Intelligent Knowledge Processing Infrastructure Integrating Physical and Virtual Domains

Intelligent Knowledge Processing Technology to Integrate Physical and Cyberspaces Leading to Society 5.0

Advanced cyber-physical system (CPS) is the key factor for Japan to realize Society 5.0 vision. They collect, process, and productivity. This project is designed to address and solve technical issues related to the establishment of CPS and create a common edge computing platform that facilitates developing IoT solutions without any special expertise. The dissemination and utilization of an edge computing platform will solve Japan's social issues and promote economic development, thereby leading to the realization of Society 5.0 vision.

Program Director

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Profile

Dr. Saso joined Fujitsu in 1976. He became Corporate Senior Vice President in 2009 and was promoted to Corporate Executive Vice President in 2010, in charge of Fujitsu's ICT Business. He then was nominated as Corporate Senior Executive Vice President and Representative Director, CTO & CMO in 2012. After that, he took office as Chairman and Representative Director, Fujitsu Laboratories Ltd. in 2016.
He has also been serving as Program Director in Intelligent Knowledge Processing Infrastructure, integrating Physical and Virtual Domains, Japanese Government Public R & D Investment Expansion Program, Cabinet Office from 2017.
Throughout his career, Dr. Saso led Fujitsu's ICT related R&D and business from personal computers and mobile phones to business servers, communication devices and the nation-level big project such as the development of supercomputer "KEI". Based on his experiences, he is very much familiar with technology, market and R&D trends in the fields.
He has also served as Chairman of the Japan MOT Society and Chairman of the Japan Institute of Electronics Packaging.

Research and Development Themes and Organizational Structure

I. Common edge computing platform technology to develop IoT solutions (Sub-theme I)

The research and development will be carried out to develop a common edge computing platform that facilitates the creation and operation of IoT solutions without IT expertise. The platform will include technologies that collect an extensive amount of data by controlling sensors in physical space, digitize the collected data utilizing advanced AI technology, and accurately control smart devices in physical space in accordance with instructions sent from cyberspace.

II. Technologies for innovative sensors and low-energy IoT chips (Sub-theme II)

Innovative sensors and low power IoT chips will be developed and commercialized. The innovative sensors are expected to be small, and available at low cost with unprecedented data collection capability. As a result, data processing will become possible at a low power consumption rate.

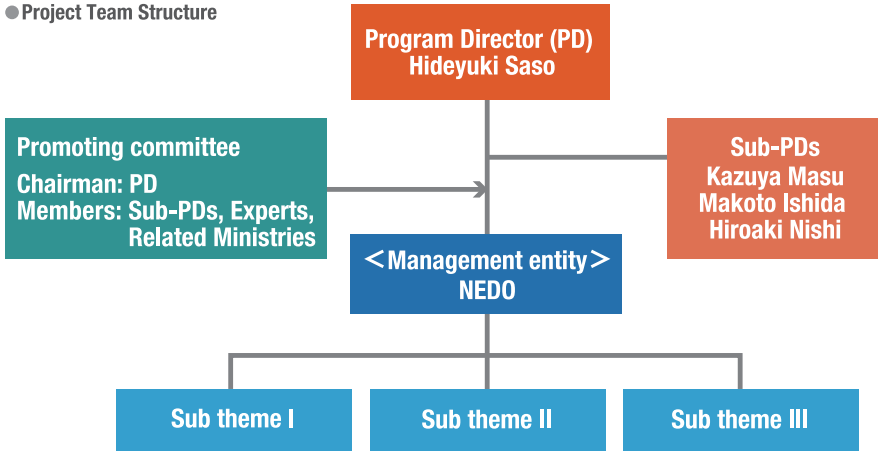
III. Technology to disseminate IoT devices for realizing Society 5.0 (Sub-theme III)

Technologies to disseminate IoT devices in Society 5.0 will be developed. These technologies will promote the introduction and use of robots and other IoT devices in manufacturing, production, nursing care, transportation and other services where such devices have not yet been fully introduced.

