超スマート社会推進コンソーシアム
Super Smart Society Promotion Consortium

Super Smart Society Promotion Consortium

Activity Report 2025



Institute of SCIENCE TOKYO

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Preface (On the Launch of a New Project)

The Super Smart Society Promotion Consortium continues its active operations as a cross-sectoral organization with over 60 partners from industry, government, and academia. Furthermore, by working in close collaboration with the WISE-Super Smart Society (SSS) Program, which brings together diverse faculty members from across various fields within the university, it serves as a next-generation social collaborative education and research platform that integrates everything from human resource development to R&D. Through these initiatives, we strongly promote the development of leaders who will support a Super Smart Society (Society 5.0).

One and a half years have passed since Science Tokyo was established through the merger of the former Tokyo Institute of Technology and the former Tokyo Medical and Dental University in October 2024. As the structure of the new university has taken shape, and following its designation as a University for International Research Excellence in early 2026, the entire university is making concerted efforts to elevate the momentum of the merger to an even higher level. Against this backdrop, this consortium operates under the Institute of New Industry Incubation, which was established alongside the new university. In the 2025 academic year (AY2025), we launched the Super Smart Society Promotion Project 2.0 to promote the creation of new industries and cultivate future talent who will play a key role in a Super Smart Society by further strengthening organic collaboration among industry, government, and academia, and leveraging and expanding upon the valuable assets of the education and research platform we have built to date. In this project, we aim to promote the social implementation of research outcomes and the creation of new industries by expanding our technological domains beyond traditional science, engineering, and informatics to include medical and dental sciences as well as nursing, and by leading cross-sectoral collaboration among industry, government, and academia. Furthermore, by strengthening international collaboration to build a global ecosystem, we are working to solve societal challenges with a clear vision for the realization of a Super Smart Society. We will strive to ensure that these new challenges lead to cutting-edge practices in convergence science toward the realization of a sustainable society.

Kentaro Nakamura
Director General of the Institute of New Industry Incubation, Institute of Science Tokyo



Super Smart Society Promotion Consortium Activity Report (2025 Academic Year)

1. Overview of Activities in the Eighth Year (AY2025)

1.1. What is the Super Smart Society Promotion Consortium?

The Super Smart Society Promotion Consortium was established in October 2018 with the aim of co-creating a next-generation social collaborative education and research platform that integrates everything from human resource development to R&D through industry-government-academia collaboration, in order to cultivate leaders who will drive the advancement of the upcoming Super Smart Society (Society 5.0). As of April 2026, a total of 66 Consortium Partners (excluding individual members), including research institutes, local governments, and private companies listed in Table 1-1, are participating in this consortium to promote open innovation and open education in support of a Super Smart Society.

The Super Smart Society Promotion Consortium consists of four committees, as shown in Figure 1-1. 1) The New Industry Incubation Committee provides networking opportunities for the creation of new industries, with activities including planning the Super Smart Society Promotion Forum and promoting public awareness through One-day Schools. 2) The Social Collaborative Education Committee engages in human resource development and career support through collaboration with the WISE-Super Smart Society (SSS) Program (established at the former Tokyo Institute of Technology in April 2020), as well as supporting off-campus projects (internships). 3) The Interdisciplinary Research Promotion Committee coordinates R&D teams by holding matching workshops and developing SSS Research and Education fields. 4) The Global Alliance Committee aims to build a global ecosystem. This report summarizes the activities of these various committees during AY2025.

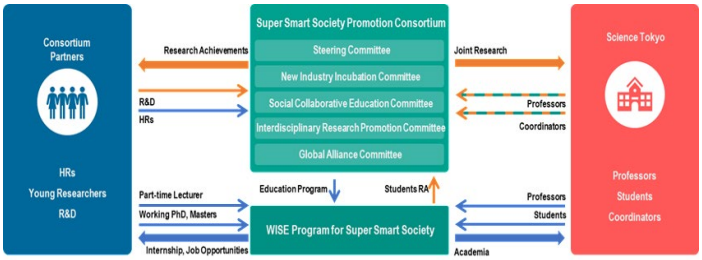


Figure1-1 Organization of the consortium

Table1-1 Consortium partners (As of April 2026)

1	Tokyo Institute of Technology	34	DENSO IT Laboratory, Inc.
2	Tokyo University of Marine Science and Technology	35	Tokyu Research Institute, Inc.
3	Japan Agency for Marine-Earth Science and Technology	36	Tressbio Laboratory Co., Ltd.
4	Information Technology and Human Factors, National Institute of Advanced Industrial Science and Technology	37	NSK Ltd.
		38	NEC Corporation
5	ICT Testbed Research and Development Promotion Center, National Institute of Information and Communications Technology	39	Panasonic Automotive Systems Co., Ltd.
		40	Hitachi, Ltd.
6	National Agriculture and Food Research Organization	41	FUJITSU LIMITED
7	RIKEN Center for Advanced Intelligence Project	42	Honda Research Institute Japan Co., Ltd.
8	National Institutes for Quantum and Radiological Science and Technology	43	Mazda Motor Corporation
9	aiwell Inc.	44	MITSUBISHI ESTATE CO., LTD.
10	ITD Lab Corporation	45	Mitsubishi Jisho Design Inc.
11	Azbil Corporation	46	Mitsubishi Electric Corporation
12	aptpod,Inc.	47	MONET Technologies Inc.
13	Idemitsu Kosan Co.,Ltd.	48	YASKAWA Electric Corporation
14	ITOKI CORPORATION	49	Yokogawa Electric Corporation
15	ACSL Ltd.	50	Rakuten Mobile, Inc.
16	AGC Inc.	51	Ricoh Company, Ltd.
17	Science & Technology Research Laboratories, NHK STRL	52	Ministry of Agriculture, Forestry and Fisheries
18	NTT, Inc.	53	Iwata City
19	NTT Urban Solutions, Inc.	54	Ota City
20	LG Japan Lab Inc.	55	Kawasaki City
21	ORNIS Corporation	56	Sagamihara City
22	Kawasaki Heavy Industries, Ltd.	57	Meguro City
23	Kubota Corporation	58	City of Yokohama
24	KDDI Research, Inc.	59	National Institute of Technology, Tokyo College
25	KODEN Holdings Co., Ltd.	60	Kanto Head Office, Organization for Small & Medium Enterprises and Regional Innovation, JAPAN
26	Komatsu Ltd.		
27	JTEKT CORPORATION	61	Ocean Policy Research Institute, The Sasakawa Peace Foundation
28	JFE Engineering Corporation	62	Institute for Marine Culture and Research Promotion
29	Square Roots Japan	63	The Ecozzeria Association
30	SoftBank Corp.	64	Japan Electronics and Information Technology Industries Association
31	Daikin Industries, Ltd.	65	Marine Open Innovation Institute
32	TsukArm Robotics Inc.	66	Japan Plant Factory Association
33	DENSO Corporation		

1.2. Activity Highlights of the Eighth Year (AY2025)

Table 1-2 provides an overview of the activities and events of the Super Smart Society Promotion Consortium during its eighth year (AY2025), together with the corresponding committees. The Joint Committees met four times during the year to plan initiatives aimed at new industry incubation and various events with Consortium Partners. In AY2025, we expanded the scope of on-campus collaboration; for instance, a joint Matching Workshop held in June with the InfoSyEnergy Consortium resulted in a record-high 58 matches, demonstrating highly active engagements.

Beginning in AY2025, the Super Smart Society Promotion Project was upgraded to version 2.0. This new phase shifts focus toward promoting the creation of new industries through organic collaboration among industry, government, and academia, utilizing the education and research platform established in version 1.0 as a foundation.

Against this backdrop, the 11th SSS Promotion Forum was held in September 2025 under the theme “Future of Semiconductor Technology for a Super Smart Society,” where participants discussed future-oriented challenges for semiconductors and the potential for new industry creation. The 12th SSS Promotion Forum, held in March 2026 and titled “The Dawn of Autonomous Driving in Japan,” shared comprehensive insights into key technologies supporting autonomous driving, such as communication coordination, expressway initiatives, and risk assessment. The details of these and other events are summarized in this activity report.

To promote open innovation and open education, the consortium has established nine SSS Research and Education fields to date, as shown in Table 1-3. These fields serve as microcosms of our envisioned Super Smart Society and function as an open platform that any Consortium Partner can utilize for technical verification toward industrialization.

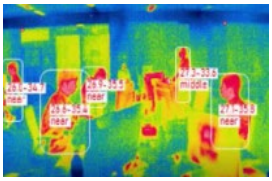
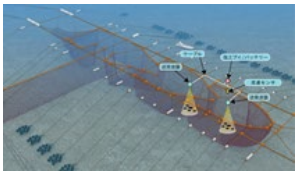
In light of the Science Tokyo-wide “Visionary Initiatives (VI)” research framework introduced in April 2025 and the official designation as a “University for International Research Excellence” in early 2026 (to be fully implemented from AY2026), the consortium will gather its accumulated technologies, knowledge, and human resources. We remain committed to promoting the co-creation of a Super Smart Society that contributes to a brighter future for humanity by solving social challenges through industry-government-academia collaboration aimed at creating new industries.

Table1-2 SSS Promotion Consortium activities in AY2025

Month	Events	Committee
Apr.-May	SSS Innovation A6	(2)
May	26th Joint Committee	(1)(2)(3)
June	SSS & ISE Matching Workshop (Spring 2025)	(3)
June-July	SSS Innovation A5	(2)
July	BLUE ECONOMY EXPO	(1)
Sep.	11th SSS Promotion Forum	(1)
Oct.	27th Joint Committee	(1)(2)(3)
Oct.-Nov.	SSS One-day School	(1)
Oct.-Nov.	SSS Innovation A4	(2)
Nov.	SSS Matching Workshop (Autumn 2025)	(2)
Dec.	28th Joint Committee	(1)(2)(3)
Dec.-Feb.	SSS Innovation A7	(2)
Feb.	29th Joint Committee	(1)(2)(3)
Mar.	12th SSS Promotion Forum	(1)

(1) The Super Smart Society Promotion Committee
(2) The Social Collaborative Education Steering Committee
(3) The Interdisciplinary Research Promotion Committee
SSS: Super Smart Society

Table1-3 SSS Research and Education fields

Smart Mobility	Smart Robotics	Quantum Science
		
A platform for new smart mobility services by utilizing automated driving vehicles and cutting-edge technologies, such as digital twin, 5G/6G, and millimeter wave V2X.	A platform for utilizing robots in the fields of land, sky, aqua, and manufacturing. We are conducting research about four-legged robots for outdoor field (land), drones (sky), underwater robots and drones (aqua), and digital manufacturing technology, etc.	A platform for quantum computing and quantum sensors for the next generation. We are conducting research and application of ultrafast next-generation quantum computers and ultrasensitive quantum sensors.
Artificial Intelligence	**Smart Workplace**	**Smart Agriculture**
		
A platform for artificial Intelligence (AI), The supercomputer “TSUBAME” and Wi-Fi 6 are used to build a platform for the use of machine learning services.	A platform for smart workplaces with the aim of establishing better workplaces. We are building workplaces for the post-COVID-19 era, including air conditioning control using a variety of sensors and AI.	A platform for smart agriculture in response to problems related to small-scale agriculture in Japan. We are working on remote agricultural technology that enables automated and stable production of high-quality crops by fully utilizing AI, IoT, and robotics Technology.
Smart Infrastructure Maintenance	**Smart Building**	**Smart Ocean**
		
A platform for achieving Sustainable Infrastructure (SSI), which supports our life and society. Its goal is to ensure secure maintenance of infrastructure and to enhance urban functionality and resilience.	A platform for evaluating the safety and continuity of use of buildings and providing occupants with early notification of building conditions in the event of earthquakes and typhoons. The platform uses data from high-performance sensors densely installed in buildings.	A platform for marine digitalization to visualize the flow of information in the ocean and demonstrate optimization techniques over industry boundaries for sustainable ocean use.

