DEPARTMENT OF TELECOMMUNICATIONS AND MULTIMEDIA

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RESEARCH ACTIVITIES

- Three main areas
  - Telecommunication technologies
  - Radiocommunication technologies
  - Digital signal processing

LABORATORIES

- Analog circuits and systems
- Digital communications
- Optical communications
- Mobile communications
- Digital video processing
- Audio signal processing
- Multimedia technologies
- Health applications
- Hardware design

ANALOG CIRCUITS AND SYSTEM - LAB

- Synthesis and Optimization of Electronic Systems using Evolution Algorithms
  - Development of new, non-conventional methods of electronic circuit and systems synthesis and optimization, based on genetic and evolution algorithms
  - Multi-criteria design optimization of integrable building blocks and subsystems for digital communication systems
- Measurements in the lab
  - Linear circuits (AF amplifiers, HF amplifiers)
  - Nonlinear circuits (LC & RC oscillators, nonlinear amplifiers, analog and digital modulators & demodulators)
  - Metallic access network measurements (hybrids and balancing network measurements, FEXT & NEXT measurements, quantization distortion and S/N measurements, bit error rate measurements)
  - Basic RF measurements (basic properties of RF receivers and transmitters measurements, EM field measurements)

ANALOG CIRCUITS AND SYSTEM - LAB

- Systems for the interactive television cabling distribution ICATV
    - Basic and experimental research in area of systems for the interactive television cable distributions
    - Laboratory and the functional patterns of the computer based system and terminal interfaces End User Box (EUB)
    - Hybrid Coax-Fibre technology and Video on demand control solution
    - Experimental research and testing of the access network ICATV on the test polygon
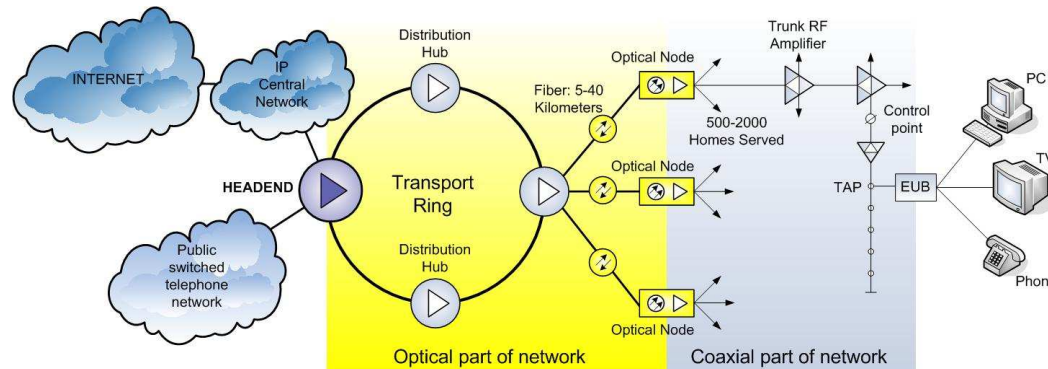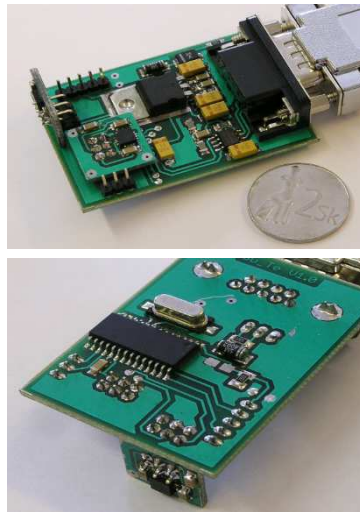
DIGITAL COMMUNICATIONS - LAB

