

DEPARTMENT OF CONTROL AND INFORMATION SYSTEMS

General Information

Department of Control and Information Systems (DCIS) provides education and research in the field of automation of transport and industrial processes on the process, operational and management level where, besides usual optimization criteria, the safety criteria is required. This includes topics related to reliability and security of information manipulation with advanced artificial intelligence methods. The department guarantees four accredited study programmes in the field of study Automation: the study programme Automation in Bachelor degree, study programme Process Control Engineering and Applied Telematics in Master degree and study programme Process Control Engineering in the Doctoral degree.

The research activities of DCIS are oriented in the field of information and safety-related system analysis and synthesis ranging from solution of theoretical models to practical projects of operation including implementation. DCIS is developing automated control methods by applying the latest knowledge from artificial intelligence, smart sensors, robotics, computer-vision, intelligent human-machine communication, machine-learning, secure communication and others, which also creates incentives for modern cloud solutions and the IoT concept. Research and development activities are realized by 8 specialized laboratories.

There are many sectors of activities in which the DCIS has an exclusive position in the Slovak Republic, especially in expertise activities in the field of analysis and synthesis of railway interlocking systems. The area of reliable and safe information transmission and processing in control of selected critical processes both in safety-related systems for all kinds of transport, complex technologies and in security systems for protection of humans and property provides dynamic incentive for all the staff.

The activities of DCIS are integrated within national and international cooperation with academic and industrial domains in distinct forms – from research projects to students and experts' exchange.

In 2024, the staff of the DCIS consisted of 13 pedagogical staff, 1 research fellow, 1 technician and administrative support and 11 full-time postgraduate students. The pedagogical staff consisted of 2 professors, 8 associate professors, 3 senior lecturers with PhD. degree.

Staff of the Department

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|------------------------------|------------------|
| Head of the Department: | Aleš Janota |
| Vice-head of the Department: | Rastislav Pirník |
| Technical Support | Kamila Baxová |

Sections of the Department

Section of Automation and Signalling Systems

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| Head of the Section: | Dušan Nemeč |
| Professors: | Aleš Janota, Karol Rástočný |
| Associate Professors: | Jozef Hrbček, Marián Hruboš, Vojtech Šimák, Juraj Ždánky |

Section of Communication and Information Systems

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| Head of the Section: | Emília Bubeníková (since 1.7.2024), Peter Holečko (until 30.6.2024) |
| Associate Professors: | Peter Peniak, Rastislav Pirník, Peter Vestenický, |
| Senior Lecturers (with PhD): | Emília Bubeníková, Peter Holečko (until 30.6.2024), Alžbeta Kanáliková, Pavol Kuchár (since 1. 9. 2024) |

Postgraduate Students

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| Internal (full-time): | Michal Skuba (until 22. 8. 2024), Pavol Kuchár (until 22. 8. 2024), Branislav Malobický (until 22. 8. 2024), Juraj Kekelák, Júlia Kafková, Mário Michalík (since 2. 9. 2024), Jakub Krško (since 2. 9. 2024), Dávid Macko (since 2. 9. 2024), Ľubomír Hrmo (since 2. 9. 2024), Patrik Kovačovič (since 2. 9. 2024), Maroš Valášek (since 2. 9. 2024) |
| External (part-time): | Ivan Sládek, Jozef Brtiš |

Education

Courses in Bachelor, Master and Doctoral Degree Programmes

Bachelor Degree Programmes

| Course ID | Name | Sem. | Hours/Week |
|--|--|------|------------|
| | | | L-E-Ls* |
| Courses at the Faculty of Electrical Engineering and Information Technology | | | |
| 3B00104 | Algorithmisation and programming | 1 | 2 – 2 – 0 |
| 3B0A101 | Introduction to study for A | 1 | 2 – 2 – 0 |
| 3B0A201 | Object-oriented programming | 2 | 2 – 2 – 0 |
| 3B0H201 | Programming in C++ | 2 | 2 – 2 – 0 |
| 3B0A202 | Computer technical and software environment | 2 | 2 – 1 – 1 |
| 3B0A203 | Professional praxis for A | 2 | 60 h |
| 3B00305 | Theory of automated control | 3 | 3 – 1 – 1 |
| 3B0A301 | Data analytics basics | 3 | 3 – 2 – 1 |
| 3B0A303 | Logical and event control | 3 | 2 – 1 – 1 |
| 3B0A302 | Communication networks | 3 | 3 – 1 – 1 |
| 3B0E302 | Network security | 3 | 2 – 0 – 2 |
| 3B00403 | Sensor technology | 4 | 3 – 0 – 1 |
| 3B0A401 | Control systems | 4 | 2 – 1 – 2 |
| 3B0A402 | Reliability and safety of control systems | 4 | 3 – 2 – 0 |
| 3B0A403 | Actuators and their control | 4 | 2 – 1 – 1 |
| 3B0A404 | Theory of information and signals | 4 | 3 – 2 – 1 |
| 3B0A406 | Professional praxis for A | 4 | 60 h |
| 3B0A501 | Control systems programming | 5 | 2 – 0 – 2 |
| 3B0A502 | Theory of signal processing in process control | 5 | 2 – 1 – 1 |
| 3B0A503 | Information systems | 5 | 2 – 1 – 2 |

