

External Awards

Excellent Paper Award

Winners: Chaiwoo Lee, Daisuke Asai, Jarrod Orszulak, Richard Myrick, Joseph F. Coughlin, and Olivier L. de Weck, AgeLab, Massachusetts Inst. of Technol., Cambridge, MA, USA, and NTT Cyber Solutions Laboratories.

Date: Oct. 1, 2011

Organization: IEEE (Communications Society)

For “Integration of Medication Monitoring and Communication Technologies in Designing a Usability-enhanced Home Solution for Older Adults”.

Technology-enabled solutions have been increasingly developed for aging-in-place. Previous studies have developed systems to assist older adults in managing medications and maintaining social connections. However, although developed for direct user interaction, most have failed to be evaluated sufficiently highly by users. This paper describes the development and testing of a home solution for older adults’ medication management and communications. The system integrates RFID-based medication management and communications technologies with an intuitive interface (RFID: radio frequency identification). A long-term field trial was conducted for extensive usability testing and evaluation. With its current design, the system was found to be useful, easy to use, and satisfying.

Published as: C. Lee, J. Orszulak, R. Myrick, J. F. Coughlin, O. L. de Weck, and D. Asai, “Integration of Medication Monitoring and Communication Technologies in Designing a Usability-enhanced Home Solution for Older Adults,” Proc. of the 2011 International Conference on ICT Convergence (ICTC), pp. 390–395, Seoul, Korea.

IEEE CAS Seoul Chapter Award

Winners: Sadayuki Yasuda, Takahiro Hadano, Hiroki Suto, Masami Urano, Mamoru Nakanishi, and Tsugumichi Shibata, NTT Microsystem Integration Laboratories.

Date: Nov. 18, 2011

Organization: IEEE, ISOCC2011

For “10G/1G Dual-rate EPON OLT LSI with Dual Encryption Modes Alternated Using DBA-information-based Algorithm Control”.

We developed a 10G/1G dual-rate EPON OLT LSI that fully conforms to the IEEE 802.3av standard (G: Gbit/s, EPON: Ethernet passive optical network, OLT: optical line terminal, LSI: large-scale

integrated circuit). To support Gigabit Ethernet optical network units (GE-ONUs) and symmetric/asymmetric 10-Gbit/s ONUs (10GONUs), we implemented a dynamic-bandwidth-allocation-information-based method for algorithm control for dynamically selecting the decryption algorithm that corresponds to the encryption algorithm used by the ONU burst by burst. In addition, while it basically conforms to the 802.1AE standard, we widened the category of encrypted frames to include multipoint control protocol data units (MPCPDUs) and operation, administration, and maintenance PDUs (OAMPDUs) by adding three simple steps of functions to existing blocks with little hardware overhead.

Published as: S. Yasuda, T. Hatano, H. Suto, M. Urano, M. Nakaniishi, and T. Shibata, “10G/1G Dual-rate EPON OLT LSI with Dual Encryption Modes Alternated Using DBA-information-based Algorithm Control,” Proc. of International SoC Design Conference (ISOCC), pp. 357–360, Jeju, Korea, 2011.

Best Paper Award for Young Researcher at the 73rd National Convention of IPSJ

Winner: Hitoshi Kawasaki, NTT Cyber Solutions Laboratories

Date: March 6, 2012

Organization: Information Processing Society of Japan (IPSJ)

For “Recommendation for Improving Level of Skill Using Skilled People’s Life-logs”.

This paper describes a method of enhancing a user’s motivation to improve his/her level of skill in a given field. Currently, the number of skilled people, who record their knowledge and release it in the form of life logs in an attempt to achieve certain aims, is increasing. The number of users who are affected by such skilled people and who also make efforts to achieve their own aims is also increasing. We report on the development of a method of enhancing user motivation to begin making self-active efforts. The method should automatically select skilled people who can inspire users and be a good reference for them and present their life logs to the users. To achieve these functions, we propose a quantitative evaluation index between the life logs of skilled people and users. Through experiments, we verified the hypothesis that the higher the proposed index of skilled people, the higher the rate of user motivation.

Published as: H. Kawasaki, H. Tezuka, T. Yagi, and S. Muto, “Recommendation for Improving Level of Skill Using Skilled People’s Life-logs,” the 73rd National Convention of IPSJ, pp. 3-1, 3-2, Tokyo, Mar. 2011 (in Japanese).

Papers Published in Technical Journals and Conference Proceedings

Sensory-perceptual Transformations for Auditory Scene Analysis

H. Kondo

Proc. of NTT-ENS Workshop 2011, École Normale Supérieure, Vol. 1, No. 1, p. 3, Paris, France, 2011.

