

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 2025, the staff of the DCIS consisted of 13 pedagogical staff, 1 technician and administrative support and 9 full-time postgraduate students. The pedagogical staff consisted of 3 professors, 8 associate professors, 3 senior lecturers with PhD. degree.

Staff of the Department

Head of the Department:	Aleš Janota
Vice-head of the Department:	Rastislav Pirník
Secretary:	Kamila Baxová

Sections of the Department

Section of Automation and Signalling Systems

Head of the Section:	Dušan Nemec
Professors:	Aleš Janota, Karol Rástočný (until 31. 7. 2025)
Associate Professors:	Jozef Hrbček, Marián Hruboš, Vojtech Šimák, Juraj Ždánsky

Section of Communication and Information Systems

Head of the Section:	Emília Bubeníková
Professors:	Rastislav Pirník
Associate Professors:	Peter Peniak, Peter Vestenický, Gabriel Gašpar (from 1. 9. 2025)
Senior Lecturers (with PhD):	Alžbeta Kanáliková, Pavol Kuchár

Postgraduate Students

Internal (full-time):	Juraj Kekelák, Júlia Kafková, Mário Michalík, Jakub Krško, Dávid Macko, Ľubomír Hrmo, Patrik Kovačovič, Maroš Valášek, Matúš Nečas (from 1. 9. 2025)
External (part-time):	Ivan Sládek, Jozef Brtiš, William Francis Stack

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
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
			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
Courses at the Faculty of Mechanical Engineering			
7I0D54	Datamining	3	0 – 0 – 2

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

Doctoral Degree Programmes

Course ID	Name	Sem.	Hours/Week
			L-E-Ls*
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 information and communication technologies

The Laboratory of Information and Communication Technologies is a specialized academic facility dedicated to instruction in ICT infrastructure, network engineering, cybersecurity, and secure communication protocols.

The laboratory's pedagogical framework for information systems is supported by a robust software stack, including relational and NoSQL database management systems such as MS Access, web server environments, and versatile source-code editors like VS Code for scripting proficiency. For core programming instruction in C, C++, and Python, the facility provides integrated development environments including CodeBlocks and Qt Creator, supplemented by MATLAB for advanced numerical computation and system simulation. In the domain of cybersecurity and network defense, the laboratory features cryptographic analysis tools such as CrypTool 1, 2, and Crypto. Penetration testing and vulnerability assessments are conducted within virtualized environments utilizing VirtualBox and VMware, hosting security-focused distributions like KALI, Parrot Linux, and Metasploitable. Students utilize an extensive security toolset encompassing HashCat, Hydra, John the Ripper, Wireshark for packet analysis, and OpenVAS for comprehensive network scanning, while GNS3 is employed for high-fidelity network topology emulation. Furthermore, the laboratory houses a legacy Sewio indoor localization system, which enables students to develop and test real-time location-based applications for their Bachelor's and Master's theses. Beyond formal curriculum delivery, the facility serves as a hub for independent research.

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	
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	
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
Co-operators:	Emília Bubeníková, Michal Gregor, Marián Hruboš, Aleš Janota, Júlia Kafková, Juraj Kekelák, Pavol Kuchár, Branislav Malobický, Vojtech Šimák, Michal Skuba, Juraj Ždánsky

TAČR CK04000082: 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 CŽV. 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)

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

VEGA 1/0147/25: Research on motion data analysis methods for applications in diagnosis and therapy of gnostically relevant symptoms	
Summary:	Ongoing diagnosis is important for control and optimization of rehabilitation for gnostically relevant symptoms. Assuming that receptive functionality is given, it is necessary to observe perceptual function with emphasis on spatial dynamic and reflective perception. The focus of rehabilitation is methodologically somatognosia and stereognosia, their diagnostically reliable classification and, based on it, continuously adapted rehabilitation. The state of available technology is insufficient, especially in terms of the reliability of the information and its real-time evaluation. The aim of the project is basic research in the measurement and data processing chain: on-body and off-body sensors, pre-processing of data in the sensor network, identification and selection of diagnostically relevant data and their lossless compression for wireless transmission to a central computer. Subsequently, processing and classification of the data in the computer by proposed methods necessary for feedback to the patient.
Realization:	01/2025 – 12/2028
Coordinator:	Gabriel Gašpar (VC UNIZA)
Co-operators:	Vojtech Šimák, Marián Hruboš, Dušan Nemec, Jozef Hrbček, Aleš Janota, Emília Bubeníková

