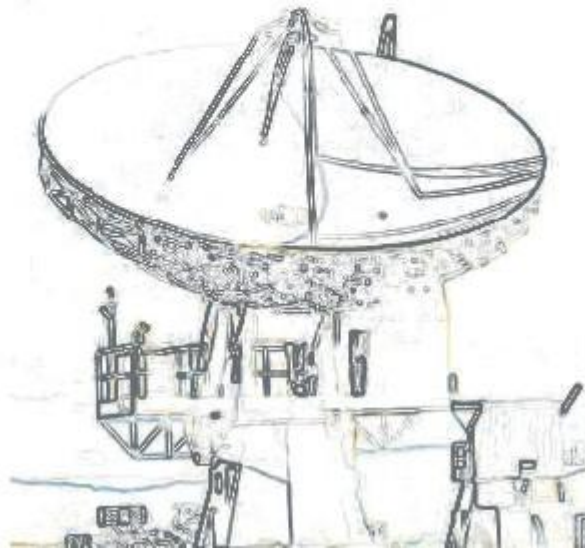

DEPARTMENT OF ELECTRONICS AND MULTIMEDIA TELECOMMUNICATIONS

Department Of
Electronics
& Multimedia Communications



Annual Report 2012

Technical University of Košice
Faculty of Electrical Engineering and Informatics

TECHNICAL UNIVERSITY OF KOŠICE
Faculty of Electrical Engineering and Informatics
(Slovak Republic)

DEPARTMENT OF ELECTRONICS AND
MULTIMEDIA TELECOMMUNICATIONS

ANNUAL REPORT 2012

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Contact Addresses

<http://www.kemt.fei.tuke.sk/>

Head of the Department

prof. Ing. Dušan Levický, CSc.
Park Komenského 13
041 20 Košice
Slovak Republic
Tel.:+421 - 55 - 602 20 29
Fax: +421 - 55 - 632 39 89
E-mail: Dusan.Levicky@tuke.sk

Secretary

Božena Marchevská
Park Komenského 13
041 20 Košice
Slovak Republic
Tel.:+421 - 55 - 602 28 53
Fax: +421 - 55 - 632 39 89
E-mail: Bozena.Marchevska@tuke.sk

doc. Ing. Ján Šaliga, CSc.
Park Komenského 13
041 20 Košice
Slovak Republic
Tel.:+421 - 55 - 602 28 66
Fax: +421 - 55 - 632 39 89
E-mail: Jan.Saliga@tuke.sk

doc. Ing. Pavol Galajda, CSc.
Vysokoškolská 4
041 20 Košice
Slovak Republic
Tel.:+421 - 55 - 602 41 69
Fax: +421 - 55 - 632 39 89
E-mail: [Pavol.Galajda@tuke.](mailto:Pavol.Galajda@tuke.sk)

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1 DEPARTMENT PROFILE

1.1 Brief overview

The Department of Electronics and Multimedia Communications was founded in 1969. The original name of department was Department of Electronics. The Department offers three types of full-time courses:

Bachelor's Degree course lasts in normal way 3 years and is leading to degree Bc. The graduates get more-or-less practical skills in mastering

- ◆ Electronics,
- ◆ Telecommunications.

Master's Degree course lasts in normal way 2 years and is leading to degree Ing. The graduates get theoretical and practical skills in specialization

- ◆ Infoelectronics,
- ◆ Multimedia telecommunications.

Doctoral Study course lasts in normal way 3 years and is leading to degree PhD. The graduates get erudition in scientific areas

- ◆ Infoelectronics,
- ◆ Telecommunications,
- ◆ Electronics measurement systems.

The subjects in the degree courses are orientated to the linear and non-linear analogue circuits, automotive electronics and diagnostic of cars, digital electronics, microwave technology, optoelectronics, signal and systems, acoustics, digital signal processing, digital filtering, signal processors and microcontrollers, electronic measurement systems, television systems, signal recording, digital communication and digital transmission systems, optoelectronic communication systems, photonics, sensor systems, multimedia communication systems, mobile and satellite communication systems, digital image communication systems and medical electronics.

The basic research activities of Department are concentrated on digital image and speech processing, multimedia communications, digital filtering, optoelectronics and optical communication, A/D convertors modelling and testing.

1.2 Department staff and structure

Total number of staff members is 34.

- ◆ Professors: Anton Čižmár, Jozef Juhár, Dušan Kocur, Dušan Levický, Stanislav Marchevský, Ján Mihalík, Linus Michaeli, Ján Turán
- ◆ Professors Emeritus: Viktor Špány
- ◆ Associate Professors: Ľubomír Doboš, Miloš Drutarovský, Pavol Galajda, Ján Gamec, Ľuboš Ovseník, Ján Šaliga
- ◆ Assistant Professors: Gabriel Bugár, Mária Gamcová, Juraj Gazda, Iveta Gladišová, Ľudmila Maceková, Stanislav Ondáš, Ján Papaj, Jozef Zavacký
- ◆ Research Assistant: Vladimír Bánoci, Daniel Hládek, Zita Klenovičová, Martin Lojka, Matúš Pleva, Jana Rovňáková, Ján Staš, Michal Varchola
- ◆ Support staff: Zuzana Ciulisová, Božena Marchevská, Viera Šumáková

2 DIVISIONS OF THE DEPARTMENT

2.1 Teaching and research laboratories

Laboratory of Multimedia Communications

Head: Professor: prof. Ing. Dušan Levický, CSc., Member of the IEEE

phone: +421-55-6335692, 6022029

e-mail: Dusan.Levicky@tuke.sk

fax: +421-55-636323989

Professor: Dr.h.c. prof. Ing. Anton Čižmár, CSc., Member of the IEEE and AES

phone: +421-55-6022294

e-mail: Anton.Cizmar@tuke.sk

Professor: prof. Ing. Jozef Juhár, PhD., Member of the IEEE, AES and ISCA

phone: +421-55-6022333

e-mail: Jozef.Juhar@tuke.sk

Associated professor: doc. Ing. Ľubomír Doboš, CSc.

Phone: +421-55-6022296

e-mail: Lubomir.Dobos@tuke.sk

Assistant professor: Ing. Gabriel Bugár, PhD.

phone: +421-55-6022808

e-mail: Gabriel.Bugar@tuke.sk

Assistant professor: Ing. Stanislav Ondáš, PhD.

phone: +421-55-6022298

e-mail: Stanislav.Ondas@tuke.sk

Assistant professor: Ing. Ján Papaj, PhD.

phone: +421-55-6022298

e-mail: Jan.Papaj@tuke.sk

Research Assistant: Ing. Vladimír Bánoci, PhD.

phone: +421-55-6022808

e-mail: Vladimir.Banoci@tuke.sk

Research Assistant: Ing. Daniel Hládek, PhD.

phone: +421-55-6022298

e-mail: Daniel.Hladek@tuke.sk

Research Assistant: Ing. Zita Klenovičová, CSc.

Phone: +421-55-6022829

e-mail: Zita.Klenovicova@tuke.sk

Research Assistant: Ing. Martin Lojka, PhD.

phone: +421-55-6022298

e-mail: Martin.Lojka@tuke.sk

Research Assistant: Ing. Matúš Pleva, PhD.

phone: +421-55-6022334

e-mail: Matus.Pleva@tuke.sk

Research Assistant: Ing. Ján Staš, PhD.

phone: +421-55-6022298

e-mail: Jan.Stas@tuke.sk

Laboratory of Digital Signal Processing and Satellite Communications

Head: Professor: prof. Ing. Stanislav Marchevský, CSc.

Phone: +421-55-6022030

e-mail: Stanislav.Marchevsky@tuke.sk

Professor: prof. Ing. Dušan Kocur, CSc.

Phone: +421-55-6024233

e-mail: Dusan.Kocur@tuke.sk

Associated professor: doc. Ing. Miloš Drutarovský, CSc.

Phone: +421-55-6024169

e-mail: Milos.Drutarovsky@tuke.sk

Assistant professor: Ing. Mária Gamcová, PhD.

Phone: +421-55-6024180

e-mail: Maria.Gamcova@tuke.sk

Assistant professor: Ing. Juraj Gazda, PhD.

Phone: +421-55-6024234

e-mail: Juraj.Gazda@tuke.sk

Assistant professor: Ing. Ľudmila Maceková, PhD.

phone: +421-55-6024108

e-mail: Ludmila.Macekova@tuke.sk

Research Assistant: Mgr. Jana Rovňáková, PhD.

phone: +421-55-6024234

e-mail: Jana.Rovnakova@tuke.sk

Research Assistant: Ing. Michal Varchola, PhD.

phone: +421-55-6024234

e-mail: Michal@Varchola.com

Laboratory of Digital Image Processing and Videocommunication

<http://www.tuke.sk/fei-ldipv/>

Head: Professor: prof. Ing. Ján Mihalík, CSc.

Phone: +421-55-6022854

e-mail: Jan.Mihalik@tuke.sk

Assistant professor: Ing. Iveta Gladišová, CSc.

Phone: +421-55-6022940

e-mail: Iveta.Gladisova@tuke.sk

Assistant professor: Ing. Jozef Zavacký, CSc.

Phone: +421-55-6024145

e-mail: Jozef.Zavacky@tuke.sk

Laboratory of Optoelectronic Communications

<http://los.fei.tuke.sk/>

Head: Professor: Dr.h.c. prof. RNDr. Ing. Ján Turán, DrSc., Senior Member of the IEEE

phone: +421-55-6022943

e-mail: Jan.Turan@tuke.sk

Associated professor: doc. Ing. Ján Gamec, CSc.

Phone: +421-55-6024180

e-mail: Jan.Gamec@tuke.sk

Associated professor: doc. Ing. Ľuboš Ovseník, PhD.

Phone: +421-55-6024336

e-mail: Lubos.Ovsenik@tuke.sk

Laboratory of Electronic Circuits & Measurement

Head: Professor: prof. Ing. Linus Michaeli, DrSc., Member of the IEEE

phone: +421-55-6022857

e-mail: Linus.Michaeli@tuke.sk

Professor emeritus: prof. Ing. Viktor Špány, DrSc.

Phone: +421-55-6022864

Associated professor: doc. Ing. Pavol Galajda, CSc.

Phone: +421-55-6024169

e-mail: Pavol.Galajda@tuke.sk

Associated professor: doc. Ing. Ján Šaliga, CSc.