5G/6G: 5th/6th Generation mobile communication system,
V2X: Vehicle to Everything(X),
AI: Artificial Intelligence,
IoT: Internet of Things.

2. Activities of the Super Smart Society Promotion Committee

2.1. Super Smart Society Promotion Forum

In AY2025, the Super Smart Society Promotion Forum was held twice, once in the spring and once in the fall semester.

(1)11th Super Smart Society Promotion Forum: “Future of Semiconductor Technology for a Super Smart Society”

To realize a Super Smart Society where ICT enables vibrant and comfortable living, manufacturing that links advanced technologies like AI to daily convenience is a vital element. While AI has become a familiar service via cloud computing and smartphones, semiconductor technology remains the core supporting our society, with high expectations for further technological progress. On September 26, 2025, we held a forum titled “Future of Semiconductor Technology for a Super Smart Society” to introduce insights from the dual perspectives of social needs and future trends, as well as technological seeds and industrial trends (Figure 2-1). The event featured global discussions on future-oriented challenges and the potential for creating new industries through industry-government-academia collaboration.

The forum was organized by the SSS Promotion Consortium and co-hosted by Science Tokyo and the Academy for Super Smart Society.

Sponsorship was provided by the IEEE Japan Council, the Japan Society of Applied Physics (JSAP), the Society of Instrument and Control Engineers (SICE), the Optoelectronics Industry and Technology Development Association (OITDA), the Information Processing Society of Japan (IPSJ), the Japan Electronics and Information Technology Industries Association (JEITA), the Institute of Electronics, Information and Communication Engineers (IEICE), the Architectural Institute of Japan (AIJ), and MIRAI SOUZOU INVESTMENTS Inc. Additionally, the forum received support from the Japan Electronic Device Industry Association (NEDIA), the Kuramae Kogyokai alumni association, the cities of Iwata and Kawasaki, the wards of Ota and Meguro, the Yokohama Economic Affairs Bureau, Integrated Green-niX, the EISESiV Consortium, and the Collaborative Research Consortium for Integrated System Materials.

To begin, Kentaro Nakamura, Director General of the Institute of New Industry Incubation at Science Tokyo, delivered opening remarks, passionately speaking about the university's strong commitment to semiconductor technology.

Following this, six distinguished speakers delivered lectures, culminating in a panel discussion featuring all the speakers (Figure 2-2). An overview is provided below.

[Keynote Speech 1] Japan's Semiconductor Policy

Kento NISHIJIMA (IT Industry Division, Ministry of Economy, Trade and Industry)

Mr. Nishijima presented the importance of semiconductors as an indispensable digital foundation of modern society and outlined the prospects of Japan's national strategy. In light of the importance of semiconductors and geopolitical risks, the understanding was shared that building a resilient domestic



Figure2-1 11th SSS Promotion Forum program



Figure2-2 Group photo at 11th forum

supply chain is essential. He outlined a policy aiming for domestic sales exceeding 15 trillion yen by 2030, which seeks to leverage over 50 trillion yen in public-private investments through more than 10 trillion yen in public support under the "Framework for Strengthening AI and Semiconductor Industrial Bases." Furthermore, he highlighted plans to promote next-generation semiconductor development, human resource cultivation, and international cooperation.

[Lecture 1] Semiconductor Market and Technology Trends
~ The super-smart society is built on semiconductors ~

Takayuki KOMORI (SUMCO CORPORATION)

Mr. Komori discussed the importance and technological innovations of semiconductors in a Super Smart Society. He introduced how semiconductors continue to evolve by overcoming the limitations of miniaturization through new technologies such as three-dimensional (3D) integration and chiplets. He emphasized that by leveraging Japan’s strengths in semiconductor materials and manufacturing equipment, there is a strong potential to re-accelerate the industry through industry-government-academia collaboration, thereby realizing a sustainable and prosperous society.

[Lecture 2] Technology Evolution in the Chiplet Era Driven by Solution SoC

Shinichiro Ikeda (Socionext Inc.)

Mr. Ikeda explained Socionext's collaborative business model, "Solution SoC," and chiplet technology designed to overcome the limitations of Moore's Law and the memory wall accompanying the evolution of AI. He introduced 2.5D/3D packaging, design, and testing technologies promoted by the company, and emphasized that collaboration across corporate boundaries within an ecosystem is becoming crucial in increasingly complex manufacturing and testing processes.

[Lecture 3] Memory-Centric AI
~ Flash Memory for Generative AI ~

Jun Deguchi (Kioxia Corporation)

Dr. Deguchi explained the importance of "Memory-Centric AI," which improves AI performance and functionality through the volume of accumulated knowledge, to address the challenges of conventional computation-dependent AI. He introduced Retrieval-Augmented Generation (RAG) and the company's proprietary algorithm for high-speed searching of vast vector data on SSDs, pointing out that semiconductor storage is indispensable for next-generation AI alongside GPUs and DRAM.

[Lecture 4] Fujitsu's High-Performance CPU for HPC

Naoki Shinjo (Fujitsu Limited)

Mr. Shinjo reviewed the development history of Fujitsu's high-performance CPUs for supercomputers such as "K computer" and "Fugaku," and explained the features of energy-saving CPUs for next-generation data centers. Furthermore, he presented the prospects of "Fugaku NEXT," which integrates AI with High-Performance Computing (HPC), expressing a commitment to supporting the global computing foundation with Japan's cutting-edge technologies.

[Lecture 5] Status and future prospects of photonic-electronic convergence technology

Nobuhiko Nishiyama (Institute of Science Tokyo)

Prof. Nishiyama explained the importance of optoelectronic integration technology to solve data communication challenges in the AI era, and outlined the prospects of large-scale optical circuits through heterogeneous integration. Additionally, he discussed initiatives for cultivating practical semiconductor design talent through the Future Co-Creation Semiconductor Innovation Arena (SiCA) led by Science Tokyo, as well as support for prototyping and measuring cutting-edge devices through the Advanced Research Infrastructure for Materials and Nanotechnology in Japan (ARIM).

[Panel Discussion]

Facilitator: Hitoshi Wakabayashi (Institute of Science Tokyo)

To conclude, a panel discussion was held with the speakers, facilitated by Prof. Wakabayashi of the Institute of Integrated Research at Science Tokyo (Figure 2-3). The panel discussion began with "functions that could be realized with semiconductor integrated circuits" and expanded into a grand vision of a "Super Smart Society realized through future semiconductor integrated circuits," sparking lively discussions in the venue, including on social deployment.



Figure2-3 Panel discussion at 11th Forum

The forum was held in a hybrid format with both in-person and online participation, attracting 80 in-person attendees and 212 online attendees, for a total of 292 participants. In the post-event survey, the forum received high ratings, with 88.9% of respondents expressing that they were either "satisfied" or "somewhat satisfied."

(2)12th Super Smart Society Promotion Forum: "The Dawn of the Autonomous Driving Era in Japan: A challenge of realizing an autonomous driving society"

To realize a Super Smart Society based on digital technologies, establishing social infrastructure that reliably connects advanced technologies such as AI to the improvement of daily convenience and safety is indispensable. The core domain of this effort is "Smart Mobility," which requires AI technologies to support autonomous driving, infrastructure coordination with roads and telecommunications, institutional design and operational environments to ensure acceptance as a safe and secure means of transportation, and the creation of a comprehensive framework including risk assessment. In Japan, which faces a declining birthrate and an aging population, securing sustainable regional transportation and improving the productivity of society as a whole are urgent challenges, and autonomous driving serves as a crucial key to solving them. Japan's integrated advancement of policy, technological development, and demonstration can serve as a leading model contributing to the realization and development of a global Super Smart Society.

Against this backdrop, the Super Smart Society Promotion Consortium held its 12th forum on Thursday, March 19, 2026, under the title "The Dawn of Autonomous Driving in Japan: Challenges Toward the Realization of an Autonomous Driving Society" (Figure 2-4).

At this forum, 12 leading experts and key figures delivered lectures covering a wide range of topics, including policy trends, regional implementation, technological innovation, road infrastructure, communication infrastructure, risk management, and the future vision of mobility coexisting with humans (Figure 2-5).

The forum was organized by the Super Smart Society Promotion Consortium and co-hosted by Science Tokyo, the Academy of Super Smart Society, and the Visionary Initiative: Innovative-Life Society. This forum was sponsored by the Japan Electronics and Information Technology Industries Association (JEITA), the Institute of Electronics, Information and Communication Engineers (IEICE), the Information Processing Society of Japan (IPSJ), the IEEE, the Japan Society of Applied Physics (JSAP), and the Society of Instrument and Control Engineers (SICE). In addition, many mobility-related organizations, including ITS Japan, the Toyota Mobility Foundation, the Japan Automobile Manufacturers Association (JAMA), and the Society of Automotive Engineers of Japan (JSAE), as well as the ASPIRE (Adopting Sustainable Partnerships for Innovative Research Ecosystem) program of the Japan Science and Technology Agency (JST), supported the forum. The forum also received support from Iwata City, Ota City, Meguro City, and the Kuramae Kogyokai alumni association.

In the opening remarks, Dr. Tetsushi Furukawa, Vice President of Institute of Science Tokyo, introduced the university's mission, "Advancing science and human well-being to create new value together with society," and encouraged attendees to join the Super Smart Society Promotion Consortium. Following this, 12 distinguished speakers delivered lectures, starting with a keynote speech by Mr. Shoichi Takeshita of the Ministry of Land, Infrastructure, Transport and Tourism. An overview of the lectures is provided below.

[Keynote Speech 1] Autonomous Driving from the Perspective of Road Infrastructure

Shoichi Takeshita (Ministry of Land, Infrastructure, Transport and Tourism)

Mr. Takeshita introduced various initiatives to achieve autonomous driving in Japan, highlighting demonstration tests on road-vehicle cooperation and driving space development in the road infrastructure sector.

[Keynote Speech 2] Regional Mobility DX Triggered by Autonomous Driving through Industry–Academia–Government–Community Co-Creation

Koichi Ota (Nagano Prefecture, Shiojiri City)

Mr. Ota presented a case study from Shiojiri City, where local residents—including women raising children—support the deployment of Level 4 autonomous driving and regional transport DX through "KADO," an initiative promoting flexible short-time work.

[Lecture 1] TIER IV's Autonomous Bus Technology: Overview and Initiatives

Yuki Iida (TIER IV, Inc)

Mr. Iida introduced autonomous driving technology using the open-source software "Autoware" along with bus operation results including Level 4 permits, and outlined the latest trends and progress from nationwide field tests toward practical implementation to solve local transport challenges.



Figure2-4 12th SSS Promotion Forum program



Figure2-5 Group photo at 12th Forum

[Lecture 2] Efforts and Challenges Toward the Realization of Autonomous Truck Line-Haul Transportation Services

Shigeto Itaya (T2 Inc.)

Mr. Itaya presented a business vision utilizing autonomous trucks, current activities, and the key challenges identified in achieving practical implementation.

[Lecture 3] Autonomous driving for large vehicles

Masaya Segawa (Advanced Smart Mobility Co., Ltd.)

Mr. Segawa presented initiatives aimed at the widespread adoption of autonomous heavy vehicles, such as buses and trucks, along with the challenges of deploying them in real-world traffic environments.

[Lecture 4] Creating Intelligent Mobility for Safe and Secure Everyday Transportation

Motoki Shino (Institute of Science Tokyo)

Professor Shino presented research outcomes on developing intelligent mobility aimed at safe and secure daily transportation.