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

KEGA 009ŽU-4/2024: 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

FEEIT projects to support young researchers

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

20446: 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

21066: The development of a prototype system for safe image processing	
Summary:	The project is focused on the development of a prototype system for safe image processing. Currently available image processing systems do not provide sufficiently reliable detection, and therefore standard methods for detecting persons in hazardous areas such as optical barriers or physical enclosures locked with special safety locks are typically used in safety-critical applications. The aim of the project is to create a system

	capable of evaluating camera images in compliance with a defined Safety Integrity Level (SIL). Achieving the required SIL is a critical prerequisite for deploying the system in industrial or transportation applications, which represent potential areas of use. To develop such a prototype, it will be necessary to mathematically model the quantitative parameters related to SIL, and based on this model, to determine the appropriate hardware components and associated algorithms.
Realization:	10/2025 – 09/2026
Coordinator:	Ľubomír Hrmo
Co-operators:	Juraj Ždánsky, Aleš Janota

21018: Innovation of the model track and its connection to the digital copy	
Summary:	The project focuses on the upgrade of a model railway track in the Transport Processes Laboratory. The model railway serves as a teaching aid in the teaching of subjects focused on railway signalling systems and for presentation purposes of the Department of Control and Information Systems. The innovation will include the design and implementation of new rail vehicle presence detectors that will be compatible with current control system. The model railway will be further complemented by a visualisation unit for the dispatcher's workstation. A digital copy of the track sections will be created which will be further used for research purposes of the thesis.
Realization:	10/2025 – 09/2026
Coordinator:	Dávid Macko
Co-operators:	Jozef Hrbček

21091: Wireless sensor system for improving rehabilitation with AI evaluation	
Summary:	The aim of the project is to design and implement the first functional prototype of a system for collecting, processing and analyzing data on human movement. The system will use sensors such as accelerometers, gyroscopes and other motion sensors, which will be part of sensor nodes. These wireless nodes will send data to a central node via an efficient communication protocol. The central node will ensure the processing, storage and visualization of the received data, as well as their subsequent evaluation using artificial intelligence. For this purpose, the Nvidia Jetson platform will be used, which will enable the application of neural networks directly on the central node. The project will result in a functional sample of the system that demonstrates the possibility of wireless data collection and intelligent evaluation of movement in real time.
Realization:	10/2025 – 09/2026
Coordinator:	Maroš Valášek
Co-operators:	Gabriel Gašpar, Aleš Janota

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

2024digVS003: Non-invasive monitoring of human stress using AI	
Summary:	The focus of our project, titled "Non-invasive Human Stress Monitoring Using AI", is on developing a device (computer mouse or keyboard) for non-invasive monitoring of physiological manifestations. This device will be able to record and analyze multiple parameters, including PPG, oximetry, body temperature, and other relevant data may also be used. The main goal of the project is to create a system that will enable 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

21019: TWIN4ECO – Digital Twin for Ecologically Sustainable Cities	
Summary:	The TWIN4ECO project will provide a methodology for collecting, processing and integrating environmental data into the Digital Twin of a City (DDM) system. The project focuses on connecting the real and digital worlds through IoT sensors that can monitor key environmental factors such as air quality, temperature, humidity, noise, emissions and other environmental and transport indicators. The project will result in a unified framework for managing environmental data, visualising it and using it in DDM to support decision-making, planning and city management. TWIN4ECO will also strengthen the connection between the digital infrastructure of smart cities and real processes in the urban environment, thereby contributing to more efficient resource management, sustainability and a higher quality of life for residents.
Realization:	10/2025 – 09/2026
Coordinator:	Pavol Kuchár
Co-operators:	Aleš Janota

