



# ZINC

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# GALVANIZE

# THE

# FUTURE



MAY 30-31, 2018



## SCHEDULE

Time	A1	B1	R1	R2	Exibiton Area	Caffe	Dinner Venue	Outside
<b>Wednesday, May 30</b>								
08:30-18:00					Registration			
10:00-16:30								Audi Demonstration
90:30-17:00					Technology Demonstrations			
09:00-19:00			Hackaton: Let the Intelligence Fly!					
09:00-10:15	Tutorial: Different Communication Styles	Galvanizing Science and Education Tools						
10:15-10:45	Madness session (by invitation only)					Coffee break		
10:45-11:25	Keynote: Nicole Beringer - Artificial intelligence for automated driving - how neural networks and robotics change the embedded software development	Galvanizing User Experience and HMI						
11:30-12:10	Keynote: Samuel Fricker - Data >< Intelligence							
14:00-18:00				Tutorial: Towards Secure Things, or How to Verify IoT Software with Framac				
12:15-13:00	Opening Session: Let the ZINC begin							
13:00-14:00						Lunch		
13:30-15:00		Panel discussion: Women in Engineering						
14:00-15:45	Open day (Serbian)				Exhibit: The Exciting World of Embedded Platforms & Software			
15:15-16:00		Lecture note (Serbian)						
15:40-16:00						Coffee break		
16:00-16:40	Keynote: Miodrag Termerinac - Per Aspera Ad Astra: MP3 Story							
16:00-17:20		Galvanizing Multidisciplinary Image Processing Applications						
16:45-17:25	Keynote: Moritz Antlanger - Automated Driving Systems - Architectural Trends and Challenges							
17:30-18:30	Galvanizing Driving Assistance Technologies	Lightning talks: Technology Overviews						
20:00-22:00							Dinner	

Time	A1	B1	R1	R2	Exibiton Area	Caffe
<b>Thursday, May 31</b>						
08:03-18:00					Registration	
09:00-10:00	Panel: Women in Engineering	Galvanizing Software Safety and Security				
09:00-17:00			Hackaton: Let the Intelligence Fly!		Technology Demonstrations	
10:00-10:30						Coffee break
10:30-11:10	Keynote: Stefan Mozar - Consumer Electronics invades Healthcare					
10:40-12:00		Galvanizing Smart Spaces				
11:15-12:15	Panel: Custom(er)zing Medical Field					
12:20-13:00	Keynote: Saraju Mohanty - Security and Energy Trade-Offs in Consumer Electronics	Projects Unveiled & Work in Progress				
13:00-14:00					Exhibit	Lunch
14:00-14:30	Madness session					
14:00-15:20		CE in the Making: Hidden Processes				
14:40-15:20	Keynote: Margarita Anastassova - Changing the Future of Interfaces with CEA					
15:20-15:40						Coffee break
15:40-16:20	Keynote: Nahum Gershon - The Internet of Nothing					
15:40-16:50		H2020 Project Overview: Stars of STARR				
16:20-17:10	Panel: What Makes Smart Cities Smart?					
15:50-17:10						Makers
17:15-18:15	Awards & Farewell Until our Roads Meet Again					

## Wednesday, May 30th

**08:30 - 18:00** Registration, Room: Exhibition Area

**09:00 - 10:15** Tutorial: Different communication styles, Room: A1  
GALVANIZING Science and Education Tools, Room: B1

### 09:00 Hybrid and Flexible Computing Architectures for Deep Learning Systems

**Filip Sušac, Toni Birka and Tomislav Matić**

At the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek on the course Digital Electronics students are learning the basics of digital electronics and VHDL with unified embedded engineering learning platform (E2LP). E2LP is designed for teaching embedded computer systems courses and system design courses, and therefore lacks basic digital I/O devices such as 16 switches, RGB LEDs, etc. This paper presents E2LP extension board developed with the aim of adding simple I/O devices to the existing E2LP system. The extension board is successfully tested, and several student examples are given.

**09:15 Supporting Constructivist Learning and Teaching with the Aid of VR-based Consumer Tech: A Case Study**

**Melania Nițu, Maria-Iuliana Dascalu, Sergean Bağış and Constanta-Nicoleta Bodea**

Technology leads to massive changes in the economy, in the way we communicate and relate to each other and in the way we learn. Thus, the classical paradigms of teaching and learning and their corresponding design models can now be supported by consumer tech. This article presents an example of experiential learning, a design model which implements constructivism, using a virtual reality application for computer architecture. The experimental results related to how the students perceive it underline the benefits and challenges brought by this type of application

**09:30 An interactive game for supporting logic circuit design education**

**Igor Rajnpreht, Marija Punt and Zaharije Radivojevic**

In this paper an educational tool for supporting logic circuit design has been presented. The tool is realized as an interactive game to be used on Android mobile devices. The game is showing logical circuit schemas to students and the students are tasked to determine the functionality of the presented schemas. Different schemas can be created by the teachers depending on the material presented in class. The created schemas can be distributed to the students via a centralized portal or students can create their own schemas for self assessment purposes.

**09:45 VR Job Interview Simulator: Where Virtual Reality Meets Artificial Intelligence for Education**

**Iulia Stanica, Maria-Iuliana Dascalu, Constanta-Nicoleta Bodea and Alin Moldoveanu**

Nowadays, people have to face many challenges when going to an interview: introversion, insecurity, lack of technical or social skills. Training becomes highly recommended in order to improve interview performances. The current paper presents VR Job, an application which proposes an innovative way of training for an interview. By combining the advantages of various technologies, such as virtual reality and chatbots, our application creates an interactive way of helping software engineers train for their interviews. Emotion recognition techniques are also included, helping provide accurate feedback for the user.

**10:00 Platform for submitting and reviewing scientific papers using Blockchain technology**

**Maja Vukasovic**

We propose a distributed platform for fast submitting, reviewing and publishing scientific papers. Papers are submitted, reviewed and published through a Blockchain-based system which preserves the reliability of the submitted results and provides non-repudiation of every step in the process. Paper reviewers are being selected among the experts in the scientific field of interest, and remunerated for their work via some crypto-currency. Resources for the remuneration could be provided from technology leaders, headhunting or jobs advertising companies or projects within the specific area paper is related to. In order to provide objectivity and avoid bias in the reviewing process the system also maintains the status of each reviewer's credibility which is verified through papers that reviewer submits and being changed with the number and quality of reviewed papers acknowledge by all the participants in the process. This whole process will create an environment with much shorter paper processing times and higher process transparency.

**09:00 - 17:00 Hackathon, Room: R1**

**Let the intelligence fly!**

**Samuel Fricker and Marcel Wuersch**

Aerotain (<http://www.aerotain.com>) builds interactive drones designed to be used at events. These drones have the capabilities of flying over crowds while providing a live stream of what it sees. The video at the top of this page is a demonstration of our drone today. It contains no intelligence and is manually flown by an operator. Your goal is to come up with ideas to further enhance the drones interaction potential or autonomos flying capacities. How would you like to interact with such a drone? How should it react to your actions? Build new experiences for participants of an event using the tools provided to you, and at the same time help the event to promote itself in the best possible way. Let the intelligence fly!

**09:30 - 17:00 Technology demos, Room: Exhibition Area**

**10:00 - 16:30 AUDI Demonstration, Room: Outside**

**10:15 - 10:45 Coffee break, Room: Caffè**

**10:20 - 10:40 One-minute Madness, Room: A1**

**10:45 - 11:25 Keynote1, Room: A1**

**Artificial intelligence for automated driving - how neural networks and robotics change the embedded software development**

**Nicole Beringer**

Automated driving needs a novel approach to cope with driving scenarios that are currently solved only by the driver's control. The reasons for the driver to take over control vary from limitations of the range of ego sensors or recognition algorithms to required information, e.g. infrastructure information like traffic lights, that cannot be derived from in-vehicle sensor observations. What all have in common is that any reaction, from the driver as well as from a driver assistance feature, needs to be in time. This becomes clear when looking at the range of ego sensors (e.g. LiDAR sensors about 40m ahead). The driver may want to have the speed reduced in advance before a speed sign is reached or be warned in time to take over control if the autonomous driving road ends. It is crystal clear that it needs more than just a high quality in-vehicle sensor processing in order to obtain a wide range of HD information needed for automated driving. To make vehicles react properly in these kinds of situations the classic embedded software development needs support by self-learning algorithms. Our approach combines techniques well established in robotics like Simultaneous Localization And Mapping (SLAM) as well as end-to-end protection and image compression algorithms with big data technology used in a connected car context. This allows to extend the sensor range as well as the sensor availability of a single vehicle. For behavior perception another well-established technique in automatic recognition scenarios enters the game: deep neural networks (DNNs). Although DNNs rely on training data in detection situations, they perform much faster as traditional software. The more samples and the more iterations the DNN gets, the better accuracy is obtained in all classification and detection situations. DNNs also become a good alternative to validate functional safety as well as the safety of the intended functionality. The keynote speech will analyze the different approaches and scenarios of using SLAM and DNN algorithms in automated driving and will give an impression how embedded software development for automated driving benefits from robotics and neural networks.