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| 3B0A504 | Communication security | 5 | 3 – 1 – 1 |
| 3B0A505 | Bachelor project 1 | 5 | 0 – 0 – 5 |
| 3B0A601 | Automated identification | 6 | 2 – 1 – 1 |
| 3B0A602 | Bachelor project 2 | 6 | 0 – 0 – 5 |
| 3B0A603 | Bachelor thesis and its presentation | 6 | 0 – 20 – 0 |
| 3B0A604 | State exam subject | 6 | 0 – 4 – 0 |
| 3B0A605 | Professional praxis for A | 6 | 60 h |

*(L) lectures - (E) exercises - (Ls) labs

Master Degree Programmes

| Course ID | Name | Sem. | Hours/Week |
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| | | | L-E-Ls* |
| Courses at the Faculty of Electrical Engineering and Information Technology | | | |
| 3I00104 | Artificial intelligence | 1 | 2 – 0 – 2 |
| 3I0D107 | Artificial intelligence | 1 | 2 – 0 – 2 |
| 3I0A101 | Advanced automated control methods | 1 | 2 – 1 – 2 |
| 3I0A102 | Control systems safety analysis | 1 | 3 – 2 – 0 |
| 3I0A104 | Systems development | 1 | 2 – 0 – 2 |
| 3I0A105 | Processes in production enterprise | 1 | 2 – 1 – 0 |
| 3I0A201 | Control systems with Safety PLC | 2 | 2 – 0 – 2 |
| 3I0A202 | Application of information systems in process control | 2 | 2 – 0 – 2 |
| 3I0A204 | Secure system communication | 2 | 3 – 0 – 2 |
| 3I0A203 | Machine learning | 2 | 2 – 1 – 0 |
| 3I0A205 | Railway traffic control | 2 | 3 – 0 – 2 |
| 3I0A206 | Road traffic control | 2 | 3 – 1 – 1 |
| 3I0A207 | Robotic systems | 2 | 3 – 0 – 2 |
| 3I0A208 | Web applications development | 2 | 2 – 0 – 2 |
| 3I0A106 | Professional praxis for RP | 2 | 60 h |
| 3I0A301 | Diploma project 1 | 3 | 0 – 0 – 5 |
| 3I0A302 | Visualisation of processes | 3 | 2 – 0 – 2 |
| 3I0A304 | Information systems security | 3 | 2 – 0 – 2 |
| 3I00306 | Embedded systems design | 3 | 2 – 0 – 2 |
| 3I0A303 | Computer vision | 3 | 2 – 0 – 1 |
| 3I0A306 | Interlocking systems | 3 | 3 – 0 – 2 |
| 3I0A307 | Intelligent traffic systems | 3 | 2 – 1 – 1 |
| 3I0A308 | Autonomous robotic systems | 3 | 3 – 0 – 2 |
| 3I0A401 | Diploma project 2 | 4 | 0 – 0 – 5 |
| 3I0A402 | Elaboration and presentation of diploma thesis | 4 | 0 – 20 – 0 |
| 3I0A403 | State exam subject | 4 | 0 – 4 – 0 |
| 3I0A404 | Professional praxis for RP | 4 | 60 h |

*(L) lectures - (E) exercises - (Ls) labs

Doctoral Degree Programmes

| Course ID | Name | Sem. | Hours/Week |
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| Courses at the Faculty of Electrical Engineering and Information Technology | | | |
| 3D0A003 | Control and automation of processes | 1 | 0 – 2 – 0 |
| 3D0A004 | Intelligent control systems | 2 | 0 – 2 – 0 |
| 3D0A005 | Risk analysis and control systems safety | 2 | 0 – 2 – 0 |
| 3D0A006 | Robotic and autonomous systems | 2 | 0 – 2 – 0 |
| 3D0A001 | Written exam for dissertation exam and defence | 3 | 0 – 0 – 0 |
| 3D0A008 | Dissertation thesis and dissertation thesis defence | 6 | 0 – 0 – 0 |

*(L) lectures - (E) exercises - (Ls) labs

Research & Development

The scientific-research and development activities of department are focused on the area of control tasks algorithmisation, automation of control on process, operational and management levels, while utilising modern artificial intelligence approaches, and on the area of reliable, safe and secure communication and information processing in control of selected critical processes, above all the ones which imply the criterion of safety besides usual optimisation criteria. For reasons given there is a large number of research projects and cooperation projects with praxis and industry directed into the area of applied telematics and intelligent control and safety systems in transport and industry.

Laboratory of SIEMENS industrial processes control systems

The laboratory is focused on the development and simulation of algorithms for controlling industrial processes. The basis of the technological equipment of the laboratory is PC, PLC and safety PLC from Siemens, expansion modules for connecting sensors and actuators, modules for connecting remote inputs and outputs, visualization panels, frequency converters, servo drives and software for programming and configuring the mentioned devices. The connection of individual components and workplaces is realized by industrial networks. Work with this technology is supported by real models of industrial processes.

