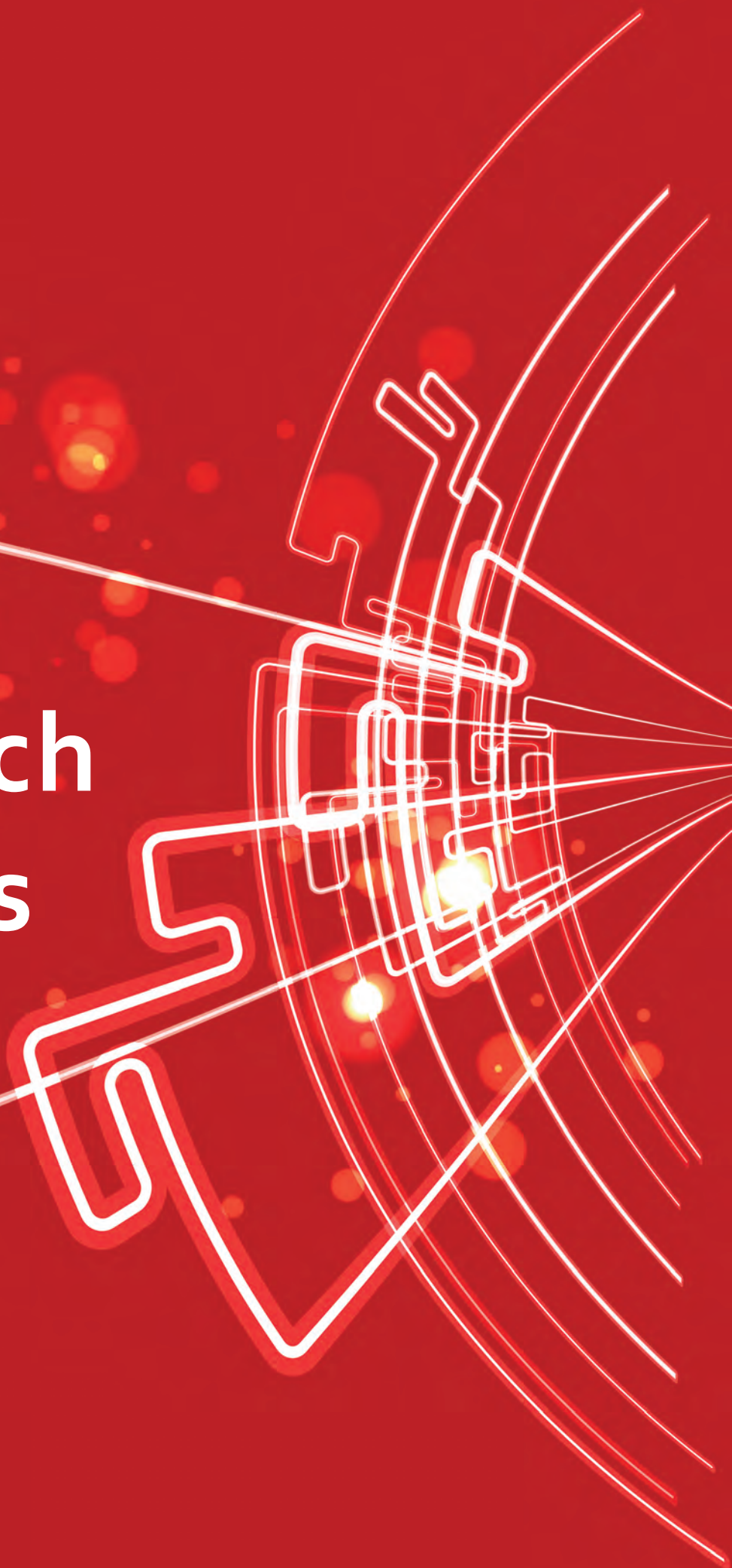




**TECHNICAL
UNIVERSITY**
OF CLUJ-NAPOCA
ROMANIA

Research Reports

2025



MINISTRY OF EDUCATION AND RESEARCH



TECHNICAL UNIVERSITY
OF CLUJ-NAPOCA, ROMANIA

RESEARCH REPORTS

2025

UTPRESS
Cluj-Napoca, June 2026

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INTRODUCING THE REPORT

FOREWORD

Scientific research is an inexhaustible source of knowledge, an important resource of society, while constituting an approach to university education as well.

The Technical University of Cluj-Napoca, one of the 12 universities of "advanced research and education" in Romania, aims at engaging itself in producing outstanding scientific results and approaching interdisciplinary and multidisciplinary subjects. Furthermore, it strives to integrate the research results in the exchange of national and international values, to increase its national and international visibility, and also attract and create highly skilled human resources.

Achieving these goals must strengthen its already established position as a university of "advanced research and education", and the recognition of the Technical University of Cluj-Napoca as a center of excellence in scientific research with a high impact on the social and economic environment.

Scientific research, by its creative nature, represents one of the most important methods both in teacher or researcher training and in educating university students in the spirit of innovation, irrespective of study level.

In the Technical University of Cluj-Napoca basic and applied research, as well as innovation are promoted. The research topics cover the fields of engineering, science, and humanities.

Research is conducted at department level, predominantly in over 80 accredited research structures. The new research strategy aims at creating self-sustainable interdisciplinary and multidisciplinary structures capable of outstanding scientific achievements, integrated within a multidisciplinary research institute.

The coordination of the scientific research is performed by academic staff experienced in research, and especially by PhD advisors relying on the broad involvement of the faculty, the young researchers, and the students.

Research teams enjoy the freedom of choosing their research topics, but their activities are in line with the national and international policy comprised within the strategy of research - development – innovation.

The goal of this volume is to present the research structures existing in the Technical University of Cluj-Napoca and the results achieved by these through the projects carried out in national and international competitions. The expected result of the volume is to enhance the cooperation between the research structures of the Technical University and other national and international structures.

Professor Florin-Ioan Oniga PhD

Vice-Rector for Scientific Research

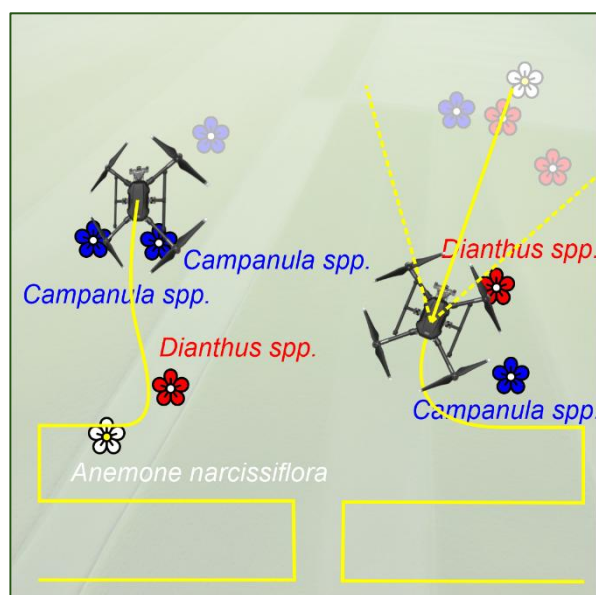
NATIONAL RESEARCH PROJECTS

AI-BASED ACTIVE CONTROL OF DRONES SEARCHING FOR INDICATOR SPECIES FOR GRASSLAND BIODIVERSITY

SkAIGreen

PN-IV-P7-7.1-PED-2024-0481

Goal of the project and short description



To support agricultural practices that reduce biodiversity loss, the EU introduced the Common Agriculture Policy. One support tool comprises result-based agripayment schemes (RBAPS), in which payments are made to farmers if they show the presence of a minimal number of indicator plant species on the targeted parcel, via a manual monitoring procedure. This procedure is inefficient, expensive, difficult to implement by farmers and to verify by the control body. The natural next step to address these shortcomings is to automate species identification.

The SkAIGreen project will therefore develop AI and deep-learning based active control of one drone or a drone team to automatically seek RBAPS indicator

plant species for the biodiversity of Romanian grasslands. AI and machine learning will play a key role both in species identification and in active drone control to find as many species as quickly as possible; and we will make fundamental advances in active robot control. The novel technology will provide faster, cheaper, and more verifiable monitoring results than the existing human-based procedure; and will be quantitatively validated in a case study in the Angofa region of Romania.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating institution

ADEPT TRANSILVANIA SRL - partner

Implementation period

01.09.2025-31.08.2027

Main activities

Deep learning for plant species identification

We develop the vision-based deep learning components required for automated

identification of grassland indicator species. This work includes drone data collection over representative parcels under controlled flight patterns, altitudes, and camera orientations, followed by expert-guided labeling to create a dataset. State-of-the-art detection methods are reviewed, adapted, and benchmarked using rigorous evaluation metrics, with special attention to rotor downwash effects, leading to a validated detection model tailored to Romanian grasslands.

AI-based active drone control

We develop prediction and control methods that enable drones to actively optimize species detection performance. Recurrent neural

networks are trained to predict future identification accuracy along feasible drone trajectories generated automatically from detection datasets. These predictors are integrated into an iterative active-control framework that selects optimal trajectory segments. Development and tuning rely heavily on a pseudo-simulator for scalable experimentation, followed by real-world validation.

Case study validation

We validate the integrated technology through a fully defined field case study conducted in representative Romanian hay meadows. First we specify experimental protocols, environmental conditions, evaluation metrics, and performance targets to ensure rigorous assessment. Detection, prediction, and control algorithms are integrated into a ready-to-use hardware–software platform centered on a DJI Matrice drone. Final field experiments compare the automated system against both algorithmic and expert human baselines, quantitatively studying gains in accuracy, efficiency, coverage, and repeatability.

Results

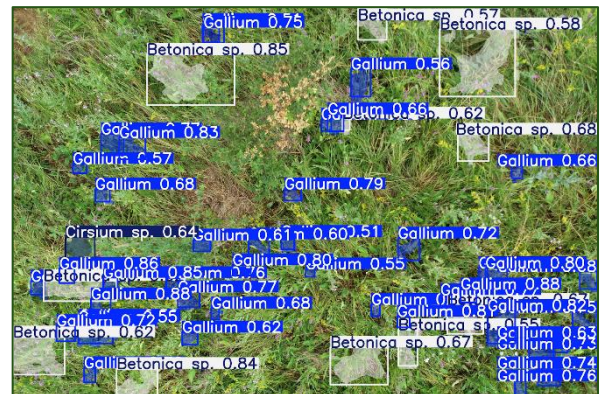
In the first year, we focused on:

- A preliminary dataset on a site in Padureni, Cluj county, labeled by an expert.
- Training an initial deep-learning model for segmenting plant species.
- Designing the case study.

Project team collecting data in the field:



Automated segmentation of test data with the learned model:



Funding source

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P7-7.1-PED-2024-0481

Research center

Robotics and Nonlinear Control - ROCON

Research Team TUCN

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RADIOFREQUENCY IDENTIFICATION SYSTEM FOR ENHANCED LAPAROSCOPIC DETECTION OF SMALL-SIZED COLORECTAL TUMOURS

IntelliSense

PN-IV-P7-7.1-PED-2024-0959

Goal of the project and short description

The overall objective of this project is to develop a precise radiofrequency identification (RFID) detection system - IntelliSense - capable of identifying RFID tags placed endoscopically on tumour margins through at least 10 mm of biological tissue, by scanning the serosal side of the bowel during laparoscopic surgical procedures. The system consists of two components: (1) a Laparoscopic RFID Sensorial Instrument (LRSI) incorporating an active RFID reader with a miniaturized antenna at its tip, connected to a signal processing unit with real-time display; and (2) miniaturized colonic mucosal implantable passive RFID tags (length 2 ± 5 mm, diameter 1 ± 2 mm), encapsulated in biocompatible resin, deployable through the 2.8 mm working channel of standard endoscopes.

The specific objectives are: (O1) design and development of customized millimetric RFID tags; (O2) design and development of the IntelliSense laparoscopic detection instrument; (O3) demonstration of concept validity and technical feasibility through ex-vivo dry-lab and wet-lab experiments; (O4) validation of results for TRL 4; (O5) dissemination of project results. The project advances IntelliSense from TRL 2 to TRL 4 and is grounded on patent RO 131186 B1/29.04.2021 and three prior publications in Materials Science & Engineering C (IF 7.32), Surgical Oncology (IF 3.4), and Scientific Reports (IF 4.379).

Partial results obtained so far: The system integrates a miniaturized laparoscopic RFID sensorial instrument (LRSI) operating at 13.56 MHz with biocompatible passive RFID tags ($8 \times 8 \times 0.7$ mm, NXP NTAG 216) implanted preoperatively near tumour sites. IntelliSense addresses a critical unmet clinical need: approximately 15% of colorectal tumours are missed during laparoscopic surgery due to the lack of tactile feedback, leading to costly reinterventions. The project encompasses electromagnetic simulation and optimization of RFID antennas in biological tissue, ergonomic and technical feasibility analysis compliant with medical standards (ISO 10993, ISO/IEC 14443-A, ETSI EN 60601-1-2), and the development of functional prototypes for both the detection instrument and biocompatible RFID tags. The research advances from TRL 2-3 to TRL 4, with validated detection ranges of 24.5 ± 1.2 mm (air) and 21.8 ± 1.5 mm (saline), sensitivity $>95\%$, specificity $>98\%$, and response time of 45 ± 8 ms.

Project implemented by
Technical University of Cluj-Napoca –
Coordinating institution
Tehnologic SRL – partner

Implementation period

13.01.2025-31.12.2026

Main activities

Phase 1 – Theoretical Analysis and Simulation:
Electromagnetic simulations (ANSYS HFSS) to
optimize RFID tag design for signal transmission
through biological tissues; feasibility studies with
tissue phantoms; ergonomic simulations for the

RFID reader integrated with laparoscopic tools (CAD/CAM/CAE).

Phase 2 – Instrument and RFID Tag Concept Formulation (TRL 2 to TRL 3): Conception, design, and manufacture of implantable RFID passive tags with biocompatible encapsulation; system design refinement of the IntelliSense instrument using CAD/CAM; stakeholder engagement through focus groups with surgeons.

Phase 3 – Proof of Concept Development (TRL 3 to TRL 4): Prototype manufacturing of RFID tags and IntelliSense instrument; laboratory testing and validation in complex tissue models and animal tissues; iterative design improvements based on testing feedback.

Phase 4 – Testing, Optimisation, and Validation: Ex-vivo dry-lab and wet-lab experiments on animal biological tissues (stomach, colon, rectum) with various thicknesses; iterative optimization of IntelliSense parameters; validation of the complete detection system on biological tissue.

Results

D1 – Report on electromagnetic behaviour simulations of RFID tags in diverse biological media: Validated FEM models (ANSYS HFSS) confirming optimal performance at 13.56 MHz (HF RFID). Key findings: tissue attenuation 4–5 dB/cm in muscle; relative permittivity $\epsilon_r = 48\text{--}78$ depending on tissue type; antenna quality factor $Q = 15\text{--}25$; detection range 20–50 mm in biological media. Strong FEM-to-experiment correlation ($r^2 = 0.96$).

D2 – Feasibility report and ergonomic analysis of the IntelliSense instrument and RFID tags: Confirmed biocompatibility (ISO 10993), electromagnetic safety ($SAR < 2\text{ W/kg}$), sterilizability (500+ autoclave cycles at 121°C). Ergonomic design validated: handle weight 45–50 g, diameter 12–14 mm, trocar compatibility 10–12 mm. Stakeholder analysis across 7 categories

yielded 16 user needs translated into 18 quantified specifications per ISO 13485.

D3 – IntelliSense instrument prototype (LRSI): Fully functional prototype integrating ferrite-core miniaturized antenna ($\varnothing 4 \times 12\text{ mm}$), ST25R3916B NFC transceiver, STM32F4 ARM Cortex-M4 microcontroller (100 MHz), rigid-flex PCB with 20 dB RF preamplifier, OLED 128×64 display, Li-Po 3.7V/2000 mAh battery (8–10 h autonomy), titanium/316L stainless steel housing. Detection: $24.5 \pm 1.2\text{ mm}$ (air), 10–15 mm (tissue); response time $< 50\text{ ms}$; 98.5% detection success rate; 200+ sterilization cycles.

D4 – Biocompatible RFID tag prototype compatible with IntelliSense: NXP NTAG 216 chip (888-byte EEPROM, ISO/IEC 14443-A, 13.56 MHz) encapsulated in borosilicate glass (12 mm × 2.12 mm). Custom 3D-printed molds for controlled manufacturing. Detection range 25–30 mm in simulated biological media through 10–30 mm multi-layer tissue phantoms. Technology maturity advanced to TRL 4.

Dissemination:

1. B. Mocan et al., “Radio Frequency Identification Technology for Precise Tumour Localization in Minimally Invasive Colorectal Surgery: Frequency Band Evaluation, Magnetic Field Analysis, and Bench Testing” - (submitted/in review).
2. B. Mocan et al., “IntelliSense: NFC-Enabled Surgical Probe for Real-Time Colorectal Tumour Localization – Design, Development, and Experimental Validation” - (in preparation).