- Technologies
  - IP telephony (SIP, H.323, Skinny)
  - ADSL
  - Wi-fi
  - DECT (Cordless telephony)
  - ISDN and EuroISDN
- Research areas
  - Speech quality assessment in telco networks
  - Networking
  - Network convergency
  - Cross-layer optimization (VoIP link adaptation algorithms design from speech quality point of view)
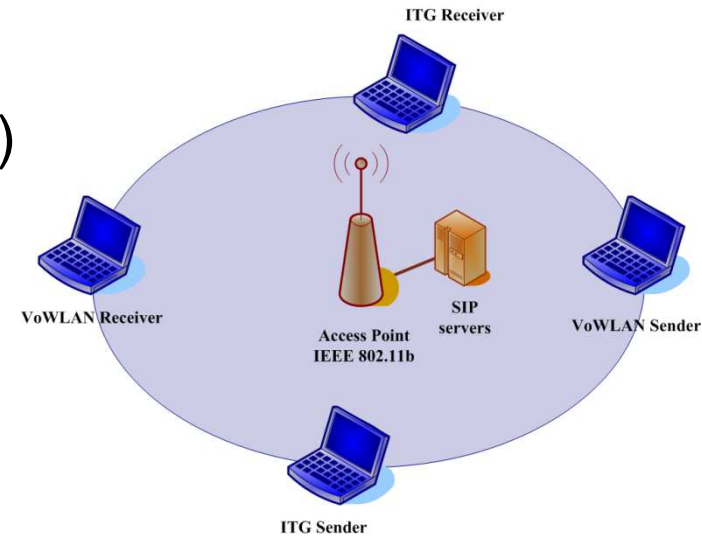
DIGITAL COMMUNICATIONS - LAB

- Board unit for dangerous cargo transportation
  - R&T development
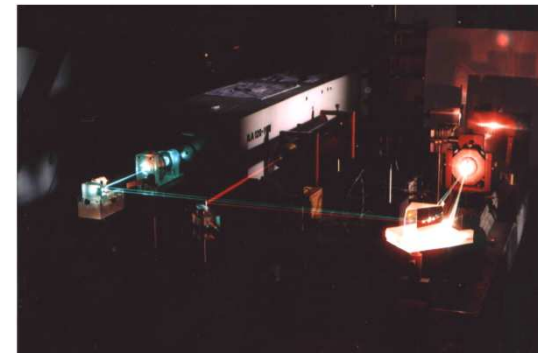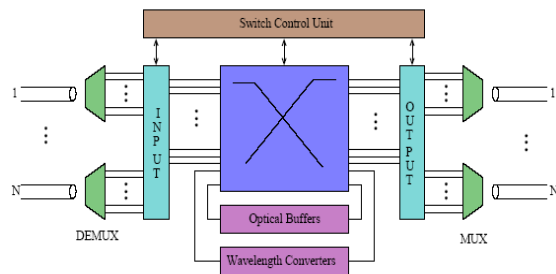 - Sensors (LPG, pressure, position, …)

Onboard unit sensor prototype

OPTICAL COMMUNICATIONS - LAB

- Optical fibers studies
- Nonlinear effects
- OTDM systems and their components
- Novel network architectures
  - OBS, OPS, λ-switching, GMPLS
- Lab SW - Virtual Photonic Incorporated

MOBILE COMMUNICATIONS - LAB

- analysis and evaluation of spreading a radio signals over the Earth surface
- analysis and design of radio-communication systems /mobile, analogue TV,DVBT, P2P and P2MP microwave systems
- hardware equipment for carrying out experiments in telecommunications theory
- collect, analyze, and post-process the network data used on a daily basis for network monitoring, troubleshooting, and optimization of WCDMA/HSDPA and GSM/GPRS/EDGE networks.
- Verifying and optimize WCDMA and GSM intersystem handover and cell reselection, compressed mode behavior, coverage and performance evaluation
- Verify WCDMA/HSDPA and GSM system accessibility ensure seamless integration between WCDMA/HSDPA and GSM/GPRS/EDGE networks.
- Performance of networks analysis through simulation and emulation
- real-time network simulation, which supports hardware-, software-, and human in-the-loop simulation
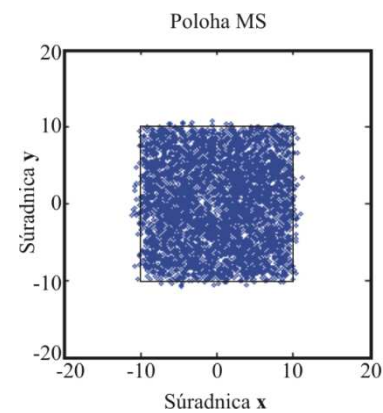
MOBILE COMMUNICATIONS - LAB

