External Awards

2014 Specially Selected Paper

Winner: Akihiro Miyata, Shunichi Seko, Ryosuke Aoki, Ryo Hashimoto, Tatsuro Ishida, Takashi Isezaki, Masahiro Watanabe, and Masayuki Ihara, NTT Service Evolution Laboratories
Date: January 15, 2015
Organization: Information Processing Society of Japan (IPSJ)

For "An Information Display System Using Digital Signage and Mobile Devices for Multiuser Environments."

We propose a digital signage system by which multiple users can access different content at the same time, and we report the results of a field evaluation. Some existing digital signage systems display multiple content in the beginning, then expand the detail of one type of content over the entire screen in response to requests from users. However, this method has the potential to fill only one user's need since the details of only one content selection occupy the entire screen. Our method enables several users to control her/his pointer to select certain content on the digital signage screen and browse details of the content on the mobile device immediately. This design also allows users to know which content is being watched by many others. The field evaluation (105 subjects) in Kumamoto City proved that our system is easy to use and acceptable for general users.
Published as: A. Miyata, S. Seko, R. Aoki, R. Hashimoto, T. Ishida, T. Isezaki, M. Watanabe, and M. Ihara, "An Information Display System Using a Digital Signage and Mobile Devices for Multiuser Environments," IPSJ Journal, Vol. 56, No. 1, pp. 106–117, January 2015 (in Japanese).

IEICE Electronics Society LQE Young Researchers Award

Winner: Kengo Nozaki, NTT Basic Research Laboratories
Date: December 19, 2014
Organization: Technical Committee on Lasers and Quantum Electronics (LQE), Electronics Society (ES), The Institute of Electronics, Information and Communication Engineers (IEICE)

For "InGaAs Photodetectors Based on Photonic Crystal Waveguide Including Ultrasmall Buried Heterostructure."

Ultrasmall InGaAs photodetectors based on a photonic crystal waveguide with a buried heterostructure (BH) were demonstrated for the first time. A sufficiently high DC (direct current) responsivity of ~1 A/W was achieved for the 3.4-μm-long detector. The dynamic response revealed a 3-dB bandwidth of 6 GHz and a 10-Gb/s eye pattern. These results were thanks to the strong confinement of both photons and carriers in a small BH and will pave the way for unprecedented nano-photodetectors with a high quantum efficiency and small capacitance. Our device potentially has an ultrasmall junction capacitance of much less than 1 fF and may enable us to eliminate electrical amplifiers for future optical receivers and subsequent ultralow-power optical links on a chip.
Published as: K. Nozaki, S. Matsuo, K. Takeda, T. Sato, T. Fujii, E. Kuramochi, and M. Notomi, "InGaAs Nano-photodetectors Based on Photonic Crystal Waveguide Including Ultrasmall Buried Heterostructure," Technical Report of IEICE. OPE, Vol. 113, No. 394, pp. 307–310, January 2014 (in Japanese).

Papers Published in Technical Journals and Conference Proceedings

Synergistic Effect between Image and Sound in 3D Audio/Visual Communication System

H. Takada, M. Date, Y. Kurokawa, Y. Honda, and A. Kojima

Proc. of EVCP 2014 (the 37th European Conference on Visual Perception), p. 36, Belgrade, Serbia, August 2014.

We developed a natural telecommunication system from a realistic spatial composition made with a high-fidelity position representation. This position representation is induced using three-dimentional (3D) imaging and acoustic technology. An image was produced using a stable 3D image generated by an edge detection method in the depth-fused 3D (DFD) visual perception. The sound was produced using acoustic wave field synthesis. The system provides realistic, natural, and comfortable communication by reproducing the distance and position of the image and sound without inconsistency. Using our system, we evaluated how images and sound together influence the relation between vision and hearing. The experiment varied the 3D position and timing of an image and sound, and the results showed that eye movements were pulled in the direction of the sound. In the future, we will develop an innovative hyper-reality communication system in which 3D sounds can guide the gaze-point on 3D images.

Efficient Virtual Network Optimization across Multiple Domains without Revealing Private Information

T. Mano, T. Inoue, D. Ikarashi, K. Hamada, K. Mizutani, and O. Akashi

Proc. of ICCCN 2014 (the 23rd International Conference on Computer Communications and Networks), pp. 694–701, Shanghai, China, August 2014.

Building optimal virtual networks across multiple domains is an essential technology to offer flexible network services. However, existing research is founded on an unrealistic assumption that providers will share their private information including resource costs. Providers, as is well known, never actually do that to remain competitive. Technically, secure multiparty computation, which is a computational technique based on cryptography, can be used to secure optimization, but it is too time-consuming. This paper presents a novel method to optimize virtual networks built over multiple domains, with great efficiency but without revealing any private information. Our method employs secure multi-party computation but only for masking sensitive values; it can optimize virtual networks under limited information without requiring a time-consuming technique. It is solidly based on the theory of optimality and is assured of finding reasonably optimal solutions. Experiments show that our method is fast and optimal in practice even when concealing private information; it finds nearly optimal solutions in just a few minutes for large virtual networks with tens of nodes. This is the first work that can be implemented in practice for building optimal virtual networks across multiple domains.

