

2018 2nd International Conference on Recent Advances in Signal Processing, Telecommunications & Computing (SigTelCom) Program

Time	Mui Ne	Nha Trang	Phu Quoc
07:30 am-08:30 am	<i>Registration</i>		
08:30 am-08:50 am	<i>Opening Ceremony</i>		
08:50 am-09:50 am	<i>Keynote speaker #1: Ultra Reliable and Low Latency Communication in 5G</i>		
09:50 am-10:20 am	<i>Coffee break</i>		
10:20 am-12:00 pm	SP:1: <i>Signal Processing</i>	CT:1: <i>Emerging Areas in Wireless Communications</i>	ECS:1: <i>Electronics and Control Systems</i>
12:00 pm-01:30 pm	<i>Lunch break</i>		
01:30 pm-03:10 pm	SP:2: <i>Signal Processing</i>	CT:2: <i>Emerging Areas in Wireless Communications</i>	ECS:2: <i>Electronics and Control Systems</i>
03:10 pm-03:40 pm	<i>Coffee Break</i>		
03:40 pm-05:20 pm	CT:4: <i>Communication Theory Track</i>	CT:3: <i>Emerging Areas in Wireless Communications</i>	FWNT:1: <i>Fixed and Wireless Networks Track</i>
06:00 pm-09:00 pm	<i>Banquet</i>		

Monday, January 29, 07:30 - 08:30

[Registration](#)

Monday, January 29, 08:30 - 08:50

[Opening Ceremony](#)

Monday, January 29, 08:50 - 09:50

[Keynote speaker #1: Ultra Reliable and Low Latency Communication in 5G](#)

Byonghyo Shim

Chair: Trung Q. Duong (Queen's University Belfast, United Kingdom (Great Britain))

Abstract: The new wave of the technology revolution, named the fourth industrial revolution, is changing the way we live, work, and communicate with each other. In order to support unprecedented services and applications requiring lower latency, better reliability, massive connection density, and improved energy efficiency, the International Telecommunication Union (ITU) defined three representative service categories, viz., enhanced mobile broadband (eMBB), massive machine-type communication (mMTC), and ultra-reliable and low latency communication (URLLC). Among three categories, physical layer design of the URLLC service is perhaps the most challenging and problematic since URLLC should satisfy two challenging requirements: low latency and ultra-high reliability. In this talk, I will explain the state-of-the-art overview of URLLC communications with an emphasis on physical layer challenges and solutions.

Biography: Byonghyo Shim received the B.S. and M.S. degree in Electrical Engineering from Seoul National University (SNU), Seoul, Korea, in 1995 and 1997, respectively, and the M.S. degree in Mathematics and the Ph.D. degree in Electrical and Computer Engineering from the University of Illinois at Urbana-Champaign (UIUC), Urbana, in 2004 and 2005, respectively. He industry experiences include LG Electronics, Texas Instruments, and Qualcomm. Since September 2014, he has been with the Dept. of Electrical and Computer Engineering, SNU, as a professor. Dr. Shim was the recipient of the M. E. Van Valkenburg Research Award from University of Illinois, Hadong Young Engineer Award from IEIE, and Irwin Jacobs Award from Qualcomm. He is an associate editor of IEEE Transactions on Signal Processing, IEEE Wireless Communications Letters, Journal of Communications and Networks, and a guest editor of IEEE Journal of Selected Areas in Communications.

Monday, January 29, 09:50 - 10:20

Coffee break

Monday, January 29, 10:20 - 12:00

CT:1 Emerging Areas in Wireless Communications

Room: Nha Trang

Chair: Tran Trung Duy (Posts and Telecommunications Institute of Technology, Vietnam)

10:20 Exact Outage Analysis of Energy-Harvesting Multihop Cluster-Based Networks with Multiple Power Beacons over Nakagami-m Fading Channel

Nguyen Toan Van, Tran Trung Duy and Vo Nguyen Quoc Bao (Posts and Telecommunications Institute of Technology, Vietnam)

In this paper, we investigate an energy-harvesting cluster-based multi-hop networks where all of the communicated nodes harvest energy from radio frequency (RF) radiation transmitted by multiple dedicated power beacons (PBs) to support the information transmission. Specifically, we propose the relay selection methods in each cluster of the energy harvesting multi-hop network. For performance evaluation, we derive the exact and asymptotic expressions for outage probability (OP) of the proposed scheme in Nakagami-m fading environments and then perform Monte Carlo simulations to verify the theoretical analysis results. The obtained results presented that the performance of the proposed scheme significantly depends on the number of relays in each cluster, the number of PBs as well as the position of PBs. In addition, the optimal time switching ratio and the number of hops are also investigated.

10:40 Performance Evaluation of Cooperative Relay Networks with One Full-Energy Relay and One Energy Harvesting Relay

Thong Nhat Tran, Tran Trung Duy and Vo Nguyen Quoc Bao (Posts and Telecommunications Institute of Technology, Vietnam)

In this paper, we propose a cooperative relay protocol in which the data transmission between a source and a destination is performed via the assistance of one full-energy (FE) relay and one energy harvesting (EH) relay. In addition, the EH relay harvests energy from the radio frequency (RF) signals of the source and the FE relay, follows a time switching method. For performance evaluation, we derive exact and asymptotic expressions of outage probability (OP) for the proposed protocol over Rayleigh fading channels. Then, the analytical results are validated by computer simulations using Monte Carlo method.

11:00 Analysis of Partial Relay Selection in NOMA Systems with RF Energy Harvesting

Dung Le The (Chungbuk National University, Korea); Hoang Tran Manh (Faculty Telecommunication, Vietnam); Trungtan Nguyen (Harbin Institute of Technology, P.R. China); Seong Gon Choi (Chungbuk National University, Korea)

In this paper, we investigate a dual hop communication decode-and-forward relaying system where a source node wants to transmit two symbols to its two desired destinations with the help of one selected energy constraint relay node. The power for relay operation is come from the harvested ambient radio frequency (RF) energy and the non-orthogonal multiple access (NOMA) technology is applied. We mathematically evaluate the impact of relay selection (RS) on the system performance by considering the probability that symbols cannot be decoded at the two end users under the effect of imperfect and perfect successive interference cancellation (SIC). We also perform Monte-Carlo simulations in MATLAB to verify the correctness of our analysis. The results shows that the performance of the system are significantly influenced by the efficiency of SIC technique. Moreover, if the power transmission is in high region, we can use approximation method to simple our analysis.