Phone: +421-55-6022866

e-mail: Jan.Saliga@tuke.sk

2.2 *Special laboratories and equipments*

Laboratory of measurement is equipped by various analog and digital electronic instrumentations, data acquisition cards, computers and software as follows:

- Agilent 81150A-002 2-channel 120 MHz Pulse-Function-Arbitrary Generator,
- Fast precise digitizer NI PXI-1033, NI PXI-5922, NI PXI-6552 100 MHz, 24 bits,
- 3 GHz spectrum analyser N9320B-TG3 3GHz with Tracking Generator,
- RF vector signal generator and analyser based on PXI by National Instruments,
- Sound and vibration analyser based on PXI - NI PXI-1033, NI PXI-4461, (24 Bit, 204.8 kS/s), NI PXI-6251,
- Reconfigurable PXI system based on FlexRIO by NI,
- Precise multimeter Agilent 3458,
- 500MHz oscilloscope with logic analyser Agilent MSO7054,
- EMC chamber,
- RLCG meter 3532-50 LCR HiTester,
- NI ELVIS II + Emona DATEx Telecommunication Board for ELVIS; Emona ETT-211 FOTEX-Fiber Optic Comm Trainer, FPGA development boards,
- Agilent N9310A RF Signal generator 9KHz to 3.0GHz,
- Logic analyser Tektronix TLA5201B,
- Arbitrary generators Agilent 33220A, Rigol, etc.,
- Digital oscilloscopes (Agilent, Tektronix, Rigol, etc.),
- Function signal generators (Agilent, Panasonic, Metex),
- Handheld multimeter (Metex, Unitest),
- Calibrator Stanford Research,
- Multimeters (Agilent 34405A, Unitrend),
- Programmable power supplies Agilent,
- Measurement systems based on PXI by National Instruments,
- Multifunction DAQ cards up to 2MHz and 18 bits by National Instruments,
- Communication cards and modules by National Instruments, e.g., GPIB, CAN, RS488, etc.,
- Remotely accessible (across the Internet) demonstration and educational stand with DAQ cards and electronic boards,
- Department multilicense for all software by NI (LabVIEW, CVI, ...).

Laboratory of communication technologies and advanced digital signal processing

- Advanced measurement equipments:
 - ◆ M-sequence UWB radar (frequency band: 0.2-6.5 GHz),
 - ◆ M-sequence UWB radar (frequency band: DC-2.25 GHz),
 - ◆ impulse UWB radar (frequency band: 0.1-6 GHz),
 - ◆ Anritsu MG3700A vector signal generator,
 - ◆ Tektronix digital storage oscilloscopes,
 - ◆ Agilent logic analyzer,
 - ◆ WiFi 802.11a/b/g link.
- Video and audio processing equipments:
 - ◆ Handycam SONY DCR SR 290,
 - ◆ 3CCD HDD camera Everio for HDD recording,
 - ◆ computer INTEL Pentium IV with satellite card STAR for reception and recording of packet oriented services and transmission of video-streams into IP networks,

- ◆ satellite Dreambox receiver supported by computer with Linux operating system,
- ◆ satellite receiver with 125cm parabola antenna and DISEC motor, combined DVB-S and DVB-T receiver,
- ◆ GPS receivers ASUS, large plasma SAMSUNG display with 108 cm diagonal,
- ◆ Pioneer sound laboratory system with recording and reproducing capabilities.
- Computers:
 - ◆ 4-core application DELL server,
 - ◆ 11 PC Pentium IV computers (2,8 GHz, HDD 200GB) and 10x 17''-LCD monitors.
- Software tools and development boards:
 - ◆ SystemView and IT ++ simulation software,
 - ◆ CAD-CAE development tools for FPGA Mentor Graphics (26 licenses) and Altera; FPGAs (16 licenses), Nanometer IC Design- HEP (Higher Educational Program) Mentor Graphics (10 licenses)
 - ◆ development tools for Analog Devices Blackfin DSPs (16 licenses),
 - ◆ Altera FPGA development boards:
 - 1x UP-1 basic development board for Altera FLEX10K FPGA family,
 - 2x UP-3 basic development board for Altera Cyclone FPAG family,
 - 1x NIOS II development board for synthetic 32-bit soft processors in Altera Cyclone FPGAs,
 - 1x Stratix DSP development kit for testing and development DSP algorithms in Stratix FPGA, support for analog signal processing up to 100 MHz , integrated AD and DA converter; 1xCyclone II DSP development kit with video input daughtercard for testing and development of video signals in Cyclone II FPGA.
 - ◆ Analog Devices Blackfin DSP development boards:
 - 8x development board EZ-KIT 533 600 MHz with Analog Devices signal processor Blackfin ADSP21533,
 - 2x development board EZ-KIT 561 600 MHz with Analog Devices signal processor Blackfin ADSP21561,
 - 5x development board EZ-KIT 535 350 MHz signal processor Analog Devices Blackfin ADSP21535,
 - 2x extender for video signal processing with Blackfin DSPs; 1x HS-USB Emulator for Blackfin DSPs.
 - ◆ Development boards for 32-bit Freescale microcontrollers:
 - 10 x development board of 32-bit microcontroller Freescale M52233DEMO with ColdFire V2 core and integrated Ethernet communication interface,
 - 2 x development board Freescale M5329EVB with ColdFire V3 core and cryptographic coprocessor.
 - ◆ Freescale development tools for RadioFerequency (RF) ZigBee networks:
 - 1x 1321xNSK: Freescale Network Starter Kit with highly integrated chips (CPU + RF), external emulation interface,
 - 8x ZigBee RF interface with integrated 2.4 GHz antenna and SPI interface.
 - ◆ Development tools for 8-bits microcontrollers:
 - 7x development boards based on Analog Devices ADuC83x microconverters with embedded 16 a 24-bits AD converters.

Laboratory of optoelectronics

- Fiber optic education system:
 - ◆ Optical bench with 2 x HeNe laser,
 - ◆ Fiber optic power meter,

- ◆ Fibre optic transmitter (7 x transmit module with LED diode – 565, 583, 635, 660, 830, 850 and 900 nm),
- ◆ Fibre optic receiver (2 x receive module with PIN diode),
- ◆ Optical bench (the simulate attenuation: air gap, axial displacement and angle of approach),
- ◆ Fiber optic (plastic fibre 0.5, 5, 10, 20 and 50 m; glass fibre 1 and 20 m),
- ◆ Coaxial cable (100 m),
- ◆ Storage case (add-on transformer),
- ◆ Opto-couplers.
- Unique optoelectronic devices:
 - ◆ Optical Cambridge correlators,
 - ◆ Fiber optic refractometer,
 - ◆ Optically powered system,
 - ◆ Weather sensor (measured: temperature, relative humidity, density of floating particles in the air).
- Advanced optoelectronic equipments:
 - ◆ FSO system LightPointe Flight Strata 155E (Free-space wavelength 850 nm, full-duplex 155 Mbps, operational range 2000 m clear air and 1000 m extreme rain),
 - ◆ FSO system FSona SONAbeam™ 155-E (Free-space wavelength 1550 nm, full-duplex 125 Mbps, operational range 3500 m clear air and 1700 m extreme rain),
 - ◆ Near-Infrared Spectrometer NIRQuest256-2.1 (wavelength range: 900 to 2050 nm),
 - ◆ OTDR: EXFO FTB-200 (compact platform for multilayer, multimedium testing),
 - ◆ All-Fibre Handheld OTDR—AXS-110 (wavelengths: 1310/1490/1550/1625/850/1300 nm),
 - ◆ Fusion splicer Fitel S178 (applicable fibers: SM, MM, DSF, NZD, EDF, BIF/UBIF (Bend insensitive fiber)),
 - ◆ Fiber Power Meters KI 7600C Series (options for 600 - 1700 nm, +27 to -70 dBm, SMF, MMF and large core (0.2 - 3 mm) fiber).
- Computers:
 - ◆ Server (PC Pentium III),
 - ◆ 2 x PC Pentium IV computers (2,8 GHz, HDD 200GB),
 - ◆ 6 x Laptop,
 - ◆ Switches (16 ports and 8 ports)
 - ◆ Web cameras, printers, scanners,...
- Software tools:
 - ◆ System RSoft's simulation software of optical communication:
 - Software OptSim (simulate single mode optical communication systems at the signal propagation level),
 - Software ModeSYS (simulate multimode optical communication systems at the signal propagation level),
- Microwave measuring bench for cm waves with klystron power.

Laboratory of multimedia and network security

- Advanced equipments:
 - ◆ 6x VoIP phones,
 - ◆ 3x Wireless LAN controllers,
 - ◆ Intrusion detection system,
 - ◆ 3x Terminal server AUX,
 - ◆ Exchange for DSL,
 - ◆ Exchange for PSTN.

- Computers:
 - ◆ Server (Monitor, CD/DVD/Blue ray,...),
 - ◆ 6x Switch,
 - ◆ 9x L3 Switch distribution,
 - ◆ Wifi 802.11a/b/g Access Point (Asus WL 520g),
 - ◆ 6x Access point,
 - ◆ 6x Lightweight Access Point,
 - ◆ 12x PC Pentium IV (2,8 GHz, HDD 200GB, Windows/Linux),
 - ◆ 13x 17''-LCD monitors, LCD TV Samsung 40'' Full HD,
 - ◆ 6x Web cameras,
 - ◆ 10x Routers (3x with VoIP accessories),
 - ◆ 2x Firewall (for VoIP services).
- Videoconferencing system Eagle,
- Magio box.

Laboratory of speech technologies in telecommunications

- Telecommunication server, equipped with 12 port Dialogic D120JCT, three GSM gateways, Skype box, SIP Linksys Gateway a PSTN link,
- Telecommunication workstation with 4 port Dialogic D40JCT card,
- Spoken language dialogue system, developed in the scope of national research project, enabling information retrieval using voice interaction between human and computer in Slovak language through telecommunication network and it finds information distributed in Internet(prototype). It serves as platform for development of speech and mobile technologies and human – computer interaction,
- Application server for research and development in the domain of speech and language technologies (XEON 2GB RAM, 2TB HDD, OS Debian Linux),
- Computing server for speech analysis and synthesis (HP ProLiant DL380 G7, 2xCore2Quad 2.4GHz, 12GB RAM, 4x HP 146-GB 6G 10K 2.5" DP SAS HDD),
- Web and FTP server department of KEMT (OS Linux, 1GB RAM, 1TB HDD, kemt.fei.tuke.sk),
- MediaServer (cooperation with TV cable company S-team, recording of broadcast TV news corpus KEMT-BN, R+TV),
- CorpusServer (DVB-T, speech data recording, text data collecting),
- Collection of „opensource“ and own software tools for research and development of speech and language technologies,
- Speech and text corpuses, containing more than 500 hours of annotated speech recordings and 2 billion tokens of text in Slovak language
- PC workstations (6 pcs) and notebooks (6 pcs),
- IBM DS3300/x3650 M3/x3850 X5 computing and data storage centre. The DS3300 provides scalable storage array which is used for text and speech databases, consisting of 12 SATA disk bays (3 disks – 5TB already installed) with iSCSI interface. The high performance 3x4CPU servers are used for acoustical and language modeling issues, which could be parallelized and needs also a huge storage and high performance access to the databases. These server provides also totally 84GB of memory which is necessary for this type of tasks,
- The VoIP Traffic Generator and Analyzer consisting of the Abacus 50 GigE test system and ClearSight™ Analyzer & Network Time Machine,
- TIMS (Telecommunication Instructional Modelling System) - hardware and software based platform for modelling telecoms theory and techniques within the laboratory telecommunications and signal processing courses,

- OPNET Modeller Simulator is the world leading discrete event R&D network tools, providing research environment for design, modelling, simulation and analysis of many types of communications networks,
- Hand-held Bruel & Kjaer Analyzer Type 2270 for sound and vibration measurement, analysis and recording,
- Acoustic measurement system Audiomatica (Clio FW Standard 10, Clio Pre-01 Mk2, Clio QC Box Model 5, CLIO accelerometer ACH-01, mics, notebook).