- Mobile positioning in mobile wireless networks
  - Cellular
  - Ad hoc
  - Sensor
  - Modular positioning systems
- Design of new positioning algorithms
  - Modelling and verification of algorithms
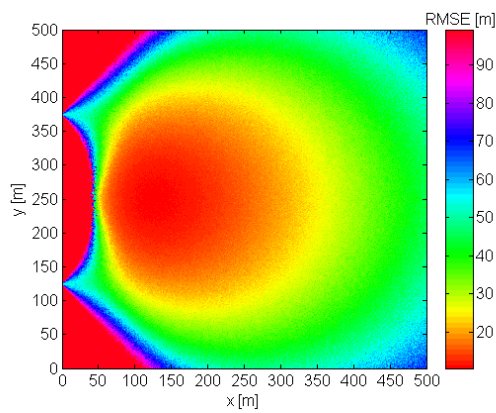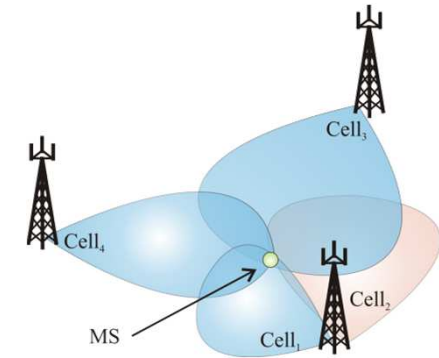
Impact of reference nodes allocation
on positioning accuracy

Impact of the number of base stations
on positioning accuracy

DIGITAL VIDEO PROCESSING - LAB

- Research areas
  - 2D Noisy grayscale/color image filtering
    - Adaptive order-statistics filters (L-filters)
    - Adaptive algorithms
    - Adaptive Signal-Depending filters
    - Spatial impulse detectors
  - Video content analysis (MPEG-7)
    - Combined low-level descriptors (color, texture, shape, …)
    - Video content segmentation (semantic approach)
    - Automatic annotation systems
  - Traffic video systems
    - Dynamic information mining from video data
    - Urban traffic monitoring system
  - 3D Computing
    - 3D Image Reconstruction by Rainbow Camera
    - Reconstruction of 3D image from Stereo Pictures
    - 3D Computer Vision
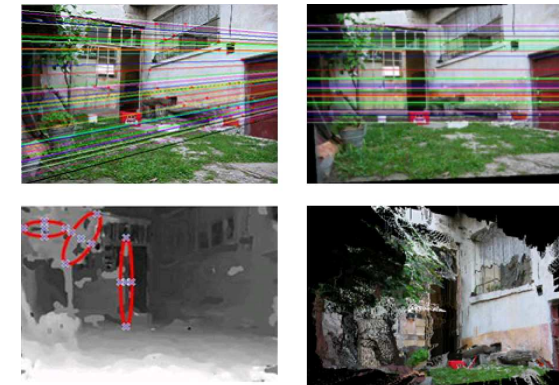
DIGITAL VIDEO PROCESSING - LAB

- Brain cancer detection and visualization-MRI/CT data
    - DICOM v3.0 image data visualization MRI/CT slice's data filtration and segmentation
    - 3D Head/Brain surface reconstruction,
    - 3D voxel interpolation
    - 3D metabolite processing and visualization (Cronin, Alanine, etc.)
    - Brain cancer localization, T2 relaxation maps (MRI) fitting
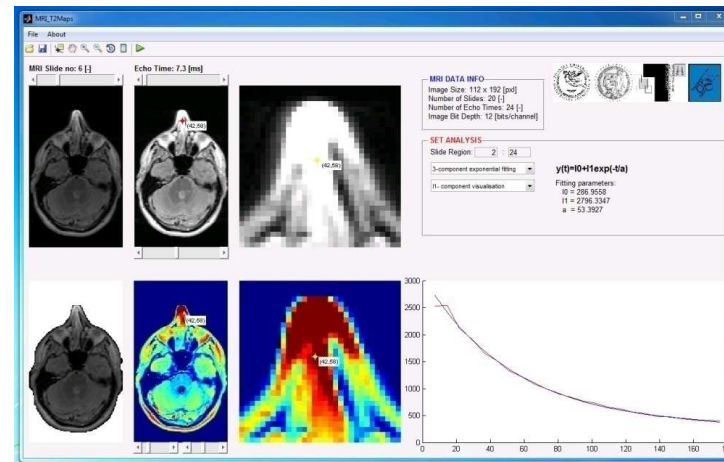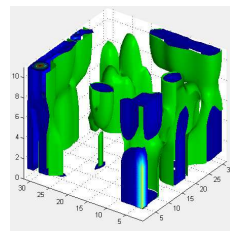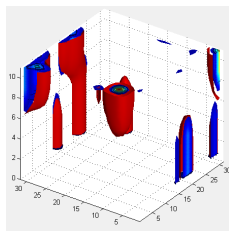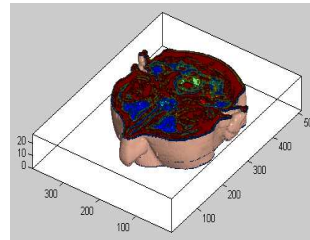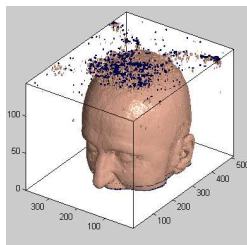
AUDIO SIGNAL PROCESSING - LAB

