

Opening Up a New Future through Value Creation Utilizing CPS Technologies



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The Toshiba Group has set the goal of becoming a cyber-physical systems (CPS) technology company. Our basic R&D policy states that, in order to achieve this goal, we will take the initiative in solving social issues and maximizing our corporate value by combining our expertise in component technologies with artificial intelligence (AI) and Internet-of-Things (IoT) technologies. More specifically, we are devoting our efforts to: (1) further enhancing our component and system technologies in the physical realm, (2) developing cyber technologies to increase value for our customers through AI- and IoT-based digitalization, and (3) creating new technologies that will contribute to the solution of various problems expected to emerge in the future.

The following is a brief look at several technological innovations achieved as of March 2019 in each business domain of the Toshiba Group.

In the R&D domain, Toshiba Corporation has employed electrospinning nanofiber fabrication to develop an SCiB™ rechargeable lithium-ion battery with a new structure that provides increased output power and eliminates the need for free-standing separators. It has also developed an SCiB™ battery with increased capacity through the use of a titanium-niobium oxide (TNO) anode. In the field of precision medicine, Toshiba Corporation has developed a technology to visualize gene activity related to the growth of live cancer cells using biodegradable liposomes.

In the energy business domain, Toshiba Energy Systems & Solutions Corporation has launched a virtual power plant (VPP) service that optimizes electricity supply-demand balancing through the integrated control and operation of distributed storage batteries and demand response. It has also commenced a large-scale demonstration project to establish a hydrogen supply chain using renewable energy so as to realize a low-carbon society. In addition, Toshiba Energy Systems & Solutions Corporation was awarded a contract from Yonsei University Health System (YUHS) in South Korea to supply a heavy-ion radiotherapy system in recognition of the technological superiority of its rotating gantry using superconducting magnets.

In the social infrastructure business domain, Toshiba Infrastructure Systems & Solutions Corporation has developed robust pick-and-place robot technologies using haptic sensors for logistics operations that accommodate the great variety of sizes, shapes, and surface conditions of the items handled in the logistics industry. In the railway sector, it has delivered high-efficiency propulsion systems that combine traction inverters using all-silicon carbide (SiC) power devices (i.e., power devices using SiC for both the diodes and switching elements), totally enclosed permanent magnet synchronous motors (PMSMs), and SCiB™ rechargeable batteries.

In the electronic devices business domain, Toshiba Corporation has developed an SiC metal-oxide-semiconductor field-effect transistor (MOSFET) with a unique trench-gate structure for automotive applications. Toshiba Electronic Devices & Storage Corporation has developed a radio-frequency integrated circuit (RFIC) with low noise and high gain for 5G (fifth-generation mobile telecommunication network) applications. It has also released 3.5-inch nearline hard disk drives (HDDs) with a capacity of 16 terabytes (tera: 10¹²) for data centers.

In the digital solutions business domain, Toshiba Digital Solutions Corporation has developed technologies, including a pathological image analysis technology and a demand forecasting technology for on-demand ridesharing services, using the SATLYS analytics AI service. In addition, Toshiba Digital Solutions Corporation has defined a unique security reference architecture for industrial IoT systems that facilitates the implementation of various controls and services by means of CPS technologies.

All of the business domains of the Toshiba Group are working in unison to realize CPS through reliable technologies so as to open up a new future while raising the quality of life of people around the world in line with the group's basic commitment to people and to the future. We hope that you will enjoy reading *TOSHIBA REVIEW Science and Technology Highlights 2019*, and would appreciate your feedback, suggestions, and comments.