3 TEACHING

3.1 Courses

Bachelor Degree Course (title Bc.) –Electronics

The Bachelor degree course is orientated into the field of Electronics into the basic electronics systems. The students achieve good skills in electrical measurement, electronics components, linear and non-linear circuits, digital electronics, microprocessors and signal processors and optoelectronics.

Bachelor Degree Course (title Bc.) –Telecommunications

The Bachelor degree course is orientated into the field of Telecommunication mainly into the basic telecommunication systems and networks. The students achieve good skills in telecommunication services, management of telecommunication networks and economics in telecommunications.

Master Degree Course (title Ing.) – Infoelectronics

The Master degree course is oriented into the field of Infoelectronics the students have been achieve good skills in mathematics, physics, electromagnetic field, electrical measurement, electronics components, linear and non-linear circuits, digital electronics, microprocessors and signal processors, optoelectronics and digital signal processing.

Master Degree Course (title Ing.) – Multimedia telecommunications

The Master degree course is oriented into the field of Multimedia telecommunications the students have been achieve good skills in digital communication and transmission systems, mobile and satellite communications, optoelectronics communication systems and multimedia communication.

Ph.D. Degree Courses (title Ph.D.) – Infoelectronics

The Ph.D. degree course is orientated into the field of digital image and speech encoding and transmission, optoelectronics systems and digital filtering as well as design of electronic and optoelectronics systems, sensor systems and digital circuit's simulation.

Ph.D. Degree Courses (title Ph.D.) – Telecommunications

The Ph.D. degree course is orientated into the field of multimedia communications, mobile and satellite communications as well as modern telecommunication technologies and networks and digital signal processing in telecommunications.

Ph.D. Degree Courses (title Ph.D.) – Electronics measurement systems

The Ph.D. degree course is focused into the methodology of instrumentation in industry, scientific research and monitoring of physical parameters. The related scientific areas are metrology, sensors of different physical qualities, digital signal processing and pre-processing, calibration and self-diagnostic as well as virtual instrumentation.

3.2 List of subjects taught

3.2.1 Study plan for Bc. degree

Undergraduate Study (Bc.) – Automotive Electronics

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Basics of electronics	2 nd	3/2	Micheali
Circuit theory	3 rd	3/2	Kocur
Digital electronics	3 rd	3/3	Levický
Microelectronic circuits	4 th	3/2	Michaeli
Automotive electronics	5 th	2/2	Gamec
Automotive embedded systems	6 th	3/2	Drutarovský
Active and passive safety systems	6 th	3/2	Gamec
Mobile networks and services	6 th	3/2	Doboš

Undergraduate Study (Bc.) – Electronics

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Basics of electronics	2 nd	3/2	Micheali
Circuit theory	3 rd	3/2	Kocur
Signals and systems	3 rd	3/2	Mihalík, Zavacký
Programming environments for electronics and communications	3 rd	1/2	Varchola, Šaliga
Electronic measurement systems	4 th	2/2	Šaliga
Networks technology	4 th	2/2	Čížmár
Microelectronic circuits	4 th	3/2	Michaeli
Electroacoustics	4 th	2/2	Juhár
Electromagnetic waves and antennas	4 th	2/2	Ovseník
CAD in electronics	4 th	2/2	Galajda
High frequency and microwave technology	5 th	2/2	Gamec
Semestral projects	5 th	0/6	Galajda
Microprocessors technology	5 th	2/2	Drutarovský
Networks architecture	5 th	3/2	Čížmár
Videocommunications	5 th	2/2	Mihalík
Automotive electronics	5 th	2/2	Gamec
FPGA circuits	5 th	2/2	Drutarovský, Galajda
Bachelor work	6 th	0/9	Galajda
Optoelectronic systems	6 th	2/2	Turán
Smart measurement systems	6 th	2/2	Šaliga
Mobile networks and services	6 th	3/2	Doboš
Satellite technology and services	6 th	3/2	Marchevský
Active and passive safety systems	6 th	3/2	Gamec

Undergraduate Study (Bc.) – Telecommunications

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Basics of electronics	2 nd	3/2	Micheali
Circuit theory	3 rd	3/2	Kocur
Signals and systems	3 rd	3/2	Mihalík, Zavacký
Digital electronics	3 rd	3/3	Levický
Networks technology	4 th	2/2	Čížmár
Programming environments for electronics and communications	3 rd	1/2	Varchola, Šaliga
Electronic measurement systems	4 th	2/2	Šaliga
Electromagnetic waves and antennas	4 th	2/2	Ovseník
Introduction to telecommunication	4 th	3/2	Levický

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Electroacoustics	4 th	2/2	Juhár
Semestral projects	5 th	0/6	Galajda
Switching technology	5 th	3/2	Marchevský
Networks architecture	5 th	3/2	Čížmár
Access networks	5 th	3/2	Marchevský, Maceková
High frequency and microwave technology	5 th	2/2	Gamec
Microprocessor technology	5 th	2/2	Drutarovský
Videocommunications	5 th	2/2	Mihalík
FPGA circuits	5 th	2/2	Drutarovský, Galajda
Mobile networks and services	6 th	3/2	Doboš
Bachelor work	6 th	0/9	Galajda
Satellite technology and services	6 th	3/2	Marchevský
Optoelectronic systems	6 th	2/2	Turán
Smart measurement systems	6 th	2/2	Šaliga

3.2.2 Study plan for MSc. degree

Graduate Study (Ing.) – Infoelectronics

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Digital signal processing	1 th	3/2	Mihalík
Programmable logic devices	1 th	2/2	Varchola, Galajda
Optoelectronics	1 th	2/2	Turán
Signal processors	1 th	3/2	Drutarovský
Electronic measurement	1 th	3/2	Šaliga
Semestral projects	2 nd	0/4	Galajda
Microwave circuits and systems	2 nd	3/2	Gamec
Digital image processing and coding	2 nd	3/2	Mihalík
Processing and transmission of speech and audio	2 nd	3/2	Juhár
Optical communication systems	2 nd	3/2	Turán
Applied cryptography	2 nd	3/2	Levický
Digital television	3 rd	3/2	Marchevský
Photonics	3 rd	3/2	Turán
Multimedia technologies	3 rd	3/2	Levický
Master thesis I.	3 rd	0/6	Galajda
UWB sensor networks	3 rd	2/2	Kocur, Rovňáková
Database systems - Oracle SQL	3 rd	2/2	Juhár
Medical electronics	3 rd	3/2	Michaeli
Interactive telecommunications systems and services	3 rd	3/2	Juhár
Mobile communications	3 rd	3/2	Doboš
Satellite communications	3 rd	3/2	Marchevský
Project management	4 th	0/2	Marchevský
Master thesis II.	4 th	0/18	Galajda

Graduate Study (Ing.) – Multimedia telecommunications

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Digital signal processing	1 th	3/2	Mihalík
Optoelectronics	1 th	2/2	Turán
Communication channel modelling	1 th	2/2	Kocur
Spread-spectrum communication systems	1 th	3/2	Kocur
Semestral projects	2 nd	0/4	Galajda
Telecommunications systems theory	2 nd	3/2	Čížmár

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Digital image processing and coding	2 nd	3/2	Mihalík
Optical communication systems	2 nd	3/2	Turán
Processing and transmission of speech and audio	2 nd	3/2	Juhár
Applied cryptography	2 nd	3/2	Levický
Multimedia technologies	3 rd	3/2	Levický
Mobile communications	3 rd	3/2	Doboš
Database systems - Oracle SQL	3 rd	2/2	Juhár
Interactive telecommunications systems and services	3 rd	3/2	Juhár
Satellite communications	3 rd	3/2	Marchevský
Master thesis I.	3 rd	0/6	Galajda
Photonics	3 rd	3/2	Turán
Digital television	3 rd	3/2	Marchevský
Project management	4 th	0/2	Marchevský
Master thesis II.	4 th	0/18	Galajda

3.2.3 Study plan for Ph.D. degree

Graduate Study (PhD.) – Infoelectronics

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Theory of infoelectronics	1 th	0/2	
Foreign language	1 th	0/2	
Research project I.	1 th	0/2	
Foreign language	2 nd	0/2	
Infoelectronics systems	2 nd	0/2	
Research project II.	2 nd	0/2	
Specialization subject	3 rd	0/2	
Research work	3 rd	0/8	
Research project III.	3 rd	0/4	
Research work	4 th	0/8	
Research project IV.	4 th	0/2	
Research work	5 th	0/12	
Research project V.	5 th	0/2	
Thesis - Research work	6 th	0/9	

Graduate Study (PhD.) – Electronics measurement systems

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Topics from mathematics and physics	1 th	0/2	
Foreign language	1 th	0/2	
Research project I.	1 th	0/2	
Foreign language	2 nd	0/2	
Measure theory	2 nd	0/2	
Research project II.	2 nd	0/2	
Specialization subject	3 rd	0/2	
Research work	3 rd	0/8	
Research project III.	3 rd	0/4	
Research work	4 th	0/8	
Research project IV.	4 th	0/2	
Research work	5 th	0/12	
Research project V.	5 th	0/2	
Thesis - Research work	6 th	0/9	

Graduate Study (PhD.) – Telecommunications

Subject	Semester	Lectures/exercises (hours per week)	Name of Lecturer
Communication system theory	1 th	0/2	
Foreign language	1 th	0/2	
Research project I.	1 th	0/2	
Foreign language	2 nd	0/2	
Advanced communication technology	2 nd	0/2	
Research project II.	2 nd	0/2	
Specialization subject	3 rd	0/2	
Research work	3 rd	0/8	
Research project III.	3 rd	0/4	
Research work	4 th	0/8	
Research project IV.	4 th	0/2	
Research work	5 th	0/12	
Research project V.	5 th	0/2	
Thesis - Research work	6 th	0/9	

4 RESEARCH AND PROJECTS

4.1 International scientific projects

Project title: INDECT – Intelligent Information System Supporting Observation, Searching and Detection for Security of Citizens in Urban Environment

Acronym: INDECT

Number: Contract No 218086

Program/agency: 7. FP

Coordinator from TU: doc. Ing. Ľubomír Doboš, CSc.