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P7-7.1-PED-2024-0959

Research center

Research Group in Interaction Design - IxD

Research Team TUCN

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<https://sites.google.com/view/rfidsurgeon/home?authuser=1>

INNOVATIVE MULTI-LIFE TIME BATTERY MANAGEMENT SYSTEM FOR FUTURE ENERGY STORAGE SOLUTIONS

INVENT

PN-IV-P7-7.1-PED-2024-1479

Goal of the project and short description

INVENT will create a Battery Management System (BMS) that is agnostic, independent of specific chemistry, low cost, and entirely reusable for second life batteries. Built upon a genuine distributed modular architecture, adhering to Battery Passport it will align with the emerging international standards. All the communication protocols are conceived in wire free philosophy, using the DC power bus as a vessel to carry data between the electronic modules of the BMS.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating institution

SIEMENS INDUSTRY SOFTWARE SRL - partner

Dissemination:

International conferences

- Mihai Dit; Sebastian Ursache; Paula Serban; Claudia Martis; Mircea Ruba; Ankidim Zinveli, A comprehensive overview of software used for battery management systems. Challenges, solutions, and future trends (Part I), 2nd edition of International Conference on Future Energy Solutions – FES, Cluj-Napoca, Romania, on 24th–26th September 2025
- Mihai Dit; Sebastian Ursache; Paula Serban; Claudia Martis; Mircea Ruba; Ankidim Zinveli, A comprehensive overview of software used for battery management systems. Challenges, solutions, and future trends (Part II), 2nd edition of International Conference on Future Energy Solutions – FES, Cluj-Napoca, Romania, on 24th–26th September 2025
- Sebastian Ursache; Paula Serban; Mircea Ruba; Claudia V. Pop; Gabriel Chindris; Claudia Marțiș, State of charge estimation and modelling of a Lithium-Ion cell using Extended Kalman Filter, 2nd

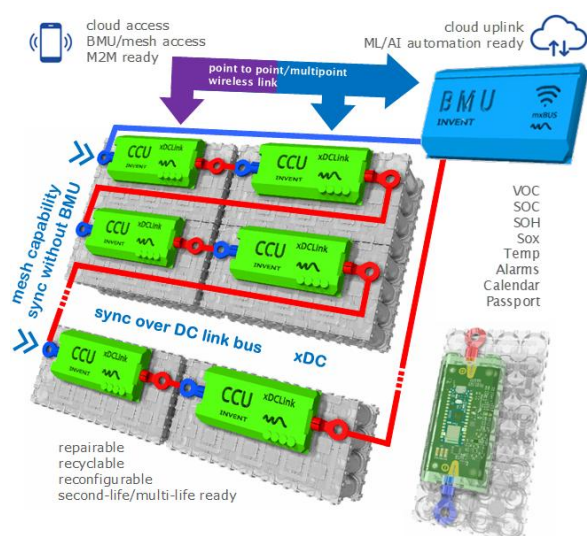
Implementation period

03.01.2025-31.12.2026

Main activities

Experimental Reserch

Results



edition of International Conference on Future Energy Solutions – FES, Cluj-Napoca, Romania, on 24th–26th September 2025

- Claudia Pop; Adelina Ilieș; Paula Șerban; Sebastian Ursache; Gabriel Chindriș; Mircea Ruba, Effects of Vibrations and Temperature on Lithium-Ion Batteries for Electric Vehicle Applications, 2nd edition of International Conference on Future Energy Solutions – FES, Cluj-Napoca, Romania, on 24th–26th September 2025
- Mircea Ruba; Sebastian Ursache; Paula Șerban; Claudia Martis; Horia Hedesiu; Patricia Trif, Analysis of an efficient cell balancing system applied to Li-Ion batteries, 2nd edition of International Conference on Future Energy Solutions – FES, Cluj-Napoca, Romania, on 24th–26th September 2025

International books

- M. Ruba, C. Martis, P. Șerban, and S. Ursache, ‘Perspective Chapter: Fundamentals on Fault Tolerance for Electrical Machines’ Structures’, Fault Tolerance in Modern Engineering Systems [Working Title]. IntechOpen, July 21, 2025. doi: 10.5772/intechopen.1011032.

International patents

- Programmable method for sensorless estimation of the load current and the state of charge of a battery – OSIM nr A00344/04.08.2025
-

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P7-7.1-PED-2024-1479

Research center

Center of Applied Researches in Electrical Engineering and Sustainable Development

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Atmosphere REentry SaTellites Orbital Parameters REfinement RESTORE

PN-IV-P7-7.1-PED-2024-0369

Goal of the project and short description

The main objective of the proposed project, "RESTORE - Atmosphere Reentry Satellites Orbital Parameters Refinement", is to develop a system for observing the trajectories of satellites on degraded orbits and updating their orbital parameters. The system will be a wide-field visual sensor, equipped with real-time processing capabilities, designed to continuously update the orbital parameters. The refined orbital parameters can be used for a more accurate immediate prediction of the future position of the objects, improving re-entry location predictions, or can be utilized by a narrow-field telescope or radar system for more detailed observations.

In this project, we intend to develop two systems operating in parallel to detect, measure, and refine the orbital parameters of re-entering satellites. Each system will be capable of operating independently, performing the following tasks: image acquisition, image processing, astrometric calibration, target identification based on orbital parameters, and orbital parameter refinement based on observations. The refined parameters will be transmitted to the second system, which may apply an additional refinement step and will also serve as a validator of the new parameters by comparing its predictions with its own observations.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating institution

CONTROL DATA SYSTEMS SRL - partner

Implementation period

05.05.2025 - 30.04.2027

Main activities

Stage 1: September 2024 – December 2024.

- Definition of the hardware and software architecture for the dual system dedicated to observing and measuring satellites on re-entry orbits. Study of validation scenarios and preliminary acquisition of real data using existing systems. Result: technical reports on system architecture and validation methodology, as well as the first sets of experimental data.

Stage 2: January 2025 – December 2025.

- Construction and implementation of the hardware observation systems and the complete software suite for real-time satellite detection, calibration, and identification. Development of algorithms for orbital parameter refinement and validation of individual components. Result: two functional systems, integrated software modules, and the first scientific publications.

Stage 3: January 2026 – August 2026.

- Final integration of the hardware and software components into a complete system for observation and orbital refinement of re-entry satellites. Experimental validation on real-case scenarios and dissemination of the results through scientific papers, conferences, and the project's website.

Results

In the first stage of the RESTORE project, the system requirements, hardware and software architectures, as well as the validation methodology necessary for developing a platform capable of observing satellites undergoing reentry in real time and refining their orbital parameters were defined. The proposed system is based on two independent observation stations, connected via the internet, which can detect objects, process images locally, and generate refined TLE sets, communicated in real time to the other station.

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P7-7.1-PED-2024-0369

Research center

Image Processing and Pattern Recognition
Research Center - IPPRRC

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<https://cv.utcluj.ro/restore/indexRO.html>

EXPLAIN SCENES USING LANGUAGE

ENGAGE

PN-IV-P7-7.1-PED-2024-0952

Goal of the project and short description

The autonomous vehicle industry is continuously improving safety and comfort during driving. In addition, we are witnessing a shift toward the emergence of very large multimodal language models that combine linguistic understanding with visual perception. Recent research proposes strategies that align visual perception with textual information using multimodal LLMs to enhance generalization and reasoning capabilities.

The goal of this proposal is the development of a novel end-to-end system, Large Language Model for Autonomous Driving (LLM4AD), which leverages both visual and textual information. In addition to acting as a high-performance motion planning tool in highway driving scenarios, the proposed solution would stand out through a high degree of explainability.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating institution

ROBERT BOSCH SRL - partner

Modified versions of the reference datasets,
containing only the relevant transformed data.

Multimodal, multitasking model LLM4AD.

Model evaluation report in a relevant context,
using the company's data.

Implementation period

05.05.2025-30.04.2027

Main activities

Phase 1 / 2025 – Data analysis and preprocessing

Phase 2 / 2026 – Design and implementation of
the LLM4AD model prototype, with a focus on
improving and evaluating reasoning capabilities.

Phase 3 / 2027 – Validation of the model in the
relevant scenario, using data provided by the
company.

Results

Dissemination:

Andrei Constantin, Vlad-Andrei Negru, Camelia
Lemnar, Rodica Potolea. (2025). VISION-RISK:
Vision-Language Model for Risk Assessment in
Autonomous Driving. In 2025 IEEE 21st
International Conference on Intelligent Computer
Communication and Processing (ICCP).

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P7-7.1-PED-2024-0952

Research center

KNOWLEDGE ENGINEERING GROUP - KEG

Research Team TUCN

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SKYLIGHT FOR BUILDINGS WITH INTEGRATED COOLING VIA PCM AND BIPVT SYSTEM

SKYCOOL

PN-IV-P7-7.1-PED-2024-2264

Goal of the project and short description

Buildings account for 36% of worldwide energy consumption, with the Heating Ventilation and Air Conditioning system representing up to 55% of a building's consumed energy.

The most thermally inefficient building envelope elements are the glazing units, causing (28-36) % of the total heat inputs during summer.

The project aims to study the efficiency of translucent phase change material (PCM) layers in the structure of photovoltaic (PV) skylights, that provide a level of daylighting.

PCMs store high amounts of thermal energy through phase change (latent heat), are classified into organic and inorganic substances, and are commercially available, with a wide range of properties, such as phase change temperatures, latent heat values, etc. It is estimated that a PCM with a phase change temperature of 25 °C will be adopted, for nighttime solidification to occur in the climate of Cluj-Napoca. PCMs have less effective thermal insulation properties compared to air/argon and can cause overheating after daytime melting. Thus, within the PCM layer, a coil manufactured out of transparent tubes will be immersed. The extracted heat will be transferred to the domestic hot water (DHW) heating system, to preheat the DHW. Therefore, the final product will obtain Building Integrated PV thermal (BIPVT) system features, increasing buildings' energy efficiency by reducing cooling load and boiler energy production, and increasing PV power generation, with the disadvantage of decreasing daylighting.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating institution

INTELTERM CONSULTING SRL - partner

Implementation period

08.01.2025-31.12.2026

Main activities

Stage 1 – Design and construction of experimental test rigs; thermal characterization of PCMs; development of numerical methods.

Stage 2 – Experimental research of the studied solution; numerical and feasibility studies.

Results

WP1 – Technical design of the BIPVT skylight; technical design of the solar simulator; technical design of the THM system.

WP2 – Hardware demo stand for the BIPVT skylight; hardware stand for the solar simulator; THM hardware stand.

WP3 – Software and report for PCM selection; DSC measurement report; THM measurement report.

WP4 – IAQ requirements report and air-treatment schematics; HVAC system simulation software; BIPVT skylight simulation software.

Dissemination:

Calota R., Pop O., Croitoru C., Bode F., Berville C., Ovadiuc E., "Performance analysis of solar collectors with nano-enhanced phase change materials during transitional periods between cold and warm seasons in the continental temperate climates", JOURNAL OF ENERGY STORAGE, 114(2025), doi: 10.1016/j.est.2025.115659.

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Financed through

The Executive Unit for Financing Higher
Education, Research, Development, and
Innovation (UEFISCDI)

Project code: PN-IV-P7-7.1-PED-2024-2264

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DEVELOPMENT OF SUSTAINABLE CONSTRUCTION ELEMENTS BY 3D PRINTING OF ULTRA-HIGH-PERFORMANCE FIBRE REINFORCED CONCRETES UHPFRC

PN-IV-P7-7.1-PED-2024-2692

Goal of the project and short description

The project aims to demonstrate the feasibility and sustainability of 3D printed ultra-high-performance fibre-reinforced concrete (UHPFRC) elements by integrating automation into both design and production processes. The optimization of elements' shape will be achieved by applying advanced finite element analysis, biomimetic principles, and 3D printing, thus minimizing the amount of concrete, and reducing the environmental impact. Considering the absence of design codes for 3D printing or UHPFRC, the project will generate a complete cycle from design to production, including laboratory testing to validate the anticipated behaviour.

Objectives include optimizing previously researched compositions of UHPFRC for printability, multidisciplinary design of UHPFRC elements, implementing 3D printing for UHPFRC element production, and characterizing mechanical behaviour through full-scale experimental testing. The results will be digitized for integration into building information modeling (BIM) and future design codes for the benefit of the construction industry.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating institution

SIEMENS INDUSTRY SOFTWARE SRL - partner

2027 - Digital data base for elements printed from UHPFRC to be used in BIM (Building information modelling) and future codes

Results

Report on the characteristics of new printable UHPFRC concrete compositions: description of the compositions, rheological and mechanical properties, and the resulting 3D printing parameters.

Creation of a digital database of UHPFRC concrete elements intended for printing, including architectural 3D drawings and results from finite element analysis.

Preparation of a research report on the mechanical performance of experimental elements.

Implementation period

05.06.2025-04.05.2027

Main activities

2025 - Elaboration of printable UHPFRC composition & 3D printing parameters

2026 - Multidisciplinary design for 3D printed UHPFRC elements and behaviour simulation

2026 - Industrial implementation of 3D Printing for UHPFRC elements 2026

2027 - Analysis of sustainability and environmental Impact

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P7-7.1-PED-2024-2692

Research Team TUCN

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COMPLETE, COMPUTER-AIDED TECHNOLOGICAL ALGORITHM FOR DESIGN AND REALIZATION OF EARTH GROUNDING ACCORDING TO OPTIMAL CRITERIA

OPTIM-EGR

PN-IV-P7-7.1-PED-2024-1377

Goal of the project and short description

The main goal of the project is the development of a reliable and economical technology for the realization of earth grounding (EGR), for all types of applications, including the security of people, constructions of any kind and goods, as well as the functionality of complex medical, computing, and other similar equipment. The fulfillment of such a developed goal requires, first, the definition and implementation of optimal criteria in the dimensioning of artificial EGRs. As such, the project aims at the realization of EGR products, based on a technology to be applied and using optimal, original, newly defined criteria in dimensioning, which ensure the economy of the realization of the grounding installation, by minimizing concrete sizes.

The following five optimal criteria are expected: the footprint area of the EGR; total volume of EGR; dispersion surface area of EGR; mass of active materials (electrodes and connecting conductors); investment expenses with EGR. Finally, the project aims to propose new standards, European and national, for the dimensioning and realization of EGR, according to the optimal criteria, which can produce significant savings in materials, labor, land, and costs.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating institution

EUROBB ENERGY SA - partner

EGR (buildings, constructions, installations); computer-assisted dimensioning of EGR, in all possible constructive variants and with the use of all applicable optimal criteria; the choice of the final variant, based on the set of data, by the united collective of the designer, the builder and the beneficiary; the physical realization of EGR; measurements of dispersion resistances for a single electrode, for their ensemble, as well as for the junction between natural and artificial EGR.

Implementation period

06.05.2025-06.05.2027

Main activities

Objective no. 1: Organizational Chart of General Technology

The organizational chart of the general technology, for dimensioning and realization of the EGR, which is structured on the following operations: analysis of the dimensional and material characteristics of the objective served by the EGR, retrieval of data related to the location plan; carrying out measurements regarding soil resistivity and dispersion resistances of natural

Objective no. 2: Soil Resistivity and Dispersion Resistance Measurements

Recording the soil resistivity and dispersion resistance measurements of the single electrodes and the EGR as a whole, for a complete dimensional control over the EGR to be made. The current measurement equipment technically supports this objective, through the simplicity and precision of the measurements. This interaction between the theoretical and the

practical aims at the safe realization of the permitted dispersion resistance.

Objective no. 3: Physical Models Composition and Processing

The composition and processing of the physical models of all types of EGR, differentiated according to the type of electrodes and according to their placement method. Most of the expressions, which express the dependencies between the variables and the characteristic parameters of the EGR, are non-linear, making it impossible to obtain explicit functions for the defining sizes, as well as for the objective functions, of the optimality criteria.

Objective no. 4: Optimal (Minimum) Criteria

The optimal (minimum) criteria, for which the team members have already proposed five original criteria, formulated and with concrete objective functions, clearly established. The five optimality criteria refer to physical quantities such as footprint area (denoted AP), total EGR volume (VP) and total dispersion area (AD), or to economic aspects such as are the mass of conductive materials (MP) and investment expenses (IP).

Objective no. 5: Numerical Identification of Minimum Areas

The numerical identification of the minimum areas, for each type of EGR and for each of the proposed optimality criteria, by using a dedicated calculation program designed specifically for this application. The numerical data represented by the objective function values are concentrated in the tables and are the basis of graphical representations in the (ℓ, a) plane, which can also highlight the existence of multi-criteria areas.

Objective no. 6: Technology Operations Ordering

The ordering in time of the operations to be performed in relation to the design and realization of the EGR, so to the technology to be followed, so that the designer, no matter how

little experience he may have, is able to make a perfect EGR from a technical point of view, but which satisfy the minimum criteria.

Objective no. 7: Laboratory Model Creation

Complementary to the theoretical and practical activities, from the field, and aims to create a laboratory model, on which certain concrete situations can be simulated, but especially certain limit situations, for which the theoretical solutions present discontinuities, instability, or anomalies.

Results

Stage 1: Physical Models and Optimal Criteria Programs

A1.1 - Physical Models Assembly

A1.2 - Calculation Programs Development

A1.3 - Results Analysis

A1.4 - Measurements Execution

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P7-7.1-PED-2024-1377

Research Team TUCN

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SPIN-ORBITRONIC DEVICES WITH CHIRAL MAGNETIC DOMAIN WALLS CONTROLLED BY GATE VOLTAGE

STRIVE

PN-IV-P1-PCE-2023-1548

Goal of the project and short description

The goal of this project is to demonstrate the feasibility of fully electrically controlled, fast, and ultra-low-power spin-current-driven chiral magnetic domain wall transistor devices as a viable beyond-CMOS technology. Emerging information technologies such as the Internet of Things, big data, and artificial intelligence demand rapidly increasing computational power, which increases the energy consumption limitations of conventional CMOS von Neumann architectures due to the physical separation of memory and processing units. Spin-based technologies offer a promising alternative by enabling non-volatile data storage combined with data processing, high scalability, and reduced power dissipation. This project addresses these challenges by developing and experimentally validating spin-orbitronic chiral devices through the fabrication of thin-film heterostructures, comprehensive structural, magnetic, magneto-electric and magneto-optic characterization, and micro-patterning of functional devices, aiming to contribute to sustainable, energy-efficient computing technologies.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating institution

Implementation period

08.01.2025-31.12.2027

Main activities

- Design and fabrication of functional spin-orbitronic chiral devices.
- Evaluation of device performance with respect to energy efficiency, speed, and scalability for future computing applications.

Results

In the field of spintronics electrical currents can be used to control the magnetic properties of materials. In our project, we explored the spin-orbit torques (SOTs) induced by these currents to manipulate magnetic structures without relying on external magnetic fields. We focused on a combination of SOTs and another effect known as the interfacial Dzyaloshinskii-Moriya interaction (iDMI), which creates unique magnetic textures

like chiral domain walls and skyrmions. Our goal was to use these effects to build viable fully electrically controlled, fast, ultra-low power operation, spin-current-driven chiral magnetic domain wall transistor devices (Fig.1). We designed ultrathin magnetic structures and used various experimental techniques to understand their properties, like second harmonic Hall experiments and Brillouin light spectroscopy and Kerr effect microscopy.

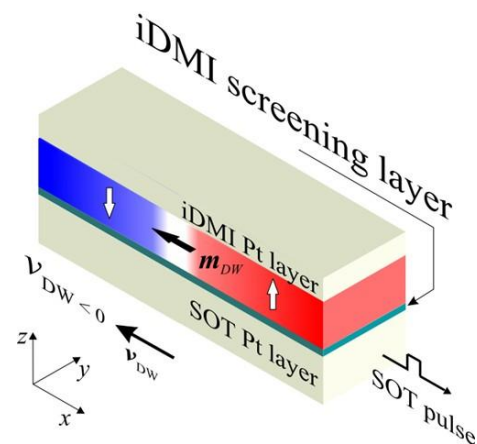


Fig. 1. Current-induced SOT DW motion under the influence of the iDMI.