11:20 Outage Probability of Energy Harvesting Relay Systems under Unreliable Backhaul Connections

Huy Thanh Nguyen (Inje University, Korea); Sang Quang Nguyen (Duy Tan University, Vietnam); Won-Joo Hwang (Computer Networks Laboratory, Inje University, Korea)

In this paper, the performance of energy harvesting systems in the presence of unreliable backhaul links is investigated over independent but not necessarily identically distributed (i.n.i.d.) Nakagami-m fading channels. In particular, the energy constrained relay uses the amount of harvested energy from the best small-cell transmitter based on time switching-based relaying (TRS) protocol to process for the next hop transmission. We derived the closed-form expression of the outage probability and the asymptotic expression in high signal-to-noise ratio (SNR) regime. Our results show that under the unreliable backhaul links the outage probability yields the error-floor in the high SNR regime which demonstrates the significant impact of the backhaul unreliability.

11:40 Outage Probability in Cognitive Wireless Powered Communication Networks Considering QoS in Primary Networks

Jinghua Zhang (Queen's University Belfast, United Kingdom (Great Britain)); Emiliano Garcia-Palacios (Queens University Belfast, United Kingdom (Great Britain))

we investigate the outage probability of the secondary network in a cognitive wireless powered communication network (WPCN). Energy-constrained secondary users harvests energy from a hybrid access-point and a primary transmitter in the first phase. In the second phase, the secondary user with the best uplink channel is selected. In this setup, the secondary

network can share the spectrum with the primary network ensuring that the desired outage probability constraint always satisfies the quality-of-service (QoS) of the primary network. The analytical expressions and asymptotic expressions of the outage probability of the secondary network are provided and verified by numerical simulation. We demonstrate that increasing the number of secondary users and relaxing the QoS of the primary network can considerably improve system performance. We show that the transmit power of the selected secondary user and harvesting energy time have a significant impact on the outage probability of the secondary network.

ECS:1 Electronics and Control Systems

Room: Phu Quoc

10:20 *Turing Motion Direction of Fish Robot Driven by Non-Uniform Flexible Pectoral Fins*

Anh Van Pham (Ho Chi Minh City City University of Technology & Pham Van Dong University, Vietnam); Quan Tuong Vo (Ho Chi Minh City, University of Technology, Ho Chi Minh City, Viet Nam, Vietnam); Tan-Tien Nguyen (HCMUT, Vietnam)

Flexible fins have many advantages in robotic fish locomotion, especially with high propulsive efficiency. The paper proposes the dynamic model and mechanism of change direction for the fish robot in two dimension plane using flexible pectoral fins. First, a mathematical description of the robot with the non-uniform flexible pectoral fin is presented. Where the effect of fluid inertia and drag of the surrounding fluid exerting onto the fin surface is considered as the Morison force. Based on the energetic method, the assume mode method (AMM) and Rayleigh - Ritz method, the solution for the body motion and deformation of points onto the flexible fins is derived. Then, the mechanism of direction change for robot motion is built. Due to complex influence of the lift forces of the pectoral fins to the robot orientation, a fuzzy controller is designed to stabilize angle trajectory of the fish robot. Finally, the motion performances and the control effectiveness are verified through numerical simulation.

10:40 *Analysis of Structural Dynamics for a Circular Wedge-wave Ultrasonic Motor*

Tai-Ho YU (National United University, Taiwan)

This study analyzed the structural dynamics of an ultrasonic motor driven by a circular wedge acoustic waveguide in order to determine the optimal motor design parameters. The motor stator comprised a metal circular wedge and piezoelectric cylindrical tube. The outer surface of the piezoelectric cylindrical tube was coated with comb-type electrodes, and equispaced electrodes on its surface formed two comb-type transducers. A self-designed high-performance dual-phase driver circuit initiated flexural waves along the wedge peak, changing the driving voltage and phases, which allowed for the speed and direction of motor rotation to be controlled accurately. This study used finite element software to analyze the resonant frequencies and dynamics of the motor. Harmonic analysis and simulation results were then used to derive optimal parameters for motor design. The results indicated that the ultrasonic motor had an operating frequency of 33.8 kHz and operating voltage of $\pm 100V$. Two pairs of dual-phase comb-type electrodes generated five flexural waves that transmitted along the wedge peak in a clockwise or counterclockwise direction. The point of contact between the stator and rotor was located approximately 1 mm underneath the wedge peak in order to ensure the motor's optimal performance.

11:00 *Implementation of Vision-based Autonomous Mobile Platform to Control by A* Algorithm*

Minh Tran (Student, (BKU) Bach Khoa University, Vietnam); Thanh Ha Quang Ngo ((BKU) Bach Khoa University, Vietnam); Phuong Thanh Nguyen and Hung Nguyen ((HUTECH) Ho Chi Minh University of Technology, Vietnam)

Aiming at rareness of navigation solutions for vehicle platform in unapplicable-GPS or low quality of GPS environment, this paper investigated an approach of vision-based path planning and navigation by a stereo camera. Firstly, camera is calibrated to get its parameters. In this stage, host PC must determine locations of all objects in working area. When start point and target point is given out, host based on A* algorithm generates trajectory for mobile platform to prevent obstacles. Later, vehicle is driven to track the path planning. Additionally, host is able to update status and re-construct trajectory to avoid dynamic obstacles. The low-cost hardware architecture of mobile platform is built-in to verify the design. From the experiments, it can be seen clearly that vehicle runs on the optimized trajectory and navigated successfully

11:20 *Implementation of A Short Word Length Ternary FIR Filter in both FPGA and ASIC*

Thanh Pham (RMIT University, Vietnam); Linh Duc Tran and Quang Tri Chiem (RMIT University Vietnam, Vietnam); Bach Xuan Hoang (RMIT University, Vietnam); Anh Vu Ho (EIU, Vietnam)

Despite the fact that Short Word Length (SWL) technique has been demonstrated to be a new efficient approach for implementing DSP systems, its applications are somehow limited. In this paper, we present the design and implementation of a Sigma-delta modulator based SWL ternary FIR filter. From predefined specifications, the filter was first modelled and simulated in MATLAB then implemented on a commercial FPGA platform and finally synthesized using ASIC method. We created two versions of the design: pipeline and non-pipeline, their performance are compared and discussed going from the operating frequency to the hardware resource usage. Also, to examine the trade-off between hardware efficiency and performance, we also evaluated the design with four different oversampling rates (8, 16, 32, 64).

11:40 *0.5W S-band Two-stage Power Amplifier: Research, Design and Implementation*

Doan Van Truong (International University, Vietnam); Linh Mai (International University of Viet Nam, Vietnam); Hung Ngoc Do (International University, Vietnam); Van-Su Tran (International University, HCMC VNU, Vietnam); Nguyen Binh Duong (International University, Vietnam)

This paper describes the study of designing a power amplifier (PA) operating at S-band which amplifies a low power radio frequency (RF) signals into a higher power signals. The RF transistor BFP740 and GaAs FET MGF-2430A are used in this work. The PA includes two-stage which has both driver and power stages. The two-stage PA with the bandwidth of 400

MHz at 2.9 GHz center frequency is designed to have the desired specifications. In the designed two-stage PA, the forward gain is over 25 dB and power-added efficiency (PAE) is rather than 20% of combining driver and power stage. Besides, the output power obtains 27 dBm in total. The input/output coefficient reflections are less than -10 dB.

