2017 IEEE International Conference on Consumer Electronics (ICCE 2017)

Las Vegas, Nevada, USA
8-10 January 2017

Additional Copies of This Publication Are Available From:

Sunday, January 8, 08:30 - 09:00

Breakfast

Room: N260-N258

Sunday, January 8, 09:00 - 10:10

Keynote + Opening. 360° Immersive technology, how will you be transported right there, in person, instantaneously. Patrice Roulet (immervision.com)

Title: 360° Immersive technology, how will you be transported right there, in person, instantaneously
Patrice Roulet (immervision.com)

Room: N260-N258
Chair: Fernando Pescador (Universidad Politécnica de Madrid, Spain)

The consumer devices of tomorrow are evolving beyond capturing classic pictures and videos. The lenses of yesterday are narrow and restrictive. New generation of super wide angle lenses capture our surroundings in full 360°, allowing our friends and families to step inside our universe and experience it, live.

Qualified as a most social platform by some and a game changer by others, this new generation of 360°/VR devices will impact the way people express themselves, share moments, and enjoyed unlimited unique experiences.

As example, we have seen off the shelf smartphones easily turning to virtual reality headsets. Next gen smartphones will become a gateway to your full immersive environment, enabling from the same device: 360° Virtual Reality capture, instantaneous sharing and immersive live experiences allowing us to share our world, our live, our feelings and our emotions.

This is the tip of the iceberg. Social media and app developers are yet to unlock the full potential of immersive 360° technologies. Its potential is only limited by our imagination. Starting from professional TV broadcast and movie cameras scaling up to our day to day consumer devices such as smartphones, this talk will explore a near future where we will never miss the unique feeling to be there.

Sunday, January 8, 10:10 - 10:30

Coffee Break

Room: Hall Area

Sunday, January 8, 10:30 - 12:10

T1.1-RF, Wireless & Network Technologies: Antennas and Infrastructure

Room: N256
Chairs: Johan J. Lukkien (Eindhoven University of Technology, The Netherlands), Jong-Hyouk Lee (Sangmyung University, Korea)

10:30 *Improving Performance of Dual-Polarized MIMO Ultra-Multilevel OFDM Under Mobile Reception* **1**
Hiroaki Otsubo, Akira Nakamura and Makoto Itami (Tokyo University of Science, Japan)
The reception characteristics are improved by proposed MIMO-ICI canceller using iterative detection for dual-polarized MIMO ultra-multilevel OFDM under mobile reception.

10:50 *Pattern Gain Based Compact 4-port Antenna for WLAN System* **3**
Daehee Park (KAIST, Korea); Dong-Ho Cho (Korea Advanced Institute of Science and Technology, Korea)
For VR/AR service, it is necessary to obtain high throughput in wireless local access network (WLAN). Conventional multi-port antenna is not appropriate for WLAN devices due to space constraints of the WLAN device. Meanwhile, it is possible to obtain multiplexing gain by achieving pattern gain. However, previous antennas with pattern gain have not been designed for the WLAN devices. In this paper, we designed a compact 4-port antenna for the WLAN device, which is 0.5 times smaller than the conventional antenna. We also show that the proposed antenna obtains close multiplexing gain compared to ideal antenna in poor channel cases.

11:10 *Performance Evaluation of Satellite Broadcasting Using SC-OFDM for 4K/8K Transmission* **5**
Akira Nakamura, Atsushi Inoue and Makoto Itami (Tokyo University of Science, Japan)

In this paper, performance of satellite broadcasting using SC-OFDM(Single Carrier-Orthogonal Frequency Division Multiplex) modulation for 4K/8K transmission is evaluated by computer simulations. As the results, it is possible to increase the transmission rate against the required Carrier to Noise Ratio.

11:30 *Modified Nonrecursive Comb Decimation Structure   7*
Gordana Jovanovic Dolecek (INAOE, Mexico)
TThis paper presents the nonrecursive comb decimation structure for the decimation factors which are the power of five. As a difference to CIC (Cascade-Integrator-Comb) structure which is area efficient, a nonrecursive structure is a power efficient. However, this structure has a low attenuation in the folding bands (bands around the zeros of comb filter), which can deteriorate the decimated signal. We proposed a modified structure in which a simple multiplierless filter is inserted in the last stage. The proposed method is based on exploiting the properties of the system function of the convolution of a comb filter with itself.

11:50 *Massive MIMO for Dynamic Spectrum Access   9*
Feng Ouyang (Johns Hopkins University / Applied Physics Lab, USA)
This paper proposes the application of massive MIMO, combined with millimeter (mm)-wave technology, in dynamic spectrum access (DSA) systems. In the proposed system, secondary users transmit together with the primary users, while using beamforming to control interference. Simulation results show significant performance gains compared to traditional DSA due to increase of antenna numbers. Such system can be used under both line of sight (LOS) and scattering channel conditions.

T2.1-Entertainment, Gaming, Virtual & Augmented Reality: Virtual & Augmented Reality

Room: N259
Chair: Kousik Ramasubramaniam Sankar (CISCO Video Technologies, India)

10:30 *Projection-Based AR Book System Involving Book Posture Detection and Robust Page Recognition   13*
Yasushi Sugama and Taichi Murase (Fujitsu Laboratories Ltd., Japan)
We propose comfortable AR book system. Our book detection method realizes projection onto books even when user holds a book. Furthermore, book page can be accurately recognized even in above mentioned situation.

10:50 *Webized Augmented Reality Mashup for Legacy Things   15*
Daeil Seo, Doyeon Kim, Byounghyun Yoo and Heedong Ko (Korea Institute of Science and Technology, Korea)
Although Internet of things devices are attractive to make our life smart, we need to replace existing equipment to IoT devices for connecting things and it causes a cost problem. We proposed a webized augmented reality mashup for legacy things that connects existing web services and the things without additional costs for replacement of existing equipment.

11:10 *MOSKIT: Motion Sickness Analysis Platform for VR Games   17*
Sangho Lee (GameCrew Creative Lab. & Yonsei University, Korea); Ashley Koo and Junekyo Jhung (GameCrew Creative Lab., Korea)
This paper introduces MOSKIT, a motion sickness analysis platform for VR gaming content. Software developers will be able to significantly reduce MS without looking to hardware for updates. The paper has investigated three known main contributors to motion sickness: system configuration, device orientation, and interaction among objects.

11:30 *Enhanced Player Interaction Using Motion Controllers for VR FPS   19*
Kyoungju Park and Przemyslaw Krompiec (Chung-Ang University, Korea)
Goal of virtual reality (VR) is to increase the realism and user experience. In order to achieve these goals, we analyze the existing solutions and design and propose a new method of user interaction for a first person shooting (FPS) game prototype. In our FPS prototype, wearing a head mounted display together with two motion controllers, we design the player interaction using both hands to operate in-game firearms and mimicking shooting action in real-world. Additionally, we make use of one of the trending and free game engines in order develop a run-able game prototype.

11:50 *Effective Display Resolution of 360 Degree Video Footage in Virtual Reality   21*
Lars Meinel, Markus Heß and Michel Findeisen (Chemnitz University of Technology, Germany); Gangolf Hirtz (Chemnitz University, Germany)
360 degree video entertainment is one of the major applications of the emerging technology of virtual reality. However, the success of immersive video is impeded by the limited effective display resolution of 360 degree footage. In this paper we present a general methodology to assess resolution loss during the projection process and therefore help to design novel 360 video systems.

T3.1-AV Systems, Image & Video, Cameras & Adquisition: Image Analysis

Room: N261
Chair: Carsten Dolar (Robert Bosch GmbH, Germany)

10:30 *Fast Semantic Region Analysis for Surveillance & Video Databases   25*
Solmaz Javanbakhti, Sveta Zinger and Peter H.N. de With (Eindhoven University of Technology, The Netherlands)
The importance of real-time surveillance video monitoring has increased recently in response to heightened security concerns. For real-time implementations, it is important to develop surveillance systems with low computational complexity. Here, we analyze the complexity of our semantic region labeling approach which aims to extract spatial contextual information in a video. In our approach, besides color and texture, also the vertical position is taken into account as part of a gravity-based model. We demonstrate that

our system provides low computational complexity while maintaining a high accuracy which makes the system suitable for real-time implementation in embedded video surveillance.

10:50 *JPEG 2000 Compression of Unfocused Light Field Images Based on Lenslet Array Slicing   27*
Cristian Perra (University of Cagliari, Italy); Daniel D Giusto (University of Cagliari & CNIT, Italy)
This paper proposes an algorithm for lossy compression of unfocused light field images. The raw light field is preprocessed by demosaicing, devignetting and slicing of the raw lenset array image. The slices are then rearranged in tiles and compressed by the standard JPEG 2000 encoder. The experimental analysis compares the performance of the proposed method against the direct compression with JPEG 2000, and JPEG XR, in terms of BD-PSNR gain and bit rate reduction. Obtained results show that the proposed method outperforms direct application of the reference state of the art image encoders.

11:10 *Building Recognition with Adaptive Interest Point Selection   29*
Nicolas Hascoët (Telecom SudParis, France); Titus Zaharia (Institut TELECOM, France)
In this paper, we propose an improvement of image retrieval for building images using the Bag of Words (BoW) model. The principles consists of pre-processing the interest points detected on the images in order to classify them into two classes, corresponding to building and no-building key points. In this way, the data involved for comparisons is reduced to only the relevant one and only the features describing the buildings are taken into account. The experimental results, carried out on the Paris6k data set shows significant improvement in terms of retrieval performances.

11:30 *A Novel Intelligent Video Surveillance System Based on Embedded Devices   N/A*
Zhongyu Li, Peng Liu and Yu Chen (North China Electric Power University, P.R. China); Jiang Liu (Waseda University, Japan)
Intelligent video surveillance has attracted extensive interest due to the great market demand. In this paper, we present an intelligent video surveillance system, which uses an hardware-oriented foreground detection algorithm based on Mixture of Gaussian model. The surveillance system with an intelligent board can realize 7 different monitoring tasks in real time, such as intrusion detection. In order to improve the detection accuracy, we use an object size detection threshold to eliminate the interference of some irrelevant moving objects in dynamic scene. The experiment results prove that our system has good performance of tolerating the interference of shadows, ripples, etc.

11:50 *Software Upgrade of Multi-Streaming Feature in Common Interface plus V1.4   33*
Marina Vuckovic (RT-RK Computer Based Systems & RT-RK Computer Based Systems, Serbia); Nenad Soskic (Faculty of Technical Sciences, University of Novi Sad, Serbia); Ilija Basicevic (University of Novi Sad, Serbia); Miroslav Dimitraskovic (RT-RK Computer Based Systems & RT-RK Computer Based Systems, Serbia)
The paper specifies software upgrade of the multi-streaming feature in CI+ V1.4 as an innovative extension to the CI+ V1.3 specification, which is the industry standard for access to protected TV channels in set-top-box devices. The purpose of this paper is to introduce software upgrade of the resources in previous version of CI+ V1.3 with the multi-streaming functionality of some resources in the new version of CI+ V1.4, in a simple manner in order to enhance capabilities of the previous version of CI+.

IEEE Future Directions 1: Convergence through the Cloud-to-Thing Continuum

Mung Chaing (Princeton University), Tao Zhang (CISCO), David G. Belanger (Sevens Institute of Technology), Robert S. Fish (Netovations), Tom Coughlin (Coughlin Associates)

Room: N262
Chair: Thomas Coughlin (Coughlin Associates, USA)

Please go here for detailed information about this session!

Sunday, January 8, 12:10 - 12:25

IEEE Fellow elevation ceremony

Stephen Dukes

Room: N260-N258
Chair: Stephan Dukes (Frontier, USA)

Sunday, January 8, 12:25 - 13:30

Luncheon Keynote. Title: Democratizing VR Innovation. Ferhan Ozkan (VR First)

Title: Different Perspectives on VR/AR Innovation
Ferhan Ozkan (VR First),

Room: N260-N258
Chair: Fernando Pescador (Universidad Politécnica de Madrid, Spain)

A recent VR First survey with the participation of academic institutions around the world shows the high interest of academia in teaching VR development but the lack of infrastructure to realize their goal. Universities cannot provide students with VR development hardware to apply theoretical skills, nor do they have prepared a curriculum to teach practical VR development skills. VR First is facilitating an industry cooperation to support universities in their goal of VR education by providing facilities, equipment, skills, mentorship and a network to empower innovation and realize the existing spin off potential.

VR First believes that every developer should have the opportunity to access to high-end VR infrastructure to develop the most immersive VR applications of the future.

In this session, it's going to be discussed how to empower students and developers with the skills and network to succeed in the VR industry.

Sunday, January 8, 13:30 - 15:10

T4.1-Automotive CE Applications 1

Room: N256
Chair: Soumya Kanti Datta (EURECOM & Co-Founder, Future Tech Lab, France)

13:30 *LED Projection Module Enables a Vehicle to Communicate with Pedestrians and Other Vehicles   37*
Masashige Suwa, Masatoshi Nishimura and Reiko Sakata (Mitsubishi Electric Corporation, Japan)
This paper propose the road illuminating system using the LED Projection Module in which the system projects image information on a road surface that enables communication between human and cars in order to reduce pedestrians' fatal accidents at night.

13:50 *Software Framework for Runtime Application Monitoring of Fail-Safe Multi-Processor ADAS SoCs   39*
Piyali Goswami, Kedar Chitnis and Brijesh Jadav (Texas Instruments India Pvt. Ltd., India); Ashish Kapania (Texas Instruments, USA); Shiju Sivasankaran (Texas Instruments India Pvt. Ltd., India)
In Advanced Driver Assistance (ADAS) systems, it is very critical to ensure a system malfunction does not cause harm to humans (also referred to as functional safety). Malfunctions could be due to incorrect software (SW) execution. Many techniques exist to catch systematic SW faults during development. However without run-time monitoring, it is impossible to guarantee a fail-safe system. In this paper, we describe a framework to monitor application statistics in heterogeneous multiprocessor SoCs targeted for fail-safe ADAS systems. With <0.5% CPU load overhead per monitor, the proposed framework was found to accurately report statistics for a front camera analytics application.

14:10 *Monitoring of a Driver's Heart Rate Using a Microwave Sensor and Template-Matching Algorithm 43*
Souksakhone Bounyong (Panasonic Corporation, Japan); Mototaka Yoshioka (PANASONIC, Japan); Jun Ozawa (Panasonic, Japan)
A method of monitoring a driver's heart rate using a microwave sensor on a seat backrest is proposed. The heartbeat signal was learned as a template while the car engine idled. This template was used to calculate correlation between observed signals. The proposed method amplifies a weak heartbeat signal and reduces road noise. A basic experiment was conducted on an actual road at low speed. The proposed method detected the heart rate with accuracy exceeding 85% relative to heart rates measured with a contact-based system.

14:30 *In-Vehicle CAN FD Network for Smart Wearable Devices   45*
Jung Woo Shin, Jung Hwan Oh and Sang Muk Lee (Seoul National University of Science and Technology, Korea); Jae Jin Ko and Sang Yub Lee (Korea Electronics Technology Institute, Korea); Seung Eun Lee (Seoul National University of Science and Technology, Korea)
In this paper, we present an in-vehicle Controller Area Network with a Flexible Data-Rate (CAN FD) bus controller for smart band-type wearable devices. The CAN FD is suitable for in-vehicle communication networks that require high reliability and high data transmission rates. The CAN FD controller system supports variable data length transmissions for wearable devices. The CAN FD controller receives data from the Audio Video Navigation system through the Serial Peripheral Interface and successfully transmits the data to the CAN FD bus.

14:50 *Detection and Tracking of Overtaking Vehicle in Blind Spot Area At Night Time   47*
Seon Geol Kim and Jai-Eun Kim (Kookmin University, Korea); Kang Yi (Handong Global University, Korea); Kyeong Hoon Jung (Kookmin University, Korea)
The many detecting and tracking in behind blind spot algorithm use a method based on edge feature information at day time. However, it is not suitable at night time since the edge feature is not obvious. In this paper, we propose the algorithm that use a headlight information. first, generate a blob by making a binary image using threshold and calculate a motion vector to estimate overtaking blobs. and then, make a projection map to specific headlight's 2 light blobs. finally, track the headlight by using calculated motion vector.