Dissemination:

Published papers:

Investigation of irreversibility and the temperature dependence of interfacial magnetic properties of Pt/Co-based systems, W. Fotso, M. G. Hafiz, E. M. Stetco, H. Wang, S. M. Chérif, Y. Roussigné, M. S. Gabor, and M. Belmeguenai *Phys. Rev. Materials*, **9**, 114419 (2025)
<https://doi.org/10.1103/2hqr-ftsr>

Electronic Noise Measurement of a Magnetoresistive Sensor: A Comparative Study, Davidas C, Stetco EM, Viman LM, Gabor MS, Pop OA, Petrisor T Jr. *Sensors*, **25**, 6182 (2025)

<https://doi.org/10.3390/s25196182>

Minimizing Sensor-Sample Distances in Scanning Nitrogen-Vacancy Magnetometry, Zhewen Xu, Marius L. Palm, William Huxter, Konstantin Herb, John M. Abendroth, Karim Bouzehouane, Olivier Boulle, Mihai S. Gabor, Joseba Urrestarazu Larranaga, Andrea Morales, Jan Rhensius, Gabriel Puebla-Hellmann, and Christian L. Degen *ACS Nano*, **19**, 825 (2025)

<https://doi.org/10.1021/acsnano.4c18460>

Conferences presentations:

Geometry-Controlled Asymmetric Diode and Routing Functionalities in Spin-Orbit Torque Driven Domain Wall Devices, EM Stetco, T Petrisor, O Pop, IM Miron, MS Gabor, Joint European Magnetic Symposia 2025, Frankfurt, Germany

Influence of Geometry on Asymmetric Diode Behavior and Routing in Spin-Orbit Torque Domain Wall Device, EM Stetco, T Petrisor, IM Miron, MS Gabor ROPMAM 2025, Cluj-Napoca, Cluj

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code : PN-IV-P1-PCE-2023-1548

Research center

Center of Superconductivity, Spintronics and Surface Science - C4S

Research Team TUCN

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MULTIFERROIC FUNCTIONAL MATERIALS FOR ENERGY CONVERSION OBTAINED THROUGH UNCONVENTIONAL METHODS

MFHEC

PN-IV-P1-PCE-2023-0969

Goal of the project and short description

The aim of this project is to search among the Ni₅₀Mn_{50-x}Sn_x Heusler alloys a nanocrystalline candidate. The Ni-Mn-Sn Heusler alloys are considered very good materials for magnetic refrigeration since they exhibit, at off stoichiometric composition, a crystallographic transition and a shift in electrical and magnetic properties at a temperature close to room temperature. The alloys will be obtained by mechanosynthesis, arc melting and subsequent milling and spark plasma sintering compaction.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating institution

Implementation period

08.01.2025-31.12.2027

Main activities

1. Nanocrystalline Heusler alloys with compositions Ni₅₀Mn_{50-x}Sn_x (x = 0 – 50) by mechanical alloying

Implement a new method for Heusler alloy obtaining in nanocrystalline state (mechanical alloying) using as initial mixture elemental powders

2. Arc melting of Heusler alloys having compositions Ni₅₀Mn_{50-x}Sn_x and theirs milling for crystallite size decrease

The L_{21} structure stability vs. internal stresses and crystallite size

3. Spark plasma sintering compacts obtained from milled powders

Consolidation in shapes of the powders sample

Results

Nanocrystalline samples across the Ni₅₀Mn_{50-x}Sn_x (X=0 – 50) compositions.

Powder characteristics.

Physical properties and transition temperatures.

Dissemination:

Florin Popa, Andra Teodora Anastasia Man, Traian Florin Marinca, Ionel Chicinas, Phase Evolution by Annealing of Mechanically Activated Ni, Mn, and Sn Elemental Powders Mixture with the Ni₂MnSn Heusler Compound Ratio, Materials 18 (2025), 5642

D. Benea, S. El Bidaoui, L. V. B. Diop, O. Isnard, Theoretical investigations on the magnetic properties of the (Sc,Nb) Fe₂ compounds, Solid state communication 404 (2025) 116074

E. Bender, R. Hirian, C. Leoștean, R. Atanasov, R. G. Hațegan, L. Barbu-Tudoran, D. Benea, Near-Compensated Ferrimagnetism in Disordered Co_{0.5}Mn_{1.5}Al Half-Heusler Alloy: Experimental and Theoretical Studies, Materials 2025, 18, 4449

Conference presentations

Florin Popa, Andra Teodora Anastasia Man, Traian Florin Marinca, Niculina Sechel, Diana Benea, Razvan Hirian, Bogdan Neamtu, Ionel Chicinas, Disordered $\text{Ni}_2\text{Mn}_x\text{Sn}_{1-x}$ off-stoichiometric Heusler alloy formation with low S_n content by mechanical alloying, International Conference on Innovative Research Iasi, 8-9May 2025.

Florin Popa, Andra Teodora Anastasia Man, Traian Florin Marinca, Niculina Sechel, Diana Benea, Razvan Hirian, Bogdan Neamtu, Ionel Chicinas, PHASES EVOLUTION IN THE ANNEALED $\text{Ni}_{50}\text{Mn}_{20}\text{Sn}_{30}$ HEUSLER ALLOY OBTAINED BY MECHANOSYNTHESIS, 4th Journal of Thermal Analysis and Calorimetry Conference, Budapesta, Ungaria

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Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P1-PCE-2023-0969

Research center

Magnetic Materials and Nanomaterials - MatMagNano

Research Team TUCN

Project coordinator: Assoc.Prof. Dr. Florin Popa

Members:

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Master's student Andra Teodora Man

DIGITIZATION OF AN EVENT-BASED SURGICAL PROTOCOL FOR SYSTEM IDENTIFICATION AND ROBUST CONTROL IN GENERAL ANESTHESIA

EBSPDSIRCGA

PN-IV-P2-2.1-TE-2023-0831

Goal and short description of the project

The project "Digitization of an event-based surgical protocol for system identification and robust control in general anesthesia" aims to build a digital infrastructure that combines real clinical data, pharmacokinetic/pharmacodynamic models, and formal rules to support control and decision-making during general anesthesia.

Project implemented by

Technical University of Cluj-Napoca - coordinator

Implementation period

08-01-2025 - 31-12-2026

Main activities

Etapa 1 - WPI. Expertiza medicala si protocole

WP2. Modele de pacienti si modele de perturbatie

WP3. Procesarea semnalelor si digitalizarea acestora

Etapa 2 - WP1 Proiectarea strategiilor de control si analiza stabilitatii WP5. Testarea sistemului si pregatirea unui demonstrator WP6. Coordonare si diseminare

Results

In stage 1/2025, data from VitalDB clinical studies (over 6,000 procedures) were integrated, detailed operative logs were reconstructed, and disturbance profiles associated with the major stages of interventions were identified, including for complex surgeries.

Dissemination:

Keyser, R.D., Birs, I.R., Muresan, C.I. et al. Revisiting the impulse response creates an improved PID autotuner. Sci Rep 15, 36203

(2025). <https://doi.org/10.1038/s41598-025-20027-4> IF: 3.9

Fernandez, Edson & Huilcapi, Víctor & Birs, Isabela & Cajo, Ricardo. (2025). The Role of Fractional Calculus in Modern Optimization: A Survey of Algorithms, Applications, and Open Challenges. Mathematics. 13. 3172. 10.3390/math13193172. IF: 2.3

Popescu, T.M.; Badau, N.E.; Tudor, A.M.; Malita, A.C.; Birs, I.R.; Muresan, C.I. Preliminaries on Mean Arterial Pressure Regulation Using Closed Loop Norepinephrine Infusion. Fractal Fract. 2025, 9, 657. <https://doi.org/10.3390/fractalfract9100657> IF: 3.3

Badau, N.E.; Popescu, T.M.; Mihai, M.D.; Birs, I.R.; Muresan, C.I. A Robust Fractional-Order Controller Biomedical Applications. Fractal <https://doi.org/10.3390/fractalfract9090597> IF: 3.3

Amani R. Ynineb, Erhan Yumuk, Dana Copot, Ghada Ben Othman, Hamed Farbakhsh, Isabela Birs, Robin De Keyser, Samir Ladaci, Cristina Muresan, Martine Neckebroek, Clara M. Ionescu, Pharmacokinetic modelling during long-term anesthesia: minimizing the gap, Journal of Advanced Research, 2025, <https://doi.org/10.1016/j.jare.2025.06.047>. IF: 13

Mihai, M.D.; Birs, I.R.; Badau, N.E.; Hegedus, E.T.; Ynineb, A.; Muresan, C.I. Personalised Fractional-Order Autotuner for the Maintenance Phase of Anaesthesia Using SineTests. *Fractal Fract.* 2025, 9, 317. <https://doi.org/10.3390/fractalfract9050317> IF: 3.3

Marcian Mihai, Isabela Birs, Erwin Hegedus, Amani Ynineb, Dana Copot, Robain De Keyser, Clara M. Ionescu, Samir Ladaci, Cristina I. Muresan, Martine Neckebroek, Online and personalised control of the Depth of hypnosis during induction using fractional order PID, *Journal of Advanced Research*, 2025, <https://doi.org/10.1016/j.jare.2025.03.053>. IF: 13

Birs, Isabela; Rizel, Catalina; Mihai, Marcian; Muresan, Cristina; Keyser, Robin. (2025). Validation of a short relay test PID autotuner on a nonlinear process with stochastic disturbances *. 305-310. 10.1109/MED64031.2025.11073414.

Muresan, Cristina & Mihai, Marcian & Hegedus, Erwin & Badau, Nicoleta & Popescu, Teodora & Birs, Isabela. (2025). Robust Fractional Order Control of a Multivariable Hemodynamic System. 678-683. 10.1109/MED64031.2025.11073354.

M. D. Mihai, E. S. Coman, H. T. Erwin, I. R. Birs and C. I. Muresan, "Adaptive Fractional Order PI-PD Controllers Applied on a DC Modular Servo System," 2025 IEEE 12th International Conference on Computational Cybernetics and Cyber-Medical Systems (ICCC), Mahe Island, Beau Vallon, Seychelles, 2025, pp. 000085-000090, doi: 10.1109/ICCC64928.2025.10999108.

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P2-2.1-TE-2023-0831

Research center

Advanced Process Control Methods - ADAPTED

Research Team

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IMPLEMENTATION OF DISTRIBUTED LEDGER TECHNOLOGIES IN INTERNAL ORGANIZATIONAL WORKFLOWS AND SUPPORT APPLICATIONS FOR COOPERATION AMONG INSTITUTIONS IN THE FIELD OF NATIONAL SECURITY – DLT-AI SECSPP

PN-IV-P6-6.3-SOL-2024-2-0312

Goal of the project and short description

The aim of the project is to strengthen national security by developing and implementing an advanced platform for handling multimedia data, using Distributed Ledger Technology (DLT) and artificial intelligence.

Project implemented by

Technical University of Cluj-Napoca –
Coordinating Institution
The Ministry of National Defense through the
Research Agency for Military Equipment and
Technologies – Partner 1
ZA Cloud SRL – Partner 2

Implementation period

16.09.2024 - 15.09.2026

Main activities

Generation of new technological solutions in response to the specific requirements of public authorities.

Configuration of a DLT system to facilitate efficient and centralized data management.

Integration of DLT mechanisms with AI technologies to optimize data processing and transaction management.

Implementation of an infrastructure for risk analysis, leveraging the combined capabilities of DLT and AI.

Development of AI models for the conversion and analysis of multimedia data in various languages, in compliance with GDPR regulations.

Results

Audio deepfake detection and model attribution system: highly accurate audio deepfake detection and model attribution systems based on pretrained SSL features and light classifiers. The model is able to generalise to real-world deepfakes across different domains: political scams, entertainment, publicity stunts. It is also language agnostic.



Dissemination:

David Combei, Adriana Stan, Dan Oneață, Nicolas Muller, Horia Cucu, "Unmasking real-world audio deepfakes: A data-centric approach", under review at Interspeech 2025

Adriana Stan, David Combei, Dan Oneață, Horia Cucu, "TADA: Training-free Attribution and Out-of-Domain Detection of Audio Deepfakes", under review at Interspeech 2025

Nicolas Muller, Piotr Kawa, Wei Choong, Adriana Stan, Aditya Tirumala, Karla Pizzi, Alexander Wagner, Philip Sperl, "Replay Attacks Against Audio Deepfake Detection", under review at Interspeech 2025

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P6-6.3-SOL-2024-2-0312

Research center

Intelligent Systems Group - ISG

Research Team for TUCN

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Assoc.Prof.Dr. Eng. Adriana Stan
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Programmer Boros Bogdan Tiberiu
Programmer Combei David-Gabriel
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THE RoSSA SYSTEM – EXTENSION OF THE INFORMATIONAL SOLUTION AND DEVELOPMENT OF THE ELECTRO-OPTICAL SYSTEM; DEVELOPMENT OF ROMANIAN CAPABILITIES FOR SPACE DOMAIN AWARENESS – RoSSA2

PN-IV-P6-6.3-SOL-2024-2-0220

Goal of the project and short description

The project aims to expand and improve the current space surveillance system (ROSSA) through a series of technological upgrades and strategic integrations. This initiative directly addresses the growing need for monitoring and analyzing space objects, reflecting a commitment to ensuring the safety and sustainability of space activities at both national and international levels.

The ROSSA2 project targets the development of new sensors and the enhancement of existing capabilities within the ROSSA system, in order to increase the accuracy and efficiency of space object detection. ROSSA2 focuses on mobile sensors and introduces key services such as satellite maneuver detection, collision avoidance, re-entry tracking, conjunction analysis, RFI detection, and the development and updating of national catalogs for space objects and near-Earth objects (NEOs). The project also explores solutions for managing space object fragmentation.

Project implemented by

Romanian Space Agency (ROSA) - Coordinating Institution
Technical University of Cluj-Napoca – Partner 1
Astronomical Institute of the Romanian Academy – Partner 2
Romanian Academy Cluj-Napoca Branch – Cluj-Napoca Astronomical Observatory – Partner 3
Institute of Space Science, INFLPR – Partner 4
GMV Innovating Solutions – Partner 5
RARTEL SA – Partner 6

Implementation period

29.07.2024 - 20.07.2027

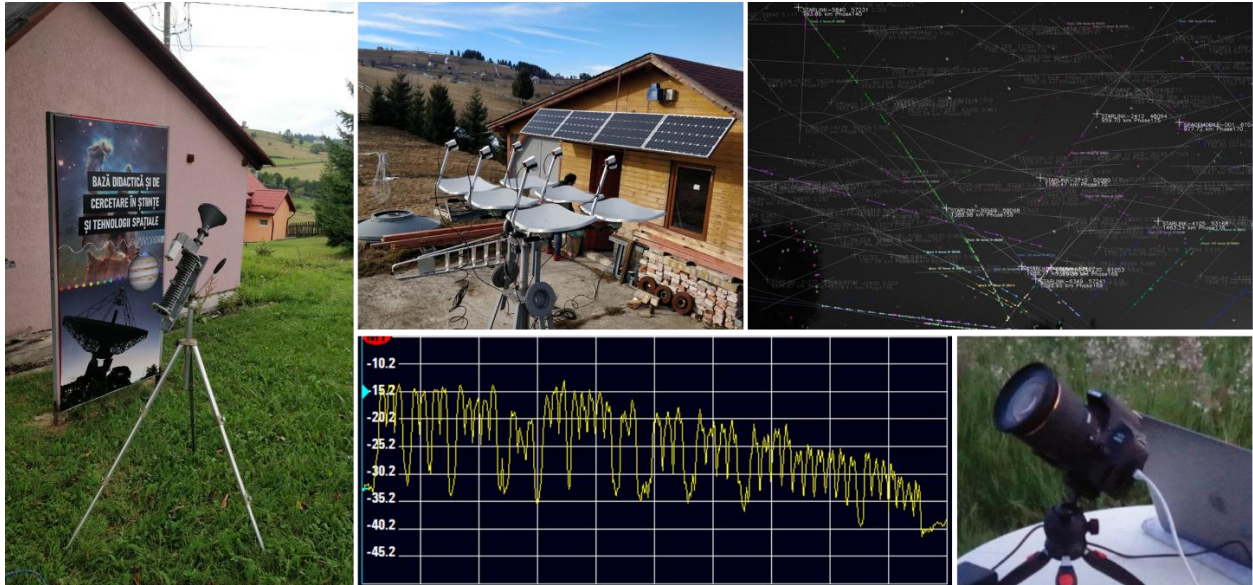
Main activities

- Development and integration of a sensor system with improved performance in terms of mobility, automation, and daytime operation.
- Analysis and evaluation of the space situation to ensure long-term resilience and security of space infrastructure.

- Testing and implementation of the national catalog of space objects.
- Development of an autonomous collision avoidance system using artificial intelligence/machine learning.
- Trials regarding the detection of satellite operator maneuvers for collision avoidance.
- Development of an initial re-entry service for space objects entering the atmosphere.
- Analysis regarding the development of a space object fragmentation service.
- Testing and validation of new sensors and services in national and international contexts, such as the ROSSA and EUSST networks.

Results

The ROSSA2 project will contribute to enhanced space surveillance by developing advanced sensors and innovative solutions. Expected outcomes include increased accuracy in orbital monitoring, improved detection and prevention of collisions, and enhanced security of space infrastructure.



Dissemination:

Radu Danescu, Razvan Itu, Attila Fuzes, Dan Moldovan, Vlad Turcu, "Observation strategy for objects on decaying orbits", 9th European Conference on Space Debris, Bonn, Germany, 1 - 4 Apr. 2025.

