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Sunday, September 3

Sunday, September 3, 09:00 - 20:00

Hackaton - IoT4Tourism

Use the Internet of Things to create a great experience for tourists

Room: Berlin 1

09.00 Door Opening
09.30 Welcome Address
10.00 Tutorials: IoT Platforms, Data, and Ontologies
12.00 Teaming/Matching with Lunch
13.00 Start Hacking
18.00 Free time
20.00 End of on-site Program

Monday, September 4

Monday, September 4, 08:30 - 09:00

Registration

Rooms: Berlin 1, Berlin 2, Break Area

Monday, September 4, 09:00 - 10:40

Consumer healthcare 1

Room: Berlin 1

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

09:00 Human-Robot Cooperation via Brain Computer Interface 1

Gabriele Foresi (Universita' Politecnica delle Marche, Italy); Alessandro Freddi (Università degli Studi eCampus, Italy); Sabrina Iarlori (Universita' Politecnica delle Marche, Italy); Andrea Monteriù and Davide Orteni (Università Politecnica delle Marche, Italy); Daniele Proietti Pagnotta (Universita' Politecnica delle Marche, Italy)

This work proposes an approach for performing Human-Robot Cooperation (HRC) tasks by integrating a Brain Computer Interface (BCI) with a robotic manipulator. In detail, the user can select one among six different objects via BCI, which analyzes the P300 signals generated by the brain when the images of the selectable objects appear on the screen. Then, the selected object is recognized by a Support Vector Machine (SVM) classifier, which scans the data acquired by the robot camera. Finally, the recognized object is grasped by the robotic arm and moved to a different position.

09:20 Bio-information Inference Platform using Underwear-type Wearable Device 3

Toru Kobayashi and Kenichi Arai (Nagasaki University, Japan); Hirofumi Miyajima (Okayama University of Science, Japan); Wataru Tarumi, Hirokazu Doi and Kazuyuki Shinohara (Nagasaki University, Japan)

We propose a bio-information inference platform, which can be used for inferring important bio-information based on the machine learning using biomedical signals collected from underwear-type wearable devices. This platform has been consisted of an underwear-type wearable device, a smartphone, a server, and a doctor terminal. Using this platform, we can collect biomedical signals during 24 hours securely from patients who wear underwear-type wearable devices via their smartphones and infer bio-information by machine learning. To confirm the feasibility of this platform, we tried to infer deep body temperature as important bio-information based on biomedical signals coming from an underwear-type wearable device.

09:40 SPoMo: IMU-based Real-time Sitting Posture Monitoring 5

Anastasios Petropoulos (University of Patras, Greece); Dimitrios Sikeridis (University of New Mexico, USA); Theodore A. Antonakopoulos (University of Patras, Greece)

Improper sitting posture can lead to a number of serious health disorders connected to the musculoskeletal system. Especially nowadays sitting periods at work or at home are increasing, and therefore consistent stance monitoring can help users improve their sitting habits and avoid related complications. In this work, we present SPoMo a real-time, practical, wearable

system that automatically tracks the user's sitting posture, through wireless sensors attached to his back. Our prototype is based on Inertial Measurement Units (IMUs) that monitor the angle deviation from the optimal position. We have also developed a cloud-assisted mobile application able to continuously visualize the user's stance, archive his performance over time and provide insight for future development of proper posture. We focus on presenting SPoMo functionality, and experimentally evaluate its performance. Our results prove our system to be accurate and therefore a good every-day solution that helps the consumer to avoid chronic improper posture.

10:00 Motion Evaluation by Means of Joint Filtering for Assisted Physical Therapy 10

Julia Richter, Christian Wiede and Lars Lehmann (Chemnitz University of Technology, Germany); Gangolf Hirtz (Chemnitz University, Germany)

The supervision of rehabilitation exercises is crucial for a successful therapy. Due to a lack of therapists, technical assistance systems have recently come into focus to assist patients during their exercises. Latest research proved that characteristic motion errors can be detected by using the Kinect skeleton joints in connection with Incremental Dynamic Time Warping (IDTW) and machine learning. However, the processed joints were manually selected and the classifier predicts in a frame-wise manner. In order to facilitate an extension with more exercises, a central issue of this paper is to realize an automatic joint selection with optimal classification accuracy. Moreover, we propose an algorithm that post processes the frame-wise prediction. The results for both joint selection and post processing are of high quality and therefore make a significant contribution to an efficient, perceptible and user-friendly feedback generation.

10:20 Real-Time Fall Detection System by Using Mobile Robots in Smart Homes 15

Lucio Ciabattini (Universita' Politecnica delle Marche, Italy); Francesco Ferracuti (Università Politecnica delle Marche, Italy); Gabriele Foresi (Università Politecnica delle Marche, Italy); Alessandro Freddi (Università degli Studi eCampus, Italy); Andrea Monteriù (Università Politecnica delle Marche, Italy); Daniele Proietti Pagnotta (Università Politecnica delle Marche, Italy)

An unobtrusive method to realize fall detection by using bluetooth beacons, a smartphone and a low cost mobile robot is presented. The method is composed by five steps. The first consists in extracting features from the smartphone acceleration data, which are then analysed online by the fall detection algorithm. Once the fall event is detected, then the location is determined by using the bluetooth signal received from beacons. Then, the mobile robot moves towards the user's location, and finally verifies if the detected fall event is a true positive or not, through a procedure based on voice interaction with the potentially fallen user. The method has been tested in laboratory, proving to be a viable solution to perform fall detection in smart homes via consumer devices.

Monday, September 4, 09:00 - 16:55

Hackaton - IoT4Tourism

Room: Berlin 2

Monday, September 4, 10:45 - 11:10

Opening ceremony

Room: Berlin 1

Monday, September 4, 11:20 - 12:40

Video delivery

Room: Berlin 1

Chair: Dmitry Vavilov (T-Systems RUS, Russia)

11:20 Stereoscopic Video Transmission using Inter-layer FEC and Hierarchical QAM over Relay Channels 17

Dongho You, Namtae Kim and Eunyoung Jeong (Seoul National University of Science and Technology, Korea); Bong-Seok Seo (Seoul National University of Science and Technology, Korea); DongHo Kim (Seoul National University of Science and Technology, Korea)

We consider an inter-layer FEC technique combined with hierarchical 16QAM schemes for stereoscopic video transmission over AWGN relay channels. The proposed system with the suitable hierarchical value can gain about 2.26--6.18 dB in the average PSNR performance, compared with the system using conventional FEC and hierarchical 16QAM schemes.

11:40 A complete multi-view video streaming system 19

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

In this paper we present a scalable multi-view video streaming system with client-side view interpolation. Most parts of the system have been shown to be able to perform in real-time, but never as a complete system. Even though our algorithms are not highly optimized, we show that running a complete multi-view streaming system video on consumer hardware is possible today. Since multi-view coding and streaming has not reached the consumer market yet due to its high requirements for computational power and Internet bandwidth, the proof that those problems can be solved without specialized hardware can lead to new and more immersive video experiences without the need for 3D glasses or VR goggles.

12:00 Suggestion of a New Architecture for 360 Video Streaming 22

Bong-Seok Seo (Seoul National University of Science and Technology, Korea); Dongho You, Namtae Kim, Eunyoung Jeong and DongHo Kim (Seoul National University of Science and Technology, Korea)

Recently, interest in contents utilizing 360 and Virtual Reality (VR) images is increasing. But, current 360 and VR images are now transformed into Equirectangular projection (ERP) and transmitted in a 2:1 ratio rectangular shape. However, because of the sagging of the upper and lower parts, the data is consumed in excess of the necessary amount for transmission, and thus the video of high video quality cannot be transmitted. In addition, the work that is performed to combine multiple videos and transmit them as one video greatly increases the burden on the sender. Therefore, in this paper, we propose a method to link images of 360 and VR images to each other by transmitting individual videos and connection information of each video.

12:20 Rate Adaptation Algorithm with Backward Quality Increasing Property for SVC-DASH 24

Simge Özcan, Tuğçe Kivilcim, Cihat Cetinkaya and Muge Sayit (Ege University, Turkey)

Adapting quality based on the underlying network conditions is one of the most important components of video streaming applications. Today, HTTP adaptive video streaming systems are used prevalently around the world and this tendency led MPEG group to standardize DASH. Scalable video coding can be used as an alternative codec in DASH applications. In this case, quality adaptation can be done by adding or subtracting video layers. In this paper, we propose a rate adaptation algorithm for a DASH system that utilizes SVC properties to increase Quality of Experience (QoE). Comparative simulation results show that, as well as the storage and bandwidth efficiency advantages, scalable video coding is also advantageous in increasing QoE due to the quality increasing method.

Monday, September 4, 13:00 - 14:00

Lightning talks / One Minute Madness

Room: Berlin 1

Chair: Milena Milosevic (RT-RK Computer Based Systems LLC, Serbia)

Adaptive temporal frame interpolation based on video signal spatio-temporal features N/A

Denis Vranješ (Faculty of Electrical Engineering, Computer Science and Information Technology Osije, Croatia); Snjezana Rimac-Drlje (University of Osijek, Croatia); Mario Vranjes (University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology, Croatia)

Video signal recorded using modern devices is not suitable for transmission or storage on some media. Therefore it is necessary to decrease its size during the encoding process. It can be done by decreasing spatial and/or temporal resolution. On the other hand, there is also a rapid development of video displaying devices (smart phones, tablets, laptops...) which, independently on screen size, can display high resolution video signal. Therefore it is necessary to increase spatial and/or temporal resolution of video signal during the decoding process (prior to presentation). Thus the interest for algorithms that perform spatial/temporal video upscaling is growing rapidly in last decade. In this research, firstly frames from uncompressed video signal are discarded. Then the interpolation of these discarded frames is done by using an engineering approach. Since the whole process is performed on uncompressed video, interpolation error is caused only by object motion and the content change. Theoretical and empirical models developed within this research have shown that in case of low video signal temporal activity, simple frame averaging (FA) method can achieve similar interpolation error to this of more complex motion compensated frame interpolation (MCFI), thus reducing the interpolation algorithm complexity. Analysis of the influence of the block size on the motion estimation error has shown that interpolation error is the lowest for the biggest block size (16x16 pixels). According to performed analyses, an algorithm for adaptive frame interpolation based on spatio-temporal features of the video signal is proposed. The proposed temporal upscaling algorithm is compared to the state-of-the-art temporal upscaling algorithms. The results show that the proposed algorithm is competitive to state-of-the-art temporal upscaling algorithms in terms of interpolated image/video quality, while its computational complexity is significantly lower, what is very important in a world of consumer electronics devices real-time operation.