Laboratory of autonomous mobile systems

The laboratory is focused on research, development and education in service robotics and autonomous transport solutions. It is equipped with large size FDM 3D printer, tools and materials for creating and programming prototypes of the ground and aerial robots, and 10 PC workstations. In the laboratory, there is a mobile robotic research platform for aggressive environments, 10 pcs of small, wheeled robots e-puck with accessories, 4-rotor drone Holybro X500, long-range video transmission system SIYI, and a prototype of a VTOL drone based on PixHawk technology. In the area of sensors, the laboratory is equipped with multiple types of LiDAR scanners from Sick and Slamtec, RGBD sensors Orbbec, GPS+INS system SPAN-CPT, and dual channel GNSS RTK receiver ArduSimple RTK3B with centimeter-level accuracy. There is a small model railway within the laboratory, controlled partially by electronic interlocking control system ESA 44 by AŽD Praha, the second part of the railway is controlled by PLC Simatic S7-300 and S7-1200 with the operator interface ILTIS by Siemens Mobility.

Laboratory of B&R industrial processes control systems

The laboratory is focused on the areas of system identification, design of control algorithms and their implementation for the purpose of managing industrial and transport processes. The laboratory is equipped

with B&R programmable logic controllers (PLCs), safety PLCs, communication and input-output modules, inverters, drives, a junction model and models of several industrial systems, such as: a mechanical model of motor control, a lever with tactile feedback, a ball-on-ball system discs, an elevator, temperature, speed and pressure control systems, a CNC multifunctional machine and its digital twin, a delta robot and a workplace for testing human physical strength. The laboratory is also equipped with specialized computers with software equipment: Automation Studio, Safe Designer, Scene Viewer, MATLAB.

Laboratory of microcomputers and robotics

The laboratory is intended for research and development in the field of robotics and microcomputers. It is equipped with computers and programming interfaces for programming microcomputers of the MICROCHIP AVR family, STM32 microcomputers and industrial robots from ABB. It is an exact copy of the real software that controls the robot in production and enables very realistic simulations using real robot programs and configuration files. The laboratory is conducting research on a mobile sensor platform for robot navigation. The laboratory also has a CNC laser with a B&R control system, which is used for the realization of bachelor's and diploma theses. Other equipment includes E-puck robots with the Webots environment, enabling the testing of robotic swarm algorithms. The equipment also includes an ABB IRB 14000 collaborative robot, DC and AC electric motors for teaching the subject Action elements and Mitsubishi frequency converters. The laboratory is also equipped with teaching modules from Global Logic for teaching STM microcomputers.

Laboratory of automated control and signal processing

The laboratory is intended for the verification of theoretical foundations in the field of automatic control theory (continuous and discrete systems), information and signal theory and digital signal processing and computer vision in process control. Own user programs and SW tool MATLAB and its specialized toolboxes (Simulink, Control Toolbox, Signal Processing Toolbox, Image Processing Toolbox) are used in the teaching. The laboratory has real teaching models from Humusoft CE 151 with accessories (Extended Real Time Toolbox and Real Time Windows Target). In the laboratory there is a laboratory model of an industrial line as a result of the KEGA project. It is equipped with a B&R PLC, communication and input-output modules, converters, drives. The model includes automatic identification systems based on various object identification technologies (vision systems from SICK and B&R), object identification systems based on scanning RFID, QR and EAN codes, color scanning, inductive and IR scanning from SICK. The line model has PLC technology based on B&R elements, which ensures, in addition to visualization of the model, its control and tasks associated with sorting objects based on selected criteria. The laboratory is also used for the individual work of students when solving year projects and diploma theses.

Laboratory of modelling and simulation

The laboratory is mainly used for teaching professional subjects that require the support of software tools. It is primarily intended for modelling the functional properties of control systems (UML; software tool Rhapsody), reliability and safety properties (software tool CARE), control procedures and control structures (in the Matlab environment). If necessary, it can also be used to work with other types of applications - for example, design and work with database systems, expert systems, and the like. The laboratory is also equipped with technology used to protect objects (alarm systems, electric fire alarm, camera monitoring systems). The laboratory is also used for the individual work of students when solving year projects and diploma theses.

Laboratory of computer networks and secure communications

The laboratory is focused on the area of LANs including wireless communication technologies, on industrial communication networks and wireless communication technologies. The technical equipment for computer networks includes basic PCs, structural cabling distributor, switches and routers 3com, Linksys and Cisco, IEEE 802.11 wireless networks analyser and tester for structured cabling testing. The technical equipment for industrial communication networks includes PROFIBUS and CAN protocol analysers. The area of radio-frequency identification (RFID) is covered by the ELATEC demonstration kits for ISO 14443, ISO 15693, ISO 18092, MIFARE Classic, MIFARE Desfire, Unique, EPC Global transponders and multiprotocol readers ELATEC TWN3, TWN4, Stronglink SL500-F and TSS HUR 120 BT.

