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Special Reports I

Human Interface Technologies Merging with Daily Life

*Toward the Merger of Human Interface Technologies with Daily Life

HIRAKAWA Hideki

*Trends in Dialogue-Based Human Interface Technologies

DOI Miwako KAMEYAMA Ken-ichi

Many microcomputers are embedded into home appliances, automotive peripherals, and mobile phones, and users unconsciously use these computers. It is becoming increasingly important to provide detailed services related to users' profiles, locations, and situations. The integration of various human interface technologies such as speech recognition/synthesis, image processing, and natural language processing enables hands-free and real-time interaction, thereby realizing secure and comfortable services and appliances.

*EUROPA: A Framework for Building Hands-Free Spoken Dialogue Interfaces

SASAJIMA Munehiko YANO Takehide

We have developed a new framework for building spoken dialogue systems, called EUROPA (Environment for utterance recognizable packages). To cope with spoken language, the voice recognition module of EUROPA performs keyword spotting. The grammar rules for EUROPA allow various ways of representing users' intentions. Furthermore, we have developed BTH, a new method for identifying input sentences from a very-large-scale keyword lattice within a short time.

We have applied EUROPA to build MINOS (Mobile interactive navigation speech system), a prototype system for car navigation, which can accept more than 2 million sentence patterns and answer within 2 seconds in most cases.

* Combination of Fractal Image Processing and Real-Time CG : "Kaotsuki MusicDance$_{TM}$"

MURATA Katsuyuki IDA Takashi KUBOTA Hidetoshi

Mobile PCs, including mini-notebook PCs, have begun to be used not only for business purposes but also for entertainment, to be carried and enjoyed anytime and anywhere. One of the reasons is that the performance of PCs has improved, and even three-dimensional computer graphics (CG) can be produced in real time.

To open the mobile entertainment era, Toshiba has developed a moving picture software named "Kaotsuki MusicDance$_{TM}$" and loaded it into the Libretto ff 1100V mini-notebook PC. This software introduces dancing characters that feature the user's face on a prepared CG body, dancing to the music. The software, which is enjoyable and easy to use, has been realized through the technologies of fractal image processing and real-time CG.

*"AQU･Pa!!" Software Package for MPEG-4 Transmission of Video Messages

FUJIURA Rie UMEDA Akira

We have developed a package software called "AQU･Pa!!" for editing of video contents by consumers. The main target of this software is to enable the sending of e-mail using MPEG-4, the international standard for audio and video compression technologies that was standardized by ISO in August 1999. MPEG-4 will be the main current of digital compression technologies because of its high compression rate and its ability to handle not only audio and video, but also still images and text.

E-mail is now an essential means of consumer communication. If video messages can be sent by e-mail, such mail will more effectively transmit the sender's intentions. Up to the present, however, the editing of video contents by consumers has appeared to be a difficult task. This paper therefore proposes a GUI design that is easy for beginners in video editing to operate.

*Navigation System for News Programs Featuring Direct Access to Desired Scenes

KAMO Yushi TAKAHASHI Hideyuki

Train information processing covers a fairly broad spectrum, from equipment monitoring and control to diagnosis and service. These functions are continually expanding. The principal functions of train information processing have been realized and improvement of operating performance is now being promoted. Not only the enhancement of functions, but also communication between trains and ground systems and the realization of service functions for passengers will be among the keywords in the technical trends for future train information control systems.

This paper describes the technical trends for future train information control systems, taking systems developed by Toshiba as an example.

*Technical Trends in Train Information Control Systems

UEHARA Tatsuya HORIKAWA Masayuki SUMITA Kazuo

A digital broadcasting system simultaneously transmits large amounts of program content. Although TV viewers can select their favorite programs, they do not have sufficient time to watch all of them.

To solve this problem, we have developed a navigation system for news programs which allows viewers to directly access desired scenes. The navigation system recognizes both visual and aural information in a news program, and integrates these recognition results. The system then divides the program into news topics and adds keywords, which help viewers in selecting desired scenes, into each topic.

*Real-Time 3DCG Technologies Evolving Consumer Game Consoles

KUNIMATSU Atsushi MORI Kenichi TAGO Haruyuki

We have developed a new LSI architecture for a new consumer game console. In order to create realistic three-dimensional computer graphic (3DCG) images in real time, massive floating-point computer power is required. We developed a new very long instruction word (VLIW) architecture oriented to 3DCG operations, including 4 x 4 matrix operations, a high-speed floating-point accumulator, and a floating-point divider. Supercomputer-class performance of 5.5 GFLOPS (giga floating point operations per second) is obtained.

*User-Friendly Route Guidance Interface for Internet-Based Information Service

TANIGAWA Satohide KUBOTA Hiroaki HASEGAWA Tamotsu

When visiting an unknown locality, it is often difficult to identify the appropriate route due to the excess of information contained in ordinary maps. A strong need therefore exists for a simple route guidance interface for people who are not familiar with the locality, enabling only the necessary information to be extracted from a detailed map.

To achieve such an interface we developed two new technologies: one that can generate a simplified map in real time by extracting the best route from a detailed map, and another that can generate texts describing the extracted route. Adopting these technologies, we have started to offer new route guidance services (i.e.,√MAP$_{TM}$ and route-map-DD$_{TM}$ (door-to-door)) at a Web site called "Ekimae Tanken Club" that provides various types of route guidance services. We have also developed a prototype route guidance system for use with cellular phones.

*Multimedia Contents Distribution at Railway Stations

KANNO Seiichiro TSUNODA Keiji

We have conducted a trial at railway stations with a service in which multimedia contents are delivered to users' new terminals (e.g., silicon-audio player). We confirmed that significant demand exists for downloading of data at railway stations or in a mobile environment, and investigated the possibility of launching a successful business related to this service by collecting questionnaires from participants in the trial.