An essential function of perceptual systems is to structure the incoming flow of sensory inputs into auditory scenes (i.e., perceptual organization). Bistable perception phenomena provide us with clues enabling us to investigate perceptual organization mechanisms. We first clarified the relationship between different forms of bistable perception: auditory streaming, verbal transformations, visual plaids, and reversible figures. Factor analyses of the number of perceptual switches in the tasks demonstrate that the three-factor model provides a better fit to the data than other possible models. A genotype group comparison results reveal that the “auditory” and “shape” factors reflect the functions of the dopamine and serotonin systems, respectively. This suggests that perceptual organization is modulated by neurotransmitters released from the brainstem nuclei.

Polarization Property of Deep-ultraviolet Light Emission from C-plane AlN/GaN Short-period Superlattices

Y. Taniyasu and M. Kasu

Appl. Phys. Lett., Vol. 99, No. 25, p. 251112, 2011.

AlN/GaN short-period superlattices (SLs) are experimentally shown to have different polarization properties from AlGaIn. As the GaN well thickness decreases from 2.5 to 0.9 monolayers, the emission wavelength decreases from 275.8 to 236.9 nm owing to a quantum size effect. Because the quantized energy level for holes originates from the heavy hole band of GaN, the emission is polarized for an electric field perpendicular to the c-axis ($E_{\perp c}$). Consequently, the SLs show intense C-plane emission compared with AlGaIn, whose emission is inherently polarized for an electric field parallel to the c-axis ($E_{\parallel c}$). Using the SLs, we demonstrate an $E_{\perp c}$ -polarized deep-ultraviolet (UV) light-emitting diode (LED).

Constant-depth Exact Quantum Circuits for the OR and Threshold Functions

Y. Takahashi and S. Tani

arXiv, Cornell University Library, Vol. 1, No. 1, pp. 1–17, 2011.

We investigate the computational power of constant-depth polynomial-size quantum circuits with unbounded fan-out gates in the exact setting, where quantum circuits output the correct answer with certainty. We show that there exists an $O(1)$ -depth $O(n \log n)$ -size quantum circuit for the OR function on n bits. This is an affirmative answer to the question of Høyer and Spalek. We also show that there exists an $O(1)$ -depth small-size quantum circuit for the threshold function.

Ca²⁺ Ion Transport through Channels Formed by α -hemolysin Analyzed Using a Microwell Array on a Si Substrate

K. Sumitomo, A. McAllister, Y. Tamba, Y. Kashimura, A. Tanaka, Y. Shinozaki, and K. Torimitsu

Biosens. Bioelectron., Elsevier, Vol. 31, No. 1, pp. 445–450, 2012.

For the functional analysis of ion channel activity, an artificial lipid bilayer suspended over microwells was formed that ruptured giant unilamellar vesicles on a Si substrate. Ca²⁺ ion indicators (fluo-4) were confined in the microwells by sealing the microwells with a lipid bilayer. An overhang formed at the microwells prevented the lipid membrane from falling into them and allowed the stable confinement of the fluorescent probes. The transport of Ca²⁺ ions through the channels formed by α -hemolysin inserted into a lipid membrane was analyzed by employing the fluorescence intensity change of fluo-4 in the microwells. The microwell volume was very small (1–100 fl), so a highly sensitive monitor could be realized. The detection limit is several tens of ions per second per square micrometer, which is much smaller than the ion current in a standard electrophysiological measurement. Smaller microwells will make it possible to mimic a local ion concentration change in the cells, although the signal-to-noise ratio must be further improved for the functional analysis of a single channel. We demonstrated that a microwell array with confined fluorescent probes sealed by a lipid bilayer could constitute a basic component of a highly sensitive biosensor array that works with functional membrane proteins. This array will allow us to realize high throughput and parallel testing devices.

Compression of View on Anonymous Networks—Folded View—

S. Tani

IEEE Trans. on Parallel and Distributed Systems, Vol. 23, No. 2, pp. 255–262, 2012.

View is a labeled directed graph containing all information about the network that a party can learn by exchanging messages with its neighbors. View can be used to solve distributed problems on an anonymous network (i.e., a network that does not guarantee that every party has a unique identifier). This paper presents an algorithm that constructs views in a compressed form on an anonymous n -party network of any topology in at most $2n$ rounds with $O(n^6 \log n)$ -bit complexity, where the time complexity (i.e., the number of local computation steps per party) is $O(n^6 \log n)$. This is the first view-construction algorithm that runs in $O(n)$ rounds with polynomial bit complexity. This paper also presents an algorithm that counts the number of nonisomorphic views in the network in $O(n^6 \log n)$ time complexity if a view is given in the compressed form. These algorithms imply that some well-studied problems, including the leader election problem, can deterministically be solved in $O(n)$ rounds with polynomial bit and time complexity on an anonymous n -party network of any topology.