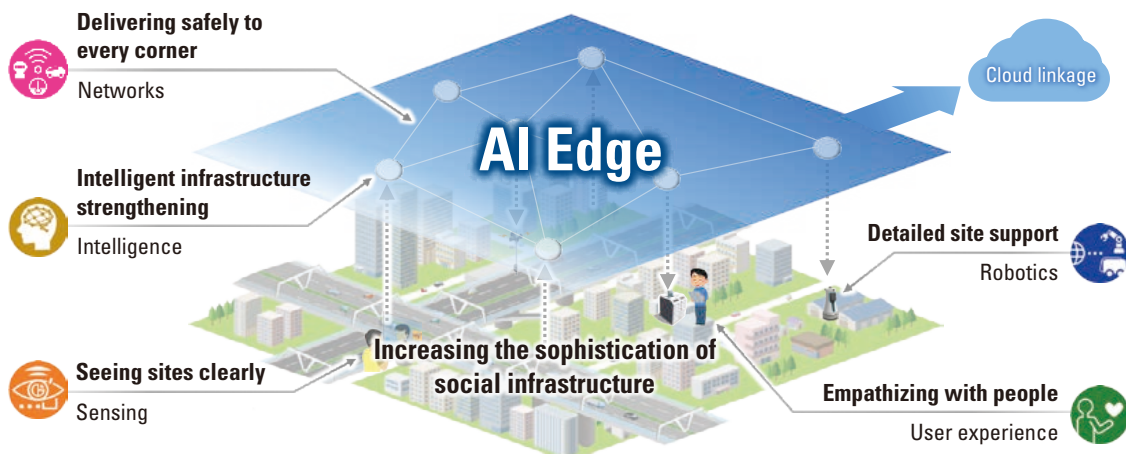
TECHNOLOGY STRATEGY

Due to the effects of the spread of COVID-19, the digital transformation (DX) of society as a whole is accelerating even as structural changes are made in line with the new normal. In response to these changes, OKI is continuing to utilize the technical strengths it has cultivated until now to pursue research and development aimed at resolving social issues and achieving the Company’s growth strategy. To bring about innovation as we flexibly respond to change, we are striving to come up with ideas from the perspective of customer value and to implement a flexible, speedy research and development process based on our Innovation Management System “Yume Pro.”

Focus Technologies

Given the progress of DX, OKI believes that being “connected” will be common sense in the society of the near future, and—in an always-online world where the digital embraces the real—our mature society will shift from heavily concentrated to locally decentralized urban functions while demanding sustainability as opposed to economic efficiency. To achieve this sort of society—in which people can enjoy safe, comfortable lifestyles—we will facilitate strong infrastructure at various sites suitable for individual needs, support cooperation that is not limited by distance, and develop services that cooperate with people and quickly respond to the situation.

OKI is responding to the above social changes and direction of technological innovation by focusing on AI Edge technologies intended to deliver services to every corner of society. AI Edge includes five technical fields: sensing, networks, intelligence, robotics, and the user experience. By enhancing technologies for which we are strong while linking them to each other, we will increase the sophistication of social infrastructure. In addition, by incorporating co-creation with our partners into our research and development process, we will contribute to the achievement of growth strategy.



Sensing

This technical field is evolving from individual detection/measurement technologies—including sound, vibration, optical, radio waves, and visual image—to recognition technologies that fuse diverse sources due to the evolution of AI. To further develop this field, which is the entrance to the digital world, as a set of technologies for clearly seeing the situation of society, we will strive to utilize the photonics technologies we have enhanced in relation to communications, increase the flexibility of AI, and expand functionality via fusion.

Networks

Due to the start of 5G and increased network functionality, the evolution of this technical field as a base for diverse industrial fields is accelerating as large numbers of decentralized

devices cooperate and are linked in real time. In addition to working on this evolution, OKI will safely deliver ICT infrastructure to every corner of society by working on zero-energy IoT technologies, security technologies, blockchains, and other new information distribution systems.

Intelligence

The AI utilization business is making dramatic progress due to deep learning and quantum computers. To intelligently strengthen infrastructure from the edge, we will work on developing technologies ensuring that advanced AI is lightweight, reliable, and easy to use as well as technologies that link different types of AI, and we will fuse these technologies with advanced domain knowledge closely connected to sites in order to resolve issues.

Robotics

Safe robots—including service robots and cooperative robots—are starting to work alongside people, taking on the burden of diverse types of operation. In this field, OKI is working on developing technologies that remotely achieve advanced cooperation between the autonomy of AI and the flexibility of people to ensure that robots can reliably handle operation and that the attentiveness of people can be effectively applied to a wider range of operation.

