

Special Reports

Product Development Innovations as Driving Force for Retail and Printing Businesses

Advancing *Monozukuri* Innovation from Customers' Standpoint

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Toshiba Tec Corporation's Activities toward Productivity Improvement in Development of Retail and Printing Products

SATO Katsutoshi / MORIMOTO Jun / HAYAMA Shuichiro

In response to the market demand for retail and printing products such as point of sales (POS) systems and multifunctional peripherals (MFPs), there is an increasing need for the sophistication of product development methods in order to shorten development periods to satisfy the rapidly changing requirements of customers and further improve product quality, as well as to realize products with diverse functionality and greater complexity.

With the aim of becoming a solution partner to solve issues faced by its customers at the sites, Toshiba Tec Corporation has been taking the initiative in providing solutions to meet the requirements of individual customers by using POS systems installed at retail stores and MFPs introduced in offices as the solution platform. This makes it necessary to maximize product development productivity to achieve the timely introduction of and improvements in the quality of products with high cost-competitiveness. We are therefore tackling the reform of product development methods by means of "*monozukuri* innovation" activities, based on the Japanese concept of *monozukuri* encompassing the art and craft of manufacturing.

Multiproduct, Variable-Quantity Production of POS Systems and MFPs Based on Integrated Product Launch Planning and Hardware Platform Development

MORIMOTO Jun / IIZUKA Toshiaki / SHISHIKURA Kenichiro

In the retail and printing businesses, both increased global competition and the growing diversity of and changes in customer requirements are driving demand for the realization of multiproduct, variable-quantity production that can flexibly respond to market needs in terms of production lineup and volume, replacing conventional mass production.

Toshiba Tec Corporation has been expanding its lineup of point of sales (POS) systems and multifunctional peripherals (MFPs) in accordance with its motto of "customer-oriented manufacturing." For the timely introduction of optimal products to meet various requirements, we have achieved multiproduct, variable-quantity production for POS systems and MFPs through integrated product launch planning to determine their specifications from a long-term, total optimization standpoint, as well as the development of hardware platforms for the efficient execution of design, manufacturing, and maintenance services.

Design FMEA to Implement Quality Risk Assessment Accompanying Development of Products Using Hardware Platform

IIDA Yoshinori / IIZUKA Toshiaki

In line with the progress of hardware platform technologies to improve the efficiency of product development by means of common units, it is necessary to take adequate measures to prevent both the occurrence of unexpected malfunctions caused by different usage environments and expansion of the range of effects of such a malfunction. However, it has become difficult to take a wider variety of usage environments into consideration using conventional design methods.

As a solution to this issue, Toshiba Tec Corporation has constructed a scheme for design failure mode and effect analysis (design FMEA) to implement quality risk assessment based on a newly developed master model, which organizes the relationship between platform components and risks, at each stage of product development from the specification review phase to the start of mass production. This design FMEA continuously assures product quality by elucidating design issues from a wider perspective and ensuring the inheritance of knowledge between products and generations.

Application of 1DCAE to Improve Efficiency of Early Design Processes for MFPs

SUZUKI Yasuhiro / KAMANNO Tadao / KOJIMA Takahiro

The expanding complexity of requirement specifications for retail and printing products in recent years has made the timely provision of a diverse lineup of products indispensable in order to satisfy the needs of individual users.

Toshiba Tec Corporation has been actively focusing on the improvement of design productivity through the introduction of innovative design processes to the development of laser exposure equipment for multifunctional peripherals (MFPs). We have applied the 1DCAE design framework, in which equipment is divided into functional units and the feasibility of a design is demonstrated using these functional units, to the early design processes for laser exposure equipment, thereby allowing even an inexperienced optical engineer to swiftly perform quantitative evaluation of laser exposure positions according to the misalignment of optical parts. 1DCAE makes it possible to improve design productivity and ensure design quality based on evaluations under various conditions.