T5.1-CE Sensors & MEMS

Room: N259
Chair: Muhammad Khurram Khan (King Saud University, Saudi Arabia)

13:30 *An Improved Design of an Automatic Detection Balance Tray with an Accelerometer, Four Servo Motors, Four Force-Sensitive Resistors and an MCU Expansion Board   49*
Chi-Huang Hung, Y. W. Bai and Ching-Hsiang Chiang (Fu Jen Catholic University, Taiwan); Hsu Yao Wu (Fu-Jen Catholic University, Taiwan)

When an user props up the tray while walking the tray often vibrates and liquids may splash out. This proposal is an improved design of an automatic detection balance tray (ADBT) by using a triaxial accelerometer module, four force-sensitive resistors (FSR), four servo motors, four LEDs, and an MCU expansion board. The triaxial accelerometer module detects the tilt angle of the tray. The MCU expansion board controls the four servo motors which are utilized to balance the tray. The four FSRs in the tray will sense the carried item positions and the four LEDs will show the weight position.

13:50 *Examination of Suppression of Stray Light of Small PM2.5 Sensor   51*

Shota Nakahara and Satoru Okagaki (Mitsubishi Electric Corporation, Japan); Kenya Nakai (Mitsubishi Electric Corporation & Advanced Technology R&D Center, Japan); Nozomi Enoki and Nobuo Takeshita (Mitsubishi Electric Corporation, Japan)

We develop a light-scattering-type PM2.5 sensor. We devised a light absorption unit with an inclined photodetector for auto power control. We confirmed that the light absorption unit suppressed the increase of stray light in the sensor using both optical simulations and experiments.

14:10 *Touched Image Transmission of a High Resolution Touch Panel Using MIPI CSI-2 for Kiosk Applications   53*

Seokman Kim, Minseok Oh, Dohyeon Yoo and Kyoungrok Cho (Chungbuk National University, Korea)

This paper presents high-speed image data transmission using MIPI CSI-2 interface for high-resolution touch panels. On MIPI CSI-2, if there are errors, the receiver notices these errors to upper-layer including application layer. Error-handling is a duty of application layers. In this case, touch response increases consequently. In this work, we added error handling path to low-level protocol layer. In addition, to compensate for signal attenuation due to increasing transmission distance, the adaptive equalizer using FVC(frequency-voltage converter) was applied to the receiver. The proposed architecture was tuned with 800Mbps that transfers data of 800x600 high resolution panel less than 10ms.

14:30 *An Embedded 6-axis Sensor Based Recognition for Tennis Stroke   55*

Weiping Pei (Sun Yat-Sen University(SYSU), P.R. China); Jun Wang (SYSU-CMU JRI & School of Electronics and Information Technology, SYSU, P.R. China); Xubin Xu, Zhengwei Wu and Xiaorong Du (Sun Yat-Sen University(SYSU), P.R. China)

This paper proposes a product that could send back information about the tennis stroke in real time. This product, consisting of sensor module, controller module and transmission module, is embedded in tennis handle. There are three steps for stroke recognition. Firstly, shot detection uses fluctuation of acceleration based on moving windows. Secondly, sensor data are used to divide those shots into 3 stroke types (forehand, backhand, serve). At last, information about how the ball rotates would be acquired. The experimental result shows high accuracy for motion recognition with 98% accuracy for shot detection and 96% accuracy for stroke recognition.

14:50 *A Secure Framework for Digital Quran Certification   59*

Muhammad Khurram Khan and Zeeshan Ahmed Siddiqui (King Saud University, Saudi Arabia); Omar Tayan (Taibah, Saudi Arabia)

This paper presents a digital Quran certification framework by utilizing modern digital authentication and certification techniques to certify and authenticate digital Quran applications available in multimedia format. A certification authority and a religious panel scrutinize the certification process and upon fulfillment of all the requirements, a digital certificate is issued to the digital Quran application developer. A general consumer of the service can easily verify the issued digital certificate in an online manner. The presented framework aims at diminishing the chances of modifying digital contents of the holy book for its consumer's belief and trust.

T3.2-AV Systems, Image & Video, Cameras & Adquisition: Video Quality

Room: N261
Chair: Stefan Mozar (UNSW, Sydney & Dynexsys Pty Ltd, Australia)

13:30 *Towards an Optimized Multiview Streaming System with View Interpolation   61*

Tobias Lange (Saarland University, Germany); Thorsten Herfet (Saarland University & Intel Visual Computing Institute, Germany)

We present an approach to optimize the transmission of multiview video over bandwidth limited channels. The main idea is to optimize the number of transmitted views by choosing a set of views to be reconstructed at the receiver using view interpolation, removing them from the stream and encoding the remaining views with a higher quality. We have shown that this approach makes sense especially in cases where the channel is very restricted. With further evolution of view interpolation algorithms, the threshold at which our method improves image quality rises quickly and can be applied to a wider range of scenarios.

13:50 *Using Pupillary Response to Assess Video Quality   64*

Deepti Pappusetty, Vishnu Chinta and Hari Kalva (Florida Atlantic University, USA)

Pupil response can be measured non-intrusively using an eye tracker and offers a potentially new approach to understanding video structure and content. An analysis of pupil response to quality variations in a video is reported in this paper. Experiments were conducted under free viewing conditions and pupillary response of subjects was analyzed. Video clip encoded with AVC/H.264 at various qualities and durations were used to assess user response. Results show pupillary constrictions at points of quality transitions.

14:10 *Adaptive Feature Selection Based on Local Descriptor Distinctive Degree for Vehicle Retrieval Application   66*

Chuang Zhu, Huizhu Jia, Tao Lu, Li Tao, Jiawen Song, Guoqing Xiang, Yuan Li and Xiaodong Xie (Peking University, P.R. China)

Performing image retrieval in large image database is becoming popular. ISO/IEC moving pictures experts group (MPEG) drafts compact descriptors for visual search (CDVS) to support the related applications. In this paper, we adopt CDVS to address traffic vehicle search in large database. After detailedly analyzing to the local descriptor, we firstly define local descriptor distinctive degree based on the gradient quantity and the spatial gradient distribution energy of the feature. Then we propose our adaptive feature selection method by combing feature distinctive degree and priori information. The proposed method is proven to be better than the standard algorithm in CDVS.

14:30 *Low-light Image Enhancement Using Variational Optimization-based Retinex Model   70*

Seonhee Park, Byeongho Moon, Seungyong Ko, Soohwan Yu and Joonki Paik (Chung-Ang University, Korea)

This paper presents a low-light image enhancement using variational-based Retinex algorithm. The proposed enhancement method first estimates initial illumination and its gamma corrected version to constrain the illumination component. Next, the variational-based minimization is iteratively performed to estimate reflectance and illumination simultaneously. Finally, the color assignment method is performed to the estimated reflectance component to restore the color component using the input RGB color channels. Experimental results show that the proposed method can provide better enhanced result without saturation, noise amplification and color distortion.

Update on ATSC 3.0 - Next Generation Broadcast Television

http://www.icce.org/conference/special-sessions/#ss1

Wayne Luplow (VP, Zenith R&D -LG Electronics-), Skip Pizzi (National Association of Broadcasters), Luke Fay (Sony Electronics), Rich Chernock (Triveni Digital), Madeleine Noland (LG Electronics)

Room: N262
Chair: Wayne Luplow (Zenith Electronics, USA)

Please go here for detailed information about this session!

Social Implication of Technology

Room: N264
Chair: Scott L Linfoot (MASS, United Kingdom)

13:30 *Autonomous Robotic Street Sweeping: Initial Attempt for Curbside Sweeping   72*

Jeongmin Jeon, Byungjin Jung, Ja Choon Koo, Hyouk Choi and Hyungpil Moon (Sungkyunkwan University, Korea); Alvaro Pintado and Paul Oh (University of Nevada, Las Vegas, USA)

Toward autonomous street cleaning, we present our recent development of autonomous robotic street sweeper. The developed system is aimed at autonomous cleaning with low cost hardware. In this work, a commercialized manual brush sweeper is robotized and equipped with two fish-eye cameras for environmental sensing.

13:50 *Advanced Technical Communications for ESL Engineers and OoI   74*

Narisa Chu (CWLab International, USA)

This talk is an excerpt of IEEE CEU Course ID: 103645 on Advanced Technical Writing and Presentation. It is designed for English-as-a-Second-Language (ESL) Engineers and Others of Interest (OoI). This talk was offered in the Global Conference on Consumer Electronics (GCCE-2015) in Osaka, Japan; the International Conference on Consumer Electronics, ICCE-Taiwan-2016;¬¬ and twice at the National Central University in Zhongli, Taiwan, in February and June, 2016, respectively. Feedback from participants has rated the course at 97% satisfaction. Demonstrations with grammatical subtlety, cultural difference, cognitive style, and logical thinking are shown with graphical illustrations to breakdown the language barrier.

14:10 *Characterization of Teen SNS Usage in Entertainment Media   76*

Evelyn Chang (Agoura High School, USA); David Stamps (University of California, Santa Barbara, Spain)

This research studies the portrayal of teenagers' use of SNS (social networking sites) within entertainment media. It is found that approximately 62% and 68% of SNS usage is dedicated to communication in the television shows Scream: The TV Series and Awkward, respectively. The findings, on a grander scale, drive the importance of media literacy, empower individuals to control their personal narrative, and address myths about teens and SNS use.

Sunday, January 8, 15:10 - 15:50

Coffee Break

Room: Hall Area

Sunday, January 8, 15:50 - 17:30

T8.1-Internet of Things and Internet of Everywhere: IoT & IOE Security

Room: N256
Chair: Daniel Díaz-Sánchez (Universidad Carlos III de Madrid, Spain)

15:50 *The Semantic Mediation for the Swarm: An Adaptable and Organic Solution for the Internet of Things   78*

Laisa C. P. Costa (University of Sao Paulo & LSI-TEC, Brazil); Pablo César Calcina Ccori and Flavio Silva (University of Sao Paulo, Brazil); Marcelo Zuffo (Polytechnic School of the University of Sao Paulo, Brazil)

This paper presents the architecture of the Mediation Service, which is a service being proposed to support interoperability in the Internet of Things and Swarm ecosystem. Mediation uses semantics and this paper presents strategies for service discovery using semantics. A software architecture is presented and results in a solution to generate a matching degree of service requests and services being offered.

16:10 *A Support Tool to Design IoT Services with NuSMV   80*

Kazuya Nakahori and Shingo Yamaguchi (Yamaguchi University, Japan)

In this paper, we developed a support tool to design IoT services and proposed a model checking method with NuSMV. With our tool, we can model an IoT service as an agent-oriented Petri net PN2 (Petri nets in a Petri net) and simulate their state transitions. Then the tool generates a description of the model and CTL or LTL specifications to verify properties automatically. NuSMV shows a trace of counterexample if the property is not satisfied. We also illustrated its usefulness with an application example of drone delivery system and considered scalability.

16:30 *Smart Umbrella for Safety Directions on Internet of Things   84*

Youngtak Han, Chungsan Lee, Youjin Kim and Soobin Jeon (Kangwon National University, Korea); Dongmahn Seo (Catholic University of Daegu, Korea); Inbum Jung (Kangwon National University, Korea)

The smart umbrella not only blocks a rain but also provides a variety of services to customers. Existing smart umbrellas have various features such as giving an alarm for raining and a loss prevention. In this paper, we propose new smart umbrella that guides the way to the destination on rainy days, collaborating with smartphone based on the IoT environment. It prevents to safety accident which occurs due to operating the smartphone for navigating. Also, it provides a convenience to customer according to self-navigating.

16:50 *Virtualization of Residential IoT Functionality by Using NFV and SDN   86*

Ana Belén García Hernando and Antonio Da Silva (Universidad Politécnica de Madrid, Spain); Luis Bellido (Telematic Systems Engineering Department, Technical University of Madrid (DIT-UPM), Spain); Francisco Javier Ruiz (Universidad Politécnica de Madrid UPM, Spain); David Fernandez (Universdidad Politécnica de Madrid (UPM), Spain)

We propose to leverage the virtualization possibilities of Network Functions Virtualization (NFV) together with the programmability of Software Defined Networking (SDN) in order to offer a portfolio of IoT-related functions to the residential users. The objectives are to reach economies of scale by offering a reasonably inexpensive customer premises equipment supporting most IoT physical communication options, whereas all self-discovery and the rest of vendor-specific functionality is externalized and implemented by the ISP (Internet Service Provider) or third parties.

17:10 *A Threat to Mobile Devices From Spoofing Public USB Charging Stations   88*

Tadashi Shiroma and Yasuhiko Nishio (Connected Consumer Device Security Council, Japan); Hiroyuki Inoue (Hiroshima City University, Japan)

USB charging stations contain potential threats. We build a threat model for spoofing the charging stations. We verified a spoofing attack that allows the attacker to peep passwords and manipulate an iOS device using USB devices and cables. We devise a countermeasure model for safe charging.

Cloud Computing: Machine Learning, Big Data, Security & Emerging Cloud Systems

Industry Speakers: Dr. Bichen Zheng Industr and Dr. Jingran Li
Cross-device User Identification & Predictive Modeling in Health Insurance

Room: N261
Chair: Bingwei Liu (Aetna Inc., USA)

15:50 *SECURE QUERY PROCESSING in CLOUD NoSQL   90*

Mohammad Ahmadian (University of Central Florida, USA)

This paper proposes a holistic security scheme so-called "SecureNoSQL" for leveraging secure querying over encrypted cloud NoSQL databases. The contributions of this paper are; (1) Introducing a novel descriptive language for regulating security parameters; (2) Designing a secure proxy for enforcing security plan on data and query/response.

16:10 *MIST: Mobility-Inspired SofTware-Defined Fog System   94*

Haymanot Gebre-Amlak (University of Missouri-Kansas City, USA); Seoungjin Lee (UMKC, USA); Abdoh Jabbari (University of Missouri-Kansas City, USA); Yu Chen (Binghamton University, USA); Baek-Young Choi (University of Missouri - Kansas City, USA); Chin-Tser Huang (University of South Carolina, USA); Sejun Song (University of Missouri Kansas City, USA)

Softwarization approaches in networks, storages, M2M, services, and smart things aim to optimize costs and processes and bring new infrastructure definitions and functional values. A recent integration of wireless and mobile cyber physical systems with the dramatically growing smart sensors enables a new type of pervasive smart and mobile urban surveillance infrastructures, which opens up new opportunities for boosting the accuracy, efficiency, and productivity of uninterrupted target tracking and situation awareness. In this paper, we present a design and prototype of a mobility-inspired efficient and effective fog system using software-defined control over mobile and wireless environment (MIST).

16:30 *Prediction Based Dynamic Resource Provisioning in Virtualized Environments   100*

Raman Bane (Department of Computer Science and Engineering & National Institute of Technology Karnataka, Surathkal, India); Annappa B (National Institute of Technology Karnataka Surathkal, India)

Paper presents an intelligent decision maker to trigger VM migration in such a way that it avoids performance interference effects due to migrations. It predicts the future workload for early detection of overloads and accordingly triggers the migration. It models the migration procedure to calculate performance and interference parameters which are used in the decision of selecting VM for migration. Experimental results shows that it improves performance by 45%-50% and 25%-30% for network intensive and cpu, memory intensive workloads respectively compared with traditional system. It improves performance by 35%-40% for network-intensive and 15%-20% for CPU, memory-intensive workloads compared with Sandpiper.

Industry Session on Consumer Technology

iGSresearch, Heywood and Sons, RT-RK, Ming Young Biomedical

Room: N262
> Chair: Thomas Coughlin (Coughlin Associates, USA)

Please go here for detailed information about this session!

IEEE Digital Senses Initiative: The Road to the Ultimate VR/AR

Philip Rosedale (High Fidelity), Jodi Schiller (New Reality Arts & ARVR Women), Ryan Pamplin, (VP of Partnerships & Sales, Meta) and Yu Yuan (Senses Global Corporation)

Room: N264
> Chair: Yu Yuan (Senses Global Corporation, P.R. China)

Please go here for detailed information about this session!