**10:45 - 12:10 GALVANIZING User Experience and HMI, Room: B1**

**10:45 A Gestures Recognition Based Approach for Human-Robot-Interaction**

**Alessandro Freddi, Marco Goffi, Sauro Longhi, Andrea Monteriù, Davide Ortenzi and Daniele Proietti Pagnotta**

This work proposes a robotic manipulator assistant for disabled users and/or for elderly people with limited motor skills. In detail, the interaction among the robot and the user is based on the user gestures recognition. The user chooses an object among those available by moving his/her arm in a specific pose, which is recognized by using an external camera. Then, images of the objects accessible to the robot are acquired via the robot camera, located at the end of the robot arm, and are analyzed by a Support Vector Machine classifier in order to recognize the user selected object. Finally, the manipulator picks the object and places it on the user's hand, whose location in the Cartesian space is determined via the external camera and updated online.

**11:05 Machine Learning techniques towards Notes Recommendation e-Book System**

**Mohammed Abdel Razek**

In the digital age, the numbers of students accessing e-Book through Smartphone, and Tablet PC has continued to grow. The generated eBook readers contain various levels of navigation, adaptation, a variety of solved exercises, and a social learning. Most of the eBook readers allow readers to add notes; however, they do not allow them to share their notes. In sharing readers' notes, the challenge is that the note is written as short texts that do not provide sufficient word to help in content filtering. On the other hand, the collaborative filtering has very good chance to help in overcome this challenge. This paper discusses a technique to filter notes based on subject, readers' preferences and credibilities.

**11:25 Monitoring Viewer Experience for Digital Terrestrial and Cable Television**

**Ioan Tache**

This paper describes a monitoring solution for the viewer experience on digital terrestrial and cable television. Compared to other systems, the proposed solution uses additional information provided by monitoring also the same television programs broadcasted by satellite, a commonly encountered situation. Also, it can simultaneously monitor all the television programs broadcasted on one terrestrial or cable channel. The viewer experience can be evaluated by monitoring 24/7 a set of parameters measured in key network locations and by correlating their values. It is thus possible to determine the cause that led to a drop in the video quality. Test results are presented for the terrestrial programs of the Romanian National Television.

**11:45 User Behavior Analytics in Virtual Training Environments for Sensory Substitution Devices**

**Daniel Flamaropol, Alin Moldoveanu, Florica Moldoveanu, Maria-Iuliana Dascalu, Iulia Stanica and Ionut Negoii**

Virtual Training Environments (VTE) are crucial for the testing and development of Sensory Substitution Devices (SSD) in a safe, controlled manner. User Analytics serve to collect and analyze user behavior, to provide clear design decisions for improving SSD development and implementation. We implemented an analytics framework capable of tracking user behavior, map real-time paths and aggregate data over multiple nominal testing sessions. Aggregated data is used to reveal patterns of use and match them to individual abilities and user groups.

**11:30 - 12:10 Keynote 2, Room: A1**

**Data >< Intelligence**

**Samuel Fricker**

The industry has started to embrace artificial intelligence (AI) as a technology to build new generations of products and services. AI enables radically new business models and has the potential to disrupt how we are building systems today. In this talk, we show how AI systems are being built today and what the enablers and hurdles are to bring this new technology into widespread use by industry. The talk offers pointers to get started in the construction of AI systems and involved as a member of the European AI community.

**12:00 - 17:00 Tutorial, Room: R2**

**Towards Secure Things, or How to Verify IoT Software with Frama-C**

**Allan Blanchard, Nikolay Kosmatov and Frederic Loulergue**

The technical subject and its importance Among distributed systems, connected devices and services, also referred to as the Internet of Things (IoT), are gaining wider and wider adoption, in both the industry and the everyday life. That means on one side that IoT is being more and more popular in many security critical domains. But also, that in domains that were not necessarily critical, we have devices that can now collect and transmit a lot of personal information. This raises important security challenges. As commonly said, the "S" in IoT stands for "Security": if it is not absent, it is at least unnoticeable. Formal methods have been used successfully for years in highly critical domains, now they can help to bring security into the IoT field. Frama-C is a source code analysis platform that aims at conducting verification of industrial-size programs written in ISO C99 source code. It provides its users with a collection of plug-ins that perform static and dynamic analysis for safety and security critical software. Collaborative verification across cooperating plug-ins is enabled by their integration on top of a shared kernel, and their compliance to a common specification language: ACSL

**12:15 - 13:00 Opening session: Let the ZINC begin, Room: A1**

**13:00 - 14:00 Lunch 1, Room: Caffè**

**13:30 - 15:00 Panel discussion: Women in Engineering (1), Room: B1**

**Women creators in Information Tehnologies**

**Milica Laufer**

MILICA magazine with support of the IEEE Women in Engineering, host two-session panels about interactions and mutual influences between women and information technologies in contemporary society, strongly focusing on the Balkans and Europe. The position of women and the question of gender equality are one of the leading topics in media throughout the world. The breakthrough of women in all spheres of the society is actually happening. The panel is examining the place women hold in IT. In what manner are women appearing as IT users? How do women contribute to the progress of the industry? Those will be the main directions to analyze with guests lecturers who will speak about their experiences in their professional careers in IT. We would especially like to point out the creative use of IT in parenthood, art and women empowerment.

**Impact of Anomalies within TTEthernet Network on Synchronization Protocol: Analysis Using OMNeT++ Simulations**  
**Miladin Sandić, Bogdan Pavković and Nikola Teslić**

The crucial mechanism for deterministic networks like TTEthernet is synchronization. Proper network startup ensures correct synchronization and consequently accurate functioning of the entire network. Since the TTEthernet is a fault tolerant system, it can deal with certain number of faulty devices in a network during startup process. Robustness property is very important in safety-critical systems like modern transportation vehicles. In this paper, a single-fault tolerant configuration of TTEthernet is simulated, where one switch is faulty. For these purposes we used a simulator that we developed in OMNeT++ according to the SAE AS6802 standard. We have simulated several anomalies: Protocol Control Frames (individual and sequences of CS, CA, and IN frames) are sent in critical moments from a port of faulty switch to one of End Systems in the simulated network. The simulations show the negative impact of a faulty switch on a startup time (stepwise increase) of a non-faulty End System.

**Performance Analysis of Protocol Stack for Inter-Processor Ethernet Communication in Automotive Industry**  
**Davor Tomljenović, Ratko Grbić, Željko Lukač and Ilija Bašičević**

In modern cars, Electronic Control Units (ECUs) can have more than one CPU which can exchange data over built-in communication network. Since majority of these ECUs can be categorized as real-time system, special attention should be given to the communication performance between processors. In this paper, analysis of TCP/IP protocol stack for 100 Base-TX Ethernet used for Inter-Processor communication for a specific system on a chip is given. The analysis is performed regarding throughput, goodput and latency from application layer using a test application. On the transport layer UDP was used. The obtained results revealed the impact of the Linux scheduler on the performance of data sending. Apart from that, an optimal packet size was determined by taking into account obtained latency and throughput.

**Integration of CAN Bus Drivers and UDS on Aurix Platform**  
**Stjepan Dekanić, Ratko Grbić, Tomislav Maruna and Igor Kolak**

CAN is communication protocol which is used in automotive industry because of its security and reliability. UDS is a diagnostic communication protocol which enables ECU diagnostics over CAN bus. In this paper, UDS program solution for AURIX platform is proposed. The CAN low level driver is configured for CAN Bus connections upon which UDS program solution is implemented. The implementation of the algorithm is written in ERIKA Enterprise operating system and is run on Infineon Triboard TC297A v1.0 experimental board. The evaluation of the proposed UDS program solution has been done by sending requests by PCAN-USB Pro device and by interpreting the received response.