Application of Numerical Analysis Technology to Product Development to Ensure Design Quality

HASEBE Yoshifumi / MORIMOTO Jun

With the extensive dissemination of three-dimensional computer-aided design (3D CAD) in recent years, computer-aided engineering (CAE) analysis based on 3D shape data has become widely adopted in the field of product development. Accordingly, demand has recently arisen for design evaluation technologies that can eliminate the need for the fabrication of prototype models.

Toshiba Tec Corporation has been promoting the effective utilization of CAE to assure design quality in the upstream processes of product development as part of its efforts for the improvement of design productivity. As part of this approach, we have developed an automated tool for multi-posture drop analysis, which can evaluate the weakness of a dropping posture and the shatter resistance in this posture and enhance durability against dropping impact, in order to reduce the occurrence of process retrogression. We have applied this tool to the development of a portable printer and confirmed that it increases robustness against dropping impact.

Software Evaluation System Enhancing Software Development Productivity by Reducing Dependence on Actual Equipment

MINOURA Yusuke / SATO Naoya / YAMAHIRA Yoshifumi

Customers' requirements for multifunctional peripherals (MFPs) and point of sales (POS) systems are becoming increasingly diversified and complicated, with the result that conventional software development entailing the use of actual equipment including prototypes and peripheral devices has recently been facing various issues including the need for long working hours and increases in costs.

To rectify this situation, Toshiba Tec Corporation has developed a software evaluation system that reduces the dependence on actual equipment and has been making efforts to enhance software development productivity. We have applied this software evaluation system to the development of software for our POS systems and confirmed that, in comparison with previous manual operations, it can shorten the product development period and improve product quality through highly reliable automated tests under a wide variety of conditions.

Product Development Support System Allowing Closer Collaboration among Multiple Development Bases

HAYAMA Shuichiro / SUGIYAMA Takahide / KUMANO Kazuhiro

In Japanese industries, the relocation of product development activities to overseas bases due to the workforce shortage and the introduction of automated design processes supporting workstyle reforms have become issues of vital importance.

With this as a background, Toshiba Tec Corporation is aiming at product development innovations under the banner of "*monozukuri* innovation" (*monozukuri* is a Japanese concept encompassing the art and craft of manufacturing). As part of these efforts, we have constructed a product development support system that allows designers at different bases to develop high-quality products through collaboration on designs based on the sharing of digital design data for hardware platforms and modules employing computer-aided engineering (CAE) in a virtual space. This system has been applied to the development of multifunctional peripherals (MFPs), and is contributing to the improvement of development productivity through the simultaneous advancement of product development using the latest digital data from each base and the efficient execution of automated design processes.

Feature Articles

Database Realizing Efficient Use of Accumulated Expertise Converted into Explicit Knowledge to Improve Productivity

YOSHIDA Satoshi / SANO Keiichi / MURAO Ryo

In order to improve productivity in manufacturing industries, demand has been growing in recent years for schemes that can facilitate not only the sharing of accumulated expertise among workers, including experience and know-how converted into explicit knowledge, but also the continuous sophistication of such expertise through utilization and development of this shared knowledge.

To support idea generation activities, the Toshiba Group has developed a methodology to effectively arrange and visualize business expertise as explicit knowledge as well as a methodology to enable the accumulation and reuse of such knowledge converted into electronic data. We are now working toward the efficient deployment of this system through verification of its effectiveness using actual in-house business data.

24 V SCiB™ Battery Pack for Mild Hybrid Electric Vehicles

MURAKAMI Manabu / SUZUKI Morio / MASAOKA Toshihiko

Mild hybrid electric vehicles (MHEVs) are driven by a gasoline engine under normal driving conditions and a low-voltage electric motor that serves only to assist the gasoline engine under low-speed or acceleration conditions. MHEVs offer improved fuel consumption at low cost by making effective use of regenerative energy during deceleration.