[Lecture 5] Initiatives to Address Communication Challenges for Level-4 Autonomous Driving Deployment

Takuya Miyazawa (Rakuten Mobile, Inc.)

Mr. Miyazawa outlined Rakuten Mobile's efforts in Saga City to address communication challenges for autonomous driving, conducted under the Ministry of Internal Affairs and Communications' FY2025 "Regional Society DX Promotion Package Project (Level 4 Verification Type)."

[Lecture 6] Automated Driving and V2I Cooperation Enabled by Highly Reliable, Always-Connected Communications

Shinsuke Funakoshi (NTT DOCOMO BUSINESS, Inc.)

Mr. Funakoshi presented that uninterrupted communication and road-vehicle cooperation are key technical elements for achieving Level 4 autonomous driving.

[Lecture 7] Digitalized Infrastructure Maintenance for a Smart Society

Masafumi Nakata (Mitsubishi Electric Corporation)

Mr. Nakata presented technologies to digitalize the condition of road surfaces, bridges, tunnels, and ancillary facilities, emphasizing that advancing and digitalizing infrastructure maintenance is essential for the practical deployment of autonomous driving.

[Lecture 8] SOMPO’s Challenge for Next-Generation Mobility

Tatsuya Watanabe (Sompo Japan Insurance Inc.)

Mr. Watanabe presented insurance solutions for the next-generation mobility sector in addition to existing insurance services, aimed at supporting an autonomous driving society.

[Lecture 9] Development and Field Demonstration and Validation of an Autonomous Driving Road-to-Vehicle Cooperation System

Shingo Sumi (Panasonic System Networks R&D Lab. Co., Ltd.)

Mr. Sumi presented development and demonstration cases of road-vehicle cooperative systems across various applications, such as safety support for manually driven vehicles and traffic analysis, in addition to expanding operational design domains (ODD) and enabling smoother driving for autonomous vehicles.

[Lecture 10] Creating New Value in Mobility through Real-Time Digital Twins

Kei Sakaguchi (Institute of Science Tokyo)

Based on the real-time digital twin demonstrated at the Ookayama Campus, Professor Sakaguchi outlined the new value created by mobility digital twins, such as enhancing safety, optimizing traffic efficiency, advancing AI training for autonomous driving, and achieving highly reliable V2X

Following these lectures, Koichi Shinoda, Chair of the Steering Committee, introduced the activities of the Super Smart Society Promotion Consortium. He expressed his gratitude for the support received and called on the audience for their continued cooperation. The forum was held in a hybrid format with both in-person and online participation, attracting a total of 439 attendees: 140 in person and 299 online.

According to the post-event survey, while first-time attendees of events organized by the Super Smart Society Promotion Consortium accounted for 83% of respondents, 93% expressed a desire to receive information regarding future events, and 63% expressed interest in consortium activities.

In closing, we would like to express our heartfelt gratitude to all the speakers, as well as to the partners of the Super Smart Society Promotion Consortium.

2.2. One-day School

As part of recurrent education for working adults, we once again provided opportunities for practical experience in the Research and Education fields to the partners of the Super Smart Society Promotion Consortium in AY2025. In AY2025, we conducted exercises in five fields: Smart Agriculture, Artificial Intelligence, Smart Mobility, Smart Robotics, and Quantum Science. Table 2-1 shows the status of implementation.

In principle, the maximum number of participants per field was set to 10 to ensure close discussions with the faculty members in charge and to provide all participants with opportunities to directly engage with the Research and Education fields. The One-day School for the Smart Agriculture field was conducted at the Yokohama Campus, the Artificial Intelligence field online, and all other fields at the Ookayama Campus. In this session, 15 people from 6 companies participated, advancing our technical contributions to Consortium Partners through hands-on exercises and lively discussions. In the post-event survey, participants provided feedback commenting that the content, including the hands-on demonstrations, was rich and fulfilling, and expressing the view that it was likely beneficial to many people. Moving forward, we plan to expand the number of fields and broaden their technical disciplines so that Consortium Partners can make even greater use of these Research and Education fields.

Table2-1 One-day School program

Field	Date	Contents (lecture/exercises)
Smart Agriculture	Oct. 16th	Lecture on Ecosystems and Genomics, Aerial photography by drone and hands-on training with agricultural robots, Experiencing farm work
Artificial Intelligence	Oct. 20th	Principles of neural networks, Exercises using Google Colab
Smart Mobility	Oct. 31st	Lectures on autonomous driving, ITS, and next-generation wireless communication technology, Exercises using an autonomous vehicle
Smart Robotics (Sky, Aqua)	Nov. 6th	Basic exercises on Robot Operating System (ROS) 2, Basic lectures on coordinated control of multi-robot systems, Demonstration of multi-robot coordinated control experiments built using ROS 2
Quantum Science	Nov. 14th	Practice concerning the fabrication of superconducting atomic-layer thin film samples that constitute quantum sensors and characterization of their physical properties, Hands-on training on techniques required for qubit device cooling and precise measurements through observation experiments of quantum phenomena

3. Activities of the Social Collaborative Education Steering Committee

3.1. Courses on Super Smart Society Innovation

The Academy for Super Smart Society offers a series of Super Smart Society courses for students enrolled in the program as well as interested master's and doctoral students. With support from consortium members serving as adjunct lecturers, these courses provide omnibus lectures on cutting-edge, real-world challenges to cultivate both specialized expertise and a broad perspective needed to realize a super smart society. Through this curriculum, the program aims to develop leaders who can create innovative science and technology spanning both cyber and physical domains, address societal issues with a comprehensive view from quantum science to a super smart society, and guide sectors across industry, government, and academia.

In AY2025, with the cooperation of Consortium Partners, we started social cooperation courses on Super Smart Society Innovation shown in Table 3-1.

For each course, lecturers—primarily consortium members—created omnibus lecture videos covering cutting-edge topics across various fields, which were delivered on demand so a diverse group of students could learn at their own pace alongside message board discussions. This flexible format was well received by students from various departments across the university, who actively participated in the coursework and provided highly positive feedback on both the content and the delivery method.

Table3-1 Courses on Super Smart Society Innovation

Courses		Students (AY2025)	Starting AY
A4	Smart Workplace	220	2022
A5	Production Process Innovation	228	2023
A6	Smart Ocean	190	2024
A7	Quantum Science and Technology Close at Hand	178	2025
Total		816	

To keep pace with rapid technological advances, this lecture series adds about one topic each year and limits all courses to a four-year run, ensuring the overall program stays updated with fresh themes and the latest trends. Accordingly, in AY2025, "A7: Accessible Quantum Science and Technology" was added, while "A3: Frontlines of Smart Agriculture" was suspended after reaching its four-year limit. In AY2026, we plan to introduce "New Smart Agriculture" as the successor to "A3," alongside a new topic, "Smart Healthcare." We look forward to your continued cooperation.

3.2. Ota City Start-up Entrepreneurship Off-Campus Project

The Ota City Start-up Entrepreneurship Off-Campus Project is a collaborative initiative with Ota City, Tokyo, that launched in AY2021 as the "Ota City Start-up Entrepreneurship Experience Seminar." The following year, it was restructured into a seven-day program and introduced as a formal credit course with two adjunct lecturers. It has since evolved to provide diverse learning opportunities that expose students to entrepreneurship, including mentoring sessions and tours of local facilities.

Since AY2023, the project has offered two separate courses—one for master's students and another for doctoral students—to deliver learning tailored to each academic stage. The master's course, "Ota City Start-up Entrepreneurship Experience Off-Campus Project," aims to help students understand entrepreneurship as a career option through lectures on business experiences by executives from former Tokyo Tech spin-offs and basic exercises on starting a business. Meanwhile, the doctoral course, "Ota City Start-up Entrepreneurship Practice Off-Campus Project," targets students interested in entrepreneurship, offering a practical curriculum aimed at commercializing research topics through the creation of concrete business plans.

In AY2025, the project featured a lecture by Takashi Kawaguchi, President of Sigma Energy Inc. (a former Tokyo Tech spin-off), alongside fieldwork unique to this collaboration with Ota City. Students visited distinctive local facilities that are typically hard to access, including advanced incubation centers and small factories. These site visits covered a wide range of locations—such as HANEDA INNOVATION CITY (HIC), Institute of Science Tokyo Hospital, Techno FRONT Murasaki, and the Tokyo Stock Exchange—giving participants a stimulating learning experience through direct explanations from facility representatives (Figure 3-1). Additionally, as part of the master's program group work, students developed business proposals for the "Ookayama Technology Town



Figure 3-1 Scene from the Scene from the tour of Institute of Science Tokyo Hospital

Concept," a "Small Factory–Student Collaboration System Connecting Technology to the Future," and "XR Entertainment." Overall enrollment for the project in AY2025 was 1 student in the doctoral "Practice" course and 15 students in the master's "Experience" course.

3.3. Tours of Consortium Partners

Since AY2023, the consortium has hosted student study tours at member organizations. These tours aim to foster networking between participating organizations and students—primarily master's students enrolled in or prospective members of the Academy for Super Smart Society—by enabling them to visit actual worksites, engage in technical discussions with professionals, and explore potential joint research or internship opportunities.

In AY2025, five organizations hosted these tours, as shown in Table 3-2 (listed in chronological order) and Figure 3-2.

The tours remain highly popular among students, and we have already received numerous inquiries from member organizations regarding the AY2026 tours. We look forward to the continued support and cooperation of all consortium members.

Table3-2 Tour of Consortium Partners

	Consortium Partner	Participants
1	Science & Technology Research Laboratories, NHK STRL	9
2	Azbil Corporation	3
3	AGC Inc.	8
4-1	National Institutes for Quantum Science and Technology (QST)	2
5	Japan Plant Factory Association	8
4-2	National Institutes for Quantum Science and Technology (QST)	3



Figure3-2 Scene from the tour of the Japan Plant Factory Association

4. Activities of the Interdisciplinary Research Promotion Committee

4.1. Matching Workshops

In AY2025, matching workshops were held twice. The spring session (June 4) was co-hosted for the first time with another consortium, the InfoSyEnergy Consortium, to strengthen collaboration between the two entities (Figure 4-1). The autumn session (November 26) featured enhanced presentations from Tokyo University of Marine Science and Technology, a member institution, in addition to our university, and was organized with a focus on co-creation between external participating organizations and the university. Both sessions consisted of the S-Round (Seeds Round) where students from Science Tokyo and Tokyo University of Marine Science and Technology presented their research seeds, the N-Round (Needs Round) where participating organizations of the Super Smart Society Promotion Consortium presented their needs, and a networking event to emerge and promote collaboration by connecting both parties. The number of successful matches was 58 for the spring session (58 students, 24 organizations) and 55 for the autumn session (51 students, 21 organizations). Going forward, we will support the consortium's contribution to the VI by promoting interdisciplinary research.



Figure4-1 Matching Workshop (Spring, 2025)

4.2. Development of SSS Research & Education fields

4.2.1. Smart Mobility

The Smart Mobility Research and Education field develops and demonstrates automated driving, the digital twin (DT) infrastructure that supports it, and traffic safety services. It serves both as an education platform for students in the WISE Program for Super Smart Society (WISE-SSS Program) and as a hub for collaboration with Consortium Partners and research institutions in Japan and abroad. In AY2025, our work centered on the Smart Mobility Digital Twin (SMDT): we continued to implement and field-test DT applications for mobility, while expanding our research platform and assessing its potential for real-world deployment through international joint research and public exhibitions.