**Implementation and Optimization of Gateway for Data Routing between CAN and FlexRay protocols**  
**Zlatko Janjić, Marijan Herceg, Ivan Kaštelan and Miodrag Djukić**

In this paper, a gateway for packet manipulation is proposed and optimized. Namely, routing protocols between different communication standards, such as Controller Area Network (CAN) and FlexRay, are essential in automotive industry. The proposed gateway supports several routing scenarios between CAN and FlexRay protocols. The gateway is tested and its performance is analyzed. Additionally, after gateway analysis, the program code has been optimized in order to increase its performances. The results after optimization show significant improvements of proposed gateway performance.

**Two Simple Capacitance Sensing Solutions Microcontroller-Based Measurements**  
**Nadica Miljković and Milan Bjelica**

Thanks to their low cost, modularity, and reusability, measurement systems based on low cost general-purpose microcontrollers are highly attractive solutions for undergraduate courses in electrical measurements and biomedical engineering. This paper describes two such systems developed for capacitance measurement – one relying upon voltage divider and another observing charging/discharging time. The results show that both systems perform well, in spite of their simplicity and modest budget. Positive feedback from undergraduate students with specific comments and proposed improvements is presented. Furthermore, possible healthcare applications of the presented solutions for human activity recognition by wearable capacitive sensors are presented.

**Adaptation and integration of IP stack in AURIX platform with ERIKA RTOS**  
**Josip Babić, Marijan Herceg, Tomislav Maruna and Milena Milošević**

In this paper, the process of lightweight IP stack implementation into an AURIX platform with ERIKA RTOS system has been shown. The system is composed of several hardware and software components and the whole system integration process is explained, as well as the configuration of all its components. In order to validate the proposed implementation, the application with UDP echo server functionality was designed and implemented. Afterward, several tests were done, providing the insight into the system reliability and performance.

**Using bitmask for reservation stations notification in systems with pipelined ALU**  
**Filip J Hadzic, Zaharije Radivojevic and Marija Punt**

This paper deals with optimization of processors with pipeline organization and out of order execution. Two approaches of computer organization were considered. The first approach uses configurable pipelined ALU implemented using lookup tables in order to speed up the processor and to minimize the number of used gates. This implementation enables multiple instructions to be executed at the same time using different lookup tables. The second approach considers notification of reservation stations using bitmasks instead of decoder logic in order to reduce decoding time by increasing the number of used gates. Instead of using the decoded lines for connecting execution units to reservation stations separate lines for each resource have been introduced.

**The FPGA System for Evaluation of UWB Wireless Sensor Network Based on Transmitted Reference Integral Pulse Frequency Modulator**  
**Leon Šneler, Tomislav Matić and Irena Galić**

The paper presents implementation of FPGA system for evaluation of Ultra-Wideband (UWB) wireless sensor network based on transmitted reference integral pulse frequency modulator (IPFM) nodes and demodulator with embedded multi user coding and decoding scheme to provide multiple channel access. The simulation of multiple IPFM modulators and IPFM demodulator is performed in field programmable gate array (FPGA) assuming ideal transmitted pulse reception at the receiver side. The results are obtained by statistical analysis regarding various modulation parameters and number of IPFM modulators sharing the same communication channel.

### **Parallelization of the Mixture of Gaussians Model for Motion Detection on the GPU**

**Petar Kovacev, Marko Mišić and Milo Tomašević**

Motion detection and object tracking have many applications in various domains. Process of motion detection depends on the detailed analysis of pixels of successive frames in the given video scene. Background subtraction techniques are commonly used for this purpose. Nowadays, even the consumer electronic devices, such as cell phones, can produce high definition videos with their cameras. Efficient, real-time analysis of those videos can be performed using modern graphics processing units. In this paper, we present GPU implementation of the mixture of Gaussians model for background subtraction. We observed speedups up to 6 times over the reference sequential implementation.

### **Arduino-Based Non-Contact System for Thermal-Imaging of Electronic Circuits**

**Miljana Milić and Miloš Ljubenović**

This paper presents the development of a custom-made system for thermal imaging of small electronic systems that is developed using Arduino platform and an infrared temperature sensor. The proposed system offers a low-cost solution for laboratory testing of electronic circuits that has good accuracy and flexibility. Experimental results of the suggested prototype show promising performances in comparison to expensive, high quality temperature measurement and thermal imaging solutions.

**14:00 - 15:45**    **Open Day**, Room: A1 (in Serbian)

**15:15 - 15:45**    **Lecture note**, Room: B1 (in Serbian)

**15:40 - 16:00**    **Coffee break**, Room: Caffè

**16:00 - 16:40**    **Keynote 3**, Room: A1

### **Per Aspera Ad Astra: MP3 Story**

**Miodrag Temerinac**

A very efficient digital audio compression method has been developed by Fraunhofer Institute for a worldwide direct satellite radio system called WorldSpace. After the market failure the developed engine, named MP3, triggered a success on Internet music services like iTunes. This story from disaster up to success, sometimes typical for consumer electronics field, is the subject of this keynote.

**16:00 - 17:20**    **GALVANIZING Multidisciplinary Image Processing Applications**, Room: B1

### **16:00 Ulmage Augmentation Techniques for Cascade Model Training**

**Dijana Vitas, Martina Tomic and Matko Burul**

A common way to reduce the computational complexity of a classifier evaluation is to decompose the classifier into a linear sequence, or cascade, of sub-classifiers. Each successive sub-classifier is trained based on the examples that pass all prior stages. Robust training requires collecting various real-world images, marking training samples and discarding images with unsatisfactory samples. Additional training data can be generated from an existing dataset. Image augmentation is the process of taking images and manipulating them in order to create many altered versions of the same image. This provides more images to train on, but can also help expose the classifier to a wider variety of colors and lighting to make a classifier more robust. In this paper the influence of different augmentation methods on traffic light classifiers training is investigated. Some augmentation methods affect sample's color and illuminance characteristics, such as brightness, contrast modifications and color jittering based on principal component analysis. Additionally, noise and blur as well as horizontal flip methods are assessed. Each method is applied to a set of training data and the impact it had on the training process is analyzed. Results are presented in the the of true positive and false positive rate changes obtained when using different augmentation methods in comparison with a non augmented baseline model. Most of the tested methods reduced FP count, but they also resulted in a reduced TP number.

### **16:20 Active Vision for Low Cost SCARA Robots Using RGB-D Camera**

**Petra Djurovic, Ratko Grbić and Robert Cupec**

In this paper, an active vision approach for low cost robots without absolute encoders, relying on visual feedback only is proposed. Lacking absolute encoders, positioning of a robot arm is performed by visual servoing based on detection of a marker mounted close to the end effector. In order to achieve a wide field of view, an RGB-D camera is mounted on a pan-tilt head. Since each change in pan and tilt angles of the camera results in a change in relative positions between the robot reference frame and the camera reference frame, constant hand-eye recalibration is required. Both hand-eye calibration and visual servoing require visibility of the marker in the camera field of view, which is ensured by an active vision strategy. Active vision also includes search for object of interest on the scene. The proposed method is evaluated using a real robot arm in SCARA configuration.

### **16:40 Creating Segmentation Masks for Benchmark in Digital Mammography**

**Mario Mustra**

Computer aided diagnosis (CAD) as a fast-developing area in medical practice relies on a good preprocessing of images. There are two general image acquisition technologies, analog or film based and digital. To be able to use analog images in CAD applications it is necessary to digitize them and preprocess them so satisfy certain standards. Preprocessing steps usually include intensity equalization and segmentation of objects of interest from the background. In this paper a methodology for automatic mask extraction from manually segmented mammograms is proposed. Medical imaging generally relies on accurate segmentation for CAD applications and it is necessary to have a good ground truth images to benchmark the performance of a given segmentation method. The proposed method describes the entire process of mask extraction using both printed and digitized images. In MLO images there are certain key-points which need to be properly detected and segmentation needs to be made according to them. Image alignment process and extraction of the breast tissue and the pectoral muscle from each mammogram available in the mini-MIAS database is proposed.



