Category Overview

Groundbreaking Technologies Underpinning the Social Innovation Business

—Center for Technology Innovation—

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ROLE OF CENTER FOR TECHNOLOGY INNOVATION

THE Center for Technology Innovation is composed of nine innovation centers that cover the areas of energy, electronics, mechanical engineering, materials, systems engineering, information and telecommunications, controls, production engineering, and healthcare. The Overview section of this Special Feature (The Hitachi Group's R&D Strategy) covers the groundbreaking technologies and platform technologies that are driving the strategic growth of the Hitachi Group's four business sectors. The Center's mission is to intensively improve these technologies, while helping to grow the Social Innovation Business through the cross-utilization of the technologies developed.

TECHNOLOGICAL INNOVATIONS FOR CREATING PRODUCTS AND SOLUTIONS

This section presents some case studies of the Center's development of technological innovations in four of the Hitachi Group's business sectors, namely, system integration (SI), engineering, procurement, and construction, and operation and maintenance (EPC/O&M), products/materials, and digital solutions.

System Integration (SI Business)

The Center's activities in this sector consist of working on technological innovations to improve the efficiency of migrating existing systems, which is a prerequisite for at least 80% of system development cases. Accurately identifying constantly changing system specifications during operation has been difficult in the past. The Center is currently researching system modernization technology that facilitates the auto-recovery of specifications from actual system assets (programs and logs), making migration to the latest IT environment easier. This technology has reduced the labor of analyzing tasks that was previously done manually, and improved the accuracy of analysis. Since first being used in service projects in 2015, it has received very favorable responses from clients looking to gain visibility of existing systems that have become black boxes, and to streamline bloated systems.

Large-scale Projects (EPC/O&M Business)

Value chain building is important for the EPC/O&M business. The Center develops and applies technological innovations throughout every phase of a project, ranging from the business proposal, to the detailed design, construction, and operation. One technology innovation project for the EPC/O&M business involved the operation phase of a wind power generation system[(1)] (see Fig. 1). A highly reliable analytics platform was developed that continually monitors operating environment parameters such as wind conditions and turbine operation status, using the data measured to prevent system shutdowns while maintaining the total power output. By increasing the

Fig. 1—5-MW Wind Power Generator Demonstration Model. The model was installed in March 2015 for various types of performance and function testing.

system's availability factor, the project has provided added value through a comprehensive O&M package that offers predictive diagnoses of safety factors and remaining life of parts. A training facility for maintenance and inspection staff providing advanced maintenance service was opened in October 2016.

Products (Products/Materials Business)

The Center has made tireless efforts to continually develop and apply technological innovations designed to improve client value and quality. The rise of EVs to reduce CO_2 emissions, and intrinsically safe solutions for the autonomous driving era are becoming increasingly important topics in the auto sector. The inverters that drive the motor with high torque are needed to achieve both a smaller size and a higher output, which enable them to fit into the narrow mounting space in a vehicle. Hitachi has developed the industry's first double-sided cooling power module, which achieves more than five times the power density compared with conventional inverters[(2)]. It has also developed a system that uses a stereo camera and multiple sensing to improve vehicle safety and smooth driving performance. Consumer applications of it have already been released by cutting-edge carmakers[(3)].

In the industrial product sector, the Center is working on augmenting motor product lineups that comply with the IE5, the latest and most stringent international energy-saving regulations for motors (which account for more than half of all domestic energy consumption in Japan), and on developing prototypes[(4)].

Other work includes developing additive manufacturing technology that uses 3D metal printers for high-entropy alloys with high strength and corrosion resistance. The technology is used for parts in facilities such as chemical plants. Variations in elemental distribution during casting have traditionally been a difficulty when manufacturing with high-entropy alloys composed of multiple elements. Using a homogeneous distribution technology for high-hardness, intermetallic compounds co-developed with Tohoku University, the Center has succeeded in manufacturing homogeneous parts with complex shapes that have 20% higher tensile strength and 70% higher corrosion resistance than parts made with conventional 3D printer-based manufacturing methods[(5)].