AI with MEMS Sensors N/A

Kaustubh Gandhi (Bosch Sensortec, Germany)

Along with unlocking newer use cases such as drones, augmented reality and robots, the artificial intelligence (AI) is all set to extend human capabilities and transform our lives. However, to truly benefit from the power of AI in our daily life, we need to apply the techniques on data generated in a non-obtrusive way. This can be achieved with Micro-Electro-Mechanical Systems (MEMS) sensors. Thanks to their small size, power efficiency, precision, mass presence and low cost, MEMS sensors are especially suited for creating self-learning machines that will benefit both its users and the product designers. In this lightning talk, Kaustubh Gandhi will elaborate on the method and describe a real life example on how one of the machine learning techniques can be used on MEMS data, going through acquisition, training, evaluation of results and optimization for industrial use. Finally, he will present some insights on performance improvements.

Lunch

Room: Break Area

Monday, September 4, 14:00 - 15:30

Keynotes 1 & 2

Room: Berlin 1

Chair: Dietmar Hepper (ex Technicolor, Germany)

14:00 Wearables, Humans, And Things (WHAT!) in Real Life N/A

Nahum Gershon (MITRE Corporation, USA)

When I use my smart watch to track the steps I walk, it takes sometimes a few minutes for the watch to show the number of steps I took. Naturally, I would have enjoyed seeing the step counter being updated simultaneously as I walk. This would be also my wish with my smart phone that also gives me delayed observations when I climb floors. After climbing a few floors, for example, it would indicate one floor only after a few minutes. Then, two floors after some more time, and sometimes three after a few more minutes... Humans like instant gratification! But, this simple human trait seems to have been ignored by this smart watch designers or maybe the engineers. Were they ignorant of this human trait, or worse, did they not care? This is just one illustration that in the areas of wearables and the Internet of Things (or Everything) and even devices and capabilities designed and produced for smart cities, there is an urgent need for engineers who design wearables and other things to get more knowledgeable about human and social needs, capabilities, and wishes or to collaborate more closely with human-oriented designers, biologists, healthcare practitioners, social scientists and psychologists. For me, it has not been just this smart watch. I have experienced more difficulties with other personal fitness trackers that I have used in the past few years. Overall, there are number of main issues. For example, Arm or Core. We tend to regard numerical data as quantitative data. But, as Einstein once said: Not everything that counts can be counted, and not everything that can be counted counts. So, having a number does not mean it represents a situation realistically. From my personal experience for example, the location where the wearable is placed on the body (e.g., arm or core) could affect the data being measured. There are other issues like choosing the most appropriate unit of measurement to fit the intended purpose (e.g., feet or flight of stairs climbed) and the benefit of the non-homogeneity of the IoT system. These are just a few examples. In this session, we will actively discuss with the audience how such issues and similar others, based on our personal and social experience, relate to the future of wearables and the Internet of Things and even smart cities. We plan to summarize the results of the discussion and post it on an IEEE site.

14:45 Future Directions in IEEE N/A

Lee Stogner (IEEE, USA)

The IEEE Future Directions Committee (FDC), in association with Societies, Councils, and OUs, anticipates and determines the direction of existing, new, and emerging technologies and related issues, and spearheads their investigation and development by IEEE. Taking a holistic view, the FDC emphasizes new, emerging technical areas and drives them to maturity within the IEEE infrastructure. Additionally, the FDC serves as a liaison to and fosters cooperative efforts among Societies, Councils, and industry to develop new products and services in emerging topics. The primary working objective of the IEEE Future Directions Committee: • Incubates emerging technologies and new applications of current technologies • Identifies opportunities to engage the engineering community and the general public • Works with IEEE members and staff to focus on emerging technologies through technical, professional, and educational activities • Serves as a catalyst for new conferences, publications, standards, educational products, forums, white papers, grants, and projects to support new technologies This presentation will give an overview of the Initiatives that have been a part of and are currently active in IEEE Future Directions. In addition, a update on the Initiatives that are unique to the CE Society.

Monday, September 4, 15:35 - 16:55

Image & Video

Room: Berlin 1

Chair: Hans L. Cycon (HTW Berlin & Daviko GmbH, Germany)

15:35 Improved Visual Odometry System Based on Kinect RGB-D Sensor 29

Shen-Ho Liu, Chen-Chien Hsu and Wei-Yen Wabg (National Taiwan Normal University, Taiwan); Yin-Tien Wang (Tamkang University, Taiwan); Mei-Yung Chen (National Taiwan Normal University, Taiwan)

In conventional visual odometry (VO) systems, perspective-n-point (PnP) method and random sample consensus (RANSAC) algorithm are generally used to estimate camera poses. However, heavy computational burden is incurred, and the pose estimations are not reliable as well. Therefore, in this paper, an improved VO system is proposed, where an off-line camera calibration method is used to obtain lesser measurement errors of image features. Moreover, an improved approach of P3P algorithm is proposed to increase the efficiency of the VO system. To validate the performances of the proposed approach, several experiments are conducted based on a Kinect sensor, where accuracy of pose estimations and runtime efficiency are both improved in comparison to the conventional VO algorithms.

15:55 An FPGA Implementation of Future Video Coding 2D Transform 31

Ahmet Can Mert, Ercan Kalali and Ilker Hamzaoglu (Sabanci University, Turkey)

Future Video Coding (FVC) is a new international video compression standard offering much better compression efficiency than previous video compression standards at the expense of much higher computational complexity. In this paper, an FPGA implementation of FVC 2D transform is proposed. The proposed FVC 2D transform hardware can perform 2D DCT-II, DCT-

V, DCT-VIII, DST-I, DST-VII operations for 4x4 and 8x8 transform units. It uses two reconfigurable datapaths for all 1D transforms. It implements multiplications with constants using DSP blocks in FPGA. The proposed FPGA implementation, in the worst case, can process 54 8K Ultra HD (7680x4320) video frames per second. The proposed FPGA implementation has up to 29% less energy consumption than the FPGA implementation of FVC 2D transform hardware in the literature.

16:15 Pixel Correlation Based Computation and Energy Reduction Techniques for HEVC Fractional Interpolation 37

Ercan Kalali, Ahmet Can Mert and Ilker Hamzaoglu (Sabanci University, Turkey)

Fractional interpolation is one of the most computationally intensive parts of High Efficiency Video Coding (HEVC). Therefore, in this paper, two pixel correlation based computation and energy reduction techniques for HEVC fractional interpolation are proposed. The proposed pixel equality based computation reduction (PECR) technique does not affect the PSNR and bit-rate. The proposed pixel similarity based computation reduction (PSCR) technique slightly decreases PSNR and increases bit-rate. In this paper, a low energy HEVC fractional (half-pixel and quarter-pixel) interpolation hardware for all prediction unit sizes including the proposed techniques is also designed and implemented using Verilog HDL. The proposed hardware, in the worst case, can process 48 quad HD (2160x1600) video frames per second. The proposed PECR and PSCR techniques reduced the energy consumption of this hardware up to 39.7% and 46.9%, respectively.

16:35 Video-processing Platform for Semi-autonomous Driving over 5G Networks 42

Damir Becirbasic and Marijana Molnar (University of Novi Sad, Faculty of Technical Sciences, Serbia); Zeljko Lukac (RT-RK Institute for Computer Based Systems, Serbia); Dragan Samardzija (Nokia Bell Labs, USA)

Semi-autonomous driving is a huge technological step, but also it introduces a range of new challenges. Real-time control, selection and development of hardware platform, data transfer and development of algorithms are just a small collection of engineers' challenges to fully take advantages of this system. The focus of this paper is analysis of some problems of semi-autonomous driving, corresponding limitations and the way ultra-reliable low-latency communications (URLLC) 5G network allows to overcome them.

Monday, September 4, 16:55 - 17:30

Coffee break / Poster session 1

Rooms: [Berlin 1](#), [Berlin 2](#), [Break Area](#)

Chair: Denis Vranješ (Faculty of Electrical Engineering, Computer Science and Information Technology Osije, Croatia)

Vehicle Detection for Forward Collision Warning System Based on A Cascade Classifier Using Adaboost Algorithm 47

Yeong-Kang Lai and Yu-Hsi Chou (National Chung Hsing University, Taiwan); Thomas Schumann (Hochschule Darmstadt-University of Applied Sciences, Germany)

This paper presents a vehicle detection for a forward collision warning using a monocular camera. We use the active-learning framework to train a cascade classifier and use a two-step vehicle detection. The first step is to train a cascade classifier using multi-scale windows to search the vehicles in the screen. The second step is to use the first stage of the test as candidates, the use of symmetry to further screening. Then, we used five test data to test our detection performance, analyzing the two-stage vehicle detection improvement, and the overall detection rate and the false detection rate.

Design of an Interoperable Framework with Domotic Sensors Network Integration 49

Emanuele Frontoni, Daniele Liciotti, Marina Paolanti, Rama Pollini and Primo Zingaretti (Università Politecnica delle Marche, Italy)

Nowadays, home devices with network capabilities are widely used and provide a procedure according to the specifications of the sensor. The technology integration offers new and exciting opportunities to increase the device connectivity within a home for many proposals of home automation. For this reason, in this paper it has been developed a framework that allows to quickly develop new hardware and software complex systems, rapidly integrate new classes of devices in existing systems and control and centralize the data. The preliminary results obtained are already consistent and demonstrate its suitability and its effectiveness.

An Adaptive TTL Allocation Scheme for Real-time Live and On-Demand Personal Broadcasting Service 51

Namtae Kim, Dongho You and Eunyoung Jeong (Seoul National University of Science and Technology, Korea); Bong-Seok Seo (Seoul National University of Science and Technology, Korea); DongHo Kim (Seoul National University of Science and Technology, Korea); Ye Hoon Lee (Seoul National University of Technology, Korea)

This paper describes an adaptive time-to-live (TTL) allocation scheme based on dynamic caching of content delivery network (CDN). This is advantageous in that when a client watches a real-time private broadcast, a load of a origin server can be efficiently reduced when a certain scene of the past is viewed again, and a storage space of a cache server can be efficiently used. Therefore, the adaptive TTL allocation scheme proposed in this paper is expected to provide a better service when personal broadcasting viewers selectively view past videos.

Traffic Lane Estimation using Road Width Information 53

Seokjun Kang and Dong Seog Han (Kyungpook National University, Korea)

This paper proposes a lane estimation algorithm on roads where lanes are not visible due to fading or bad weather conditions. The proposed algorithm is conducted by utilizing the road width and remained lines on roads. The results indicate that the proposed algorithm can estimate lanes in heavy rains and nights.

