# TOSHIBA REVIEW

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## Special Reports-1

**Universal Design**

***Making Universal Design a Reality**
KATAGAMI Yoshinori

***Universal Design Trends and Future Outlook**
IKEMOTO Hiroyuki SAKAI Masaaki
Universal design refers to the design of products, services, and environments intended for use by as many people as possible, regardless of differences in age, gender, or ethnicity, nor whether an individual is disabled or not. In the United States and many other countries including Japan, governments, administrative bodies, businesses, and organizations are boosting their efforts in the area of universal design. For systems that allow differing needs to be reflected in the development of universal design, including the needs of the elderly and disabled, close attention to training and a stronger technical platform for universal design are essential to ensure the supply of high-quality universal design products.

Toshiba designs products from the customer's perspective, based on design processes with a human focus. We are now stepping up our activities not only in the field of universal design, but also in terms of user experience.

***Application of Universal Design Principles to Household Appliances**
KIKUCHI Satoko YAMAZAKI Shusuke
Household appliances are an essential part of daily life as labor-saving devices, and the aim of designers has always been to supply appliances that are easy to use. This will continue to be the case, with a focus on what is called universal design.

To make more user-friendly household appliances a reality, the Toshiba Design Center conducts voice of customer (VOC) surveys on appliances among various users, including the elderly and disabled, to rate the usability of these appliances. This paper discusses universal design initiatives in the field of household appliances, including a refrigerator that opens automatically by touch, developed with the goal of ensuring accessibility for as many users as possible.

***Accessibility Survey Involving Actual Use of Palmtop PCs**
HATAKEYAMA Hatsumi TOYAMA Toshie
Accessibility is one approach to the issue of universal design. Accessibility means enabling people with physical disabilities to also operate information and telecommunications technology in order to access information. Various laws to facilitate accessibility have been enacted over the years, and consideration of accessibility will become even more important as information technology continues to develop. When developing information and telecommunications devices, designers need to know the extent to which those with physical disabilities will actually operate such devices, and identify points vital for their development work.

Toshiba asked people with impaired eyesight, people with paralysis of one of the arms (hemiplegia), and people with cerebral palsy to use a palmtop PC, observed them operating it, and asked them for their views on the device. Consequently, we identified a number of design points important for accessibility.

***Elevator Control Panel Displays for People with Visual Disabilities**
ABE Takashi NAKAO Kazuhiko IKEDA Kyoichi
Recent years have witnessed growing interest in and expectations for universal design, with the rapid aging of the population and burgeoning awareness of the needs of those with physical disabilities. Elevators are a means of mobility available to all, found in ordinary buildings as well as in transportation-related and commercial facilities frequently used by the public. However, because elevators must be operated, the physical characteristics of the user can lead to interface problems. In particular, elevator use by people with visual disabilities poses numerous problems deserving of attention.

Toshiba formulated hypotheses and explored various practical solutions to these problems, then investigated these solutions and conducted verification testing and evaluation assisted by people with visual disabilities. As a result, we found the use of raised characters on elevator controls and different shapes for buttons with different functions to be effective means of improving elevator operability.

***Universal Design Principles to Development of Electronic Ballot Box**
NAKAHARA Michihiro SUZUKI Shogo MORIWAKE Takashi
Electronic voting was introduced in 2002. The move toward electronic voting is expected to provide voting privacy that people with disabilities have dreamed of for many years.

Toshiba set out to develop an electronic ballot box designed for easy use by as many people with disabilities as possible. This box was employed by the city of Shiroishi in Miyagi Prefecture for unified local elections in April 2003. Electronic voting is currently limited to local elections, although the technology is being explored for future use in national elections. Because consistency is demanded at the national level, including Japanese Industrial Standards (JIS) certification, we will continue collaboration with other companies in the same industry to conduct further research on an electronic ballot box accessible to as many voters as possible.

***Application of Universal Design Principles to Multifunctional Peripherals**
WASHIZUKA Keiichi KOMAMIYA Yuko
The multifunctional peripheral (MFP) is a common item of office equipment, developed from the photocopier, that combines the multiple functions of photocopying, faxing, scanning, and printing. As such, MFPs are used by countless people, naturally including those with disabilities. One can therefore imagine that users in wheelchairs using MFPs from a low position, or users with visual disabilities operating MFPs by touch or with very limited visual information, may experience difficulties.

This paper discusses the application of universal design principles to MFPs by the Design Department of Toshiba TEC Corporation based on two objectives: allowing access to MFPs with less effort (accessibility), and designing MFPs that can be operated in a more flexible and easily comprehensible way (usability).

***Web Accessibility**
FUKAYA Midori TONAMI Chiaki TAKADA Reiko
Websites need to be more accessible so that users visiting them can have equal access to the information they seek, regardless of their physical characteristics or their user environment. The Web Content Accessibility Guidelines (WCAG) published by the World Wide Web Consortium (W3C) have had a major influence on the guidelines of individual countries; in Japan as well, the government, local bodies, and companies are working to improve website accessibility.

In 2002, Toshiba drew up 39 Toshiba Guidelines for Web Accessibility using WCAG 1.0 as a reference. We are continuing work on a variety of initiatives aimed at improving website accessibility.

## Special Reports-2

**Measurement and Control Systems**

***New Deployments of Measurement and Control Systems**
OBANA Hideo

***Trends in Measurement and Control System Equipment**
OHBA Akira KAKEHI Atsuyuki
Twenty-five years have passed since the debut of digital control systems as microprocessor-based products. In the meantime, Toshiba control systems have evolved from TOSDIC$_{TM}$ through TOSDIC$_{TM}$-CIE to TOSDIC$_{TM}$-CIE DS, and are still progressing through enhanced cooperation with information technology systems today. This paper explains the technological development of measurement and control systems by introducing the trends in such systems then describing recent topics in relation to system components.