SP:1 Signal Processing

Room: Mui Ne

10:20 *A New Algorithm for Viewshed Computation on Raster Terrain*

[Nguyen Hao](#) (Modeling and Simulation Institute, Viettel R&D Institute, Vietnam); [Nguyen Trong](#) (Modelling and Simulation Institute - Viettel R&D Institute, Vietnam); [AnhTra Duong](#) (Viettel, Vietnam)

Viewshed is a geographical area that is visible from a given location. Viewshed computation from a given point is a complex problem and plays an indispensable role in many applications of military civil engineering such as electronic warfare simulation or wireless transmittance. There are some approaches applied to analyze viewshed such as R2 (Franklin and Ray's method), sweep-line (Van Kreveld's method). In this paper, a new approach that increases the order of accuracy and can be easily implemented is introduced: High Level Direction (HLD). This method implements a unique radar-like algorithm to divide terrain into sectors for analysis. Compared with the other methods such as R2 or sweep-line, the advantages of this approach are in its storage approach and handling of cached data to export the final viewshed results. In contrast with the Van Kreveld's method, that uses the complicated AVL trees, HLD method uses only data structure in a vector type to keep the same computational speed and high resolution export results. HLD is flexible in the selection of its accuracy and complication since a parameter that helps to balance accuracy, computational complexity, and practical requirements is used. The simulation results show that the HLD approach improves upon the practical application and implementation compared to other viewshed calculation methods having the same order of accuracy

10:40 *Dual Image based LSB Steganography*

[Giridhar Maji](#) (Asansol Polytechnic, India); [Sharmistha Mandal](#) (University of Calcutta, India); [Soumya Sen](#) (University of Calcutta, Kolkata, India); [Narayan Debnath](#) (International Society for Computers and Their Applications, USA)

A new steganographic model using dual image has been proposed to increase the obscurity of the secret as well as to make it more secure. It uses two different images namely reference image and cover image along with a secret embed key (stego key). Reference image is divided into blocks with assigned block-codes. Total number of blocks and other embedding parameters (block traversing direction, starting block etc.) are stored in the embed key. Secret message converted to binary and bit pairs are made. Bit pairs of secret message are encoded using the bit pairs of different blocks of reference image and sometimes updating a few LSB bits in the reference image. As an optional capacity enhancement module for text only secret messages dictionary word indexing based encoding is applied. Finally encoded bit stream is embedded into the cover image using any standard LSB technique with its own merits and demerits. LSB changes in the reference image are almost negligible. Embedding key is encrypted using public key of the receiver hence even if someone gets the encoded message it is not possible to get the secret message. As this model can use any existing LSB replacement scheme to embed encoded message into the cover image the state of the art security and other quality features are by default available to it. This is made more secure by using different dictionary word indexing scheme every time based on a random secret key that is appended in the embed key.

11:00 *Rainfall Prediction using Hybrid Neural Network approach*

[Sankhadeep Chatterjee](#) (University of Engineering & Management, Kolkata, India); [Bimal Datta](#) (Budge Budge Institute of Technology, India); [Soumya Sen](#) (University of Calcutta, Kolkata, India); [Nilanjan Dey](#) (India, India); [Narayan Debnath](#) (International Society for Computers and Their Applications, USA)

A novel rainfall prediction method has been proposed. In the present work rainfall prediction in Southern part of West Bengal (India) has been conducted. A two-step method has been employed. Greedy forward selection algorithm is used to reduce the feature set and to find the most promising features for rainfall prediction. First, in the training phase the data is clustered by applying k-means algorithm, then for each cluster a separate Neural Network (NN) is trained. The proposed two step prediction model (Hybrid Neural Network or HNN) has been compared with MLP-FFN (multilayer perceptron feed-forward network trained with scaled conjugate gradient descent algorithm) in terms of Accuracy, Precision, Recall and F-Measure. The data for experimental purpose is collected by Dum Dum meteorological station (West Bengal, India) over the period from 1989 to 1995. The experimental results have suggested a reasonable improvement over traditional methods in predicting rainfall. The proposed HNN model outperformed the compared models by achieving 84.26% accuracy without feature selection and 89.54% accuracy with feature selection.

11:20 *A hybrid GMTI method for reliable detection results in SAR images*

[Vu Viet Thuy](#) (Blekinge Institute of Technology, Sweden); [Thomas K Sjögren](#) (Swedish Defence Research Agency, Sweden); [Mats Pettersson](#) (Blekinge Institute of Technology, Sweden); [Anders Gustavsson](#) (Swedish Defence Research Agency, Sweden)

Stand-alone synthetic aperture radar (SAR) ground moving target indication (GMTI) methods have both advantages and disadvantages. This paper introduces a hybrid SAR GMTI method that is based on two well-known methods: space time adaptive processing (STAP) and moving target detection by focusing (MTDF). The input of the proposed hybrid method is two time separated complex radar images. The output are detected ground moving targets, the target normalized relative speeds (NRS), and focused images of the detected targets. In the paper, we provide the mathematical background behind the hybrid SAR GMTI method in details. We also provide some experimental results for validating the proposed method. The data for the experiments was acquired in early 2015 by TanDEM-X and TerraSAR-X operating in monostatic pursuit mode. The ground scene where the measurements were conducted is around Mantorp, west of Linköping, Sweden.

11:40 [A Novel Content Adaptive Search Strategy for Low Complexity Frame Rate Up Conversion](#)

[Xiem HoangVan](#) (Vietnam National University & University of Engineering and Technology, Vietnam); [Huy Phi](#) (Posts and Telecommunications Institute of Technology, Vietnam)

Frame rate up-conversion (FRUC) is an important technique for various film/video conversions, and technology displays due to its benefits in both increasing the viewing quality experiences and reducing the cost of video transmission. However, with the growing of video resolutions and the exceeding of computation associated to the motion estimation (ME), FRUC is hardly suitable for real-time video applications. In this context, we propose a novel ME search strategy for low complexity, yet effective FRUC framework. In the proposed FRUC framework, the search strategy, one of the major aspects which directly influences to the FRUC processing time as well as the interpolated frame quality, is adaptively driven by the video content. Both temporal and spatial activities are considered to adjust the number of searching points according to the minimum of mean absolute difference (MAD) between current and reference blocks. Experimental results conducted for a rich set of video sequences shown the advantages of the proposed FRUC scheme, notably in both interpolated frame quality and time processing when comparing to relevant benchmarks.