Submitted Proposals of International Research Projects in 2025

Type/Call	Project title	Outcome of evaluation
SK-UA-25-0002	Joint Research on Sensor Systems and Applications	under evaluation

Outputs from Solved Research Tasks

Publication activities at the department in 2025

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	...
V3	Scientific output of publication activity from the journal	...
O1	Professional output of publishing activity as a whole	...
O2	Professional output of publishing activity as part of a book publication or collection	...
O3	Professional output of publication activity from the journal	...
P1	Pedagogical output of publication activity as a whole	...
P2	Pedagogical output of publication activity as part of a textbook or a script	...
TOTAL (listed categories)		...
TOTAL (listed categories and other categories – U, D, I)		...

Patents, Industrial Designs, Author's Certificates and Discoveries

Granted in 2025:

[1]	Category: Patent No. 289358 Application Number: 35-2022 Authors: Bujňák Marek, Nemec Dušan, Pirník Rastislav, Hruboš Marián, Kuchár Pavol and Gregor Michal. Title: Equipment for hazardous environment exploration
[2]	Category: Utility Model 10388 Application Number: 109-2024 Authors: Pirník Rastislav, Kačková Júlia, Kuchár Pavol and Kekelák Juraj Title: Capacitive Bioelectrode with Impedance Minimization
[3]	Category: Utility Model 38738 (Czech Republic) Application number: 2025-42884 Authors: Zuzana Bělinová, Jiří Brož, Pirník Rastislav, Tomáš Tichý, Martin Vlkovský Title: System for decision support in the management and control of transport, military, industrial and energy technology equipment

Co-operation

Co-operation Partners in Slovakia

- AŽD Praha, s.r.o., organizačná zložka Žilina
- B+R automatizace, s.r.o, Nové Mesto nad Váhom
- Betamont, s.r.o., Zvolen
- Continental Matador Truck Tires s.r.o., Púchov
- FMACH Žilina
- Industry Solutions Žilina
- KIA Slovakia, s.r.o. Žilina
- MTS Krivá
- SEC Technologies, Liptovský Mikuláš
- Scheidt&Bachmann Slovensko, s.r.o., Žilina
- SICK Bratislava
- Siemens Mobility s. r. o., Žilina
- Siemens s.r.o., Digital Industries/ Factory Automation/ Automation Systems
- Slovenská technická univerzita Bratislava
- Technická univerzita KošiceCISCO Academy, Košice

International Co-operation Partners

- AŽD Praha s.r.o., Czech Republic
- B&R Industrial Automation GmbH, Austria
- Continental – Group sector Tire Hannover, Germany
- České vysoké učení technické Praha, Czech Republic
- Inductive Automation, California

- University of Haifa, Israel, the Hatter Department of Marine Technologies, Charney School of Marine Sciences

Non-contractual Cooperation with Academic Institutions

- Český institut informatiky, robotiky a kybernetiky, ČVUT Praha, Czech Republic
- Fakulta dopravní ČVUT, Praha, Czech Republic