**17:00 Video transmission artifacts detection using no-reference approach****Mario Vranjes, Marijan Herceg, Denis Vranješ and Denis Vajak**

In real-time (RT) applications that include transmission of digital video, different artifacts (caused by compression and transmission processes) can appear in video received at the end-user side. In order to ensure high level of end-user Quality of Experience (QoE), video application/service providers have to continuously measure and monitor the quality of perceived video. Since in RT video applications uncompressed video is unavailable at the receiver side, artifacts detection as well as video quality assessment (VQA) are often performed using no-reference (NR) approach. In this paper we present a novel NR algorithm that efficiently detect packet loss (PL) artifacts in received video frames, called Packet Loss Detection Algorithm (PLDA). The proposed PLDA operates only on pixel values of the processed video frame and it requires no additional information about processed video. The performance of the proposed PLDA is compared to this of other existing PL detection algorithm on video sequences of significantly different content, in which distinct error concealment methods are used to conceal errors caused by PL. The results show that PLDA outperforms other tested algorithm when detecting PL artifacts in network transmitted video and that it is very robust in terms of different content types and error concealment methods. Additionally, proposed PLDA is capable of processing up to 25 frames per second (fps) of Full HD video in RT and thus it is suitable for usage in RT video transmitting applications.

**16:45 - 17:25 Keynote 4, Room: A1****Automated Driving Systems - Architectural Trends and Challenges****Moritz Antlanger**

While current automated driving systems are already highly complex, the next generation will have to go far beyond this to provide interesting and useful features to consumers. Systems capable of autonomous driving need to solve several major challenges to ensure both safety and availability of their functions. This problem needs to be carefully addressed in the system architecture, before self-driving cars can finally be ready for mass adoption.

**17:30 - 18:30 GALVANIZING Driving Assistance Technologies, Room: A1****17:30 Development of Sensor Fusion Based ADAS Modules in Virtual Environments****Velibor Ilić, Mališa Marijan, Ayhan Mehmed and Moritz Antlanger**

Advanced Driving Assistance Systems (ADAS), like adaptive cruise control, collision avoidance systems, and, ultimately, autonomous driving are increasingly evolving into safety-critical systems. To increase reliability of the system, virtual simulation environments are used during design, development, and validation phases. This paper describes a practical experience and high-level results from the development of ADAS functions in a virtual simulation environment. Two sensor-fusion based ADAS functions have been developed, namely, (i) static obstacle detection and (ii) dynamic object detection and tracking.

**17:50 Virtual Cockpit on Embedded Platform****Ninoslav Jovanov, Milena Milošević, Željko Lukač and Dragan Samardžija**

Autonomous driving is one of the largest trends in the automotive industry. One of the levels of autonomous driving is a semi-autonomous driving, where in addition to the fact that the vehicle has a large number of autonomous systems, the driver can still operate the vehicle. This paper describes the method of using the virtual cockpit to control a car from a remote location. The main idea of the virtual cockpit is that the remote operator has a panoramic view of the vehicle environment, based on real time video streams from cameras which track the environment. In this way, the remote operator has control over the vehicle and can manage it. Special emphasis will be on the implementation of the virtual cockpit on the embedded platform and its performance.

**18:10 Using GANs to Enable Semantic Segmentation of Ranging Sensor Data****Vladimir Lekić and Zdenka Babić**

Ranging sensors are very robust, and due to this fact, they have found a broad applicability in driver assistance, and consequently in autonomous driving systems. On the other hand, they lack precision what makes classification task rather difficult. In this paper we propose a method for semantic segmentation of the ranging sensor data using the generative adversarial networks. Using the fully unsupervised learning algorithm we convert the sensory data to artificial, camera-like, environment images that are further used as input for the state-of-the-art semantic image segmentation algorithms.

**17:30 - 18:30 Lightning talks: Technology Overviews, Room: B1****17:30 From Artificial Intelligence to Augmented Age An Overview****Duško Lukač, Miljana Milić and Jelena Nikolić**

In this work the overview about the development of artificial intelligence to augmented age is presented. In the last 20 years the terminology "Artificial Intelligence", also known as A.I., has been gaining credibility from the common population because of its growing presence and utility in our day to day activities by solving problems. In this paper we define and summarize the history of the A.I. to provide a better understanding the present and future of the same. We engage the terms Machine Learning and Deep Learning which represent our actual technological/knowledge state of the A.I. And finally, we will give a short insight into the terminology and example Augmented Age in the present A.I. technology.

**17:40 Overview of novel protocol design and verification methods****Jelena Vlaović, Drago Zagar and Goran Horvat**

The development process, especially of complex software systems, is a sequence of different steps like conducting project feasibility studies, defining system requirements, prototyping, implementing, testing and verifying the code. The development process usually starts with the definition of several high-level description elements like finite state machines, communication paths, messages, etc. The developers tend to use different validation methods so that the faults in the design are found as early as possible. Previously the development process, verifications and validations were done with informal methods, but for many years now, they are done with formal methods. As opposed to formal methods, the informal methods like informal textual documentation and graphical description techniques have no means to verify consistency of the system design and implementation. Much progress has been made in the development of formal methods for different applications. Formal methods are mathematically-based (formal logic, automata theory, discrete mathematics, proofs) techniques that provide a basis for software development through various steps for specification, design, verification and development of different systems. Formal verification is used to verify if a design of the system satisfies all the requirements and properties listed in requirements. Formal methods ensure cost effective development process which results in reliable, reusable and low-maintenance software. For development process to be most affective, the characteristics of each formal method should be analyzed so that the most suitable method could be selected for every development phase.



**17:50 Modern JavaScript frameworks: A Survey Study****Sanja Delčev and Dražen Drašković**

With the increasing popularity of the web, some new web technologies emerged and introduced dynamic content to web applications, in comparison to HTML, as a static programming language. JavaScript is the language that provided a dynamic web site which actively communicates with users. JavaScript is used in today's web applications as a client script language and on the server side. The JavaScript language supports the Model View Controller architecture that maintains a readable code and clearly separates parts of the program code. The topic of this research is to compare the popular JavaScript frameworks: Angular, Ember, Knockout, Backbone. All four frameworks are based on MVC or similar architecture. In this paper, the advantages and disadvantages of each framework, the impact on application speed, the ways of testing such JS applications and ways to improve code security are presented.

**18:00 Security and Privacy Protocols for IoT networks****Srilatha Pamuri**

Internet of Things IoT is a modern communication paradigm which is a network of physical devices equipped with sensors, actuators connected over internet via wired or wireless network configuration. IoT plays vital role in different domains such as smart home, industrial automation, Environmental monitoring, medical & health care, smart grids, traffic management and many other applications. This paper details about the IoT applications and classification based on related technologies, network types and their protocols in addition to the challenges and security issues that are facing by the IoT implementation.

**18:10 An Overview of the Algorithmic Diagnostics Methodology: A Big Data Approach****Aleksandar Kupusinac and Rade Doroslovački**

Modern medical diagnosis requires the development of algorithms for processing large amounts of data (big data analytics), with numerous complex and unconventional cases, where the analysis with classical statistical methods is usually inapplicable. Methods of machine learning are good solution, since they can learn complex relationships from known data and then apply this knowledge on unknown data. This paper considers methodology of algorithmic diagnosis based on artificial neural networks.

**20:00 - 22:00**     **Dinner, Room: Dinner Venue****Thursday, May 31st****08:30 - 18:00**     **Registration, Room: Exhibition Area****09:00 - 10:00**     **Panel discussion: Women in Engineering (2), Room: A1****Women creative users of Information Tehnologies****Milica Laufer**

MILICA magazine with support of the IEEE Women in Engineering, host two-session panels about interactions and mutual influences between women and information technologies in contemporary society, strongly focusing on the Balkans and Europe. The position of women and the question of gender equality are one of the leading topics in media throughout the world. The breakthrough of women in all spheres of the society is actually happening. The panel is examining the place women hold in IT. In what manner are women appearing as IT users? How do women contribute to the progress of the industry? Those will be the main directions to analyze with guests lecturers who will speak about their experiences in their professional careers in IT. We would especially like to point out the creative use of IT in parenthood, art and women empowerment.