Laboratory of experimental works

In the laboratory the mechanical and electrical works related to the solution of research tasks, dissertations, diploma and bachelor's theses are being performed. The laboratory is equipped with basic instruments and tools for mechanical work, soldering and measuring electrical quantities

Projects of International Programmes

HORIZON 2020

| 101071330: InCITIES – Trailblazing Inclusive, Sustainable And Resilient Cities | |
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| Summary: | The InCITIES project aims to foster the transformation and modernisation of HEIs and their ecosystems with a focus on partners from widening countries centred on cities' needs. It will be achieved by building capacity and strengthening the pathway to excellence with integrated knowledge HUBs. They will rely on the R&I based cooperation of the participating institutions and their surrounding ecosystems in the field of inclusive, sustainable, and resilient cities. |
| Realization: | 10/2022 – 09/2025 |
| Coordinator: | Tatiana Kováčiková (OMVP-ERA) |
| Co-operators: | Peter Vestenický |

Other International Research Projects

| APVV SK-IL-RD-23-0002: Advanced Localization Sensors and Techniques for Autonomous vehicles and Robots | |
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| Summary: | The integration of global navigation satellite systems, odometers, and inertial sensors is commonly used in land vehicles and mobile robots. There have been several studies showing that mounting inertial sensors on the vehicle wheels improves the accuracy of the navigation system. In parallel, deep learning approaches are utilized in many different navigation tasks showing superior performance than their model-based counterpart. In this research, we propose to design a learning framework to better utilize wheel mounted inertial sensors in the fusion process. We aim to explore the optimal placement of the inertial sensors and derive a hybrid learning based navigation filter. To validate our proposed algorithms, field experiments will be carried out using land vehicles and mobile robots. |
| Realization: | 02/2024 – 12/2025 |
| Coordinator: | Dušan Nemec |

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| Co-operators: | Emília Bubeníková, Michal Gregor, Marián Hruboš, Aleš Janota, Júlia Kafková, Juraj Kekelák, Pavol Kuchár, Branislav Malobický, Vojtech Šimák, Michal Skuba, Juraj Ždánsky |
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| TAČR CK0400082: Modern methods of ensuring cyber security in tunnel systems as part of critical transport infrastructure | |
| Summary: | The research project is focused on trajectories of knowledge/education in the field of transport construction and engineering, as well as on other fields of study and courses aimed at the field of transport at the level of universities and ČŽV. Part of the project is research into the possibilities of use and the use of patents from NUT by entities on the Slovak market. |
| Realization: | 01/2023 – 12/2026 |
| Coordinator: | Tomáš Tichý, ČVUT FD |
| Coordinator for FIIT | Rastislav Pirník |
| Co-operators: | Rastislav Pirník |

Projects of National Programmes

Research Projects Funded by the Scientific Grant Agency of the Slovak Republic (VEGA)

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| VEGA 1/0775/24: Increasing the accuracy of 3D documentation of trasological traces for the purposes of forensic and expert activities | |
| Summary: | Shoe marks (trasological traces) at the sites of forensically relevant events represent one of the most important types of traces, thanks to which it is possible to perform group, and in ideal cases also individual, identification. In domestic conditions, such traces are commonly secured by conventional methods, while 3D documentation techniques, especially 3D scanning, photogrammetry and 3D printing, are increasingly coming to the fore. In the field of forensic and expert examination, these techniques have the potential to significantly refine documentation and effectively extract trace parameters in the x, y and z axes. In the research in question, attention is focused on increasing the accuracy of 3D documentation of trasological traces, since a survey of the current state identified the absence of a comprehensive and systematic verification that would declare the accuracy and unambiguous suitability of such a procedure. The aim of the research is not only to bring verified results of a scientific nature, but also to create a framework of knowledge usable for forensic practice. |
| Realization: | 01/2024 – 12/2026 |
| Coordinator: | Veronika Adamová (Faculty of security engineering, Department of security management) |
| Co-operators: | Peter Vestenický |

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| VEGA 1/0241/2022 Mobile robotic systems as support during crisis situations | |
| Summary: | The scientific project is focused on the research of methods and approaches in the field of mobile robotic systems for the needs of emergency services intervening in crisis situations, e.g. in case of fires, biological threats, etc. The aim of the project is to theoretically process and laboratory verify the methods of data acquisition, their processing and subsequent decision-making (control) of a mobile robot based on the information obtained during a crisis situation. In the first phase of the project, the critical parts of the robotic system are defined and the principles of their |

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| | operation are proposed, taking into account the demanding operating conditions during a crisis situation. The second phase is the implementation of the proposed methods and the verification of their functionality with the help of team members from the FBI UNIZA faculty, who have direct influence on the creation of intervention plans of the rescue services of the Slovak Republic. It will be possible to apply the proposed methods in the development and construction of robotic systems for the support of rescue services intervening during particularly dangerous crisis situations. |
| Realization: | 01/2022 – 12/2024 |
| Coordinator: | Rastislav Pirník |
| Vice-coordinator: | Aleš Janota |
| Co-operators: | Gregor Michal, Nemeč Dušan, Hruboš Marián, Šimák Vojtech, Bubeníková Emília, Kanáliková Alžbeta, Anđel Ján, Bujňák Marek, Pavol Kuchár |