Key Point Localization for 3D Model Generation from Facial Illustrations Using SURF and Color Features 55

Risako Aoki, Shun Aoki and Yakumo Ohtagaki (Meiji University, Japan); Ryusuke Miyamoto (Meiji University & School of Science and Technology, Japan)

This paper proposes a novel scheme to improve localization accuracy of facial key points in facial illustrations. The proposed scheme estimates the location of facial key points considering global structure of facial key points evaluated by RANSAC like scheme where local evaluation is performed with SURF and color features. Experimental results using a data set composed of facial illustrations show that the estimation error can be reduced to about 8.93 pixels per a key point.

Cloud Based Design and Implementation of a Voice Controlled Radio Transmitter System 57

Muneeb Ur Rehman (Software Engineering, USA)

This paper presents a cloud based design and implementation of a voice controlled radio transmitter system that can be used in a variety of different consumer electronics. More precisely, this paper looks into the possible upgrade of the traditional radio transmitter-receiver system and incorporates the use of Cloud Computing and Internet of Things, so that radio transmitters can now be controlled via voice commands. Furthermore, we take a look at the transformation of a 27.145 MHz remote control toy car and convert it into one that can now be controlled using voice commands by providing an upgrade to the existing system. The proposed system has made use of Amazon Alexa as the voice interface platform and Amazon Web Services as the cloud computing platform. Specifically, the system designed makes use of the Lambda and S3 Service by Amazon Web Service. As the entire system is now cloud based, range issues associated with transmitters and receivers are eliminated. At a high level, the system designed essentially demonstrates a method in which voice commands can now be converted into encoded radio signals, which can then be received by the receiver so that the intended task can be performed by the user.

Hardware Aware Fast Depth Map Generation Algorithm 62

Pei-Jun Lee and Hung-Peng Lee (National Chi Nan University, Taiwan); En-Pei Wu (National Chi nan University, Taiwan)

This paper proposes a jumped matching depth estimation algorithm to calculate the disparity value in the 3D virtual view synthesis. The matching criterion adopts pixel value similarity, distance similarity and color information similarity as the weighted cost aggregation. In order to reduce the depth discontinuing and then providing the comfort of 3D watching, this paper proposes the disparity prediction method to obtain the disparity value in an object. To reduce the depth discontinuous on scene changed, we proposed a depth stability algorithm to smooth the depth transition on sequential depth maps. The experimental result shows that the method proposed in this paper reduces almost 90% computation time than that of the document [7] and the depth map accuracy of the method is very close to that of other methods in SSIM estimation. Finally, the designed algorithm is implemented in FPGA.

Collection and analysis of system usage data in smart home automation systems 65

Sandra Ivanovic (University of Novi Sad, Serbia); Suncica Milivojsa (Oblo Living, Serbia); Tatjana Eric (University of Novi Sad, Serbia); Milan Vidakovic (University of Novi Sad - Faculty of Technical Sciences, Serbia)

In this paper, we implement a basic solution for collection and retrieval of usage data within the existing home automation system. Data collection modules are implemented, which run on the home automation gateway and within the home automation cloud, and allow us to connect to the already existing big data middleware platform. This represents the initial step in building the extensive data storage and analysis component for the existing home automation solution. The recorded data can be used to enable various scenarios interesting for the end users, such as detection of emergency situations and irregularities within the system.

A Sensor Fusion Approach for Measuring Emotional Customer Experience in an Intelligent Retail Environment 67

Lucio Ciabattini (Universita' Politecnica delle Marche, Italy); Emanuele Frontoni, Daniele Liciotti and Marina Paolanti (Università Politecnica delle Marche, Italy); Luca Romeo (Universita' Politecnica delle Marche, Italy)

Customer experience depends not only on the aspects which retailers can easily control, but also on emotional factors that are unpredictable. In this paper, a Multi-Task Multi-Kernel learning approach is proposed to recognize positive users' emotion in a retail scenario. The overall system is composed by the Ultra-Wide Band (UWB) tracking system and a consumer smartwatch device. Data gathered from sensors are combined in a multi-kernel scenario to estimate shoppers emotion (i.e., valence and arousal) which is strictly correlated to different shoppers feelings. Results in term of accuracy and macro-F1 score the effectiveness and the suitability of the proposed approach.

Monday, September 4, 17:30 - 19:10

Enabling technologies

Room: Berlin 1

Chair: Milan Z. Bjelica (University of Novi Sad, Serbia)

17:30 Cell Write Reduction Based on Reed-Solomon Codes for MLC Non-Volatile Memory N/A
Masashi Tawada, Masao Yanagisawa and Nozomu Togawa (Waseda University, Japan)

The demand for nonvolatile memory that can be normally off is on the rise in the recent years because of the popularization of the IoT devices. Multilevel cell nonvolatile memory, which assigns multiple states to a single memory cell in particular, has become mainstream. Multilevel cell nonvolatile memories have a problem that the durability of written data is low. Memory redundancy based on error-correction codes was considered in order to resolve this problem. Redundancy increases the number of patterns for writing data when information is written onto a memory cell. Much information can be stored even on a small number of rewritable memory cells since the data writing positions can also be considered as information, in addition to the contents of written data. The number of memory cells on which data is rewritten is reduced to improve the durability of written data by rewriting the states of memory cells based on the Reed-Solomon Codes.

17:50 Estimation of Channel State Information for Non-volatile Flash Memories 69

Juergen Freudenberger (University of Applied Sciences, Konstanz & Institute for System Dynamics (ISD), Germany); [Mohammed Rajab](#) (University of Applied Sciences, Konstanz, Germany); Sergo Shavgulidze (Georgian Technical University, Georgia)

Error correction coding based on soft-input decoding can significantly improve the reliability of flash memories. Such soft-input decoding algorithms require reliability information about the state of the memory cell. This work proposes a channel model for soft-input decoding that considers the asymmetric error characteristic of multi-level cell (MLC) and triple-level cell (TLC) memories. Based on this model, an estimation method for the channel state information is devised which avoids additional pilot data for channel estimation. Furthermore, the proposed method supports page-wise read operations.

18:10 A Deep Learning Convolution Architecture for Simple Embedded Applications 74

[Chan Kim](#), Yong Cheol Cho and Youngsu Kwon (Electronics and Telecommunications Research Institute, Korea)

A simple AXI based convolution architecture for deep learning is presented. Input feature maps and kernel weights are stored in $P \times K \times K$ memory blocks and convolution is done from output feature map 0 to $M-1$, and inside a feature map, output is generated in raster scan order. Data from P input feature maps are summed in parallel during convolution. It is possible to provide $P \times K \times K$ input feature map data, $P \times K \times K$ weights and the bias for the input and output feature maps being processed by manipulating the read addresses and read data alignment. Dual buffers are used to perform convolution for output feature map while DMA write for previous final output feature map is in progress. Correct operation was verified by comparing RTL simulation and C program run results. This method provides over 2,000 speed-up compared to pure software method and with flow control between DMA and convolution, much less memory can be used. This architecture can be used for convolution acceleration for moderate deep learning applications on embedded systems.

18:30 A Robust Scan-based Side-channel Attack Method against HMAC-SHA-256 Circuits 79

[Daisuke Oku](#), Masao Yanagisawa and Nozomu Togawa (Waseda University, Japan)

A scan-based side-channel attack is still a real threat against a crypto circuit as well as a hash generator circuit, which can restore secret information by exploiting the scan data obtained from scan chains inside the chip during its processing. In this paper, we propose a scan-based attack method against a hash generator circuit called HMAC-SHA-256. Our proposed method is composed of three steps and restores the secret information by finding out the correspondence between the scan data obtained from a scan chain and the internal registers in the target HMAC-SHA-256 circuit, even if the scan chain includes registers other than the target hash generator circuit and an attacker does not know well the hash generation timing. Experimental results show that our proposed method successfully restores two secret keys of the HMAC-SHA-256 circuit in at most 6 hours.

18:50 A 37-40 GHz Power Amplifier for 5G Phased Array Applications using 0.1- μ m GaAs pHEMT Process 85

Jeng-Han Tsai, Yi-Chien Cheng and [Chuan-Chi Hung](#) (National Taiwan Normal University, Taiwan)

A 37-40 GHz power amplifier (PA) has been designed and fabricated on 0.1- μ m GaAs pHEMT process. Utilizing two-way direct shunt power combining and low impedance transmission line pre-matching technique, the PA achieves measured saturation output power of 26.5 dBm with peak power added efficiency (P_{AE}) of 28% at 38 GHz. The measured output 1-dB gain compression point is 25.4 dBm and the peak gain is 14.1 dB. The chip size is 2.03 \times 1.03 mm².

Cloud & IoT components

Room: Berlin 2

Chair: Dietmar Hepper (ex Technicolor, Germany)

17:30 Design of Fog Computing based IoT Application Architecture 88

[Seung Woo Kum](#) (Korea Electronics Technology Institute, Korea); Jaewon Moon and Tae-Beom Lim (Korea Electronics Technology Institute, Korea)

With the advent of IoT technologies and standards, IoT services has become popular these days. To populate IoT service, collaboration of IoT services on service level is essential. From the viewpoint of application, most of interfaces of existing IoT services are proprietary, which induces vertical silo problem. In this paper, IoT application architecture to access multiple IoT services using fog computing is proposed. By adapting Fog computing concept to application level, the proposed architecture works as a service gateway to multiple IoT services for IoT applications. The proposed architecture is suitable to build an IoT application utilizing multiple IoT service.

17:50 Leak Detection for Cloud-Based IoT Devices 90

[Myeongjin Cho](#) (NAVER Corporation, Korea); Seong-Won Lee (NAVER LABS, Korea); Hyungwook Lee (NAVER Corporation, Korea)

As consumer electronics rely on cloud services for their applications, a web engine based application on a popular OS such as Windows IoT is a reasonable solution like interactive Kiosks or Point of Sales (POS) systems which are facing customers. A memory leak is more critical in those hardwares considering their tight memory constraints and higher standards of reliability. Since the complexity of their software architecture is beyond leak-free development cost, developers have no choice but to

depend on qualified development tools in order to detect memory leaks. This paper proposes a fast heap allocation analyzer to improve the performance of an existing profiler, called User-Mode Dump Heap (UMDH). The result shows that we achieved orders of magnitude better performance than the existing UMDH.