Visitors to the Department in the academic year 2024/2025

Name	Institution	Length of stay
Roman DANEL	VŠB-TU Ostrava, Czech Republic	1 day

Visits to Foreign Institutions in the academic year 2024/2025

Name	Institution	Length of stay
Aleš Janota	University of Katowice, Poland	1 day
Aleš Janota	Fakulta dopravní ČVUT Praha, Česká Republika	2 days
Aleš Janota	FEI VŠB-TU Ostrava, Česká Republika	1 day
Aleš Janota.	VUT Brno, Česká Republika	3 days
Pavol Kuchár	Fakulta dopravní ČVUT Praha, Česká Republika	3 days
Juraj Ždánsky	Technická univerzita Liberec, Fakulta mechatroniky, informatiky a medziodborových štúdií, Česká Republika	5 days
Rastislav Pirník	VUT Brno, Česká Republika	3 days
Rastislav Pirník	Fakulta dopravní ČVUT Praha, Česká Republika	4 days
Dušan Nemec, Vojtech Šimák, Juraj Kekelák	Charney School of Marine Sciences, University of Haifa, Israel	7 days
Alžbeta Kanáliková	Technická univerzita Liberec, Fakulta mechatroniky, informatiky a medziodborových štúdií, Česká Republika	4 days

Contracts (Business Activities)

S-103-0014/15: Rámcová zmluva o poskytovaní konzultačných služieb	
Zákazník:	AŽD Praha s. r. o.
Zodpovedný riešiteľ:	prof. Ing. Karol Rástočný, PhD.

S-103-0001/24: Posudky bezpečnosti	
Zákazník:	KUMAT s. r. o.
Zodpovedný riešiteľ:	doc. Ing. Juraj Ždánsky, PhD.

S-103-0003/25_1: Service Agreement	
Customer:	KIA Slovakia s. r. o.
Coordinator:	Juraj Ždánsky

S-103-0003/25_2: Service Agreement	
Customer:	KIA Slovakia s. r. o.
Coordinator:	Juraj Ždánsky

Other Activities

Conferences, Workshops, Symposiums Organized by the Department

- Cybersecurity in the regions – Žilina, 10.06.2025, University of Žilina, responsible organizer: Marián Hruboš and Aleš Janota.

Specialised Lectures and Courses Organized by the Department

Ing. 4.0 - module Robotics and advanced robotics	
Customer:	Small and medium-sized enterprises of the Slovak Republic
Lecturer:	Aleš Janota, Dušan Nemec, Vojtech Šimák
Date:	17 th January – 7 th March 2025

Ing. 4.0 – module Image Processing, Large Language Models	
Customer:	Small and medium-sized enterprises of the Slovak Republic
Lecturer:	Pavol Kuchár
Date:	10 th November 2025

Practical inspection tasks with COGNEX cameras	
Customer:	DCIS students and staff
Lecturer:	Michal Tuhý (MTS Krivá spol. s r.o.)
Date:	25 th November 2025

Object identification solutions with SICK systems in industry	
Customer:	DCIS students and staff
Lecturer:	Adam Brňo (SICK spol. s r.o. Bratislava)
Date:	09 th December 2025

Smart Automation: B&R's role in shaping tomorrow's industry	
Customer:	DCIS students and staff
Lecturer:	Michal Bors, Ján Žabka (B&R)
Date:	29 th April 2025

Embedded system design for Danfoss electrohydraulic valves	
Customer:	DCIS students and staff
Lecturer:	Tomáš Mravec (Danfoss)
Date:	10 th November 2025

PVX hydraulics and electrohydraulics	
Customer:	DCIS students and staff

Lecturer:	Tomáš Mravec (Danfoss)
Date:	23 rd April 2025

Invited Lectures/Papers

Security and reliability of ITS systems	
Lecturer:	Pavol Kuchár
Where:	ČVUT Praha, CZ
Date:	7 th April 2025

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

Individual membership of employees in the scientific committees of international conferences		Function
Aleš Janota	22nd International Conference on Informatics in Control, Automation and Robotics (ICINCO 2025), Marbella, Spain: Oct 20-22, 2025	member of the programme committee
Aleš Janota	26th International Carpathian Control Conference ICCC'2025, Starý Smokovec, Slovakia: 19-21 May, 2025	member of the technical programme committee
Aleš Janota	16th International Conference on Marine Navigation and Safety of Sea Transportation TransNav2025, Gdynia, Poland: June 11-13, 2025	member of the scientific program committee
Aleš Janota	16th International scientific conference on Sustainable, Modern and Safe Transport (TRANSCOM 2025), Grand Hotel Bellevue, High Tatra Mountains, Slovakia: May 21-23, 2025	member of the scientific committee
Aleš Janota	32nd International Conference Cybernetics & Informatics '25, Mikulov, Czechia: Feb 2-5, 2025	member of the technical programme committee