Projects Funded by the Cultural & Education Grant Agency (KEGA)

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| KEGA 009ŽU-4/2024: SCORE4AI: SCORE4AI: Slovak Collaborative Open Research and Education Ecosystem for AI | |
| Summary: | Modern education is undergoing a paradigmatic change that goes beyond the introduction of new methods or technologies and affects the very philosophy of teaching. The role of both the teacher and the student is changing, with an emphasis on active learning, motivation and effective use of knowledge in rapidly changing fields such as artificial intelligence and machine learning. The project aims to create an ecosystem of cooperation between experts and educational institutions in Slovakia. The main means are a network of experts, a common educational platform, educational and research activities. The aim is not only to increase the effectiveness of teaching, but also to support interdisciplinary cooperation and innovation in education. The experience of the research team from previous projects will provide a solid foundation for the implementation of these changes with a possible impact on other fields. |
| Realization: | 01/2024 – 12/2026 |
| Coordinator: | Michal Gregor (FBI-KBM) |
| Co-operators: | Aleš Janota, Alžbeta Kanáliková |

Research Projects Funded by the Slovak Research and Development Agency (APVV)

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| APVV-20-0626 HuDyM: Biofidelic human body surrogate to increase the objectivity within the forensic analysis of road traffic accidents | |
| Summary: | Forensic analysis of road traffic accidents (TA) within the expert department "03 03 01 Road traffic accidents" is complex and interdisciplinary problematics with potentially extensive volume of input parameters within the axis "vehicle-human-road". Input parameters are often of partial character and with technical uncertainties. This has a negative influence with respect to unambiguity of technical reconstruction and analysis of TA, that serves as a basis for decision making in criminal justice system. Within the forensic analysis of TA with vulnerable road users (pedestrians, cyclists), influence of the element "human" is significant for reconstruction and analysis of this subset of TA. This is valid particularly regarding using the human body injuries as a basis for determining the course of TA. Suggested research deals with current problematics of virtual and real-world surrogates of human body that will serve primarily for interdisciplinary objective |

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| | forensic analysis of TA with vulnerable road users, but with application in other fields that use knowledge of injury biomechanics. Mathematical-physical models and real-world surrogates of human body that currently exist do not provide level of commonly available and universally applicable tools for wide spectrum of applications. This argument is valid in international context. The goal of suggested project is integrated research and construction of simulation mathematical-physical model and real-world surrogate of adult human body with increased biomechanical fidelity for multidirectional mechanical loading with focus on dynamic impact loading of vulnerable road users within TA. Project outputs will be applied directly in traffic accident analysis, but also in analysis of human body movement in forensic reconstruction of criminal cases, analysis of other accident events (work injury) and biomechanical research of injury mechanisms in human body dynamic loading. |
| Realization: | 07/2021 – 12/2024 |
| Coordinator: | Eduard Kolla (Institute of forensic research and education) |
| Co-operators: | Peter Vestenický |

FEEIT projects to support young researchers

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| 17125 Intelligent control and support systems in transport. | |
| Summary: | As part of the transport systems, today we observe a constant increase in the volume of traffic, which leads to the emergence of congestion and traffic collapses, which has serious consequences - e.g. increase in emissions, negative effects on the environment and human health, but also considerable economic damage: both directly caused by delays and as a result of the deteriorated economic environment. The increasing volume of traffic also has an impact on traffic safety, not only in the context of cities, but also more broadly - e.g. in the context of tunnel systems, crossing security systems, etc. The long-term goal of the project and proposed research activities is to contribute to the development of new approaches and methods in the field of intelligent transport systems. The activities can be divided into three parts: (i) intelligent traffic management systems; (ii) support systems for intelligent transport; (iii) ancillary research activities. Among the supporting goals of the project is also the creation of an ecosystem for other projects in the same area. |
| Realization: | 02/2022 – 01/2025 |
| Coordinator: | Hruboš Marián |
| Co-operators: | Michal Gregor, Michal Skuba, Pavol Kuchár, Marek Bujňák, Aleš Janota, Rastislav Pirník, Juraj Ždánsky, Jozef Hrbček |

UNIZA grant system – projects of Doctoral (PhD.) students

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| Using AI tools to monitor physiological manifestations and human activity | |
| Summary: | This project focuses on designing a device for non-invasive monitoring of physiological manifestations. During its deployment, ECG, PPG, oximetry, human body temperature and other parameters can be recorded, which can be used to evaluate the level of physical stress. |
| Realization: | 10/2024 – 09/2025 |
| Coordinator: | Júlia Kafková |
| Co-operators: | Rastislav Pirník, Aleš Janota |