***New Developments in Industrial Controllers and Industrial PCs**
ASHIDA Kazuhide FUJII Naoki
Toshiba has incorporated various features into the V series integrated controller, including a new synchronous trend function and the FL-net transmission module. We have also developed and commercialized the FA3100A model 8000/8010, FR2100 model 70 (rack-mounted type), and FB2100 model 70 (box type) industrial PCs, responding to diversified user needs.

In addition to the above, we have forecast technical trends in industrial controllers and proposed the ubiquitous network, standardization for data exchange, and other technologies to improve the management and applicability of factory automation (FA) and process automation (PA) systems. We also describe here the development of products that will be released in the future.

***Model-Driven PID Control**
BABA Yasushi SHIGEMASA Takashi KOJIMA Fumio
Although proportional integral differential (PID) control is widely used, it cannot achieve good control results when applied to systems with long dead times. Because PID is not always the best method, Toshiba has been investigating more sophisticated and specially designed control technologies such as model predictive control.

Model-driven PID (MD-PID) consists of proportional differential (PD) local feedback and a simple control model. It has a wide range of capabilities, and is especially suitable for systems with long dead times. We have applied it to customers' systems and have obtained very encouraging results. MD-PID is not only applicable to process control but to any control target. It is therefore expected to be used in a broad variety of fields.

***New Measuring Instrument Technologies**
FUTOO Makoto
This paper introduces two new measuring instruments employing new technologies: a capacitance type electromagnetic flowmeter and a microwave density meter. The capacitance type electromagnetic flowmeter can applied to new fields where measuring is difficult with existing electromagnetic flowmeters, such as low-conductivity fluids. The microwave density meter is based on the phase difference method using microwaves, which is a Toshiba original measuring principle, and is useful in various fields including the pulp and paper industry and the food industry. The applications for these instruments are expected to further widen in the future.

***Recent Technologies for Energy Measurement by Electronic Watt-Hour Meter**
KOBAYASHI Shunichi IIMURA Toshikazu
The environment of energy measurement has been drastically changing due to the progress of electronic technologies and diversification of tariff systems. In this article, past electronic watt-hour meter technologies are reviewed and the latest models are introduced.

***Data Supervisory Control System for Wide Area Use via Multi-Network**
SUZUKI Hiroyuki TERANISHI Hiroyoshi TONOZUKA Yoshikazu
Data management systems for water supply and sewage treatment systems have conventionally been located at a fixed place such as an operating room. In recent years, however, the diffusion of information technology has made so-called ubiquitous systems possible in which the supervision of process data can be performed anytime and anywhere. In addition, improved work efficiency and labor saving are required from the administrative standpoint.

This paper describes a data supervisory control system for wide area use via a multi-network, developed by Toshiba in response to such customer needs.

***Approach to DCS Renewal in Processing Industries Field**
KOIKE Tatsuro OOTA Hiroshi NAKANO Hiroshi
Investment in equipment in the processing industries field is limited by the low rate of economic growth. However, generational changes in electronic parts are occurring very rapidly, and it is becoming difficult to purchase old model parts. As a result, most distributed control system (DCS) vendors are encountering numerous problems in continuing maintenance and service of their existing systems.

In response to these circumstances, Toshiba is providing methodologies for achieving DCS system renewal with minimum investment by the customer and minimum risk.

## Feature Articles

***Application of Lead-Free Solder to Cellular Phone Circuit Boards**
SAKAMOTO Hirofumi YAMABE Mitsuharu OOISHI Masako
Eliminating lead from the solder used to join parts in the printed circuit boards of cellular phones is required from the perspective of environmentally conscious product development. The melting point of lead-free solder is generally higher than that of conventional solder. This necessitates the use of parts with high heat resistance as well as a high-performance reflow furnace, thus increasing product costs.

Due to significant improvements in soldering conditions such as the development of solder paste and optimization of the reflow profile, Toshiba has realized the application of lead-free solder to its cellular phones, thereby maintaining low-cost operation.

***From Program Coding to Software Modeling**
YAMASHIRO Akihiro SUGIMOTO Nobuhide HOSOYA Ryuichi
Toshiba has been developing model-based component (MBC) technologies that apply model-driven architecture (MDA) proposed by the Object Management Group (OMG). MDA enables program code generation for specific platforms by a model compiler. A model compiler compiles both platform-independent model code as input and an application product-specific platform declaration as compile options.

By applying MDA, we expect software products to require a shorter period of development until their release as well as lower maintenance cost after their release.

***Oilless Helical Compressor**
FUKUDA Takashi OKUDA Masayuki HIRAYAMA Takuya
The compressor is the key component in air conditioners and refrigerators that compresses the refrigerant. In 2000, Toshiba Carrier Corp. developed and launched the helical compressor featuring an original compression mechanism with excellent performance.

This paper introduces the development of a new oilless helical compressor, which is a new oil-free type helical compressor for air compression applications. Oil-free type compressors have a wide range of applications, such as clean environment equipment, medical equipment, food-processing equipment, and various other types of industrial equipment, where oil can be a contaminant. The new oilless helical compressor takes advantage of the essential benefits of its compression mechanism to provide superior performance for these applications, including low energy consumption, downsizing, and low noise and vibration.

## Frontiers of Research & Development

***Livemark$_{TM}$ Engine**
-- Providing Consistent Services Even if Time, Place, or Device Changes

***DSP Realizing New Evolution in Home Appliances**