

Tsukuba Science City Area

Development of Ubiquitous Visual Information Surveillance System for Safe and Secure City-Life

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Project Promotion

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Major Participating Research Organizations

Industry... Hitachi Medical Corp., Athene Corporation, KDDI Corporation, TEAC Corporation, Hitachi Ltd., Niigata Seimitsu CO., Toshiba Corporation, Yamamoto System Design, Inc., Tsuji Electronics CO., LTD., TCM Corporation, Kowa Company, Ltd., Agro-information Consulting Co., Ltd. and others
Academia... University of Tsukuba
Government... National Institute of Advanced Industrial Science and Technology (AIST), National Agriculture and Food Research Organization (NARO)

Core Research Organizations

University of Tsukuba, National Institute of Advanced Industrial Science and Technology (AIST), National Agriculture and Food Research Organization (NARO)

Aim of research and development

The safety and security for crime prevention and health care are demanded strongly in recent urban complicated life and society. In this project, the pre-project results on the image information technology, such as image sensing, compression, transmission, displaying and recognition, could be developed and integrated into "the ubiquitous visual information surveillance systems for the safe and secure city life" that provide highly improved compression and resolution images using mobile instrumentation regardless of the time and places, and that enable a more adequate situation assessment by the support of intelligent surveillance. On the other hand, different security systems are required for the new type of country-city formed along the newly constructed Tsukuba Express railway line where dispersed urban and rural functions are fused. So, the prototypic visual surveillance systems developed in this project will be applied to resolve the security problems specific to the vast and dispersed country-city area.

Contents of research

1. Mobile high-resolution image information monitoring system

Realization of ubiquitous monitoring of the information concerning environment, medical care, crime prevention, and disaster prevention using mobile networks is indispensable for "safe and secure city life". It is currently difficult to transmit in real time high-resolution image information of the medical treatment etc. because of the restriction of the transmission rate and the limitation of transmission capacity, so that it is necessary to develop efficient technologies to encode and compress image information without lowering the image quality. It is also important to develop securer communication technology for mobile network to monitor safely the image information on medical care and crime prevention. Moreover, in order to extract and analyze the critical image information using mobile instrumentation such as mobile phones, it is important to develop an image processing technology to seek and expand the region of interest efficiently within the limited display area. In the present research, we aim to develop an advanced mobile instrumentation system that enables to monitor and process high-resolution image information using mobile network.

2. Next-generation intelligent surveillance system

Based on the video surveillance technology developed in the pre-project for human traffic-line detection and robust face recognition, the dynamic pattern recognition technology is created for the automatic detection system that can distinguish automatically unusual behavior patterns from ordinary ones. The technology can provide an image surveillance system with the function of automatic unusualness-detection which is extremely useful for social security. Thus, the feasibility of the function is tested using the field server installed with the intelligent surveillance system. Finally, the intelligent camera systems connected with an internet network system are integrated to make up the advanced intelligent surveillance system.

3. Field server (FS) sensor network system

The present research is concerned with the "Field Server" (FS) that was developed by NARO as an outdoor setting autonomous monitoring server connectable with a wireless LAN system. The aim of the research is integration of the technologies of image recognition, pollen sensing and remote vehicle operation into that of the FS to construct the surveillance and alarm systems for detecting disorder in environment and behavior and to apply for the protection of safety and security of the country-city. Applications of the systems are prevention of illegal disposal and farm product theft, detection and warning of environmental or behavioral unusualness, presentation of information on regional pollen count, and monitoring with a moving vehicle on the FS network. The research involves an improvement of the FS system open to mount various devices and to install image recognition algorithms so as to respond to the demands for the urban security in function, utility and design.

The main study results

- 1. Mobile high-resolution image information monitoring system**
 - (1) Based on Fluency information theory, high qualification of the sound of mobile terminals and high resolution image reproduction by developing the processing method of the non-equivalent interpolation between video image frames were achieved.
 - (2) The functional modules for the computer virus checking and the secret data coding were developed.
 - (3) The software for supporting image monitoring with mobile instrumentation was developed.
- 2. Next-generation intelligent surveillance system**
 - (1) Performance of the ubiquitous stereo-vision system developed in the pre-project was practically tested in the Aichi Exposition.
 - (2) The unusual behavior recognition technology based on the CHLAC (Cubic Higher-order Local Auto-Correlation) algorithm was adopted as the elevator room surveillance system.
 - (3) The algorithm for identification using multi-viewpoint images was developed and tested with the self-made system consisting of 6 cameras.
 - (4) The technology to extract automatically unusualness-images from the vast image data was developed and its effectiveness was verified using the actual image data collected and stored by the FS system.
- 3. Field server (FS) sensor network system**
 - (1) The FS was improved to be an open platform for a variety of sensor equipment, to enable to install a face recognition system board, and to be equipped with the Wi-Fi mesh network function connectable to movable field servers.
 - (2) The head for the omnidirectional camera developed in the pre-project was made and the image transmission experiment from the camera system installed in the FS to the dome display was done in the field.
 - (3) The two-eye camera system with zoom and pursuit functions that is magnetic-driven and installable to the FS was produced.
 - (4) The remote drive experiment between indoor and outdoor using a tractor as a model of the movable FS was successful.
 - (5) The automatic pollen analyzer was developed and its property was tested in the outdoors by analyzing practically the cryptomeria pollen etc.



Prototype example of PDA medical monitor



Recognition of abnormal behavior with CHLAC



Prototype of field server for city area