- Research areas
  - Automatic speech recognition
    - Hidden Markov Models
    - Neural Networks
    - ASR front-ends development based on 2-D Cepstrum
    - Development of fast ASR algorithms for limited-power applications
  - Automatic Speaker recognition and segmentation
    - Novel methods of signal parametrisation and voice feature extraction (spectro-temporal approach, prosodic features)
    - Speaker segmentation in audio
    - Speaker indexing
  - Audio Content Analysis and Audio Scene description
    - Speech/Music discrimination
    - Generic sound recognition (e.g. jingle, applause …)
    - Acoustic environment detection (e.g. indoor vs. outdoor)
  - Joint Audio/Visual analysis for multimedia content analysis
    - Audio/Video content segmentation – semantic approach
    - Audio and Video Content description
    - XML, MPEG 7

MULTIMEDIA TECHNOLOGIES - LAB

- Technical background
  - math, physics, transmission technology, electroacoustic, digital video and audio, TV technology, Photographic and Film technology, Communication networks, Sound production, WEB design, Computer graphics
- Creative content creation
- The pre – and post production of multimedia (A/V) materials in DV/DVD/HDV formats
- Sound recording and digital mastering
- Projection of created or external materials
- Speaker training

HEALTH APPLICATIONS - LAB

- Research areas
  - SYDMOS system (SYstem for Distant MOnitoring of the health State).
    - TEBID (TErminal for collecting and transmission of BIoData).
    - SYDES system (SYstem of connectivity to the Data of the E-health State).
  - TEBID-ASCII protocol
  - Services (Client Personalization, Position via GSM Network, Health Condition on Demand, ECG monitoring, SpO2, …)
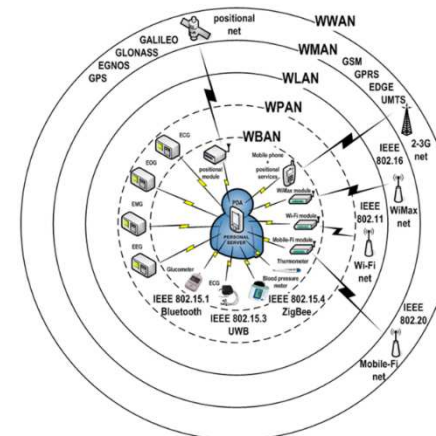
HARDWARE DESIGN - LAB

- Design, manufacture, testing, SMT pick & place and soldering up to 8-layer PCB
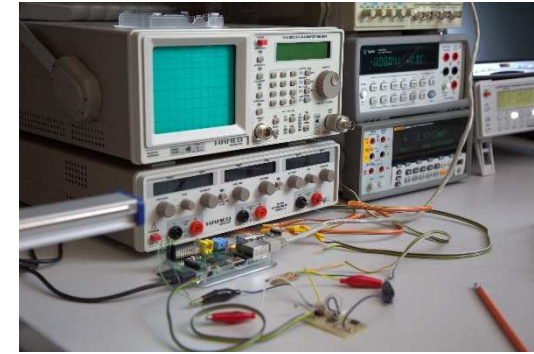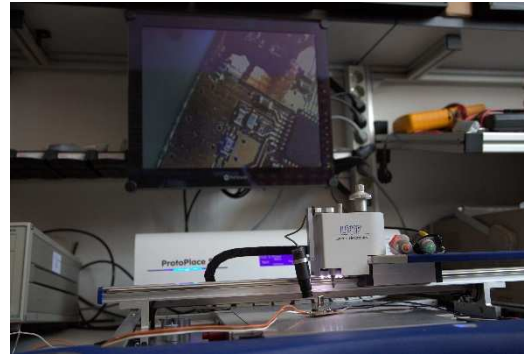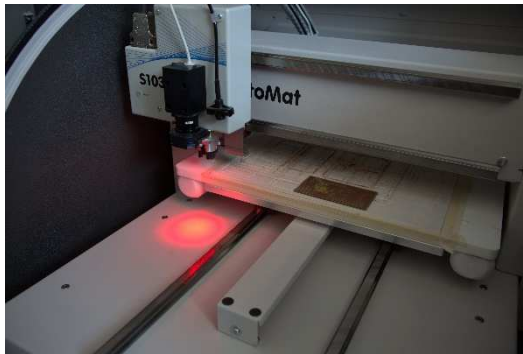
THE MOST SIGNIFICANT PROJECTS

