

## Application of User Experience (UX) Design to Products and Services of Toshiba Group

UX Design Facilitating Creation of New Customer value  
YUSHIMA Akira

## Trends in and Prospects for UX Design

IKEMOTO Hiroyuki / ONAI Katsuhiko

Semantic value arising from functional value in the creation of products and services has become increasingly important for consumers and customer companies. In a constantly changing business environment, many companies have recently been focusing on the creation of not only functional value but also semantic value as a driving force for innovation to improve quality of life. User experience (UX) design to offer new semantic value contributes to increased customer satisfaction and competitiveness, by making it possible to embed positive UXs into products and services and maximize semantic value to customers through a process of repeated conceptualizing and prototyping using fieldwork and visualization. In order to enhance the competitiveness of semantic value, strategies to enhance accumulated know-how and experience as well as organizational and human resource capabilities are essential. In the formulation and execution of strategies, a method for evaluating the effect of investment in semantic value and UX design is also required.

Toshiba has positioned UX design as one of its activities to add both functional and semantic value to a wide range of products and services.

## Toshiba's Approaches to UX Design Methods

IKEMOTO Hiroyuki / FUKUSHIMA Rieko / MIKAMI Tatsuyuki

Toshiba has been promoting the development of user experience (UX) design as one of its activities for the creation of new value aimed at realizing benefits for society together with customers, through semantic value resulting from functional value by the integration of products and services. Our concept of UX design is to disseminate a synergistic cycle of well-being throughout society by creating positive experiences for users.

Utilizing flexible toolsets to effectively perform UX design processes, we are further expanding their areas of application from the business-to-consumer (BtoC) to business-to-business (BtoB) markets and contributing to the creation of new customer values.

## Approach to Cloud-Based Transportation Planning System Using UX Design

DOI Masaharu / KUBO Hideki / SUZUKI Tatsunori

Toshiba has been engaged in the development of products and services using user experience (UX) design aimed at creating positive user experiences and disseminating a synergistic cycle of well-being throughout society.

We have now developed a cloud-based transportation planning system that allows even inexperienced users to improve planning operations and work efficiency through the use of intuitive displays applying user interface (UI) design. This system was realized by employing the UX design concept based on assessment of the users' current situation. In the business-to-business (BtoB) market, UX design contributes to the solution of management issues faced by our customers through the improvement of users' operations, thereby meeting the needs of society.

## Collaborative Workshop with Local Residents Realized by UX Design to Facilitate Miyakojima City Small-Sized Electromotive Mobility Project

YAMAKAWA Mizuki / TERAOKA Keiko / MINEGISHI Hidenori

In the social infrastructure business field, demand has been growing in recent years for individual solutions reflecting the actual situation of each local community. However, complex issues often have to be dealt with when formulating a community-targeted solution due to the large number of parties involved with various values.

Toshiba is promoting community design based on user experience (UX) design, in which importance is placed on empathy and joint creation with the community concerned through visualization methods including graphic facilitation and prototyping. In promoting the Miyakojima City Small-Sized Electromotive Mobility Project, we have obtained good results applying our UX design process to the design of a community event to install murals painted by children in Miyakojima City on electric vehicle (EV) charging stations, and confirmed the effectiveness of this approach for resolving community issues through participation of the local residents in the project.

## UX Design for Medical Equipment and Its Application to Vantage Elan™ 1.5-Tesla MRI System

OHMUKAI Shinya / KANAZAWA Hitoshi / ADACHI Akira

Toshiba has been developing and supplying medical equipment that can be used without anxiety in hospitals, aimed at providing medical professionals with easy operation while reducing the burden on patients through the application of user experience (UX) design promoted by its Design Center.

As part of this work, we have developed the Vantage Elan™ 1.5-tesla magnetic resonance imaging (MRI) system adopting a new approach to the solution of social issues associated with hospital management in addition to our conventional design approaches. In the field of medical equipment, the improvement of performance is often accompanied by increased size and complexity. To overcome this trade-off and disseminate MRI diagnosis services more widely, we employed a different approach for the creation of a next-generation standard for MRI systems offering high performance while maintaining ease of installation and operation by implementing the UX design process from the viewpoint of customers, based on the concept of eliminating unnecessary specifications without sacrificing performance.