Monday, January 29, 12:00 - 13:30**Lunch break**

Non La Restaurant 19 Nguyen Dinh Chieu, Dakao Ward, District 1, Ho Chi Minh City

Monday, January 29, 13:30 - 15:10**CT:2 Emerging Areas in Wireless Communications****Room: Nha Trang****1:30 [Optimal Sum-Throughput Analysis for Downlink Cooperative SWIPT NOMA Systems](#)**

[Tri Nhu Do](#) (Hongik University, Sejong Campus, Korea); [Beongku An](#) (Hongik University, Korea)

In this paper, we investigate the sum-throughput of cell-center and cell-edge users in downlink scenarios of cooperative simultaneous wireless information and power transfer (SWIPT) non-orthogonal multiple access (NOMA) systems. Specifically, we consider a two-user NOMA system, in which the cell-center user acts as a power-splitting (PS)-based SWIPT relay aiming to improve the performance of the cell-edge user. In order to evaluate the performance of the considered system, we first derive a closed-form expression for the outage probability (OP) of the cell-center user and a closed-form approximate expression for the OP of the cell-center user. Adopting the gradient decent method, we then propose an algorithm that finds the optimal value of the PS coefficient, which results in a maximum sum-throughput of the system. With the obtained optimal PS coefficient, we show that the optimal SWIPT NOMA system provides essential throughput improvement for the cell-edge user while the use of SWIPT-based relaying transmission does not jeopardize the sum-throughput of the system compared to that of non-cooperative NOMA systems.

1:50 [Two-Stage Precoder for Massive MIMO Systems with Limited Feedback](#)

[Jinho Kang](#) (KAIST, Korea); [Jung Hoon Lee](#) (Hankuk University of Foreign Studies, Korea); [Wan Choi](#) (KAIST, Korea)

A two-stage precoder is able to solve the feedback overhead problem in frequency division duplex (FDD) massive MIMO systems since an outer precoder reduces the dimension of the effective channel which is fed back to the base station for inner precoder design. We show that optimization of an outer-precoder dimension is consequential for two-stage precoder design with limited feedback. A smaller dimension of the outer precoder is beneficial to both inter-group interference (IGI) cancelation and the amount of feedback, but it restricts same-group interference (SGI) cancelation. Based on a lower-bound of the expected signal to interference plus noise power ratio (SINR), we optimize the dimension of an outer precoder to maximize average sum-rate. Since the derived lower-bound depends only on channel covariance matrix and the dimension of the outer precoder, the dimension of an outer precoder can be pre-determined at the BS without knowing the instantaneous dimension-reduced effective channel via feedback. Our simulations results show that our proposed scheme achieves near-optimal average sum-rate.

2:10 [Uplink Training for Pilot Decontamination in a Multicell Massive MIMO System](#)

[Hieu V. Nguyen](#), [Van-Dinh Nguyen](#) and [Oh-Soon Shin](#) (Soongsil University, Korea)

In this paper, we investigate pilot contamination in a multicell massive multiple-input multiple-output (MIMO) system, in which the estimated channel state information (CSI) suffers a crucial difference from the real CSI. Pilot contamination is an obstacle to the achievable rate for users. We propose an uplink training strategy to limit the effect of intercell pilot contamination on channel estimation with low complexity. As a result, the downlink data rate through the reciprocity channels is significantly improved, which is verified by numerical results.

2:30 [Exact Outage Probability of Two-Way Decode-and-Forward NOMA Scheme with digital network coding](#)

[Phuoc Tan Huynh](#) (VIET NAM, Vietnam); [Ngoc Son Pham](#) (Ho Chi Minh City University of Technology and Education, Vietnam); [Miroslav Voznak](#) (VSB - Technical University of Ostrava, Czech Republic)

In this paper, we propose a two-way decode and forward non-orthogonal multiple access (NOMA) scheme (called a TWNOMA protocol) in which an intermediate relay helps for two source nodes communicate with each other. In the proposed protocol, we implement digital network coding (DNC) to compress received data from these source nodes. We

analyze and evaluate the system performance in terms of exact closed-form outage probability over Rayleigh fading channels. Simulation and analysis results discover contributions as follows. Firstly, the outage performance of the proposed protocol TWNOMA is improved when comparing with a conventional two-way scheme using DNC (called a TWDNC protocol), two-way scheme without using DNC (called a TWNDNC protocol) and two-way scheme in amplify-and-forward relay systems (called a TWANC protocol). Finally, the theoretical analyses are validated by performing Monte Carlo simulations.

2:50 Large-Scale MU-MIMO Uplink Channel Estimation using Sounding Reference Signal

[Hai Minh Tran](#), [Tuan-Anh Mai](#), [Son Dang](#) and [Hoang-Anh Ngo](#) (R&D Center, Viettel Network Technologies Center, VIETTEL)

This paper proposes a practical channel estimation method for the uplink channel of Orthogonal Frequency Division Multiplexing (OFDM) Large-Scale Multi-User (MU) Multiple-Input-Multiple-Output (MIMO) systems by using user specific Sounding Reference Signal. The method is convenient for hardware implementation since it only utilizes Fast Fourier Transform (FFT), Inverse-FFT and multiplication. Given the OFDM parameters of the Long Term Evolution (LTE), this method is able to support the uplink channel estimation of up to 8 users simultaneously under the multipath channel. Additionally, we applied the raised-cosine windows for separating channel impulse responses of each user individually. The raised-cosine window reduces the Bit Error Rate (BER) for a long delay channel such as the ITU Pedestrian B compared with the rectangular windows. Experiments with 16 antennas at Base Station side, 4 users and 256QAM are conducted to validate the proposed channel estimation.

ECS:2 Electronics and Control Systems

Room: Phu Quoc

1:30 Silicon On Insulator Null Convention Logic based asynchronous circuit design for high performance low power digital systems

[Nguyen L Huy](#) (RMIT University Vietnam, Vietnam & RMIT University Melbourne, School of Engineering, Australia); [Anthony S Holland](#) (RMIT University Vietnam, Vietnam); [Paul Beckett](#) (RMIT University, Australia)

Integrated Circuits developed for portable hardware systems must be capable of running at an ultra-low power supply level with a considerable speed performance while occupying a relatively small circuit area. These circuit design and optimization constraints, all together, impose significant challenges to the whole semiconductor industry. Null Convention Logic based approach has evolved to a prominent clock-less circuit design and optimization technique due to its easiness and readiness in circuit design, implementation, and optimization with Electronic Design Automation tool support. This paper presents a new NCL design architecture based on Fully-Depleted Silicon on Insulator technology targeting ultra-low power high-performance portable systems. Results indicate that NCL circuit designed using the newly proposed architecture has superior performance in comparison to their conventional counterparts and can be dynamically tuned to operate at different performance modes, allowing fine-grained tradeoffs between throughput and leakage power.