User Experience

This technical field has been strongly affected by the COVID-19 crisis, and there are strong needs to ensure safety through non-contact/non-face-to-face solutions, maintain efficiency, foster engagement in remote environments, etc. To help achieve advanced teamwork without requiring people to gather in one place, OKI is working on achieving new user experiences to which we apply XR (AR/VR/MR) technologies as well as AI technologies for communication.

R&D Case Study

Area Sound Enhancement Technology that Improves Remote Work Environments

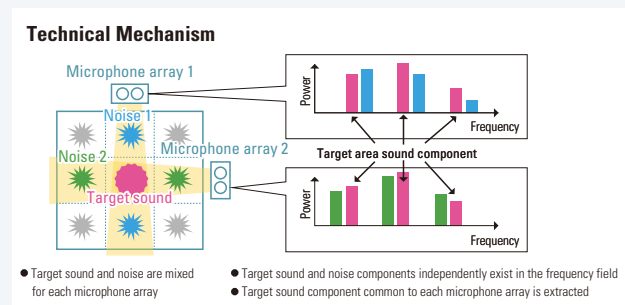
Due to the spread of COVID-19, work styles around the world are dramatically changing, and the range of remote work is rapidly expanding. In addition to working from home at companies, remote lectures by tutoring schools, universities, and other institutions are increasing. In addition, due to labor-saving needs as well, the stores of financial institutions and the like are increasingly providing remote customer service via human operators.

As people are practically forced to rapidly shift to remote operations, there are more and more cases in which the development of suitable environments cannot keep up. For example, in cases where the sounds of other people talking and the sounds of daily life, such as appliances, can be heard by whomever one is talking to, it not only gets in the way of meetings and lectures but also results in real privacy concerns.

OKI has been working hard on sound-related technologies since the Company was founded. To respond to these issues regarding remote work environment, we are working on improvement utilizing “area sound enhancement technology” that can pick up only sounds in a specific area by using a small number of microphones. There are already a wide range of highly directional microphones on the market. However, although these microphones can in fact pick up only the sounds coming from a specific direction, they pick up all the sounds coming from that direction, so they cannot actually remove the sounds of the surrounding environment. However, OKI’s innovative area sound enhancement technology makes it possible to pick up only the sounds in a specific area. This means that the utterances of a specific person can be clearly extracted even in cases where the surrounding environment is noisy.

To achieve this technology, we developed sound-source separation technology involving microphone arrays with strong frontward directivity. Two microphone arrays that use this technology are set up at different locations facing the same specific area, and signal processing focused on the relationship between the two obtained speech signals is performed. In this way, our sound enhancement system extracts and picks up only the sounds of the field where the directions of the two microphone arrays overlap. Each microphone array consists of two microphone elements, so our system can pick up only the speech of a person sitting in front of a computer with nothing but four microphone elements.

Our area sound enhancement technology is assumed to be mainly applicable to the remote work and education fields. OKI is currently promoting PoC* work to improve environments related to remote lectures by tutoring schools, universities, and other institutions, customer service remotely provided at home, etc., and we hope to commercialize this technology as soon as possible.



*PoC (Proof of Concept): A simple test to demonstrate the feasibility of a new concept or theory

Optical Signal Processing Technology with Expanding Applications in the Sensing Field

OKI is developing sensing technologies to which the Company applies advanced optical signal processing technologies cultivated over the years in the optical communications field. In September of 2018, we used an original optical signal processing circuit to detect weak reflected light in optical fiber, thereby creating an optical-fiber temperature/distortion sensor product that achieves over 100 times the speed of conventional sensors.

In addition, in October of 2020, we applied this optical signal processing technology to develop a multi-point laser vibrometer that uses laser light to measure the vibration and speed of the target object without making contact. Conventional laser vibrometers only measure the vibrations at a single point, but our multi-point laser vibrometer can measure the vibrations at multiple points without the need for additional pieces of equipment. Our eventual goal is to combine optical switches, optical

fiber, and multiple sensor heads to measure the vibrations at 100 points up to 600 meters apart using a single optical signal processing unit. By using easily obtainable optical communications components and applying silicon photonics technologies, we will promote the further miniaturization and cost reduction of optical signal processing units in order to achieve high-precision measurement at a low vibrometer price.

OKI is also applying silicon photonics technologies in order to develop ultra-sensitive optical sensor technologies to detect very small quantity of macromolecules and the like by using light resonance. These technologies offer the possibility of instantly understanding a wide range of health conditions based on human blood, sweat, urine, and other substances in the future. We are committed to continuing to achieve optical signal processing technology innovations that help resolve social issues.