Project partners: Coordinator AGH Cracow + next 16 partners from EU countries

Start of project: 01/2009

End of project: 12/2013

Total founding: 287.203,00 EUR

Annotation: The main objectives of the INDECT project are: (1) to develop a platform for: the registration and exchange of operational data, acquisition of multimedia content, intelligent processing of all information and automatic detection of threats and recognition of abnormal behavior or violence, (2) to develop the prototype of an integrated, network-centric system supporting the operational activities of police officers, providing techniques and tools for observation of various mobile objects, (3) to develop a new type of search engine combining direct search of images and video based on watermarked contents, and the storage of metadata in the form of digital watermarks, (4) to develop a set of techniques supporting surveillance of internet resources, analysis of the acquired information, and detection of criminal activities and threats. The main expected results of the INDECT project are: (a) to realise a trial installation of the monitoring and surveillance system in various points of city agglomeration and demonstration of the prototype of the system with 15 node stations, (b) implementation of a distributed computer system that is capable of acquisition, storage and effective sharing on demand of the data as well as intelligent processing, (c) construction of a family of prototypes of devices used for mobile object tracking, (d) construction of a search engine for fast detection of persons and documents based on watermarking technology and utilizing comprehensive research on watermarking technology used for semantic search, (e) construction of agents assigned to continuous and automatic monitoring of public resources such as: web sites, discussion forums, UseNet groups, file servers, p2p networks as well as individual computer systems, (f) elaboration of Internet based intelligence gathering system, both active and passive, and demonstrating its efficiency in a measurable way.

Project title: European Digital Virtual Design Lab

Acronym: eDiViDe

Number: 518565-LLP-1-2011-1-BE-ERASMUS-ESMO

Program/agency: LLP

Coordinator from TU: doc. Ing. Miloš Drutarovský, CSc.

Project partners: Limburg Catholic University College, Hochschule Bonn-Rhein-Sieg, University of Oslo

Start of project: 10/2011

End of project: 09/2014

Total founding: 34.590,00 EUR

Annotation: In this project, we will develop a virtual laboratory that allows students to access several real-life FPGA setups whenever they are connected to the internet. These setups will be developed by the partnering institutes and will be made programmable through the internet using VHDL. Each setup will be accompanied by a camera that films the behaviour of the setup and

sends back the result to the student. This way, the verification of the design is done by checking the behaviour of the application instead of digital simulation results.

Project title: Trustworthy Manufacturing and Utilization of Secure Devices

Acronym: TRUEDEVICE

Number: COST Action IC1204

Program/agency: COST

Coordinator from TU: doc. Ing. Miloš Drutarovský, CSc.

Project partners: 17 partners from university, research and industrial institutions

Start of project: December 12/2012

End of project: December 11/2016

Total founding: not defined

Annotation: Hardware security is becoming increasingly important for many embedded systems applications ranging from small RFID tag to satellites orbiting the earth. Its relevance is expected to increase in the upcoming decades as secure applications such as public services, communication, control and healthcare will keep growing. The vulnerability of hardware devices that implement cryptography functions (including smart cards) has become the Achilles's heel in the last decade. Therefore, the industry is recognizing the significance of hardware security to combat semiconductor device counterfeiting, theft of service and tampering. This COST Action aims at creating a European network of competence and experts on all aspects of hardware security including design, manufacturing, testing, reliability, validation and utilization. The network will play a key role in developing solutions responding to the hardware security challenges, hence strengthening the position of Europe in the field.

Project title: RF/Microwave Communication Subsystems for Emerging Wireless Technologies

Acronym: RFCSET

Number: COST Action IC0803

Program/agency: COST

Coordinator from TU: prof. Ing. Dušan Kocur, CSc.

Project partners: 25 partners from university, research and industrial institutions

Start of project: 04/2009

End of project: 10/2012

Total founding: 17.000,00 EUR

Annotation: The research within RFCSET is focused on two different directions. The former is represented by MIMO-OFDM systems, considering channel estimation problems, peak-to-average-power ratio reduction problem, MIMO-OFDM receiver design and compensation of the non-linear distortion due to the high power amplifiers of the transmitters. The latter research line of RFCSET is intent on radar signal processing for through wall tracking of moving target by UWB radar systems. Some of the problems considered here will be the design of new sophisticated methods of background subtraction and weak signal enhancement, development of new methods of multiple-target detection and tracking and the development of suitable cooperative methods of target localization by two independent UWB radar systems.

Project title: Integrating Biometrics and Forensics for the Digital Age

Acronym:

Number: COST Action IC1106

Program/agency: COST

Coordinator from TU: Ing. Matúš Pleva, PhD.

Project partners: 27 partners from university, research and industrial institutions

Start of project: March 14/2012

End of project: March 13/2016

Total founding: not defined

Annotation: Forensics is the application of a broad spectrum of sciences to answer questions of interest to a legal system. This may be in relation to a crime or a civil action” [Wikipedia]. Since many such questions boil down to identifying, or verifying the identity, of people allegedly involved in some action, a clear relationship exists between forensics and biometrics. Biometrics developed a number of techniques which can clearly facilitate the identification of people involved in criminal actions or civil incidents. Thus, although the two communities have traditionally often operated in relative isolation, there are many scenarios where the synergic cooperation of multimodal biometrics and forensics can be successfully applied. To address such multifaceted areas it is important to develop an interdisciplinary network with complementary competences, to foster the birth of a new community which can develop novel technological solutions to crucial issues and new challenges in forensic science.

Project title: Propagation Tools and Data for Integrated Telecommunication, Navigation and Earth Observation Systems

Acronym:

Number: COST Action IC0802

Program/agency: COST

Coordinator from TU: Dr.h.c. prof. RNDr. Ing. Ján Turán, DrSc.

Project partners: TU Graz, TU Budapest, TU Toulouse, University Nothumbia UK, CVUT Prague, University Bonn, University Roma, University Vigo

Start of project: 09/2009

End of project: 09/2013

Total founding: 32.000,00 EUR

Annotation: Telecommunication, Navigation and Earth Observation systems and services are developing world-wide with a multiplicity of standalone terrestrial and space systems that operate in diverse frequency bands. Global Integrated Networks (GIN) will be necessary in the near future to provide better integrated services. Their design requires a comprehensive knowledge of the various propagation media. Up to now radio channel modelling has been performed separately for each type of radio systems.

This activity will develop a coordinated set of models, techniques and data related to the radio channel in order to improve the design and performance of Global Integrated Networks.

The activity will recommend and provide the most appropriate radio channel models, channel assessment techniques and data for the design and operation of these GINs.

The frequencies of interest range from 100 MHz to 100 GHz (VHF to W band) and cover optical free space communications. The target architectures include mobile and fixed, satellite and terrestrial communication systems (including optical links), satellite navigation systems and Earth Observation systems.

The activity will bring together remote sensing, propagation and systems experts. The physical propagation fundamentals will be based on experimental and climatological data.

4.2 National scientific projects

Project title: Complex Modular Robotic System of Middle Category with Increased Intelligence

Acronym: KomoRob

Number: Req-00169-0001

Program/agency: Ministry of education of Slovak Republic

Coordinator from TU: prof. Ing. Jozef Juhár, CSc.

Project partners: ZŤS VVÚ Košice, a.s., Sjf TU v Košiciach

Start of project: 01/2010

End of project: 08/2013

Total founding: 184.797,00 EUR

Annotation: The main objective of the project is research and development of complex system of intelligent modules for construction of robotic systems meant for using in heavy environment conditions like natural disasters, fire infernos, etc.

Project title: Through Wall Tracking of Moving Targets by Using UWB Radar Systems

Acronym: TW-MTT-UWB

Number: LPP-0080-09

Program/agency: APVV

Coordinator from TU: prof. Ing. Dušan Kocur, CSs.

Project partners:

Start of project: 09/2009

End of project: 08/2012

Total founding: 62.000,00 EUR

Annotation: The project is intent on the design of new methods of radar signal processing obtained by the UWB radar for the purpose of through obstacle (e.g. wall) detection and tracking of moving multiple targets with a possibility to track individual targets within a group of targets. For that purpose, two research lines will be followed and investigated. The former will be represented by the development of a multiple target tracking method based on a modification and extension of the trace estimation method. On the contrary, the latter approach will be based on the application of two independent radar systems in combination with the advanced methods of the multiple target localization by using cooperative positioning methods.

Project title: Development of Experimental Measurement Apparatuses and Multimedial e-Learning Textbook for the Purpose of the Education Process Support in the Field of UWB Radar System

Acronym: UWB-RSS

Number: 010TUKE-4/2012

Program/agency: KEGA

Coordinator from TU: prof. Ing. Dušan Kocur, CSc.

Project partners:

Start of project: 01/2012

End of project: 12/2014

Total founding: 6.500,00 EUR

Annotation: Project UWB-RSS is intent on the development of students' cognitive abilities in the field of UWB radar system within the master study program Infoelectronics provided at Technical University of Košice by the development of the experimental parts of the subject „UWB Sensor Networks“. Within the project, two apparatuses for the measurement execution by the UWB radar with a synthetic aperture (SAR) at laboratory and landscape conditions will be developed. These apparatuses will enable to create the radar images of the static objects localized in a free space, behind an obstacle or underground. The software development for processing of radar signals scanned by the measurement apparatuses will be also included into the project tasks. Except of the measurement apparatuses and software, the e-learning textbook focused on the static object imaging by a short range UWB radar will be developed, too. Following this partial project goals, the creation of the suitable environment and conditions for receiving practical skills and knowledge concerning UWB radar technology fundamentals and applications will be the most important project output.