Convex Object Surface Mapping for Wide-field of View Video Representation

D. Mikami, D. Ochi, and A. Kojima

IEEJ Transactions on Electronics, Information and Systems, Vol. 134, No. 10, pp. 1451–1457, October 2014.

This paper proposes a new video representation method for videos capturing events held in a wide field. Such events can be captured with high resolution thanks to the recent development of video capturing technologies. Despite the development of these technologies, progress in representation methods for wide field-of-view (wide-FOV) video is quite limited. Some methods prioritize ease of overviewing, and forgo detailed observations; other methods put a high priority on detailed observations while sacrificing overviewing. Our work is aimed at simultaneously achieving (1) high visibility for regions of interest (ROIs), (2) easy overviewing, and (3) intuitive comprehension of the relative positions of video objects. Because of these advantages, the proposed method is especially suitable for showing wide-FOV videos on small display devices such as tablets and smartphones. To achieve the abovementioned aims, this paper propose a convex object surface mapping technique that provides high ROI visibility and easy overviewing. In addition, by selecting an elliptic cylinder or an oval as a convex object, the convex object surface mapping enables intuitive comprehension of the relative positions of video objects. The efficacy of the proposed method was verified through objective and subjective experiments.

Low-power Liquid Crystal Driving Technique Based on Capacitors for 1-Pixel Displays

H. Manabe, M. Date, H. Takada, and H. Inamura

Proc. of IDW 2014 (the 21st International Display Workshops), pp. 1343–1346, Niigata, Japan, December 2014.

Liquid crystal displays (LCDs) are suitable as elements for wearable and ubiquitous computing, thanks to their low power consumption. A technique that drives LCDs with lower power is proposed. It harvests charges on the LCD and stores them in an additional capacitor for reuse when the polarity changes. A simulation shows that the technique reduces the charge requirements by up to 50%. An experiment on a prototype shows that the reduction is only partially offset by the overhead of micro-controller operation. Overall, a 30% reduction was achieved with large 1-pixel LCDs. With a small 10 × 10-mm LCD, the overhead matched the reduction and no improvement was measured.

Sodium-ion Insertion/Extraction Properties of Sn-Co Anodes and Na Pre-doped Sn-Co Anodes

Y. Yui, Y. Ono, M. Hayashi, Y. Nemoto, K. Hayashi, K. Asakura, and H. Kitabayashi

Journal of the Electrochemical Society, Vol. 162, No. 2, pp. A3098–A3102, January 2015.

The electrochemical properties of Sn-Co were investigated to show the correlation between the cycle performance and the binders of electrode component materials. Sn-Co electrodes with polyacrylic acid (PAA) exhibited a better cycle property (about 300 mAh/g up to 30 cycles) than those with polyvinylidene difluoride (PVdF). This better cycle property with PAA was due to the slight change in the volume of the electrode that occurred during cycling as revealed by in-situ light microscopy. In addition, Na pre-doping in Sn-Co electrodes improved the average coulombic efficiency from 95.4% to 99.9% at 2–10 cycles.

Recognizing the Use of Portable Electrical Appliances Using Battery-shaped Sensor Node

T. Maekawa, Y. Kishino, Y. Yanagisawa, and Y. Sakurai

IPSJ Journal, Vol. 56, No. 1, pp. 229–238, January 2015 (in Japanese).

This paper proposes a battery-shaped sensor node that can monitor the use of an electrical device into which it is inserted by sensing the electrical current passing through the device. We live surrounded by large numbers of electrical devices and frequently use them in our daily lives, and so we can estimate high-level daily activities by recognizing their use. Therefore, many studies on ubiquitous and wearable sensing devices have attempted to recognize the use of electrical devices by attaching sensor nodes to the devices directly or by attaching multiple sensors to a user. With our node, we can easily monitor the use of an electrical device simply by inserting the node into the battery case of the device. We also propose a method that automatically identifies which electrical device the sensor node is inserted into and recognizes electrical events related to the device by analyzing the current sensor data.

Recognizing the Use of Portable Electrical Appliances Using Hand-worn Coil

T. Maekawa, Y. Kishino, Y. Yanagisawa, and Y. Sakurai

IPSJ Journal, Vol. 56, No. 1, pp. 239–249, January 2015 (in Japanese).

This paper describes the development of a new finger-ring shaped sensor device with a coil of wire for recognizing the use of handheld electrical devices such as digital cameras, cellphones, electric toothbrushes, and hair dryers by sensing time-varying magnetic fields emitted by the devices. Recently, sensing the usage of home electrical devices has emerged as a promising area for activity recognition studies because we can estimate high-level daily activities by recognizing the use of electrical devices that exist ubiquitously in our daily lives. A feature of our approach is that we can recognize the use of electrical devices that are not connected to the home infrastructure without the need to equip them with sensors. We evaluated the performance of our approach by using sensor data obtained from real houses. The

evaluation revealed that our approach can successfully recognize the use of appliances with motors.