T6.1-Consumer Healthcare & Systems: Smart Device

Room: N259
> Chair: Narisa Chu (CWLab International, USA)

15:50 *A Real-Time Emergency Rescue Assistance System for Mountaineers   106*
> Shih Hsiung Lee (University of National Cheng Kung, Taiwan); Chu-Sing Yang (National Cheng Kung University, Taiwan); Jui-Chung Ni and Yong-Gang Zhao (University of National Cheng Kung, Taiwan)
> This paper proposes a mountaineering-assisted wearable device and emergency rescue system architecture which comprises wearable devices, a mobile device application software, and a backstage management platform. This architecture can effectively prevent mountaineering accidents, guide mountaineers, and inform relevant units so that they can offer emergency rescue as soon as possible.

16:10 *The Smart Shoes Providing the Gait Information on IoT   108*
> Soobin Jeon, Youngtak Han and Chungsan Lee (Kangwon National University, Korea); Dongmahn Seo (Catholic University of Daegu, Korea); Inbum Jung (Kangwon National University, Korea)
> This paper proposes the smart shoes system classifying a normal, out-toeing, and in-toeing gait to provide the gait information to customer. It measures and analyzes the gait posture using the distribution of pressure sensors on the insole. It sends the gait information to the smartphone application using a BLE communication. The experiment was performed to test the accuracy of proposed system. Finally, this paper showed that proposed system can measure the accurate gait posture.

16:30 *Real-time Mental Stress Detection Based On Smartwatch   110*
> Lucio Ciabattoni (Universita' Politecnica delle Marche, Italy); Francesco Ferracuti, Sauro Longhi and Lucia Pepa (Università Politecnica delle Marche, Italy); Luca Romeo and Federica Verdini (Universita' Politecnica delle Marche, Italy)
> In this work we propose a real-time monitoring of mental stress during different cognitive tasks. Different level of stress is classified processing Galvanic Skin Response (GSR), RR Interval and Skin Temperature (ST) acquired by a commercial smartwatch. The unobtrusive system proposed is validated through clinical psychological tests.

16:50 *Emergency Warning and Bidirectional Communication via Digital Audio Broadcast   112*
> Hongsheng Zhang, Guoyu Wang, Mingying Lu, Daicheng Wang and Peng Xu (Chongqing University of Posts and Telecommunications, P.R. China)
> Digital broadcast has been proved to be the most efficient way to provide messages after heavy disasters where all the communication networks may be damaged. This paper reports several new techniques for Digital Audio Broadcast (DAB) to enhance its ability in emergency warning. A novel bidirectional multimedia communication method between two DAB transmitters is also reported. Government in disaster area can use the local DAB transmitter to communicate in multimedia with the outside. These techniques may find a new application area for the DAB system.

Sunday, January 8, 18:00 - 21:00

Welcome Reception

Social Event to networking with other attenddes
> Chair: Fernando Pescador (Universidad Politécnica de Madrid, Spain)

Monday, January 9, 08:30 - 09:00

Breakfast

Room: N260-N258

Monday, January 9, 09:00 - 10:00

Keynote. Electrostatic Discharge (ESD) Protection of Low-Voltage Consumer Electronics: Challenges and Solutions. Juin J. Liou (University Central Florida)

Title: Electrostatic Discharge (ESD) Protection of Low-Voltage Consumer Electronics: Challenges and Solutions.
Juin J. Liou (University Central Florida)

Room: N260-N258
Chairs: Thomas Coughlin (Coughlin Associates, USA), Jong-Hyouk Lee (Sangmyung University, Korea)

There has been a wide spread use of integrated circuits in consumer applications. For example, due to the huge market of civil wireless communications, low-voltage integrated circuits are in high demands. To ensure the reliable daily use of these electronics, development and implementation of robust and effective ESD structures which operate within a very narrow ESD design window and with a minimal loading effect (i.e., high transparency) are required. Unfortunately, a set of constraints and challenges must be overcome before such ESD protection solutions can be realized.

A brief overview on the ESD protection guidelines, schemes and testing will first be given in this talk. This is followed by presenting various ESD designs aimed for meeting the stringent ESD requirements imposed by the modern CMOS and emerging FinFET technologies. Challenges and solutions pertinent to this objective will be emphasized and addressed.

Monday, January 9, 10:00 - 10:30

Young Professional Session

Room: N262
Chairs: Thomas Coughlin (Coughlin Associates, USA), Shingo Yamaguchi (Yamaguchi University, Japan)

"Have you ever wondered how interesting - or boring - audiences find your presentations?

Do you think in the 21st century that the "facts will speak for themselves"? Think again, the biggest impact in a presentation for most listeners comes from the delivery of the content. If you are going to be an effective presenter, you need to know how to make an impactful presentation.

Whether you need to convince other scientists, grant agencies, investors, bosses or potential employees, this YPs seminar is your chance to gain frank feedback from the audience. On the other side of the podium, audience participants will learn by counter-example how to communicate and persuade effectively.

Selected speakers will present a 10 minutes version of a conference paper, a technology idea or a business start-up proposal to a group of their peers as well as industry professionals. Their presentation will be judged by the audience who will have an opportunity to express their opinions using flying toy animals!

Coffee Break + Poster Sessions: Track 1, 2, 6, 9 and Cloud Computing

Room: Hall Area
Chair: Lucio Ciabattoni (Universita' Politecnica delle Marche, Italy)

Design Scheme of a Passive Intermodulation Distortion Finder for Common Feeder Cable in In-building   114
Kyu-Min Kang, Jae Cheol Park and Sungjin You (ETRI, Korea); Seung Keun Park (Electronics and Telecommunications Research Institute, Korea)
This paper presents the design scheme of a passive intermodulation distortion (PIMD) finder in order to find out the birthplace of PIMD which is introduced by sharing a feeder cable in in-building wireless multi-band networks. To this end, a frequency-modulated continuous-wave (FMCW) signal generation module and a fast Fourier transform (FFT)-based signal processing module are implemented to figure out the exact PIMD occurrence point. By improving the common feeder cable conditions with the timely PIMD detection, mobile consumer devices are expected to be well operated in in-building without call drop due to the PIMD.

Auto Generation System of MPEG-V Motion Sensory Effects Based on Media Scene   160

Hyun-Woo Oh (Electronics & Telecommunications Research Institute, Korea); Jae-doo Huh (Electronics and Telecommunications Research Institute, Korea)

There is a method for producing 4D media for 4D rider media or a 4D cinema by providing a 3D effect after producing a general 2D image or adding an sensory effect to 3D media generated through a 3D camera. In this paper, we propose a technology for generating sensory effect metadata for providing a media-based sensory experience, more particularly to a technology for generating sensory effect metadata corresponding to tilting, rotation, zoom-in, zoom-out, camera-moving and camera-rotation of objects included in media.

Monday, January 9, 10:30 - 12:10

T1.2-RF, Wireless & Network Technologies: Application Support Technology

Room: N256

Chairs: Johan J. Lukkien (Eindhoven University of Technology, The Netherlands), Jong-Hyouk Lee (Sangmyung University, Korea)

10:30 ***An Insightful Write Buffer Scheme for Improving SSD Performance in Home Cloud Server   164***

Tae Hyung Lee, Minho Lee and Young Ik Eom (Sungkyunkwan University, Korea)

Nowadays, home cloud server uses SSD as its main storage due to the positive characteristics of the SSD such as high performance and low energy consumption. But, the frequent fsync calls generated by software platforms of the home cloud server negatively affect I/O performance and lifespan of the SSD, because it generates massive random-write traffic. This paper introduces a smart SSD model which efficiently reflects write requests to the storage, with process-aware flush operation. Experimental results show that our SSD model reduces response time and the number of writes by up to 12.6% and 17.9%, respectively, compared with conventional SSD.

10:50 ***Range Extension of LED Control Systems Using a Bluetooth Mesh Network   166***

Taeyang Lee and Phuc Huu Truong (Kookmin University, Korea); Cheol-Kyun Lee (DNCI, Korea); Gu-Min Jeong (Kookmin University, Korea)

In this paper, we propose a new method to extend the handling ranges of LED device control systems using a Bluetooth mesh network. We apply the mesh network concept to the LED devices control systems for increasing the Bluetooth communication ranges. The proposed method is to send data between devices through Bluetooth for increasing the controlling range. Hence, we have tested the available communication ranges and transfer rates from device to device. The experimental results proved the validity and applicability of the proposed method.

11:10 ***iHAC: Smart Appliance Controller Using AR Technology   168***

Rina Umeyama and Hidekazu Suzuki (Meijo University, Japan)

Smart home appliances have become popular, and many controller applications are available for smartphones and tablets. However, users must properly use controller applications according to their various communication protocols and distinguish operable appliances only by obtainable character information. This paper proposes a smart appliance controller, one that can control smart appliances without being aware of differences in communication protocols, and its essential framework, namely "iHAC" (intuitive home appliance control). With the proposed controller, users can control smart appliances intuitively by using not only character information but also a video image displayed by an augmented reality technology.

11:30 ***A Novel Intelligent Mechanism for Monitoring in Wireless Sensor Networks   170***

Fekher Khelifi (University of Poitiers, France); Abbas Bradai (XLIM Institute, University of Poitiers, France); Med Kaddachi (University of Monastir, Tunisia); Priyanka Rawat (University of Avignon, France)

One of the main fundamental problems in designing a sensor network is to detect and locate their positions. Hence, sensors can be utilized for data collection in order to detect and organize the objects of interest. In this paper, we present a novel mechanism for object localization and detection in protected areas and surveillance zones. The goal of the proposed approach is to enhance area supervision and localize objects efficiently in wireless sensor networks.

11:50 ***DCF: Dynamic Cluster Flow Architecture for SDN Control Plane   172***

Hadar Sufiev (The Open University of Israel, Israel); Yoram Haddad (Jerusalem College of Technology, Israel)

Software Defined Networking is considered as the new telecom revolution. Within SDN the control plane acts as the brain of the network and should be designed in the most efficient manner. In this paper we propose a novel architecture to deploy the controllers in a SDN based network. We distribute the controllers into clusters which are managed dynamically by a super controller. We develop a load balancing algorithm to avoid overloaded controllers and prove that our solution outperform the existing ones in term of complexity.

IEEE Digital Senses Initiative 2: Standardization Needs and Efforts in VR/AR

Yu Yuan (Senses Global Corporation)

Alpesh Shah (IEEE Standards Association), Philip Rosedale (High Fidelity), John Simmins (EPRI), Lloyd Green, (Director IEEE Standards Association) and Yu Yuan (Senses Global Corporation)

Room: N264

Chair: Yu Yuan (Senses Global Corporation, P.R. China)

Please go here for detailed information about this session!

T2.2-Entertainment, Gaming, Virtual & Augmented Reality: Entertainment & Gaming Technology

Room: N259
Chair: Gordana Velikić (RTRK Computer Based Systems LLC, Serbia)

10:30 *Interactive Sticker System with Intel RealSense   174*
Chung-Yan Chih, Yi-Chen Wan and Yu-Chi Hsu (National Taiwan University, Taiwan)
We present an interactive sticker system, which can detect user's face expression and gesture to stitch the corresponding image to the face or replace the background picture with Intel RealSense depth camera. The proposed system combines both facial expression detection and finger count detection in the same time to realize the respond for expression change and the command that the user gives the camera simultaneously. The proposed system also provides drawing and image saving function, so users can paint directly on the picture by hand and then save the image using a different gesture.

10:50 *Spatial Augmented Reality Meets Robots: Human-Machine Interaction in Cloud-based Projected Gaming Environments   176*
Giovanni Piumatti and Andrea Sanna (Politecnico di Torino, Italy); Marco Gaspardone (Telecom Italia, Italy); Fabrizio Lamberti (Politecnico di Torino, Italy)
Augmented Reality (AR) is expected to change the way we play, by transforming the world around us in an incredibly rich gaming environment. In this work, connected robots and natural interaction means are combined with projected AR to create a gaming experience more physical and engaging.

11:10 *Accelerating Vector Graphics on Low-End Device   180*
Jeong-Joon Yoo (Samsung Advanced Institute of Technology & Samsung Electronics, Korea); Sundeep Krishnadasan (Samsung Electronics, SRI-Bangalore-GPU, India); Youngsam Shin (SAIT Samsung Electronics, Korea); Won-Jong Lee (SAIT, SAMSUNG Electronics, Korea); Soojung Ryu (Samsung Advanced Institute of Technology, Korea)
In this paper, we present an efficient vector graphics rendering algorithm which is suitable to use on low-end device. To enjoy high performance vector graphics on low-end device, our algorithm must satisfy two folds; i) providing parallel rendering scheme, ii) removing redundant computations. To do so, we propose BSP Tree-based vector graphics rendering which provides a good solution in such situation. Experimental result shows that our scheme outperforms prior art about 2-times fps in high resolution.

11:30 *Multimedia Experience Enhancement Through Affective Computing   182*
Lucio Ciabattoni (Universita' Politecnica delle Marche, Italy); Francesco Ferracuti, Sauro Longhi and Lucia Pepa (Università Politecnica delle Marche, Italy); Luca Romeo and Federica Verdini (Universita' Politecnica delle Marche, Italy)
The aim of this work is to offer multimedia access (i.e. video queue and playlist) based on affective aspects of the interaction. In particular, the biosignals gathered from a commercial smartwatch are processed to propose an unobtrusive video classification based on users emotions. The validation performed allows to find a relation between the biosignal and the reported affective experience obtained using the Self- Assessment Manikin (SAM).

11:50 *Film-Type Bendable Vibrotactile Actuator for Mobile Games   184*
Won-Hyeong Park (Korea University of Technology and Education & Intraction Laboratory, Korea); Eun-Jae Shin (Korea University of Technology and Education, Korea); Sang-Youn Kim (Korea University of Technology and Edcuation, Korea)
In this paper, we propose a new wave-shaped eco-friendly PVC gel, and a new flexible and bendable vibrotactile actuator that could easily be applied to wearable electronic devices. An experiment for measuring vibrational amplitude was conducted over a wide frequency range. The experiment clearly showed that the proposed vibrotactile actuator could create a variety of haptic sensations in wearable devices.

Industry Session on Consumer Electronics Technology (2)

IP Action Partners, Coughlin Associates, Future Tech Lab and Consumer Technology Association (CTA)

Room: N262
Chair: Thomas Coughlin (Coughlin Associates, USA)

Please go here for detailed information about this session!

Cloud Computing: Emerging Cloud Systems

Session Cancelled
Room: N261
Chair: Haneul Ko (Korea University, Korea)

Monday, January 9, 12:10 - 13:30

Networking & Awards Lunch

Awards Committee

Room: N260-N258
Chair: Stuart Lipoff (IEEE & ICCE, USA)

Monday, January 9, 13:30 - 15:10

T7.1-Energy Management in CE Infrastructure, Systems & Devices: Applications Related to Energy in CE

Room: N259
Chair: Michael Zeifman (Fraunhofer Center for Sustainable Energy Systems, USA)

13:30 *An Energy-Efficient Task Scheduler for Mobile Web Browsing* 188
Sang Jun Nam, Young Geun Kim and SungWoo Chung (Korea University, Korea)
In this paper, we propose an energy-efficient task scheduler for mobile web browsing, which provides lower CPU resources for non-critical web browser threads. In experiments on an off-the-shelf mobile device, our proposed task scheduler saves average system-wide energy consumption by 8.2%, compared to the conventional task scheduler, without performance degradation.

13:50 *LED Electronics, Harmonic Issues and Augmenting Standards* 190
Piyush Verma, Nitish Patel and Nirmal Nair (University of Auckland, New Zealand)
This paper presents a comprehensive analysis of the harmonics generated by the driver circuitry of reputed international brands of energy efficient LED (Light Emitting Diode) lamps. The paper explains how the proper selection of the combination of LED lamps by the consumers can help reduce the harmonic emissions. This also deliberates the importance of phase angle of each harmonic component in managing the harmonic emissions and how it could be a useful tool for driver circuit manufacturers as well as the Standard developers.

