

Special Reports

Social Infrastructure Based on Radio Wave Technologies

Realizing the Future by Extension of the Radio Wave Domain

UMEKAWA Eikichi

Toshiba's Activities in Radio Wave Field

ADACHI Hideo / ANDO Yasuhiro

Toshiba has been contributing to society under the concept of constructing efficient social infrastructure and a comfortable environment. The scope of our activities in the radio wave field includes air traffic control, disaster prevention, and emission surveillance. In these activities, our aim is to accurately understand the situation and promote solutions that will contribute to the further advancement of society. Recently, various threats have arisen such as serious transportation accidents and natural disasters (earthquakes, tsunami, etc.). This paper introduces Toshiba's measures to deal with such circumstances.

Integrated Tracking and Control System for Stratospheric Platform

KATSUYAMA Yasuhiro / OHBA Yoichi

The stratospheric platform (abbreviated SPF) is a Japanese national R&D project for the world's first stratospheric unmanned airship, envisioned as a unique network node for communications, broadcasting, and earth observation.

Since the inception of the project, Toshiba has been engaged in the design and integration of the integrated tracking and control system for the SPF. Our long experience in air traffic control systems as well as satellite tracking, telemetry, and command systems has assisted us in dealing with the unprecedented SPF realm.

This paper describes our approach to developing the integrated SPF tracking and control system, mainly from the standpoint of air safety precautions among many other technological and operational challenges.

MEWS Subsystem for Stratospheric Platform

MUTO Ryuichi / YUGE Nobuko / HORIKOMI Junichi

As the lead managing company, Toshiba is committed to the development of the integrated tracking and control system for the stratospheric platform (abbreviated SPF), a stratospheric unmanned airship being built as a Japanese national project. The fragility of the airship imposed stringent requirements on the system performance in terms of the meteorological aspects, especially wind observation and prediction.

This paper gives a concise overview of the "meteorological, especially wind observation and prediction subsystem" (MEWS), which integrates various weather sensors with a local-weather-forecast model, focusing on how it has outperformed all of the system requirements. It is our hope that this accomplishment will become a springboard leading to further expansion of our solution business for greater benefits to society.

Upgraded "Weather-plus_{TM}" Weather Information Service

MIZUTANI Fumihiko / KAWAHARA Satoru / WADA Masakazu / SUGAI Hiroyuki

Weather information services have become increasingly important, not only for the general public but also for companies and organizations engaged in business activities that tend to be affected by weather conditions.

Toshiba has been offering a weather information service called Weather-plus_{TM} since October 2003, which provides weather data on a fine mesh with 5 km intervals. We have now completed an upgrade of the system in terms of data precision and timeliness of dissemination by introducing new algorithms employing real-time radar data as additional information for analysis, and have announced the commencement of upgraded services throughout Japan.

It is our hope that these services will be of help in developing subscribers' business opportunities.

SSR Mode S Radar System for Central Japan International Airport

KAJIO Hiroshi / HASHIDA Yoshio / INO Masami

Two types of radar systems are the key to air traffic control (ATC) operations: air route surveillance radar (ARSR) and airport surveillance radar (ASR). Mode S, the radar designation of an upgraded version of a system called secondary surveillance radar (SSR), has been introduced in ARSR systems since 2003 as the first step. As the next step, it was introduced in an ASR system in January 2005 when it was deployed at Central Japan International Airport, the first deployment at a Japanese airport.

Toshiba delivered the Mode S radar system to Central Japan International Airport and has obtained good results from a series of operational field evaluation tests. We have therefore completed our lineup of both types of Mode S radar systems by delivering them to both ARSR and ASR systems.

Radar Data Processing System for Air Traffic Control

TAGUCHI Jitsuo / YAMADA Tatsuro / AKAISHI Takatoshi

Recent data processing systems (DPS) are expected to flexibly meet the demands for sophistication of functional requirements and diversification of computer architectures. In response to this trend, Toshiba has revamped its radar DPS (RDPS) for air traffic control in accordance with today's advanced computer and software design practices. While conventional RDPS used to incorporate centralized software processing on a large central computer complex, we have developed a new model of RDPS by applying our own methodology of software construction, implementing the block-and-build approach to software engineering on a distributed processing system so as to flexibly respond to changes in computer hardware and/or operating systems.

These technology bases are expected to be applicable to the development of similar DPS in the ever-evolving software engineering environment.

Geolocation Technique for Sources of Satellite Communication and Broadcast Interference

KAMIMURA Yukihiko / NOZAWA Tatsuya

While the current expansion of satellite communication and broadcasting services has brought about social benefits, at the same time it has also created overcrowded orbits in space as well as congestion of the radio wave spectrum. If a geostationary satellite were to suffer a jamming intrusion into its uplink for whatever reason, location of the jamming source would be necessary. However, this is a technical challenge that is yet to be solved.