**09:00 - 10:00**     **GALVANIZING Software Safety and Security, Room: B1****09:00 Implementation of SYN Flood Attack Simulator in NS-3****Nikola Blažić, Ilija Bašičević, Miloš Pilipović, Zhaomin Chen and Chai Kiat Yeo**

The paper presents an implementation of support for simulation of SYN Flood DDoS attacks in the NS3 simulator. The software architecture of NS3 is outlined, as well as code changes that were made. The unbalanced dumbbell topology is used in simulation. The simulated DoS attacks are presented visually using diagrams of Shannon entropy time series, calculated on distributions of destination IP addresses. The implementation enables researchers to study methods for detection and mitigation of SYN Flood attacks using NS3 simulator.

**09:20 Recovery from error states during communication based on CAN and FlexRay****Josip Turjak, Ratko Grbić, Danijel Spasojević and Marko Kovačević**

The functionality of a modern car is heavily dependent on proper communication between different Electronic Control Units (ECUs). Errors that may occur during communication between ECUs have to be timely recognized and resolved in the shortest possible time to avoid improper work of the car subsystems, material damage, etc. This paper analyzes ECU error recovery in the case of CAN and FlexRay communication protocols. In order to simulate errors in CAN and FlexRay networks, appropriate functions for error injection were developed. The error recovery ability is evaluated for both protocols on the available Aurix TC 275 development board. While the CAN module has the built-in error recovery function, FlexRay module does not have one, so the appropriate error recovery function is proposed.

**09:40 DDoSSim - System for visual representation of the selected distributed denial of service attacks****Tijana Apostolović, Nevena Stanković, Katarina Milenković and Žarko Stanisavljević**

This paper describes the software system for visual representation of the selected direct and reflected distributed denial of service attacks on the internal and the network resources, which is entitled DDoSSim. The system was designed to enable users to observe the method of operation of typical DDoS attacks through a visual simulation. It is configurable and interactive, thus allowing different scenarios to be predefined, simulated, and also modified during the simulation. After configuration the system plays a scenario in a step by step animation manner, making it possible for users to follow the complete attack. DDoSSim can be used as a teaching aid at the courses covering topics from computer security and/or network security area or to improve the overall awareness about the DDoS attacks.

**09:00 - 17:00**    **Hackathon, Room: R1**

**10:00 - 10:30**    **Coffee break, Room: Cafee**

**10:30 - 11:10**    **Keynote 5, Room: A1**

#### **Consumer Electronics Invades Healthcare**

**Stefan Mozar**

There is a new generation of Consumer Electronics companies that have identified a market segment for consumers that want to stay healthy and fit. This market segment is growing rapidly for a number of reason. Wearables are fashion items and serve a monitoring function. Wearables can track how active we are; and thus provide an incentive to keep "moving". These fitness trackers are made for fun and to provide some feedback on how one is tracking with personal fitness goals. They are not intended to be used for healthcare applications. Newer wearables also include functions that track health performance indicators. They can measure blood pressure, or blood glucose levels, or Oxygen levels to mention a few. These devices are not of medical grade, but many healthcare practitioners ask their patients to monitor their health using these devices. Their advantage is that they are low cost, reasonably accurate. Further innovation, the IoT, and low cost mass produced products are now invading the healthcare industry. Remote patient monitoring systems, fall detectors, driver alert systems, are new avenues where these consumer grade devices are intruding in healthcare. This invasion is changing how healthcare practitioners are interacting with their patients. For one there is information overflow, and privacy concerns. Will these devices be abused by thrill-seekers, who are starting to implant them to become Trans humans? Can medical device manufacturers' justify the high cost of medical grade monitoring system when it can be done cheaper on a smartphone?

**10:40 - 12:00**    **GALVANIZING Smart Spaces, Room: B1**

#### **10:40 Voice-controlled Smart Office Implementation**

**Zhen Yue Chan**

Home automation and the concept of Internet of Things (IoT) have been existing for more than a decade, with billions of devices are connected to the internet. The conventional home automation system allows users to control household appliances such as lights, air-conditional, surveillance camera etc. via smartphone applications, webpages and control panels. One of the major drawbacks is with the operation efficiency, where people would still need their hands on the physical interfaces to excess the system. It could be quite inconvenient for specific groups such as the elderly and disabled people, who will not benefit much from such systems. In light of this, the project proposes a methodology and design of a voice-controlled environment with emphasis on speech recognition and voice control based on Amazon Alexa and Raspberry Pi. In this implementation, office users can easily control their office appliances with voice commands, the model can be implemented for smart home users as well. The proposed voice-controlled implementation comprises eight main features: 1) Control of wired electrical appliances; 2) Control of Radio Frequency (RF) and Infrared (IR) appliances; 3) YouTube connected entertainment system; 4) Digital memo; 5) Face recognition attendance taking system with SQL database; 6) Security and surveillance; 7) Room occupancy detection; 8) Telegram-based voice-controlled text messaging. The proposed system not only save time but also bring convenience to people.

#### **11:00 Ambient Assisted Control using Smart Luminaires**

**Iuliana Marin, Nicolae Goga, Ionel-Bujorel Pavaloiu, Maria-Iuliana Dascalu, Ionut Draghici and Melania Nițu**

The population aging, the need to reduce the cost of elderly care, as well as to increase security and energy efficiency have led to the emergence of many home monitoring systems. However, most of these systems are expensive, are not standardized, are complicated to implement (individualized wiring, wireless nodes) and can only be used with qualified personnel. Our light bulb prototype aims to reduce such deficiencies as well as remove the obstacles to adopting such systems by reducing costs and simplifying installation. The proposed solution aims to capitalize on existing electrical and lighting equipment, to set up a monitoring system only by replacing the luminaires in the existing electrical system with other lighting sources developed specifically for this purpose. Through the periodic replacement process and based on the current trend in light-emitting diode usage, these smart luminaires can be gradually introduced to supervise the location within houses, mostly elders' homes that live alone.

#### **11:20 Cooperative Robots Architecture for an Assistive Scenario**

**Leonardo Ciuccarelli, Alessandro Freddi, Sauro Longhi, Andrea Moneriù, Davide Ortenzi and Daniele Proietti Pagnotta**

This paper proposes an assistive robotic solution for elderly people and/or people suffering from lower limbs problem. The proposed architecture consists of a Smart Wheelchair (SWC) and a Robotic Workstation (RW) which cooperate in order to perform an autonomous navigation and manipulation task. The system allows the user to choose a point on the map to move to and/or an object to manipulate. The SWC is able to autonomously navigate to the desired RW, while the localization is performed via an Unscented Kalman Filter (UKF). Moreover, QR codes have been used as landmarks to compensate the pose estimation error. The system was tested both in simulation and in a real scenario.

#### **11:40 Fall Detection System by using ambient intelligence and Mobile Robots**

**Lucio Ciabattoni, Gabriele Foresi, Andrea Moneriù, Daniele Proietti Pagnotta and Leonardo Tomaiuolo**

In this paper a robust Fall Detection Algorithm by using a deep learning approach and a low-cost mobile robot equipped with an RGB camera is presented. This method consists of four steps. The first step is the user detection, achieved by a real-time video stream and a Deep Learning approach. Once the user is detected, then its position is estimated in the second step. In the third step, if a fall is detected, a photo is acquired and a pre-registered audio message asks the user how he is. In the last step the photo and the audio captured are sent to a Telegram Bot (TB) in order to alert family members or caregivers. Tests have been performed in a real scenario.

**11:10 - 12:10**    **Panel 3, Room: A1**

#### **Custom(er)zing Medical Field**

**Dragana Živković and Dušan Marić**

'DIY stem cell: „multipratic“ that brings extraction of stem cells closer to the consumer world' & 'Turning cubersome hospital devices into easy-to-use portable home devices'

## 12:10 - 13:10 Projects Unveiled & Work In Progress, Room: B1

### 12:10 Fostering Entrepreneurship and Open Innovation among Students through iDEALab Network

**Vladimir Todorović and Danijela Ćirić**

The aim of this paper is to introduce the concept and results of iDEALab project. In the introducing part of the paper the necessity for such environment in the Western Balkan Countries (WBC) was described, while the utilization of entrepreneurial potential among the students was recognized as an important driver and enabler for economic growth in general and mechanism for self employment with focus on students as a target group. In addition, the conceptual model of iDEALab was presented and discussed. Furthermore, core activities and results were described and presented concisely. A network of co-creative centers (iDEALabs) in WBC countries is proposed in this paper, which aims to generate greater orientation of young people towards self-employment and entrepreneurship by creating a system of continuous support, training and mentoring for (potential) young entrepreneurs.