14:10 *Communicating Thermostats as a Tool for Home Energy Performance Assessment* 192
Michael Zeifman (Fraunhofer Center for Sustainable Energy Systems, USA); Kurt Roth (Fraunhofer Center for Sustainable Energy Systems CSE, USA); Bryan Urban (Fraunhofer Center for Sustainable Energy Systems, USA)
Communicating thermostats (CTs) can provide a stream of home data (e.g., room temperature and HVAC status) to participating utility companies. We show how these data can be used to estimate physical home parameters that represent such major categories of home energy performance as wall insulation, air infiltration and HVAC efficiency. The estimation is based on a coarse-grained physics based modeling technology that connects weather data and household thermal comfort preferences with CT data through these parameters. The proposed method is scalable and can be automatically applied to numerous households to identify home improvement opportunities.

14:30 *Algorithm Design for Life Event Sensor on Field Data* N/A
Noriyuki Kushiro and Kazuki Tomonaga (Kyushu Institute of Technology, Japan); Yuki Ogawa (Mitsubishi Electric Corporation, Japan); Toshiyasu Higuma (Mitsubishi Electric Corp, Japan)
Life event sensor is expected as an activity recognition sensor to give actionable information about residents' daily lives. We constructed a long-term data collection system and a simulator for power line to design the sensor in practical level. An algorithm for detecting uses of devices was designed and evaluated on the three-years field data and the experimental data elicited from these tools.

Digital Experience 1

Room: N264
Chairs: Timothy Hyungsoo Jung (Manchester Metropolitan University, United Kingdom), Si Jung Kim (University of Nevada Las Vegas, USA), Woontack Woo (KAIST, Korea)

13:30 *Active Panoramic VR Video Play Using Low Latency Step Detection on Smartphone* 194
Azeem Syed Muhammad, Sang Chul Ahn and Jae-In Hwang (Korea Institute of Science and Technology, Korea)
This paper introduces the use of walk-in-place interface to actively control the speed of 360-degree panoramic VR videos. Low latency step detection algorithm is implemented on smartphone and the effect of using it to control 360-degree VR videos is evaluated with respect to the amount of simulator sickness and presence in the environment felt by the users. Results are compared with passive interface of watching panoramic VR videos. Our WIP interface is shows significantly better results in terms of simulator sickness but no significant difference is observed for presence. The paper concludes with limitations and future work.

13:50 *HoVR-Type: Smartphone as a Typing Interface in VR Using Hovering* 198
Youngwon Kim and Gerard J. Kim (Korea University, Korea)
We propose a text entry method for VR, using the smartphone and its hovering function, called the HoVR-Type. The hovering function effectively acts as the finger tracking sensor thereby allowing the user to type in the virtual space. When added with the additional phase to correct the initial touch input and having the final key entered upon the finger release, the proposed method showed competitive performance to that of the conventional "aim-and-shoot" method and also exhibited much higher usability. HoVR-Type also showed a significantly faster speed of input for the individual character. However, it remains to improve the interface with regards to reducing

the error. Overall, the use of the smartphone leverages on the already established mobile user experience and can be further extended to other VR interaction techniques so that one can use the common smartphone as an all-purpose VR interaction device.

14:10 *Reorienting Viewpoint with Respect to Body Pose for 360 Degree Videos in Confined Space*   202
Seokjun Hong and Gerard J. Kim (Korea University, Korea)
In this paper, we present a functionality of resetting the viewpoint into the 360 degree video relative to the user's body pose. Such a functionality can improve the usability of the 360 degree videos in terms of reducing excessive movement, thereby reducing fatigue and more usable in the public setting. Two variant methods are proposed and compared to the baseline case (no resetting possible) in terms of usability and content understanding. In both methods, the user can select a particular direction and associated view, then turn the body to a nominal direction and apply the reset. In method 1, the video stops (screen going to black momentarily) in between these actions, while in 2, the video continues. The Method 1 was found to be the viable method for viewpoint recalibration for casual viewing in a constrained public setting that can minimize excessive physical movement, yet not much different from the baseline case (freely rotate in 360 degrees) in terms of sickness, disorientation and content understandability.

14:30 *Tourists' Experience of Virtual Reality Applications*   206
Timothy Hyungsoo Jung, M. Claudia tom Dieck, Natasha Moorhouse and Dario tom Dieck (Manchester Metropolitan University, United Kingdom)
Virtual Reality (VR) has enjoyed a significant upswing of interest from researchers and businesses generally but also specifically from the tourism sector. However, qualitative research on tourists' experience of VR applications is scarce. Therefore, the present study aims to explore tourists' experience of VR using the Lake District National Park as a case study. 35 VR experiments and interviews with tourists were conducted and analyzed using thematic analysis. Findings show a positive attitude towards the use of VR in the tourism context as tourists were fully immersed in the experience which appeared to influence their behavioral intention to visit the destination in the future.

T3.3-AV Systems, Image & Video, Cameras & Adquisition: Video Processing

Room: N261
Chair: Thomas Coughlin (Coughlin Associates, USA)

13:30 *An Efficient Spherical Video Sampling Scheme Based on Cube Model*   209
Yize Jin, Liming Wang and Qinwei Jiang (Fudan University, Shanghai, P.R. China); Xiaoyang Zeng (Fudan University, P.R. China); Yibo Fan (State Key Lab of ASIC and System, Fudan University, P.R. China)
Virtual reality (VR) is rapidly arising in various fields. Spherical panoramic video, instead of 3-dimensional (3D) modeling, provides immersive and omnidirectional views in a much more convenient way. However, state-of-art video encoding techniques are not fit for spherical videos. In traditional ways, spherical videos are often projected onto a plane or a cube for the convenience of encoding, but mapping quality and encoding efficiency are not considered. In this paper, a Cube-Snyder (CS) projection is proposed, along with a gradually-varied sampling method, to generate panoramic video, with which visual quality is improved and a more uniform pixel distribution is obtained.

13:50 *A Novel Burn-in Potential Region Detection Method Using Image Processing Technique*   213
Yong-Goo Shin, Dae-Hong Lee and Mun-Cheon Kang (Korea University, Korea); Jeisung Lee (LG Display, Korea); Sung-Jea Ko (Korea University, Korea)
The organic light emitting diode (OLED) display has been widely adopted to various multimedia devices. However, the luminance degradation of the OLEDs, called burn-in, is still one of the major problems. This paper presents a method of detecting the burn-in potential region (BPR) to alleviate the luminance degradation. First, in order to extract the burn-in potential pixels (BPPs), we calculate the remaining lifetime of OLED of each pixel. Then, the BPRs are detected by the level set based image segmentation using the BPPs as the seed points. The experimental results demonstrate that the proposed method detects BPRs with superior effectiveness

14:10 *Deep Learning for Facial Expression Recognition: A Step Closer to a SmartPhone That Knows Your Moods*   215
Shabab Bazrafkan (NUI Galway, Ireland); Tudor Nedelcu (National University of Ireland Galway, Ireland); Peter Corcoran (National University of Ireland, Galway & National University of Ireland Galway, Ireland); Pawel Filipczuk (Fotonation LTD, Ireland)
By growing the capacity and processing power of the handheld devices nowadays, a wide range of capabilities can be implemented in these devices to make them more intelligent and user friendly. Determining the mood of the user can be used in order to provide suitable reactions from the device in different conditions. One of the most studied ways of mood detection is by using facial expressions, which is still one of the challenging fields in pattern recognition and machine learning science. Deep Neural Networks (DNN) have been widely used in order to overcome the difficulties in facial expression classification.

14:30 *An Enhanced Fractional Motion Estimation Algorithm for HD Video*   219
Pavel Arnaudov and Tokunbo Ogunfunmi (Santa Clara University, USA)
Motion estimation (ME) consumes most of the time and power in HEVC and H.264. This paper evaluates Fractional Motion Estimation for HD Videos if applied along with Signature Based Fast Motion Estimation (FME) algorithm. A comparison of Fractional Fast Motion Estimation (FFME) vs Enhanced Fast Motion Estimation (EFME) assuming they have similar computation complexity, hence power consumption. The main purpose is improving the image quality for the same power consumption or equivalently reducing cost and power for the same quality in handheld devices performing ME. The algorithms used are an extension to one of the most efficient algorithms - HMDS.

T4.2-Automotive CE Applications 2

Room: N256
Chair: Soumya Kanti Datta (EURECOM & Co-Founder, Future Tech Lab, France)

13:30 *Determination of Threshold for IR Image by Using PICA with RBF Neural Network   221*

Rappy Saha, Jai-Eun Kim and Ki-Doo Kim (Kookmin University, Korea)

This paper is about determining the threshold for a gray scale IR image. At first, Pixel Intensity Clustering Algorithm (PICA) is used to have the center for the Radial Basis Function (RBF) neural network. PICA clusters the image into a defined number. Every group has a centroid which has been used as RBF neural network center. The output of the every hidden neuron is weighted according to the desired output requirements and the neural network output will be a threshold value for the regarding gray scale image. The simulation result shows the validity of our proposed algorithm.

13:50 *Real-Time Automotive Street-Scene Mapping Through Fusion of Improved Stereo Depth and Fast Feature Detection Algorithms   223*

Hossein Javidnia (National University of Ireland, Galway, Ireland); Peter Corcoran (National University of Ireland, Galway & National University of Ireland Galway, Ireland)

The real-time tracking of street scenes as a vehicle is driving is a key enabling technology for autonomous vehicles. In this work we provide the basis for such a system through combining an improved advanced random walk with restart technique for stereo depth determination with fast, robust feature detection. The enables tracking and mapping of a wide range of scene structures which can be readily resolved into individual objects and scene elements. Thus it is practical to identify moving objects such as vehicles, pedestrians and fixed objects and structures such as buildings, trees and roadside kerb

14:10 *Intelligent Safety Information Gathering System Using a Smart Blackbox   227*

Chanjin Kang and Seo Weon Heo (Hongik University, Korea)

This paper presents an intelligent way to collect the safety information using the widespread blackbox system. Conventionally, when information is needed after an accident or crime happened, investigators seek for possible clues non-systematically. We propose a systematic method of gathering that information using an intelligent blackbox system which analyzes and gathers information of neighboring vehicles while driving. For this purpose, we add a recognition engine to extract and record the license plate number and color of neighboring vehicles. We also add the IOT functionality to receive information request message from the server and upload the matched information to the server.

14:30 *Real Time Structure From Motion for Driver Assistance System   229*

Deepak Poddar and Pramod Swami (Texas Instruments India Pvt Ltd, India); Soyeb N Nagori and Prashanth Viswanath (Texas Instruments, India); Manu Mathew (Texas Instruments (Indi) Ltd, India); Kumar Desappan (Texas Instruments, India); Anshu Jain (Texas Instruments India Pvt. Ltd., India); Shyam Jagannathan (Texas Instruments, India)

Understanding of 3D surrounding is an important problem in Advanced Driver Assistance Systems. Structure from Motion (SfM) is well known computer vision technique for this purpose. Inherent complexities of the SfM pose different algorithmic and implementation challenges to have an efficient enablement on embedded processor for real time processing. This paper focuses on highlighting such challenges and innovative solutions for them. The proposed SfM solution which performs Sparse Optical Flow, Fundamental matrix estimation, Triangulation, 3D points pruning consumes 42% of EVE and 10% of DSP for 25 fps processing at 1MP image resolution on TDA3x which is TI's ADAS Soc.

14:50 *Efficient Object Detection and Classification on Low Power Embedded Systems   231*

Shyam Jagannathan and Kumar Desappan (Texas Instruments, India); Pramod Swami (Texas Instruments India Pvt Ltd, India); Manu Mathew (Texas Instruments (Indi) Ltd, India); Soyeb N Nagori (Texas Instruments, India); Kedar Chitnis and Yogesh Marathe (Texas Instruments India Pvt. Ltd., India); Deepak Poddar (Texas Instruments India Pvt Ltd, India); Suriya Narayanan L (Texas Instruments, India); Anshu Jain (Texas Instruments India Pvt. Ltd., India)

Identifying real world 3D objects such as pedestrians, vehicles and traffic signs using 2D images is a challenging task. Some approaches use hand coded object features such as HOG, Haar, SIFT with a linear classifier such as SVM, AdaBoost to detect objects. Recent developments have shown that a deep CNN classifier can learn the object features on its own and also classify at an accuracy surpassing human vision. In this paper we implement object detection using HOG features and AdaBoost classifier followed by object classification using CNN. The approach is implemented on TI's low power TDA3x SoC.

IEEE Standards Activities: 3D Body Processing (3DBP) Technology Accelerating the Immersive Consumer Experience

Luciano Oviedo (Intel - Strategy and Product Development), David Bruner (Size Stream - Chief Technology Officer), Sandra Gagnon (Target - Director - 3D Virtual/Transformation), Alexis Kantor. (VP, Apparel & Accessories Product Development Target) and Amory Wakefield (TrueFit - Director of Product)

Room: N262
Chair: Rudi Schubert (IEEE Standards Association, USA)

Please go here for detailed information about this session!

Monday, January 9, 15:10 - 15:50

Coffee Break + Poster Sessions: Track 3 & 4

Room: Hall Area
Chair: Lucio Ciabattoni (Universita' Politecnica delle Marche, Italy)

A Hybrid Approach for Efficient Color Gamut Mapping   252

Maryam Azimi, Timothée-Florian Bronner and Ronan Boitard (University of British Columbia, Canada); Mahsa T Pourazad (TELUS Communications Company, Canada); Panos Nasiopoulos (University of British Columbia, Canada)

Ultra High Definition and High Definition Television standard recommendations support different color gamuts with the HD gamut much smaller than that of the UHD one. To adapt UHD content to the restricted gamut of HD televisions, a process known as gamut mapping is required. Gamut mapping can be performed in any color space and using different projection methods. In this paper, we present a hybrid gamut mapping method which selects one combination of color space and projection method for each UHD color outside the HD gamut. Results show improvements in terms of ΔE2000 when comparing original and projected colors.

Efficient Rate-Distortion Optimization for HDR Video Compression   254

Junaid Mir (University of Surrey & CVSSP, United Kingdom); Gosala Kulupana, Dumidu S. Talagala and Hemantha Kodikara Arachchi (University of Surrey, United Kingdom); Anil Fernando (Center for Communications Research. University of Surrey, United Kingdom)

Rate-Distortion optimization is updated to improve HEVC coding performance for HDR content. The proposed method employs Perceptually Uniform encoding as a distortion measure and shows on average performance improvement of 1.06% for HDR-VDP-2.2 Q factor and 4.02% in HDR-VQM with respect to the reference encoder. Further, with proposed change, better bit budget estimation is achieved showing performance improvement in Rate-Control. In comparison to NRMSE values from 0.5991 to 3.7670 achieved by the reference encoder, the proposed method is able to achieve improved NRMSE values from 0.2896 to 2.7754.

Analysis on Decoding Error Rate of Systematic Network Coding   256

Minhae Kwon and Hyunggon Park (Ewha Womans University, Korea)

In this paper, we consider a real-time multimedia broadcasting system with systematic network coding over packet erasure channel. We focus on studying a theoretical decoding error rate which is a function of encoding number, packet loss rate of wireless channel and code rate of system. It is shown that the decoding error rate is inversely proportional to the encoding number if packet loss rate is low, while it is proportional to encoding number if packet loss rate is high. The simulation results confirm theoretical analysis.

Lazy Dragging: Effortless Bounding-box Drawing for Touch-screen Devices   258

Kyuwon Kim (Yonsei University & Samsung Electronics, Korea); Sunok Kim and Kwanghoon Sohn (Yonsei University, Korea)

Dragging rectangular boxes with a finger is among the most intuitive and popular operation to select a whole object. This work proposes a convenient method of bounding-box drawing for touch-screen devices, called Lazy Dragging. To achieve real-time and accurate performance, it first filters out explicit non-borders via graph-based segmentation. It then singles out the best four box sides among the remaining candidates using edge feature-based Random Forest. Experiments on a real-world dataset demonstrate that Lazy Dragging convincingly enhances the quality of bounding-box inputs, enabling easy object selection on small touch-screen devices.