R. Danescu, P. Dolea, V. Turcu, and M. Barbosu, "Accurate Optical Observations on Low Earth Orbit Satellites During the May 2024 Severe Solar Storm: Analysis of the O-C Values and their Causes," Romanian Astronomical Journal, Manuscript ID RoAJ#2513, accepted for publication, 2025

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P6-6.3-SOL-2024-2-0220

Research center

Centre of competence for wireless Intra-SATellite Technologies - IntraSAT-Tech

Research Team for TUCN

Project coordinator for TUCN: Assist. Prof. Dr. Eng. Andra Pastrav

Members:

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Prof. Dr. Eng. Emanuel Puschita
Prof. Dr. Eng. Tudor Palade
Assist. Prof. Dr. Phys. Paul Dolea
Assist. Prof. Dr. Eng. Razvan Itu
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Project website: <https://rossa2.rosa.ro/>

AI-BASED FUSION METHODS FOR INTEGRATED 2D–3D CAMERAS APPLIED TO AUTONOMOUS ROBOT VISION

Abrasive

PN-IV-P7-7.1-PTE-2024-0105

Goal of the project and short description

1. Development of specific algorithms for 2D-3D data fusion for the new generation of
2. Optimal representation for hybrid data flow in client-server applications
3. Providing a set of client-oriented use cases for the new generation of hybrid cameras from Tvarita.

Project implemented by

Technical University of Cluj-Napoca – partner

TVARITA SRL - coordinator

Implementation period

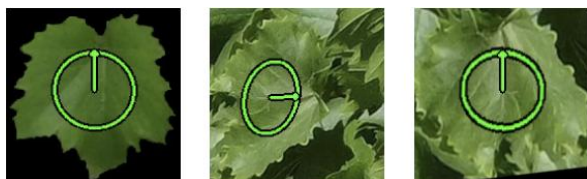
05.05.2025-30.04.2027

Main activities

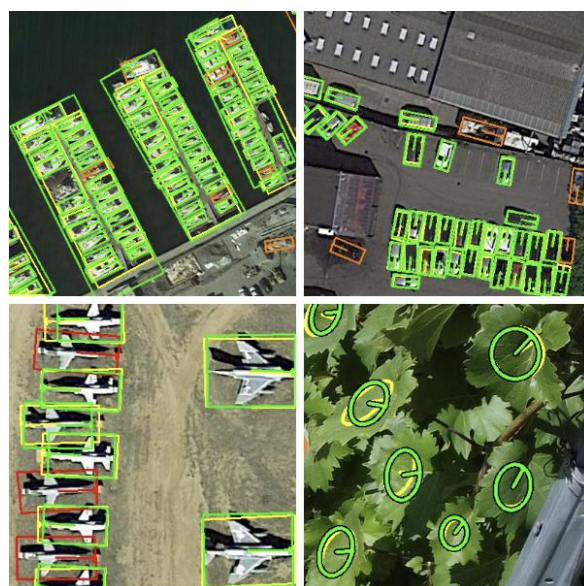
1. Fused data processing embedded nodes
2. Heterogeneous 2D-3D data representation modalities
3. Application-specific demos and tech transfer

Results

Novel object detection method with
Directional Object Bounding Box (DOBB):



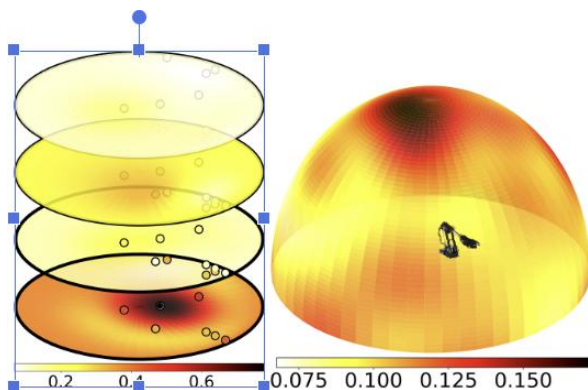
Orientation detection of vine leaf for



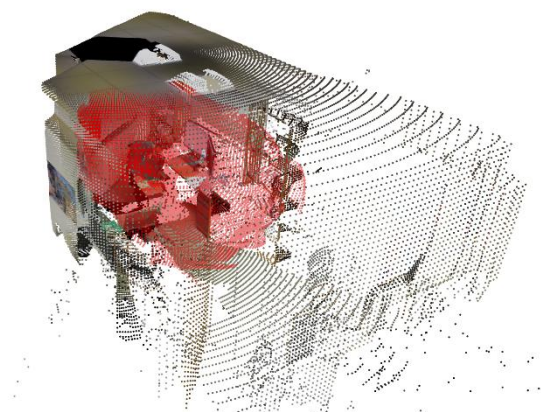
Extensions of the orientation detection
over a wider range of objects



Extension towards 3D pose estimation in
outdoor and indoor environments



Optimization of the camera placement for robot proprioception



Heterogeneous data registration trials using ERP, fisheye and pinhole 3D reconstruction

Dissemination:

- 1 Konievic R., Keresztes B., & Tamas, L. (2025). Dual focus: To Flash or Not To Flash: A Case Study on Vine Foliar Disease Detection. In *IEEE International Conference on Intelligent Computer Communication and Processing*.
2. Szilard Molnar, Levente Tamas and Zoltan Kato Directional Object Detection in Aerial Images, MIGARS2025

S **Molnar**, Z Amstadt, L Tamas, Z **Kato**. Object-Based Camera Pose Estimation from a Single Object Detection and Gravity Vector International Symposium on Visual Computing, 205-218, 2025. 2025.

Financed through

The Executive Unit for Financing Higher Education, Research, Development, and Innovation (UEFISCDI)

Project code: PN-IV-P7-7.1-PTE-2024-0105

Research center

Robotics and Nonlinear Control - [ROCON](#)

Research Team TUCN

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PhD student Robert Anton Konievic
PhD student Victor Domsa

Research Team TVARITA (partner)

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INTERNATIONAL RESEARCH PROJECTS

HOLISTIC & GREEN AIRPORTS -OLGA

H2020 - LC-GD-2020-1

Goal and short description of the project

hOListic & Green Airports (OLGA) is a Horizon 2020 project that aims to reduce the environmental impact of the aviation sector. It develops innovative and sustainable solutions to reduce CO2 emissions, optimize energy efficiency, preserve biodiversity, and improve air quality and waste management while involving the entire aviation value chain. **The ambition is to accelerate and move faster than the EU 2050 Climate Neutrality objective in achieving sustainable airports.** OLGA airports are committed to the ACI Europe "Net-Zero 2050" pledge, and the partners support the forthcoming "Destination 2050" roadmap for a net-zero European aviation sector.

The OLGA Project brings together a diversified consortium of 41 partners and 17 third parties, ranging from large and small airports, airlines and the aviation industry, to public authorities, researchers and innovative start-ups.

Project implemented by

AEROPORTS DE PARIS SA - **Coordinator**

Partners:

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA, RO

SEA MILAN AIRPORTS, IT

AIT GMBH, AT

IFP ENERGIES NOUVELLES, FR

AIRPORT REGIONS COUNCIL, BE

ENVISA SAS, FR

CLUJ AIRPORT, RO

ZAGREB AIRPORT, CR

AIR FRANCE SA, FR

ARC, BE

L - UP SAS, FR

SNAM S.P.A., IT

BUREAU VERITAS EXPLOITATION, FR

UNIVERSITY OF ZAGREB, CR

SERVICE TECHNIQUE DE L'AVIATION CIVILE, FR

RINA, IT

and other partners

Objectives: This work package ensures the relevance, quality and reliability of impact assessments across the project. It will support the replication process to assess the environmental impacts of green airport solutions for landside transport, airside transport, terminal and energy.

WP 2 – Transport landside, access and multimodal

Objectives: This work package is responsible for developing and demonstrating the integration of a decision support tool for planning city bus transport electrification with the software solution for airports and gravitational areas. It will also create and integrate a transport decision support platform that will include new tools and traffic optimization mechanisms.

An autonomous bus demonstration was done by the TUCN team in November 2025, on the airside of Cluj International Airport, with all representatives of OLGA were present. The event was also covered by the press. More details on:

Implementation period

01.10.2021 - 30.09.2026

Main activities

WP 1 – Baseline and impact assessment



<https://www.monitorulcj.ro/economie/133603-aeroportul-international-cluj-are-autobuz-care-se-conduce-singur-vezi-cum-arata>

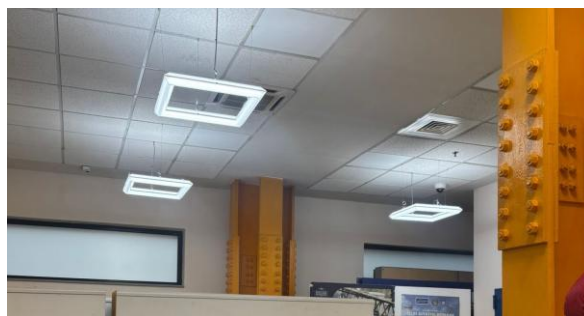
| WP 3 – Transport airside

Objectives: This work package aims to demonstrate the implementation of decarbonized solutions across the entire value chain airside. From energy transition of ground handling (electrification of the fleet of service vehicles, use of alternative fuels like H₂ or SAF, installation & optimization of charging infrastructures) to the reduction of aircraft emissions (Green Taxiing, environmental monitoring of aircraft apron, reduction of the use of APU unit) this work package aims to assess & develop the new technologies available to cope with emission reduction & carbon neutrality objectives for the airside activities.

WP 4 – Terminal area

Objectives: This work package is responsible for improving energy efficiency at the airport, bringing environmental innovations in lighting in a terminal, on aircraft stands, and in pre-boarding bridges where thermal discomfort is strongly noticed. It will develop methodologies to achieve environmentally friendly construction and deconstruction processes.

In autumn 2025, four innovative prototypes of luminaires were installed at the Cluj Airport, based on the concept of Human Centric Lighting, with tunnable white, enhancing the passenger's circadian rhythm.



WP 5 – Energy and hydrogen

Objectives: This work package is responsible for developing guidelines to turn the airport in H₂ Hub into H₂-powered aircraft operations. In addition, it will (i) demonstrate green H₂ production and use in airports through the design and installation of a green H₂ plant, (ii) promote Sustainable Aviation Fuels (SAF), showcasing their use on AF flights, and (iii) valorize local organic wastes towards biomethane production for its use in local buses through the design, installation and monitoring of a biomethane "pilot" system.

WP 6 – Cross-cutting aspects

Objectives: This work package is responsible for developing a methodology that will allow real-time emissions and air quality assessment with a fully integrated monitoring and modelling platform hence improving air quality. It will identify the contribution of airport-related emission sources to local urban air quality, including sustainable aviation fuel implementation.

WP 7 – Communication and dissemination

Objectives: This work package is responsible for creating public awareness about the project's outputs and contribution to sustainable, smart mobility and (in)direct benefits. It will disseminate project results to the audience that can add additional value to the project's impact and initiate exchanges with other projects, groups and stakeholders to enhance the coherence and efficiency of innovation.

WP 8 – Exploitation and technology transfer

Objectives: This work package is responsible for optimizing the use of results and ensuring technology transfer to users (airport community). It will define an exploitation strategy and roadmap for the results generated by OLGA and

build a coherent action plan for implementation & impact during and after the project.

WP 9 – Project management and common IT framework

Objectives: This work package is responsible for achieving the project's strategic aims and objectives through clear milestones. It will provide contractual, legal and financial management for the consortium and ensure the quality of the work and the deliverables, data management and IT integration.

WP 10 – Ethics requirements

Objectives: This work package is responsible for overseeing data processing relevancy and technical and organizational measures for implementing and safeguarding the rights of data subjects and research participants. It will describe anonymization/pseudonymization techniques, all relevant authorizations & actions.

Results

OLGA's initiatives include CO2 reduction, air quality improvement, and biodiversity preservation, engaging the entire airport and aviation value chain. These sustainable impacts will be felt on local, national, and European scales, addressing societal, environmental, and economic dimensions. OLGA unites a wealth of expertise from airports, airlines, handlers, industry, research institutions, and Small and Medium Enterprises (SMEs) to tackle the complex climate challenge. Their solutions focus on efficient and carbon-neutral airport and airline operations, sustainable logistics, smart energy and mobility, intermodal passenger and freight transport, emission and air quality assessments, green construction, and circular end-of-life solutions.

- ✓ Smart Innovative Lighting - task in progress
- ✓ Improved energy consumption at airport passenger pre-boarding bridge - task in progress
- ✓ Solar installation on passenger bridge - task in progress
- ✓ Biodiesel for Heavy-duty Vehicles - task completed

- ✓ BiodiversIT - task in progress
- ✓ Dynamic apron lighting - task in progress
- ✓ Air Quality Source Apportionment Study - task in progress
- ✓ Airport Equipment Reuse (Decommissioning and Upcycling) - task in progress
- ✓ Sustainable aviation fuel (SAF) - task in progress
- ✓ Reducing taxiing times on arrival & departure - task in progress
- ✓ Feasibility study for the multi-energy station air side - task completed

Dissemination:

[1] Ioan-Tudor Oargă, Gabriel Prunean, Bogdan Ovidiu Varga, Dan Moldovanu and Dan Doru Micu, Comparative Analysis of Energy Efficiency between Battery Electric Buses and Modular Autonomous Vehicles, Appl. Sci. 2024, 14(11), 4389; <https://doi.org/10.3390/app14114389>

[2] Dan Moldovanu, Florin Mariașiu, Bogdan Ovidiu Varga, Adela Ioana Borzan, Horațiu Căraușan, Dan Doru Micu, Analysis of the modes of operation of an electric vehicle on energy consumption, 2023 10th International Conference on Modern Power Systems (MPS), 979-8-3503-2682-6/23, IEEE, DOI: 10.1109/MPS58874.2023.10187463

[3] Horațiu Căraușan, Bogdan Ovidiu Varga, Dan Moldovanu, Florin Mariașiu, Gabriel Prunean, Ioan-Tudor Oargă, Dan Doru Micu, Energy Efficiency Assessment of Sustainable Public Transport Solutions: a Comparative Analysis Fuel Cell vs Battery in Real Life Scenarios, 2023 58th International Universities Power Engineering Conference (UPEC), 979-8-3503-1683-4/23, IEEE, DOI: 10.1109/UPEC57427.2023.10294682

Financed through

OLGA project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 101036871.

Research center

Energy Transition Research Center – EnTReC
<https://entrec.utcluj.ro/>

Research Team

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New care pathways for supporting TRANSitional CARE from hospitals to home using AI and personalized digital assistance - TransCare

THCS 1449 – ERANET 80/2024

Goal and short description of the project

The main goal of TransCare is to address the open challenges and necessities for the health and care systems by adapting, scaling, and evaluating a technology-assisted transitional care solution based on Internet of Things (IoT) monitoring, Machine Learning (ML) and digital assistance to a larger number of patients and considering the specific contexts of different healthcare systems in Europe (NO, IT, RO) as well as various types of comorbidities. To achieve the challenging goal, we will pursue the following support objectives: (O1) Study how the care pathways will need to be re-designed for allowing the integration and usage of the technology in different hospital and healthcare settings providing the necessary knowledge for care relocation from hospital to home; (O2) Adapt and scale the developed IoT, ML & digital assistance solution for transitional care considering the specificity of the different contexts in which the trials will be conducted; (O3) Setup and conduct longitudinal trials to assess the potential of the technology to reduce the rate of rehospitalization within 30 days relieving the pressure on health and care facilities, aiming to establish a clinically validated value proposition for the technology; (O4) Study the value-based payment models in the target countries to provide guidelines for shared payment responsibilities (national or local government, insurance companies, patients), and quality metrics focused on patient outcomes that can incentivize hospitals and healthcare providers to invest in avoiding readmissions; (O5) Dissemination of the findings and key stakeholders' engagement through a multi-channel dissemination strategy.

TransCare seeks to improve transitional care: (i) effectiveness by providing the IoT infrastructure for remote monitoring of patient's data and adherence to treatment, (ii) efficiency by offering digital assistance based virtual communication and coordination for proactive and personalized intervention freeing up healthcare providers time (iii), timely care due to AI-driven proactive detection of lack adherence post-discharge leading to better outcomes, and more efficient care pathways and (iv) safety and equity of the process. Additionally, TransCare will help build the essential knowledge required for redesigning of patient care pathways to facilitate the seamless integration of technology within various healthcare environments considering healthcare providers' roles and responsibilities payment models and hospital incentivization.

Project implemented by

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA,
ROMANIA – COORDINATOR
KARDE AA, NORWAY
TELLU AS, NORWAY
ISTITUTO NAZIONALE DI RICOVERO E CURA PER
ANZIANI, ITALY
INSTITUTUL INIMII" NICULAE STANCIOIU" CLUJ-
NAPOCA, ROMANIA
FARSUND KOMMUNE, NORWAY

Implementation period

01/05/2024 - 30/04/2027

Main activities

TransCare will augment transitional care pathways by developing and integrating IoT, ML and digital assistance technologies with a view of improving patient outcomes and quality of care. The envisioned platform targets the integration of IoT devices for remote patient monitoring (RPM) of daily life activities/vital signs through non-intrusive wearable devices, AI models for offering support to healthcare professionals in identifying problems leading to rehospitalization and digital assistance solutions for personalizing the post-discharge follow-up and intervention. Tellucare's remote patient monitoring service will be adapted for the TransCare platform, while for digital assistance Karde's Memas service will act

as a communication and information resource bank and retrieval service to be used by discharged patients, carers and family. Additionally, a ML-based post discharge analytics service will be developed based on the deep-learning architectures for predicting and correlating heart rate during physical activities like running, walking, swimming or cycling, for a specific patient.

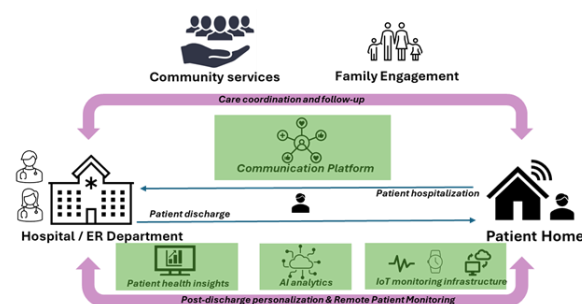
The TransCare overall strategy of the work plan is based on in three subsequent stages:

Phase 1 (M1 to M12) – the aim is to lay the foundation for the subsequent phases by identifying challenges, adapting technological solutions, and developing a functional platform prototype. The setup of the trials protocol and framework will ensure that the project is ready to move forward with testing and evaluating the platform's effectiveness in addressing the identified healthcare systems challenges.

Phase 2 (M12 to M24) – implementing transitional care pathways knowledge, recruiting users, defining roles and responsibilities, installing solution devices, and starting the trials evaluation. This phase aims to gather data and insights to assess the platform's performance in real-world settings and evaluate its impact on improving transitional care outcomes.