1:50 A Low Power Two-Step Cyclic Time-to-Digital Converter without Startup Time Error in 180 nm CMOS

[Jong-Wook Lee](#) and [Nhan Van Nguyen](#) (Kyung Hee University, Korea)

We present a low power, small area time-to-digital converter (TDC) based on Venier cyclic digital controlled oscillator (DCO) structure. The TDC is designed to be combined with an array of single photon avalanche diodes (SPAD) arranged in a digital silicon photomultiplier (SiPM) architecture to form a fluorescence lifetime sensor. The high dynamic range is achieved by using two individual counters in two (coarse and fine) conversion steps. The TDC is fabricated in 0.18 μm CMOS process in a compact chip area of $0.23 \times 0.12 \text{ mm}^2$. Using a 1.8 V supply, the TDC achieves a resolution of 100 ps, dynamic range of 160 ns and an average power consumption of 0.8 mW.

2:10 Performance Evaluation of a Multi-stage Classification for Cow Behavior

[Phi-Khanh Phung Cong](#) (Hanoi National University of Education, Vietnam); [Long TonThat](#) (International University HCMC, Vietnam); [Dinh-Chinh Nguyen](#) (VNU University of Engineering and Technology, Vietnam); [Tran Duc-Tan](#) (VNU University of Engineering and Technology (VNU-UET), Vietnam)

Decision tree (DT) algorithm is a simple and effective method for classification of cow behavior. In order to evaluate the performance of this classifier, receiver-operating characteristic (ROC) curve is used. However, this classification is often consists of multiple stages of simpler classifiers with multilevel decision thresholds. In this paper, we firstly evaluate the performance of the multistage system using a series of ROC and thresholds. After that, we propose to use a parallel of multiple thresholds in order to maximize one of statistical measures of performance (i.e. sensitivity, specificity, and precision). Our work is verified by experimental published data in order to highlight its advantages compared to previous work.

2:30 Performance Enhancement of Encryption and Authentication IP cores for IPSec based on Multiple-Core Architecture and Dynamic Partial Reconfiguration on FPGA

[Tuan Nguyen Trong](#) (University of Da Nang & Global CyberSoft, Vietnam); [Nguyen Van Cuong](#) (Danang University of Technology, Vietnam); [Thang Viet Huynh](#) (Danang University of Science and Technology, Vietnam); [Yen Luong](#) (Duy Tan University, Vietnam); [Hai Dang](#) (DLU, Vietnam)

The goal of this paper is to propose a Multiple Core architecture and DMA bus connectivity to increase the core processing speed of encryption and authentication in high speed IPSec security systems. Dynamic partial reconfiguration technology (DPR) has been used to reduce FPGA resources and power consumption on chips. Paper proposes a model for high-speed Multiple-IPSec security systems that meet real-time applications. As results, the system throughput, power consumption, and resources used when applying Multiple-Core and DPR architectures have been calculated.

2:50 *Impact of Temperature on Electrical Performance of Ni film on n-type 4H-SiC Contacts in Terms of Micropipes Density*

Hung Pham (RMIT University, Vietnam); Anthony S Holland (RMIT University Vietnam, Vietnam); Stanley Luong (RMIT, Australia); Nguyen L Huy (RMIT University Vietnam, Vietnam & RMIT University Melbourne, School of Engineering, Australia)

Silicon carbide (SiC) is novel semiconductor material which is intensively studied recently due to its outstanding physical and electrical characteristics. One of the drawbacks of this innovative SiC material is the micropipe defect, which is created during SiC crystal growth. These defects worsen the performance of the semiconductor devices by increasing leakage current and decreasing breakdown voltage. As heat treatment is a necessary process in making Ohmic contact, it is interesting to examine the correlation between defects density and heating temperature. Nickel (Ni) films are deposited on n-type 4H-SiC substrate to test for this correlation. Although different defects densities have similar effects on the current voltage characteristics of the contact of Ni films and n-type 4H-SiC substrate, it poses other questions about the geometry of the micropipe and the micropipe-material interaction at the contact layer

SP:2 Signal Processing

Room: Mui Ne

1:30 *Randomized Dimensionality Reduction of Deep Network Features for Image Object Recognition*

Hieu Bui (RMIT University, Vietnam); Margaret Lech (RMIT University, Australia); Eva Cheng (University of Technology Sydney, Vietnam); Katrina L. Neville and Richardt Wilkinson (RMIT University, Australia); Ian Burnett (University of Technology Sydney, Australia)

This study investigates data dimensionality reduction for image object recognition. The dimensionality reduction was applied to features extracted from existing pre-trained Deep Neural Network (DNN) structure called the AlexNet. An analysis of the neurons in different layers of the AlexNet revealed an incremental increase in the pair-wise orthogonality between weight vectors of neurons in each layer, towards higher-level layers. This observation motivated the current study to evaluate the possibility of performing randomized dimensionality reduction by mimicking the observed orthogonality property of the high-level layers on activations of low-level layers of the AlexNet. Image object classification experiments have shown that the proposed random orthogonal projection method performed well in multiple tests, consistently outperforming the well-known statistics-based sparse random projection. Apart from being data independent, the proposed approach achieved performance comparable with the state-of-the-art techniques, but with lower computational requirements.

1:50 *Evaluation of maintained effect of hypertonic saline solution in Guyton's closed-loop model*

Chau Nguyen (International University VNUHCM, Vietnam); Long TonThat (International University HCMC, Vietnam); Huong Cao (Pham Ngoc Thach University of Medicine, Vietnam)

This paper aims to evaluate the sustainable effects of hypertonic saline solution in Guyton-based closed-loop model. A model involving the correlation of sodium intakes (NID), antidiuretic hormone (AHM), angiotensin hormone (ANM), Aldosterone hormone (AM) and diminishing rate of sodium (NOD) is created for investigation. The proposed model is then compared with the cardiovascular dynamics system originally schemed by Guyton in 1972. The output results from closed-loop circuitry simulation show a difference of +/- 5.86% to the Guyton 1972 original model outputs and less than +/- 2% difference to the steady state values. The effect of hypertonic saline thought short-lived but stimulated excess body fluid excretion moderately as expected.

2:10 *Automatic Feature Extraction for Vietnamese Sign Language Recognition using Support Vector Machine*

Hai The Pham and Thinh Chau Huynh (Ho Chi Minh City University of Technology, Vietnam); Phuc Van Bui (Ho Chi Minh city University of Technology, Vietnam); Ha H Kha (Ho Chi Minh City University of Technology, Vietnam)

This paper aims at finding an automatic approach for extracting features of the Vietnamese sign language to classify both static Vietnamese alphabet letters and their combing diacritic marks as dynamic hand gestures. A Vietnamese sign language recognition system (VSLRS) collects all images including depth images, RGB images, and skeletal joint maps to extract the desired features of each hand gesture and their own movements. These characteristics are normalized, converted to build a full Vietnamese sign language combing diacritic marks. The primary features of this system are automatically extracting the hand gestures of the observed person before the Kinect device version 1, and both dynamic and static diacritic marks are able to be recognized because of the movement detection method. Multi-classes SVM and the One-Against-All approach are employed to find two suitable SVMs for static and dynamic hand gesture recognition. During a recognition phase, all hand gestures are extracted, normalized, and then they will be filtered out based on the Euclid distance difference of hand positions in captured frames to go through the exact SVMs, the recognized letter or diacritic is the positive label of all the SVM classes. The experimental results demonstrate the proposed VSLRS recognized the VSL in real-time with the high accuracy.