- International projects
  - FP7 ERAdiate - Enhancing Research and Innovation Dimension of the University of Zilina in Intelligent Transport Systems, 2014-2019, coordinator – prof. Ing. Milan Dado, PhD
  - E! 6752: DETECTGAME – R&D for Integrated Artificial Intelligent System for Detecting the Wildlife Migration, (EUREKA, Brussels), 2013-2016, UNIZA coordinator – R. Hudec.
  - FP7 ERDC Emergence of Research Driven Clusters in Central Europe, 2008-2010, coordinator – prof. Ing. Milan Dado, PhD
  - ETSI STF 436: Adaptation of the ETSI QoS Model to better consider results from field testing (2011-2013), UNIZA coordinator – P. Počta.
  - A-0930-RT-GC, HElicopter fuselage Crack moniToring and prognosis through on-board sensOR network – HECTOR, (European Defence Agency, Brussels), 2010-2012, UNIZA coordinator – R. Hudec.
  - ETSI STF 437: QoS of connections from current technologies to LTE (2012), project coordinator – P. Počta.
  - ITMS 22420320001: Interregional Mobile Television DVB–H, 2010-2012, UNIZA coordinator – M. Vaculík.
  - ETSI STF 363: QoS Implications of NGN architectures, 2008-2009, UNIZA coordinator – P. Počta.
  - FP6 RIS ZIP Regional Innovation Policy – 2005-2008, project coordinator – M. Dado
  - COST 292: Semantic Multimodal Analysis of Digital Media, 2008, UNIZA coordinator – R. Jarina.

- National projects
  - APVV-0369-07: Speech Technologies for Advanced Telecommunication and Information Services in Slovak Language – SPEETIS , 2008-2010, UNIZA coordinator – R. Jarina
  - VEGA č. 1/0705/13: Image elements classification for semantic image description, 2013-2015, project coordinator- R. Hudec
  - VEGA č. 1/0313/08: The Investigation of the Methods of Detection of the Critical Conditions in Telecommunication Networks from the Speech Quality Point of View (2008-2010), project coordinator- P. Počta
  - VEGA-11/0392/10: The research of mobile nodes positioning in wireless sensor networks, 2010-2012, project coordinator – P. Brída
  - VEGA 1/0336/10: Enhancement of QoS parameters in MANET and mesh networks, 2010-2011, project coordinator – V. Wieser
  - VEGA 1/1271/12: Study of the influence of the degradation effects in the physical layer of the high-speed optical networks on the transport mechanisms, 2012-2014, project sub-coordinator -M. Dado PhD.