Phase (M24 to M36) – deals with running and finalizing the trials, data analysis, and validation of the project hypothesis. It involves finalizing the technology platform, developing exploitation plans, documenting replication requirements, and providing an overview of the achieved results. This phase ensures that the project outcomes are consolidated, and the groundwork is laid for potential future implementation and scaling of the technology platform for transitional care.

Results



TransCare aims to produce new knowledge, and tools for the transformation of the hospital-to-home transitional process, thus filling current knowledge gaps to ICT technology adoption and care paths redesign. Moreover, TransCare is promoting the transfer of technology and successful practices from previous Ambient Assisted Living (AAL) projects to diverse healthcare systems in Europe, at a larger scale, validating their effectiveness in different contexts and with various comorbidities by setting up trials with a higher number of patients to provide evidence that supports the adoption of this solution and its potential to reduce the need for hospital readmissions.

The main TransCare outcome will be an integrated technology for managing the transitional care of patients from hospital to community care or at home to reduce rehospitalization rates for patients with chronic diseases, addressing the challenge of a growing number of patients admitted to hospitals or other healthcare facilities.

A second outcome of the project will be a set of guidelines for re-designing the care paths for patients to consider the utilization of the novel technology developed in different care settings and national contexts. The guidelines will consider the specific circumstances and healthcare systems of the countries where the trials are conducted, defining the roles and responsibilities of healthcare providers, caregivers, and patients to improve coordination.

Dissemination:

Web of Science indexed journals:

A. Mateescu, I. Hadarau, I. Anghel, T. Cioara, O. Anchidin, A. Nemes, A Laplace diffusion-based

transformer model for heart rate forecasting within daily activity context, *Machine Learning with Applications*, Volume 22, 2025, 100746, ISSN 2666-8270, **WoS Q1, IF 4.9**.
<https://doi.org/10.1016/j.mlwa.2025.100746>.

I. Anghel, T. Cioara, R. Bevilacqua, F. Barbarossa, T. Grimstad, R. Hellman, A. Solberg, L.T. Boye, O. Anchidin, A. Nemes & C. Gabrielsen, New care pathways for supporting transitional care from hospitals to home using AI and personalized digital assistance. *Scientific Reports*, 15, 18247 (2025), **WoS Q1, IF 3.9**.
<https://doi.org/10.1038/s41598-025-03332-w>

A. Rancea, I. Anghel, I., T. Cioara, Edge Computing in Healthcare: Innovations, Opportunities, and Challenges. *Future Internet*, 16(9), 329, 2024. **WoS Q2, IF 3.6**.
<https://doi.org/10.3390/fi16090329>.

Conference proceedings papers:

M.-S. Burlacu and I. Anghel, A Platform for Enhanced Remote Care and Support for Older Adults, 2024 *IEEE 20th International Conference on Intelligent Computer Communication and Processing (ICCP)*, Cluj-Napoca, Romania, 2024, pp. 1-7, **WoS indexed**.
<https://doi.org/10.1109/ICCP63557.2024.10793004>

Financed through

TransCare project has received funding from the UEFISCDI & European Commission

Research center

Distributed Systems Research Laboratory – DSRL

Research Team

Project leader for TUCN: Prof. Dr. Eng. Ionut Anghel

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Positive Energy Communities Led by Citizens - PERSIST

COFUND – DUT - PERSIST

Goal and short description of the project

PERSIST identifies the most relevant participation archetypes to develop decarbonization scenarios for an optimized flexible and participative Energy System.

Project implemented by

Coordinator: Hochschule Luzern
Partners:
Technical University of Cluj-Napoca
Hogskolen I Ostfold
Rigas Tehniska Universitate
Universidad del Pais Vasco/ Euskal Herriko
Unibertsitatea
Universidade de Coimbra
SmartCity Alliance

Implementation period

01-03-2024 - 31-12-2026

Main activities

Empirical research on the establishment of PED, energy flexibility, energy transition. Impact assessment and identification of conditions for the expansion and transferability of PED

Development of tools, methodologies, specifications and protocols

Solution transfer and replication

Results

Energy transition action plan for developing countries

Impact monitoring and evaluation protocol and framework

Recommendations on improving the efficiency and effectiveness of public funding supporting investment in sustainable energy for consumers

Energy efficiency guidelines for PEDs

Recommendations for demonstrating PED

Roadmap to excellence in energy culture

Tools and methods for expansion and reproduction of PEDs

Empowering Positive Energy Districts – A Practical Guide to Energy Efficiency

DUT PERSIST Assessment Protocol

Dissemination:

Journal article

J. Teremranova, L. Petrchenko, A. Mutule, Y. Sidqi, M. Arias, S.D. Cirstea, et al., Electricity customer satisfaction with renewable energy support schemes, *Frontiers in Energy Research*, 16 Jan 2026

Conference presentations

Ş.D. CÎRSTEA, D.L. ŞTEȚ, L. CZUMBIL, R.V. BRISCAN, Understanding stakeholders' perspective to increase PED deployment, 5th LA SDEWES 2026

Events

TECH Workshop 2025

22-24 September 2025 | Gaeta, Italy, 2nd Interdisciplinary Workshop on Technology, Employment, Change Management and Human Well-Being

SMART DIASPORA 2025

4-7 November 2025 | Cluj-Napoca, România

Conference dedicated to innovation and international collaboration in the field of energy and sustainable urban development

Workshop Stakeholders

11 June 2025 | Cluj-Napoca, România

Workshop dedicated to stakeholder engagement in the development of Positive Energy Districts

Financed through

The project has received funding from the European Commission under the Horizon Europe Partnership scheme and from UEFISCDI national agency.

Research center

Energy Transition Research Center - EnTReC

Research Team

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METHODOLOGICAL STUDY ON THE DEVELOPMENT POTENTIAL OF MICROGRIDS AND THE INTEGRATION OF RENEWABLE ENERGY IN NORTH AFRICA - MiDiNA

COFUND-LEAP-RE-MiDiNA

Goal and short description of the project

The MiDiNA project aims to elaborate a multidisciplinary study to sustain the implementation of MGs to improve power supply and RESs integration in the context of African countries. Beginning with a building-scale MG, the study will first focus on the optimal technoeconomic sizing with the objective to secure off-grid operation and on-site meteorological and consumer specificities. The objective is then to demonstrate that resilient control solutions will ensure the effectiveness of this concept under critical conditions.

In this project, several original and innovative actions will be implemented. In first step, synthesis work will be carried out for the constitution of a database of techno-economic models of the different MG components to be considered for the project. These models will concern both the most recent component technologies such as Li-ion batteries, photovoltaic panels, vertical axis wind turbines, power converters, etc., but also older and widely proven components, such as the classic lead-acid batteries, or even second-life batteries, which are of very significant economic interest. Using accurate on-site data of representative arid regions will lead to original sizing solutions for building integrated MG. Based on these modelling and realistic information collected, techno-economic sizing solutions will be proposed for a building, while considering the on-site specificities.

Project implemented by

Coordinator: Nantes Université (NU) – France

Partners:

- Technical University of Cluj-Napoca
- M'sila University (MU) – Algeria
- Sidi-Mohamed BenAbdellah University (USMBA)- Morocco
- Morocco Université Mohammed V de Rabat (UM5R) - Morocco
- Aouina Kamel (KA-SE) –Algeria

Implementation period

01-04-2024 - 31-03-2026

Main activities

Electricity coverage in North African countries is among the most advanced in Africa. However, in recent years energy demand has been increasing with the growing economic development as well as the increasing use of high energy-consuming loads like Heating Ventilation, and Air Conditioning loads to handle extreme weather conditions. To cope with this increase in energy

needs, grid operators resort to load shedding by switching of non-essential load equipments. Load shedding reduces consumers comfort and impacts the economic development of these countries. Besides, there is a strong political commitment to exploit the abundant renewable energy sources (RESs). This willingness is motivated by the need to meet the increasing energy demand and to reduce fossil fuel utilization. The development of this concept represents a huge challenge as it gathers multiple considerations with both technical and socio-economical aspects. Therefore, the MiDiNA project aims to elaborate a multidisciplinary study to sustain the implementation of MGs to improve power supply and RESs integration in the context of African countries. The study will explore the deployment of these solutions at a neighborhood scale using a cooperative energy management between off-grid MGs. In addition, this project also has a social dimension as it aims to assess the social acceptance aspect. It includes also a projection study on the economic growth of MGs and several policy guidelines. The project objectives are structured into 4 WPs:

WP1: Making technological choices and optimal techno-economic dimensioning for a building scale MG considering meteorological and consumers specificities.

WP2. Development of resilient control techniques to demonstrate that MGs solutions can ensure service continuity under critical conditions.

WP3. Design of cooperative energy management strategies for a district-scale off-grid MGs cluster.

WP4. Evaluating societal acceptance of MGs and their role in economic development of targeted countries. Guidelines measures will be prepared in collaboration with a local grid operator.

The transfer of knowledge can be achieved at different levels: (i) knowledge transfer between senior and junior researchers, (ii) knowledge transfer in both methodological and experimentation aspects. (iii) The project actions foresee students training as well as awareness-raising actions for the civil society on the role of MGs.

Results

The project explores the benefits of MG technologies to support the deployment of eco-friendly RE sources to secure power supply at the small and medium-sized scale communities in North Africa. It can contribute to develop their energy sector and to achieve a sustainable energy mix that supports their low-carbon development strategies while enhancing economic and energy security.

Dissemination:

- D. Mitrea, T. Cioara, I. Anghel, L. Todorean, Evolutionary game for incentivizing social cooperation of prosumers in transactive energy communities, Energy and Buildings, Volume 327, 2025, 115057, ISSN 0378-7788

WoS

Q1

<https://doi.org/10.1016/j.enbuild.2024.115057>

- A. A. Pop, S. Breban, M. Ruba, V. Maier, A. Constantinescu, T. Cioara, I. Anghel, Technical and socio-economic perspectives

for microgrid control and cooperation, EPI Web Conf. 330 03012 (2025), <https://doi.org/10.1051/epjconf/202533003012>

- I.O. Cipleu, V.R. Chifu, C. B. Pop, I. Anghel, T. Cioara. A Blockchain-based Framework for Microgrids Energy Trading Using Greedy Mechanisms, 2025 IEEE 21st International Conference on Intelligent Computer Communication and Processing (ICCP 2025), Cluj-Napoca, Romania. <https://iccp.ro/call-for-papers>
- A. Mateescu, T. Cioara, I. Anghel, Transformer model with Fourier Embeddings for District Energy Prediction, Future Energy Solutions Conference, 24-26 September 2025, Cluj-Napoca, Romania, <https://fes2025.com/program/>
- Adrian Augustin Pop, Razvan Inte, Claudiu Oprea and Mircea Ruba, A Passive Battery Management System for Lead-Acid battery EPI Web Conf., 330 (2025) 07002 DOI: <https://doi.org/10.1051/epjconf/202533007002>
- Ferencz Havadi, Adrian Augustin Pop, Design of a cost effective IoT-based solar irradiance monitoring system, Conference Proceedings FUTURE ENERGY SOLUTIONS, Cluj-Napoca, 24-26 September 2025, UTCN.
- Adrian Augustin Pop, Mircea Ruba, Real-Time Simulation and Analysis of Green Energy Harvesting Microgrid Systems , Conference Proceedings FUTURE ENERGY SOLUTIONS, Cluj-Napoca, 24-26 September 2025, UTCN.
- Khadija El HAROURI, Nisrine NASERI, Soumia El HANI, Youssef MCHAOUAR, Saad MOTAHHIR, Adrian-Augustin POP , Energy Management Strategy for V2G-Enabled Smart Parking in a PV Microgrid , Conference Proceedings FUTURE ENERGY SOLUTIONS, Cluj-Napoca, 24-26 September 2025, UTCN.
- Adrian Augustin POP, Mircea RUBA, Stefan BREBAN, Soumia El HANI, Azeddine HOUARI, Saad MOTAHHIR, Development of flexible simulation tool for analysis of microgrid

systems, Conference Proceedings FUTURE ENERGY SOLUTIONS, Cluj-Napoca, 24-26 September 2025, UTCN.

- Anca Constantinescu-Dobra, MA Cotiu, Veronica Maier, Pop Augustin Adrian From Grids to Growth: How Renewable Energy Drives Social Transformation in Europe and North Africa, Conference Proceedings FUTURE ENERGY SOLUTIONS, Cluj-Napoca, 24-26 September 2025, UTCN.
- Veronica Maier, MA Cotiu, Anca Constantinescu-Dobra, Pop Augustin Adrian, Macroeconomic Indicators and Renewable Energy Infrastructure: Romania's Pathway Towards a Microgrid Future, Conference Proceedings FUTURE ENERGY SOLUTIONS, Cluj-Napoca, 24-26 September 2025, UTCN.

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Project website:

<https://www.leap-re.eu/midina/>

Financed through

The project has received funding from the **European Commission under the Horizon Europe Partnership** scheme and from UEFISCDI national agency.

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Assoc. Prof. Dr. Eng. Viorica Chifu
Assoc. Prof. Dr. Eng. Stefan Breban
Assoc. Prof. Dr. Eng. Mircea Ruba
Assoc. Prof. Dr. Eng. Anca-Constantinescu Dobra
Assist. Prof. Dr. Eng. Veronica Maier
Research Assist. Madalina Cotiu

NETWORK OF EXCELLENCE IN DIGITAL TECHNOLOGIES AND AI SOLUTIONS FOR ELECTROMECHANICAL AND POWER SYSTEMS APPLICATIONS - DiArtIS

HORIZON-WIDERA-2021-ACCESS-03-01

Goal and short description of the project

The project is built around two challenging research topics, aligned to the Horizon Europe Pillar 2 (Global Challenges and European Industrial Competitiveness)/Climate, Energy and Mobility and Digital, Industry and Space clusters and to the Romanian national smart specialization.

The goal of the mentorship program is to accelerate the personal and professional development of young researchers, inside and outside the consortium. This will be achieved by providing the young researchers with guidance, advice and feedback from mentors with more experience.

The goal of the mentorship program is to accelerate the personal and professional development of young researchers, inside and outside the consortium.

Project implemented by

Technical University of Cluj-Napoca – Coordinator
Partners: TECHNISCHE UNIVERSITEIT
EINDHOVEN, NL
University of VAASA, FI
UNIVERSITAT POLITECNICA DE VALENCIA, ES
SIEMENS INDUSTRY SOFTWARE SRL
Typhoon HIL, NOVI SAD, RS

Implementation period

01.10.2022-30.09.2025

Main activities

Research strategy

Topic R1: Digital Transformation for green energy transition

RS1. Flexible and adaptable AI & digital solutions for renewable-based electrical energy sources, storage, and smart household and building equipment and devices integration in smart building, houses and nanogrids;

RS2. AI-based demand side management (DSM) architecture based on virtual energy community and living labs in compliance with the national and European regulations and markets;

Topic R2: AI and digital solutions for EMS and PS

RS3. AI-based electrical machines and drives (design, analysis, control, testing)

RS4. Data driven condition monitoring and predictive maintenance in EMS

Mentorship program

Target group 1: at least 18 young researchers coming from UTC and twinning partners interested in developing their career path.

Target group 2: at least 6 young researchers coming from other countries (including third countries) interested in international mobility in European countries.

Target group 3: highly skilled researchers from UTC and twinning partners (6 to 8 mentors) interested in supporting in guiding career

development and/or integration of young researchers in the research teams.

Training program

First event: A one-day workshop on Introduction to Artificial Intelligence.

A half a day workshop on Research data management and Open science.

Second event: One-day workshop, focused on Digital Twin, as a central concept in digital transformation.

A half-day workshop on Management of Technology transfer & Innovation and Entrepreneurship

Third event: Training module on Cybersecurity and Resilience of Digital Energy Systems Training Module.

Training module on AI Applied to the Design Optimization of Electrical Machines, Drives and Solid-State Transformers.

A half-day training workshop in the development of business models for enabling scaling-up and market replication of digital solutions in smart power systems.

Fourth event: A one-day workshop addressing Advanced tools for condition monitoring and fault diagnosis of electromechanical devices

A workshop on Entrepreneurship and industrial marketing.

Results

D1.1 Dissemination communication and exploitation plan

D1.2-DMP

D1.3-Project-website-version-1

D1.4 Templates for marketing materials

D2.1 First report on twinning and networking activities

D3.1 First report on the mentoring activities

D4.1 First year training report

Financed through

Funded by the European Union's Horizon Framework Programme under the Grant Agreement number: 101079242

Research center

Center of Applied Researches in Electrical Engineering for Sustainable Development –

CCAIEDD

Research Team

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Project website: <https://ditartis.utcluj.ro/>

SUSTAINABLE ACT FOR CONSTRUCTION MARKET: A NEW PERSPECTIVE ON PASSIVE SEISMIC PROTECTION - STF4SW

ERANET-M-3-STF4SW

Goal and short description of the project

The project proposes an innovative method to enhance structural performance by using shear-thickening fluids (STF) for vibration damping and impact absorption in structures, particularly under dynamic loads or earthquakes. The method is presented as an efficient and viable solution for the rehabilitation of existing structures, including heritage buildings, where traditional solutions may be costly and invasive.

The project brings together multidisciplinary teams from three countries, collaborating to achieve the proposed objectives by continuously contributing expertise and innovation. The project consortium comprises research teams from three countries: Romania, the Czech Republic, and Turkey.

The project aims to advance the technological readiness level (TRL) of this innovation from TRL2 (experimental level) to TRL5 (demonstration in relevant conditions), providing an innovative and viable structural rehabilitation solution for vibration absorption.

Project implemented by

Coordinator: Kalekim (Türkiye)

Partners:

Technical University of Cluj-Napoca

University of Pardubice (Czech Republic)

Czech Technical University in Prague (Czech Republic)

Červenka consulting (Czech Republic)

Implementation period

01-06-2024 - 31-05-2027

Main activities

Development and Testing of STF: Shear-thickening fluids will be developed and characterized.

Material Characterization Tests: The mechanical performance of STF will be analyzed under dynamic loads (impact, low-frequency, and high-frequency).

Numerical calculations and simulations: the material properties obtained from tests will be introduced in computational programs, in order to observe their effects on the structure.

Implementation as a Rehabilitation Technique: STF will be applied to reinforced concrete (RC) specimens to evaluate its efficiency as a vibration damping system.

Results

- Numerical simulations.
- Material testing using RMN techniques.

Dissemination:

- Consortium meeting.

Financed through

The project has received funding from the European Commission under the Horizon Europe Partnership scheme and from UEFISCDI national agency.