Semi-Automatic Player Detection for Real-Time Broadcasting Systems   260

Min Sung Kang (Deagu Gyeongbuk Institute of Science & Technology, Korea); Jung Won Lee and Sung Jong Kang (Jinmyung I&C Inc, Korea); Young Chul Lim (Deagu Gyeongbuk Institute of Science & Technology, Korea)

In our system, an operator only assists by means of a simple input for a key player position in the sports game and our semi-automatic detection scheme accurately estimates the region of interest related to the key player.

Noise Suppressing Microphone Array for Highly Noisy Environments Using Power Spectrum Density Estimation in Beamspace   263

Shoichiro Saito, Kazunori Kobayashi and Tomoko Kawase (NTT Media Intelligence Laboratories, Japan); Hitoshi Ohmuro (NTT Media Intelligence Laboratories)

We propose a noise-suppressing microphone array using power spectrum density (PSD) estimation. The microphones of the proposed microphone array achieve more than 20-dB higher signal-to-noise ratio than other commercial microphones. This microphone array is useful for voice communication and voice recognition in highly noisy environment such as factories and construction sites.

A Framework for Energy-Efficient Operation of Set-top Boxes   265

Junghak Kim (Electronics and Telecommunications Research Institute, Korea); Hyunho Park and Eui-Suk Jung (ETRI, Korea); Yong-Tae Lee (Electronics and Telecommunications Research Institute, Korea); Hyun-Woo Lee (ETRI(Electronics and Telecommunications Research Institude), Korea)

This paper introduces a framework for the efficient operation of energy-saving set-top boxes. The energy-saving set-top box supports a deep-sleep passive standby state in which almost all functional modules are stopped and turned off except those required for a fast wake-up. However, if the set-top box stays in the deep-sleep passive standby state, applications or EPG cannot be updated. To overcome the shortcomings, this paper proposes a mechanism that remotely wakes up the set-top box using wake-on-LAN capabilities and makes it go into an active standby state for a moment so that applications or EPG can be updated.

Application Environment for Browser-based In-Vehicle Infotainment Units   267

Ivana Nikolic (Faculty of Technical Sciences, University of Novi Sad, Serbia); Milos Ilic (Faculty of Technical Sciencis - University of Novi Sad, Serbia); Nikola Popovic (Faculty of Technical Sciences of Novi Sad, Serbia); Milena Milosevic (RT-RK Computer Based Systems LLC, Serbia)

In industry there are several application platforms which are available for in-vehicle infotainment units (IVI), such as OEM and customer solutions. There is still no unified way for application execution and/or management and for access to vehicle data. This paper presents application environment design for HTML/JavaScript applications in the IVI systems considering application switching and proposes application programming interface based on JavaScript that enables access to vehicle bus data from a standard web browser in an uniform way.

3D Around View Monitoring System for Automobiles   269

Tien-Ying Kuo, Yu-Shuo Wang, Yi-Jun Cheng and Kuan-Hung Wan (National Taipei University of Technology, Taiwan)

We proposed a 3D Around View Monitoring System that is both accurate and efficient. This system consists of images taken from four fisheye cameras which, through an improved calibration process combined with our self-designed triangle-patterned locating method, will be able to automatically determine the homography matrix. A 3D model can then be generated to complete the 3D AVM system.

Not only did we propose a new fisheye calibration method to improve the stitching accuracy of the AVM system but we also simplified the once complex registration process.

Enhancing V2V Network Connectivity for Road Safety by Platoon-based VANETs   271

Chunxiao Li, Dawei He, Anran Zhen, Jun Sun and Xuelong Hu (Yangzhou University, P.R. China)
In vehicular ad-hoc networks(VANETs), road services related messages are propagated by V2V and V2I communications. So the connectivity of VANETs is one key factor to ensure the successfully message dissemination. However, due to the dynamic changing topology of VANETs, the lifetime of the links between vehicles is short. Therefore, it is necessary to enhance the network connectivity for efficient message dissemination. In this paper, we propose a connectivity probability enhancing scheme by platoons, which also has considered the minimum safety distance between adjacent vehicles. The simulation results indicates the connectivity probability is always higher than those without platoons.

Algorithm Optimization Framework for Advanced Driver Assistance Systems   273

Joakim Janjatovic (Faculty of Technical Sciences, University of Novi Sad, Serbia); Radivoje Ostojic (Faculty of Technical Sciences of Novi Sad, Serbia); Gordana Velikić (RTRK Computer Based Systems LLC, Serbia); Tomislav Maruna (RT-RK Computer Based Systems LLC, Serbia)
With the rapid technology development of systems that assist drivers, the lack of uniform support for efficient algorithm development has emerged. We propose a universal Software Development Kit (SDK) concept with common optimization routines that can be applied to typical Advanced Driver Assistance Systems (ADAS) algorithms. The evaluation confirmed that the SDK decreased execution time for ADAS algorithms and works seamlessly across different embedded architectures.

Traffic Light Recognition Using Deep Neural Networks   275

Gwang-Gook Lee (Video Tech Lab, SK Telecom, Korea); Byung Kwan Park (SK Telecom, Korea)
Conventional traffic light detection methods often suffers from false positives in urban environment because of its complex backgrounds. To overcome such limitation, this paper proposes a method that combines a conventional approach, which is fast but weak to false positives, and a DNN, which is not suitable for detecting small objects but a very powerful classifier. Experiments on real data showed promising results.

A Novel Hardware Architecture of CAN Applications   277

Hong-Yuan Li (Southern Taiwan University of Science and Technology & Shanghai Jiao Qiao University, P.R. China); Jing-Jou Tang and Chao-Tang Yu (Southern Taiwan University of Science and Technology, Taiwan); Wei-Wen Hu (Southern Taiwan University, Taiwan); Wan-Jung Chang and Da-Huei Lee (Southern Taiwan University of Science and Technology, Taiwan); Yung-Chi Chung (Myson Century, Inc, Taiwan)
In this paper, a novel hardware architecture of Controller Area Network (CAN) applications is proposed. Taking advantage of a highly integrated chip, which functions as a CAN controller as well as a CAN transceiver, the proposed architecture reduces the number of necessary external components, supports popular serial buses and thus facilitates application development. The architecture is applied in a CAN to Bluetooth bridge, whose design is described in this article. It is demonstrated that the proposed architecture is stable and practical.

Monday, January 9, 15:50 - 17:30

T7.2-Energy Management in CE Infrastructure, Systems & Devices: Energy Management Systems for Smart Buildings

Room: N259
Chair: Michael Zeifman (Fraunhofer Center for Sustainable Energy Systems, USA)

15:50 *User Experience to Enable Long-term Operation for HEMS*   279

Kazuki Arima and Masayuki Kaneko (Kanagawa Institute of Technology, Japan); Takashi Murakami (Panasonic Corporation, Japan); Masao Isshiki (Kanagawa Institute of Technology and Keio University, Japan); Hiroshi Sugimura (Kanagawa Institute of Technology, Japan)
In recent years, there are many studies on Home Energy Management System, HEMS for short. HEMS reduces electric power consumption by a visualization function and a remote control function. However, an action for a trouble of apparatuses and a setting of a system are complicated in using HEMS. If a user has no clue for solving, it is necessary to ask the maker or seller. Thus we focus on the trouble shoot problems for HEMS apparatuses. This study develops user experience to support long-term operation for HEMS.

16:10 *Design and Implementation of Interactive Control System for Smart Houses*   281

Masayuki Kaneko and Kazuki Arima (Kanagawa Institute of Technology, Japan); Takashi Murakami (Panasonic Corporation, Japan); Masao Isshiki (Kanagawa Institute of Technology and Keio University, Japan); Hiroshi Sugimura (Kanagawa Institute of Technology, Japan)
In this paper, we propose the interactive control system to operate home appliances in smart house. The system is assembled by two servers which the Cloud server to communicate Facebook Messenger, and the Local server to control home appliances. We describe the outline of system, the implementation and the evaluation of a prototype system.

16:30 *Low-Cost Monitoring of Photovoltaic Systems At Panel Level in Residential Homes Based on Power Line Communication*   283

Jinsoo Han, Jin-Doo Jeong and Il-Woo Lee (ETRI, Korea); Sang-Ha Kim (Chungnam National University, Korea)
This paper proposes a low-cost power line communication (PLC) module to monitor photovoltaic (PV) systems at panel level. The PLC module measures the voltage and current of four PV panels at a time. The aggregation time of monitoring PV panels is reduced down to one fourth. The installation cost of PV monitoring is expected to become one third by reducing the required number of PLC modules.

16:50 *Analysis of Recovery Effect in Supercapacitors for Wearable Devices   285*

Harneet Arora, R. Simon Sherratt, Balazs Janko and Harwin William (University of Reading, United Kingdom)

Supercapacitors are likely to be adopted as power sources for wearable sensors; in particular where the sensor mechanism relies on energy harvesting. A specific advantage of supercapacitors over traditional batteries is their performance over large numbers of discharge cycles. Likewise, in case of wearable devices it is essential to efficiently manage the available power. Supercapacitors exhibit a small recovery effect, in part due to ion diffusion. Modelling this effect allows an increase in available energy to be realized following the sleep times of typical wearable devices during the discharge cycle.

17:10 *Intelligent Office Energy Management System by Analysis in Hyper-connected-IoT Environments   287*

Keonhee Cho (Chung-Ang University, Korea); SeungHwan Kim (Chung-ang University, Korea); Byeongkwan Kang (Chung-Ang University, Korea); SeongMan Jang (University of Chung-Ang, Korea); Sehyun Park (Chung-Ang University, Korea)

As the importance of efficient energy management continues to increase, energy management systems (EMS) are also being actively researched and propagated. The most familiar and widely used system is the scheduling-based EMS. However, this system disallows maximized efficiency of energy management in environments where various users and devices coexist. In this paper, suggested energy management method through User-Device intimacy that based on the materialization of Hyper-connected-IoT environments (a concept that links Data, IoT, and space). Ultimately, more energy can be saved than from existing scheduling-based EMS.

Consumer Robotics

Room: N256
Chair: Brian Markwalter (CTA Tech, USA)

15:50 *Semio: Developing a Cloud-based Platform for Multimodal Conversational AI in Social Robotics   289*

Ross Mead (Semio, USA)

Semio is developing a cloud-based platform to allow humans to use robots through natural communication---speech and body language. The platform allows developers to create and deploy speech/gesture-based applications to be executed by robots, and allows non-expert users to access and use those robot applications through natural communication.

16:10 *Universal Accessory for Object-Avoidance of Mini-Quadrotor   291*

Eakkachai Pengwang and Sermchai Chaikasetsin (King Mongkut's University of Technology Thonburi, Thailand)

Development and implementation of mini-quadrotors or drones are widely spread through several applications with various customers. However, one of important limitations is an autonomous control for many perspectives, especially for beginners. In this paper, we present the novel design of universal apparatus for autonomous object-avoidance of mini-quadrotors. The goal is to implement this tool to several designs of mini-quadrotors. This device consists of a control box with IR sensors and small propellers at four locations. The testing results showed that the four propellers can be controlled with the various speed depended on the distance to the obstacle.

Future Directions 2: Future Directions in Consumer Electronics

Cloud Computing (Tom Coughlin), IoT Initiative (Soumya Kanti Datta), SAMP Initiative (Lee Stogner), Brain Initiative (Narisa Chu)
Room: N262
Chairs: Thomas Coughlin (Coughlin Associates, USA), Lee Stogner (IEEE, USA)

Please go here for detailed information about this session!

VR First Panel

Ferhan Ozkan (VR First), Chris from Vancouver Film School (Canada) and Leon Zhang from Deepoon (China). Other speakers will be confirmed.

Room: N264
Chair: Ferhan Ozkan (VR First, Spain)

Please go here for detailed information about this session!

T3.4-AV Systems, Image & Video, Cameras & Acquisition: Video Processing 2

Room: N261
Chair: Stefan Mozar (UNSW, Sydney & Dynexsys Pty Ltd, Australia)

15:50 *Iterative Refinement of Transmission Map for Stereo Image Defogging   294*

Heegwang Kim, Jinho Park, Hasil Park and Joonki Paik (Chung-Ang University, Korea)

This paper presents a novel stereo image defogging algorithm using the disparity map. The proposed algorithm iteratively performs three steps; i) disparity map estimation using the optical flow, ii) transmission map generation using the estimated disparity map, and

iii) reconstruction of defogged image using the transmission map. Experimental results show that the proposed method can successfully remove the fog without color distortion or ringing artifacts.

16:10 *Prototype Holographic Drive with Wavefront Compensation for Playback of 8K Video Data*   296

Yutaro Katano (Japan Broadcasting Corporation (NHK)); Tetsuhiko Muroi, Nobuhiro Kinoshita and Norihiko Ishii (Japan Broadcasting Corporation (NHK), Japan)

We developed a prototype holographic drive for archival use. For stable reproduction, wavefront compensation technology was introduced into the drive, and hologram distortion was optically compensated for by controlling the wavefront of the laser beam. A compressed 8K Super Hi-Vision video signal recorded on a holographic disk was successfully played back in real time.

16:30 *Global Motion Compensated Saliency Estimation with a Hand-held Camera for Video Retiming*   298

Won Jong Jo, Jong Min Choe, Jae Young Lee and Rae-Hong Park (Sogang University, Korea)

This paper proposes a global motion compensated saliency estimation method for video retiming application. The method consists of four steps. First, a foreground mask is estimated. Second, motion features are computed using optical flow. Third, Global motion compensated motion features are computed. Finally, the saliency scores are estimated using the global motion compensated motion features.

16:50 *Theoretical Analysis of the Physiologic Mechanism for Visual Comfort in 3D Virtual Reality*   300

Kim Taewan (SK Telecom, Korea)

We investigate a unique temporal visual comfort model for temporal prediction of 3D VR images tracing human perception process of visual comfort based on physiologic mechanism. With regard to the neural pathway of eye movements and brain activity, TVCM is composed of the eyes, brain and the related optic nerves.

17:10 *A Compressed-Domain Corner Detection Method for a DCT-based Compressed Image*   304

Jongseok Lee (Kwangwoon University); Hyunjae Lee, Dong-Kyu Lee and Seoung-Jun Oh (Kwangwoon University, Korea)

Researchers have developed compressed-domain computer vision algorithms. Despite the recent progress, the demands for interesting point extraction in compressed-domain still exist. In this paper, we propose a compressed-domain corner detection for a DCT (Discrete Cosine Transform)-based compressed image. It partially decodes the image to obtain DCT data and then split the data into the high precision data. The edge map is then estimated by gradient patterns and coefficients to detect corners. Experimental results show that the proposed method has about 6 pixels of average distance and about 2% miss rate compared to a pixel-domain method with low computational complexity.

Tuesday, January 10

Tuesday, January 10, 08:30 - 09:00

Breakfast

Room: N260-N258

Tuesday, January 10, 09:00 - 10:00

Keynote. The Emerging Era of Fog Computing and Its Impact on Consumer Electronics. Tao Zhang. IEEE Fellow and Cisco Distinguished Engineer.

The Emerging Era of Fog Computing and Its Impact on Consumer Electronics
Tao Zhang. IEEE Fellow and Cisco Distinguished Engineer.

Room: N260-N258
Chair: Thomas Coughlin (Coughlin Associates, USA)

Moving computing, control, and storage into the Cloud has been a key trend in the past decade. However, Cloud alone is encountering growing limitations in supporting many new systems and applications such as the Internet of Things (IoT), 5G wireless systems, distributed data analytics, embedded AI, and more. Addressing the growing need for distributed computing requires a new paradigm - Fog, which can dynamically distribute computing, storage, communication, and control services closer to the users, to the network edge or anywhere along the Cloud-to-Thing continuum that can best meet user requirements.

Many new challenges arise in enabling Fog computing and services, creating a fertile ground for innovation. What Fog architectures make the most sense? How should Fog interact with Cloud? How to enable scalable, manageable, and reliable distributed Fog systems and services? How to secure such Fog systems and services? The list continues. Addressing these challenges necessitates rethinking of the end-to-end computing, networking, and control architectures.

In this talk, I will discuss what Fog is, how it complements and differs from other related technologies and initiatives, how it can help address some critical challenges we face, and what the global industry-academia consortium - Open Fog Consortium (OpenFog) - is doing to accelerate Fog development and adoption.