THE MOST SIGNIFICANT CURRENT PUBLICATIONS

- Current Content Journals
  - KAMENCAY, Patrik – HUDEC, Róbert – BENCO, Miroslav – ZACHARIASOVA, Martina: 2D-3D Face Recognition Method Based on a Modified CCA-PCA Algorithm, In: International Journal of Advanced Robotic Systems, Vol. 11, No. 36, 2014, ISSN 1729-8806, p. 1-9.
  - BENCO, Miroslav – HUDEC, Róbert – KAMENCAY, Patrik – ZACHARIASOVA, Martina – MATUSKA, Slavomir: An Advanced Approach to Extraction of Colour Texture Features Based on GLCM, In: International Journal of Advanced Robotic Systems, Vol. 11, No. 36, 2014, ISSN 1729-8806, p. 1-8.
  - BENEDIKOVIČ, Daniel – CHEBEN, Pavel – SCHMID, Jens H. – XU, Dan-Xia, LAPOINTE, Jean – WANG, Shurui – HALIR, Robert – ORTEGA-MOÑUX, Alejandro – JANZ, Siegfried – DADO, Milan: High-efficiency single etch step apodized grating coupler using subwavelength structures. In: Laser & Photonics Reviews, Vol. 8, No.6, October 2014, pp. L93-L97.
  - POČTA, P., HOLUB, J.: Effect of speech activity parameter on PESQ's predictions in presence of independent and dependent losses, V Computer Standards & Interfaces, vol.36, No.1, str.143-153, ISSN 0920-5489.
  - BRIDA, P., MACHAJ, J.: A Novel Enhanced Positioning Trilateration Algorithm Implemented for Medical Implant In-Body Localization, International Journal of Antennas and Propagation, vol. 2013, Article ID 819695, 10 strán, ISSN 1687-5877, 2013
  - Jarinová, D.: On autoregressive model order for long-range prediction of fast fading wireless channel. Telecommunication Systems, March 2013, Volume 52, Issue 3, str. 1533-1539, ISSN 1018-4864.
- Journals indexed in a world-wide database (Thomson Scientific Master Journal List or SCOPUS)
  - BRIDA, Peter – MACHAJ, Juraj – BENIKOVSKY, Jozef: Wireless Sensor Localization Using Enhanced DV-AoA Algorithm, In: Turkish journal of electrical engineering & computer sciences, Vol. 22, No. 3, 2014, ISSN 1300-0632, p. 679-389.
  - BRIDA, Peter – MACHAJ, Juraj – BENIKOVSKY, Jozef: A Modular Localization System as a Positioning Service for Road Transport, Sensors, 2014, 14(11), pp. 20274-20296. ISSN 1424-8220.
  - MRVOVÁ, M., POČTA, P.,: A Quality Estimation of Synthesized Speech Transmitted over IP Networks, V Communications – Scientific Letters of the University of Žilina, Volume 16, 1/2014, Žilina, str.121-126, ISSN 1335-4205.
  - HUDEC, Robert – BENCO, Miroslav – MATUSKA, Slavomir – KAMENCAY, Patrik – ZACHARIASOVA, Martina: Approach to Electro-Conductive Parameters of Blended Ag/PA Textile Yarns for Intelligent Textile Structures. In: Fibres and Textiles (Vlákna a Textil) , 21 (4) 2014, pp. 30 – 38 . ISSN: 1335-0617.
  - ČAKAN, T., WIESER, V., TKÁČ, A.: QoS Enhancement in MANET by Directional Power Control. In: Komunikacie , 16 (1) 2014, pp. 72 – 77 . ISSN: 1335-4205.
  - Hlubík, J., Schwartz, L.: Design of a Dynamic Allocation of Frequency Channels to Services in CATV Networks, V ADVANCES IN MILITARY TECHNOLOGY, Vol. 6, No. 2, 2011, ISSN 1802-2308.
  - KAMENCAY, P. , BREZNAN, M., JARINA, R., LUKAC, P., ZACHARIASOVA, M.: Depth Map Computation from Stereo Images based on Hybrid Segmentation Algorithm, V Radioengineering Journal, Vol. 21, No. 1, str.70-78, ISSN 1210-2512, 2012.
  - LUKAC, P., HUDEC, R., BENCO, M., DUBCOVA Z., ZACHARIASOVA, M., KAMENCAY, P.: The evaluation criterion for color image segmentation algorithms, V Journal of Electrical Engineering, Vol. 63, No.1, str. 13-20, 2012, ISSN 1335-3632.

SERVICES

- Cisco Academy – contact: ivan.dolnak@fel.uniza.sk, peter.kortis@fel.uniza.sk

- MikroTik Academy – contact : ivan.dolnak@fel.uniza.sk

- 3D models printing – contact: robert.hudec@fel.uniza.sk

- Design, manufacture, testing and shouldering up to 8-layer PCB – contact: robert.hudec@fel.uniza.sk

- Audiovisual productions and recordings – contact: martin.vaculik@fel.uniza.sk

- Measurements of room acoustics – contact: roman.jarina@fel.uniza.sk

- Design and creation printed and online documents – contact : jozef.dubovan@fel.uniza.sk, miroslav.markovic@fel.uniza.sk

- Web design – contact : jozef.dubovan@fel.uniza.sk, miroslav.markovic@fel.uniza.sk

- The education curses in area of fiber optics communication systems – contact : jozef.dubovan@fel.uniza.sk, miroslav.markovic@fel.uniza.sk

- Testing of GPS devices and design of ubiquitous positioning solutions – contact: peter.brida@fel.uniza.sk

THANK YOU FOR YOUR ATTENTION

More information: http://ktam.uniza.sk