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Special Reports

Intelligent Transport Systems Entering Practical Stage

ITS Realized by Concentration of Latest Technologies
OZAWA Shinji

New Trends in ITS at Beginning of Practical Use
SHIMADA Shigehito / SUZUKI Katsuyoshi / ADACHI Toshiro
New information systems for vehicles and road traffic networks began to enter practical use in the 1990s. Starting with the dissemination of navigation systems, the Vehicle Information and Communication System (VICS), which provides real-time traffic information to vehicles such as information on traffic accidents, entered the practical stage in 1996. The Electronic Toll Collection (ETC) system, which had been developed and refined over a number of years, began test operation in 2000.

The navigation systems and VICS that spread in the 1990s are systems providing information to drivers. From now on, however, information services using two-way communication with drivers and pedestrians will be the focus of attention. It is said that the ubiquitous society will be realized in the 2000s. It is hoped that an omnipresent information and communication environment available anytime and anywhere will improve the safety of drivers and pedestrians while realizing various convenient and easy-to-use services, by applying not only personal cellular phones but also advanced information and communication technologies developed in succession.

New Fare Structure Utilizing Electronic Toll Collection System
KAWAMI Atsushi / MATSUI Kiyoshi / HONDA Koki
The Electronic Toll Collection (ETC) system is now available at most tollgates in Japan and the installation of its onboard units in vehicles has been steadily expanding since its introduction in March 2001. ETC enables cashless, nonstop payment at tollgates and also makes possible new fare services utilizing information processing.

We have participated in the system development for new ETC services such as discounts according to the route and night discounts. We are confident that we can build systems that satisfy user requirements by leveraging the technical capabilities and operational knowledge developed through long experience.

Actual Road Verification of AHS Support System for Prevention of Vehicle Overshooting on Curves
OKI Yoshiaki / YAMADA Fumio / MAKINO Hiroshi / MIZUTANI Hiroyuki
The Ministry of Land, Infrastructure and Transport (MLIT) is developing the Advanced Cruise-Assist Highway System (AHS), which is expected to reduce traffic accidents. As a member of the Advanced Cruise-Assist Highway System Research Association (AHSRA), we organized proving tests on the Tomei Expressway in the Osawagawa district, where a significant number of traffic accidents have occurred because of a succession of small-radius curves in that section of the road. This paper describes a verification system for roadside-to-vehicle communications by the Dedicated Short Range Communication (DSRC) system for prevention of vehicle overshooting on curves. It also describes the results of AHS service effectiveness verification, drivers' evaluations, and verification of the reliability of the AHS support system.

Evaluation of AHS Road Sensor Detection Characteristics under Poor Visibility Conditions
KURATA Ryoichi / TOHNO Masatoshi / ISHII Takakazu / OOUCHI Hiroyuki
The Advanced Cruise-Assist Highway System Research Association (AHSRA) is furthering the development of road sensors that detect the tail of traffic congestion, stopped vehicles, and low-speed vehicles. For realization of the AHS, it is important to clarify the detection characteristics of these road sensors on a practical level.

As one of the members of the road sensor research team of AHSRA, Toshiba carried out tests on the detection performance of the road sensors under poor visibility conditions in fog at the Hiji Junction on the Oita Highway in Kyushu. The test results will be useful for the design of AHS and road sensor systems.

Diverging/Merging Tunnel Ventilation Simulator Applying Microscopic Traffic Model
KOYAMA Toshihiro / TOKIMOTO Hiroyuki / WATANABE Yasuo
In the Tokyo metropolitan area, underground tunnels are being planned to connect with ground roads at diverging and merging sections. Such tunnels have never before been planned in the world. While the urban districts around these tunnels are to be protected against air pollution, driver visibility and carbon monoxide concentration in the tunnels also have to be controlled.

Toshiba is now developing a diverging/merging tunnel ventilation simulator applying a microscopic traffic model in order to design ventilation control systems for these tunnels.

Application of Mobile Broadcasting Service to ITS
YAMAGUCHI Yoshitake / ITAKURA Makoto
"Mobile broadcasting," to be launched in the summer of 2004 throughout Japan, is a world-first service with the new concept of "broadcasts for mobile users." This service is being prepared by the Mobile Broadcasting Corporation, of which Toshiba is the major shareholder. This digital satellite broadcasting service uses a frequency of 2.6 GHz (S band), and will provide high-quality audio programs, video programs, and data broadcasts to users throughout Japan by maximizing the merits of digital technology.

To realize stable service even for cars, trains, marine vessels, and aircraft moving at high speeds, a hybrid system composed of a geostationary satellite with high-power transponders and terrestrial repeaters (gap fillers) has been adopted. By using this broadcast technology for mobile users as a ubiquitous multimedia information technology, there are strong expectations for future applications in intelligent transport systems (ITS) in such areas as seamless road information, weather information, and map data downloading services.