Tuesday, January 10, 10:00 - 10:30

Coffee Break + Poster Session: Track 7, 8, & 11
Room: Hall Area

DRAM Frequency Scaling for Energy Efficiency Based on Memory Usage   306
Jaehyeon Jang and Moonju Park (Incheon National University, Korea)
This paper proposes a DRAM frequency selection method based on memory usage. The proposed method was implemented and tested with embedded Linux on a system equipped with a multicore processor and 2GB LPDDR3 RAM. Experimental results show that our method enhances energy efficiency of the device by up to 18%.

State of Charge, State of Health, and State of Function Monitoring for EV BMS   308
Chua-Chin Wang, Zong-You Hou and Pang-Yen Lou (National Sun Yat-Sen University, Taiwan)
The computation and monitoring of three key indices, namely, state of charge, state of health, and state of function for EV (electrical vehicle) BMS (battery management system) are proposed in this work. Because most of SOC definitions are directly related to nominal capacity, the accuracy of residual capacity is doubtful. Therefore, the SOC is re-defined by present maximum capacity to reduce the error of SOC estimation. The measurement of the proposed SOC demonstrates that the maximum error is 0.334 %. Moreover, this paper also proposes SOF based on SOC and SOH to reveal the driving power of the system.

Multi-Level Energy Management and Optimal Control of a Residential DC Microgrid   310
Enrique Rodriguez-Diaz, Amjad Anvari-Moghaddam, Juan Vasquez and Josep M. Guerrero (Aalborg University, Denmark)
Extensive exploitation of renewable energies together with the increased role of low-voltage DC (LVDC) micro-sources in the generation mix of the future electricity networks, have become the driving force behind the DC microgrid applications. In this paper, an optimal dispatch model of a residential DC microgrid (R-DCMG) with different distributed generations (DGs) and loads is proposed and implemented as an optimal hierarchical control strategy. A system-level optimizer is designed to calculate the optimal operating points of the controllable energy sources (CESs) when needed, while lower-level controllers are utilized to enforce the CESs to follow optimal set-points.

Optimal Energy Management Scheme for Multi-dwelling Units with Clustered Energy Storage Systems   312
Eunsung Oh (Hanseo University, Korea); Sung-Yong Son (Gachon University, Korea)
Energy storage system (ESS) has started to be adopted for home energy management. However, in multi-dwelling units that are common in the urban area, it is difficult to have enough space to install and operate ESS at home. In this work, installing clustered ESS in the shared space of multi-dwelling units is considered. For more effective operation the ESS resources are shared and virtually integrated to the individual houses. Simulations show that the proposed clustered ESS management scheme has outperformance than the conventional individual management scheme. In addition, the effect of the demand characteristic is also numerically measured.

Network Assistance Platform for Saving Power Consumption of IoT Devices and Set-Top Boxes   314
Hyunho Park and Eui-Suk Jung (ETRI, Korea); Wonjae Lee (Electronics and Telecommunications Research Institute, Korea); Hyun-Woo Lee (ETRI(Electronics and Telecommunications Research Institude), Korea); Yong-Tae Lee (Electronics and Telecommunications Research Institute, Korea)
In this paper, network assistance platform is proposed for saving power consumption of IoT (Internet of Things) devices that includes set-top boxes. The platform enables a server and smart device (e.g., smartphone) to monitor and control operation modes of the IoT devices. If IoT devices consume a large amount of power, the server or smart device can switch the IoT devices' operation mode to low-power mode (e.g., Passive Standby), and thus the IoT devices' power consumption can be reduced. In this paper, architecture and implementation of the network assistance platform are explained.

Indoor and Remote Controls and Management of Home Appliances by a Smartphone with a Four-quadrant User Interface   317
Y. W. Bai, Han-Wen Su and Wen-Cheng Hsu (Fu Jen Catholic University, Taiwan)
This paper proposes a design both for indoor and remote controls and for management of home appliances by a smartphone by utilizing a four-quadrant user interface. This design features the use of a low power Bluetooth to connect indoor home appliances. A mobile Internet is used to connect home appliances to a smartphone at the remote-side mode. For home appliance management, this design not only measures but also monitors the power consumption of the home appliances. For the user interface, this design uses a four-quadrant user interface of a smartphone to provide a more user-friendly operation.

Prioritized Energy Optimal Management for Home-to-Home in Smart Grid   319
Yoon-Sik Yoo (ETRI, Korea); Jae-Seang Lee (KAIST, Korea); Il-Woo Lee (ETRI, Korea); Jun Kyun Choi (KAIST, Korea)
This paper designs a prioritized energy optimal management. As a way of assigning the prioritized optimal energy, if there is a surplus of energy from the energy provider, the intermediator in smart grid allocates the optimal energy to the requesting user in order to maximize the user satisfaction.

A New Variable Switching Frequency Control for Active Cell Balancing Systems   321
Sangwon Lee and Yoongeol Choi (Pohang University of Science and Technology, Korea); Sungwoo Bae (Yeungnam University, Korea); JaeJung Yun (Daegu University, Korea)
This paper presents a new active cell balancing control method for the Battery Management System (BMS). The proposed method modulates the switching frequency for the controlling an active balancing circuit. Consequently, the active cell balancing speed is improved. The Labview simulation was implemented.

Implementation and Demonstration of Cost-Effective Wireless Monitoring Module for PV System   323
Jin-Doo Jeong, Jinsoo Han, Chang-Sic Choi, Wan-Ki Park and Il-Woo Lee (ETRI, Korea); Jong-Wha Chong (Hanyang University, Korea)
Photovoltaic (PV) is an attractive renewable energy source and the global cumulative PV capacity is growing steadily. Implementation of a cost-effective wireless PV monitoring system is required in order to apply it commercially to the massive number of PV panels. This

paper proposes an implementation method for cost-effective wireless PV monitoring module, and describes demonstration results on the practical PV system.

Realisation of a Smart Plug Device Based on Wi-Fi Technology for Use in Home Automation Systems   325

Sava Jakovljev (University of Novi Sad & Research and Development Institute RT-RK, Serbia); Milos Subotic (Faculty of Technical Sciences, University of Novi Sad, Serbia); Istvan Papp (University of Novi Sad, Serbia)

Existing devices used in home automation are mostly based on ZigBee or Z-Wave technologies. While these solutions are proven, they require additional hardware to be used as gateways. These technologies are based on mesh topology and often require additional routers to provide better connectivity. This increases cost of the system, and can increase communication latency time. Device described in this paper tries to solve these problems using Wi-Fi technology, based on star topology, with no additional hardware needed. Purpose of this paper is to compare the performance of an existing ZigBee solution with a device based on Wi-Fi technology.

A Service-Oriented Monitoring System Based on Rule Evaluation for Home Automation   327

Ramon Alcarria and Diego Martín de Andres (Universidad Politecnica de Madrid, Spain); Borja Bordel Sanchez (UPM, Spain); Diego Sánchez De Rivera (Universidad Politecnica de Madrid, Spain); Álvaro Sánchez-Picot (UPM, Spain); Tomas Robles Valladares (Technical University of Madrid, Spain)

This paper proposes a monitoring system based on the provision of monitoring services for the real-time checking of the correct behavior of sensors and actuators. Monitoring services consist of a set of user-defined rules, which can be registered in a cloud domain and directly executed on a controller device. An implementation of this system and an evaluation of the system's response time in detecting unexpected behavior of monitored devices is presented.

An Extended Identification System of Cosmetics Based on GS1-128   329

Miyeon Lee and Younghwan Kim (KAIST, Korea)

Cosmetics have been being used for centuries. However, the digitalized identification of cosmetics relies solely on the normal barcode and other information such as expiration date and period after opening is not integrated. Expired cosmetics can be dangerous but customers cannot easily recognize expiry information. This research suggests an extended identification system of cosmetics based on GS1-128 and provides an implementation of a smart dressing table.

A Novel Low Power WLAN Operation Scheme for Multiple Wake-Up Receivers   332

Hanseul Hong and Young Kim (Yonsei University, Korea); Ronny Yongho Kim (Korea National University of Transportation, Korea); Sunghyun Hwang (Electronics and Telecommunications Research Institute(ETRI), Korea); Seung Keun Park (Electronics and Telecommunications Research Institute, Korea)

In this paper, a novel low power Wireless Local Area Network (WLAN) operation scheme for multiple low power receivers is proposed. Recently, substantial amount of Internet of Things (IoT) devices are used for various applications, and their delay and energy consumption requirements vary depending on their applications. Therefore, the tradeoff between power saving and delay should be carefully considered when power saving scheme is designed for different traffic patterns. In this paper, an efficient low power operation scheme of many low power devices with options to meet the requirements of power consumption and delay

In-band Cellular IoT for Smart Home Applications   334

Hyunchul Joe, Hongsun An, Woowan Wang and Wonseok Lee (Korea Advanced Institute of Science and Technology, Korea); Hyuncheol Park (KAIST, Korea)

Smart home and its applications are one of the main interests of IoT (internet of things). Recently, 3GPP has introduced cellular IoT systems including LTE-M and NB-IoT (narrowband IoT). In this letter, we propose a unified frame structure for providing the applications of cellular IoTs to smart home scenario and implement using the USRP-RIO. The experimental results verify the performances of cellular IoTs in smart home environments.

Retrieving the Useful Information From the Binary Files Compiled by C Compiler   336

Srđan Popić (University of Novi Sad & RT-RK Institute, Bosnia and Herzegovina); Ivan Velikic (RT-RK, Serbia); Nikola Teslic (University of Novi Sad, Serbia)

In order to reuse or verify compliance of a software component, the information about compiler that compiled the component is very significant. When it comes to the matter of software components developed in C language, the only place to look for this information is in compiled binary file. This paper investigates what is the possibility of retrieving the information about compiler name and version based on the content of the binary code, without decompiling the binary code. It uses natural language process of classification in order to find compiler information.

Home Lighting Controller Based on BLE   338

Gonzalo Ruiz-Garcia and Jose-Maria Flores-Arias (University of Cordoba, Spain); Francisco J. Bellido Outeiriño, Antonio Moreno-Munoz, Emilio J. Palacios-Garcia and Miguel Angel Quero-Corrales (University of Córdoba, Spain)

This work deals with an application of wireless communication technologies (BLE) to the creation of a Home Lighting Management System (HLMS). Our aim is to create a system based on BLE in order to implement an universal smart lighting controller which allows performing a remote lighting control and monitoring system for home environments. As lighting control protocol DALI appears to be the best option due to its simplicity and half-duplex communication, this last one is an essential quality in what is called IoT or in general when referring to Smart environments. BLE and DALI integration allow to easily control lights making DALI a feasible option for inhome facilities. Each node is attached to a ballast with a DALI control interface plus a controller implemented with Arduino supporting BLE. An Android App has been developed to control and interface the management system. Finally, results and conclusions from several tests are provided showing how the wireless nodes controlled DALI system allows smart lighting control at home plus energy savings benefits.

Tuesday, January 10, 10:30 - 12:10

T1.3-RF, Wireless & Network Technologies: Communication Performance

Room: N256
Chair: Francisco J. Bellido Outeiriño (University of Córdoba, Spain)

10:30 *PAM 4 Correlated Random Jitter Modelling for High Speed Links   340*

Ali Ayub and Aldo Morales (Penn State Harrisburg, USA); Sedig S Agili (Penn State University, USA)

In this paper an extension to the previous work done in the Jitter modeling for high speed communication links, is presented. For the technique called "Bin Multiplication" the work was done only for NRZ systems, we derived a new general equation to find the total number of combinations for any-level system: PAM4, PAM8, etc. Moreover, the bin multiplication algorithm is developed for correlated random jitter, modeled using correlated Gaussian probability density functions (pdfs). With this approach, a more generalized and accurate jitter modeling, for PAM 4 is provided

10:50 *Implementation of Seamless Connection System for Bluetooth Low Energy Devices in Remote Locations   342*

Mami Okada and Hidekazu Suzuki (Meijo University, Japan)

Many consumer electronic devices in the home can be connected to and controlled by smartphones. However, the Bluetooth range is limited, and a user typically cannot communicate with home Bluetooth devices from outside the home. A technology is therefore proposed that identifies Bluetooth devices in the home and connects with them without a communication range limitation. The proposed method is extended to support Bluetooth Low Energy (BLE). Based on an experimental evaluation of the prototype system, we confirmed that the proposed technology enables users to identify remotely located BLE devices through the Internet within an allowable communication delay range.

11:10 *An Effective Distributed Synchronization Method for Device-to-Device Communications   344*

Hyungsik Han and Jinwoo Kim (Korea Advanced Institute of Science and Technology, Korea); Hyuncheol Park (KAIST, Korea); Hyuck Kwon (Wichita State University, USA)

This paper configures an effective distributed synchronization architecture in a decentralized wireless network which are considered for device-to-device communication standards. The paper proposes a random transmit selection scheme with an adaptive selection factor, which works by allowing a node to choose randomly either transmitting or receiving the clock pulses. With the adaptive selection factor-based method, the proposed scheme achieves performance improvements in both convergence time and synchronization error senses. In all of the contexts, the proposed scheme suggests the simple but strongly effective architecture, and shows enhanced behaviors.

11:30 *A Bluetooth Low Energy Mesh Network Auto-Configuring Proactive Source Routing Protocol   346*

Julio León, Abel Dueñas, Yuzo Iano and Cibele Makluf (UNICAMP, Brazil); Guillermo Kemper (University of San Martín de Porres & INICTEL-UNI, Peru)

Mobile Ad-Hoc Networks are vital for the Internet of Things. However, Bluetooth is based in Master/Slave connections. Literature shows work on mesh networks with Bluetooth Low Energy (BLE), but none address auto-configuration and topology maintenance. We propose a new BLE auto-configuring map discovery routing scheme that any message protocol can utilize.

11:50 *Low-Complexity Twiddle Factor Generator for FFT Processors   348*

Chu Yu and Kuang-Hsiao Lee (National Ilan University, Taiwan); Chien-Feng Kuo (National Ilan University, Taiwan)

This paper presents a low-complexity twiddle factor (TF) generator suitable for radix-8/4/2 fast Fourier transformation (FFT). The proposed TF generator employs a full complex multiplier only and simple logic units to produce all the twiddle factors required for use in FFT computation. This generator approximately costs constant chip area for arbitrary points of FFT processors, almost independent of the FFT processing size.

T2.3-Entertainment, Gaming, Virtual & Augmented Reality: Graphics & Multimedia Technology

Room: N259
Chair: Brian Markwalter (CTA Tech, USA)

10:30 *Frequency-Domain Based Reed Solomon Decoders for GPU   350*

Arul Subbiah (Santa Clara University & Broadcom Ltd, USA); Tokunbo Ogunfunmi (Santa Clara University, USA)

Recent development and popularity of the Graphical Processing Unit (GPU) has attracted researchers to utilize it for error correction codes like Reed Solomon (RS). In this paper, we have proposed an efficient implementation of the RS decoder based on Frequency-Domain analysis. This decoder employs the Finite-field Fast Fourier Transform (FFFT) in finite field to convert the received code in Frequency-Domain; the error locator polynomial is derived using the inversion less Berleykamp-Massey algorithm (iBMA), and the error vector is generated in the frequency-domain using the coefficients of the key equation and the message is retrieved using the IFFFT method.

10:50 *Fast Stereoscopic Rendering on Mobile Ray Tracing GPU for Virtual Reality Applications   353*

Won-Jong Lee (SAIT, SAMSUNG Electronics, Korea); Seok Joong Hwang (SKT, Korea); Youngsam Shin (SAIT Samsung Electronics, Korea); Jeong-Joon Yoo (Samsung Advanced Institute of Technology & Samsung Electronics, Korea); Soojung Ryu (Samsung Advanced Institute of Technology, Korea)

In this paper, we present a stereoscopic rendering based on a mobile ray tracing GPU. Adopting an existing algorithm to new mobile GPUs specialized for ray tracing enables two high performance techniques such as reprojection and tile-based rendering. Experimental results show that our implementation can be a versatile solution for future virtual reality applications, as it achieves up to 1.64 times better performance and 20% better energy efficiency compare with state-of-the-art solutions. To the best of our knowledge, our solution is the first to demonstrate mobile virtual reality based on real-time ray tracing.