Our first focus was cooperative automated driving based on the SMDT. At hazardous locations such as intersections, sensors on Road Side Units (RSUs) monitor surrounding traffic over a wide area in real time, and this information is integrated into the DT. Instead of relying solely on each vehicle's own decisions, the DT oversees the entire intersection and directly coordinates multiple vehicles so that they pass through safely and efficiently. Field experiments confirmed that this approach improves safety while keeping traffic flowing smoothly, demonstrating the effectiveness and feasibility of SMDT-based cooperative driving at intersections (Figure 4-2).

For pedestrians, we developed and tested a system that uses augmented reality (AR) glasses to reveal vehicles hidden in blind spots and to warn of approaching hazards. Using RSU sensors and edge servers, the system detects nearby objects, predicts their trajectories and potential collisions, and manages the results in a hierarchical DT. It then displays hidden vehicles on the pedestrian's AR glasses in real time, with warnings scaled to the level of risk. LiDAR-based self-localization correction and a latency compensation mechanism improve both display accuracy and responsiveness. A proof-of-concept (PoC) demonstration confirmed that the DT can provide effective and practical support for pedestrian safety (Figure 4-3).

Internationally, we partnered with Virginia Tech on the Japan-U.S. project "R&D of a Wireless Edge Computing Service Platform for IoFDT (Internet of Federated Digital Twin) to Realize Society 5.0." The project was highly rated, receiving an S grade in its ex-post evaluation.

To share these results, we co-organized and exhibited at the Digital Mobility Society Pavilion at CEATEC 2025, presenting the SMDT concept together with our DT-based automated driving support and pedestrian safety systems (Figure 4-4). The exhibition reached a wide audience from industry, government, and academia, and showcased the scalability of our research platform and its potential for real-world deployment.

Overall, in AY2025 we pursued DT-centered R&D, field demonstrations, international collaboration, and public outreach as one integrated effort. These activities confirmed that the Smart Mobility Research and Education field effectively bridges education, research, demonstration, and social implementation, and they laid the groundwork for new applications and broader international collaboration.

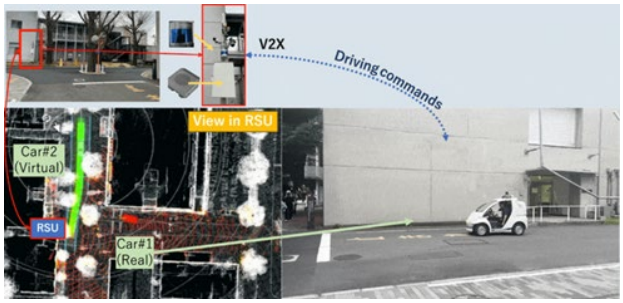


Figure4-2 Cooperative automated driving utilizing SMDT

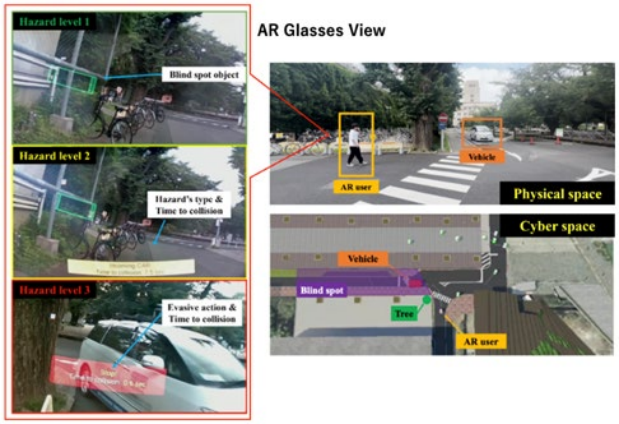


Figure4-3 Blind Spot Visualization and Hazard Notification System Using AR Glasses

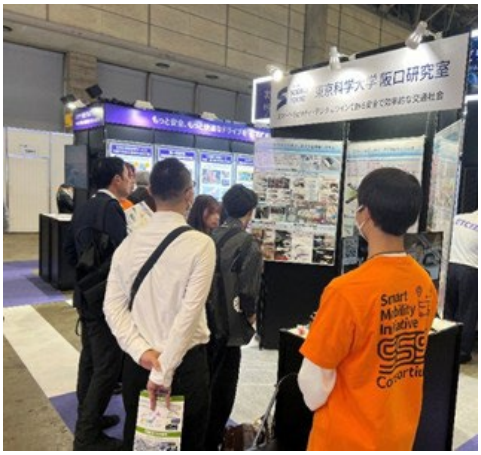


Figure4-4 Exhibition booth at CEATEC 2025

4.2.2. Smart Robotics

- **Robot Zoo Sky**

Robot Zoo Sky was established in AY2019 as a platform to simultaneously control multiple heterogeneous drones and mobile robots. This Research and Education field aims to contribute to the realization of a Super Smart Society by developing efficient and robust environmental monitoring technologies to support the assessment of damage situations after natural disasters. Furthermore, through exercises in this field, students acquire techniques for safely controlling and operating multiple systems connected via networks.

In AY2025, we constructed a novel human-robot collaboration system that separates autonomous control from manual control, utilizing a system integrated into ROS 2 (Robot Operating System 2) that includes NeuralRecon for real-time 3D model construction and AR/VR interfaces developed in the previous academic year (Figure 4-5). This significantly improves the human operability of the robots. Additionally, we constructed human models from operation data obtained through

experiments, enabling the analysis of human-in-the-loop system stability from both theoretical and experimental perspectives. In recognition of these achievements, Prof. Hatanaka, the faculty member in charge was invited to serve as a Plenary Speaker at the international conference Complex Adaptive Systems 2026.

We also conducted the intensive exercise in interdisciplinary research planning (Figure 4-6) and the recurrent education event, One-day School (Figure 4-7). In the One-day School, we provided lectures on how to use ROS 2 through exercises and classroom learning, and confirmed its effectiveness through experimental demonstrations.

Under the framework of WASP (Wallenberg AI, Autonomous Systems and Software Program), seven PhD students from multiple universities in Sweden and two faculty members from Lund University visited Science Tokyo and held a workshop (Figure 4-8), where experimental demonstrations of Robot Zoo Sky and Aqua were conducted. The event concluded successfully, highlighted by inquiries from visitors regarding future collaboration.

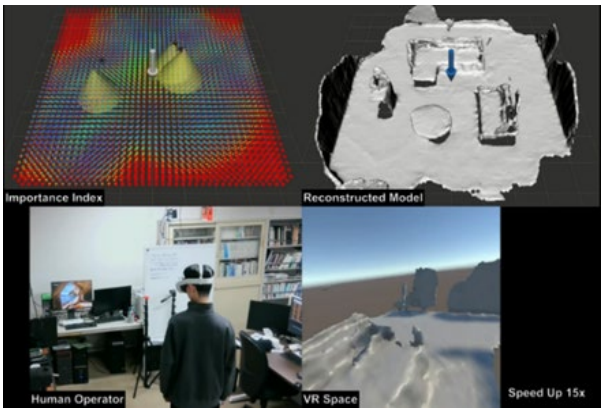


Figure4-5 Integration of 3D reconstruction through autonomous control and VR-based manual control

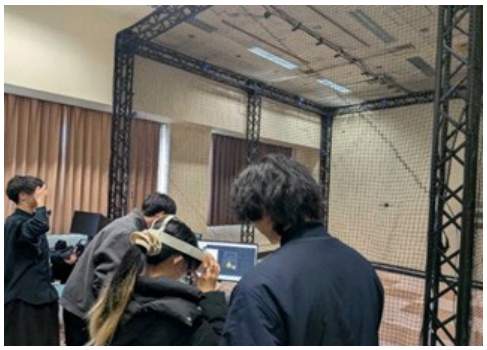


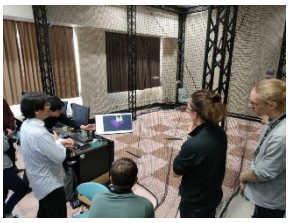
Figure4-6 Interdisciplinary Research Planning



Figure4-7 One-day School







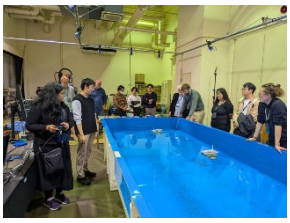


Figure 4-8 WASP-Science Tokyo Joint Workshop

- **Robot Zoo Aqua**

Robot Zoo Aqua aims to significantly expand the field of robot activity into water environments. This Research and Education field was established in the experimental room for the Systems and Control Engineering Department of the School of Engineering (Ookayama Campus).

We expanded the coordinated control testbed for multiple uncrewed surface vehicles (USVs) to build a system capable of controlling five USVs simultaneously (Figure 4-9). Furthermore, a paper on aquatic environmental monitoring, which received the Best Student Paper Award at the 2024 IEEE Conference on Control Technology and Applications, was accepted as a Regular Paper in IEEE Transactions on Control Systems Technology. A photograph from Robot Zoo Aqua also graced the cover of the IEEE Control Systems Society's Publication Content Digest (Figure 4-10).

The development of a new underwater humanoid robot was completed. Similar to the previous model, it is built at a 1/2 scale of the actual human body but utilizes waterproof motors for all

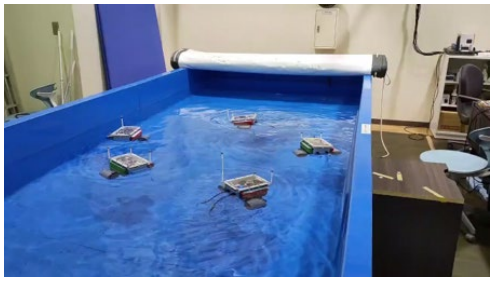


Figure 4-9 Cooperative control platform of five USVs

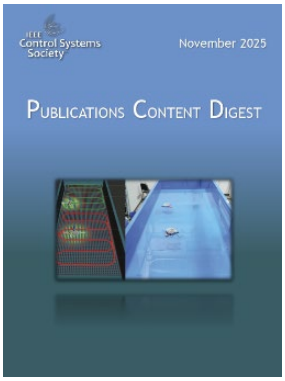


Figure 4-10 IEEE Control Systems Society Publication Content Digest (November)

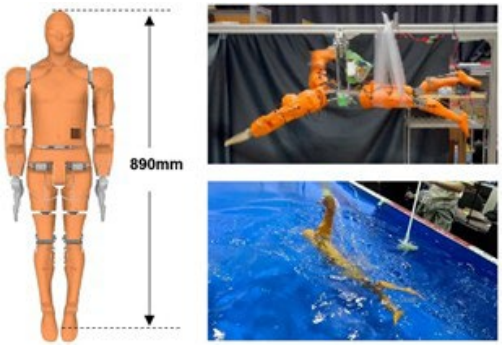


Figure 4-11 New underwater humanoid robot



Figure 4-12 Penguin-shaped Flapping-wing Underwater Robot

joints, simplifying the structure by eliminating the need for sealing treatments. Initial motion tests on land and swimming trials in a still-water tank have commenced (Figure 4-11). While parameter adjustments are still underway and swimming remains unstable, basic performance is proving to surpass the previous model, with full-scale operation expected soon.

Furthermore, research continues on a Penguin-shaped Flapping-wing Underwater Robot (Figure 4-12). In AY2025, the mechanism was redesigned to reduce the frontal projected area, aimed at low-resistance and high-speed swimming. The results will be presented at a domestic conference in June 2026.

- **Robot Zoo Land**

Robot Zoo Land consists of robot platforms for education and research (such as collaborative robots and multifunctional robot actuator modules) and facilities for prototyping, evaluation, and control of robots—including digital signal processors and controller devices, high-speed motion capture systems for control, high-precision GNSS+INS (Global Navigation Satellite System + Inertial Navigation System) hybrid equipment, and multiple carbon fiber-reinforced nylon 3D printers. Using this equipment, we offer 5G-, IoT-, and AI-driven smart robotics education and research programs, aiming to advance practical research that addresses societal challenges like disaster response, infrastructure maintenance, and aging populations.