2:30 *Real-time Lane Marker Detection Using Template Matching with RGB-D Camera*

Hoàng Quách (Hanoi VNU University of Engineering and Technology, Vietnam); Minh-Trien Pham (VNU University of Engineering and Technology, Vietnam); Hung Nguyen (University of Engineering and Technology, VNUH, Vietnam); Thang Nguyen (University of Engineering and Technology, Vietnam); Van-Lien Tran (VNU University of Engineering and Technology, Vietnam); Manh Duong Phung (Vietnam National University, Hanoi, Vietnam)

This paper addresses the problem of lane detection which is fundamental for self-driving vehicles. Our approach exploits both colour and depth information recorded by a single RGB-D camera to better deal with negative factors such as lighting conditions and lane-like objects. In the approach, the colour and depth images are first converted to a half-binary format and a 2D matrix of 3D points. Those representations are then used as inputs of template matching and geometric feature

extraction processes to calculate a response map that its values present the probability of pixels being lane markers. To enhance the result, the principal component analysis and lane model fitting techniques are employed to refine the template and form lane surfaces. A number of experiments have been conducted on both synthetic and real datasets. The result shows that the proposed approach can effectively eliminate the unwanted noise to accurately detect lane markers in various scenarios. With the hardware configuration of a popular laptop computer, the program implementation operates at the speed of 20 frames per second which is sufficient for real-time autonomous driving applications.

2:50 *Data Sampling Imbalance with Steerable Wavelets for Abnormal Detection in Brain Images*

Nam Anh Dao (Electric Power University, Vietnam)

A long standing goal within artificial intelligence application for medical imaging has been the ability for appropriate detecting abnormalities in MRI image of brains to support early diagnostics of cancer. This paper presents a solution relying on analysis of class imbalance in data sampling from brain image database instead of error statistics to improve accuracy of the abnormality detection. Here we use modification of training data set both for minority class and majority class to overcome under segmentation and over segmentation of detection of abnormality where abnormality is seen as minority class but its distribution is assumed unknown. In this approach, steerable wavelet features are encoded with machine learning methods to allow for the data sampling imbalance study. In order to increase the detection sensitivity a set of wavelets features is selected from a number of feature set in the learning task. The results with benchmark medical image database show the effectiveness of the proposed method of abnormality detection in brain images.

Monday, January 29, 15:10 - 15:40

Coffee Break

Monday, January 29, 15:40 - 17:20

CT:3 Emerging Areas in Wireless Communications

Room: Nha Trang

3:40 *Secrecy Performance Evaluation of TAS Protocol Exploiting Fountain Codes and Cooperative Jamming under Impact of Hardware Impairments*

Dang The Hung (Le Quy Don Technical University, Vietnam); **Tran Trung Duy** (Posts and Telecommunications Institute of Technology, Vietnam); **Trinh Do Quoc** (Military University of Science and Technology, Vietnam); **Vo Nguyen Quoc Bao** (Posts and Telecommunications Institute of Technology, Vietnam)

In this paper, we propose a transmit antenna selection (TAS) protocol exploiting Fountain codes for secure communication. In the proposed protocol, a base station (BS) selects its best antenna to transmit Fountain packets to a legitimate user (US). Moreover, a cooperative jammer (JA) is used to generate artificial noises to an eavesdropper (EA). The transmission between BS and US will terminate as soon as US can receive a sufficient number of the encoded packets for decoding the original message. To obtain a secure communication, US must receive enough the number of the packets before EA can. Under impact of hardware noises at all of the nodes, we derive expressions of probability of successful and secure communication (SSC), intercept probability (IP) and average number of the packets transmitted by BS over Rayleigh fading channel. Monte Carlo simulations are presented to verify the theoretical results.

4:00 *Secrecy Performance of Cognitive Radio Networks with Optimal Source Selection under the Impact of Unreliable Backhaul*

Minh Nghia Nguyen (Queen's University Belfast, United Kingdom (Great Britain)); **Truong Vu** (Duy Tan University, Vietnam); **Chinmoy Kundu** and **Long D. Nguyen** (Queen's University Belfast, United Kingdom (Great Britain))

In this paper, the effect of unreliable wireless backhaul to the secrecy performance of cooperative half-duplex cognitive relay networks (CRN) comprises of multiple primary users and multiple eavesdroppers is studied. We consider relay networks with single relay applying Optimal Source Selection (OSS) scheme, and obtain exact closed-form and asymptotic expressions for secrecy outage probability. Monte Carlo simulations are also operated to validate the correctness of our analysis. The outcomes demonstrate that OSS strategy is capable of counteracting the negative impact of unreliable backhaul on CRN. Furthermore, the secrecy performance of the system converges to an asymptotic limit in high-SNR ranges that is only dependent on the backhaul reliability and the order of selected source.

4:20 *A Multi-Storey Building Actuator and Sensor System Using 6LoWPAN Based Internet of Things: Practical Design and Implementation*

Minh-Thanh Vo and **Hung Ngoc Do** (International University, Vietnam); **Van-Su Tran** (International University, HCMC VNU, Vietnam); **Khanh Ma** (International University, Vietnam); **Thong Le Chi** (Ho Chi Minh University of Technology, Vietnam); **Linh Mai** (International University of Viet Nam, Vietnam)

The development of IPv6 has enabled the idea of IP-based Internet of Things where the every embedded device connected to the Internet has its unique IPv6 address. 6LoWPAN is proposed and defined by Internet Engineering Task Force (IETF) to be an adaption layer to apply IPv6 to the IEEE 802.15.4 standard, which allows direct access to control and monitor smart devices from over the world through Internet. 6LoWPAN-based Internet of Things technology is a scalable system which can help to lower expense and decrease the complexity of smart building monitoring and controlling system. This paper describes the design and implementation of a multi-storey building actuator and sensor

system using 6LoWPAN-based Internet of Things. The system consists of low-power wireless building network based on 6LoWPAN using Contiki real-time operating system and COAP application protocol. The building HTTP-COAP proxy is implemented in gateway node provides an efficient data packet transferring which makes the system scalable and accessible to the world based on Ethernet or Wi-Fi Medium. A prototype smart building system has been implemented and evaluated in real multi-storey building environment which has the functions to monitor and control the electrical usage in the smart building. The testing results show that 6LoWPAN-based Internet of Things is a good solution for scalable actuator and sensor networks which can be applied not only multi-storey smart building but also for large scale smart city.