11:10 *Towards an Efficient Data Transfer on Mobile Device: a Case Study on Ray-Tracing   356*

Youngsam Shin (SAIT Samsung Electronics, Korea); Won-Jong Lee (SAIT, SAMSUNG Electronics, Korea); Jeong-Joon Yoo (Samsung Advanced Institute of Technology & Samsung Electronics, Korea); Soojung Ryu (Samsung Advanced Institute of Technology, Korea)

In this paper, we propose an efficient ray scheduling algorithm and non-block cache architecture to hiding main-memory access latency targeting real-time ray tracing on mobile device.

11:30 *Evaluation of 360VR Cinematic Stereoscopic DASH Service   358*

Julián Cabrera, Marta Orduna, Lara Muñoz and Narciso García (Universidad Politécnica de Madrid, Spain)

In this paper a DASH streaming service of 360VR stereoscopic service analyzed in terms of the effect that bitrate has on Quality of Experience of the user, and the benefit of the use of advance delivery schemes in terms of bandwidth savings. Preliminary results show that effects such as user stability and dizziness are related low bitrate representations, while advance delivery schemes can produce significant bitrate savings while preserving the level of QoE.

11:50 *Multiclass Image Clustering for Grouping App Icons Based on App Usage and TV Programs Gouping Based on Assigned Genre Icons   N/A*

Ali Ayub and Aldo Morales (Penn State Harrisburg, USA)

Image classification has been an important problem for past several years because of its applications in many fields. Many techniques have been proposed for classification of multiclass objects using wavelets. In this paper we propose an image clustering method using different wavelets and k-means clustering algorithm. This method can be used to group similar icons based on the corresponding apps' usage. This will help smartphone users visualize the app usage patterns. This technique can also be used in different streaming film and tv series provider companies like Netflix, to group together similar genre of programs based on their assigned icons.

T3.5-AV Systems, Image & Video, Cameras & Adquisition: HEVC

Room: N261

Chair: Thomas Coughlin (Coughlin Associates, USA)

10:30 *An Improved Adaptive Quantization Method Based on Perceptual CU Early Splitting for HEVC   360*

Guoqing Xiang and Huizhu Jia (Peking University, P.R. China); Mingyuan Yang (Beijing BOYA-HUALU Technology Inc, P.R. China); Jie Liu, Chuang Zhu and Yuan Li (Peking University, P.R. China); Xiaodong Xie (Peking University)

The adaptive quantization (AQ) in HEVC tool suffers from underestimated spatial activity and Lagrange multiplier selection problems. So, we first solve problems existed and then propose a novel perceptual AQ method to improve performance. Experiments demonstrate that we have achieved -9.3% BD-Rate performance on HM10.0 encoder with better subjective quality.

10:50 *A Feature Based Complexity Model for Decoder Complexity Optimized HEVC Video Encoding   364*

Thanuja Mallikarachchi (University of Surrey & University of Surrey, United Kingdom); Dumidu S. Talagala, Hemantha Kodikara Arachchi and Anil Fernando (University of Surrey, United Kingdom)

The complexity of the novel video compression algorithms is a major contributor for the increased demand of processing and energy resources for video playback in consumer electronic devices. Therefore, a decoder complexity reduction mechanism is proposed which constitutes a model that predicts the decoder's complexity requirements to decode the HEVC encoded bit streams with a 4.2% average prediction error and a decoder complexity optimized encoding algorithm, which reduces the decoding complexity by an average of 28.06% and 41.19% with a -1.91 dB and -2.46 dB impact to the BD-PSNR for the low delay P and random access configurations, respectively.

11:10 *Real Time HEVC Decoding with OpenHEVC and OpenMP   368*

Fernando Pescador, Miguel Chavarrias, Matias J Garrido, Javier Malagón and Cesar Sanz (Universidad Politécnica de Madrid, Spain)

In this work, the open source OpenHEVC decoder has been modified in order to support parallel decoding at the slice level using OpenMP instead of pthreads. The advantage of this unthreaded decoder is that it can be used with any architecture, providing it supports OpenMP. Tests have been carried out with three different multicore chips and the performance results are similar to those obtained with the pthreaded OpenHEVC decoder.

11:30 *A Novel Scheme for Extracting a JPEG Image From an HEVC Compressed Video   370*

Hyunjae Lee (Kwangwoon University, Korea); Jongseok Lee (Kwangwon University, Korea); Dong-Kyu Lee and Seoung-Jun Oh (Kwangwoon University, Korea)

We propose a JPEG image extraction method from an HEVC bitstream compressed video. We employ the extracted data from the bitstream and process them to be available for JPEG compression. In order to unify the DCT block size, we use the direct splitting and merging in DCT domain. We obtain the coefficients of the prediction frame by performing motion compensation in DCT domain. The coefficients of the current frame are reconstructed by adding the residual coefficients to the prediction coefficients. The reconstructed coefficients are used for JPEG compression.

11:50 *Error Resilience Aware Rate Control and Mode Selection for HEVC Video Transmission   372*

Htoo Maung Maung (Chulalongkorn University, Thailand & Ministry of Education, Myanmar); Supavadee Aramvith (Chulalongkorn University, Thailand); Yoshikazu Miyanaga (Hokkaido University, Japan)

To provide acceptable output quality, efficient error resilience framework for HEVC is very important especially in transmission applications. This paper demonstrates a region-of-interest based coding mode selection and rate control algorithm for improving the performance of our previously proposed RPS method. Experimental results show our method can achieve an average PSNR improvement of 0.9 dB and 1.8 dB for WVGA and 720p sequences, respectively.

IEEE Standards Activities: Mixed Reality - Engineering the Empathy Experience

Monique Morrow - Cisco Systems - CTO - Evangelist New Frontiers Development & Engineering. Jay Iorio - IEEE SA Director of Innovation. Brenda Wiederhold - Executive Director - Virtual Reality Medical Center

Room: N262

Chair: Rudi Schubert (IEEE Standards Association, USA)

Please go here for detailed information about this session!

Digital Experience 2

10:30 *A Fast Browsing Model for Web Contents on Wearable Devices   374*
Jinwoo Song (Samsung Electronics, Korea); Ming Jin (Samsung Electronics Co., Ltd., Korea); Honguk Woo (Samsung Electronics, Korea)
In this paper, we revisit the web browser model and propose the notion of fast-access browsing that incorporates lightweight, always-on web snippets, namely widget view, into web applications. This allows users to rapidly access web contents (i.e., within 200ms) similarly as they interact with notification on smartwatches. We analyze 90 smartwatch applications, identify the quick preview pattern, and then define the constrained web specifications. Our implementation, the wearable device toolkit for fast-access browsing, is now being tested and deployed on commercialized smartwatches and the tool for building widget view-enabled web applications will be soon available as the smartwatch SDK extensions.

10:50 *A Confetti Drone: Exploring Drone Entertainment   376*
Si Jung Kim and Gabriel Quiroz (University of Nevada Las Vegas, USA)
Drones are taking flight, through services in packaging and delivering, reconnaissance, film, and public services. It is only a matter of time before drones are integrated to enhance the entertainment experience at a certain venue on social gathering. This paper explores the concept and develops an abstract design of a confetti drone for dronetainment that dispenses particles of debris. Its specifications were identified through a group 6-3-5 method that led to a model being implemented by taking 3 steps of a system design approach. A confetti canister was introduced to test the feasibility of a drone dispensing paper particles.

11:10 *The Mail Art Box: An Analog to Digital Postal Service   380*
Yunhwan Jeong, Su Jin Park and Si Jung Kim (University of Nevada Las Vegas, USA); Moon-Ryul Jung (Sogang University, Korea)
This paper introduces an interactive media art work called the Mail Art Box that converts a handwritten message to a digital message to be transmitted to another person digitally. This paper explored the technology of taking a postcard picture in the embedded system and sending it via a wireless communication network. The work includes computer vision technology of recognizing the information of the postcard and extracting handwriting. The Mail Art Box was installed in a gallery SAI.

11:30 *Narrative Design for Rediscovering Daereungwon: A Location-based Augmented Reality Game   382*
Jae-eun Shin (Korea Advanced Institute of Science and Technology, Korea); Junghwa Kim and Woontack Woo (KAIST, Korea)
Rediscovering Daereungwon is a location-based Augmented Reality(AR) mobile game application that aims to enrich the experience of navigating Daereungwon, a Korean cultural heritage site consisting of various royal tombs from the Silla dynasty. In this paper, a framework binding 3 main PoIs with distinctive features into a successive, cohesive, and immersive narrative is introduced. It appropriates and combines the Memorable Experience Design(MED) Framework and the Interest Curve proposed by Bulencea and Egger (2015) to guide tourists through Daereungwon, while game challenges and rewards in the form of augmented objects and interactions provide them with information on the PoIs and the site of Daereungwon as a whole.

11:50 *Metadata Design for AR Spacetelling Experience Using Movie Clips   386*
Hyerim Park (KAIST UVR Lab, Korea); Woontack Woo (KAIST, Korea)
There have been a number of researches to provide new media experience through augmented reality technology. However, most of them focus on creating new virtual content rather than remediating existing content such as films and TV programs. In this paper, we design a metadata schema and use cases to provide location-based film experience based on the Spacetelling framework. For evaluating proposed metadata, we implement the application based on the relational database and provide it to visitors in the historical site. By analyzing users' requirements, we could find that the proposed metadata properties provide new and valuable media experience in terms of affective, cognitive, and operative aspects. People felt more familiar with and interested in the place by watching movie clips in the related place. As a result, we suggest the design guideline derived from the experiment.

Tuesday, January 10, 12:10 - 13:30

Luncheon Keynote. Integrating Brain-Computer Interface Technology With Augmented and Virtual Reality. Paul Sajda, Columbia University

Integrating Brain-Computer Interface Technology With Augmented and Virtual Reality
Paul Sajda, Ph.D. Professor, Departments of Biomedical Engineering, Electrical Engineering and Radiology Columbia University

Augmented and Virtual Reality (AR/VR) are platforms that offer the potential to revolutionize how we interact with media, enabling new forms of experiences in real and/or virtual environments. Brain computer interfaces (BCIs) are new technologies under development to enable direct communication between brain and machine. The integration of BCI with AR/VR offers new opportunities and products for the consumer . It also offers new ways for neuroscientists to understand how the human brain processes information in naturalistic and interactive experiences. In this talk I will describe our work integrating BCI and AR/VR to opportunistically sense neural and physiological signals for labeling information in a VR environment, using this labeling to optimize navigation through a virtual world. I will also discuss how arousal and workload can be tracked using a BCI in a VR-based flight simulation task, showing how neurofeedback can be used to optimize user performance in terms of flight time for this game-like application.

Tuesday, January 10, 13:30 - 15:10

T8.2-Internet of Things and Internet of Everywhere: IoT &I OE Applications

Room: N256
Chair: Haneul Ko (Korea University, Korea)

13:30 *Smart Crossing System Using IoT   390*
KwangEun An, Young Ju Jeong, SungWon Lee and Dongmahn Seo (Catholic University of Daegu, Korea)
A new system called Smart Crossing which is another type of crosswalk using sensors, CCTV, illuminator and an IoT device to keep pedestrian in safe while crossing

13:50 *Open Software Platform for Companion IoT Devices   392*
Hyemin Lee, Dongig Shin, Eunsoo Park, Injung Hwang, Gyeonghwan Hong and Dongkun Shin (Sungkyunkwan University, Korea)
In recent years, a variety of IoT devices have been introduced in market. However, most of the IoT devices are designed to perform dedicated functions and cannot be programmed by consumers. In this paper, we propose an open IoT platform which enables users to implement various services swiftly and easily via JavaScript API set. In particular, the platform is designed for the companion IoT devices, which can be accessed and controlled by mobile devices such as Android smartphone. The proposed software platform for companion IoT devices equips with the various state-of-the-art techniques in application management system, sensor, camera, and network.

14:10 *Design and Implementation of Hyper-connected IoT-VR Platform for Customizable and Intuitive Remote Services   394*
Myeong-in Choi (Chung-Ang University, Korea); Lee Won Park (ChungAng University, Korea); Sanghoon Lee, Jun Yeon Hwang and Sehyun Park (Chung-Ang University, Korea)
This paper proposes a Hyper-connected IoT-VR (HI) Platform that designed interconnection of human, device and space. We utilized the high interoperability of IoT platform based services and the intuitive services from VR contents. HI Platform can provide customizable and intuitive remote services. Furthermore, this paper shows a Hyper-connected IoT-VR Office (HIO) Zone in order to implement the HI Platform.

14:30 *Design and Implementation of Intelligent HVAC System Based on IoT and Bigdata Platform   396*
Tacklim Lee and Seonki Jeon (Chung-Ang University, Korea); DongJun Kang (Chung-ang University, Korea); Lee Won Park (ChungAng University, Korea); Sehyun Park (Chung-Ang University, Korea)
Through the development of high-tech industry and networks, IoT technology collect and analyze data about consumer and environmental information to provide various services. One of devices that utilize IoT technologies is IoT based HVAC systems such as the thermostat. However, such systems provide user customized environment control services, and have operational problems. In order to solve these problems, this paper suggests IoT and Bigdata based intelligent HVAC system.

T6.2 Consumer Healthcare & Systems: Intelligent System

Room: N259
Chair: Lee Jae-Kwang (University of Hannam, Korea)

13:30 *Soft hip walking assist experimental system featuring variable compliance control   398*
Stephen W. John (Panasonic, Japan); Mayumi Komatsu (Panasonic Corp., Japan); Kenta Murakami, Jun Ozawa and Masaki Yamamoto (Panasonic, Japan)
In this paper, we present a tethered soft assist experimental system for the hip, incorporating virtual compliant actuator model into the control system. We adjust the parameters of the virtual compliant actuator to generate assistance torques around the hip during walking. Experimental tests for level walking at 1.25 m/s shows that variable stiffness assist is capable of reducing the energy cost of walking on level ground by an average of 5.5\% across 4 test subjects. This result confirms that our approach is capable of generating effective assistance.

13:50 *Controlling a Wheelchair by Gesture Movements and Wearable Technology   400*
Jeet Desai (Texas A&M University - Kingsville, USA); Lifford McLauchlan (Texas A&M University-Kingsville, USA)
This is a proposal of a wheelchair which can be controlled by Individuals who are unable to move his legs and/or hands, but can use organs like the Eyes. The gestures of these organs are detected and its data is sent to the Embedded System, which directs the wheels accordingly.

14:10 *Automated Malaria Cell Counter using Hough Transform based Method   402*
Mohammed Harris Mohammed Saleh (Korea University & ISPL, Korea); Bonwha Ku (Korea University, Korea); Chae Seung Lim (Korea University Guro Hospital, Korea); Hanseok Ko (Korea University, Korea)
Malaria is still a threat and serious disease especially in the low income countries. Instead of the slow manual counting, an automated method of counting malaria cell should provide rapid diagnostic information to physician with online convenience. This paper proposes a circular Hough transform to detect and count the malaria cells among normal blood cells via using adaptive histogram equalization. The proposed method attains accurate and satisfying results in counting even the overlapped cells. Experimental evaluations show 96.04% average accuracy achieved for detecting malaria cells and 94.5% average accuracy for counting its ratio from the whole cells.

14:30 *Dictionary Memory based Software Architecture for Distributed Bluetooth Low Energy Host Controllers Enabling High Coverage in Consumer Residential Healthcare Environments   404*

R. Simon Sherratt and Balazs Janko (University of Reading, United Kingdom); Terence Hui (The University of Reading, United Kingdom); Harwin William (University of Reading, United Kingdom); Daniel Díaz-Sánchez (Universidad Carlos III de Madrid, Spain)

This work presents a novel gateway software architecture based on threads being managed by dictionary memory. The architecture has been deployed in a distributed interconnected set of low-cost consumer grade gateway devices using Bluetooth Low Energy (BLE) that are positioned around the home. The gateway devices can then be used to listen, monitor or connect to BLE based healthcare sensors to continually reveal information about the user with full residential coverage. A further novelty of this work is the ability to maintain handover connections between many sensors and many gateways as a user moves throughout their home.