In AY2025, we conducted experiments using 5G—a high-speed, low-latency wireless technology—on a mobile manipulator (a mobile robot equipped with a robotic arm; Figure 4-13). Tasks such as robot motion planning require heavy computation, which can be difficult to execute or take excessive time depending on the onboard computer's performance. To address this, we focused on Multi-access Edge Computing (MEC)—a technology that processes data on a high-performance server placed near the robot via high-speed wireless communication and sends results back, rather than relying on the onboard computer. By combining MEC and 5G to perform motion planning on the server, we developed a system (Figure 4-14) that executes tasks faster than processing solely within the robot. For wireless communication between the robot and server, we used a dedicated high-speed 5G experimental network provided by Rakuten Mobile, a Consortium Partner.

We conducted motion planning experiments using the developed system. We set up a task to recognize a small box on a table using the robot's onboard camera, grasp it, and place it at a target position, then measured the motion planning time for two cases: processing solely on the onboard computer vs. processing on a server using 5G/MEC (Figure 4-15). Experimental results showed that using 5G/MEC reduced computation time by 16% compared to processing solely within the robot.

Next, we conducted experiments on Vision-Language-Action (VLA) models, in which tasks are instructed to the robot using language, and the robot recognizes the environment via cameras to plan and execute actions. We successfully instructed the robot in language to grasp an object and place it in a box or drawer, generating motion on the server for the robot to execute the task. This workload exceeds the computing capacity of the mobile manipulator's onboard computer. We found that even with a high-performance GPU, power consumption would be over three times that required to drive the robot itself, demonstrating that this is an impractical mobile robot design. In contrast, utilizing 5G/MEC demonstrated that VLA models can be used even on compact, lightweight mobile manipulators.

A part of these research results was presented at the Robotics and Mechatronics Conference 2025.

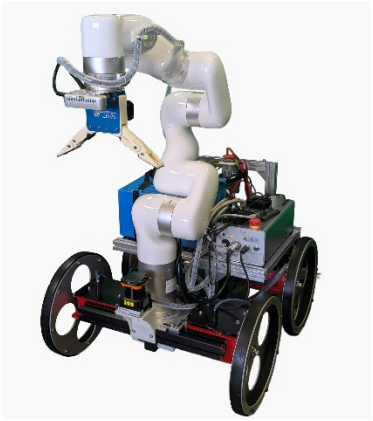


Figure 4-13 Overview of the mobile manipulator

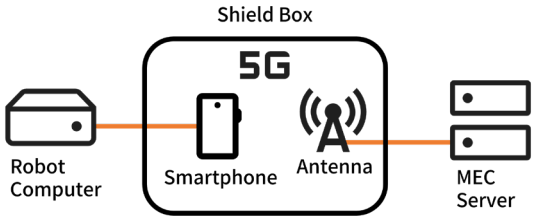


Figure 4-14 Robot–server communication

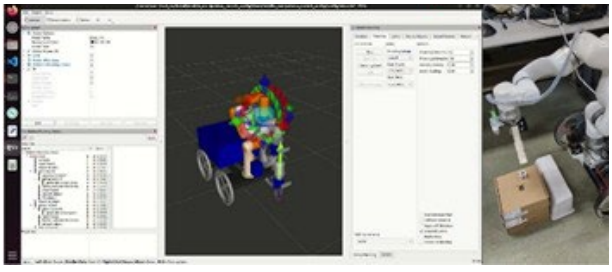


Figure4-15 Motion Planning and Pick-and-Place Experiments Using MEC

- **Robot Zoo Manufacturing**

In AY2025, we compiled interim summaries for several research projects that utilized field resources for design and fabrication. In addition to equipment for creating 3D models and the design and fabrication based on them, this Research and Education field is well-equipped with instruments for measuring mechanical vibrations. These were utilized to conduct theoretical analyses and verify the results through experiments and measurements (Figure 4-16). Examples include developing high-precision, high-quality cutting and drilling technologies for soft materials like biological tissue using vibration, as well as developing CAM (Computer-Aided Manufacturing) software to efficiently manufacture tools designed for optimal cutting performance. We continued research on localized surface modification of complex-shaped parts using plastic forming processes, aiming to establish efficient techniques based on modification mechanisms. We believe that combining the experimental results of these individual technologies with theoretical analysis will lead to practical applications. On-demand video lectures related to this field are scheduled for AY2026 as well, and we hope many students take them and develop an interest in the manufacturing field.

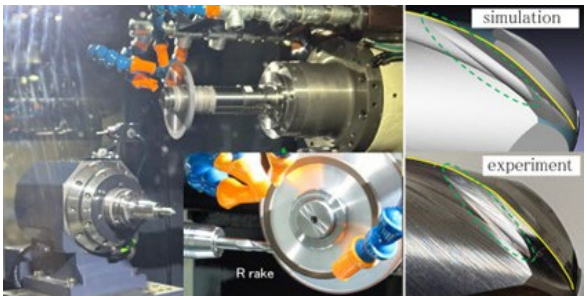


Figure4-16 Evaluation of Grinding Wheel Paths Based on Tool Grinding Experiments

4.2.3. Quantum Science

- **Quantum Computing**

Quantum computers are expected to be ultra-fast next-generation computers based on the principles of quantum mechanics. While conventional computers process information using bits that are either “0” or “1,” quantum computers use qubits, which can exist in a superposition of the “0” and “1” states. Potential applications include machine learning, quantum chemistry calculations, optimization problems, and financial engineering. Quantum computers are also expected to contribute to solving a wide range of information-processing problems that must be addressed in a Super Smart Society.

Research to realize qubits is being actively pursued across various physical systems. While superconducting approaches are among the most advanced platforms, spins in semiconductor silicon quantum dots are also viewed as a promising platform. This approach offers key advantages: it enables future device integration using semiconductor fabrication technology and features a long coherence time, which corresponds to information retention capability.

In this Research and Education field, we conduct advanced quantum technology research and talent development while focusing primarily on research toward realizing large-scale quantum computers using this silicon-based approach. In AY2025, through collaborative research with Consortium Partners at the Ishikawadai Research and Education field (Figure 4-17), we developed and demonstrated key technologies using the qubit implementation and evaluation system shown in Figure



Figure4-17 Quantum Computing Education and Research Field in the Ishikawadai Area

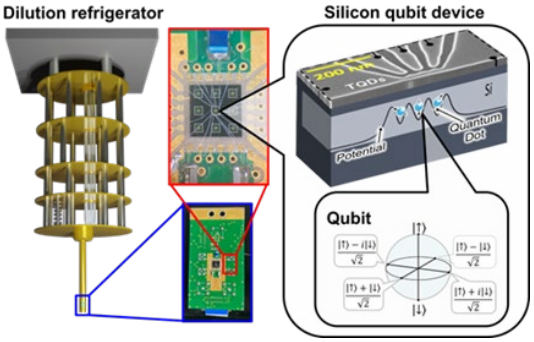


Figure4-18 Semiconductor qubit measurement system

4-18. These include robust control of silicon spin qubits against environmental noise (Institute of Science Tokyo press release, March 17, 2026) and qubit-state classification technology using signal modulation and machine learning for efficient, high-precision qubit readout. Students enrolled in the Academy of Super Smart Society who contributed to these achievements earned multiple presentation awards at domestic and international conferences in recognition of their research. Additionally, we conducted events such as the One-day School for Consortium Partners and practical exercises for enrolled students, offering hands-on training and demonstrations to help participants master high-frequency, precision measurement, cryogenic, and vacuum technologies used in cutting-edge quantum research. Moving forward, we aim to further encourage utilization of these facilities by related companies and National Research and Development Agencies to drive joint research forward.

- **Quantum Sensors**

A sensor is a device that converts physical phenomena or the state of an object into electrical signals. In particular, devices utilizing quantum effects (phenomena in quantum mechanics) are called quantum sensors; offering higher sensitivity than conventional devices and enabling previously impossible detections, they are expected to contribute to the construction of a Super Smart Society.

While various types of quantum sensors exist, we focus particularly on Superconducting Quantum Interference Devices (SQUIDs) sensors, which can detect minute magnetic fields. In AY2025, we advanced the development of high-temperature superconductors a few atomic layers thick to serve as materials for smaller SQUIDs that operate at higher temperatures. As a novel trial, we evaluated the superconducting properties of bismuth telluride (Bi_2Te_3) / iron telluride (FeTe) heterostructures. Although the literature reported superconductivity without fabrication difficulties, preparing this heterostructure proved extremely challenging; through trial and error by a master's

student, signs of superconductivity were observed. Moving forward, we plan to perform more detailed measurements to verify whether a topological superconducting state—combining superconductivity with the topological properties of Bi_2Te_3—can be realized. This special superconducting state hosts Majorana quasiparticles, offering potential applications in next-generation topological quantum computers.

Additionally, in collaboration with Consortium Partners, we began exploring optimal surface oxidation conditions in AY2021 to develop a new quantum sensor utilizing oxygen defects on the surface of silicon carbide (SiC) crystals, a wide-gap semiconductor. Previous research revealed that post-oxidation photoluminescence characteristics vary depending on the periodic structure of the pre-oxidized SiC surface, and that this effect originates from the thickness of silicon dioxide (SiO2) layer. In AY2025, continuing our work from the previous academic year, we thoroughly investigated the photoluminescence characteristics of samples in which an ordered silicon oxynitride (SiON) structure was formed instead of amorphous SiO2 by introducing nitrogen molecules (N2) during the pre-oxidation SiC treatment. Although there is currently no evidence that these function as single-photon sources applicable to qubits (Figure 4-19), we plan to further improve the samples to achieve higher-performance SiC light sources.

Furthermore, utilizing the newly constructed equipment, we conducted a "One-day School" for young employees of Consortium Partners, as well as an intensive exercise in interdisciplinary research planning for doctoral students in the Academy from other laboratories within Science Tokyo (Figure 4-20). We received feedback from One-day School participants, including comments such as:
"I was able to understand the basic principles, latest research, and current challenges of quantum sensors. Learning about a field expected to grow in the future made this a meaningful opportunity. Touring a laboratory that I would normally not be able to visit was also a valuable experience."
"Books on quantum science often give conceptual explanations, making it hard to imagine specific operations as a real-world technology. In this lecture, seeing the actual equipment and hearing detailed explanations of required peripheral devices—such as refrigerators and scanning tunneling microscopes (STM)—gave me a clear grasp of how it would operate in practical applications."

As demonstrated above, the Quantum Sensor Research and Education field conducts research while simultaneously developing human resources and educating students in quantum science; to this end, we maintain various experimental devices operating under ultra-high vacuum. We encourage interested personnel from related companies and National Research and Development Agencies to make use of this field.

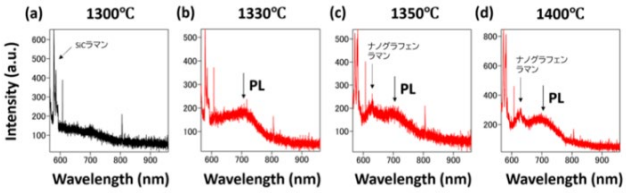


Figure 4-19 Photoluminescence (PL) spectra of SiON-terminated SiC substrates. No luminescence is observed at heating temperatures of 1,300°C or lower, but a peak appears near 700 nm at temperatures of 1,330°C or higher.