18:10 A Low Power Temperature Sensor for IOT Applications in CMOS 65nm Technology 92

Michele Caselli, Nicola Garulli, Andrea Boni and Matteo Tonelli (Università di Parma, Italy);
Alessandro Magnanini (Silis Srl, Italy)

This paper describes the architecture of a smart temperature sensor designed in CMOS 65nm technology node, intended for IOT and RFID applications. The power consumption is minimized thanks to a reduced complexity in the analog front-end of the sensor and by shifting the trimming circuitry and part of the readout operations into the digital domain. The maximum inaccuracy of the sensor is +/- 0.3°C over the [-40°C-125°C] temperature range as a result of a two-point calibration, with an average power consumption of 375nW at a conversion speed of 1 Sa/s.

18:30 Architecture of Voice Control Module for Smart Home Automation Cloud 97

Una Radosavac (OBLO Living, Serbia); Eleonora Nan and Istvan Papp (University of Novi Sad, Serbia); Marija Antic (RT-RK, Serbia)

This paper presents one implementation of the voice control module within the smart home automation cloud. The implemented voice control module can process the textual result of arbitrary speech-to-text conversion engine, to detect patterns corresponding to the device names, their locations and actions that should be executed. Based on the detected command semantics, control messages for smart home automation cloud are generated, which result in the desired action within the HA system. The proposed voice control module is implemented within the existing HA cloud, and its performance is tested.

18:50 Enhanced Visual Odometry Algorithm Based on Elite Selection Method and Voting System 99

Hao Shen, Chen-Chien Hsu and Wei-Yen Wang (National Taiwan Normal University, Taiwan); Yin-Tien Wang (Tamkang University, Taiwan)

In this paper, we address the problems of camera pose estimation accuracies and runtime efficiency by incorporating an elite selection method and a voting system to a general visual odometry (VO) method, called the "enhanced VO algorithm". The use of elite selection method improves the efficiency of perspective-3-point (P3P) algorithm by only employing an elite subset of landmarks to estimate the camera pose. The proposed voting system, on the other hand, provide reliable consensus set derived from random sample consensus (RANSAC) algorithm such that accuracy of camera pose estimations can be increased. To verify the performances of the proposed approach, we conducted various experiments using a Kinect RGB-D sensor, and the results show that the proposed VO system performs well in terms of not only estimation accuracy but also computational time.

Monday, September 4, 19:10 - 20:10

Cocktail & Hackaton Showcase

Room: Berlin 1

Tuesday, September 5

Tuesday, September 5, 08:30 - 09:00

Registration

Rooms: Berlin 1, Berlin 2, Break Area

Tuesday, September 5, 09:00 - 10:20

Driver assistance

Room: Berlin 1

Chair: Yeong-Kang Lai (National Chung Hsing University, Taiwan)

09:00 Multi-SoC Load Balancing System for ADAS Application 101

Milos Pranjikic (University of Novi Sad, Serbia); Marko Gostovic (Faculty of Technical Sciences, Serbia); Zeljko Lukac (RT-RK Institute for Computer Based Systems, Serbia); Tomislav Maruna (RT-RK Computer Based Systems LLC, Serbia)

Nowadays we can see very rapid evolution of algorithms for Advanced Driver Assistance Systems (ADAS). With every new algorithm there is need for more processing power. The problem with this is the fact that hardware, that runs algorithms,

cannot support so fast growing need for more processing power because development of the hardware is a lot slower than software development. One of the possible solutions is to add more system on chip (SoC) components to a single system. With this approach instead of adding more processing power to a single unit, we add more SoC units and try to balance entire load between the SoC's.

09:20 Informational Bird's Eye View System for Parking Assistance 103

Veselin Gojak (Faculty of Technical Sciences, Serbia); Joakim Janjatovic (Faculty of Technical Sciences, University of Novi Sad, Serbia); Natasa Vukota (RT-RK Institute for Computer-Based Systems, Serbia); [Milena Milosevic](#) (RT-RK Computer Based Systems LLC, Serbia); Milan Z. Bjelica (University of Novi Sad, Serbia)

Primary goals of Advanced Driver Assistance Systems (ADAS) are increased safety and situations with no stress for all traffic participants. Parking safety is improved by presenting real-time vehicle environment to the driver (surround view, bird's eye view). Bird's eye view is 3D camera and parking sensors system which assist driver with parking. It covers all angles and alerts the driver about obstacles, thus minimizing possibility of traffic accidents. This paper presents one portable informational bird's eye view system.

09:40 Real Time Video Recording Architecture of the ADAS Algorithm Verification System 105

Aleksandar Cumbo (RT-RK Institute for Computer Based Systems, Serbia); Nebojsa Pjevalica (University of Novi Sad, Serbia); [Bosko Kragulj](#) (Faculty of Technical Sciences, Serbia); Nikola Teslic (University of Novi Sad, Serbia)

In this paper example of architecture system for examination existing devices for visual perception of the environment in Advanced Driver Assistance Systems is analyzed and presented. An overview of modern testing techniques as well as the motivation for such a device development arises from the specific testing conditions, increased volume of testing embedded software and applied algorithms as well as from the high standardized demands for functional safety engineered devices.

10:00 Finger-Trace Generator for SWYPE Touch Screen Testing Applications 109

[Martin Pöllöt](#) (University of Erlangen-Nuremberg); Dominic Springer, Ralph Schleifer and Monika Nitsch (Audi AG Ingolstadt, Germany); Andre Kaup (University of Erlangen-Nuremberg, Germany)

With the introduction of touch-screens for an increasing number of applications such as smart phones, vending machines and automotive displays, the need for testing input possibilities for such displays arose. For many different test scenarios not only synthetic, but also human-like inputs are desired. This paper describes an approach capable of creating human-like finger-traces for the input method including, but not limited to swiping. In the process, the algorithm will calculate splines that imitate human finger-traces and run through specified control points. These control points are lying on a given keyboard layout and are analyzed by image processing algorithms. Providing different user profiles for varying input styles - such as precise and sloppy, slow and fast - automated test runs on the robustness and accuracy of applications can be realized, considering the finger-trace that was utilized.

Consumer healthcare 2

Room: Berlin 2

Chair: Valentina Bianchi (Università di Parma, Italy)

09:00 An Efficient D2D-Assisted Transmission Mechanism to Improve the Quality of Emergency Services by Prioritizing Elderly Adults 114

[Yao-Liang Chung](#) (National Taiwan Ocean University, Taiwan)

In this study, an efficient device-to-device communication-assisted transmission mechanism that improves proximity-based emergency services by prioritizing elderly adults is proposed. The proposed method allows substantially enhanced service quality to be provided to users experiencing life-threatening situations, while ensuring that service quality is maintained for users facing less dire situations as well. At the same time, the proposed method ensures that the rates of transmission for all transmitting users either meet or surpass the average required rate for the system. The results of simulated tests indicate that for users with the most urgent needs, the blocking ratio yielded by the proposed method is considerably improved over that yielded by the existing method. In addition, the simulation results indicate that the average transmission rate for a system utilizing the proposed method could be kept above the minimum required level under relatively low traffic loads.

09:20 Mastering an Advanced Sensory Substitution Device for Visually Impaired through Innovative Virtual Training 120

Alin Moldoveanu (Politehnica University of Bucharest, Romania); Silviu Ivascu, [Iulia Stanica](#) and Maria-Iuliana Dascalu (University Politehnica of Bucharest, Romania); Robert Gabriel Lupu (Gheorghe Asachi Technical University of Iasi, Romania); Gabriel Ivanica and Oana Balan (University Politehnica of Bucharest, Romania); Simona Caraiman and Florina Ungureanu (Gheorghe Asachi Technical University of Iasi, Romania); Florica Moldoveanu (University Politehnica of Bucharest, Romania); Anca Morar (Politehnica University of Bucharest, Romania)

Nowadays, people have to face many challenges in order to become familiar with all the functionalities of electronic devices. The training process becomes thus essential, especially when we are referring to consumer electronics created for people with disabilities. Our paper presents the importance of training visually impaired people for an advanced sensory substitution device. By using the advantages of virtual reality, a series of 3D virtual scenes were developed, in order to ease the training process for the device. Our proposed training program shows encouraging results and helps us draw relevant conclusions in the development process of a revolutionary device.

09:40 Interactive Social Robots in Special Education 126

[Angelos Amanatiadis](#) (Democritus University of Thrace, Greece); Vasileios Kaburlasos

(Technological Educational Institute of Eastern Macedonia and Thrace, Greece); Christina Dardani (PRAXIS Treatment and Counseling Unit, Greece); Savvas A Chatzichristofis (Democritus University of Thrace, Greece)

This paper presents advances in robot-assisted special education by specially designed social interaction games. The therapeutic targets of the proposed games include an improvement in social communication and interaction skills, joint attention, response inhibition and cognitive flexibility of children diagnosed with autism spectrum disorders. To achieve the aforementioned targets, social interaction dynamics are investigated in games with humanoid robots. Preliminary application results suggest that robot-assisted therapy can improve children behavior allowing further penetration of humanoid robots in the therapeutic market. Additional improvements are pursued based on Lattice Computing computational intelligence modeling techniques toward increasing the autonomy of the robots during a game.

10:00 A real-time Fuzzy Logic algorithm for freezing of gait management on a smartphone 130

Lucia Pepa and Marianna Capecci (Università Politecnica delle Marche, Italy); Lucio Ciabattini (Università Politecnica delle Marche, Italy); Luca Spalazzi and Maria Gabriella Ceravolo (Università Politecnica delle Marche, Italy)

Freezing of gait is considered a clinical problem in Parkinson's disease, due to its episodic nature, heterogeneous manifestation, and drug resistance. Automatic and objective assessment of freezing of gait may help to increase clinical knowledge and to manage its effects on daily living. In this paper, a fuzzy logic algorithm is presented and tested in real-time on a smartphone.

Tuesday, September 5, 10:20 - 10:35

Coffee break

Room: Break Area

Tuesday, September 5, 10:35 - 11:55

Smart Homes

Room: Berlin 1

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

10:35 One Solution for Voice Enabled Smart Home Automation System 132

Eleonora Nan (University of Novi Sad, Serbia); Una Radosavac (OBLO Living, Serbia); Milica Matic (University of Novi Sad, Serbia); Igor Stefanovic (Oblo Living, Serbia); Istvan Papp (University of Novi Sad, Serbia); Marija Antic (RT-RK, Serbia)

In this paper, we propose one solution to enable voice control within the existing home automation system. The solution is based on the available voice recognition engines. First, we describe the proposed architecture and system components. Then, we verify the correctness of the implementation. Also, we confirm that the response time of the proposed solution is acceptable for practical purposes.