UNIZA grant system – projects of young scientific-pedagogical employees under 35 years of age

| 18771 Innovation of the arm intended for measuring the physical condition of a person | |
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| Summary: | The project is focused on the innovation of an arm designed to measure a person's physical condition. The arm with the converter and the motor were created as part of the grant project in 2022. The new PLC will ensure the control, setting of the system and display of the necessary results on the local display. A friendly, local and remote user interface will be designed and created. The innovation will also include the application of new security functions ensuring the safety of the tested persons. The created system will be portable and will be used for presentation activities and also as a teaching aid. |
| Realization: | 10/2023 – 9/2024 |
| Coordinator: | Marián Hruboš |
| Co-operators: | Jozef Hrbček, Aleš Janota |

| 2024digVS003 Non-invasive monitoring of human stress using AI | |
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| Summary: | The focus of the project entitled "Non-invasive monitoring of human stress using AI" is on the development of a device (computer mouse or keyboard) for non-invasive monitoring of physiological manifestations. This device will be able to record and analyze several parameters, including PPG, oximetry, body temperature, and it is possible to use other relevant data. The main goal of the project is to create a system that will allow the detection of vital functions, such as physical stress and possibly pre-infarction states, acute infarction, arrhythmias and others (if such data is recorded in the training set). |
| Realization: | 10/2024 – 06/2025 |
| Coordinator: | Pavol Kuchár |
| Co-operators: | Júlia Kafková, Juraj Kekelák, Rastislav Pirník, Aleš Janota |

Other National Research Projects

| Proposal for a supplementary information system - Muráň | |
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| Summary: | Proposal for an additional traffic light information system on the route from the village of Muráň to the Veľká Lúka location to launch two-way cyclist traffic. |
| Realization: | 04/2024 – 07/2024 |
| Coordinator: | Rastislav Pirník |
| Deputy Coordinator: | Pavol Kuchár |
| Co-operators: | Aleš Janota, Martin Boroš (FBI) |

Outputs from Solved Research Tasks

Publication activities at the department in 2024

| Category | Category name | Number |
|----------|--|--------|
| V1 | Scientific output of publication activity as a whole | - |
| V2 | Scientific output of publication activity as part of an edited book or collection | 11 |
| V3 | Scientific output of publication activity from the journal | 9 |
| O1 | Professional output of publishing activity as a whole | - |
| O2 | Professional output of publishing activity as part of a book publication or collection | - |

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| O3 | Professional output of publication activity from the journal | - |
| P1 | Pedagogical output of publication activity as a whole | 1 |
| P2 | Pedagogical output of publication activity as part of a textbook or a script | - |
| TOTAL (listed categories) | | 21 |
| TOTAL (listed categories and other categories – U, D, I) | | 26 |

Patents, Industrial Designs, Author's Certificates and Discoveries

Submitted in 2024:

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| [1] | Category: utility model Application number: 109-2024 Authors: Rastislav Pirník, Júlia Kafková, Pavol Kuchár a Juraj Kekelák Title: Capacitive bioelectrode with impedance minimization |
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Granted in 2024:

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| [1] | Category: utility model Application number: 23-2023 Authors: Rastislav Pirník, Pavol Kuchár a Júlia Kafková Title: PUV 9928 - Device for detecting people in buildings |
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Specific Realization Outputs

Output type: Prototype

Output description: Signal conditioner for sensor equipment of a biofidelic human body surrogate, developed within the framework of APVV-20-0626 (Peter Vestenický). The research results were published at the international scientific conference ICEET 2024, Dubai, UAE

Co-operation

Co-operation Partners in Slovakia

- AŽD Slovakia, Bratislava
- B+R automatizace, s.r.o. Nové Mesto nad Váhom
- Betamont, s.r.o. Zvolen
- Continental Matador Rubber, s.r.o., Púchov, Slovakia
- FMach, s.r.o., Žilina
- GR ŽSR, Bratislava
- MTS Krivá
- Scheidt & Bachmann Slovensko s. r. o., Žilina
- SICK Bratislava
- Siemens s.r.o., Digital Factory/ Factory Automation/ Automation systems (IA&DT)
- Siemens s.r.o., Digital Industries/ Factory Automation/ Automation Systems
- Slovak University of Technology in Bratislava
- Technical university of Košice

International Co-operation Partners

- AŽD Praha s.r.o., Czech Republic
- B&R Industrial Automation GmbH, Austria
- Continental – Group sector Tire Hannover, Germany
- CTU - Faculty of Transportation Sciences, Department of Transport Telematics, Prague, Czech Republic
- Czech Technical University in Prague, Czech Republic
- SIEMENS Mobility GmbH, Austria
- TeZaSig s.r.o., Czech Republic
- The Hatter Department of Marine Technologies, Charney School of Marine Sciences, University of Haifa, Israel
- University of Haifa, Israel, the Hatter Department of Marine Technologies, Charney School of Marine Sciences

Non-contractual Cooperation with Academic Institutions

- Czech Institute of Informatics, Robotics and Cybernetics, Prague, Czech Republic
- Faculty of Transportation Sciences, Czech Technical University in Prague, Czech Republic

Visitors to the Department in the academic year 2023/2024

| Name | Institution | Length of stay |
|-----------------|--|----------------|
| Richard Feddeck | Continental – Group sector Tire Hannover, Germany | 1 day |
| Roman Danel | Institute of Technology and Business in České Budějovice, Czech Republic | 1 day |
| Ondřej Příbyl | Czech Technical University, Faculty of Transportation Sciences, Prague, Czech Republic | 1 day |
| Jerzy Mikulski | University of Economics in Katowice, Poland | 1 day |
| Bożena Gajdzik | Silesian University of Technology in Katowice, Poland | 1 day |