Project title: Through-Wall Localisation of People by Means of Portable Ultra-Wideband (UWB) Sensors**Acronym:****Number:****Program/agency: DAAD, MŠVVaŠ****Coordinator from TU: prof. Ing. Dušan Kocur, CSc.****Project partners: Technische Universität Ilmenau, Germany****Start of project: 01/2012****End of project: 12/2013****Total founding: 2.000,00 EUR**

Annotation: The aim of this project is to propose new approaches for the through wall detection, localisation and tracking of people by means of UWB sensors. The main challenge is the localisation of multiple persons that do not carry any tag. It is assumed that portable sensors equipped with one transmitter and two receivers will be used for the localisation of people. Each sensor should be capable of the standalone operation however cooperative localisation of multiple sensors will be analysed too. The targets have to be detected and localized just by using electromagnetic waves (EMW) scattered from them. It has been showed that the detection of multiple persons suffers especially from “shadowing effects”. A person standing in front of transmitter of a sensor shadows persons standing behind it. Since the human body contains a lot of water, EMW are scattered back from the body of the closest person and do not propagate further (are strongly attenuated) to persons standing behind it. Therefore, these persons are hardly “visible” by the UWB sensor. Within the project, novel localization approaches respecting specifics of the EMW propagation in multi-target scenarios will be proposed. We will be intent on the development of two localisation approaches. The first one will be proposed for the scenario in which only one UWB sensor will have to detect and localise multiple persons. We anticipate that this approach could benefit from new antenna arrangements that will be proposed within the measurement campaign. The second approach will be developed for the cooperative detection and localisation of multiple persons by means of a sensor network. The spatial diversity in obtained measurements should help to detect and localise also persons shadowed in particular sensor measurements. This approach will require novel data fusion algorithms. Performance of both approaches will be investigated theoretically, by simulations and tested on data measured by UWB sensors available at TU Ilmenau and TU Kosice.

Project title: Security in Modern Telecommunication Networks**Acronym:****Number: 1/0386/12****Program/agency: VEGA****Coordinator from TU: prof. Ing. Dušan Levický, CSc.****Project partners:****Start of project: 01/2012****End of project: 12/2014****Total founding: 17.898,00 EUR**

Annotation: Scientific project is oriented to selected aspects of the modern telecommunication network security with references to three areas: multimedia content security, security of mobile networks and information content analysis of audio signals. In the area of multimedia content security the development of the new methods for multimedia content protection by using digital watermarking in video and image steganography is expected. In the area of mobile networks security design of cross-layer model for new generation of mobile networks with respect to robust multi-layer security and implementation of security mechanisms which protect mobile networks from various types of attacks is expected. In the area of information content evaluation for audio

signals the development and verification of the new methods and approaches for detection and evaluation of the audio events indicating abnormal situations from point of view people's security is expected.

Project title: New Testing Methods for Analog-to-Digital Interfaces Based on the Error Model Identification

Acronym:

Number: 1/0555/11

Program/agency: VEGA

Coordinator from TU: prof. Ing. Linus Michaeli, DrSc.

Project partners:

Start of project: 01/2011

End of project: 12/2013

Total founding: 21.000,00 EUR

Annotation: Research of the new testing approaches Analog to Digital Interfaces based on the identification of their error models, suitable for assessment main parameters in the less equipped laboratories. Proposed method will match error parameters of technologically new components and accuracy needs appropriate to the particular implementation. Existing standards do not cover the actual needs for parameter description of end users and system designers because of their persistence in the standards.

Proper error model will be utilized for dynamic error characterization both functional and integral error parameters from the testing of chosen segments of the full scale range. Implementation of non standardized easily generated testing signals and error estimation in time and stochastic domain using already recommended testing procedures will be another objective of the project. Traceability of the proposed method to the actual standards will be estimated in both approaches.

Project title: Laboratory Workplace for Electronic Course Controlled by IT Technology (E-Lab)

Acronym:

Number: 029TUKE-4/2012

Program/agency: KEGA of Ministry of education of Slovak Republic

Coordinator from TU: prof. Ing. Linus Michaeli, DrSc.

Project partners:

Start of project: 01/2012

End of project: 12/2014

Total founding:

Annotation: (E-Lab) represents one component of e-learning in subjects of the course "Electronics" and "Telecommunication" where the laboratory exercises are scheduled for gaining practical skills with electronic systems. It allows full time and distance students to become familiar with standard measuring instruments and their utilisation in the electronic measurement using any web browser.

The significant objective is the cost reduction on experimental classes, thanks virtual instruments and accessibility of laboratory stands out of regular time schedule devoted for laboratory experiments. Developed system will be an example of virtual measuring system for students in the subject Instrumentation. It will serve professionals from the industry as the demonstration sample of the virtual instrumentation.

Project title: Electromagnetic Compatibility of Technological Equipment in Tyre Industry

Acronym: INTRO

Number: APVV-0333-11

Program/agency: EMC-IND

Coordinator from TU: doc. Ján Šaliga, CSc.

Project partners: STU in Bratislava, Koštrukta Trenčín, a.s.

Start of project: 07/2012

End of project: 12/2015

Funding in 2012: 37.329,00 EUR

Total funding: 248.469,00 EUR

Annotation: The project deals with innovation of technological equipments in tire industry in term of EMC properties, that increase the usability, utility value and also the competitiveness of the equipment developed and designed in Slovakia, which is reflected particularly at international level. The project involves identifying sources of interference, their analysis in term of behaviour in the electromagnetic environment and suppression of their negative effects. Also parts of equipments will be identifies which are sensitive to electromagnetic interference and other task within the project realisation is to ensure their failure-free operation.

Project title: **Digital Signature Power Analysis Attack and Countermeasures**

Acronym: DISIPA

Number: APVV-0586-11

Program/agency: EMC-IND

Coordinator from TU: Ing. Michal Varchola, PhD.

Project partners: STU in Bratislava, Micronic, s.r.o.

Start of project: 07/2012

End of project: 12/2015

Funding in 2012: 45.065,00 EUR

Total funding: 246.658,00 EUR

Annotation: Research and development of advanced methods of side channel attacks against elliptic curve cryptography (ECC) based digital signatures schemes is main focus of this project as well as research and development of suitable countermeasures. Power analysis attack can reveal the secret of digital signatures and so alien person can sign documents using a false identity. We intend to develop and evaluate rigorous algorithmic countermeasures and countermeasures based on suitable topology of electronic circuits. These countermeasures should practically inhibit the successful attacks based on the power analysis. The result of this project will be suite of regulations, instructions, and recommendations how to use various countermeasure methods in order to avoid the power analysis attacks against digital signatures based on the ECC in various commercial or diplomatic cryptographic devices. Next goal of project is to optimize power analysis attack methods using highly parallel processor structure of the CUDA video adapters in order to shorten time which is needed for the successful attack. The Micronic Company will be a purchaser of the developed technology. Micronic develops and produces various cryptographic devices and systems for the various state institutions and agencies as well as for the commercial market. Digital signatures based on the ECC are essential component of their devices. That is why the secure implementation of digital signatures is highly top priority for them.

4.3 Operational program research and development

Project title: **Development of the Center of Information and Communication Technologies for Knowledge Systems**

Acronym: CE-FEI-II

Number: IMTS-26220120030

Program/agency: Operational Program Research and Development

Coordinator from TU: prof. Ing. Dušan Kocur, CSc.

Project partners:**Start of project:** 04/2010**End of project:** 03/2013**Total founding:** 2.782.500,00 EUR

Annotation: The project objective is to develop the “Center of Information and Communication Technologies for Knowledge Systems” as the excellency center of the research and development in the field of information and communication technologies and artificial intelligence with the stress to basic and applied research, development and technology transfer providing extensive support to all stages of the university education in the field of information and communication technologies and artificial intelligence. The Center will be completed with instrumentation, software and other equipments with goal to create the meaningful support and development of the research and development and university education at Technical University of Košice in the field of the Center scope.

Project title: **Centre of Excellence of the Integrated Research & Exploitation the Advanced Materials and Technologies in the Automotive Electronics****Acronym:** CE III**Number:** IMTS-26220120055**Program/agency:** Operational Program Research and Development**Coordinator from TU:** prof. Ing. Alena Pietriková, CSc.**Project partners:** KEMT FEI TUKE (Gamcová M., Gamec J., Gladišová I., Maceková L., Ovseník Ľ., Tatarko M., Urdzík D.)**Start of project:** 09/2010**End of project:** 08/2013**Total founding:** 4.123.558,00 EUR

Annotation: The project objective is to establish the “Centre of Excellence of the Integrated Research & Exploitation the Advanced Materials and Technologies in the Automotive Electronics” as the excellency center of the research and development in the field using of the advanced materials and technologies in the automotive electronics with the stress to basic and applied research, development and technology transfer providing extensive support to all stages of the university education in the field of information and communication technologies and artificial intelligence. The Center will be build up in such a way as to be the important subject of the Technical University of Košice with regard to creation of the meaningful support and development of the research and development and university education at Technical University of Košice in the field of the Center scope.

Project title: **Research of Modules for Intelligent Robotic Systems****Acronym:** IntelliRobs**Number:** IMTS- 26220220141**Program/agency:** Operational Program Research and Development**Coordinators from TUKE:** prof. Ing. Jozef Juhár, CSc., Dr.h.c. mult. prof. Ing. František Trebuňa, CSc.**Project partners:** ZŤS VVÚ Košice, a.s., SPINEA, s.r.o., PROCONT, s.r.o.,**Start of project:** 01/2011**End of project:** 12/2014**Total founding:** 2.334.416,49 EUR

Annotation: The goal of the project is research enforcement of intelligent robotic platforms and convertible modules, autonomous control of robots based on artificial intelligence and building of laboratory for applied research in robotics.

Project title: Competency Centre for Knowledge Technologies Applied at Innovation of Production Systems in Industry and Services

Acronym: ZATIPS

Number: IMTS- 26220220155

Program/agency: Operational Program Research and Development

Coordinator from TUKE: prof. Ing. Stanislav Kmeť, CSc., prof. Ing. Jozef Juhár, CSc. (KEMT)

Project partners: Žilinská univerzita, Prešovská univerzita, ZŤS VVÚ Košice a.s., T-Systems Slovakia s.r.o., Elcom s.r.o., ANTIK Telecom s.r.o., CEIT SK, s.r.o., ITKON, spol. s r.o., IPM SOLUTIONS, s.r.o.

Start of project: 09/2011

End of project: 12/2014

Total founding: 5.252.128,28 EUR

Annotation: Establishment of the competency centre and farming of its functionality and long-term sustainability out. Scientific management of the competency centre. Providing of the competency centre with important equipment. Excellent research and development in the competency centre. Research and development knowledge technologies for innovation of producing systems and services.