10:55 Implementation of Home Energy Management System with Optimal Load Scheduling based on Real-Time Electricity Pricing Models 134

Muhammad Umer Qureshi, Alan Girault, Mickael Mauger and Santiago Grijalva (Georgia Institute of Technology, USA)

In this paper, we implement a complete Home Energy Management System (HEMS) capable of scheduling loads based on real-time electricity pricing information and user-defined priority. Real-time pricing information can provide numerous economic advantages as compared to the conventional flat rate tariffs. It can allow customers to respond to the price changes by increasing or decreasing energy consumption at different times of the day. It also provides a means for utilities to invoke price based demand response. To automate the process of scheduling, we use an embedded platform, namely Raspberry Pi 3 Model B, to firstly solve the optimization problem and consequently turn the loads on and off based on the resulting optimal schedule. In addition, we perform real-time data acquisition to compute the kWh-energy consumption of various loads to improve the accuracy of our optimization algorithm. To demonstrate the efficacy of our proposed HEMS device, we interface it with a test 5V DC bus with numerous loads attached to it.

11:15 Voice Control for Smart Home Automation: Evaluation of Approaches and Possible Architectures 140

Tatjana Eric and Sandra Ivanovic (University of Novi Sad, Serbia); Suncica Milivojsa (Oblo Living, Serbia); Milica Matic (University of Novi Sad, Serbia); Nikola Smiljkovic (RT-RK, Computer Based Systems, Serbia)

In this paper, we explore the possibility of using existing voice recognition tools, in order to add the voice control interface to the existing smart home automation system. The choice of the voice recognition engine influences the architecture of the voice command interface, and determines its performance. We discuss the possible architectures of the voice enabled smart home automation systems. Then, we present the overview of available speech to text and text to speech engines, and analyze the possibilities of using them within our system.

11:35 Enhanced AODV Based-on Home Sensors Power 142

Hesham Abusaimh (Middle East University, Jordan)

Most home sensor devices nowadays is based on low data rate and on-demand routing protocol such as Ad hoc On-demand Distance Vector (AODV). This routing protocol has less overhead and good efficiency in term of delivery ratio and bandwidth. AODV has two phases the route discover phase which discover route to the destination devices based on the shortest and the freshest hop, and the data delivery phase which I have improved it to make power aware in [1]. Therefore, the enhancement on the AODV in this paper to make the discovering phase considering the power of the devices in addition to the other factors. This new enhancement makes the AODV consider the power level of the home sensor devices in finding the optimal path to the destination device. The highest home sensor power route will be selected with the shortest and freshest routes with giving the priority to the power of the devices. The enhanced AODV has better performance on the lifetime of the home sensor devices by increasing their lifetimes with 25%.

Digital TV technologies

Room: Berlin 2

Chair: Istvan Papp (University of Novi Sad, Serbia)

10:35 A solution of generic digital television middleware 148

Nikola Vranic (RT-RK Computer Based Systems LLC, Serbia); Nikola Špirić (Faculty of Technical Sciences, University of Novi Sad, Serbia); Nemanja Nikolic and Vladimir Nesic (RT-RK, Serbia)

Nowadays the consumer electronics market is changing in such a way of making set-top box devices with more features in smaller time frames. Meanwhile, in parallel, advanced multimedia operating systems appearing containing abstraction of basic media components, like demultiplexer, decoder and digital right management plugins. Basic media components must be implemented by vendors, to make their device certificated. This paper presents a solution of generic digital television middleware which instead of traditional approach implementing hardware abstraction layer and connecting middleware to low level drivers, reuses media components from the system, skips the porting phase and thus allows to build the final product in less time. In this paper, two approaches to accomplish this goal are presented and compared.

10:55 Android permission system and user privacy- A review of concept and approaches 153

Asma Khatoun (National University of Ireland Galway, Ireland); Peter Corcoran (National University of Ireland, Galway & National University of Ireland Galway, Ireland)

Use of smartphones in our everyday life has become widely popular. A large proportion of smartphones use Android OS, which supports third party software development, so there is increasing number of developers developing applications for the android platform. But this means there are significant privacy risks associated with the use of android based smartphone applications. In this paper the process through which different apps gain access to sensitive device permissions when installed on an android devices is studied. More specifically we emphasize the difficulty for the user to understand how different device permissions can affect its privacy. The context and use-case for each permission affects its impact and when multiple permissions are granted determining the potential impact on the privacy of users becomes a much more complex problem. In this work we quantify the potential impact of the most important individual permissions and take some first steps towards an evaluation of privacy impact of multiple device permissions. It is also noted that many 'free' apps tend to request unnecessary or redundant permissions, often with the aim to gather valuable user data. This is discussed and some strategies to discourage such permission requesting are outlined. Some ideas for further development of this research are provided in the concluding discussion.

11:15 Evaluation of Required Adjustments for HDR Displays under Domestic Ambient Conditions 159

Simon Thompson, Katy C Noland and Manish Pindoria (BBC, United Kingdom (Great Britain))

In this paper, the authors present results of subjective experiments undertaken at BBC R&D. The results show that it is possible to simply adjust the system gamma (γ) of a Hybrid Log-Gamma High Dynamic Range (HDR) television display to perceptually match images shown on a screen in a non-reference viewing environment to those shown on the same screen in a reference viewing environment.

Tuesday, September 5, 12:00 - 13:30

Keynotes 3 & 4

Room: Berlin 1

Chair: Milan Z. Bjelica (University of Novi Sad, Serbia)

12:00 Artificial Intelligence: Mysteries of Emotions N/A

Timothy Llewellynn (nViso, Switzerland)
Artificial Intelligence: Mysteries of Emotions

12:45 How Brands Keep Up With Today's Connectivity N/A

John Beckett (ChannelSight, Ireland)
John will speak on how Artificial Intelligence (AI) is driving e-commerce innovations of the world's biggest brands to increase digitally influenced sales both online and offline.

Tuesday, September 5, 13:30 - 14:30

Lunch & IFA Next Tour

Room: Break Area

Tuesday, September 5, 14:30 - 15:15

Keynote 5

Room: Berlin 1

Chair: Lucio Ciabtoni (Universita' Politecnica delle Marche, Italy)

14:30 From Requirements Engineering to Self-Adaptive Personalization N/A

Samuel Fricker (Blekinge Institute of Technology, Sweden)

40 years ago, software engineers came to the insight that the most difficult thing is not how to build a system but to decide what thing to build. Still today, many products seem to fail on the last mile because of a lack of acceptance and trust by the users. In this talk, we explore the history of requirements engineering with anecdotes that reflect the succession of the engineers' fundamental beliefs of how the social-technological alignment problem may be solved. The feedback loop from users to the engineers will be accompanying us on this journey. The talk ends with an invitation to collaborate on emerging technologies that make feedback immediate and let systems self-adapt.

Tuesday, September 5, 15:20 - 16:40

Automotive solutions

Room: Berlin 1

Chair: Lee Stogner (IEEE, USA)

15:20 Interface checks of the automotive embedded software components 163

Srdan Popić (University of Novi Sad & RT-RK Institute, Bosnia and Herzegovina); Marko Vulić (RT-RK Institute for Computer Based Systems, Bosnia and Herzegovina); Ivan Velikic (RT-RK, Serbia)

Process of detailed testing and verification of all automotive embedded software components generates detailed reports about each segment of tested electronic control units (ECU). The very first group of tests in this process is Acceptance tests, and one of the most important tests in this stage of testing and verification is interface check of the software component. The interface check must ensure that software component implements all necessary interfaces, and doing so, not to use any unnecessary library functions and interfaces. This paper proposes the technique for the interface check of the AUTOSAR software components and reveals potential benefits of this process.

15:40 Tool-Supported Design Space Exploration of a Processor System for SIFT-Feature Detection 168

Julian Hartig and Guillermo Paya-Vaya (Leibniz Universität Hannover, Germany); Holger Blume (Leibniz Universitaet Hannover, Germany)

This paper presents a tool-supported flow for exploring the design space of an FPGA-based application, which is the Scale-Invariant Feature Transform (SIFT), a common image feature detection algorithm used as key component in computer vision tasks such as advanced driver assistance systems (ADAS). The proposed system is based on a dedicated hardware accelerator tightly coupled to a soft-core VLIW processor. Starting with a parameterizable implementation and measurements taken in emulation, empirical models of the design space are created. After that, an optimization algorithm identifies optimal design alternatives as basis for trade-off analysis.

16:00 Video Processing for Virtual Cockpit over 5G Networks 170

Marijana Molnar and Damir Becirbasic (University of Novi Sad, Faculty of Technical Sciences, Serbia); Zeljko Lukac (RT-RK Institute for Computer Based Systems, Serbia); Dragan Samardzija (Nokia Bell Labs, USA)

Autonomous driving is the next breakthrough in automotive industry. Although the current achievements are very promising we still envision applications in which a certain level of assistance from the remote operator would be required. The goal of the project is to realize a semi-autonomous driving platform prototype with low-latency control/command channel to the operator over the 5G wireless network. The main operational mode of the vehicle is autonomous and in a certain situation the vehicle will transfer control to the remote operator. In order to control the vehicle in the real time, the remote operator should have a live video stream from the vehicle with limited bandwidth and ultra-reliable low-latency communication link in both directions.

Room: Berlin 2

Chair: Ratko Grbić (University of Osijek, Faculty of Electrical Engineering, Croatia)

15:20 Integration of EBU-TT-D subtitles in HbbTV surrounding 173

Mario Hrbak (RT-RK, Croatia); Marijan Herceg (Faculty of Electrical Engineering, Croatia); Dejan Stefanovic (RT-RK, Serbia); Nemanja Fimic (Faculty of Technical Sciences, University of Novi Sad & RT-RK Institute for Computer-Based Systems, Serbia)

In this paper, the design and implementation of European Broadcasting Union Timed Text part 'D' (EBU-TT-D) subtitles interpreter, based on eXtensible Markup Language (XML), is presented. The design is realized using web technologies HyperText Markup Language (HTML), Cascading Style Sheets (CSS), while implementation is performed with JavaScript programming language, which allows its easy integration with different HTML5 video players. In summary, the proposed solution parses and displays XML subtitles in the video player. Targeted platforms, for the proposed solution, are all platforms that have support for different web browsers.