Research center

COMPUTATIONAL MODELING AND ADVANCED
SIMULATION IN STRUCTURAL AND
GEOTECHNICAL ENGINEERING

Research Team

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Project website: [Actiune durabila pentru piata constructiilor: O noua perspectiva asupra protectiei seismice pasive](#)

DESIGN AND EVALUATION OF TECHNOLOGICAL SUPPORT TOOLS TO EMPOWER STAKEHOLDERS IN DIGITAL EDUCATION – EMPOWER

HORIZON-CL2-2021-TRANSFORMATIONS-01

Goal and short description of the project

Children with neurodevelopmental disorders face increased challenges at school, where they are called on to utilise and maximise their skills in settings that have not been designed with their particular needs in mind. To address this issue, the EU-funded EMPOWER project seeks to facilitate the educational experience of these children by capitalising on the advantages provided by the digital age. To that end, it created an innovative platform involving various relevant stakeholders with the aim of improving these students' executive function and emotional self-regulation, skills considered key in helping them derive maximum benefits from their education. The new concept has been tested across schools to validate the significance of technology-augmented education and enable the transition to inclusive educational environments.

Project implemented by

UNIVERSITAT DE VALENCIA, ES - **Coordinator**

Partners:

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA, RO
STICHTING RADBOUD UNIVERSITEIT, NL
UNIVERSITATEA BABES BOLYAI, RO
HOGSKULEN PA VESTLANDET, NO
AUTISME-EUROPE AISBL, BE
INESC ID - INSTITUTO DE ENGENHARIADE
SISTEMAS E COMPUTADORES, INVESTIGACAO E
DESENVOLVIMENTO EM LISBOA, PT
ISCTE - INSTITUTO UNIVERSITÁRIO DE LISBOA, PT
ITDATA TELECOM SRL, RO

Implementation period

01.10.2022-30.09.2025

Main activities

WP1 - Project Management and Coordination

Provide efficient management and administration of all aspects of the project, while fulfilling all legal and European Commission (EC) requirements, as the mandatory consortium agreement. Establish a management structure to ensure efficient communication, internally and with the EC.

WP2 - Framework for digital education

Identify the needs of assessment and interventions to be implemented in the digital platform for children with NDD

from stakeholders. This will feed the start of the first three EMPOWER iterations.

Specify in detail the behaviour assessment requirements in the school context

Design and develop the psychological content according to the needs of children with NDD from stakeholders

WP3 - Platform development

To create the Educational Platform that will be the engine of all the project iterations.

To integrate all the complex emerging technologies that will support the platform performance.

To adapt and maintain the educational platform and guarantee its reliability (proper functioning) and engagement

(usability) while connecting with other WP for reaching all the project objectives

WP4 - Platform algorithms

Interpret and analyse the data provided by WP4 to allow the delivery of the functionality defined in WP 2

Deliver these algorithms in a fast and agile manner; in particular to release initial versions quickly and to refine these throughout the lifetime of the project in line with the project development cycle

WP5 - Ethics of technology in education

Specify and operationalize the conceptual framework that will be used to guarantee the adherence to basic principles and requirements for responsible, trustworthy and human supporting research

Share, apply and evaluate this framework with stakeholders and in close interaction consortium members

Monitor and evaluate adherence to the principles and requirements in research, development, application and evaluation during the project's research

WP6 - Platform impact

Investigate the effectiveness of the platform in assessing cognitive and emotional characteristics of children with NDDs

in an ecological context

Investigate innovative capabilities at schools and the possibilities for scaling up the platform

Establish the key features of children with NDDs that might be important when developing interventions

WP7 Dissemination and Exploitation

WP8 - Ethics requirements

Results

D1.5 Appointment of the Ethics Board

This deliverable is to appoint an Ethics Board that will oversee the activities in the project, and be involved, in particular, in tasks T5.1-5.5

D2.1 Common framework for game development

This deliverable describes the game development process, including the theoretical background, the description of standardized tasks which led to game development, the common framework used and the process which it guided, illustrations used for game development, content adaptation and appendix.

D2.3 Conceptual Development Protocol of EMPOWER Platform and Games

This deliverable includes the Protocol on how to develop educational technological platforms This protocol will present in detail all the necessary steps of the conceptual development of the psychological and educational contents of the platform. It is part of WP2.

D3.2 Platform features and abilities

This deliverable will reflect detailed descriptions of all the features and abilities of the platform

D3.3 Wearables Module

This deliverable provides detailed information on the implementation of the Wearables module.

D3.4 Eye-tracking module

System components needed to get eye-tracking data from devices to be used as an input for the platform games, as well as interfaces with WP4.

D4.2 Initial Algorithms

A report on the initial algorithmic development demonstrating the ability to identify relevant aspects as defined in D4.1 from sensors used on the platform in WP3

D5.1 Ethics Evaluation and Improvement

A report that specifies the first observations and experiences of WP researchers and stakeholders while using the ethical framework, as well as the recommended additions and improvements.

D5.2 Exchange of experiences, expectations, and concerns (improved framework specifications)

The following report, produced by Work Package 5, documents “the exchange of experiences, expectations, and concerns as expressed by Work Package researchers and stakeholders during the first auditing session”

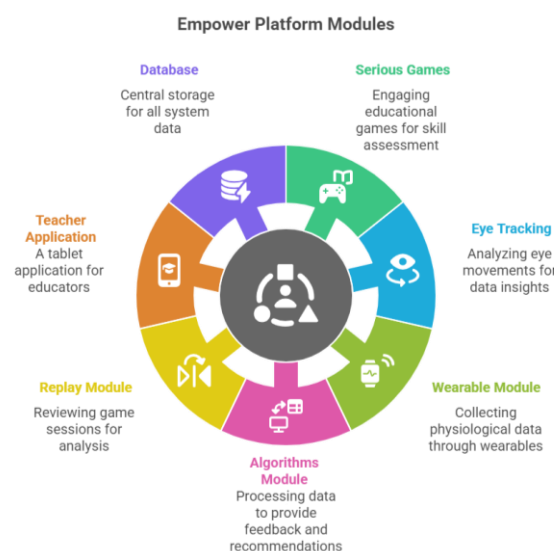
(Empower, 2021) of the Empower Project.

D7.1 Website and Social Media Channels

Project website and social media accounts

D7.2 Dissemination plan and Annexes

This document describes the communication and dissemination strategy of EMPOWER project.



The Empower platform is an innovative, multi-modal technological platform designed to support children with neurodevelopmental disorders (NDDs) by fostering the development of crucial executive functions (EF) and emotional regulation (ER) skills. It integrates engaging gameplay with real-time physiological and

attentional monitoring, leveraging artificial intelligence to deliver personalized feedback to the child and actionable insights to educators and therapists.

Example of games included in the platform

Delay of gratification:



Sustained attention



Working memory:



Dissemination:

Ferreira, P., David, C., Costescu, C., Vera, L., Herrera, G., Lopes, S., Stilwell, D., Ferreira, A., Domingues, D., Brito, J., Campos, J., Paiva, A. M., Veiga Simão, A. M., Heldal, I., Stefanut, T., Roşan, A., & Trindade, F. (2025). Neurodevelopmental disorders: Assessing and training working

memory. BMC Psychology, 13(1), Article 1163. <https://doi.org/10.1186/s40359-025-02912-9>

Are Dæhlen, Ilona Heldal, Abdul Rehman, Qasim Ali, Jozsef Katona, Attila Kóvári, Teodor Stefanut, Paula Da Costa Ferreira, Cristina Costescu , Towards More Accurate Help: Informing Teachers how to Support NDD Children by Serious Games and Eye Tracking Technologies, Proceedings of the 2024 Symposium on Eye Tracking Research and Applications, <https://doi.org/10.1145/3649902.3653943>

Raul-Alexandru Gorgan, Teodor-Traian Ştefănuţ, Cognitive Load Detection Using Physiological Data from Commercial Smartwatches, Proceedings of ICUSI 2025 - International Conference on User-System Interaction, pp. 141-148, <https://doi.org/10.37789/icusi.2025.20>

Financed through

Funded by the European Union's Horizon Framework Programme under the Grant Agreement number: 101060918

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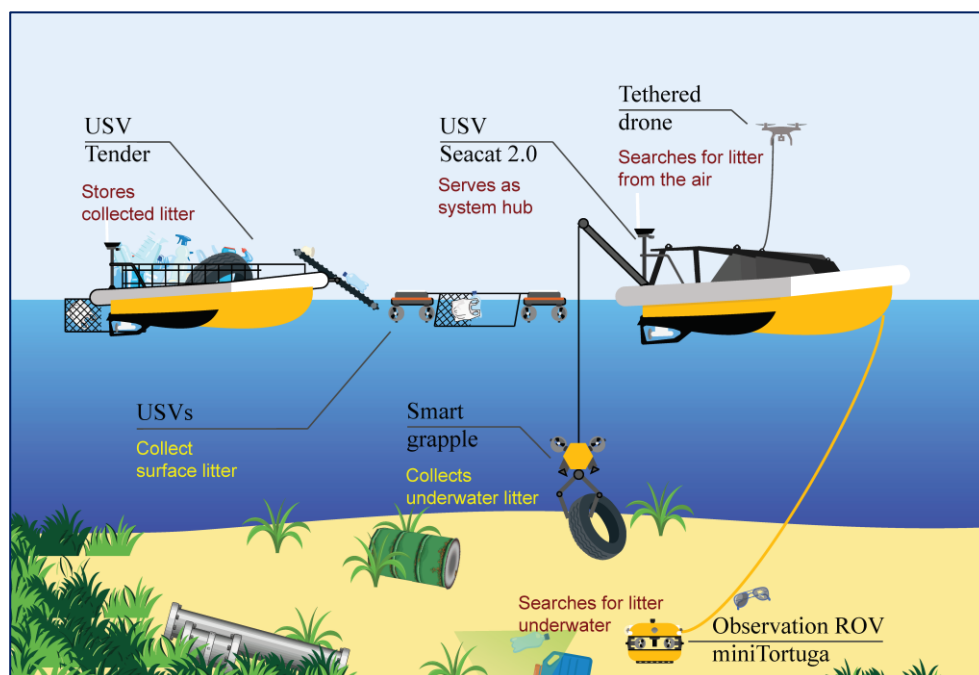
Project website: <https://project-empower.eu/>

SCALABLE FULL-CYCLE MARINE LITTER REMEDIATION IN THE MEDITERRANEAN: ROBOTIC AND PARTICIPATORY SOLUTIONS

SeaClear 2.0

HORIZON-MISS-2021-OCEAN

Goal and short description of the project



Today's oceans contain roughly 25 million tons of plastic waste. Over 90% of all marine litter is located on the seafloor, making it difficult and expensive to collect. Every year, up to 600,000 tones of macroplastics and microplastics enter European seas. While plastic pollution affects all seas across Europe, the Mediterranean is the most affected sea, due to its semi-enclosed basin and the intense human activities taking place on the surrounding coastal areas.

SeaClear2.0 will develop an integrated approach to address the full cycle of marine litter in a way that will help meet the objectives of the Mission to restore, protect and preserve the health of our oceans, seas and waters by 2030, in the context of the Mediterranean sea basin lighthouse of the European Commission. A key component of the approach is a robotic team consisting of an uncrewed surface vehicle, the SeaCat2, which deploys a MiniTortuga uncrewed underwater vehicle to search for litter; and then a smart grapple to collect it. After collection, litter is deposited in a tender called the SeaDragon. Additional surface vehicles called the SeaBees collect surface and water column litter, while a drone searches for litter from the air.

Project implemented by

Delft University of Technology - Coordinator
Partners:
REGIONALNA AGENCIJA DUNEA, HR
Fraunhofer CML, DE

Hamburg Port Authority, DE
ISOTECH LTD (ISOTECH), Cyprus
Subsea Tech SAS, FR
Technical University of Cluj-Napoca, RO
M. DANCHOR LTD, Israel

Technical University of Munich, DE
 TÉCNICAS Y OBRAS SUBACUÁTICAS, SLU
 (TECNOSUB), Spain
 University of Dubrovnik, HR
 VEOLIA PROPLETE (VEO), France
 VENICE LAGOON PLASTIC FREE (VLPF), Italy

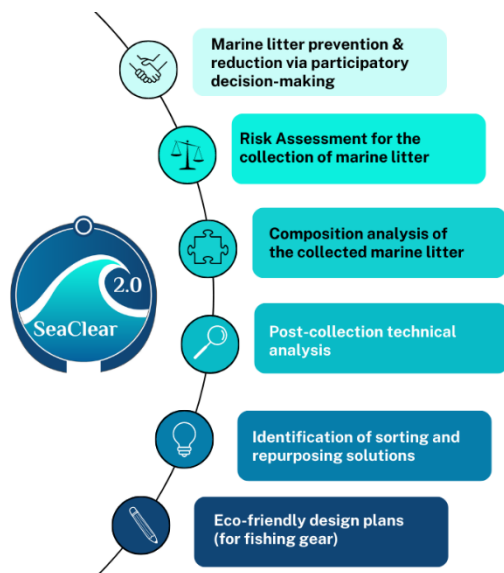
Implementation period

01.01.2023-31.12.2026

Main objectives and activities

1. Reduce litter in the Mediterranean and beyond

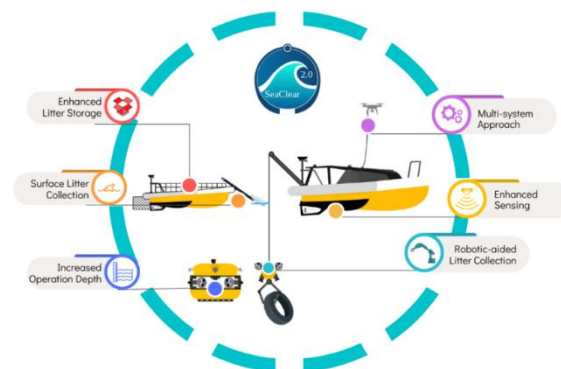
SeaClear2.0 adopts a full-cycle strategy when it comes to addressing marine litter: Reduce, Analyze, Restore, Collect, Repurpose. We will begin by identifying site-specific solutions for preventing and minimizing marine litter. Before collecting any litter, we will evaluate its potential impacts on the seafloor and marine wildlife. Collected litter will be sorted and analyzed and its valorization, through recycling or repurposing, will be assessed.



2. Develop and demonstrate the SeaClear2.0 robotic system

The SeaClear2.0 system consists of a team of collaborative, heterogeneous robots for in-situ mapping, detection, classification, and collection of marine litter from the seafloor and sea surface.

Our team will build on the system that was developed in the EU-funded SeaClear project, to develop a more advanced system of autonomous robots with enhanced sensing that will be able to collect heavier litter items (up to 250 kg) from greater depths (up to 100m), and with greater autonomy.



The SeaClear2.0 system components are tested at three pilot locations, Larnaca (Cyprus), Venice (Italy) and Hamburg (Germany), whereas the entire system is demonstrated in Dubrovnik (Croatia), Marseille (France), and Tarragona (Spain).

3. Demonstrate collaboration between the SeaClear and SeaClear2.0 systems

A key goal of SeaClear2.0 is to demonstrate the dual-system collaboration between SeaClear and SeaClear2.0. This will allow more efficient marine litter identification and collection, as well as the collection of heterogeneous litter (larger and smaller items) from diverse seafloor environments. The collaborative aspects between the SeaClear and SeaClear2.0 systems has been tested during a demo in Marseille, France.

4. Engage stakeholders, transfer knowledge, and empower citizens

SeaClear2.0 will help create an ocean literate society by providing opportunities for citizen and other targeted stakeholder engagement in a series of activities and events planned at the project's demonstration and pilot sites. These will include cleanups for marine litter identification,

collection, and monitoring through contests and digitalized gamification, workshops and exhibitions, calls for actions, and outreach events.

Communities of Practice will be set-up at each of the demonstration and pilot sites. These Communities of Practice will include the main stakeholders at each site, those that can affect and be affected by the SeaClear2.0 project activities.

5. Outline policy recommendations and exploit the SeaClear2.0 system

SeaClear2.0 will contribute to better policy-making on two levels. At the local level, Communities of Practice and other stakeholders at the pilot and demonstration sites will be engaged, through participatory processes, in the identification of solutions for the minimization of site-specific marine litter. At the EU level, policies will be mapped and analysed to identify barriers, opportunities, synergies and coherence problems, and identify key factors and interactions that can support the uptake and wider use of our innovative solution.

Information and data from the demonstrations and pilots, including the views of the engaged stakeholders, will be used to develop a feasibility study and a business plan that will facilitate the exploitation of the SeaClear2.0 system.

Results

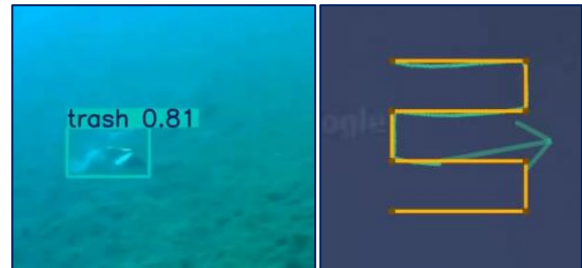
The SeaClear robotic system has so far been successfully validated in several field tests at increasing levels of autonomy:

- Pilot test in Hamburg, Germany, where the full system hardware has been tested:
[https:// youtube.com/watch?v=HHda-Rp_beg](https://youtube.com/watch?v=HHda-Rp_beg)
- Full demonstration in Marseille, France:
<https://youtube.com/watch?v=2TFbwLI-pf0>
- Pilot test for detection and mapping in Larnaca, Cyprus:
<https://youtube.com/watch?v=2TFbwLI-pf0>

For technical deliverables, see

<https://www.seaclear2.eu/project-deliverables/>

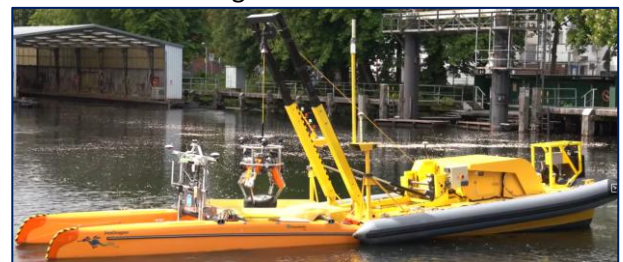
View of MiniTortuga camera with trash detection and lawnmower mapping trajectory being automatically executed in field trials:



Smart grapple gathering litter underwater:



The SeaCat2 using the grapple to drop collected litter in the SeaDragon litter collection tender:



Papers (selection, UTCN contributions bold)

Weston, J., Tolić, D. & Palunko, I. [Application of Hamilton–Jacobi–Bellman Equation/Pontryagin’s Principle for Constrained Optimal Control](#). J Optim Theory Appl 200, 437–462 (2024).