### 12:20 Cross-Border IT Network for Competitiveness, Innovation and Entrepreneurship

**Vladimir Todorović and Nenad Simeunović**

The XBIT network tackles the issue of inadequate conditions for the optimal and structured development of the IT industry and entrepreneurship within the programme area, and its sub-optimal utilization as a generator of innovation and competitiveness. This project intervention is using an approach built around Cross-border IT Network (XBIT Network), defined as a congregation of key stakeholders relevant for establishing a favorable environment for the development of the IT industry, fostering entrepreneurship, creation of jobs and employment opportunities, increasing the retention of talent in the industry and increasing the number of skilled professionals. The most significant project results will be introduced such as: creation of Cross border network of stakeholders relevant in the field of ICT, design and implementation of educational, motivational and networking programmes, creation of Fab Labs and Mobile Lab.

### 12:30 Modernizing Laboratories for Innovative Technologies (DRIVE)

**Bogdan Pavković, Ivan Kaštelan, Miroslav Popović, Mario Vranješ and Gordana Velikić**

Rapid expansion of ICT sector, although promising, does not have a satisfactory business environment support which can adapt fast to trends and demands, for sustainable economic growth. In addition, one of the leading European employers - the automotive industry, has included in its focus the software and embedded systems. As a result, there is a growing need for engineers with adequate skills and ICT companies that can respond to the demand. This presentation is about the recently started project "Modernizing Laboratories for Innovative Technologies" (DRIVE) which aims to establish four laboratories for automotive software engineering, two at each partner: Faculty of Technical Sciences in Novi Sad and Faculty of Electrical Engineering, Computer Science and Information Technology in Osijek. In addition to laboratories, partner will develop workshop and course materials which will be offered to students and engineers in the region. Collaboration will be established with at least 3 companies to make the curriculum current and to satisfy educational demands of this increasingly expanding industry.

### 12:40 DRIVE - Market-Adapted Curriculum

**Mario Vranješ, Marijan Herceg, Ratko Grbić, Denis Vranješ, Ivan Vidović and Zdravko Krpić**

Trends in automotive industry have been changing significantly in the last decade. Autonomous vehicles become abundant and the level of vehicle autonomy has been rising on a daily basis. In order for vehicles to make autonomous decisions and perform functions without the driver intervention, it is necessary to embed artificial intelligence in vehicles. To adapt our students, i.e. future engineers, to the market changes, FERIT started a completely new curriculum regarding automotive computing and communications. Equipment and knowledge transfer procured during the DRIVE project will significantly enhance the quality of the new curriculum.

### 12:50 Implementing Hammock Cost Techniques using the parallel programming paradigm of EFL (Embedded Flexible Language)

**Oren Eliezer and Moshe Goldstein**

EFL is an embedded language which allows parallel programs to be written using the new Flexible Algorithms' approach to parallel programming, which has an imperative programming style, and ensures lock-free determinism. Hammock cost techniques have been proven useful in project management. They reduce much of projects' costs and use projects' resources more efficiently than other techniques. In this research we are proposing to implement the intrinsically parallel Hammock cost techniques by using EFL's parallel programming paradigm. We believe that this will allow to get better project overall performance

## 12:15 - 13:00 Keynote 6, Room: A1

### Security and Energy Trade-Offs in Consumer Electronics

**Saraju P Mohanty**

In the current connected world, security of information as well as that of the consumer electronic (CE) system are equally important. Security is a broad concept that covers many aspects including information security, privacy, trustworthiness, and intellectual property protection. The information security covers the security of data, information, and multimedia which are handled all the time by consumer electronic (CE) systems. The system security may refer to the security of the system (e.g. a specific CE system) that handles the data or information. For example, how trustworthy is the CE system and how much resilient is the system against side channel attacks. Malicious design modifications and hardware Trojans can compromise security or trustworthiness of the system. Side channel attacks rely on analyzing power and timing traces of the security hardware than breaking the encryption algorithm involved. IP protection can be applicable for copyright protection of information (movie, multimedia) or IP protection of the hardware design itself in this global supply chain in the social networking era of Internet. The attacks on the CE systems as well as the security solutions can be either software or hardware based. The software based security solutions that rely on some form of encryption is not full proof as breaking them is just matter of time. The emergence of quantum computing will make things even worse. The talk will present broad perspective of the vast multifaceted forms of security attacks and solutions provided by hardware. Any form of security solutions using software or hardware increases the energy consumption overhead of a CE system. The talk will discuss the security and energy-consumption trade-offs in designing a typical CE system.

**13:00 - 14:00** Lunch, Room: Caffè

**13:00 - 14:00** EXHIBITING What's Cool, Room: Exhibition Area

#### **Implementation of PC application for controlling RT-AG external sound card**

**Nenad Pekez, Jelena Kovačević and Nives Kaprocki**

Digital audio systems have developed rapidly and significantly over the last four decades. Beginning with systems that could process one audio channel at 32kHz/13-bit resolution to today's systems such as AV receivers and sound bars which are capable of reproducing more than 15 audio channels at 192kHz/32-bit resolutions. Problems that audio engineers are facing during development and testing phases of these systems are delivering high quality multi-channel signals from PC to audio systems and vice versa - recording 15-channel outputs at high sample rates. PC's sound card is most often not capable of neither delivering nor recording these kind of audio signals. In practice, audio engineers use external sound cards with features that enable them to play and record such complex audio. RT-RK R&D Institute has developed an external sound card for these purposes named RT-AG (RT-Audio Grabber). In this paper, we represent the implementation of PC application that is used for controlling this sound card. Since PC and RT-AG can be interconnected by either Ethernet or USB, the focus is on implementation of Ethernet part of application. This study continues to a paper "The technical solution of the software architecture of RT-AG digital grabber/player device" published at ETRAN 2017 conference.

#### **Distance Estimation Based on RSSI Improvements of Orientation Aware Nodes**

**Mirko Ivanić and Ivan Mezei**

Received signal strength indicator (RSSI) is widely used as an indicator that could be used to estimate distance between two nodes. However, many factors influence on the accuracy of RSSI ranging (e.g. antenna radiation pattern, reflections, obstacles etc.). Hence, RSSI alone is rarely used as a tool for precise distance measurement. In this paper, an improvement of RSSI ranging based on finding the best node orientation is presented. The experimental results are obtained using IRIS wireless sensor network nodes for outdoor and indoor scenarios. It is shown that lower bounds for the relative distance estimation accuracy, using curve fitting for the best orientation outdoor and indoor scenario, are 91% and 57%, respectively.

#### **Software module for processing EEG signals in a biofeedback based system**

**Milana Prodanov, Marija Punt, Nadica Miljković and Zaharije Radivojević**

This paper presents the implementation of a software module applied to the field of psychophysiology that examines the causal link between the physiological and the psychological state of a person. The realized module provides the ability to process and display EEG signals in real-time and is part of a larger software system based on the biofeedback method. Signals can be displayed either in the time or frequency domain and can be subjected to a variety of processing functions. The aim of this module is to provide a reliable tool for processing and displaying brain waves in arbitrary frequency band and to offer a platform for biofeedback training implementations that can enhance the degree of attention, concentration, relaxation and learning ability in the person participating in the training.

#### **Upper Limbs Dyskinesia Detection and Classification for Patients with Parkinson's Disease based on Consumer Electronics Devices**

**Marianna Capecci, Giulia Belgiovine, Lucio Ciabattini, Maria Chiara Fiorentino, Andrea Monterù, Lucia Pepa and Luca Romeo**

This paper presents a L-dopa-Induced Dyskinesia Detection and Classification System based on Machine Learning Algorithms, wearable device (smartwatch) data and a smartphone, connected via Bluetooth. This system was developed in three steps. The first step is the data collection, where each patient wears the smartwatch and performs some tasks while the smartphone App captures data. In the second phase, some features were extracted from acceleration and angular velocity signals and a Z-score normalization is applied. In the last step two Machine Learning Algorithms, trained with these features as input, are used in order to detect and classify dyskinesias.