Automated blood analyzers need to enable rapid and safe blood testing. Full automation and anticontamination measures to protect workers from blood spatter are key requirements. When dispensing blood samples directly from blood collection tubes with rubber plugs, plug fragments can break off when the plug is pierced with a probe. The Center has developed a probe structure that prevents plug fragments, and a flow that enables high-speed dispensing (7.2 second cycles) of fixed blood quantities. These innovations have resulted in the world's fastest (500 tests/hour)* Hemoglobin A1c testing device without the procedure to open the plug of blood collection tubes (Hemoglobin A1c is a diagnostic marker of diabetes).

Reducing operational costs and improving operational efficiency are key client needs in the data center sector. To meet these needs, the Center has developed a converged platform that unifies servers, storage, networks, and operation management software[(6)]. The platform automates the configuration work needed for disaster recovery (a highly demanded function), reducing the number of configuration steps by 86% to greatly reduce the time and effort needed for operation management.

The Center has developed a system for elevator overhaul projects that performs three-dimensional measurement of elevator shafts, automatically calculates dimensions, and automatically creates drawings. It began operation in April 2015[(7)]. The system has greatly reduced elevator downtime and reduced the total inspection and design time needed to create work estimates by over 80%.

Other work being done by the Center for the Products business (on modular power converters, autonomous driving, and railway systems) is presented in later articles in this Special Feature.

Social Innovation Business Driven by Digital Technology

The importance of the new value being created through the use of digital infrastructure has recently started to receive widespread recognition. To solve essential challenges facing particular clients or the world as a whole without easy solutions, the Center is combining its technological strengths in the SI, EPC, and Products businesses described above, with IT innovations for areas such as the up-and-coming Internet of Things (IoT) and artificial intelligence (AI).

One example is a work anomaly detection system for production systems that identifies work-flow-lines from video data provided by plant surveillance cameras, and uses machine learning to automatically

* From a study by Hitachi, Ltd. in December 2015; applies to Hemoglobin A1c testing device with functions for dispensing from blood collection tubes with plugs.

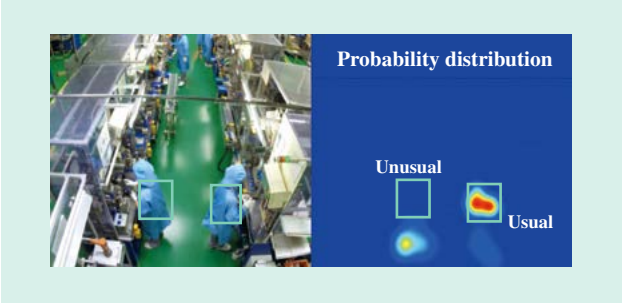

Fig. 2—Work Monitoring Using Video Analysis Technology. The technology identifies work-flow-lines, and detects unusual work behaviors in real time using automatically-generated models of standard movements.

generate models of standard worker movements[8]. By comparing these standard models to actual worker movements, the system can detect unusual work behaviors linked to product failures in real time. Unusual work behaviors can be detected within 1 second and with at least 95% accuracy (see Fig. 2). Sales of the system to the manufacturing industry started in January 2016, as one of the component solutions in the Hitachi Total Supply Chain Management Solution/IoT.

The Center has also developed an AI application that uses business information, business results, and other big data gathered daily by business systems to gain an understanding of improvement activities or changes in demand at business sites, and to issue appropriate work instructions[9]. When incorporated into logistics warehouse management systems and subjected to on-site testing to measure the efficiency of logistics warehouse picking work, the application has demonstrated a work efficiency increase of at least 8%.

This Special Feature presents work being done towards Hitachi's new open IoT platform "Lumada," which integrates key enabling technologies in SI, EPC/O&M, and products in order to achieve digital solutions that enhance the future value of our customers.

The Center is working on breakthroughs in elemental technologies for analysis, measurement, manufacturing, and reliability, which are demands shared by cross-section of business sectors. This Special Feature also covers reliability analytics.

CONCLUSIONS

The Center for Technology Innovation will continue working to be an innovation partner for the IoT era, improving its technology platform and offering high added-value products and services to a continually changing world and clientele.

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