Implementation Structure

In order to maximize the outcome of this project, researchers will develop technologies aiming for autonomous growth while collaborating with each other across the research subthemes. Moreover, with regard to the edge computing platform, we will discuss vertical integration and horizontal development and improve it to have international competitiveness.
In addition to that, PD will revise the direction of the program flexibly considering social trends.

● Project Team Structure



Exit Strategies

R&D promotion toward commercialization

The effectiveness of the common platform and low power IoT chips should be demonstrated by applying it to the manufacturing sector where social problems such as shortage of workers are serious. The activities for releasing this serious situation will encourage other industry sectors to use the platform. For encouraging these activities, the three subthemes will be promoted with an eye for the exit strategy, and aim for commercialization of concrete R&D results.

Approach to technology dissemination

The project is designed to establish a common edge computing platform as a solution for integrating cyber and physical spaces with low effort. It is expected that the IoT market will be revitalized by the entry of various industries that have missed business opportunities due to IT workforce shortages. In accordance with Japan's open and closed strategies, the common edge computing platform will be open to the public and maintained so that a variety of organizations, including small and medium-sized companies and venture businesses, will be able to develop IoT solutions.

Expected Outcomes

I. Common edge computing platform technology to develop IoT solutions (Sub-theme I)

Since most CPSs are currently developed in accordance with individual system requirements, there are issues with regard to the development period required as well as cost and resource-related issues. One of the objectives of developing a common platform is to allow Japanese companies in various industries to easily establish CPS by themselves. To this end, IT expert know-how and technology to produce IoT solutions will be integrated, automated, and provided with the companies. After the project is completed, a consortium will be established to maintain and update the common platform. The technology and support scheme will contribute to expanding new business opportunities for all Japanese businesses, including small and medium-sized enterprises and venture companies.

II. Technologies for innovative sensors and low-energy IoT chips (Sub-theme II)

In order to realize Society 5.0 through the implementation of advanced CPS, more innovative devices need to be developed, including those capable of operating in severe environments where power is unavailable or conventional sensors cannot obtain the data. Furthermore, to continuously operate such devices, it is mandatory to tackle challenges such as reducing energy consumption for obtaining data from sensors and uploading it to servers, downsizing sensors, and practical application of energy harvesting technology. These technologies will be developed and their effectiveness verified during the project. By leveraging R&D achievements, Japan's state-of-the-art technology will be commercialized and it will be competitive worldwide.

III. Technology to disseminate IoT devices for realizing Society 5.0 (Sub-theme III)

With the aim of realizing Society 5.0, technologies to disseminate IoT devices will be developed. These technologies will promote the introduction and use of robots and other IoT devices in manufacturing, nursing care, transportation, and service where such devices have not yet been applied. R&D activities will be carried out using the common edge computing platform developed under the R&D subtheme described above. Technologies to encourage the dissemination of CPS in society should include enhancement of real-time processing, which has limitations when used in cloud applications; technology to make the data intelligent through multi-point sensing; and technology to coordinate controls in physical space with cyberspace.

● Goal of this project

Society 5.0

A society capable of generating new value by connecting everyone and everything and sharing knowledge and information.

What are required in physical space?

① Technical Gaps

Collection	● Collecting necessary data from anywhere without using batteries ➡ Digitalizing sensing data to facilitate IT processing
Connection	● Increasing telecommunications data amount and connection frequencies; raising wireless connection quality ➡ Allowing real-time processing and wireless connection in whatever circumstances
Sharing of Knowledge and Information	● Realizing real-time control, physical AI and low-power connection ➡ Allowing processing within physical space and creating value

② Gaps related to CPS implementation

Elimination of implementation hurdles	● Existing ones are largely for specific use and professionals ➡ Eliminating obstacles to entry and reducing labor hours through generalization
Promotion of dissemination	● Ensuring usability for everyone and enlarging the range of use ➡ Establishing business ecosystem and applying demonstration methods to similar situations.

The goal of this project is to realize Society 5.0 by eliminating the above two gaps in physical space.