As an answer to this situation, this paper briefly introduces Toshiba's in-house experimental research efforts to estimate the possible location of a jamming transmitter by a novel scheme of signal processing applied to the collected downlink signals. Our hope is that this work will help to pave the way toward a new perspective of radio wave administration in space.

Radio Source Visualizing System

SHIMOMAKI Hirokazu / KAWANO Shuichi

With the rapid increase in radio stations as typified by the proliferation of mobile phones, depletion of the radio wave spectrum is becoming a grave social problem such that even a small number of unlicensed and unlawful radio stations could endanger the radio wave users' community, causing mutual interference or denial of service.

Toshiba has developed a radio source visualizing system whose display indicator outputs a photo image with overlaid markings on the suspected areas of radio wave emission, which can assist governmental radio wave administration. The novel and inventive concept of this system permits its applicability to be readily expanded to search-and-rescue operations, detection of eavesdropping, real-time spotting of mobile phone users in a crowd, and so on.

Feature Articles

Power Demand Monitoring System

MIZUKAMI Tomoko / KASAI Miyuki

As the deregulation of the electric power industry progresses, electric utilities are expanding their service energy management systems and energy-saving systems as well as their conventional safety inspection systems. Under these circumstances, both the electrical safety inspection industry and its customers need high-level energy monitoring that is efficient and cost-effective.

Toshiba has recently enhanced Fine Terminal_{TM} with the addition of a power demand monitoring function for low-tension circuits. Fine Terminal_{TM} offers high added value and improved convenience with two-way transmission capability so as to satisfy users' needs for the advancement of electrical safety inspections and streamlining of operations.

High-Power and High-Efficiency Permanent-Magnet Reluctance Motor for Hybrid Electric Vehicles

SAKAI Kazuto / HAGIWARA Keizo / HIRANO Yasuo

The recent progress of new technologies will eventually lead to the realization of new-generation vehicles with high efficiency and high performance. One new technology is the variable-speed drive that operates over a wide range of speeds.

Toshiba has developed a novel permanent-magnet reluctance motor (PRM) that operates over a wide variable-speed range (1:5) with high efficiency (95-97 %). The PRM has been applied to two hybrid electric vehicles (HEVs): a sports utility vehicle (SUV) and a truck. The PRM for the world's first hybrid SUV features an output power of 65 kW and a high rotational speed of 13,500 rpm.

Novel Compost Analyzer Using Laser-Induced Breakdown Spectroscopy

MAIDA Mitsuhiro / HAMADA Tomohiro / KUWAKO Akira

Toshiba has developed a novel compact analyzer using laser-induced breakdown spectroscopy (LIBS) to analyze the constituents of compost. Fertilizer elements with low atomic numbers such as C, N, P, K, Ca, and Mg were rapidly measured by Nd:YAG pulse laser (1.06 μm, 5 ns, 10 Hz) applied to the compost samples. This device makes it possible to simply analyze the solid material, instead of dissolving compost in nitric acid as has been required in the conventional method.

Ku-Band High-Power 30 W GaAs FET

TAKAGI Kazutaka / OHMORI Tomohito / KASHIWABARA Yasushi

Toshiba has recently succeeded in developing a Ku-band field-effect transistor (FET) with the highest output power in the world. It outputs 30 W in the 14.0 to 14.5 GHz frequency range. This was achieved by improvement of the thermal dispersion, optimization of the package configuration to control its cavity resonance, and the best mix of substrates for the internal power-combining circuit.

Toshiba has been in the leadership position in providing high-power microwave devices. This latest development further strengthens our lineup of microwave power FETs for high-power solid-state amplifiers used in very small aperture terminals (VSATs) and similar equipment.

FlyingServ® J-Frame Server®: New Java™ Technology Expanding Scope of Web Applications

MIYAZAKI Masashi / FUNAKI Ryoichi

Many business application systems are now being built on the Web platform. The graphical user interface (GUI) capabilities of the Web platform are limited, however, making it difficult for developers to create rich forms that are typically used in conventional systems.

FlyingServ® J-Frame Server® is a framework that provides a rich, interactive GUI to the client. It is used in conjunction with Java™-based Web application programs, and helps developers to concentrate on the business logic rather than the GUI operation. By using its form function and COBOL interface function, it is possible to expand the use of the Web to a variety of applications.

Electric Power Market Price Analysis for Trading Risk Management

ITOH Yasuyuki

Wholesale electric power trading commenced in Japan in April 2005. Risk management of power trading requires estimation of the magnitude of market price risk.

For this purpose, Toshiba has developed techniques for electric power market price analysis. These techniques enable users to forecast electric power spot prices and forward prices with confidence intervals and to perform long-term simulations.

Frontiers of Research & Development

Real-Time High-Accuracy Pupil Detection Technology

Specification Synthesis Technology for System-on-a-Chip (SoC) System-Level Design