## Proposal of New POS Systems for General Merchandising Stores Utilizing UX Design Approach

KOMAMIYA Yuko / HOSHINO Naoki

In the field of retail solutions, Toshiba TEC Corporation leads the market for point of sales (POS) systems in Japan with a share of almost 50%. However, due to the changes taking place in both customers' purchasing behavior and store operations due to the wide dissemination of notebook PCs and smartphones in recent years, it has become difficult to develop POS systems using the product development approach as in the past.

To solve this issue, we have developed proposals for new POS systems and services for general merchandising stores to be realized by 2020 through the analysis of customers' purchasing behavior and attitudes, based on a user experience (UX) design approach. Our proprietary UX design approach, incorporating an idea generation process using customer journey (CJ) maps, makes it possible to propose optimal solutions to meet various requirements.

## dynabook KIRA L93 Shape-Shifting Notebook PC with Seven Modes to Accommodate Multiple Usage Scenarios

KURIMOTO Ryusuke / AOYAGI Tatsuya / TAKENOUCHI Hiroki

Toshiba has been incorporating user experience (UX) design processes into the development of notebook PCs with the aim of creating a new type of device.

As a result, we have succeeded in commercializing the dynabook KIRA L93, a high-end slim and light notebook PC targeting active creators focusing on the fact that notebook PCs provide users with significantly higher input and creative capabilities than smartphones and tablets. In a cooperative study with designers working at an outside design company aimed at confirming their requirements, we identified various device, time, and location constraints experienced by such users. As a solution to these issues, we applied UX design to each touchpoint from the development of the product concept through to the technical challenges including the keyboard attachment mechanism and the design of the communication functions. The fruit of these efforts was the dynabook KIRA L93, a product based on the concept of a shape-shifting notebook PC with seven different modes to accommodate a variety of individual usage scenarios.

## Grip for Vacuum Cleaners Designed Based on UX Concept to Reduce Physical Burden of Operation

IDO Kenji / FUTO Masafumi / MANO Fumiki

The concept of Toshiba's user experience (UX) design is to propose positive experiences to users through its products and services, thereby disseminating a synergistic cycle of well-being to benefit society.

As part of our efforts in the development of home appliances, we have been actively focusing attention on the shape of the grip of vacuum cleaners as a touchpoint between products and users, to realize the UX of easily and comfortably cleaning any location in the home. We have developed a grip with high usability for vacuum cleaners through repeated design processes from conception to visualization and verification in order to reduce the burden on the user's arm and wrist when moving the vacuum cleaner head and cleaning various locations, and incorporated it into our vacuum cleaner products since 2010. We are continuously improving grip shape by feeding back users' opinions and introducing more highly evolved products with the aim of disseminating optimal UXs throughout society.

## Feature Articles

## Automatic Tunable Antenna Applicable to Various Wireless Communication Systems

HIGAKI Makoto

Built-in antennas for wireless communication terminals including smartphones are susceptible to changes in the matching condition with the transceiver due to disturbance of the radio waves caused by objects in the vicinity such as the user's hand or head, a desk, and so on. The resulting degradation of matching characteristics can lead to a reduction in the receiver sensitivity and/or an increase in the output power of the transmitter.

To address this issue, Toshiba has developed an automatic tunable antenna to achieve both reduction of the space required for installation of the antenna and automatic optimization of its characteristics in real time. Wider bandwidth and downsizing of the antenna system were realized by adopting microelectromechanical system (MEMS) variable capacitors between the antenna and transmitter together with an optimization controller. Experiments on a prototype antenna system have confirmed that it can reduce the output power of the transmitter by improving the matching condition in real time.

## Model Synthesis Method Automatically Combining Target System with External Environment in Model Checking

SUMI Takeshi / FUJIMOTO Hiroshi / MORI Namiko

In software development, it has become difficult to assure system quality solely by design reviews and tests due to the increasing scale and complexity of software in recent years. As a solution to this issue, model checking is attracting attention as a means of realizing effective design verification in the upstream processes of software development. However, in the case of large-scale software model checking that requires verification of the external environment in addition to the target system itself, integration of the external environment into the system verification model often leads to the failure of verification due to a lack of the necessary computing resources.