Visits to Foreign Institutions in the academic year 2023/2024

| Name | Institution | Length of stay |
|------------------|--|----------------|
| Aleš Janota | Faculty of Transport Sciences, Czech Technical University in Prague, Czech Republic | 2 days |
| Aleš Janota | Technical University Ostrava, Czech Republic | 1 day |
| Juraj Ždánsky | TeZaSig Ltd., Místecká 1120/103, Vítkovice, 703 00 Ostrava, Czech Republic | 5 days |
| Juraj Ždánsky | Czech Technical University in Prague, Faculty of Transportation Sciences, Department of Transport Telematics | 5 days |
| Rastislav Pirník | Czech Technical University in Prague, Faculty of Transportation Sciences, Czech Republic | 4 days |

Contracts (Business Activities)

| S-0014/15/23: Cooperation in solving technical safety of GP JAZZ (Generic Product JAZZ - Kernel) | |
|---|--|
| Customer: | AŽD Praha s.r.o. , Žirovnická 3146/2, Záběhlice, 106 00 Praha 10, Czech Republic |
| Coordinator: | Karol Rástočný |

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|---|----------------|
| S-103-0001/24: Contract for the Preparation of an Opinion on the Safety Assessment of a Level Crossing Protection System | |
| Customer: | Kumat Ltd. |
| Coordinator: | Juraj Ždánsky |
| Co-operators: | Karol Rástočný |

Other Activities

Conferences, Workshops, Symposiums Organized by the Department

- 18th international conference on railway, signalling and interlocking technology, April 22 – 24, 2024, Žilina, the main organizer: Betamont s.r.o., Zvolen, co-organizer (DCIS FEIT UNIZA): Aleš Janota

Specialised Lectures and Courses Organized by the Department

| | |
|---|-------------------------|
| Databases in SCADA and MES systems | |
| Customer: | DCIS students and staff |
| Lecturer: | Petra Humaj (IPESOFT) |
| Date: | 11th December 2024 |

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|--------------------------------------|--------------------------|
| Cybersecurity Auditor's Notes | |
| Customer: | DCIS students and staff |
| Lecturer: | Martin Berzák (Brain IT) |
| Date: | 04th December 2024 |

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|--|--------------------------|
| How to PKI and PKI infrastructure | |
| Customer: | DCIS students and staff |
| Lecturer: | Martin Berzák (Brain IT) |
| Date: | 04th December 2024 |

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|--|--------------------------------------|
| Industrial automation in practice | |
| Customer: | DCIS students and staff |
| Lecturer: | Anton Tomáš (NASA Slovakia s. r. o.) |
| Date: | 03th December 2024 |

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|--|-------------------------------|
| Object identification solutions with SICK systems in industry | |
| Customer: | DCIS students and staff |
| Lecturer: | Adam Brňo (SICK spol. s r.o.) |
| Date: | 30th October 2024 |

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|--|--------------------------------------|
| Industrial automation in practice | |
| Customer: | DCIS students and staff |
| Lecturer: | Michal Tuhý (MTS Krivá spol. s r.o.) |
| Date: | 20th November 2024 |

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|---|--|
| SciTea workshop on "Computer Vision" | |
|---|--|

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|-----------|--|
| Customer: | DCIS students and staff |
| Lecturer: | Michal Gregor (KInIT Bratislava), Viera Krešňáková (TUKE), Alexander Brecko (KInIT), Jaroslav Kopčan (KInIT) |
| Date: | 15th November 2024 |

Membership in International Institutions/Committees

| Individual membership of employees of international organizations | | Function |
|---|---|----------|
| Aleš Janota | ACM – Association for Computing Machinery, USA | Member |
| Aleš Janota | International Institute of Informatics and Systemics, USA | Member |

| Individual membership of employees in scientific committees of international journals | | Function |
|---|---|--|
| Aleš Janota | TransNav – International Journal on Marine Navigation and Safety of Sea Transportation, ISSN 2083-6473, eISSN 2083-6481, Poland | member of the scientific journal committee |
| Aleš Janota | TransEngin – Journal of civil engineering and transport, ISSN 2658-1698, e-ISSN 2658-2120, Poland | member of the scientific journal committee |
| Aleš Janota | Journal of Automation, Electronics and Electrical Engineering, p-ISSN 2658-2058, e-ISSN 2719-2954, Poland | member of the scientific journal committee |
| Karol Rástočný | Advanced in Electrical and Electronic Engineering, ISSN 1804-3119, Czech Republic | member of the editorial board |
| Karol Rástočný | Archives of Transport System Telematics, ISSN 189-8208, Poland | member of the editorial board |
| Karol Rástočný | WST Journal, ISSN 2449-7851, Poland | member of the editorial board |
| Karol Rástočný | Railway Reports, ISSN 0552-2145, Poland | member of the editorial board |