5 CO-OPERATION

5.1 National co-operation

- Elcom s.r.o., Prešov
- Slovak Academy of Science
- Slovak Telekom, a.s.
- Volkswagen Slovakia, a.s.
- VSE, Košice (RWE Group)
- ZŤS výskumno-vývojový ústav Košice, a.s.

5.2 International co-operation

- Austrian Research Institute for Artificial Intelligence (OFAI) of the Austrian Society for Cybernetic Studies
- FTW Telecommunications Research Center Vienna, Austria
- Geozondas Ltd., Lithuania
- Ingenieur Büro Ralf Klukas, Germany
- INESC Lisabon, Portugal
- Meodat Meßtechnik, Germany
- Statens Råddningsverk, Sweden
- ŠkodaAuto Mladá Boleslav, Czech Republic
- Second University of Naples, Italy
- Technische Universität Ilmenau, Germany
- Hamburg University of Technology, Germany
- AGH University of Science and Technology Krakow, Poland
- Gdansk University of Technology, Poland
- Bulgarian Academy of Sciences, Bulgaria
- Technische Universiteit Delft, Netherlands
- Universitat Ramon Llull, Barcelona, Spain
- Technical University Budapest, Hungary
- Technical University of Ljubljana, Slovenia
- Technical University of Clju-Napoca, Romania
- University of Firenze, Italy
- University of Gent
- University of Maribor, Slovenia
- University of Sannio, Benevento, Italy
- University of Reggio Di Calabria, Italy
- University of Mediteranea, Italy
- University of Gävle, Sweden

6 FACULTY ESSAYS

Bánoci Vladimír

Research assistant

His research interests include hidden communication systems, steganography, steganalysis, digital image processing and watermarking, network technologies, information and network security.

Bugár Gabriel

Assistant professor

His research interests include hidden communication systems, steganography, steganalysis, digital image processing and watermarking, network technologies, information and network security.

Čižmár Anton

Full professor

His research interests include speech processing, data compression, digital communications, project management, telecommunication technologies and services.

Doboš Ľubomír

Associated professor

His current research interests include mobile and wireless communication systems with focus on Call Admission Control algorithms for next generation mobile systems, Routing protocols for Mobile Ad-Hoc systems, MIMO systems and Multimodal mobile systems and services (focus on Speech processing).

Drutarovský Miloš

Associated professor

His research interests include applied cryptography, digital signal processing, algorithms and architectures for embedded cryptographic architectures and sensor networks, digital signal processors, FPGAs, microcontrollers and soft microcontrollers embedded into the FPGAs.

Galajda Pavol

Associated professor

His research interests include nonlinear circuit's theory and Chaos theory, nonlinearities in digital transmission systems MC-CDMA OFDM UWB, analog and mixed signal ASIC design and implementation for UWB sensor systems.

Gamec Ján

Associated professor

His general research interests include digital signal processing, block - matching algorithm and motion estimation.

Gamcová Mária

Assistant professor

Her general research interests include one and two-dimensional processing based on the method of digital filtering.

Gazda Juraj*Assistant professor*

He is focused mostly on the advanced wireless communication systems, including LTE, LTE-Advanced and WiMax. He also deals with the spectrum trading and sharing theory for cognitive radio schemes.

Gladišová Iveta*Assistant professor*

Her research interests are in the digital signal processing, geometric source coding and vector quantization, an algorithm for lattice and pyramid quantizers and codes.

Hládek Daniel*Research assistant*

His current research interests include natural language processing, language modelling and text processing for LVCSR language databases.

Juhár Jozef*Full professor*

His research interests are in digital speech/audio processing and transmission, automatic speech/speaker recognition, speech synthesis, dialogue modelling and application of speech technologies in developing and deploying automatic voice services in telecommunications and Internet.

Klenovičová Zita*Research assistant*

Her research interests include digital circuits and digital picture processing.

Kocur Dušan*Full professor*

His research interest is in short-range UWB radar systems and sensor networks applied for detection, localization and tracking of people under disaster situations; in the physical layer of wireless communication systems with the special stress to OFDM, SC-FDMA, FBMD, OFDM/OQAM and GFDM transmission systems.

Levický Dušan*Full professor*

His main interests and activities are in the multimedia communications, cryptography and watermarking.

Lojka Martin*Research assistant*

His current research interests include speech decoding based on WFST and front-end speech processing.

Maceková Ludmila*Assistant professor*

Her main interests and activities are in area of communications in various types of access networks.

Marchevský Stanislav*Full professor*

His main research interests are multidimensional digital filters, linear and non-linear digital filters for image processing, and design of multi-user detectors for CDMA signals from satellites.

Mihalík Ján*Full professor*

His current research interest includes signal and information theory, image and video coding, digital image and video processing, application the techniques of coding and processing in the standard image and video codecs, finally multimedia videocommunications in telecommunication networks and Internet on the basis of the standards.

Michaeli Linus*Full professor*

His research interests are the pre-processing systems in the instrumentation, modelling of AD and DA converters and methods for correction of their uncertainties, industrial measurement and virtual instrumentation.

Ondáš Stanislav*Assistant professor*

His research interests include spoken dialogue systems, dialogue processing, spoken language understanding, speech processing and conversational agents.

Ovseník Ľuboš*Associated professor*

His general research interests include digital signal processing (Video Control and Video Surveillance Systems), fiber optical sensors and the fiber optics and its applications in communications (FSO-Free Space Optics, VLC-Visible Light Communication, etc.), sensing and signal processing (Optical Correlator, etc.).

Papaj Ján*Assistant professor*

His current research interests include mobile ad hoc networks (MANET), QoS, security and routing protocols for MANET.

Pleva Matúš*Research assistant*

His research interests include speech processing, automatic broadcast news processing, digital communications, Voice over IP technologies and services, telecommunication technologies and routing backbone networks.

Rovňáková Jana*Research assistant*

Her general research interests are focused on advanced methods of signal processing whereby her main activities are in the field of UWB radar signal processing.

Staš Ján*Research assistant*

His current research interests include Slovak language modelling for LVCSR.

Šaliga Ján*Associated professor*

His general research interests include ADC testing, distributed measurement systems, measurement instruments, systems and methods.

Špány Viktor*Professor Emeritus*

His main interests and activities are in the non-linear circuits theory, smart sensors, flip-flop sensors, integrated functional blocks and statistical sensors.

Turán Ján*Full professor*

His main interests and activities are in the digital signal processing, Hough transform, rapid transform, fiber optics and its applications in communications, sensing and signal processing.

Michal Varchola*Research assistant*

His main research interests are cryptography for embedded systems, particularly true random number generators and elliptic curve crypto-processors, wireless sensor networks and embedded systems based on FPGAs and microprocessors generally.

Zavacký Jozef*Assistant professor*

His current interest includes signal and information theory, sampling of the one-dimensional and multidimensional signals.

7 Ph.D. STUDENTS

<u>Name</u>	<u>Supervisor</u>	<u>Degree Course</u>
<i>First year of study</i>		
<u>Internal form:</u>		
Ing. Martin Broda	<i>prof. Levický</i>	Telecommunications
Ing. Peter Kažimír	prof. Kocur	Infoelectronics
Ing. Martin Petrvalský	doc. Drutarovský	Infoelectronics
Ing. Lukáš Sendrei	prof. Marchevský	Infoelectronics
Ing. Martin Sulír	prof. Juhár	Telecommunications
Ing. Daniel Zlacký	prof. Čižmár	Telecommunications
<u>External form:</u>		
Ing. Matej Žiga	doc. Galajda	Infoelectronics
<i>Second year of study</i>		
<u>Internal form:</u>		
Ing. Ondrej Kováč	prof. Mihalík	Infoelectronics
Ing. Jozef Lipták	doc. Šaliga	Measurement technique
Ing. Ján Valiska	prof. Marchevský	Telecommunications
Ing. Matúš Tatarko	doc. Ovseník	Infoelectronics
<u>External form:</u>		
Ing. Martin Kmec	doc. Galajda	Infoelectronics
Ing. Matúš Kozák	prof. Kocur	Infoelectronics
Ing. František Rakoci	doc. Ovseník	Infoelectronics
<i>Third year of study</i>		
<u>Internal form:</u>		
Ing. Denis Dupák	prof. Kocur	Infoelectronics
Ing. Patrik Gallo	prof. Levický	Telecommunications
Ing. Marek Godla	doc. Šaliga	Measurement technique
Ing. Tomáš Harasthy	prof. Turán	Infoelectronics
Ing. Anna Kažimírová Kolesárová	doc. Ovseník	Infoelectronics
Ing. Ján Krekáň	doc. Doboš	Telecommunications
Ing. Jozef Vavrek	prof. Čižmár	Telecommunications
<i>Fourth year of study</i>		
<u>Internal form:</u>		
Ing. Vladimír Cipov	doc. Doboš	Telecommunications
Ing. Peter Goč-Matis	prof. Levický	Telecommunications
Ing. Martin Sekerák	prof. Michaeli	Measurement technique
Ing. Peter Viszlay	prof. Juhár	Infoelectronics
Ing. Eva Vozáriková	prof. Čižmár	Telecommunications
<u>External form:</u>		
Ing. Daniel Fábry	doc. Šaliga	Telecommunications

8 MEMBERSHIP

Čižmár Anton, Member of Technical Standardization Commission No.41 for Telecommunications.

Čižmár Anton, Member IEEE Affiliate Computer Society, No. 41237162.

Čižmár Anton, Member of AES (Audio Engineering Society), New York, I.D. 44 154.

Doboš Ľubomír, Member of Technical Standardization Commission No.80 for Radiocommunications.

Drutarovský Miloš, Member of the editorial board of the journal "Acta Electrotechnica et Informatica".

Galajda Pavol, Member of Czech and Slovak Radioelectronics Engineering Society.

Galajda Pavol, Member of EURO PRACTICE IC Service.

Juhár Jozef, Member of ISCA (International Speech Communication Association).

Juhár Jozef, Member of AES (Audio Engineering Society), Memb. No. 76122.

Juhár Jozef, Member of IEEE, Memb. No. 90402602.

Juhár Jozef, Member of EU Domain Committee COST for ICT (Information and Communication Technologies) – national delegate.

Juhár Jozef, Member of the editorial board "International Journal of Signal and Imaging Systems Engineering", Issued by Inderscience Publishers, Geneva, Switzerland.

Juhár Jozef, Member of Technical Standardization Commission No.55 for Electroacoustics and ultrasound.

Kocur Dušan, Executive editor of the editorial board of the journal "Acta Electrotechnica et Informatica".

Kocur Dušan, Member of the editorial board of the journal "Acta Polytechnica Hungarica".