Image Processing System Specific to Automotive Domain
SASAKI Kazuhito / KAWAMOTO Shinji
The purpose of intelligent transport systems (ITS) is to support safe and comfortable driving.Various technologies have been applied to realize this purpose. In recent years, image-processing technology has reached the practical stage as one of these technologies.

Toshiba has developed an image-processing algorithm and image-processing LSI designed for automotive use. We have also established a technique for dynamic range expansion in cameras for automobiles, which are essential input equipment for image processing.

Microscopic Traffic Simulator
HIRATA Yosuke / OHBA Yoshikazu / UENO Hideki
Intelligent transport systems (ITS) are mostly large and complex, and evaluating their functions in experiments using real vehicles is difficult.Traffic simulators are very useful and important tools from this perspective; however, most existing simulators are macroscopic and unsuitable for simulating the behavior of individual cars because they treat the traffic as a continuous flow.

Toshiba is now developing a microscopic traffic simulator based on molecular dynamics simulation for use in the R&D of large traffic systems. Such a microscopic traffic simulator can simulate the behavior of individual cars and is applicable to traffic systems that can cope with accidental phenomena.

Pedestrian Navigation System Supported by Voice Technology
HOSHINO Masashi / MASAI Yasuyuki
Intelligent transport systems (ITS) for pedestrians have been attracting considerable attention recently. Toshiba has been conducting research and development of a system that can provide various types of information to pedestrians. Among the features of the system that we have developed is a voice interface. Data can be input by a voice recognition method and information output by a voice synthesis method. This system can handle not only Japanese, but other languages as well such as English and Spanish.

Feature Articles

Comfort Air-conditioning Control for Building Energy Saving
YAMADA Fumio / YONEZAWA Kenzo / HANADA Yuuichi
General energy consumption is increasing year by year and countermeasures for energy saving need to be implemented immediately. In particular, strict energy management of air conditioning is necessary for large-scale office buildings in order to conform with energy-saving regulations. Building owners require not only low-cost facility operation but also air-conditioned space management to satisfy the thermal needs of occupants.

To meet these requirements, Toshiba has developed an automated comfortable air-conditioning system that provides both comfort and energy saving at the same time by introducing a thermal comfort index based on the occupants' thermal sensations such as hot and cold. There are expectations for this system as a new energy-saving technology utilizing building energy management systems.

Dual-Stage Compressor for Air Conditioner
ONODA Izumi / KITAICHI Shoichiro / TAKASHIMA Kazu
Residences with high heat insulation have been increasing in number in recent years. Air conditioners in these residences are therefore often operated with a comparatively small air-conditioning load. Moreover, air conditioners are seldom used in spring and autumn, and are often operated minimally because of accumulated indoor heat from home electronic or lighting equipment.

In response to these changes in housing characteristics, Toshiba has developed a dual-stage compressor adopting the first variable-cylinder system in the world, which can stop one of two cylinders. This new technology realizes efficient compressor operation at low loads, and significantly improves energy saving along with air-conditioner operating performance.

Power Trader$_{TM}$ Energy Trading and Risk Management System
HIROMOTO Hiroshi / KANO Yuichi / KOBAYASHI Takenori
The Japan Electric Power Exchange will start operation in April 2005. Existing electric power utilities and new entrants such as power producers and suppliers therefore have to prepare for their energy-trading business activities.

Toshiba has developed an energy trading and risk management system called Power Trader$_{TM}$ for these energy companies in a technological alliance with KWI, London. The essential features of Power Trader$_{TM}$ are well-integrated front, middle, and back office functions for power trading, a scenario-based asset risk analysis function to support strategic decisions, and a power market simulator function taking Japanese power system constraints into consideration.

Restoration and Life Extension of Aging Pipe Facilities
UMEDA Narumi / ITABASHI Shigeki / SAWAGUCHI Toru
Hydroelectric power plants and other types of plants are largely constituted of pipe facilities, the capabilities of which deteriorate over the course of long-term operations. We have been studying lining technologies as a repair method for aging pipe facilities, and have developed a pipe lining method that is highly suitable for pipes having a complex form such as buried pipes of pumped-storage power plants. This pipe lining method can also be used in other types of plants, and is expected to have expanded practical applications as a useful rehabilitation technique for repairing pipe facilities and maintaining them in good condition.

Coin Carrier Simulation
KOYAMA Hiroyuki / TOI Shigekatsu
In designing a coin dispenser, it is necessary to understand the actions of the coins in order to convey and select coins correctly. The development of simulation technology in recent years has made it possible to perform verification by simulation, thereby speeding up development times and reducing costs.

Toshiba TEC Corp. replicated the phenomenon of coin stopping occurring at the time of coin conveyance in a coin dispenser by simulation, enabling us to check the effectiveness of countermeasures against this phenomenon. In addition, we were able to check the action of coin flipping, as well as the positional relationship between the coins and studs when using a precut separation roller. As a result, we have established a simulation technology for coin conveyance that speeds up the development time and reduces the cost.

Frontiers of Research & Development

Next-Generation Rewritable DVD Recording Media