4:40 Securing Full-Duplex Cognitive Relay Networks over Nakagami- m Fading Channels with Partial Relay Selection

Ziwei Xu and Nam-Phong Nguyen (Queen's University Belfast, United Kingdom (Great Britain))

In this paper, the secrecy performance of full-duplex underlay cognitive relay networks over Nakagami- m fading channel is studied. The considered system consists of a primary transmitter, multiple primary receivers, a secondary transmitter, multiple secondary full-duplex relays, a secondary destination node, and an eavesdropper. The eavesdropper attempts to overhear the confidential information in all transmission hops, i.e., from the secondary transmitter to the relay and from the relay to the secondary destination node. In order to enhance the system's secrecy performance, the partial relay selection scheme is applied at the secondary transmitter with the assumption of its partial knowledge of the network's channel state information. Besides, to protect the primary network from the interference of the secondary network, primary network's quality-of-service based constraints for the secondary network's transmit power are established. The exact closed-form expression for the secrecy outage probability of the considered network is derived. The numerical results based on Monte-Carlo simulation are also provided to confirm the correctness of our analysis.

5:00 Secrecy Performance Analysis of QoS-based Non-Orthogonal Multiple Access Networks Over Nakagami- m Fading

Dung Tran and Dac-Binh Ha (Duy Tan University, Vietnam)

In this paper, we consider the physical layer security of a downlink non-orthogonal multiple access (NOMA) system, in which users' quality of service (QoS) requirements are investigated to perform NOMA and all channels are assumed to follow Nakagami- m fading. Specifically, we investigate the scenario that a source transmits information to two legitimate users (LUs) using NOMA scheme in the presence of a passive eavesdropper, where each LU has the different priority based on its QoS requirements. In order to characterize the secrecy performance, the new closed-form expression of overall secrecy outage probability is derived. Finally, our theoretical analyses validated by Monte-Carlo simulation show that in QoS-based NOMA system, the better secrecy performance of overall communication process can be obtained in case that there is not much difference in the level of priority between LUs.

CT:4 Communication Theory Track

Room: Mui Ne

3:40 Performance Analysis of In-Band Full-Duplex Amplify-and-Forward Relay System with Direct Link

Ba Cao Nguyen and Nam Xuan Tran (Le Quy Don Technical University, Vietnam); Dinh Tan Tran (Telecommunication University, Vietnam)

In this paper, we analyze performance of the inband full-duplex amplify-and-forward one-way relay system in which two terminal nodes operate in the half-duplex mode while the relay node in the full-duplex mode. Unlike previous works we consider the case of imperfect loop-interference cancellation at the full-duplex relay and assume that the direct link between the source and the destination nodes exists in the system. We show that the system performance in the case with the direct link is significantly improved over the case without this link. Using theoretical analysis we can obtain the closed-form of the approximate outage probability, throughput, achievable capacity and symbol error probability of the system. Based on this analysis an effective power allocation for the full-duplex mode is derived to improve the system performance. Numerical results are compared with simulated ones for different levels of residual loop-interference to verify the theoretical analysis.

4:00 An Spectrum Efficient WO-OFDM using Windowing and Overlapping on the Cyclic Prefix and Postfix

Changyoung An, Jungu Lee and Heung-Gyoon Ryu (Chungbuk National University, Korea)

In this paper, we like to propose an WO-OFDM (windowing and overlapping - orthogonal frequency division multiplexing) which is an improved version of conventional OFDM system. For the new radio waveform of the 5G and the beyond mobile system, the spectrum efficiency is the most important factor. Especially, OOB (out-of-band) power spectrum must be reduced to increase the spectrum efficiency and to save the frequency resources. Filtering is the one way to get the sharp OOB spectrum. But, due to the very complicated process and some difficulty to the realization of the filtering method, windowing method has been enlightened more. WOLA-OFDM (weighted overlap and add - orthogonal frequency division multiplexing) system is the most representative windowing method. However, the WOLA-OFDM system has some serious problem. The first problem is the time loss because of the copy and extensions in the right and left part in the conventional CP-OFDM (cyclic prefix - orthogonal frequency division multiplexing). There must be the extension in the right and left ends of the CP-OFDM even though there are overlapped in the consecutive symbols. This is the obvious loss problem of the time resource. The second problem is that when the consecutive symbols are overlapped keeping the same CP-OFDM period in order not to lose the time resource, the sharpened OOB spectrum of single WOLA-OFDM symbol cannot exist any longer because of the waveform change due to the overlapping of the consecutive symbols. The last is the data collision, which is very serious problem even before the transmission. Due to the overlap of the 2 extensions of copy and addition processes, the left part of the copied and added parts invades into the right part of the previous OFDM symbol. So, in this paper, to improve the WOLA-OFDM system and to avoid these problems of WOLA-OFDM, we like to propose an WO-OFDM (windowing and overlapping - orthogonal frequency division multiplexing). In this WO-OFDM system there are WO1-OFDM system and WO2-OFDM system, whether the overlapping between the

consecutive OFDM symbols is allowed or not. Compared with the conventional WOLA-OFDM system, the proposed WO-OFDM system is a simple and solve the problems. Simulations results show that the proposed WO-OFDM system has comparable OOB spectrum reduction characteristics and can be designed by simple some modification from the conventional OFDM system.

4:20 Performance Comparison of 16-QAM and 16-DAPSK Systems Using Nonlinear HPA

[Kyeongsoo Jang](#) and [Heung-Gyoon Ryu](#) (Chungbuk National University, Korea); [Sang Burm Ryu](#) and [Sang Gyu Lee](#) (Korea Aerospace Research Institute, Korea)

When using HPA(High Power Amplifier) to amplify transmit power in a communication system, the nonlinear response of the HPA causes degradation of important performances such as power and spectral efficiency, BER. In this paper, we propose a case where a Saleh model is used as an HPA model in a communication system using 16-QAM (Quadrature Amplitude Modulation) and 16-DAPSK (Multi-level Modulation and Phase Shift Keying) The performance of each system was analyzed. The predistorter and IBO (Input Back Off) techniques were used to compensate for the nonlinear response of HPA. The IBO divided the cases with and without the predistorter and evaluated the performance by deriving the required IBO value according to each case. Simulation results show that the predistorter compensates the nonlinear response due to HPA in the constellation, spectrum and BER performance graph before and after using the predistorter. Also, the IBO value required for each system to be close to the theoretical value was confirmed by applying the IBO value differently.

4:40 Stochastically Resonant Spectrum Sensing for White Space Communications, Dynamic Spectrum Access and Intelligent Radios and Networks

[Shastri Jayram](#) and [Khmaies Ouahada](#) (University of Johannesburg, South Africa); [Suvendi Rimer](#) (UJ (formerly), South Africa); [Andreas Pitsillides](#) (University of Cyprus, Cyprus); [Fisseha Mekuria](#) (CSIR: Council for Science and Industrial Research, South Africa & CSIR Meraka Institute, Sweden)

Research, design and development of a Stochastically Resonant Spectrum Sensing (SRSS) module for Dynamic Spectrum Access and TV White Space communication systems using both Additive and Multiplicative stochastically resonant noise towards an Ontological Cognitive Radio (OCR) including active Interference Management (IM) techniques such as interference mitigation, radio environment noise mapping, etc.