Kocur Dušan, Member of the editorial board of the journal "Radioengineering".

Kocur Dušan, Member of committee of Scientific Grant Agency of the Ministry of Education of the Slovak Republic and of Slovak Academy of Sciences.

Levický Dušan, Member of the editorial board of the journal "Acta Electrotechnica et Informatica".

Levický Dušan, Member of the editorial board of the journal "Slaboproudý obzor".

Levický Dušan, Member of the IEEE.

Levický Dušan, Member of Czech and Slovak Radioelectronics Society.

Michaeli Linus, Head of Slovak IMEKO National Committee and head of the IMEKO Technical Committee TC-4 "Measurement of Electrical Quantities".

Michaeli Linus, Member of the editorial board „Computer Standard & Interfaces“, Issued by Elsevier, Amsterdam, New York.

Michaeli Linus, Member of the reviewer board "Measurement". Journal IMEKO, Issued by Elsevier, Amsterdam, New York.

Michaeli Linus, Co-ordinator of IMEKO Working Group "AD and DA metrology".

Michaeli Linus, Member of the IEEE, Instrumentation & Measurement Society.

Michaeli Linus, Member of the scientific board of Electrotechnical Faculty, University Transport and Communication, Žilina, Slovakia.

Michaeli Linus, Member of the editorial board „Measurement Science Review“, Issued by SAV, Bratislava.

Michaeli Linus, Editor in Chief of the editorial board of the journal "Acta Electrotechnica et Informatica".

Michaeli Linus, Scientific Grant Agency of Slovak Republic.

Šaliga Ján, Member of the international board of IMEKO Technical Committee TC-4 "Measurement of Electrical Quantities".

Šaliga Ján, Member of the editorial board of the journal "Acta Electrotechnica et Informatica".

Šaliga Ján, Member of the editorial board of the journal "Radioengineering".

Turán Ján, Member of the Slovak Technical Standardization Committee No.53 for Cables, Conductors and Isolating Materials.

Turán Ján, Member of the Slovak Technical Standardization Committee No.43 for Terminology.

Turán Ján, Senior Member of the IEEE.

Turán Ján, Member of Czech and Slovak Radioelectronics Society.

Turán Ján, Member of the editorial board of the journal "Acta Electrotechnica et Informatica".

9 PUBLICATION ACTIVITY OF THE DEPARTMENT

9.1 Books

1. GAMEC,J.-KUČMA,P.: Signalizačný systém 7. In: Košice: TU, Slovakia, 2012, 120 pp.
2. GAMEC,J.-BLICHA,Š.: Digitálne spojovacie systémy. In: Košice: TU, Slovakia, 2012, 120 pp.
3. GLADIŠOVÁ,-MIHALÍK,J. Kvantovanie a entropické kódovanie (Návody na cvičenia). In: Košice: TU, Slovakia, 2012. 63 pp.
4. GRAZIOSO,P.-TRALLI,V.-KULAKOWSKI,P.-CARNIANI,A.-DOBOŠ,L.: Advances in Wireless Ad Hoc and Sensor Networks. In: Pervasive Mobile and Ambient Wireless Communications: Cost Action 2100, London: Springer Verlag, Germany, 2012, pp. 519-544.
5. HLÁDEK,D.-VAŠČÁK,J.-SINČÁK,P.: Towards Fuzzy Learning Classifier Systems Theory and Application of the Reinforcement Learning, Fuzzy Logic and Learning Classifier Systems. In: Saarbrücken: Lap Lambert Academic Publishing, Germany, 2012, 117 pp.
6. JUHÁR,J.-STAŠ,J.-HLÁDEK,D.: Recent Progress in Development of Language Model for Slovak Large Vocabulary Continuous Speech Recognition. In: New Technologies: Trends, Innovations and Research, Rijeka: InTech, Croatia, 2012, pp. 261-276.
7. KOCUR,D.-GAMEC,J.-GAMCOVÁ,M.-ROVNÁKOVÁ,J.-URDZÍK,D.: UWB bezdrôtové senzorové siete. In: Košice: TU, Slovakia, 2012, 120 pp.
8. LEVICKÝ,D.: Multimédia a ochrana ich obsahu. In: ELFA, Košice, Slovakia, 2012, 249 pp.
9. LEVICKÝ,D.-KLENOVIČOVÁ,Z.-BUGÁR,G.: Digitálna vodotlač v multimédiách. In: ELFA, Košice, Slovakia, 2012, 64 pp.
10. MARCHEVSKÝ,S.: Satelitné technológie a služby. In: Košice: TU, Slovakia, 2012, 128 pp.
11. MIHALÍK,J.-GLADIŠOVÁ,I.: Kódovanie obrazov (Návody na cvičenia). In: Košice: TU, Slovakia, 2012, 75 pp.
12. MICHAELI,L.: Elektronické súčiastky a obvody. In: ELFA, Košice, Slovakia, 2012, 224 pp.
13. ŠIMKA,M.-DRUTAROVSKÝ,M.: Selected Blocks for Public-Key Cryptosystems in FPGAs Analysis and Implementation of Montgomery Modular Multiplier and True Random Number Generator. In: Saarbrücken : Lambert Academic Publishing, Germany, 2012, 163 pp.
14. ŠIMKOVÁ,M.-GARABÍK,R.-GAJDOŠOVÁ,K.-LACLAVÍK,M.-ONDREJOVIČ,S.- JUHÁR,J.-GENČI,J.-FURDÍK,K.-IVORÍKOVÁ,H.-IVANECKÝ,J.: The Slovak Language in the Digital Age. In: Berlin Heidelberg: Springer-Verlag, Germany, 2012, 85 pp.
15. ZAVACKÝ,J.-MIHALÍK,J.: Banky filtrov. In: Košice: TU, Slovakia, 2012, 93 pp.

9.2 Journal papers

1. BALOGH,L.-KOLLÁR,I.-MICHAELI,L.-ŠALIGA,J.-LIPTÁK,J.: Full information from measured ADC test data using maximum likelihood estimation. In: Measurement, Vol. 45, no. 2 (2012), pp. 164-169.
2. BÁNOCI,V.-BUGÁR,G.-LEVICKÝ,D.-KLENOVIČOVÁ,Z.: A Novel JPEG Steganography Method Based on Modulus Function with Histogram Analysis. In: Radioengineering. Vol. 21, no. 2 (2012), pp. 758-763.
3. BUGÁR,G.-BÁNOCI,V.-LEVICKÝ,D.: Steganografia vo farebných obrazoch na báze DWT. In: Slaboproudý obzor, Vol. 68, no. 2 (2012), pp. 11-17.

4. CIPOV,V.-DOBOŠ,Ľ.-PAPAJ,J.: Anchor-free localization algorithm with time of arrival node distance estimation. In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 39-42.
5. CIPOV,V.-DOBOŠ,Ľ.-PAPAJ,J.: ToA Node Distance Estimation Enhancement in MANET Localization Algorithm Based on Cooperative Trilateration. In: Information and Communication Technologies and Services, Vol.10, no. 4 (2012), pp. 211-217.
6. CORRADO,M.-DE VITO,L.-RAMOS,H.-ŠALIGA,J.: Hardware and software platform for ADCWAN remote laboratory. In: Measurement, Vol. 45, no. 4 (2012), pp. 795-807.
7. ČIŽMÁR,A.-PAPAJ,J.-DOBOŠ,Ľ.: Security and QoS integration model for MANETS. In: Computing and Informatics, Vol. 31, no. 5 (2012), pp. 1025-1044.
8. GAZDA,J.-DUPÁK,D.-KOCUR,D.: Performance evaluation of M-APSK modulation in the nonlinearly distorted LTE uplink. In: Information Technology Journal, Vol. 11, no. 10 (2012), pp. 1418-1425.
9. HLÁDEK,D.-STAŠ,J.-JUHÁR,J.: Word Clustering for a Slovak Class-Based Language Model. In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 85-88.
10. KREKÁŇ,J.-DOBOŠ,Ľ.-PLEVA,M.: Accelerated GPU powered methods for auditing security of wireless networks using probabilistic password generation. In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 111-114.
11. MIHALÍK,J.: Generovanie textúrovej bázy ľudskej tváre. In: Slaboproudý obzor, Vol. 68, no. 3 (2012), pp. 14-19.
12. MICHAELI,L.-ŠALIGA,J.: Instrumentation for the information and communication technology era. In: Measurement, Vol. 45, no. 2 (2012), pp. 145-147.
13. ONDÁŠ,S.-JUHÁR,J.: Improving robustness of the SCORPIO robot speech interface by iterative spectral subtraction. In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 151-154.
14. ONDREJ,D.-OREJAS,M.E.-GAZDA,J.j: Simulation of code tracking error variance with early late Dll for GalileoGPS bandlimited receivers. In: Journal of Theoretical and Applied Information Technology, Vol. 41, no. 2 (2012), pp. 214-219.
15. OVSENÍK,Ľ.-TURÁN,J.-MIŠENČÍK,P.-BITÓ,J.-CSURGAI-HORVÁTH,L.: Fog Density Measuring System. In: Acta Electrotechnica et Informatica, Vol. 12, no. 2 (2012), pp. 67-71.
16. PAPAJ,J.-DOBOŠ,Ľ.-ČIŽMÁR,A.: Opportunistic networks and security . In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 163-166.
17. PAPAJ,J.-DOBOŠ,Ľ.-ČIŽMÁR,A.: Routing Strategies in Opportunistic Networks. In: Journal of Electrical and Electronics Engineering. Vol. 5, no. 1 (2012), pp. 167-172.
18. PAPAJ,J.-DOBOŠ,Ľ.-ČIŽMÁR,A.: OPNET Modeler Simulation Testing of the New Model Used to Cooperation Between QoS and Security Mechanisms. In: Information and Communication Technologies and Services, Vol.10, no. 4 (2012), pp. 218-223.
19. PLEVA,M.-ČIŽMÁR,A.-DOBOŠ,Ľ.: Voice Quality Measuring Setup with Automatic Voice over IP Call Generator and Lawful Interception Packet Analyzer. In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 191-194.
20. PLEVA,M.-LOJKA,M.-JUHÁR,J.: Modified Viterbi Decoder for Long-Term Audio Events Monitoring. In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 195-198.
21. ROVNÁKOVÁ,J.-KOCUR,D.: Experimental Comparison of Two UWB Radar Systems for Through-wall Tracking Application. In: Acta Electrotechnica et Informatica, Vol. 12, no. 2 (2012), pp. 59-66.