Aleš Janota	IEEE 23rd World Symposium on Applied Machine Intelligence and Informatics (SAMI 2025), Stará Lesná, Slovakia: Jan 23-25, 2025	member of the technical programme committee
Pavol Kuchár	26th International Carpathian Control Conference ICC'C'2025, Starý Smokovec, Slovakia: 19-21 May, 2025	member of the technical programme committee
Rastislav Pirník	26th International Carpathian Control Conference ICC'C'2025, Starý Smokovec, Slovakia: 19-21 May, 2025	member of the technical programme committee
Emília Bubeníková	Multidisciplinary Aspects of Production Engineering MAPE 2025, 9-12 September 2025, Kielce, PL	member of the scientific committee
Jozef Hrbček	16th International scientific conference on Sustainable, Modern and Safe Transport (TRANSCOM 2025), Grand Hotel Bellevue, High Tatra Mountains, Slovakia: May 21-23, 2025	member of the organizing committee
Gabriel Gašpar	22nd MECHATRONIKA 2026, Prague, Czech Republic	member of the scientific committee
Gabriel Gašpar	37th Central European Conference on Information and Intelligent Systems Conference, 16 - 18 September, 2026 / organized by University of Zagreb Faculty of Organization and Informatics / Varaždin, Croatia	member of the programme committee
Gabriel Gašpar	15th Computer Science On-line Conference 2026, https://csoc.openpublish.eu/	member of the programme committee
Gabriel Gašpar	10th Computational Methods in Systems and Software 2026, https://comesyso.openpublish.eu/	member of the programme 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

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
Rastislav Pirník, National Centre of Robotics, Bratislava, Slovakia	member

Individual membership of employees in editorial boards of national journals	Function
Juraj Ždánsky	ATP Journal, ISSN 1335-2237 chairman of the editorial board
Rastislav Pirník	Acta Technologica, ISSN 2453-675X member of the scientific and program committee
Gabriel Gašpar	Komunikácie – Vedecké listy Žilinskej univerzity v Žiline, ISSN (print version) 1335-4205, ISSN (online version) 2585-7878 editor-in-chief

Individual membership of employees in the scientific committees of national conferences	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	STU, Bratislava, branch committee of the doctoral study department of cybernetics member
Aleš Janota	MTF STU, Trnava, program committee PhD study for the program Automation and Informatization of Processes member
Aleš Janota.	FEI STU, Bratislava, program committee PhD study for the Robotics and Cybernetics program member
Aleš Janota	FEI STU, Bratislava, program committee PhD study for the program Mechatronic Systems member
	member
Rastislav Pirník	STU Faculty of Mechanical Engineering, Bratislava, working group for the third degree in the program Automation and Informatization of Machines and Processes member
Rastislav Pirník.	Council for the Internal Quality Assurance System at STU Bratislava - Cybernetics member
Rastislav Pirník	Mechatronic systems in the field of study Cybernetics, 3rd level working group member
Emília Bubeníková	VTS Association at UNIZA member
Gabriel Gašpar	Scientific Council of the Faculty of Health, SZU, Banská Bystrica member

Individual membership of employees in scientific boards and trade committees outside of FEEIT UNIZA	Function
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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
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	working group member
Gabriel Gašpar	Slovak Medical University, Faculty of Healthcare in Banská Bystrica, scientific board	member

Awards

Júlia Kafková	Laureate of the Student Personality of Slovakia 2024/2025 award in the category of computer science, mathematical and physical sciences
Emília Bubeníková	J.A. Komenský Plaque for meritorious pedagogical activity

Contact Address

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