15:40 Hybrid Electronic Program Guide Application for Digital TV Receiver 177

Dražen Grbić (RT-RK Institute for Computer Based Systems Osijek, Croatia); Mario Vranjes (University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology, Croatia); Branimir Kovacevic and Milena Milosevic (RT-RK Computer Based Systems LLC, Serbia)

Hybrid broadcast-broadband TV (HbbTV) is a global initiative that brings new solutions to world of digital television (DTV) in terms of entertainment. In comparison to previous initiatives, different services are additionally provided in HbbTV. This paper describes an application for displaying of hybrid Electronic Program Guide (EPG) for a digital TV receiver. The application works with and without Internet connection which makes it hybrid. If Internet connection is available, Extensible Markup Language (XML) file which contains the data for populating of EPG will be downloaded from remote server and parsed. Otherwise the required data will be parsed from Event Information Table (EIT) which can be found in MPEG transport stream (TS). Graphics and graphical elements are supported by DirectFB library and downloading of files from the server is implemented using thttpd server and cURL library. The application is modular and consists the following modules: main module, module for parsing of Service Information (SI) and Program-specific information (PSI) tables, module for graphics, module for handling of input from remote controller, module for downloading of the XML file from the server and module for parsing of the XML file to get data required for EPG. By pressing the EPG button on remote controller, the EPG dialog with current TV show will be shown on the screen. The solution proposed in this paper combines different technologies in order to provide robust application for end user.

16:00 Flexible multimedia player architecture for embedded systems 181

Darko Lulic (RT-RK Institute for Computer Based Systems, Novi Ssad, Serbia); Mario Radonjic (RT-RK Computer Based Systems LLC, Serbia)

This paper describes a flexible multimedia stack which provides media content from number of different streaming protocols. The main goal is to facilitate and accelerate integration with different TV and Set Top Box platforms. Presented solution can be used on Android as well as on Linux based systems. Advantages of this solution are unified data flow and processing of media data. It provides elementary stream data to vendor specific APIs independent of streaming protocol. Such approach simplifies integration effort by consisting on single integration API, towards vendor specific decoder APIs. Solution is verified using official HbbTV test suite.

16:20 Realization of Subtitle Support in Hybrid Digital TV Applications 184

Ana Bilandžić (RT-RK Institute for Computer Based Systems Osijek, Croatia); Mario Vranjes (University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology, Croatia); Milena Milosevic and Branimir Kovacevic (RT-RK Computer Based Systems LLC, Serbia)

Hybrid Broadcast Broadband TV (HbbTV) become very popular last few years, because it provides some new services to the users when watching TV. This paper describes the new proposed application for the subtitles support in the hybrid digital TV applications with relatively simple hardware equipment. The subtitle files are downloaded from the server. In case when the respective language is selected, the downloaded subtitle file is parsed and the time that has elapsed from the beginning of the event is calculated so the subtitle is shown just on time. Graphical elements are displayed by DirectFB library and downloading of subtitle files from the server is implemented using thttpd server and cURL library. The application is written in C programming language and consists of main module, module for parsing of service information (SI) and program-specific information (PSI) tables, module for graphics, module for handling inputs from remote controller, module for downloading of the .srt file from the server and module for parsing of the .srt file. Apart from the basic TV utilities, the proposed application offers the selection of the subtitles language to the user. By pressing the SUBT button on remote controller, the subtitle menu is shown on the screen and user can select the appropriate language of subtitles.

Tuesday, September 5, 16:40 - 17:00

Coffee break

Room: Break Area

Tuesday, September 5, 17:00 - 18:20

Consumer networks 1

Room: Berlin 1

Chair: Yao-Liang Chung (National Taiwan Ocean University, Taiwan)

17:00 Complexity Reduction for Consumer Device Compressed Sensing Channel Estimation 189

Kelvin Chelli and Praharsha Sirsi (Saarland University, Germany); Thorsten Herfet (Saarland University & Intel Visual Computing Institute, Germany)

High mobility has become a mandatory consideration in the design and development of wireless communication systems today. It results in a doubly selective or a time-varying multipath channel that is arduous to estimate. Compressed Sensing (CS) schemes like the Rake Matching Pursuit (RMP) algorithm exploit the inherent sparsity in these channels and are often able to resolve the multipath environments into their respective sparse representations, even under the presence of large Doppler shifts. However, the complexity involved is substantial and might imperil practical implementation on resource limited consumer device hardware. We propose a novel low-complexity CS scheme, called as Gradient Rake MP (GRMP) that optimizes the search related to the multipath delays resulting in a complexity that is significantly lower than all CS based channel estimation schemes. Additionally, the results confirm that the Bit Error Rate (BER) performance of GRMP is comparable to that of the more complex RMP algorithm. The dictionary is an imperative requirement of CS schemes and plays a decisive role in the quality of the channel estimate. Often in literature, details regarding the generation of the dictionary and its complexity is ignored and instead a suitable dictionary is assumed to be available at the receiver. This paper investigates the complexity and memory demands associated with the dictionary and presents a novel scheme to build it using the concept of wavelets. The ideas proposed in this paper are targeted towards reducing the complexity associated with the estimation of a doubly selective channel with a goal to enable implementation on consumer hardware. Although implemented for the IEEE 802.11p standard, the proposed ideas are applicable to any Orthogonal Frequency-Division Multiplexing (OFDM) based wireless system that is expected to work in highly mobile environments.

17:20 Simulation-based Performance Prediction for Indoor Optical Wireless Communication System N/A

Daniel Pfefferkorn, Nils Stanislawski and Tobias Stuckenberg (Leibniz Universität Hannover, Germany); Holger Blume (Leibniz Universität Hannover, Germany)

The specific properties of optical wireless communication (OWC) or visible light communication (VLC) systems make them ideal to provide indoor network services complementary to existing Wi-Fi infrastructure. Indoor applications can benefit from these systems' inherent localization capabilities and could this way provide indoor navigation to their users. However, as a considerable number of system parameters are fixed with the lighting infrastructure's installation, performance prediction during the planning phase is essential. This can be achieved with the help of discrete event-based network simulation as shown in this paper. Precise modeling of the physical layer allows capturing of the changing communication channel in dynamic user scenarios and can reveal the corresponding protocol behavior. This is illustrated by means of a case study investigating application level throughput in a virtual hallway scenario. Additionally, the simulation results are compared against measurements performed with real-life OWC system showing very good correspondence.

17:40 An Analytical Task Assignment Model in Wireless Sensor Actor Networks 195

Morteza Okhovvat (Iran University of Science and Technology, Iran); Mohammadreza Kangavari (Iran University of Science & Technology (IUST), Iran); Houman Zarrabi (ITRC & Concordia University, Canada)

In this paper, an analytical model for assigning tasks to the actors is presented. The model is based on queuing networks and tries to minimize the network make-span in wireless sensor and actor networks. To achieve this goal, through a steady state analysis of the proposed model to solve equations and inequalities, the best distribution rates of tasks to the actors is calculated. It is shown that this distribution rate can enhance the total residual energies of the actor nodes, too. Experimental results on a typical scenario have shown the superiority of the proposed model in terms of minimizing makespan and enlargement of residual energies of actors compared to the stochastic allocation of tasks to the actors.

18:00 M2M Home Data Interoperable Management System Based on MQTT 200

Francisco J. Bellido-Outeiriño (University of Córdoba, Spain); Jose-Maria Flores-Arias (University of Córdoba, Spain); Emilio J. Palacios-García (University of Córdoba, Spain); Víctor Pallarés-López (University of Córdoba & Electronics and Electronic Technology Area, Spain); David Matabuena-Gomez-Limon (University of Córdoba, Spain)

Wireless sensors networks (WSN) have an enormous potential for measuring environmental parameters such as those found in building or residential scenarios. The range of available sensors is not only limited temperature, gas, humidity or presence detection, but even power grid analyser can be integrated. This work aims to develop a Home energy management system (HEMS) for a residential scenario or nanogrid. Inside this nanogrid and using short term power availability together with demand response (DR) techniques, the system will be able to control and schedule the main domestic loads such as HVAC systems, white goods or lighting among others. The control system is designed following the latest M2M communication trends and standards defined by the oneM2M consortium. Thus, a first approach to the Message Queue Telemetry Transport (MQTT) protocol is presented as a means of developing a smart home appliances control using devices with limited resources.

Digital TV systems

Room: Berlin 2

Chair: Mario Vranjes (University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology, Croatia)

17:00 Verification of devices synchronization in HbbTV systems 203

Zvonimir Ivešić (RT-RK Institute for Computer Based Systems, Croatia); Ratko Grbić (University of Osijek, Faculty of Electrical Engineering, Croatia); Dejan Stefanovic (RT-RK, Serbia); Zvonimir Kaprocki (RT-RK Institute for Computer Based Systems, Serbia)

Hybrid Broadcast Broadband TV (HbbTV) is an industry standard for hybrid multimedia devices that are able to combine broadcast and IPTV delivery. This paper deals with companion screen devices, companion screen applications and communication of those applications with HbbTV terminal and its applications. Companion screen devices offer additional content to user and for pleasant experience communication between HbbTV terminal and companion screen devices must work flawlessly. The paper propose design and presents implementation of a framework needed for testing HbbTV device communication capabilities defined in HbbTV 2.0.1. specification. The usage of the framework is demonstrated using a simulated example.

17:20 Protecting Interactive DVB Broadcasts 207

Robert Esterer (Institut für Rundfunktechnik, Germany)

The digitalization of modern television broadcasts makes it possible to provide interactive content to consumers over the air. But the hitherto unsecured nature of such broadcasts combined with the ever-increasing complexity of Smart TV software have created an opportunity for attackers to strike at consumers. DVB has updated the relevant standard to allow broadcasters to secure their services against manipulation and protect consumers from malicious content. This paper is intended to provide background information on the threat that made this new standard necessary as well as introduce the core concepts of the standard and provide relevant references for further reading. The author has been part of the standardization effort at DVB.

17:40 System for DASH support verification in HbbTV environment 212

Nemanja Nikić (RT-RK, Croatia); Marijan Herceg (Faculty of Electrical Engineering, Croatia); Vukota Pekovic (RT-RK d.o.o., Serbia); Nenad Soskic (Faculty of Technical Sciences, University of Novi Sad, Serbia)

Due to the diversity in today's communication networks, adaptability is one of the key requirements in developing of a quality multimedia streaming client. In this paper, a system for verification of Hybrid Broadcast Broadband TV (HbbTV) standard, with special emphasis on the Moving Picture Experts Group Dynamic Adaptive Streaming over Hypertext Transfer Protocol (MPEG-DASH) functionality, is given. System functionality was tested by using of developed JavaScript DASH player, which structure is described in this paper. Player was developed to verify the adequate DASH content support, by using HbbTV application interface (API), in accordance with the testing rules defined by HbbTV.

18:00 Design and Verification of the Procedure for Interoperability between Video Surveillance Systems 217

Dongchil Kim (Korea Electronics Techonlogy Institute (KETI), Korea); Sungjoo Park (KETI, Korea)

This paper proposes a design of the procedure for interoperability between video surveillance systems and verifies whether these systems are interworked according to the designed interworking procedures. In order to verify the interworking procedure of video surveillance systems, we implemented interoperability verification monitoring system. Through implementation results, we prove that video surveillance systems are well interworked based on designed interoperability procedures.