Đuraš, A., Wolf, B.J., Ilioudi, A. et al. [A Dataset for Detection and Segmentation of Underwater Marine Debris in Shallow Waters](#). Sci Data 11, 921 (2024).

Bilal Yousuf, Radu Herzal, Zsófia Lendek, Lucian Buşoniu, [Multi-agent active multi-target search](#)

[with intermittent measurements](#), Control Engineering Practice 153, 2024, 106094.

T. Sântejudean, Ș. Ungur, R. Herzal, I.-C. Morărescu, V.S. Varma, L. Bușoniu, [Globally convergent path-aware optimization with mobile robots](#), Nonlinear Analysis: Hybrid Systems 55, 2025, 101546.

A. Ilioudi, A. Dabiri, B.J. Wolf, and B. De Schutter. [Deep learning for object detection and segmentation in videos](#). IEEE Access, 2022, vol. 10, pp. 34562–34576.

G. Battocletti, D. Boskos, D. Tolić, I. Palunko, and B. De Schutter. [Entanglement definitions for tethered robots](#). IEEE Access, 2024, vol. 12, pp. 178153–178170.

Funding

The SeaClear2.0 project is co-funded by the European Union under the HorizonEU research and innovation programme, grant agreement No. 101093822/2023.

Research center

Robotics and Nonlinear Control – ROCON, <http://rocon.utcluj.ro/>

Research Team

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Research Engineer Mihalıs Vicu Maier
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MODULAR AXIAL FLUX MOTOR FOR AUTOMOTIVE – MAXIMA

HORIZON-CL5-2022-D5-01

Goal and short description of the project

MAXIMA aims to create a low-cost modular permanent magnet axial flux electrical machine with improved performance, and with a low environmental impact that caters specifically to the needs of the automotive market.

To achieve this, MAXIMA will develop an advanced multiphysics design procedure that includes new thermal management concepts. A digital twin will also be built to develop an optimal control strategy to operate the electrical machine up to the limit.

The end-of-life of the electrical machine will also be considered, with a focus on recycling the permanent magnet made from critical raw materials. MAXIMA will conduct a life cycle assessment for every solution, analyzing its impact throughout the lifecycle, with the goal of minimizing the environmental impact.

Project implemented by

ECOLE NATIONALE SUPERIEURE D'ARTS ET METIERS, FR - Coordinator

Partners:

Technical University of Cluj-Napoca

NIDEC PSA EMOTORS, FR

UNIVERSITAT POLITECNICA DE CATALUNYA, ES

HOGANAS AB, SE

And other 6 partners

Implementation period

01.02.2023-31.01.2027

Main activities

WP1 – Project Management

The Work Package 1 aims to ensure high-quality research and streamline development activities across partners, while meeting time, budget, and quality targets.

WP2 - Requirements and specifications

The goal of Work Package 2 is to determine the types of electric vehicles and their typical usage patterns in the primary market.

WP3 – Electrical machine design

The primary aim of this work package is to design and virtually evaluate a modular axial flux electric machine, taking into consideration the integration of power electronics, drive system,

and thermal management at the sub-system level.

WP4 – Digital Twin for optimal control

The main goal of Work Package 4 is to develop a Digital Twin that can predict the performance of prototypes and optimize their control strategy.

WP5 – Magnetic Materials and Manufacturing/Recycling Processes for mass production

Work Package 5 focuses on ferromagnetic materials such as Electrical Steel, Soft Magnetic Composites, and Permanent Magnets, along with their associated manufacturing and recycling processes for axial flux electrical machines.

WP6 – Life cycle management

Life cycle management is a cross-cutting activity. It involves the assessment of environmental impacts associated with the project's developments in a collaborative approach with project partners throughout various phases of the project.

WP7 – Drive prototypes Assembly and Testing

There are four primary objectives of this work package. The first objective is to conduct experimental verification of whether the targets, key performance indicators and requirements expressed in the project, and materials resources management & cost are met. The second objective is to assess the simulation tools used and developed by comparing them with the

experimental results. The third objective is to evaluate the mass production process flow. Finally, the dismantling and recycling concepts of the electrical machine and materials will be practically assessed.

WP8 – Communication, Dissemination & Exploitation

Results

- MAXIMA aims to design and manufacture two prototypes, one with a power output of 60 kW and the other with 120 kW, to cater to the specific market targeted by MAXIMA, as well as to accommodate the modular concept of the electrical machine system.
- The motor, including its cooling system, is capable of sustaining continuous power densities of over 23 kW/litre and 7 kW/kg, or continuous torque densities of over 50 Nm/litre and 20 Nm/kg.
- A decrease of 20% in losses incurred during typical vehicle operation.
- A 60% decrease in the utilization of scarce resources.
- An energy consumption reduction of 2% achieved through the utilization of optimal electrical machine control during driving cycles.
- The unit cost of a complete motor, when produced at mass production levels of 100,000 units per year, is projected to be below €6 per kilowatt (kW).
- A recyclability rate of over 60% for Critical Raw Materials achieved through repurposing Permanent Magnets without extracting individual rare elements.
- A framework that outlines best practices, requirements, and key considerations for assessing the environmental impacts of an electrical machine, with a specific focus on ecodesign.

Dissemination:

Butnariu, B., Rebhaoui, A., Ințe, R. A., Jurca, F.N., Jannot, X., Marțiș, C.S., Influence Of Slot/Pole Combinations On The Performance Of Dual-Rotor Axial-Flux Surface-mounted Permanent Magnet Electric Motor for Automotive Applications, Elektro 2024, Zakopane, Poland.

Butnariu, B., Rebhaoui, A., A.Inte, R., N. Jurca, F., Deac, I., & S. Martis, C. (2024). Design of an Axial Flux Machine with Distributed Winding for Automotive Applications: Comparison of Different Rotor Structures. 13th IEEE International Conference and Exposition on Electrical and Power Engineering, Iași, Romania

Financed through

Funded by the European Union's Horizon Framework Program under the Grant Agreement number: 101096097

Research center

Center of Applied Researches in Electrical Engineering for Sustainable Development –

CCAIEDD

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Research Assist. Raymond Birasa
Eng. Bogdan Butnariu
Financial officer Crina Ianchis

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Project website: <https://maxima-he.eu/>

ENERGY TRANSITION AUDITS TOWARDS DECARBONIZATION - EnTRAINER

LIFE21-CET-AUDITS-ENTRAINER

Goal and short description of the project

EnTRAINER aims to introduce a paradigm shift from conventional energy audits to a new, holistic and complete methodology of “Energy Transition Audits” (ETA). With this new approach, the main focus is to provide a multi-benefit scheme and a complete action plan towards full decarbonization of the audited sites. The holistic methodology of **EnTRAINER** includes training elements, in the form of 2 accredited courses for energy auditors and energy experts and 1 course for company staff. It also includes a web-portal with 4 new and upgraded tools, freely offered to energy professionals, and a training platform and knowledge hub that will allow continuous interaction and knowledge sharing between participants.

Project implemented by

The Aristotle University of Thessaloniki -
Coordinator

Partners:

The University of Western Macedonia, GR

The Polytechnic University of Valencia, ES

Technical University of Cluj-Napoca, RO

The CasaClima Agency, IT

Servelect ESCO, RO

BEON, ES

Implementation period

01.12.2022 - 30.11.2025

Main activities

The specific project objectives are listed below:

1. To propose the transformation of conventional industrial Energy Audits (EA) into energy transition audits, paving the way to reach 100% decarbonization.

2. To design a methodology that can be adapted to the needs of each industrial sector.

3. To enhance the skills of energy professionals to move further from conventional EA into the proposed one, which would better appeal to top managers and decision makers.

4. To go beyond conventional energy efficiency action plans and simple quantification of energy and costs savings, by proposing a roadmap for

decarbonization, including short-, medium- and long-term measures.

5. To perform detailed energy transition audits in relevant industrial energy intensive sites in the 4 participating countries and thus shift the paradigm of doing conventional audits in performing energy transition audits with complete decarbonization action plans.

6. To trigger another 40 indirect energy transition audits, done by the project trained auditors, all in industrial energy intensive sites.



7. To focus on specific types (i.e., identified by the relevant NACE code) of industries in each country, which are energy intensive, e.g., sites/industries with relevant energy use of more than 500 toe/year (approx. 1500 tons/year of equivalent CO2 emissions). The ambition is to identify and materialize decarbonization action plans and

reach zero total equivalent CO₂ emissions up to 2030 – 2050.

8. To adopt the multiple benefit approach of energy audits, to successfully promote energy efficiency projects after the audit is conducted.

9. To design, accredit with 2 ECTS (EQF level 6), and deliver 4 specialized training/educational courses in the 4 participating countries targeting energy auditors and energy managers.

10. To design, accredit with 5 ECTS (EQF level 6), and deliver 4 specialized training/educational courses in the 4 participating countries, targeting Energy Experts.

11. To improve the skills and knowledge of at least 400 company staff members, through in-house training and by engaging with the knowledge sharing hub.

12. To trigger at least 1.58 GWh/year primary energy savings; 1.72 GWh/year renewable energy generation and 16 M Euro Investments in sustainable energy within the project's lifetime.

13. To integrate new digital tools to be used in the energy transition audits, and available from the project's web portal.

14. To introduce through the project's web portal, a knowledge sharing hub, where different stakeholders can bring their expertise and lessons learned.

15. To involve authorized energy auditors in this process, to trigger the replication of the energy transition audits, using auditing tools, knowledge sharing hubs and education and training programs.

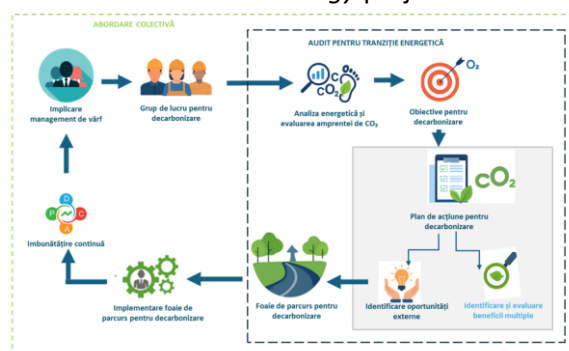
16. To focus on the relation between the energy transition auditors and the clients' people, from top decision makers to energy managers and other relevant professionals, using instruction, education and behavior changing instruments, knowledge sharing hubs and interactive communication during the energy transition audits implementation.

17. To reveal and highlight not only the direct energy savings and CO₂ reduction benefits, but also the other multiple benefits of energy efficiency

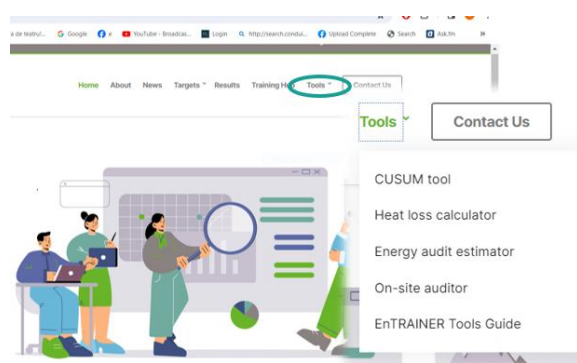
Results

The main achievements of the EnTRAINER project for the UTCN partner are summarized as follows <https://entrainer-project.eu/results/> :

- **Designing a methodology tailored to the needs of each industrial sector and focusing on specific industry types in each project-participating country within the Holistic Energy Transition Audit Methodology project.**



- **Developing Monitoring & Targeting (M&T) and Measurement & Verification (M&V) digital tools for energy analysis.**



- **Enhancing knowledge and skills for implementing energy transition audits by developing and delivering continuing professional training programmes for energy professionals, as well as in-house training sessions for companies.**

UTCN, through DECIDFR, accredited and delivered **two postgraduate programmes**,

attended by **over 170 energy professionals** from across the country:

- ✓ **1 postgraduate continuing professional training and development programme (2 ECTS)** – *Energy Transition Audits*
<https://decidfr.utcluj.ro/cursuri/2105>
- ✓ **1 postgraduate advanced training programme (5 ECTS)** – *Solutions and Actions for Corporate Decarbonization*
<https://decidfr.utcluj.ro/cursuri/2111>
- Scientific papers that highlights the impact of the EnTRAINER actions.

Financed through

EnTRAINER has been funded by the Environment and Climate Action (LIFE) programme under the Grant Agreement No 101076424

Research center

Energy Transition Research Center – EnTReC



Research Team

Project leader for TUCN: Prof. Dr. Eng. Denisa Stet

Members:

Members of the UTCN team were involved; in addition, external experts also participated in the implementation team for the postgraduate programmes, serving as lecturers:

Assoc. Prof. Dr. Eng. Andrei Ceclan
Assoc. Prof. Dr. Eng. Levente Czumbil
Assoc. Prof. Dr. Ec. Stefan Cirstea
Prof. Dr. Eng. Dan Doru Micu
Prof. Dr. Ing. Eng. Radu Adrian Munteanu
Researcher assist. Claudia Maria Muresan
Researcher assist. Bianca Pascu
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ROMANIAN NATIONAL QUANTUM COMMUNICATION INFRASTRUCTURE - RoNaQCI

DIGITAL-2021-QCI-01-DEPLOY-NATIONAL

Goal and short description of the project

RoNaQCI proposes the deployment of a 1500+ km QCI network including 6 metropolitan networks in the cities of Bucharest, Iasi, Cluj-Napoca, Timisoara, Craiova and Constanta.

The project includes activities for deployment of advanced production-grade quantum systems and networks combining the best of quantum and classical security devices, explicitly including testing the interface between the QCI's space and terrestrial systems, activities for training and education of, as well as dissemination and communication to a large number of potential users, activities for demonstrating, testing and exploiting the first long-distance quantum communication national and metropolitan networks in Romania.

Project implemented by

NATIONAL UNIVERSITY OF SCIENCE
AND TECHNOLOGY POLITEHNICA BUCHAREST -
Coordinator

Partners:

Agentia ARNIEC/RoEduNet, RO

Technical University Gheorghe Asachi of Iasi, RO

Technical University of Cluj-Napoca, RO

and 20 another RO partners

Implementation period

01.01.2023-30.06.2025

Main activities

The project represents a key step towards implementing state-of-the-art quantum technology (QT) with the aim to approach and mitigate major challenges raised by the digital era, among which the most prominent are secure communication and enhanced computing capability based on the laws of quantum physics. Moreover, the project is perfectly aligned to the Digital Europe Programme, as its primary objective consists in building and deploying a secure quantum communication infrastructure in Romania that is intended to serve as the local backbone of a future "quantum Internet" on a wider EU scale.

The specific objectives of the projects are:

O1. Deploy advanced national quantum systems and networks (RoNaQCI)

O2. Test, monitor and integrate RoNaQCI with classical communication infrastructure

O3. Develop advanced use cases tailored around strategic interests in exploiting RoNaQCI, linking Public Authorities, Governmental entities, Universities, Research Institutes and Private Companies

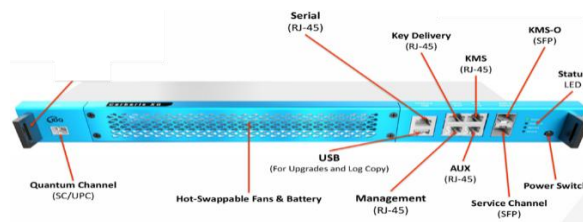
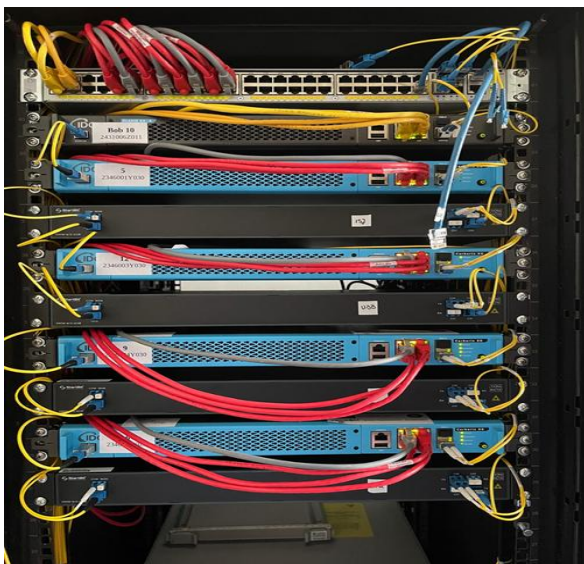
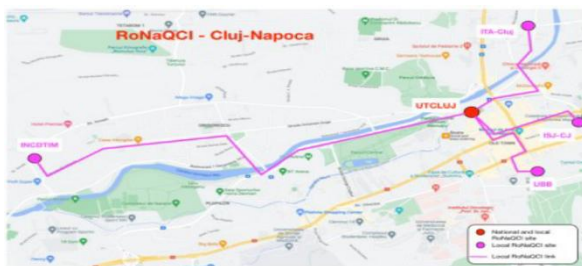
O4. Upskill to create a large number of trained users based on specific profile and particular interests

O5. Participate in EU-wide design and development efforts anticipating the Quantum Internet

Results

The project will accomplish the deployment of advanced QKD networks (RoNaQCI) in the form of a single, unified, national terrestrial backbone with a number of 16 QKD links, covering over 1350km (see Fig. 1 - Implementation), 6 metropolitan terrestrial networks (in Bucharest, Cluj-Napoca, Iasi, Timisoara, Craiova and Constanta – see below) with a total sum of 19 terrestrial QKD links and 1 free-space QKD link all of them integrated and operating with existing communication networks. The project tests and integrates QC technologies at multiple levels and

will also exploit RoNaQCI addressing advanced use cases blending quantum and classical communications by combining QRNG and QKD with classical communication protocols using also post quantum algorithms. More explicitly, the project will develop software for: a) monitoring of QKD networks (used firstly on RoNaQCI) including functional, performance and usage parameters; b) employing QRNG devices in signing X.509 security certificates (at UPB, UB, UBB, UTCN, UAIC, TUIasi, UPT, UVT, UCv, CMU and IFIN-HH); c) employing QKD and post-quantum algorithms in VPNtunnelled traffic (all 19 metropolitan qkd links will benefit and this will assure all the use cases involved); d) employing QKD and post-quantum algorithms in SSH traffic as well as other scenarios in distributed computing (UPB-IFIN-HH, UCv-ClusterPower and TUIasi-Imago-Mol).