Special Reports II

Laser Technologies in the Nuclear Field

*Nuclear Energy Business and Laser Technologies

NIWANO Masao

*Development of Laser Application Technologies for Nuclear Field

MIYANO Hiroshi SASAKI Norio SUDO Akira

Toshiba has been developing and applying laser application technologies in the nuclear field based on its skills and design capabilities as a leading plant manufacturer. Work in a radiation environment or under water can be performed remotely by means of lasers with high directivity and controllability. Preventive maintenance technologies using lasers have been developed and applied to core components of aging nuclear power plants to meet the requirements of life management. Repair, inspection, and instrumentation technologies using lasers are being intensively developed. Uranium enrichment technology using lasers is also under way. Laser processing aimed at enhancing added value and shortening production periods is under active development.

*Maintenance Technologies for Reactor Internals

SATO Kenji KOBAYASHI Masahiro SANO Yuji KIMURA Seiichiro

Toshiba places the highest priority on maintenance technologies for the reactor pressure vessel (RPV) and its internals in operating nuclear power plants. This paper summarizes the status of applied laser maintenance technologies, both preventive and repair.

For laser peening and laser desensitization treatment (LDT) technologies in particular, field applications are also described in detail. In the future, the area of field applications for preventive maintenance, repair, and inspection technologies will be further expanded.

*Laser-Applying Instrumentation Technologies for Power Plants

TAKESHIMA Noriyuki KUWAKO Akira KANEMOTO Shigeru

Laser-applying instrumentation technologies make it possible to perform remote, noncontacting, and highly sensitive measurement instantaneously, and are expected to be used for analysis and inspection work in both nuclear and fossil-fuel power plants. Toshiba is making efforts toward the development and practical use of laser-applying instrumentation technologies, aiming at the realization of detection technologies for power plants such as trace element analysis in water and sodium and oil leak detection, as well as inspection technologies such as laser-induced ultrasonic inspection and optical torque measurement.

*Atomic Vapor Laser Isotope Separation (AVLIS)

ABE Motohisa KIMURA Hironobu ISHITOYA Kenji

Atomic vapor laser isotope separation (AVLIS) technology is expected to be a more economical method, in terms of both capital and operating costs, compared with conventional gas diffusion and gas centrifuge enrichment. AVLIS technology will be applied not only to uranium but also gadolinium enrichment, which will have economic merit in light water reactor (LWR) operation. Technological development for its practical application is under way.

A copper vapor laser (CVL) pumped dye laser (DL) system, in which both of the lasers are high-power, high-repetition-rate pulsed lasers with precise frequency stability, has been developed for the AVLIS program in Toshiba. A CVL maximum output power of 2.4 kW has been successfully achieved in a master oscillator power amplifier (MOPA) configuration. A DL output power of 542 W has been demonstrated in long-term operations exceeding 200 hours.

This laser system will be applied at a demonstration facility in Tokaimura for a trial of industrial-scale uranium enrichment.

*Processing Techniques Applying Laser Technology

YAMADA Yuji MAEKAWA Osamu MAKINO Yoshinobu

The requirements for the processing of nuclear energy equipment include high precision, low distortion, and low heat input. Toshiba has developed laser processing techniques for cutting, welding, and surface heat treatment of nuclear energy equipment because the zone affected by distortion and heat in laser processing is very small.

Laser processing contributes to the manufacturing of high-quality and high-reliability equipment and reduces the manufacturing period.

Feature Articles

*Study on SiO_2 Degradation Mechanism and Novel Oxidation Process for Highly Reliable Gate Oxide

SATAKE Hideki MITANI Yuichiro

We investigated the mechanisms of dielectric breakdown in ultra-thin SiO_2 used for scaled Si LSIs, using newly developed investigation methods. It was found that SiO_2 dielectric breakdown is dominated by the amount of discharging energy and the time constant for discharging of the stored energy in a MOS system. For the suppression of defect generation in SiO_2, we demonstrated that fluorine-incorporating SiO_2 has a great potential for realizing a very steep charge-to-breakdown (Q_{bd}) distribution.

*NEO BALL Z$_{TM}$ Series Compact Fluorescent Lamp

ITOH Hidenori OOSAKI Hajime

In 1998, Toshiba introduced the NEO BALL Z$_{TM}$ self-ballasted compact fluorescent lamp on the market as an alternative to 60 W incandescent lamps. It is the most compact lamp of its type in the world, and can be easily attached directly to ordinary incandescent bulb fittings.

We have now developed new "3U"- and "4U"-shaped compact bulbs and a new compact circuit driven by a complementary pair type MOSFET. As a result, various types of NEO BALL Z$_{TM}$ fluorescent lamps have been realized as replacements for 40 W and 100 W incandescent lamps.

*CDM－9000 Tri-Mode CDMA/AMPS Handheld Portable Cellular Telephone

SUIZU Shinichi INAMORI Michiaki MATSUKI Shigeru

To satisfy the emerging demand for seamless and flat-rate service in conjunction with the recent mergers among major U.S. CDMA carriers, we have developed a triple-mode phone (800MHz CDMA/AMPS, 1.9GHz CDMA) that provides entire national coverage in a single unit.

Equipped with microbrowser and asynchronous data functions for business and mobile users, this cellular/personal communication system (PCS) phone also offers the user-friendly functions of voice-recognition dialing and vibrator alert. Fully loaded as it is, the phone weighs only 135 g (4.8 oz), yet it offers 190 minutes of talking time and 170 hours of standby time.

Epoch-Making Toshiba Technologies

*9. SAW Devices