22. STAŠ,J.-HLÁDEK,D.-JUHÁR,J.: Morphologically Motivated Language Modeling for Slovak Continuous Speech Recognition. In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 233-236.
23. STAŠ,J.-HLÁDEK,D.-JUHÁR,J.-ZLACKÝ,D.: Analysis of Morph-Based Language Modeling and Speech Recognition in Slovak. In: Information and Communication Technologies and Services, Vol.10, no. 4 (2012), pp. 291-296.
24. TATARKO,M.-OVSENÍK,L.-TURÁN,J.: Availability and Reliability of FSO Links Estimated from Visibility. In: Carpathian Journal of Electronic and Computer Engineering Vol. 5, no. 1 (2012), pp. 121-126.
25. TURÁN,J.-OVSENÍK,L.-TURÁN,M.-VÁSÁRHELYI,J.: Léggöri paraméterek minőségi monitorozási rendszerének tervezése és mérése. In: Gép, Vol. 63, no. 5 (2012), pp. 11-14.
26. TURÁN,J.-OVSENÍK,L.-HARASTHY,T.: Traffic Sign Recognition System based on Cambridge Correlator Image Comparator. In: Carpathian Journal of Electronic and Computer Engineering Vol. 5, no. 1 (2012), pp. 127-132.
27. TURÁN,J.-OVSENÍK,L.-VÁSÁRHELYI,J.: A Multimedia Visual Feedback in the Web-controlled Laboratory. In: Carpathian Journal of Electronic and Computer Engineering Vol. 5, no. 1 (2012), pp. 133-138.
28. VISZLAY,P.-JUHÁR,J.-PLEVA,M.: Two-dimensional linear subspace learning based on discriminant analysis of speech. In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 273-276.
29. VISZLAY,P.-JANEČKO,J.-JUHÁR,J.: Eigenvalue Criterion-Based Feature Selection in Principal Component Analysis of Speech. In: Information and Communication Technologies and Services, Vol.10, no. 4 (2012), pp. 303-307.
30. VALISKA,J.-HRUŠOVSKÝ,B.-MARCHEVSKÝ,S.-PILLÁR,S.: Error models simulations transmission channels using network simulator environment. In: Acta Electrotechnica et Informatica, Vol. 12, no. 2 (2012), pp. 51-58.
31. VAVREK,J.-PLEVA,M.-JUHÁR,J.: TUKE MediaEval 2012: Spoken Web Search using DTW and Unsupervised SVM. In: CEUR Workshop Proceedings (CEUR-WS.org): Multimedia Benchmark Workshop 2012, Vol. 927 (2012), pp. 1-2.
32. VOZÁRIKOVÁ,E.-JUHÁR,J.-ČIŽMÁR,A.: Acoustic event detection based on MRMR selected feature vectors. In: Journal of Electrical and Electronics Engineering, Vol. 5, no. 1 (2012), pp. 277-282.
33. VOZÁRIKOVÁ,E.-JUHÁR,J.-ČIŽMÁR,A.: Dual Shots Detection. In: Information and Communication Technologies and Services, Vol.10, no. 4 (2012), pp. 297-302.
34. VOZÁRIKOVÁ,E.-LOJKA,M.-JUHÁR,J.-ČIŽMÁR,A.: Performance of Basic Spectral Descriptors and MRMR Algorithm to the Detection of Acoustic Events. In: Communications in Computer and Information Science: Multimedia Communications, Services and Security, No. 287 (2012), pp. 350-359.
35. ZAVACKÝ,J.-MIHALÍK,J.: Mnohokanálové diskrétné systavy s polyfázovou štruktúrou a dokonalou rekonštrukciou. In: Slaboproudý obzor, Vol. 68, no. 2 (2012), pp. 1-7.

9.3 Conference papers

1. ADAMIŠIN,J.-MACEKOVÁ,L.: Testovanie architektúr 1-Wire senzorových sietí In: Electrical Engineering and Informatics III.: Proceeding of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, Košice, Slovakia, 2012, pp. 293-298.

2. AUGUSTÍN,M.-VARCHOLA,M.: Pattern Recognition For Intrusion Detection Systems. In: ELITECH '12: 14th conference of doctoral students, Bratislava, Slovakia, May 22, 2012,pp. 1-3.
3. BÁNOCI,V.-BUGÁR,G.-LEVICKÝ,D.-KLENOVIČOVÁ,Z.: Histogram Secure Steganography System in JPEG File Based on Modulus Function In: Radioelektronika 2012: Proceedings of 22nd International Conference, Brno, Czech Republic, April 17-18, 2012, pp. 297-300.
4. CARNI,D.L.- GRIMALDI,D.-MICHAELI,L.-ŠALIGA,J.-LIPTÁK,J.: Measurement of the exponential signal distortion. In: I2MTC 2012: International Instrumentation and Measurement Technology Conference, Graz, Austria, May 13-16, 2012, pp. 1-5.
5. CIPOV,V.-DOBOŠ,Ľ.-PAPAJ,J.: ToA estimation enhancement for indoor manet cooperative localization algorithms. In: AEI'2012: International Conference on Applied Electrical Engineering and Informatics 2012, Germany, August 26 - September 2, pp. 63-69.
6. CIPOV,V.-COPÁK,M.: Anchor-free positioning using ToA node distance estimation and LoSNLoS detection. In: SCYR 2012: Proceedings from 12th Scientific Conference of Young Researchers, Herľany, Slovakia, May 15, 2012, pp. 23-26.
7. DEMIAN,D.-GLADIŠOVÁ,I.: Základné princípy MIMO systému pre komunikáciu v automobilovej doprave. In: Electrical Engineering and Informatics III.: Proceeding of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, Košice, Slovakia, 2012, pp. 299-304.
8. DOBOŠ,Ľ.-PAPAJ,J.-ČIŽMÁR,A.: Testing of the new model used to cooperation between QoS and security for MANET in OPNET modeler. In: AEI'2012: International Conference on Applied Electrical Engineering and Informatics 2012, Germany, August 26 - September 2, pp. 57-62.
9. DUPÁK,D.-BLICHA,R.: Filter bank multicarrier transmission system. In: SCYR 2012: Proceedings from 12th Scientific Conference of Young Researchers, Herľany, Slovakia, May 15, 2012, pp. 133-135.
10. GALLIK,B.-BUGÁR,G.-BÁNOCI,V.-LEVICKÝ,D.: Steganalýza farebných statických obrazov na báze DWT transformácie. In: Electrical Engineering and Informatics III.: Proceeding of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, Košice, Slovakia, 2012, pp. 326-329.
11. GALLO,P.-LEVICKÝ,D.: Modified Simmons'authentication scheme using elliptic curve arithmetic and combinatorial design. In: Electrical Engineering and Informatics III.: Proceeding of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, Košice, Slovakia, 2012, pp. 305-309.
12. GALLO,P.-LEVICKÝ,D.-BUGÁR,G.: Authentication Threats in PSTN-VoIP Architecture Using Multi-Service Gateways. In: Elmar 2012: 54th International Symposium, Zadar, Croatia, September 12-14, 2012, pp. 153-156.
13. GLADIŠOVÁ,I.-MIHALÍK,J.: DCT vizuálneho objektu pomocou ortogonalizácie jej bazových funkcií v oblastiach hraničných blokov. In: Electrical Engineering and Informatics III.: Proceeding of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, Košice, Slovakia, 2012, pp. 310-314.
14. GLADIŠOVÁ,I.: Implementácia algoritmu mriežkového vektorového kvantovania. In: Electrical Engineering and Informatics III.: Proceeding of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, Košice, Slovakia, 2012, pp. 315-319.

15. GOČ-MATIS,P.-BRODA,M.-LEVICKÝ,D.: Digitálna vodotlač vo videu na báze hybridného algoritmu DCT-SVD. In: Electrical Engineering and Informatics III.: Proceeding of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, Košice, Slovakia, 2012, pp. 330-336.
16. GODLA,M.-MICHAELI,L.-ŠALIGA,J.-SEKERÁK,M.-FÁBRY,D.: Effective measurement stand for teaching electronic circuits. In: Electrical Engineering and Informatics III.: Proceeding of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, Košice, Slovakia, 2012, pp. 320-325.
17. GODLA,M.-FABRI,D.-LIPTÁK,J.: Effective measurement stand for teaching basic electronic circuits. In: SCYR 2012: Proceedings from 12th Scientific Conference of Young Researchers, Herľany, Slovakia, May 15, 2012, pp. 333-336.
18. HARASTHY,T.-OVSENÍK,L.-TURÁN,J.: Typy a aplikácie optických korelátorov. In: Electrical Engineering and Informatics III.: Proceeding of the Faculty of Electrical Engineering and Informatics of the Technical University of Košice, FEI TU, Košice, Slovakia, 2012, pp. 337-342.
19. HARASTHY,T.-TURÁN,J.-OVSENÍK,L.-FAZEKAS,K.: Optical Correlator Based Traffic Signs Recognition. In: IWSSIP 2012: 19th International Conference on Systems, Signals and Image Processing (IWSSIP), Vienna, Austria, April 11-13, 2012, pp. 142-145.
20. HARASTHY,T.-RÁKOCI,F.: Cambridge Correlator in Traffic Sign Recognition System. In: 12nd Workshop of Elektrotechnical Research and Practice, Ostrava, Czech Republic, April 25, 2012, 4 pp.
21. HARASTHY,T.-OVSENÍK,L.-TURÁN,J.: Video Driver Assistance System Using Optical Correlator. In: MIPRO 2012: Jubilee 35th International Convention, Opatija, Croatia, May 21-25, 2012, pp. 493-495.
22. HARASTHY,T.-OVSENÍK,L.-TURÁN,J.: Road line detection using cambridge correlator. In: CSE 2012: International Scientific Conference on Computer Science and Engineering, Stará Lesná, High Tatras, Slovakia, October 3-5, 2012, pp. 170-174.
23. HARASTHY,T.-MIŠENČÍK,P.: Cambridge Correlator in Traffic Sign Recognition System. In: SCYR 2012: Proceedings from 12th Scientific Conference of Young Researchers, Herľany, Slovakia, May 15, 2012, pp. 306-308
24. HLÁDEK,D.-STAŠ,J.-JUHÁR,J.: Dagger: The Slovak Morphological Classifier. In: Elmar 2012: 54th International Symposium, Zadar, Croatia, September 12-14, 2012, pp. 195-198.
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9.4 Thesis

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For further information:

Department of Electronics and Multimedia Communication
prof. Ing. Dušan Levický, CSc
Faculty of Electrical Engineering and Informatics
Technical University of Košice
Letná 9
041 20 Košice
Slovak Republic

phone: +421-55-6022029
e-mail: Dusan.Levicky@tuke.sk