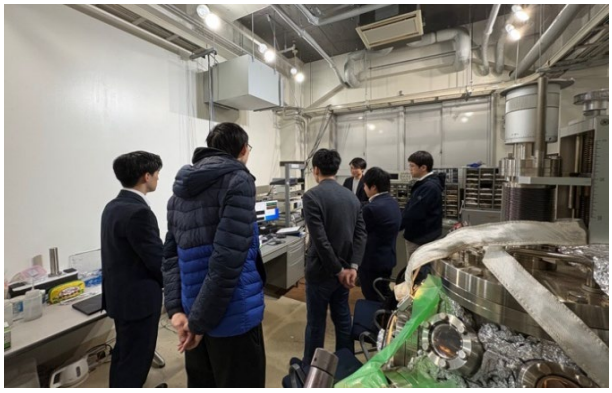


Figure 4-20 A scene from the One-day School showing a presentation on the equipment to employees from partner organizations.

4.2.4. Artificial Intelligence

In a Super Smart Society, everyday devices are expected to become connected smart objects, enabling safe and convenient lives. Essential for computer control are systems that recognize, understand, and act upon surrounding conditions using sensors and cameras. Physical-world data is often noisy and ambiguous; to process it accurately in the cyber world, it must be converted into symbolic, computer-readable data. The Academy of Super Smart Society views AI as a foundational technology connecting the cyber and physical worlds in a Super Smart Society, educating enrolled students to easily make use of AI technology.

Since AY2020, the university has offered university-wide Data Science and Artificial Intelligence (DSAI) education for graduate students. Unlike conventional lecture-based classes, this program enables hands-on practice where students actively operate machine learning tools in practical environments. Efficient use of deep neural networks requires a computational environment equipped with GPUs (Graphics Processing Units). In this education system, students can easily access cloud-based learning environments via Wi-Fi using their own PCs. On the cloud, students can use Google Colaboratory as well as GPUs hosted on the university's TSUBAME supercomputer (Figure 4-21). Students can execute course materials and assignments as "interactive textbooks," ensuring a smooth and engaging learning experience (Figure 4-22).

While the Academy requires students completing the program to acquire a certain level of AI literacy, it has also offered motivated enrolled students an intensive exercise program on planning interdisciplinary research using AI since AY2020. In this program, students learn cutting-edge research findings directly from Science Tokyo faculty members through demonstrations, aiming to further enhance their skills. In September 2025, the program conducted lectures on neural

network technology, practical exercises focused on image recognition, and student presentations on their learning outcomes.

In October 2025, a One-day School was also conducted for members of the Consortium. This session explained the principles of neural networks and provided introductory hands-on practice using Google Colaboratory (Note 1) and PyTorch (Note 2). In the AY2025 exercises, participants worked on two common tasks (image style transformation and sentence generation using large language models) and three elective tasks (PyTorch basics, image/speech recognition, and reinforcement learning).

(Note 1) Google Colaboratory: A development environment for machine learning education and research provided by Google.

(Note 2) PyTorch: An open-source Python machine learning library used in computer vision and natural language processing.



Figure4-21 TSUBAME

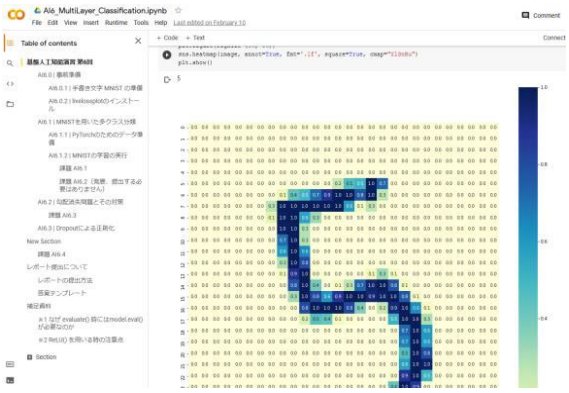


Figure4-22 Interactive Notebooks

4.2.5. Smart Workplace

In this Research and Education field, we are building a “Smart Workplace” platform aimed at realizing environments where individuals can work healthily and vibrantly.

In AY2025, to create a thermally comfortable environment, we conducted a participant-based experiment in an office equipped with radiant air conditioning and underfloor air distribution systems to evaluate their impact on thermal comfort and productivity (Figure 4-23). The experiment was conducted in the summer (August) with 24 student participants from Science Tokyo, who were divided into two groups of 12 and tested over two days each (four days in total). We tested four cases: a baseline case with neither radiant nor underfloor air conditioning (Case 1), a case with radiant air conditioning only (Case 2), a case with underfloor air conditioning only (Case 3), and a case with both air conditions (Case 4) (Figure 4-24). Assuming a typical office environment, the target air temperature and relative humidity were set to 26 °C and 50% for all cases. To measure productivity, participants performed three simulated tasks: (1) the Brief Psychomotor Vigilance Task (PVT-B), a reaction task where participants quickly tap the screen when numbers appear; (2) Sudoku, a convergent thinking task; and (3) the Torrance Test of Creative Thinking (TTCT) Figural test, a divergent thinking task where participants freely create drawings from simple shapes or lines.

The experimental results showed that the average air temperature and relative humidity for all cases remained within 26.0 ± 0.5 °C and 50 ± 5%, confirming that the intended environment was created; despite this, Case 3 (without radiant AC, with underfloor air distribution) generated the highest number of dissatisfaction responses regarding the thermal comfort (Figure 4-25). This is likely because airflow from the underfloor air distribution affected participants' thermal sensation and satisfaction with the thermal environment. However, subjective work efficiency survey results (Figure 4-26) showed that efficiency in Case 3 was generally high, and objective work efficiency measurements (Figure 4-27) also showed the best performance for Case 3, in the PVT-B task. Both subjective and objective task efficiency were high in Case 3 despite it having the lowest environmental satisfaction, suggesting that a highly comfortable environment does not necessarily lead to improved productivity.

To build workplaces where individuals can work comfortably and healthily while maintaining high productivity, we plan to continue evaluations, primarily in actual office environments, from AY2026 onward.

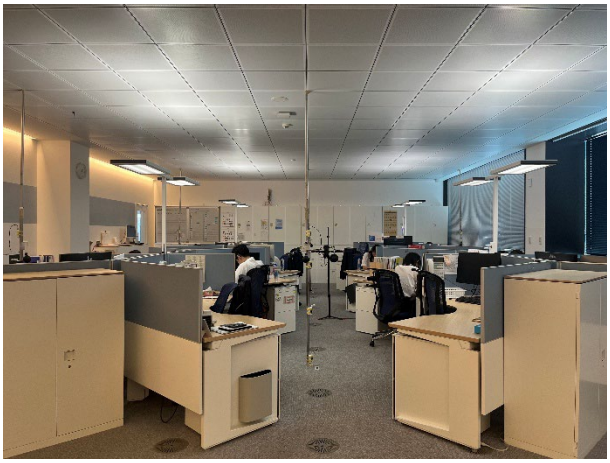


Figure4-23 Experimental setup

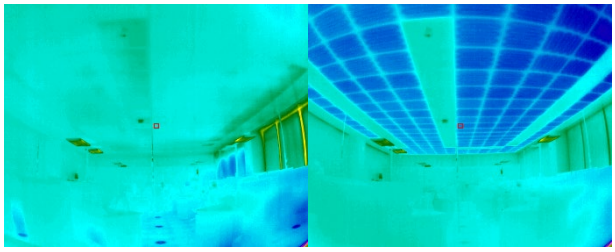


Figure4-24 Thermal images without (left) and with (right) radiant air conditioning

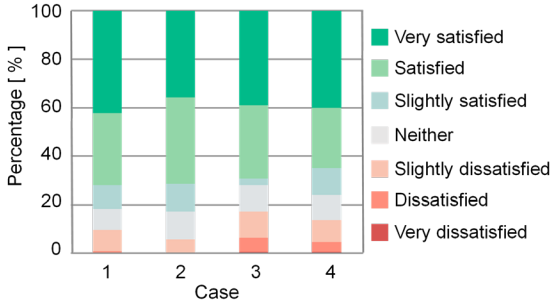


Figure 4-25 Comparison of thermal environment satisfaction between

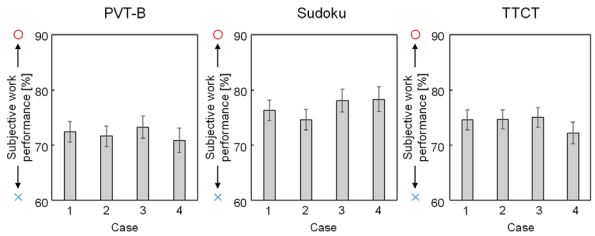


Figure 4-26 Comparison of subjective work performance between cases, by task

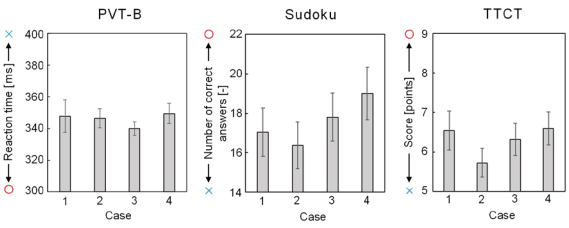


Figure4-27 Comparison of objective work performance between cases, by task

4.2.6. Smart Agriculture

The Smart Agriculture Research and Education field provides a platform for education and research in smart agriculture, with a focus on remote farming.

Leveraging the unique feature of Science Tokyo—which does not have a faculty specialized in agriculture—it aims to address the societal challenges of Japanese agriculture from the perspectives of science, engineering, and medicine.

Our focus is on mountainous areas. Accounting for 40% of Japan's cultivated land, these areas are crucial for improving the nation's food self-sufficiency rate. However, because small farmland plots are scattered in these regions, the large-scale technologies promoted by conventional smart agriculture cannot be directly applied. Furthermore, as the number of agricultural workers continues to decline, properly managing farmland in these areas will become increasingly difficult. Therefore, automating farmland management is necessary; however, automation remains impractical under current conditions due to the lack of infrastructure, such as electricity and telecommunications. We believe that by bringing together the advanced technologies of Science Tokyo — such as telecommunications, sensing, AI (Artificial Intelligence), and robotics—we can overcome these challenges and achieve abundant crop production in mountainous areas.

In our vision for future agriculture in mountainous areas, farmland digital twins will be utilized. Farmlands are replicated on data center servers using data collected from sensor networks, drones, and robots installed on the farm. This digital twin processes all decision-making processes for automated cultivation—such as growth evaluation and prediction, automated control simulation, robot control, and human-robot collaboration—serving as the foundation for automated crop production. By utilizing a solar tracking power generation system for electricity and Low Earth Orbit (LEO) satellite communications, complete off-grid functionality becomes possible.

The Smart Agriculture Research and Education field at the Yokohama Campus is the first farm developed by Science Tokyo in its 140-year history. Development began in 2022 on a vacant area previously used as a material storage yard. In addition to soil improvement through organic farming methods, sensor networks, solar power systems, automated irrigation equipment, Real Time Kinematic (RTK) base stations, and LEO satellite communication equipment have been installed to date, serving as a demonstration field for off-grid remote farming. In AY2025, a demonstration experiment for automated control technology was conducted (Figure 4-28): a 3D model of the farm was reconstructed from drone imagery, with humans detected by fixed cameras and robots tracked by RTK rover stations mapped in real time, allowing the robot to navigate to its destination while avoiding humans in the farm. In AY2026, technology development and demonstration experiments are planned for more advanced human-robot collaboration and automated cultivation using robots equipped with end-effectors.

The Ookayama Rooftop Garden is an urban rooftop garden established on the third-floor balcony of Building 3 in the Ishikawadai area at the Ookayama Campus, with development starting in 2024. In addition to providing functions of urban agriculture—such as local production for local consumption, community building, and food education—it serves as a

platform for developing technologies like sensing, automated cultivation, and robotics through challenges in small-scale multi-crop farming and rare crop cultivation.