#### **Implementation of the sound classification module on the platform with limited resources**

**Nives Kaprocki, Nenad Pekez and Jelena Kovačević**

There is a growing trend of using algorithms based on deep and machine learning in consumer devices, which imposes a challenge to the system's development because of the limited amount of resources in an embedded device. This paper presents integration of the sound classification module based on machine learning into a home audio system. The additional module enables dynamic change of processing controls according to the resulting confidence scores which indicate whether the current audio is speech, music or background noise. Main challenge of this paper is overcoming real-time processing constraints and embedded system's resource limitations. Results show that the sound classification module has been successfully integrated and improves the quality of the output content.

#### **Web Server and QR Decoder Applications for Xilinx FPGA Boards**

**Zoltan Horvat, Velibor Ilić and Miloš Nikolić**

The microelectronic industry is undergoing dramatic changes nowadays. Every year faster and more advanced systems are released. They are capable of running more complex tasks than before for a fraction of a PC's price. The task of this paper is realization of two applications that run on an embedded system. The first one is a QR (Quick Response) image decoder and the second one is a web server. The requirement was for the QR decoder to decode a stream of images and for the web server to process certain HTTP requests. Most existing versions of these applications are designed to run on PC computers. Since we needed only a part of their functionalities, the best solution was to develop the applications in C programming language and implement them on our system as bare-metal programs. With this approach we can maximize the performance and shorten the development time of the software.

### **Integrating Android to Next Generation Vehicles**

**Nemanja Pajić and Milan Z. Bjelica**

Modernisation of automotive industry has contributed to the new technologies development that ensure greater driver's safety and comfort. Vehicle systems that provide entertainment and information content integrated into digital cockpit, are representatives of a new generation of multimedia systems. Availability of Android OS on most of modern portable devices and usage of already made and user accepted applications are encourages automotive industry to integrated those systems into their products. Even though Android is a widely used system in consumer electronics world, there are only a few of these solutions in the automotive industry. Safety level, fast boot and memory usage are the biggest challenges. In this paper we are presented solution of vehicle infotainment based of Android system. To provide safety level, we are presented concept of integrating two different system (Android and QNX) into one chip.

### **Metrics against intuitive code writing**

**Milena Milošević and Velibor Mihić**

Metrics against intuitive code writing To show the impact of the results can be the trickiest part of the work. How to put in "white and black" something that is in the "gray" zone? This paper shows how objective metrics are interpreted to show the importance of the experienced researcher or subjective part of the code writing.

### **Artificial Intelligence and Data - How Deep We Should Go?**

**Ivan Velikić, Danica Szadzanić Velikić and Nikola Teslić**

The main obstacle for a good model that has artificial intelligence in its roots, requires a good amount of data. Data add importance to two phases of the development. First to generate the model, and second to test the model. In addition, the initial assumptions that are establish to create the model can add the bias to the final results. Thus, even with the high computational power for deep learning, we can end up with the poor model. It is in particular important to have all sides of the problem thoroughly examined when we create models for the healthcare cases. This paper shows an example that with good presentation of the problem, we may be able to save some computational power.

**14:00 - 14:30**    **One-minute Madness**, Room: A1

**14:00 - 15:20**    **CE In The Making: Hidden Processes**, Room: B1

### **14:00 Comparative Technology Assessment using Patent Evaluation**

**Sandra Nemet, Maja Barić, Franja Benčić and Dragan Kukolj**

This paper gives a qualitative analysis of the RT-RK company's patent portfolio with an aim to find the basic common characteristics and specificity. In that sense, three parts of patent portfolio were separated in the following technological groups: smart lighting, software solutions for STB and DTV, as well as automatic device testing. A publicly available software tool was used as the analytical tool for evaluation of intellectual property - IPscore. In addition, a technological 2D space was created using the automatic text analysis of patent documents with Python programming language and DeepLearning4j tool.

### **14:20 Solution for Licensing of Software Modules in Automotive Industry**

**Filip Kraus, Mario Vranješ, Nemanja Lukić and Gordana Velikić**

Electronic control units, used in automotive industry, often have many different functionalities and manufacturers need to control the distribution and prices of different variants of the same product. In this paper, analyses of different models for license security and encryption methods are carried out and several potent solutions for licensing of software modules are designed. Ultimately the most beneficial module for automotive industry is proposed. With defined module and with subsequent testing, a program-based library is created ready to be put into the intended devices as licensing controller for software modules.

### **14:40 Application lifecycle management while developing Consumer Electronics software using A-SPICE**

**Jelena Vlaović, Milan Vidaković, Marko Kovačević, Branimir Kovačević and Nemanja Lukić**

Electronic Program Guide (EPG) engine software module is developed as a self-contained product. It is characterized by stability, high performance and configurability. It is made to satisfy the wide range of digital television standards and complete set of hardware platforms. Considering that this module can be used in automotive infotainment systems, it has to be in compliance with the Automotive software process improvement and capability determination (A-SPICE) standard and Hersteller initiative Software - Manufacturer's software initiative (HIS) metrics. To ensure that all procedures according to A-SPICE were followed and to simplify project management, authors used Application Lifecycle Management (ALM) tool. In static code analysis, code was tested to verify if it's consistent and compliant with the Motor Industry Software Reliability Association (MISRA-C) rules and coding guidelines. Dynamic code testing included unit testing, integration testing and software and system testing. Additional code analysis was done through the code coverage analysis with runtime performance analysis tool. During the project lifecycle there were several problems found and solved concerning complying with A-SPICE standard while using ALM tool, testing procedures and quality of code in general.

### **15:00 Big Data Brand Sense Building of Consumer Electronics**

**Vladimir Radojević**

Big Data Brand Sense Building in Consumer Electronics (research in progress) As we know "cutting edge" innovation could be used for "cutting bread" and "cutting head". Sometimes both like Big Data. Something we get, something we lose. MS Windows start up logo (including colour of windows) and start up sound are unique value of master brand recognition. Apple could not be imagined without an unique "Apple logo visualization" far more than only "Iphone". G O O G L E coloured letters on Google search engine also have unique master branding value. So, Brand sense building in "cutting edge" technologies has had been around with us many years before formal brand sense building marketing discipline.



Recently, Samsung start up sound in mobile phones is also widely recognized and even more spreading in many other products of its consumer electronics like TV sets, vacuum cleaners, wash machines etc. In consumer electronics we had seen brand sense building implementation in many aspects such as USB sticks (with special shape, product, colour, for e.g. trains, animals, figures etc), smart devices (for e.g watches) with different shapes, colours and sounds. However, a lot more should be done in further development and tailoring of consumer electronics products in marketing customization towards unique brand sense favors of local customers. Besides, including and insisting for introducing more and more senses (if not all five senses) in consumer electronics, we are researching how to use Big Data analytics get by Google, Facebook and other social networks, online questionnaire from existing buyers and consumer habits and even wishes towards brand sense product oriented building according to the special habits and wishes of local consumers worldwide. Developing proper sets of data mining algorithms for brand sense favors is a ongoing research project and we are open and willing to include all positive ideas and experiences that public and interested companies of consumer electronics and GOOGLE and Social Networks might have.

**14:40 - 15:20**    **Keynote 7**, Room: A1

**Changing the Future of Interfaces with CEA**

**Margarita Anastassova**

Changing the Future of Interfaces with CEA

**15:20 - 15:40**    **Coffee break**, Room: Caffè

**15:40 - 16:20**    **Keynote 8**, Room: A1

**The Internet of Nothing**

**Nahum Gershon**

Judging from sensors and cameras I have installed at my home and wear on my body, quite often components of the Internet of Things produce situations that do not agree with the way I would like to or used to conduct my life. These include fitness trackers that are not accurate or responsive enough, warnings issues by my IoT cameras of moving trees or cars in or close to my yard and when lights are turned on or off inside my house. The many warnings I am getting from these IoT components join the unwelcome distractions issued by my cell phones and tablets. I find that these interruptions reduce the productivity of my work and the quality of my life. These distractions are in addition to the benefits I get from these devices (like warnings about the mail delivery person tossing my packages up in the air instead of placing them appropriately). I would thus like to propose evaluating IoT components and systems using both their positive properties ("The Internet of Things") and their negative properties ("The Internet of Nothing"). Focusing on both scores would lead to a more realistic & balanced view of the systems, pointing out directions for improvement for the benefit of the users and to help reduce the potential of an unrealistic hype. Yes, technology is not above all. People & their needs are.