5:00 MAC SoC Hardware Implementation For Fast Industrial WLAN Communication Systems

[Duc Khai Lam](#), [Hoai Luan Pham](#) and [Trung Thien Bui](#) (University of Information Technology, VNU-HCM, Vietnam)

This paper presents a System on a Chip (SoC) Field-Programmable Gate Array (FPGA) implementation for Media Access Control (MAC) layer of a fast industrial Wireless Local Area Network (iWLAN) system, which is used to control industrial robots in factory automation environments. This protocol promises to be a potential communication protocol in communication field by using the Low overhead Packet Division Multiple Access (PDMA) scheme controlled by MAC layer. In our previous research, the MAC layer hardware was implemented and tested on simulation software, but the SoC design for the MAC layer has not been implemented and real tested on the FPGA. In this paper, we have successfully implemented the SoC system for MAC layer of this high-speed wireless communication protocol on the FPGA.

FWNT:1 Fixed and Wireless Networks Track

Room: Phu Quoc

3:40 An Efficient Spectral Leakage Filtering for IEEE 802.11af in TV White space

[Phu Nguyen](#) (Ho Chi Minh City, Vietnam); [Thinh Hung Pham](#) (HCMUT, Vietnam); [Hoang Trang](#) (University of Technology, HoChiMinh City, Vietnam); [Oh-Soon Shin](#) (Soongsil University, Korea)

Orthogonal Frequency Division Multiplexing (OFDM) has been widely adopted for modern wireless standards and become a key enabling technology for cognitive radios. However, one of its main drawback is the leakage of signal spectrum due to the summation of the infinite spectrum of multiple sinusoidal sub-carriers. In this paper, we present a novel pulse shaping scheme for efficient spectral leakage suppression in OFDM based physical layer of IEEE 802.11af applied to reuse TV White Space band. Pulse shaping filters such as state of the art raise cosine, vestigial symmetry can be used to reduce spectral leakage very effectively. However, these pulse shaping filters require long guard interval i.e. Cyclic Prefix (CP) to avoid the inter-symbol interference (ISI). This reduces the spectral efficiency. The proposed pulse shaping method based on asymmetric pulse shaping achieves better spectral leakage suppression and decreases ISI caused by the effect of filtering in comparison to the state of the art pulse shaping filters.

4:00 Energy Aware Event Driven Routing Protocol and Dynamic Delivering Scheme for MultiEvent Wireless Sensor Network

[Nguyen Thi Thu-Hang](#) (Posts and Telecommunications Institute of Technology, Vietnam); [Nguyen Trinh](#) (Posts and Telecommunications Institute of Technology & Telecom. Faculty, Vietnam); [Nguyen Tien Ban](#) (Posts and Telecommunications Institute of Technology, Vietnam)

Multievent wireless sensor networks (WSN) require different levels of reliability and latency based on event types and network energy saving because of resource limitation. Most of researches in this area have dealt with one or two of the requirements. This paper proposes a novel solution combining of energy aware, event driven routing protocols, and dynamic delivering scheme to support the requirements for multievent WSN. Simulation results show that, the proposed solution reduces packet loss rate for high reliability requirement events and extends the network lifetime of multievent WSN. Moreover, in case of high traffic condition, sharing packet scheme over multiple paths would reduce latency for the urgent events in the multiple events network.

4:20 *Monte-Carlo Performance Analysis of OFDM System in the presence of Multi-path Fading Environment and Non-Gaussian Noise*

[Bao Quoc Vuong](#) and [Huu Tue Huynh](#) (International University, HCMC VNU, Vietnam); [Hung Ngoc Do](#) (International University, Vietnam)

In recent years, the fantastic growth of using mobile devices and wireless communication tools leads to requirements of higher data rate for the connection and higher capacity for the subscribers in the communication industrial area. Therefore, multi-carrier transmission technique has been proposed to be a robust and efficient technique to transmit data over severe communication channels. The Orthogonal Frequency Division Multiplexing (OFDM) is a very efficient multi-carrier technique that can fulfill users' high demands. OFDM has been studied by many researchers, mainly as mean to combat fading and Additive White Gaussian Noise (AWGN). However, in the real communication environment, the main source of additive noise is man-made noise which by its nature is impulsive. Impulsive noise is composed by thermal noises in electronic devices of receivers and incoming electromagnetic impulses from nearby other electrical devices. These kinds of noise inject high electromagnetic energy into receivers so that it strongly affects to quality of received signals. Therefore, in this paper, the performance of OFDM system in the presence of multi-path fading environment and non-Gaussian noise, which modeled by the class A Middleton noise, is illustrated by using the Monte Carlo simulation technique.

4:40 *On Exploiting Wireless Sensor Networks for Enhancing the Logistics Operation Efficiency in the Physical Internet*

[Dang-Hoa Tran](#) and [Dong Seong Kim](#) (Kumoh National Institute of Technology, Korea)

The Physical Internet (pi) concept was developed to address the current unsustainability problem of the current logistic systems. One of the key elements in the Physical Internet is pi-containers designed to be world-standardized, smart, green and modular boxes such that they can be handled and transported throughout an open global logistic infrastructure. Logistic processes such as partial loading/unloading or composing/ decomposing of pi-containers play an important role for a successful Physical Internet. However, the large variety of these physical transformation processes can introduce desynchronisation between the physical and informational flows of the supply chain management system. To overcome this problem, this paper proposes to integrate wireless sensors into pi-containers and then develop an algorithm for this wireless sensor network to monitor the pi-containers as well as the logistics operation efficiently. The proposed methodology evaluated by simulation processes shows that our proposition can be realized practically in the era of Industrial Internet of Things

5:00 *Analysis and Assessment of LoRaWAN*

[Kieu-Ha Phung](#), [Hieu Tran](#), [Quan Nguyen](#) and [Huong Thu Truong](#) (Hanoi University of Science and Technology, Vietnam); [Thanh Long Nguyen](#) (Vrije Universiteit Brussel, Belgium)

Low-Power Wide Area Network (LPWAN) supports long-range communication for hundreds to millions smart devices and it enables new types of services in Internet of Things (IoT) context. Several wireless technologies have proposed; LoRa wireless technology is arguable the most adopted. It promises popular connectivity in outdoor applications, while maintaining simple network structures and managements. This work provides an overview of LoRa technology and LoRaWAN standard and an in-depth analysis of its functional components. The network performance evaluation has given the hints for scalability of network deployment.

Monday, January 29, 18:00 - 21:00

Banquet

There will be the bus to pick up all guests at 6pm 29th January. This bus will depart at 6.15 pm in front of the conference venue.