In this context, Toshiba has developed a model synthesis method that automatically combines the models for a target system and its external environment in such a way that inspection processes can be successfully executed even in the case of model checking for large-scale systems. We have confirmed the effectiveness of this model synthesis method through the results of tests showing that it can be applied to systems approximately 10 times larger than those handled by conventional methods.

## Two-Pole 60 Hz Turbine Generator with World's Largest-Class Capacity of 1,230 MVA

NEMOTO Kosuke / CHIBA Hideki

Thermal power plants recently constructed in Japan and other countries can be classified into two groups: large-capacity plants, and medium- and small-capacity plants. In the field of large-capacity coal-fired thermal power plants, higher efficiency and greater single-unit capacity are increasingly required in terms of economic efficiency and optimal site utilization.

To meet these market requirements, Toshiba has manufactured and delivered a large number of 1,000 MW-class steam turbine generators. We have now developed a two-pole 60 Hz steam turbine generator that achieves both the world's largest-class capacity of 1,100 MW (1,230 MVA) and the world's highest-level efficiency of 99% through the optimization of the structural design and application of our latest technologies to increase the hydrogen gas pressure and terminal voltage and to reduce the power loss. This turbine generator was shipped in November 2013 after successful shop tests, and is currently under installation with the start of commercial operation scheduled for 2015.

## Control Technologies for Quadruped Walking Robot to Facilitate Carrying Operations in Reactor Buildings

SUGANUMA Naotaka / UEHARA Takuya / NAKAMURA Norihito

At the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Co., Inc., which was seriously damaged by the Great East Japan Earthquake of March 11, 2011, it has been difficult for workers to approach the reactor buildings due to the hazardous surrounding environment. The need has therefore arisen for remote-controlled robots to facilitate inspection and restoration work on behalf of workers in such a high-level radiation environment.

Toshiba has developed a quadruped walking robot that can carry various tools for decommissioning work. This robot is capable of maintaining its balance while walking on uneven surfaces, slopes, and stairs due to the adoption of control technologies to not only autonomously determine the leg trajectories and center of gravity, but also to correct the leg landing positions and posture with operator intervention according to the walking situation. It also offers high mobility and workability through a manipulation function that allows it to unload tools carried on its back storage area by using two of its legs like arms. This quadruped walking robot was applied to the investigation of suspected water leakage areas in the reactor building of Fukushima Daiichi Nuclear Power Station Unit 2 in December 2012.

## "Becquerel Screening" Device to Automatically Measure Activity Level of Contaminated Soil in Flexible Containers

OKADA Hisashi / YAMAGUCHI Yoshihisa / YAMAMOTO Shuji

Contaminated soil and incineration ash collected during offsite decontamination work following the accident at the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Co., Inc. is being stored in flexible containers. These containers are managed taking their activity level into account in accordance with the Decontamination Guidelines issued by the Ministry of the Environment.

Toshiba has developed the "Becquerel Screening" device that can automatically measure the activity level of the contents of each flexible container simply by placing the container on a palette, without the need to take samples for analysis from the container. The Becquerel Screening device is expected to contribute not only to improved operational efficiency but also to reduced exposure of operators to radiation, because it eliminates the need for direct contact with contaminated soil and ash.

## OLED Panels Offering New Concept for Luminaires Including Thin-Form-Factor Bracket Lights and Transparent Luminaires

ENOMOTO Shintaro / HAYASHI Junya / KANEKO Takashi

The organic light-emitting diode (OLED) is a diffused surface light source that is currently attracting attention as a next-generation lighting technology to uniformly illuminate wide spaces, whereas the LED is a discrete light source with high luminance.

Toshiba Lighting & Technology Corporation has been promoting the development of luminaires based on a new concept applying OLEDs. We have developed four types of thin-form-factor bracket lights using OLED panels, and released them in April 2014 for the first time in the industry. An optimal layout with a combination of these bracket lights offers comfortable ambient lighting by enhancing the brightness of the entire indoor space including walls and ceilings. We have also developed a prototype luminaire incorporating our proprietary transparent one-side-emission OLED panels, and verified that the transparent OLEDs achieve a reduction in the feeling of presence of the luminaire when turned off due to their transparency, as well as a high level of comfort with their soft light when turned on.

## Frontiers of Research &amp; Development

High Dynamic Range Display Technologies for REGZA Z9X Series 4K UHD TVs to Enhance Reproduction of Brilliance