**15:40 - 16:50**    **H2020 Project Overview: Stars of STARR**, Room: B1

**15:40 A Multidisciplinary Project on Technologies for Stroke Survivors**

**Margarita Anastassova**

The presentation will give an overview of the objectives and current developments done in the H2020 project STARR. It will also present a vision of the development of similar technologies in the future.

**15:50 Disabled Stroke's Perspective, Do They Need the Same?**

**Leire Ortiz Fernandez, Joana Sagastagoya Zabala, Eunate Arana Arri and Lorea Martinez Indart**

Stroke is the leading cause of long-term disability in developed countries resulting in life altering changes for both the stroke survivor and their closest family, sometimes, resulting in profound difficulties and needs. Limited data exist on the long-term needs of community-dwelling stroke survivors but for the new technologies, scarcity of data is the norm. Previous surveys on long-term unmet needs were focused on needs resulting from functional deficits. The principal aim of this study is to detect the unmet needs of the chronic stroke survivors in home basis according to previous situation, socio-familial support and health needs related to the possibilities that new technologies can offer.

**16:00 A Toolkit for Rehabilitation in the Home**

**Charlotte Magnusson**

While rehabilitation centres have access to tailor made rehabilitation technology, there is a lack of devices suited for home use. We have been working on a flexible toolkit design to allow users to pick and choose devices suited for their abilities, and will present three components from this toolkit, an interactive balance mat, an activity app and feedback lamps.

**16:10 Key-Skeleton Based Feedback Tool for Assisting Physical Activity**

**Renato Baptista, Abd El Rahman Shabayek, Enjie Ghorbel, Djamilia Aouada and Björn Ottersten**

Nowadays, automatically assisting physical activities is an active research topic due to a wide range of applications, going from sports to rehabilitation. In this paper, we aim at providing an intuitive feedback tool able to implicitly guide the user improving the motion with respect to a reference movement. To achieve that, key-skeleton frames are detected from the reference. The feedback is based on the 3D geometry analysis of the skeletons by taking into account the key-skeletons. Finally, the feedback is illustrated by a color-coded tool, which reflects the motion accuracy.



**16:20 One Solution for Execution of JavaScript in Java EE Application Servers**

**Milan Vidakovic, Stefan Ćosić, Ognjen Ćosić, Ivan Kaštelan and Gordana Velikić**

This paper describes one solution for execution of JavaScript code inside Java Enterprise Edition (Java EE) application servers. Since Java Virtual Machine (Java VM) is able to execute JavaScript code, it is possible to integrate JavaScript into Java EE. Instead of implementing JavaScript code in Node.js server, we have decided to integrate JavaScript inside Java EE environment. This way, it is possible to call other Java EE modules within JavaScript code, since it is now a part of the enterprise system. To achieve that goal, we have designed an architecture which introduces a Middleware as a link between Enterprise system and JavaScript code. We have also measured performance of three usual platforms for JavaScript execution and concluded that JavaScript inside Java VM is not significantly slower than the Node.js system.

**16:30 Semantic Network Analysis for Evaluation of Patient Condition**

**Matthieu Pfeiffer and Emmanuel Vaumorin**

When examining a patient and his relative evolution over time, it is crucial to consider available information in an holistic manner. In the context of the STARR project, heterogeneous information about the patient is considered: physical activity through sensed data from wearables, evaluations and annotations by carers, information related to his health condition, the followed care plan, the medications prescribed, etc. Furthermore, depending on the patient these factors may have direct influence on one another, which has to be taken into account when evaluating the relative progress. In this talk, we will show how the Magillem Content Platform can be used to create a semantic network between the heterogenous data considered in STARR. We will then explain how this network can be leveraged to provide some context about a patient's condition or to generate some patient specific notifications.

**16:40 The EU General Data Protection Regulation and STARR**

**Diana Dimitrova and Francesca Pichierrri**

This presentation will point to the main provisions of the GDPR which have to be respected when data are processed in the EU, by controllers established in the EU or when people in the EU are targeted. The main principles and requirements of the GDPR will be presented on the example of smart applications such as the one developed in STARR.

**16:20 - 17:10 Panel 4, Room: A1**

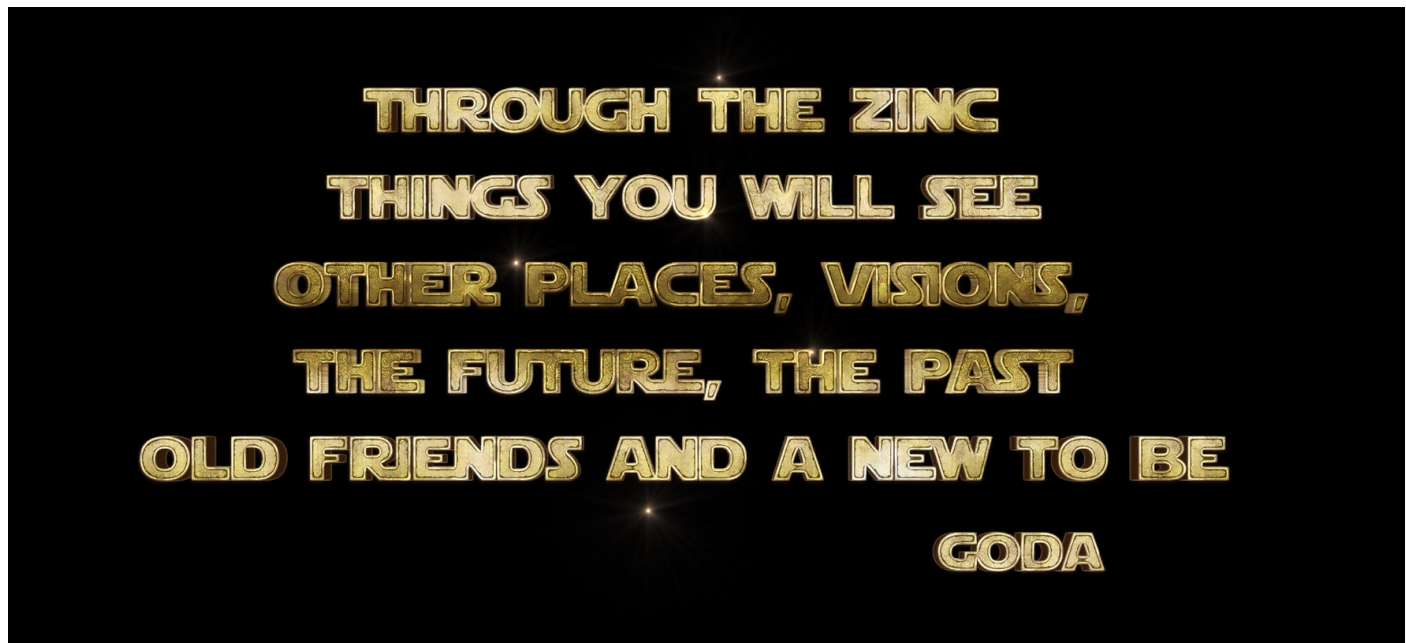
**What Makes Smart Cities Smart?**

**Nahum Gershon**

Is all smartness in smart cities spelled "Technology"?

**17:15 - 18:15 Awards & Farewell Until our Roads Meet Again, Room: A1**

**Conference awards, Hackathon awards, Closing**



**THROUGH THE ZINC  
THINGS YOU WILL SEE  
OTHER PLACES, VISIONS,  
THE FUTURE, THE PAST  
OLD FRIENDS AND A NEW TO BE  
GODA**

## Dear Friends,

This is the third year since we started “not another conference”.

Our hearts are thrilled just as in the first year. We keep the spirit that we have evoked and prepared the best program yet.

We welcome new friends. We are eagerly waiting to chat with the old friends.

We invite You to have fun, enjoy the great talks, research papers, tutorials, and panels. Not to mention coffee breaks, lunches, and gala dinner.

Galore of new things you will see this year. However, one thing we will be happy to repeat again and again - that we are happy to see you (again).

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