Additionally, we launched a smart agriculture remote monitoring project in October 2025, utilizing a portion of the fallow land at the Educational Farm of Keisen University. This farm was the first educational institution to obtain Organic JAS certification in 2001. In AY2025, we cultivated daikon radish, turnips, komatsuna, bok choy, and spinach, and held a harvest event for Science Tokyo staff and students (Figures 4-29 and 4-30). In AY2026, we plan to continue using the site for cultivation and agricultural experience while conducting demonstration experiments for remote monitoring.

Furthermore, in AY2025, taking over the activities of the Innovative Research Project for Symbiotic Ecosystems for Agriculture, Aquaculture, Forestry and Industry (July 2019 – March 2025)—which was established at the former Tokyo Institute of Technology in 2019—lecture sessions (digital workshops) were held, featuring researchers and business leaders active at the forefront of agriculture. Targeting staff and students of Science Tokyo as well as Consortium Partners, these hybrid-format workshops were held five times in total (featuring six speakers), with lively discussions taking place each time. These workshops are scheduled to continue in AY2026.

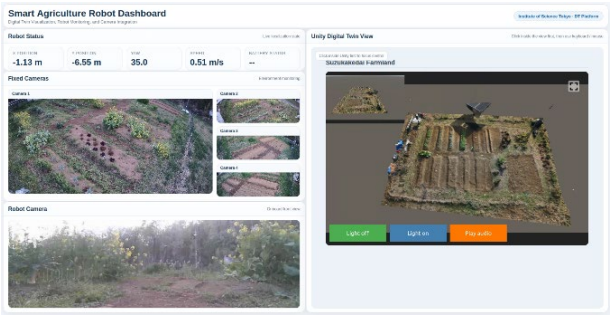


Figure 4-28 Digital Twin Dashboard (upper left) Robot status, (bottom left) image of robot camera, (right) Digital Twin

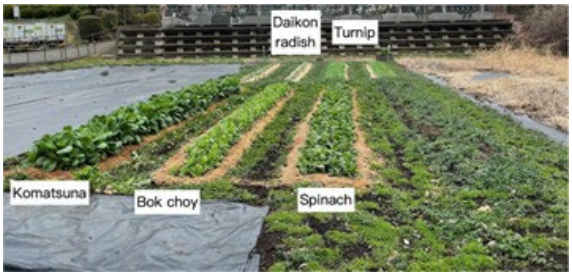


Figure 4-29 Keisen satellite field (date taken: March 6th, 2026)

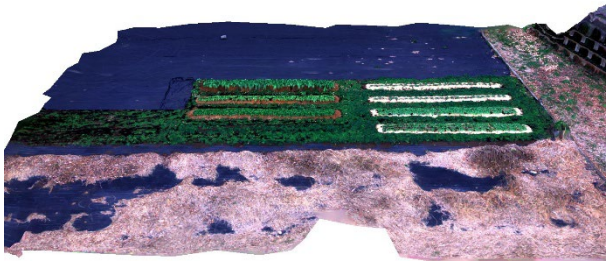


Figure 4-30 3D model of Keisen satellite field (date taken: March 6th, 2026)

An agriculture channel was created in the Slack workspace of Science Tokyo to report on the activities of the Smart Agriculture Initiative and to serve as a platform for agriculture-centered interaction among staff and students. This channel is also utilized to promote the aforementioned hands-on harvest events and digital workshops.

Following AY2024, an intensive exercise in interdisciplinary research planning for students participating in this educational program was held on September 25th, and a One-day School for Consortium Partners was conducted on October 16th. Additionally, on December 17th, a student tour of Consortium Partners was held at the Japan Plant Factory Association in Kashiwa City, Chiba Prefecture.

From October 1 to 3, we exhibited at J-AGRI (Agriculture Week)—one of Japan's largest agriculture and livestock exhibitions held at Makuhari Messe—under the title "Super Smart Society Promotion Consortium: Smart Agriculture Initiative." While most other booths served as venues for displaying materials and products or conducting business negotiations, our booth—which presented proposals for the future of Japanese agriculture—attracted a large number of visitors. In addition to raising broad awareness of our activities, we gained valuable experience by engaging in enthusiastic discussions on the challenges and future of Japanese agriculture with people from diverse backgrounds (Figure 4-31).

In recognition of the educational contributions of these activities, the team received the Excellence Award (Achievement Category) of the AY2025 Science Tokyo Education Award (Awarded Achievement: "Development and Educational Expansion of the Smart Agriculture Research and Education field"; Representative: Associate Professor Hideharu Takahashi).

In AY2026, we plan to continue focusing on developing remote farming technologies utilizing farmland digital twins, as well as advancing agricultural education through the three fields (Yokohama and Ookayama Campuses, and Educational Farm of Keisen University) and various media.

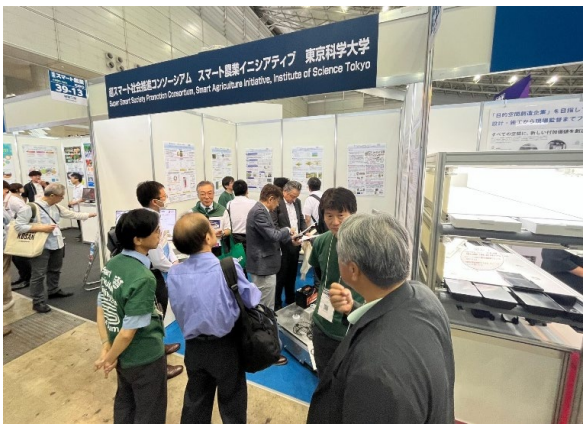


Figure 4-31 Exhibition booth at J-AGRI

4.2.7. Smart Infrastructure Maintenance

Ensuring reliable maintenance of infrastructure, which serves as the foundation supporting our daily lives and industries, is considered essential for securing urban functions and resilience. At Science Tokyo, initiatives related to Sustainable Social Infrastructure (SSI) are highlighted as one of its ten world-leading research fields. To make infrastructure maintenance smarter—a key factor in achieving a Super Smart Society—this Research and Education field carries out activities aimed at developing and demonstrating essential future technologies, including inspection and survey, evaluation techniques, and repair and reinforcement.

This Research and Education field consists of an on-campus laboratory for developing individual underlying technologies through experiments, and a real structure field for demonstrations and exercises of developed and advanced technologies. The real structure field is expected to be utilized as a platform to deploy various technologies targeting actual on-campus infrastructure, such as bridges and tunnels. In Phase 3 of the SIP initiative, titled "Building a Smart Infrastructure Management System"—which is currently undergoing multifaceted examination—the real structure field is being utilized as a site for technology verification.

While various approaches are being considered for smart infrastructure maintenance, one approach under study aims to achieve Society 5.0 by integrating real/physical and digital/cyber spaces to construct highly reproducible digital twin models, thereby managing structures while monitoring their condition.

To date, a real structure field equipped with measurement systems such as accelerometers has been developed across three structures on the Ookayama Campus: Fujimi Bridge (Figure 4-32), Todoroki Bridge (Figure 4-33), and the Ishikawadai Area Tunnel (Figure 4-34), enabling various data analyses and research through the accumulation of long-term monitoring data. For example, the long-term monitoring data collected from the real structure field includes changes in structural characteristics caused by seasonal and temperature variations, which led to the proposal of a system that accounts for the effects of environmental factors when building digital twin models.

To make the construction of digital twin models more efficient, an algorithm was developed to build structural analysis-ready digital twin models from point cloud data (Figures. 4-35 and 4-36) acquired using 3D scanners and other tools. This approach offers the advantage of creating models that accurately reflect the shape, location, and other characteristics of actual structures. Although structural information such as design drawings can be difficult to obtain for some real structures, this modeling technology enables the recreation of their exact shapes. While



Figure4-32 Fujimi Bridge



Figure4-33 Todoroki Bridge



Figure 4-34 Structure in Ishikawadai area



Figure 4-35 Point cloud data (Todoroki Bridge)

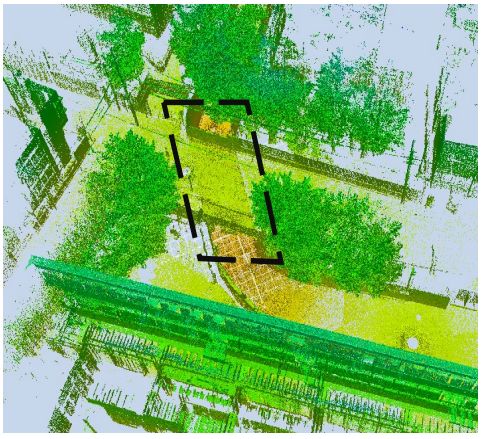


Figure 4-36 Point cloud data in Ishikawadai area

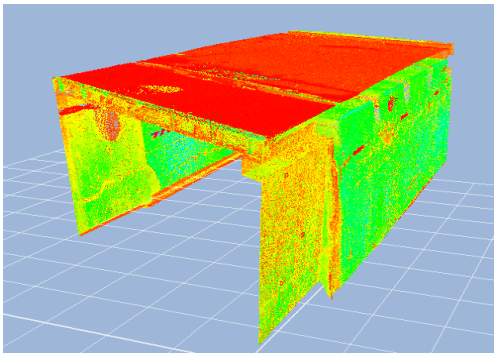


Figure 4-37 Point cloud data of the structure in Ishikawadai area

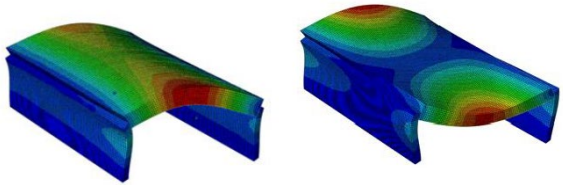


Figure 4-38 Digital-Twin Model constructed from point cloud data (Example of vibration analysis: Mode 1 (left), Mode 2 (right))

some sections of the Ishikawadai Area Tunnel were difficult to confirm through drawings, using point cloud data (Figure 4-37) made it possible to construct a model that recreates its 3D geometry (Figure 4-38).

In the intensive exercises in interdisciplinary research planning at this Research and Education field, students from various majors participate in lectures on initiatives to make infrastructure maintenance smarter, as well as practical exercises—such as field measurements and data analysis—to assess structural conditions by visualizing the vibrations of real structures on the campus, thereby utilizing the field as an educational platform. Additionally, in the real structure field targeting Fujimi Bridge, joint research and development is underway to assess the conditions of both the bridge and its attached optical fiber conduits through vibration analysis; furthermore, through vibration measurement experiments using a mock bridge with simulated damage (Figure 4-39), results leading to new maintenance methods that utilize optical fibers as vibration sensors have been achieved.

In the future, in addition to evaluating the effects of temperature-driven property changes and seismic behavior for Fujimi Bridge and Todoroki Bridge, research will lead to making inspection, repair, and reinforcement methods smarter—including studying practical implementation, advancing inspections through techniques such as hammer sounding tests in the real structure field, and evaluating the performance of repair materials and methods. To achieve practical implementation, initiatives targeting long-span structures are underway, including constructing digital twin models to understand the behavior of railway truss bridges and examining modeling techniques for long-span bridges with cable systems, such as cable-stayed bridges. Additionally, studies will be conducted to evaluate the remaining performance of structures damaged by earthquakes.



Figure 4-39 Collaborative study on the vibration measurement using fiber optic cable

4.2.8. Smart Buildings

This Research and Education field is a research platform for the evaluation of building safety and continued usability during earthquakes and typhoons, as well as early notification methods for occupants, using high-performance sensors densely installed within the building. It aims to contribute to improving the resilience of both individual buildings and broader urban functions.