Toshiba has been supplying SCiB™ rechargeable lithium-ion batteries as an auxiliary power source for automobiles, thereby contributing to the reduction of carbon dioxide (CO₂) emissions and improvement of fuel consumption. In line with the global trend toward the electrification of automobiles to comply with increasingly stringent environmental regulations, we have now developed a 24 V SCiB™ battery pack for MHEVs using 10 Ah SCiB™ cells with enhanced input-output power characteristics. In Japan, this battery pack has been adopted in the Mazda3 released by Mazda Motor Corporation in May 2019, following its evaluation as a package with appropriate performance for installation outside of the vehicle compartment that provides superior input-output power characteristics as well as high safety.

Construction of Net Zero-Energy Building and Smart Wellness Office Based on Digital Transformation in Buildings and Facilities Field

KISHIMOTO Ariyuki / ARAKI Katsuhiko / NODA Hajime

The progress made in the buildings and facilities field in recent years has led to advances in various technologies for digital transformation (DX) using cloud computing. This has created a need for big data that encompasses not only data from facility equipment but also the observed behavior of individual people in a facility to achieve a balance between energy saving and a comfortable environment as well as reduction of the management burden.

Toshiba Infrastructure Systems & Solutions Corporation is aiming to develop technologies related to buildings and facilities based on DX and offering services and solutions that effectively utilize features cultivated through the development of its products and systems in this field in order to resolve issues faced by customers. With the aim of realizing a net zero-energy building (ZEB) and smart wellness office (SWO), we have developed new services using cloud system databases containing various data obtained by the SMART EYE SENSOR MULTI multifunctional image sensing device and the Sharepo facility inspection support cloud service in cooperation with building owners and management companies.

Renewal of Master Control Systems and Server Systems for Digital Terrestrial Broadcasting and Satellite Broadcasting Facilities

MIKOSHI Toshihiro / KOMATSU Hajime / USHIO Yasuyuki

Broadcasting organizations in Japan have recently been encountering the need for the renewal of aging facilities that were inaugurated at the inception of the digital terrestrial broadcasting and satellite broadcasting eras, in addition to the renewal of facilities to accommodate the significant shifts taking place in their business environments.

Toshiba Infrastructure Systems & Solutions Corporation has been developing products applying advanced technologies with the objective of offering optimal renewal systems to meet the needs of domestic broadcasting stations. As part of these efforts, we have delivered new master control systems and server systems for digital terrestrial broadcasting and satellite broadcasting facilities to Fuji Television Network, Inc. for the renewal of existing systems that were introduced in 2008, accompanying the expansion of equipment for the filing of broadcast materials and changes taking place in viewing styles including content distribution via the Internet. These new systems provide various solutions for space saving, reduction of power consumption, enhancement of fault tolerance, and improvement of maintainability, as well as the functions required for key station systems.

Small Transmitter/Receiver Module Employing High-Power and High-Efficiency GaN MMIC High-Power Amplifier for Radar Systems

SENJU Tomohiro / TAKAHASHI Koji

To meet the need for expansion of the detection range of weather radars and other radar systems, high-power amplifiers (HPAs) that achieve higher output power through the application of gallium nitride (GaN) high electron mobility transistor (HEMT) devices have been developed in recent years. However, as increases in the output power of HPAs can lead to increased power consumption and heat dissipation, there is growing demand for improvements in the efficiency of such devices.

Toshiba Infrastructure Systems & Solutions Corporation has addressed this issue by developing a small transmitter/receiver (T/R) module for X-band (8–12 GHz) radar systems employing a high-power and high-efficiency GaN monolithic microwave integrated circuit (MMIC) HPA. Experiments on prototypes have confirmed that this T/R module achieves an output power of more than 13.5 W and a power-added efficiency (PAE) of more than 41.4% in the frequency range of 9–10 GHz.

Frontiers of Research & Development

Software Management System to Enhance Software Component Reuse and Open Source Compliance
Solid Oxide Electrolysis Cell for Hydrogen Production Realizing High Efficiency and Long Life