T3.6-AV Systems, Image & Video, Cameras & Acquisition: Digital Television

Room: N261
Chair: Kousik Ramasubramaniam Sankar (CISCO Video Technologies, India)

13:30 *EPG Data Control Optimization for DTV Set-Top Box   406*

Nenad Soskic (Faculty of Technical Sciences, University of Novi Sad, Serbia); Boris Mlikota (RT-RK Computer Based Systems LLC, Serbia); Laslo Benarik (RT-RK Computer Based Systems, Serbia); Ilija Basicevic (University of Novi Sad, Serbia)

This paper presents optimized EPG data control on DTV Set-Top Box. Optimization is reflected in lesser memory consumption by the data and lesser time consumption in data control. This leads to faster access to the desired information and its presentation to the end user.

13:50 *Interoperability Study for Interactive Digital TV   408*

Gustavo Moreira Calixto (University of Sao Paulo, Brazil); Marcelo K Zuffo (University of São Paulo, Brazil)

This paper aims to present a study regarding interoperability for interactive digital television systems. Experimental setups are carried out in order to propose a first step to coexist different digital TV systems and second screens software components. This study motivates improvements aiming to proceed field tests involving households.

14:10 *ISDB-T and HbbTV Hybrid Receiver   410*

Rafael Sotelo (Universidad de Montevideo, Uruguay); Jose Joskowicz (Universidad de la República & Facultad de Ingenieria, Uruguay)

Each Integrated Broadcast and Broadband (IBB) Television standard is associated with one Digital Television (DTV) standard, leading to separate and different systems. This paper presents a prototype of a Hybrid Receiver that can merge an interactive application developed according to the IBB HbbTV standard (originally defined to be used with the DTV DVB standard), working with the DTV ISDB-T standard.

14:30 *Automatic Extraction of Story Units From TV News   412*

Bogdan Mocanu (Institut TELECOM, France); Ruxandra Tapu (Institut Telecom / Telecom SudParis, France); Titus Zaharia (Institut TELECOM, France)

In this paper we propose a novel method for automatic identification of semantically consistent story units from TV news programs. The method includes a temporal segmentation procedure of the video based on visual cues, as well as a graph-driven textual analysis technique of the subtitles documents. The experimental results, obtained on a dataset of 50 videos selected from one week video archive of France Television demonstrate the pertinence of the proposed approach.

14:50 *A Survey on the Sensitivity and Selectivity of Consumer ISDB-Tb Receivers   414*

Rafael Sotelo (Universidad de Montevideo, Uruguay); Álvaro Pérez (Laboratorio Tecnológico de Uruguay LATU, Uruguay)

This paper presents the results of reception tests made to twenty-five ISDB-Tb receivers. For each one we measured its maximum sensibility, and its co-channel and adjacent-channel interference tolerance, for both upper and lower channel. Results are better than the requirements of the applicable standards.

T11.1-Other Technologies Related with CE 1

Room: N262
Chair: Jose-Maria Flores-Arias (University of Cordoba, Spain)

13:30 *Reconfigurable Hardware Design of Low-Area-Cost Computing Kernel Engine for Different Radixes of Single-Path Delay Feedback FFT Systems   416*

Xin-Yu Shih and Hong-Ru Chou (National Sun Yat-sen University, Taiwan)

This work proposes a reconfigurable low-area-cost computing kernel engine for 1-stage-of-radix-5, 2-stage-of-radix-3, and 4-stage-of-radix-2 SDF FFT applications. By using TSMC 90nm CMOS technology, our design with higher hardware utilization ratio has a synthesis area occupation of 0.093mm2, only increasing 10.7% circuit overhead with respect to pure radix-5 computing kernel design.

13:50 *LZ4m: A Fast Compression Algorithm for In-Memory Data   418*

Se-Jun Kwon (Sungkyunkwan University, Korea); Sang-Hoon Kim (Korea Advanced Institute of Science and Technology (KAIST), Korea); Hyeong-Jun Kim and Jin-Soo Kim (Sungkyunkwan University, Korea)

Compressing in-memory data is a cost-effective solution for dealing with the memory demand from data-intensive applications. This paper proposes a fast data compression algorithm for in-memory data that improves performance by utilizing the characteristics frequently observed from in-memory data.

14:10 *An Advanced TRIM Command for Extending Lifetime of TLC NAND Flash-based Storage   422*

Kirock Kwon (Samsung Electronics, Korea); Dong Hyun Kang, Jonggyu Park and Young Ik Eom (Sungkyunkwan University, Korea)

In mobile environments, the popularity of TLC-based flash storage is steadily growing due to its high capacity. In this paper, we study the relationship between TLC-based storage and log-structured file system in terms of lifetime of the storage device. We also propose a novel technique, called Segment Trimming, which helps to eliminate the unnecessary data migration inside TLC storage. Our experimental results clearly show that our technique reduces the unnecessary data migration by 83% on average, compared with the traditional approach.

14:30 *CoW Link: Duplicated Data Block Management Scheme for Multi-user Consumer Electronics Devices   424*

Sung Jae Park (Sungkyunkwan University & Samsung Electronics, Korea); Dong Hyun Kang and Young Ik Eom (Sungkyunkwan University, Korea)

In consumer electronics (CE) environments, as the needs for multiple user account grow, operating system for CE devices began to support multi-user features. Unfortunately, with this feature, the system installs software packages individually for each account, and it would waste the storage space of CE devices. In this paper, we propose a scheme, called Copy-on-Write (CoW) Link, that efficiently saves the storage space by eliminating duplicate blocks of the files belonging to software packages. Our evaluation results show that CoW Link reduces the storage space by up to 9 times, compared with the traditional scheme.

14:50 *Dynamic Hot-Cold Separation Scheme on the Log-structured File System for CE Devices   426*

Dong Hyun Kang and Young Ik Eom (Sungkyunkwan University, Korea)

Recently, many researchers have focused on the log-structured file system because its layout helps to enhance the performance of the consumer electronics (CE) devices that employ NAND flash storages as their main storage. In this paper, we present a novel hot-cold separation scheme that dynamically identifies the temperatures of blocks in the file system with a hint from the page cache. Our experimental results clearly show that our scheme reduces the number of copy operations by up to 6.1 times compared with the F2FS.

Tuesday, January 10, 15:10 - 15:50

Coffee Break

Room: Hall Area

Tuesday, January 10, 15:50 - 17:30

T10.1-Enabling & HCI Technologies

Room: N256

Chair: Francisco J. Bellido Outeiriño (University of Córdoba, Spain)

15:50 *Contactless Touch Interaction Using Thermal Image for Fingerless and Handless Users   430*

Kanghoon Lee (Hanyang University, Korea); Taeyoung Uhm (KIST); Jong-Il Park (Hanyang University, Korea)

In this paper, contactless touch interface using thermal imaging is, for who are not capable of using their fingers and hands. In this way, an interaction where a user does not need to directly touch with his/her finger is made possible. The proposed method is highly useful in the sense that many users who cannot use their fingers and hands can interact under a system that is quasi-identical to normal touch system, along with the sense that it can enlarge available ranges of touch interface.

16:10 *Read My Lips, Login to the Virtual World   432*

Daehyun Lee (KAIST, Korea); Kyungsik Myung (Samsung Electronics, Korea)

Login systems in smart devices demand multi-factor authentication for high security and at the same time, it requires simple user experience. We propose a novel application of lip-reading satisfying these requirements. We present the adequacy of lip-reading as a biometric factor by experiment. In addition, automatic lip-reader can be implemented by LSTM (Long Short Term Memory) neural network architecture with good accuracy that can translate visual utterance to password as a knowledge factor. Furthermore, our proposed method, iterative method, can improve accuracy as much as login system required. Our work achieved 93.8% by single iteration from the first result (69.1%).

T9.1-Security and Privacy in CE Infrastructure, Systems & Devices

Room: N259

Chair: Lee Jae-Kwang (University of Hannam, Korea)

15:50 *Blind Copula Based Copy-Move Forgery Detection Algorithm   434*

Saif alZahir and Radwa Hammad (UNBC, Canada)

We present a new blind copy-move forgery detection algorithm that employs copula functions on sub-band(s) of a steerable pyramid decomposed image. Our results from 3000 images of the COMOFOD database are precise. This algorithm is ideal for security printing documents verification and can be used off line on or online.

16:10 *Walkthrough-Style Multi-Finger Vein Authentication   436*

Yusuke Matsuda, Naoto Miura, Yo Nonomura, Akio Nagasaka and Takafumi Miyatake (Hitachi, Ltd., Japan)
We propose a new concept of walkthrough-style finger vein authentication. Adaptive light-sources control enables multi-finger vein capturing in real time. Each finger vein region is precisely detected by utilizing a depth camera. Experiments in a prototype show real-time authentication with high accuracy.

16:30 *Mitigating Row Hammer Attacks Based on Dummy Cells in DRAM   440*

Andres Amaya and Hector Gomez (Universidad Industrial de Santander, Colombia); Elkim Roa (Universidad Indsutrial de Santander, Colombia)
This paper presents an alternative to prevent data corruption in DRAM memories due to Row Hammer attacks by the usage of dummy cells connected to each row as attacks indicators. These special cells are characterized for having a higher sensitivity to coupling noise. The strategy was validated by simulations on a 65nm CMOS 64x64 memory array, including process variations for coupling and interconnections. A outstanding characteristic of this suggested solution is the low-complexity additional hardware.

16:50 *Efficient Protocol for Searchable Encryption and Secure Deletion on Cloud Storages   442*

Joon-Woo Yu (Sungkyunkwan University); Hyoung-Kee Choi (Sungkyunkwan University, Korea)
Services on cloud storages becomes popular and useful to individuals and corporations. Security on files and information stored in remote cloud servers is claimed by users a primary requirement for a reliable service. Secure deletion, an encrypted file system, and a searchable encryption are three essential requirements for a secure cloud storage. However, available cloud services have a distance in satisfying those requirements. The proposed protocol is designed for secure cloud storages accessible by a user located from anywhere in Internet and any devices. Evaluations on the performance backs an efficiency of the protocol in time.

17:10 *An Intrusion Detection Scheme for Driverless Vehicles Based Gyroscope Sensor Profiling   446*

Khattab M. Ali (University of Essex, United Kingdom); Rabab Al-Zaidi (Essex University, United Kingdom); John Woods and Klaus McDonald-Maier (University of Essex, United Kingdom)
Vehicular ad-hoc networks of self-driving vehicles are potentially exposed to both internal and external attacks. The privacy and security of these networks is paramount for effective protection of communication systems from possible attacks. We propose an intelligent intrusion detection system in this paper that is based on Integrated Circuit Metrics (ICMetrics), which has significant defensive capability against unexpected attacks. The proposed security system shows good performance in identifying and blocking malicious vehicles in vehicular ad-hoc networks of driverless vehicles and semi driverless vehicles.

T3.7-AV Systems, Image & Video, Cameras & Acquisition: Other Topics

Room: N261
Chair: Carsten Dolar (Robert Bosch GmbH, Germany)

15:50 *Soiled Banknote Fitness Determination Based on Morphology and Otsu's Thresholding   448*

Sanghun Lee and Sangwook Baek (Yonsei University, Korea); Euisun Choi and Yoonkil Baek (Nautilus Hyosung Inc., Korea); Chulhee Lee (Yonsei University, Korea)
This paper presents a soiled banknote determination method based on morphology and Otsu's thresholding method. Using morphology, a texture image was extracted with selective morphological closing operations. Next, the Otsu threshold was calculated for estimating global contrast. The proposed method showed good performance on Euro and Russian banknotes.

16:10 *Speaker System with 100-W High Output Power and 0.17% THD Using 9-V Power Supply with Digitally Direct-Driven Technique   450*

Yuki Furuya (University of Hosei, Japan)
In recent years, high-quality and high-efficiency speaker systems have grown in importance. However, to improve sound quality, implemented electric circuits increase in size and consume more power. In addition, efficiency at low output power and total harmonic distortion (THD) at high output are degraded. In this paper, we report on a small speaker system that can output 110 W and higher from an 9-V input without using analog circuits. Using only digital processing, we build a low-power, fully digital speaker using a digital direct-driven speaker system (DDDSP) that can achieve high efficiency, low noise, and low THD.

16:30 *A Tablet Personal Computer with Diagonal Microphone Placement for the Landscape/Portrait Interchangeable Mode   454*

Akihiko K. Sugiyama (NEC Corporation, Japan); Ryoji Miyahara (NEC Engineering Ltd., Japan)
This paper proposes a tablet PC with diagonal microphone placement for landscape/portrait interchangeable mode. Two microphones are diagonally located at a screen corner to provide useful directivity for interference attenuation in both landscape and portrait modes. The diagonal microphone placement guarantees a nonzero microphone spacing in either the landscape and the portrait mode so that interference attenuation is achieved for good subjective signal quality and a higher speech recognition rate. Evaluations in speech recognition scenario demonstrate that the diagonal microphone placement is effective in both the landscape and the portrait position with comparable command recognition rates of about 90\%.

16:50 *Synchronization Method for Color-independent Visual-MIMO Communication   456*

Tae-Ho Kwon, Jai-Eun Kim and Ki-Doo Kim (Kookmin University, Korea)
An effective synchronization method is proposed that maintains color uniformity and ensures that the human eye is unable to detect flickering when using a general purpose commercial camera as a receiver for color-independent visual-MIMO communication.

17:10 *PSF Estimation Using Total Variation Regularization and Shock Filter for Blind Deconvolution   458*

Hiroki Senshiki, Satoshi Motohashi and Tomio Goto (Nagoya Institute of Technology, Japan); Haifeng Chen and Reo Aoki (EIZO Corporation, Japan)
In this paper, we propose a novel PSF estimation using total variation regularization and the shock filter. The experimental results show that our method is the best of several methods with respect to deblurring performance. Furthermore, our proposed method creates high quality images for consumer cameras.

T11.2-Other Technologies Related with CE 2

15:50 *A Smart Mat for Assisting Muslims in Praying*   460
Kasman Kasman and Vasily Moshnyaga (Fukuoka University, Japan)
Muslim praying ritual is quite complex and challenging especially for old and forgetful people. This paper presents new smart mat system to assist Muslims in praying. The proposed system computes starting time of a pray, reminds the user about the pray time, indicates the direction to Mecca and counts the number of postures performed during a pray. Unlike related formulations, it utilizes optimized sensor array and new posture detection approach. The electronics embedded into the mat are inexpensive yet efficient. Experiments show that the smart mat has good accuracy, easy to use and is helpful for Muslim prayers.

16:10 *Feature-level Fusion of Deep Convolutional Neural Networks for Sketch Recognition on Smartphones*   464
Mustafa Sert and Emel Boyaci (Baskent University, Turkey)
Understanding hand-free sketches with automated methods is a challenging task due to the diversity and abstract structures of the sketches. Here, we propose a robust feature-level fusion scheme that use deep convolutional neural networks (CNNs) for recognizing hand-free sketches and develop a sketch recognition application for smartphones based on client-server application architecture. We employ inter-layer CNN features to capture different levels of abstractions of sketches. Our results on TU-Berlin hand-free sketch benchmark dataset show that, proposed scheme achieves a recognition accuracy of 69.175%. This result is promising when compared with the human recognition accuracy of 73.1% on the same dataset.

16:30 *Beacon Alarming: Informed Decision-Making Supporter and Privacy Risk Analyser in Smartphone Applications*   466
Majid Hatamian and Jetzabel Serna-Olvera (Goethe University of Frankfurt, Germany)
We are currently confronting with a large number of smartphone applications which are produced for different purposes. One important issue regarding this phenomenon is that, smartphone users are often unaware of the data collected by applications running on their devices. As a result, there is a mixed variety of factors which can substantially threaten the users' privacy. For this reason, it is an essential need to make the users aware of the potential risks of such misuses. In this paper, we aim to introduce a novel concept which is called Beacon Alarming.

Additional Paper:

Auto Charging Platform and Algorithms for Long-Distance Flight of Drones   186
Chungki Woo, Sanha Kang, Hojin Ko, Hochan Song, and Jae Ook Kwon

A Real-Time and Low-Cost Hand Tracking System   428
Leyuan Liu, Xin Li, Yi Zhao, and Jingying Chen