We have completed the installation of anemometers as well as acceleration, displacement, and strain sensors (Figures 4-41 and 4-42) in an ultra-high-rise seismically isolated building (Building J2-3, Figure 4-40) on the Yokohama Campus of Science Tokyo, alongside additional accelerometers on ceilings and non-structural walls (totaling 141 channels). We have built a system that enables users to check this data on PCs and smartphones via the internet, and we are currently using it to conduct constant observation.

In AY2025, we evaluated the dynamic characteristics—such as natural frequencies and damping constants—of light gauge steel (LGS) partition walls using multiple methods, based on records obtained from accelerometers installed on non-structural walls on the 7th floor (Figure 4-43). Table 4-1 lists the time periods targeted for microtremor observation. The target periods were 480-second intervals from 00:00:00 to 00:08:00 on the 10th, 20th, and 30th of each month from July 2024 to June 2025. We evaluated frequencies and damping constants using three methods: the Spectral Ratio (SR) method, which identifies vibration characteristics through curve fitting using the absolute value ratio of response spectra; the Frequency Domain Decomposition (FDD) method; and the Random Decrement (RD) method.



Figure4-40 High-rise base-isolated building undergoing high-density monitoring (Building J2-3, Yokohama Campus)

Figures 4-44(a) and (b) show the identification results of natural frequencies and damping constants for each observation date. The horizontal axis represents the observation date, while the vertical axes represent the natural frequency and damping constants, respectively; results from accelerometers P1 and P2 (Figure 4-44) are plotted together for the SR, FDD, and RD methods. First, we address the natural frequency identification results in Figure 4-44(a). On all observation dates, the results from all methods and both accelerometers fall within the range of 7.5 Hz to 8.5 Hz, showing that they are generally consistent. Furthermore, almost no differences are observed depending on the method or accelerometer location. This indicates that all methods appropriately capture the same modal component, allowing for stable identification of the natural frequency. On the other hand, the damping constant identification results shown in Figure 4-44(b) reveal clear systematic differences among the methods. The results identified by the FDD and RD methods agree well with each other, which is consistent with previous studies. While the values identified by these two methods generally range between 2% and 5%, the SR method tends to yield higher values than the other two. This difference is likely due to variations in the evaluation process of each method. Because the SR method evaluates damping by curve-fitting the overall shape near the peak of the response spectrum ratio, it tends to overestimate damping due to the influence of background noise and adjacent modes. In contrast, the FDD and RD methods evaluate damping based on waveforms extracted using narrow filtering to avoid envelope modulation. Consequently, the influence of surrounding components is suppressed, leading to lower damping estimates compared to the SR method.

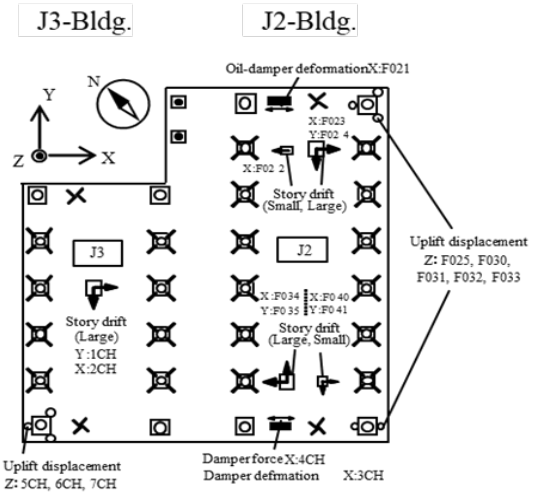


Figure4-41 Displacement meter installation location (base isolation layer)

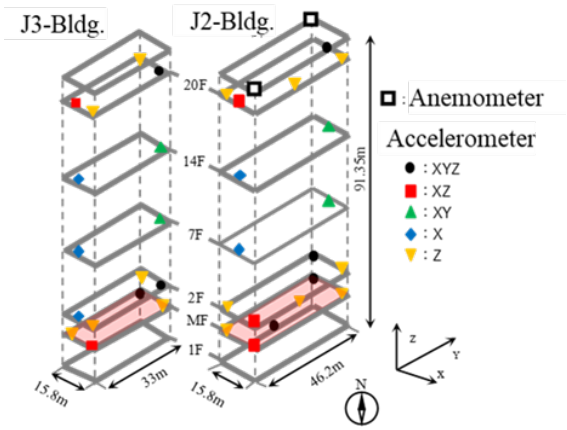


Figure4-42 Locations of anemometers and accelerometers

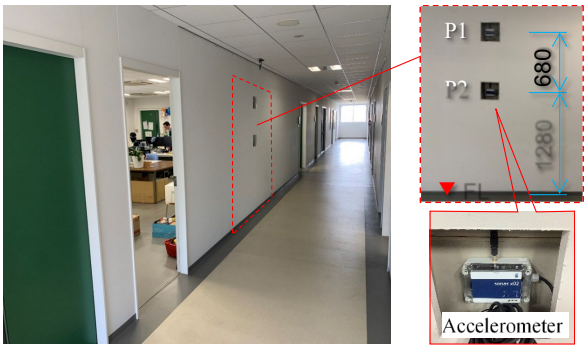
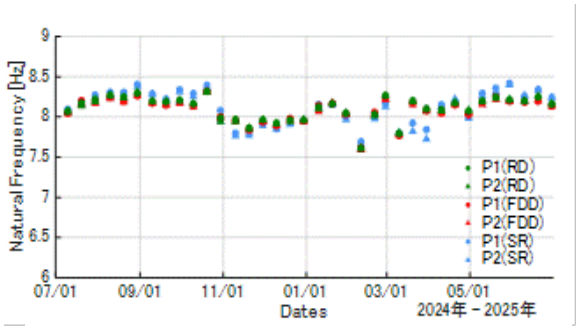


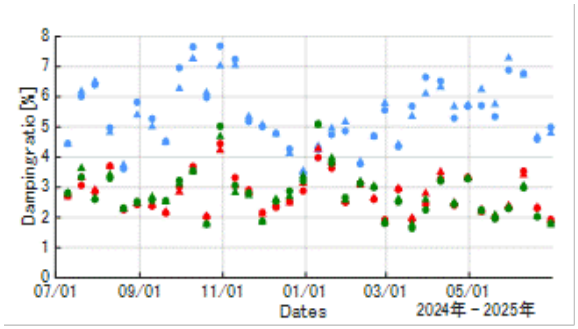
Figure 4-43 Measurement of non-structural walls on the 7th floor.

Table 4-1 Date and time

Year	Month	Date	Time
2024	July	10th, 20th, 30th	0:00:00 ~ 0:08:00
	Aug.		
	Sep.		
	Oct.		
	Nov.		
	Dec.		
2025	Jan.		
	Feb.	10th, 20th, 28th	
	Mar.	10th, 20th, 30th	
	Apr.		
	May		
	June		



(a) Natural frequency



(b) Damping ratio

Figure 4-44 Identification results

4.2.9. Smart Ocean

The marine industry involves diverse sectors, including fisheries, shipping, energy, and leisure, but faces growing challenges such as climate change, depleting fish stocks, and biodiversity loss. The Smart Ocean initiative aims to quantify and visualize marine data flows to demonstrate optimization technologies for sustainable ocean use.

In AY2025, the Smart Ocean Initiative (formerly the working group) fully launched its activities while advancing research to correlate fish species with acoustic sensing data collected from Ubiquitous Fishfinders on Smart Buoys installed in fixed nets off Yui, Shizuoka Prefecture. Starting with ocean data processing via Ubiquitous Fishfinders (Figure 4-45), the Initiative promoted discussions and outreach to maximize value by optimizing the seafood supply chain from fishing sites to consumers (Figure 4-46).

Continuing from AY2024, in July 2025, the Super Smart Society Promotion Consortium participated in the BLUE ECONOMY EXPO held in Shimizu Ward, Shizuoka City, hosting a booth at the Ocean EXPO to showcase its initiatives. LDP Representative Yoko Kamikawa, Chair of the Suruga Bay Smart Ocean Parliamentary League, visited the booth, providing an opportunity to promote the initiatives through direct dialogue (Figure 4-47).

Additionally, the Super Smart Society Innovation course “A6: Smart Ocean,” offered to Science Tokyo students with seven instructors invited from Consortium Partners, has grown into a course taken by nearly 200 students from across the university. In AY2025, it attracted widespread attention across the university—including not only science and engineering but also medical and dental fields—leading to active assignment submissions and lively discussions.

In March 2026, we held a Smart Ocean Seminar, inviting ocean-related organizations from outside the consortium. The seminar began with opening remarks from Professor Sakaguchi of Science Tokyo, who expressed the university's commitment to building an ecosystem while stepping up its activities as a University for International Research Excellence. Next, Dr. Tanaka of the Ocean Policy Research Institute of the Sasakawa Peace Foundation shared the direction of the initiative toward social implementation and explained the objectives of the seminar. Subsequently, Advisor Arata of Koden Electronics, Professor Akamatsu of Waseda University, and Professor Endo of Tokyo University of Marine Science and Technology presented their latest R&D achievements, followed by a discussion among all participants. During the discussion, participants exchanged views on a wide range of topics, including technical challenges such as the commercialization of land-based aquaculture, observational data accuracy, and the potential of AI analysis. They also covered practical issues in fishing fields, the applicability of smart technologies as solutions, and interdisciplinary collaboration with agriculture, making the event highly meaningful.

In AY2026, we aim to achieve the social implementation of past R&D results through the "construction of an integrated ocean infrastructure across surface, underwater, and air via an ocean real-time digital twin." Additionally, we will continue and expand our outreach activities to contribute to the advancement of marine smart technology—often noted as lagging behind land-based efforts—while promoting activities to share the appeal of the ocean with as many people as possible.

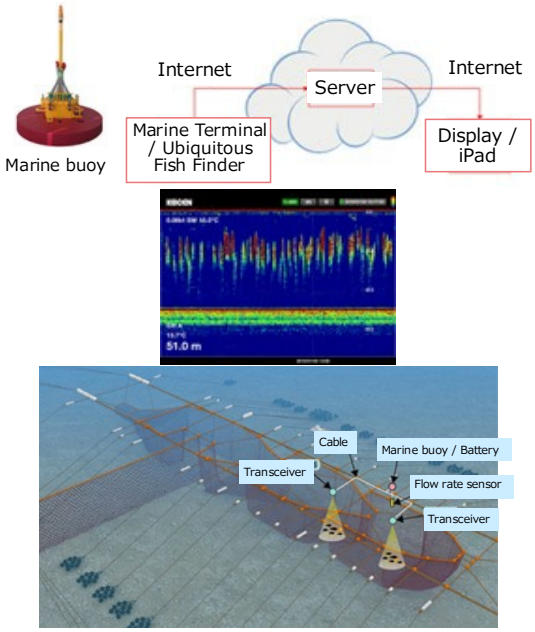


Figure 4-45 Ubiquitous Fish Finder

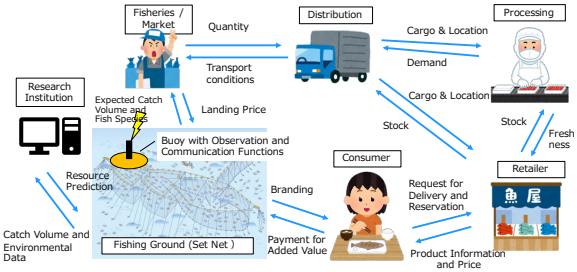


Figure 4-46 Fisheries Supply Chain



Figure4-47 Blue Ocean Expo

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