Tuesday, September 5, 20:00 - 22:00

Gala dinner

Room: Outside

Wednesday, September 6

Wednesday, September 6, 08:30 - 09:00

Registration

Rooms: Berlin 1, Berlin 2, Break Area

Wednesday, September 6, 09:00 - 10:20

User monitoring

Room: Berlin 1

Chair: Marija Antic (RT-RK, Serbia)

09:00 An Unobtrusive Wi-Fi System For Human Monitoring 219

Marco Bassoli, [Valentina Bianchi](#), Ilaria De Munari and Paolo Ciampolini (Università di Parma)

Human monitoring is important in a wide range of applications and, most notably, in health management. Within the Active and Assisted Living (AAL) framework, human monitoring techniques have particular relevance: among AAL purposes, is that of applying ambient intelligence paradigm to enable older adults or people with specific demands to live longer and independently in their homes, reducing the need of institutionalization. Sensors are used to track some features of daily living activities, which are then processed to infer health-relevant information. When dealing with the home environment, cost, intrusiveness and ease of installation and management are of the utmost importance: wireless sensors are therefore often used, and cloud-based service can be exploited to reduce the need for home-based hardware devices, this matching the increasingly widespread Internet of Things (IoT) paradigm. Wireless sensor connectivity may rely upon different standards and protocols: most frequently, WSN (wireless sensor network) dedicated protocols are exploited (e.g. ZigBee, Z-Wave) taking advantage of optimization toward low data-rate, low power features. However, ad-hoc deployment of such networks is required, which may result in expensive and burdening installation and management tasks. In this paper, we present a complete Wi-Fi based solution (named CARDEA Wi-Fi), in which sensors specifically designed for human monitoring purposes are straightforwardly connected to the internet cloud by exploiting the Wi-Fi communication protocol (universally diffused for home connectivity), without the need of local gateway devices (except for a Wi-Fi modem router). This results in lightweight installation and management procedures, leading to a "plug and play" approach, which is particularly appealing when interacting with persons having low or no technical skill. The CARDEA Wi-Fi architecture is discussed, and the implementation of a set of "behavioral" sensors is described. Preliminary figures about performance are also given, with particular reference to battery lifetime.

09:20 Feasibility of using a smart unobtrusive wearable system for the autonomic characterisation of endurance trail runners 224

Alessandro Tonacci, Francesco Sansone, Roberta La Spina and Lucia Billeci (Institute of Clinical Physiology (IFC) National Research Council of Italy (CNR), Italy); Claudio Domenici (Istituto di Fisiologia Clinica - CNR, Italy); Raffaele Conte (Institute of Clinical Physiology (IFC) National Research Council of Italy (CNR), Italy); Simona Mrakic-Sposta (Institute of Bioimaging and Molecular Physiology, National Research Council, Italy); Guido Giardini (Mountain Medicine Center, Valle D'Aosta Regional Hospital Umberto Parini, Italy); Lorenza Pratali (Institute of Clinical Physiology (IFC) National Research Council of Italy (CNR), Italy)

Wearable sensors currently represent a non-invasive way of monitoring health-related parameters, quite useful for both self-assessment and naturalistic studies. The autonomic imbalance experienced by athletes engaged in strenuous physical exercises could be also seen through this minimally obtrusive approach, possibly opening the field to a variety of novel investigations. Here, 41 athletes, taking part to two of the most strenuous ultra-trail competitions in Europe were assessed in terms of autonomic evaluation before, during and after the race, through a minimally invasive ECG system based on a fitness-like chest strap. Results showed an increased sympathetic activity both before and after the race, whereas vagal tone appeared increased during the race. Having proven the good feasibility of the proposed approach in such field, further investigations are needed to clarify the scientific basis explaining such modifications.

09:40 Towards EEG-Based Eye-Tracking for Interaction Design in Head-Mounted Devices 227

[Marc Dietrich](#) and Götz Winterfeldt (Deggendorf Institute of Technology, Germany); Sebastian von Mammen (Julius Maximilian University of Würzburg, Germany)

Augmented Reality (AR), Mixed Reality (MR) and Virtual Reality (VR) have an increasing impact on our daily lives. They improve worker's performance in industry and medicine. In addition gaming and entertainment profit from these innovations. Their devices are often head-mounted. New intuitive interaction methods must be developed to control application, because conventional input devices such as keyboards, touch screens or classical touch pads cannot be used. This paper introduces electroencephalographic (EEG) eye-tracking as an additional interaction channel. Ocular artefacts (EOG) in the EEG signal are used to detect eye positions. A Brain-Computer Interface (BCI) is used to capture the data. Data is processed and EOG artefacts are extracted to compute the position of the pupil. The first test runs confirm that ocular artefacts in the EEG signal are strongly correlated with the position of the pupils. Extreme positions of the pupils (horizontal left, horizontal right, vertical up and vertical down) can be detected with high accuracy (person-related true-positive-rate of up to 96,6%). In further steps the direction and speed of eye movement will be successively refined and their usage tested in real-time.

10:00 Hierarchical Search of Optimal Limbus Circle Matching for Gaze Tracking Systems 233

[Wen-Chung Kao](#) and Yi-Chin Chiu (National Taiwan Normal University, Taiwan)

The core technology of visible light gaze tracking (VLGT) system is the determination of iris contour (limbus circle) on the eye image. In this paper, we proposed a hierarchical search scheme for the matching between the ellipse models and the iris contour on the eye image. The experimental results show the proposed hierarchical search scheme efficiently matches the rotational models of human eyes with the limbus circle on an input image.

Automotive solutions

Room: Berlin 2

Chair: Angelos Amanatiadis (Democritus University of Thrace, Greece)

09:00 Experience from Porting Complex Algorithms on Heterogeneous Multi-Core Systems 235

[Marko Gostovic](#) (Faculty of Technical Sciences, Serbia); Milos Pranjic (University of Novi Sad, Serbia); Ognjen Kocic (RT-RK, Serbia); Tomislav Maruna (RT-RK Computer Based Systems LLC, Serbia)

Advanced Driving Assistance Systems (ADAS) are intended to improve driving safety, so they have to process large amount of data within real time constraints. To achieve the satisfying execution speed, data processing is scheduled to multiple

processing units. Multi-core systems are widely used to increase the execution speed of a set of programs. Besides, some of those programs can be realized as a set of tasks. ADAS algorithms that run on a multi-core system-on-chip (SoC) are decomposed to multiple modules in order to support the parallelism of complex data processing. This paper presents an experience from distributing algorithm modules to processing elements (PEs) with various architectures. Each algorithm module runs as a task on a processor core which has the most appropriate architecture for that kind of work.

09:20 An Electromagnetic Energy Harvester with Self-Generator and Energy Storage UPS System for Bicycle Warning Lighting N/A

Shun-Yu Chan (Cheng Shiu University, Taiwan); Yong-Nong Chang (National Formosa University, Taiwan); Hung-Liang Cheng (I-Shou University, Taiwan); Lin-Hsuan Huang (National Formosa University, Taiwan); Hau-Chen Yen (Far East University, Taiwan)

In this study, an electromagnetic energy harvester with self-generator and energy storage UPS system for bicycle warning lighting is proposed with no battery required. The circuit topology comprised electromagnetic kinetic energy harvester, LEDs, energy storage device-ultra capacitor, and voltage boost controller IC. Indeed, the proposed circuit is featured with:(1) employing induction generator to harvest vibration energy to power LEDs lighting with no extra power supply;(2) making use of ultra-capacitor instead of battery to store energy and combining voltage booster IC controller to constitute a UPS lighting set;(3)using a full-wave rectifier to rectify the collected AC induced voltage from the generator and shortening the charging time by promoting the charging efficiency of the ultra-capacitor;(4)powering the LEDs incessantly from the energy on the storage device when bike rider stops intermittently, thus ensuring the safety of riders.

09:40 Personalized One-day Travel with Multi-Nearby-Landmark Recommendation 239

Siya Bao (Waseda University, Japan); Masao Yanagisawa and Nozomu Togawa (Waseda University, Japan)

This paper proposes a personalized travel recommendation algorithm with time planning. We use landmark categorization and region clustering to obtain effective elements. Our proposed algorithm has better performances in terms of the landmark recommendation precision and time planning compared with other conventional algorithms.

10:00 System for Automotive Machine Vision 243

Natasa Perkovic and Milos Pranjic (University of Novi Sad, Serbia); Igor Kolak (RT-RK Institute for Computer Based Systems, Bosnia and Herzegovina); Gordana Velikić (RTRK Computer Based Systems LLC, Serbia)

The advanced driver assistance systems (ADAS) are becoming widely used in automobile industry. Each new generation of ADAS require more complex hardware platform. Analysis of contemporary ADAS systems and their requirements is given in this paper. A platform that satisfies all identified requirement is presented.

Wednesday, September 6, 10:20 - 10:50

Coffee break / Poster session 2

Rooms: Berlin 1, Berlin 2, Break Area

Chair: Tobias Lange (Saarland University, Germany)

Design of a Hybrid Multi-Occupant Visitor Communication and Door Control System 246

Anthony O.T Adeyemi-Ejeye (University of Surrey, United Kingdom (Great Britain)); Mujtaba Mehdi, Maria G. Martini, Nada Y Philip and James Matthew Orwell (Kingston University, United Kingdom (Great Britain))

Door phone systems, allowing occupants of a building communicate with visitors at the door, have evolved over the years, with the current advancements being a fully internet protocol (IP) based solution. In order to adopt newer IP based solutions, current analogue systems can be replaced, yet this may be costly and cumbersome, especially in a multi-occupant buildings. We therefore propose an architecture which supports current analogue door phone systems and also provides IP based functionality. We have implemented the proposed architecture based on SIP, WebRTC and an IoT gateway system connected to the multi-occupant conventional video door phone system.

Consumer Electronic for Practical Fall Prediction N/A

William Engel and Wei Ding (Florida Polytechnic University, USA)

The growing elderly population has inspired a great deal of research in the prevention of fall injuries common among geriatric patients. A convenient and accurate technique to predict fall incidence, along with a matching mobile app, is proposed in this paper. The technique combines the benefits of both traditional paradigms in fall prediction, namely medical history based paradigm and non-historical paradigm. The app analyzes single leg motion to predict if the carrying individual is about to fall with a desirable time range of alert period, not too long like in the medical history based paradigm, not too short like in the non-historical paradigm. Furthermore, this approach utilizes leg motion instead of torso motion to gain considerable longer alert time. This fall prediction technique will be a perfect fit into a real time automated system for fall prevention.