| Individual membership of employees in the scientific committees of international conferences | | Function |
|--|--|---|
| Aleš Janota | IEEE 22nd World Symposium on Applied Machine Intelligence and Informatics (SAMI 2024), 25.1.-27.1.2024, Stará Lesná, Slovakia | member of the Technical Programme Committee |
| Aleš Janota | ICINCO 2024, 21st International Conference on Informatics in Control, Automation and Robotics, November 18-20, 2024, Porto, Portugal | member of the Programme Committee |
| Dušan Nemeč | 15th International Conference ELEKTRO 2024, Zakopane, Poland | organizing committee member |
| Karol Rástočný | International Conference „Applied Electronics“, AE 2024, Czech Republic | member of the scientific committee |
| Karol Rástočný | 15th International Conference ELEKTRO 2024, Zakopane, Poland | member of the scientific committee |

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|-------------------|---|------------------------------------|
| Dušan Nemeč | 15th International Conference ELEKTRO 2024, Zakopane, Poľsko | member of the organizing committee |
| Rastislav Pirník | 15th International Conference ELEKTRO 2024, Zakopane, Poľsko | member of the scientific committee |
| Emília Bubeníková | XXI International Conference, Multidisciplinary Aspects of Production Engineering MAPE 2024, Poľsko | member of the scientific committee |

| Individual membership of employees in scientific boards and trade committees abroad | | Function |
|--|--|--|
| Aleš Janota | Czech Technical University in Prague, Faculty of Transport Sciences, Czech Republic | member of the scientific board |
| Aleš Janota | Czech Technical University in Prague, Faculty of Transport Sciences, Czech Republic | member of the professional committee for the PhD study program in Smart Cities |
| Aleš Janota | VŠB-TU Ostrava, FEI, Czech Republic | member of the professional committee for the study program in Cybernetics |
| Aleš Janota | Polish Academy of Sciences, Katowice, Poland | member of Transport Committee |
| Peter Vestenický | VSB-Technical university of Ostrava, Faculty of mining and geology, Czech Republic, trade committee of the study programme P3970 Management of systems in the field of mineral resources | member |

Membership in National Institutions/Committees

| Membership of the Department in organizations of the SR | Membership since |
|--|-------------------------|
| Slovak Society for Cybernetics and Informatics (SSKI) | 2000 |

| Individual membership of employees in organizations of the SR | Function |
|--|-----------------|
| Aleš Janota, National Centre of Robotics, Bratislava, Slovakia | honorary member |
| Dušan Nemeč, Slovak committee of the Physics Olympiad | member |
| Rastislav Pirník, National Centre of Robotics, Bratislava, Slovakia | member |

| Individual membership of employees in editorial boards of national journals | | Function |
|--|-----------------------------|---------------------------------|
| Juraj Ždánky, | ATP Journal, ISSN 1335-2237 | chairman of the editorial board |
| Karol Rástočný | AT&P Journal, ISSN 1336-233 | member of the editorial board |

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|------------------|----------------------------------|--|
| Rastislav Pirník | Acta Technología, ISSN 2453-675X | member of the scientific and program committee |
|------------------|----------------------------------|--|

| Individual membership of employees in scientific boards and trade committees outside of FEEIT UNIZA | | Function |
|--|--|--|
| Aleš Janota | Faculty of Management Science and Informatics, University of Žilina, Žilina, branch committee for the field of study in Applied Informatics | member |
| Aleš Janota | University of Žilina, Žilina, scientific board | member |
| Aleš Janota | Slovak University of Technology (STU), Bratislava, branch committee for the field of study in Cybernetics | member |
| Aleš Janota | MTF STU, Trnava, branch committee for the field of study in Automation and Informatization of Processes | member |
| Aleš Janota | FEI STU, Bratislava, branch committee for the field of study in Robotics and Cybernetics | member |
| Aleš Janota | FEI STU, Bratislava, branch committee for the field of study in Mechatronic Systems | member |
| Aleš Janota | <ul style="list-style-type: none"> • Working Group for periodic evaluation of MSc. degree study programs in the branch of study Cybernetics at the FEI STU Bratislava • Working Group for periodic evaluation of Bc. degree study program Automotive Mechatronics and evaluation of the new Bc. degree study programs Smart Technologies and Automotive Mechatronics at the FEI STU Bratislava • Working Group for evaluation of new Bc. degree study program Digital Technologies at the FEI STU Bratislava Working Group for periodic evaluation of PhD. degree study programs in the branch of study Cybernetics at the FEI STU Bratislava | member |
| Karol Rástočný | MTF STU Bratislava | member of the branch committee of the Cybernetics study program |
| Karol Rástočný | MTF STU Bratislava | member of the program committee of the Cybernetics study program |
| Rastislav Pirník | Faculty of Security Engineering UNIZA, scientific board | member |
| Rastislav Pirník | Faculty of Mechanical Engineering, STU Bratislava, working group for the third degree in the program Automation and informatization of machines and processes | member |
| Rastislav Pirník | Board for internal quality assurance system at STU Bratislava - cybernetics | member |
| Rastislav Pirník | Mechatronic systems in study branch Cybernetics, III. degree | member of working group |

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