Challenges of Integrating Smart Home Automation with Cloud Based Voice Recognition Systems 248

Milica Matic (University of Novi Sad, Serbia); Igor Stefanovic (Oblo Living, Serbia); Una Radosavac (OBLO Living, Serbia); Milan Vidakovic (University of Novi Sad - Faculty of Technical Sciences, Serbia)

In this paper we discuss the possibility of using available cloud based voice recognition services, to enable voice control in

the smart home automation system. We identify possible architectures, depending on the voice recognition service API. We implement two of the proposed architectures, and compare them in terms of the performance and development cost.

Modelling and Hardware-In-the-Loop Simulation for Energy Management in Induction Cooktops 250

Mariorosario Prist, Emanuele Pallotta, [Andrea Monteriù](#), Sauro Longhi, Paolo Cicconi, Anna Costanza Russo and Michele Germani (Università Politecnica delle Marche, Italy)

Induction cooktops are very efficient systems, but, their energy consumption should be reduced using a temperature controller for optimizing the electrical power. Such controllers are already widely spread in several applications (air conditioning, ovens, etc.). Induction cooktops work with discrete levels of power, and, therefore, the user can select and modify the requested power level during the cooking. This paper presents the Hardware-In-the-Loop simulation to develop an active temperature controller, which optimizes the energy management of the water boiling using an induction cooktop. A thermal and induction model has been developed in MATLAB/Simulink® framework, while a discrete PID controller has been implemented inside a physical ATMEGA processor and tested within the Hardware-In-the-Loop platform.

Radio over Internet Protocol Transmission in Optic based Cable TV Networks 252

[Joon-Young Jung](#), Dong-Joon Choi and Heung Mook Kim (ETRI, Korea)

This paper presents a method named RoIP (Radio over Internet Protocol) for converting an analog upstream radio frequency signal to a digitized signal and transmitting the digitized signal via an internet protocol in an optic based cable TV network. RoIP allows cable operators to begin installing PONs today while keeping their investment in set-top-boxes, cable modems, and back-office systems.

Coupling of HbbTV test system with automatic testing subsystem 254

Marko Plenkovic (RT-RK, Croatia); [Marijan Herceg](#) (Faculty of Electrical Engineering, Croatia); Sebastian Novak (RT-RK Computer Based Systems LLC, Serbia); Vukota Pekovic (RT-RK d.o.o., Serbia)

In this paper, a hybrid broadcast broadband TV (HbbTV) test system with the automatic testing subsystem is proposed. The proposed system is based on Node.js framework with SQLite database on the backend side and Polymer framework on the front end side. The paper covers basic testing methodology and design process with emphasis on the implementation and testing.

IEEE 802.11ac wireless delivery of 4kUHD video: The impact of packet loss 258

Anthony O.T Adeyemi-Ejeye (University of Surrey, United Kingdom (Great Britain)); Mohammed Alreshoodi (Qassim University, Saudi Arabia); Laith A Al-Jobouri, Martin Fleury and John Woods (University of Essex, United Kingdom (Great Britain)); [Mujtaba Mehdi](#) (Kingston University, United Kingdom (Great Britain))

This paper examines the 4kUHD video quality from streaming over an IEEE 802.11ac wireless channel, given measured levels of packet loss. Findings suggest that there is a strong content dependency to loss impact upon video quality but that, for short-range transmission, the quality is acceptable, making 4kUHD feasible on head-mounted displays.

A novel approach for performing measurements in diagnostic images on a mobile-based App for the training of professionals 260

Elisa Fonsa, Francesco Sansone, Andrea Grande, Alessandro Tonacci, Francesco Napoli, Anna Paola Pala, Roberto Guarino, Patrizia Landi, Mauro Raciti and [Raffaele Conte](#) (Institute of Clinical Physiology (IFC) National Research Council of Italy (CNR), Italy)

Mobile Apps are deeply entering in daily lives and could be also used for e-learning/e-training purpose. The realisation of a Mobile App, designed for iOS, would allow a wide spread of such tools, even among the medical community. However, several key points should be faced to build up a reliable product for this purpose, among which the implementation of accurate, reproducible methods to perform measurements on biomedical images. To this extent, a new approach for computing distances on biomedical images was developed and the results obtained with this approach were comparable to the ones achieved with more complex systems. Such result could foster the implementation of more complex functions and Apps devoted to healthcare professionals in various fields.

Wednesday, September 6, 10:50 - 12:50

User Experience & HMI

Room: Berlin 1

Chair: Eugenie Grinenko (Saint Petersburg State University of Film and Television, Russia)

10:50 Implementation of Voice Control Interface for Smart Home Automation System 263

[Suncica Milivojsa](#) (Oblo Living, Serbia); Sandra Ivanovic and Tatjana Eric (University of Novi Sad, Serbia); Marija Antic (RT-RK, Serbia); Nikola Smiljkovic (RT-RK, Computer Based Systems, Serbia)

In this paper, we implement a voice command interface for smart home automation systems. The proposed interface defines command patterns, which can be easily mapped to specific devices, device functionalities and device locations. Also, the control of devices in a group is supported. The proposed voice command interface is implemented in way that supports various voice recognition engines.

11:10 Motion UI: Motion-based User Interface for Movable Wrist-worn Devices 265

Saet-Byeol Yu, [Hyoseok Yoon](#), Se-Ho Park and Kyung-Taek Lee (Korea Electronics Technology Institute, Korea)

A general use of today's consumer wearable devices in real life is constrained due to a small or no touchscreen integrated in smartwatches and fitness trackers. In this paper, we propose a motion-based user interface using built-in 6-axis sensor, where a user can express four directional inputs by tapping the body of movable wrist-worn device. We present concept and design of this UI, followed by an implementation on a commercial smartwatch to demonstrate an enabling and Human-Computer Interaction enhancement to consumer wearable devices.

11:30 On the improvements of fast user interactivity in consumer electronic devices using Linux 267

[SungKyo Oh](#) (Samsung Electronics Co., Ltd, Korea); [Cheulhee Hahm](#) (Samsung Electronics, Korea); [Bongwon Seo](#) and [Jaegil Lee](#) (Samsung Electronics Co., Ltd, Korea); [Taeyoung Lee](#) (Samsung Electronics. Co., Ltd, Korea)

In this paper, we present an improvement technique and a measurement method for fast user interactivity in consumer electronic devices using Linux OS. The proposed technique is to apply real time policy to dynamic boosting [1], and the proposed measurement method is to use a repetitive measurement to evaluate user's continuous fast user response. Experimental results show that the proposed technique gives 34% better performance in an application launching time and shows stable fast channel change response in terms of repetitive measurements compared with the conventional ones.

11:50 Implementation of the Wake Word for Smart Home Automation System 271

[Igor Stefanovic](#) (Oblo Living, Serbia); [Eleonora Nan](#) (University of Novi Sad, Serbia); [Boris Radin](#) (Faculty of Technical Sciences, University of Novi Sad, Serbia)

As part of the voice command system for the existing smart home automation solution, we want to build the wake word module. This module should continuously listen and process the sounds from the environment, in order to detect the pre-defined wake word. Once the wake word is pronounced by the user, wake word module should trigger the actual voice command processing, which will result in the action within the home automation system. In this paper, we evaluate the possibility of using some of the existing offline speech recognition engines for this purpose. We analyze their accuracy and performance, and set guidelines for the future work.

12:10 An User-Centered approach to design Smart Systems for people with dementia 273

[Luca Giraldi](#), [Silvia Ceccacci](#) and [Andrea Generosi](#) (Polytechnic of Marche, Italy); [Maura Mengoni](#) (Università Politecnica delle Marche, Italy)

This study describes an User-Centered approach to design an User Interface (UI) to support daily activities of people with dementia. Such interface is the main hub of a home automation system able to monitor the house and reminds to the users some information when they approach the door to leave the home. In order to involve end users in UI evaluation at the end of the first stage of the design process, a specific experimental protocol, based on task analysis, structural interview, and behavioral observation, is defined. It allows to evaluate user-machine interaction considering aspects related to both adequacy of product feature and user's subjective opinion and behavior. A disposable high fidelity prototype of the UI is realized by using a touch screen tablet. Two tests, respectively dedicated to verify the adequacy of the icons and the understandability of the interface, are performed. A total of 20 subjects with different MMSE score are involved. Results show that people with low and medium dementia are able to understand and use the touch interface and provide some suggestion about how the GUI can be improved. Finally, some approaches to support the future development activities and the next usability tests are discussed.

12:30 Evaluation of MPTCP Congestion Control for DASH 279

[Shadi Bikas](#), [Cihat Cetinkaya](#) and [Muge Sayit](#) (Ege University, Turkey)

Dynamic Adaptive HTTP Streaming (DASH) is a popular MPEG standard. In DASH systems, the clients adapt quality based on the observed network and internal parameters in order to achieve high Quality of Experience (QoE). The throughput of Internet applications can be increased if the underlying transport protocol utilizes the network conditions by using multiple end-to-end connections. MPTCP is a recent technology that allows clients to open multiple TCP connection without requiring a change in the client software. In this paper, we investigate the performance of MPTCP when DASH clients use this protocol. The experimental results show that QoE achieved by the clients significantly changes due to congestion control algorithm that MPTCP uses.

Wednesday, September 6, 10:50 - 12:30

Tutorial session

Room: Berlin 2

Chair: Milena Milosevic (RT-RK Computer Based Systems LLC, Serbia)

10:50 5G Wireless Radio Access N/A

[Dragan Samardzija](#) (Bell Labs, Nokia, USA)

The goal of this tutorial is to present up-to-date information on the 5G new-radio (NR) access technology and the corresponding 3GPP standards. We will present technical details on massive MIMO, cmWave/mmWave access, massive machine-type communications (mMTC) and ultra-reliable low-latency communications (URLLC). A number of novel use-cases and the corresponding requirements such as throughput, reliability and latency will be considered. In addition to enhanced mobile broadband (eMBB) we will focus on IoT and cyber-physical systems in different industrial and automotive

applications. Radio-access solutions that lead to meeting those application requirements, types of spectrum, system capacity and deployment analysis will be presented. We will argue in which situations the existing technologies such as LTE, NB-IoT and WiFi would suffice and when the 5G new-radio is needed. Furthermore, the conventional versus dynamic edge-cloud architectures will be considered.

Wednesday, September 6, 13:00 - 13:20

Closing remarks & Awards

Room: Berlin 1