The equipment installed in the NOC in Cluj-Napoca

Once installed and tested in the Cluj-Napoca metropolitan area, the network infrastructure was used, on research-dedicated lines, to validate QKD use cases—File Transfer using OTP (One Time Pad) and VPN using PQC—applications to whose development the UTCN team contributed significantly.

Dissemination:

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Guțoiu, R.A., Tănăsescu, A. & Popescu, P.G. Simple exact quantum search. *Quantum Inf Process* 23, 356 (2024).

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Ciobanu, BC., Perju Verzotti, L. & Popescu, P.G. Optimal and scalable entanglement distribution over crossbar quantum networks. *Nature Sci Rep* 14, 11714 (2024).

Popa, AB., Ciobanu, BC., Iancu V., Pop F. & Popescu, P.G. SkySwapping: Entanglement resupply by separating quantum swapping and photon exchange, *Future Generation Computer Systems* 158, (2024).

Popa, AB. QGP-VPN: QKD enhanced VPN solution for general-purpose encrypted communications, 22nd RoEduNet Conference: Networking in Education and Research (RoEduNet), Craiova, Romania, pp. 1-6, (2023).

Perju Verzotti, L., Ciobanu, BC. & Popescu, P.G. Optimal quantum network decongestion strategies. Nature Sci Rep 13, 9834 (2023).

Workshop RoNaQCI Cluj-Napoca

<https://www.ronaqci.eu/workshop-2025-cluj-napoca-february-10-11/>

Training session in Quantum Fundamentals

<https://www.ronaqci.eu/training-2025-cluj-napoca-may-20-23/>

Financed through

Funded by the European Union's Digital Framework Programme under the Grant Agreement number: 101091562

Research center

Cellular and Wireless Communications Research Laboratory - CWL

Research Team

Project leader for TUCN: Prof. Dr. Eng. Tudor Palade

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Assist. Prof. Dr. Eng. Paul Dolea
Research Assist. Cristian Codau
Research Assist. Rares Buta
Research Assist. Raluca Maria Stefanescu

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DEMONSTRATION OF INNOVATIVE FUNCTIONAL FOOD PRODUCTION SYSTEMS BASED ON A MORE SUSTAINABLE VALUE CHAIN OF MARINE AND FRESHWATER RAW MATERIALS FOR CONSCIENTIOUS EUROPEAN CONSUMERS – NOVAFOODIES

HORIZON-CL6-2022-FARM2FORK-02-two-stage

Goal and short description of the project

NOVAFOODIES is an interdisciplinary project bringing together partners from **Europe, Israel and China**, with complementary backgrounds to interact closely in a synergistic manner to deliver the expected results, research outputs and **six key objectives**. NOVAFOODIES aims to provide consumers with **new functional and traceable products of marine and freshwater origin**, produced with more sustainable processes without compromising sectoral competitiveness.

Project implemented by

IDENER RESEARCH & DEVELOPMENT
AGRUPACION DE INTERES ECONOMICO -
Coordinator

Partners: Technical University of Cluj-Napoca
UNIVERSITA DEGLI STUDI DI GENOVA, IT
UNIVERSITAET ROSTOCK, DE
FUNDACION CENTRO TECNOLOGICO
ACUICULTURA DE ANDALUCIA, ES
UNIVERSITY COLLEGE CORK - NATIONAL
UNIVERSITY OF IRELAND, CORK, IE
and other 23 partners.

Implementation period

01.05.2023-30.04.2026

Main activities

1. Integrated Multi-Trophic Aquaculture (IMTA) with 7 case studies in Europe, Israel, and China. IMTA is acknowledged as a promising solution to improve the sustainability and efficiency of aquaculture, as it ensures that wastes and by-products are valued.
2. Cultivation of macroalgae in earthen pounds and in liquid wastes for obtaining high-value products, demonstrating the microalgal commercial potential as a novel protein source, while promoting novel products for human consumption.

3. Microwave-assisted algae drying, bacterial-based algae-decomposition process, extraction of functional components from fish and valorization of fisheries discards for improving the nutritious value of human food products.

4. Environmental, economic and logistics optimization of processes, and traceability systems implementation to collect and monitor aquaculture data.

5. Development of functional food for human consumption based on biomass

6. Development of NOVAFOODIES marketplace platform and App for end-users.

Results



Energy bar and smoothies based on fish hydrolysate



Sausage and gluten bread based on Gracilaria



Hamburgers, liver paté and gluten bread based on *Alaria esculenta*

Fig. 1. Functional foods based on biomass developed by TUCN team



Fig. 2. Sensory studies on functional foods

The NOVAFOODIES project is entering the experimental phase of **digital traceability** at its pilot sites: [Aqua de Ma – University of Genoa](#) (Italy) and [Kefalonia Fisheries](#) (Greece).

Dissemination:

1. L. Mihaly Cozmuta, A. Peter, C. Nicula, A. Uivarasan, Z. Szakacs, S. Scarfi, M. Moussa, S. Mirata, P. Fajardo Bernardez, S. Baldassari, G. Drava, A. Mihaly Cozmuta (2025). Influence of *Alaria esculenta* powder on sensory acceptance, nutritional aspects, and staling of wheat bread. *Future Foods* 12 (2025) 100805. <https://doi.org/10.1016/j.fufo.2025.100805>.

2. A. Peter, C. Nicula, L. Mihaly Cozmuta, A. Uivarasan, P. Costin, C. Todorean, N. Buda, A.

Maries, S. Kraan, A. Mihaly Cozmuta. Exploring the inclusion of *Alaria aesculenta* in all hamburger's components and their consumers' impact. II Feira do Mar, 6-8 Sept., 2024 -Sagres

3.A. Mihaly Cozmuta, S.Gite, A. Uivarasan, L. Mihaly Cozmuta, A. Peter, C. Nicula. Influence of fish hydrolysate enriched energy bars on consumer acceptability. INTERNATIONAL SCIENTIFIC SYMPOSIUM "Young Researchers and Scientific Research in Life Sciences" for Bachelor, Master and Ph.D. Students. 21-22 November 2024, Timisoara.

4. A. Uivărășan, S.Kraan, B. Mihalescu, L. Mihaly Cozmuța, A. Peter, C. Nicula, A. Mihaly Cozmuța. Sensory Impact of Seaweed-Enriched Hamburgers: The Role of *Alaria esculenta*. 2025 Multidisciplinary Conference on Sustainable Development, 15-16 May 2025, Timisoara.

Financed through

Funded by the European Union's Horizon Framework Programme under the Grant Agreement number: 101084180

Research center

Center of Scientific Research of Environment, Food and Health Safety- Physical-Chemical Analysis - CCESMAS

Project leader for TUCN:

Prof. Dr. Eng. Anca Mihaly Cozmuta

Members:

Prof. Dr. Anca Peter
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Assist. Prof. Dr. Anca Dumuta
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Project website: <https://novafoodies.eu/>

DATA-DRIVEN RESIDENTIAL ENERGY CARRIER-AGNOSTIC DEMAND RESPONSE TOOLS AND MULTI-VALUE SERVICES – DEDALUS

HORIZON-CL5-2022-D4-01

Goal and short description of the project

In the European Union, households represent 27,4% of the final energy consumption. The residential loads often contribute significantly to seasonal and daily peak demand. To support this variation, and avoid interruption in power supply, utility companies need to increase their energy generation. Within this context, flexible consumption can play a pivotal role in the residential sector as it offers enormous energy demand flexibility, mainly due to the immense thermal energy storage and power management capabilities of the buildings. However, matching electricity supply and demand at all times is becoming increasingly challenging, highlighting the need for greater flexibility in the electricity system. Residential demand response can reduce the need for fossil fuel power plants and facilitate the integration of renewable energy into the electric grid by providing increased stability and management. DEDALUS aims at designing, developing and demonstrating a multi-value energy carrier-agnostic micro (home/apartment)-to macro (building & district-scale) participatory Demand Response (DR) ecosystem. Main goals are: (a) facilitate and scale up residential energy consumers massive participation to DR, and (b) adapt to a variety of different mono-carrier (electricity, heat) or multi-carrier synergetic scenarios (electricity vs heat and natural gas) at building/district scale, while strengthening social interactions within respective communities.

The DEDALUS Consortium intends to deploy:

- a Social Science Framework for multi-dimensional incentives and nudging interventions tools,
- AI-based individual/building/districts consumers clustering and segmentation algorithms,
- Open APIs for DR-ready smart appliances,
- Energy Data Space adaptation for extended DR interoperability and privacy-preserving DLT/Blockchain Data Governance and flexibility coordination,
- Digital Twins for consumers-aware DR flexibility planning,
- Comfort-based flexibility models and tools for serviced apartments for elderly people,
- Flexibility management tools for building and physical/virtual districts energy communities, based on pre-aggregation and shared DR assets,
- Optimal aggregation of flexible energy assets for district heating and decentralized power2heat
- Business Sandbox with novel sharing economy social innovation-based business models.

DEDALUS solutions are being validated by 5 Front Runners full-scale pilots and replicated by 2 Multipliers in 7 countries, deployed at the interplay of energy, and non-energy (comfort/healthcare, ageing, social innovation) sectors, and operated by different stakeholders (social housing operators, building operators, aggregators, energy communities, retailers/suppliers, DSOs/District Heating Network operators). Capacity building and blueprints will support policy makers and regulators to enable market take-up and EU-wide replication of residential DR.

Project implemented by

COORDINATOR: ENGINEERING INGEGNERIA
INFORMATICA SPA

PARTNERS: TECHNICAL UNIVERSITY OF CLUJ-NAPOCA, ETHNICON METSOVION POLYTECHNION, FUNDACION CARTIF, UNIVERSITA POLITECNICA DELLE MARCHE, ARCELIK A.S., COMSENSUS, OURPOWER, GREEN-

POINT, BLUEPRINT, FAELLESBO, NEOGRID, EUROPEAN GREEN CITIES, HERON, DOMX, ISTITUTO PER SERVIZI DI RICOVERO E ASSISTENZA AGLI ANZIANI, DYNAME SRL, CENTRE INTERNACIONAL DE METODES NUMERICS EN ENGINYERIA, PRODUCTORA ELECTRICA URGELLENCA, ROMUR, CENTRICA, SMART INNOVATION NORWAY, FONDAZIONE ICONS

Implementation period

01.05.2023-30.04.2026

Main activities

- Use social sciences and humanities-based tools and methodologies to design an innovative concept for participatory, multi-value, and energy carrier-agnostic residential demand response.
- Build on and improve current data-driven models, algorithms, and flexible assets. Adapt end-user multi-value energy consumption models, beyond consumption user profiling.
- Deliver new demand-response algorithms, models, and ICT-based services for residential buildings, covering different commodities, stakeholders and the whole value chain.
- Demonstrate, validate, and replicate DEDALUS solutions through pilots located in seven countries across Europe and operated by different stakeholders.
- Explore and validate new business models for the sharing economy and social innovation. These will combine the cost socialization of demand-response infrastructure and the cost reduction of unit demand response among many B2B and B2C stakeholders.

Results

Business level

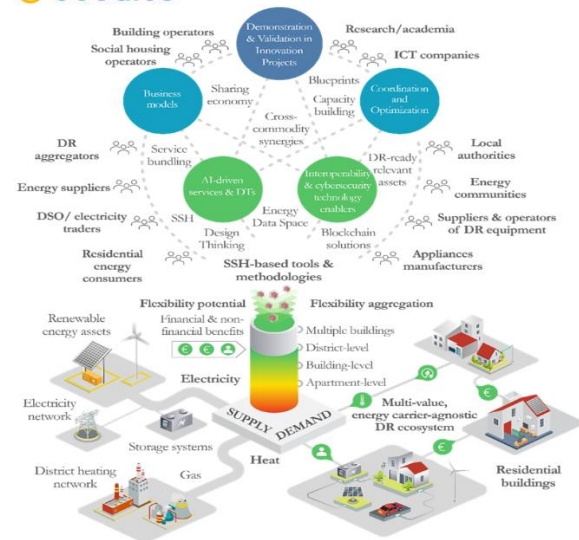
- 15% increase in the energy efficiency of the pilot buildings, and cheaper energy bills for residents thanks to DR
- 15% Cost reduction of the overall energy system
- >25% Reduction of demand response transaction costs after 5 years

Technological level

- 12 Smart residential asset types ready for demand response after 3 years
- >=7 New aggregation models and data-driven services
- >=2 Digital twins to facilitate consumer activation and market participation

Social level

- 45% Increased share of energy consumption data by active consumers after 5 years
- 15-20% Increased share of aggregated flexibility achieved by piloted assets
- >18-20% Carbon emission reduction in the areas of the 7 pilots



Dissemination:

Journals:

E. Sarantinopoulos, V. Michalakopoulos, E. Sarmas, V. Marinakis, L. Todorean, T. Cioara, Meta-heuristic federated learning aggregation methods for load forecasting, *Energy and AI*, Volume 22, 2025, 100594, ISSN 2666-5468, **WoS Q1**

G. Antonesi, T. Cioara, I. Anghel, V. Michalakopoulos, E. Sarmas, L. Todorean, A systematic review of transformers and large language models in the energy sector: towards agentic digital twins, *Applied Energy*, Volume 401, Part A, 2025, 126670, ISSN 0306-2619 **WoS Q1**

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VR Chifu, T Cioara, I Danci, CB Pop, I Anghel, Whale optimization-based clustering for buildings' energy consumption profiles, *Energy Reports* Volume 14, December 2025, Pages 1207-1221 **WoS Q2**

L. Todorean, M. Daian, T. Cioara, I. Anghel, V. Michalakopoulos, E. Sarantinopoulos & E. Sarmas, Heuristic based federated learning with adaptive hyperparameter tuning for households energy prediction, *Nature Scientific Reports* volume 15, (2025) **WoS Q1**

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using multi-objective Harris Hawks Optimization, *Energy Reports*, Volume 12, 2024, **WoS Q2**

D. Mitrea, V. Chifu, T. Cioara, I. Anghel and C. B. Pop, Social Factors in P2P Energy Trading Using Hedonic Games, in *IEEE Access* 2024 **WoS Q2**

O. Marin, T. Cioara, L. Todorean, D. Mitrea, I. Anghel, Review of Blockchain Tokens Creation and Valuation. *Future Internet* 2023, **WoS Q2**

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G. Antonesi, T. Cioara, L. Todorean, I. Anghel, C. De Mulder, A Machine Learning Pipeline to Forecast the Electricity and Heat Consumption in a City District. *Buildings* 2023, 13, 1407. **WoS Q2**

D. Mitrea, T. Cioara, I. Anghel, Privacy-Preserving Computation for Peer-to-Peer Energy Trading on a Public Blockchain. *Sensors* 2023, **WoS Q2**

O. Marin, T. Cioara, I. Anghel, Blockchain Solution for Buildings' Multi-Energy Flexibility Trading Using Multi-Token Standards. *Future Internet* 2023, 15, 177. **WoS Q2**

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L. Todorean, M. Daian, T. Cioara, A. Suciu, I. Anghel, V. Michalakopoulos, E. Sarmas, "Quantum Enhanced Energy Blockchain for Peer-to-Peer Trading," 2025 16th International Conference on Information, Intelligence, Systems & Applications (IISA), Mytilene, island of Lesbos, Greece, 2025, pp. 1-8

C. B. Pop, Z. Varga, V. Chifu, T. Cioara and I. Anghel, "Optimizing Appliances Usage for Apartment Buildings Participation in Demand Response Programs," 2025 IEEE International Workshop on Metrology for Living Environment (MetroLivEnv), Venezia, Italy, 2025

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Financed through

Funded by the European Union's Horizon Framework Programme under the Grant Agreement number: 101103998

Research center

Distributed Systems Research Laboratory - DSRL

Research Team

Project leader for TUCN: Prof. Dr. Eng. Tudor Cioara

Members:

Prof. Dr. Eng. Ionut Anghel
Prof. Dr. Eng. Ioan Salomie
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RENEWABLE ENERGY-BASED POSITIVE HOMES – RENplusHOMES

HORIZON-CL5-2022-D4-01

Goal and short description of the project

As the urgency to combat climate change intensifies, REN+HOMES takes the lead in developing a universal methodology for positive energy homes and residential districts. This approach addresses the crucial role that buildings play in energy consumption and carbon emissions. Due to the significant impact of buildings on emissions, there is an increasing focus on positive energy buildings (PEBs).

REN+HOMES aims to contribute to a sustainable transition by not only reducing carbon emissions but also addressing resource scarcity and energy poverty. In this respect, stakeholders are involved through education and participation programs. Our goal is to establish a universal approach for developing positive energy homes and residential districts. This facilitates the transition to climate-neutral and energy-positive residential buildings.

Project implemented by

RINA CONSULTING SPA - **Coordinator**

Partners:

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA
ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS
ANAPTYXIS, EL
ELLINIKO INSTITOUTO PATHITIKOU KTIRIOU, EL
COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX
ENERGIES ALTERNATIVES, FR
GREENFLEX, FR
and 16 more partners

Implementation period

01.06-2023-30.11.2026

Main activities

Hardware solutions

HW#1 - Industrialized panel with recycled materials
HW#2 - Prefabricated wall panels with PV/with greenery
HW#3 - Wireless Internet of Things (IoT) for structural monitoring
HW#4 - Niagara platform and Building Management Systems (BMS)
HW#5 - Low-power, wide-area network (LPWAN) infrastructures

HW#6 - Geothermal wall system

HW#7 - Drainage water heat recovery (DWHR)

HW#8 - BIPV system using recycled cells

HW#9 - Heat controlled Metal Hydrides H2 Storage (HY2 System)

Software solutions

SW#1 - Building Dynamic Energy Assessment tool (BDEA)

SW#2 - INTEMA (Forecasting)

SW#3 - VERIFY-B (LCALCC)

SW#4 - Green Factor Tool

SW#5 - TCQi – building design and operation.

SW#6 - Resilient Construction Site (RCS)

SW#7 - Cognitive IoT Framework for Building Energy Optimization (CBEO)

Results

REN+HOMES will demonstrate its revolutionary technical solutions and methodologies at four demo sites situated in **Austria, Spain, Estonia, and Romania**. These demonstrators will showcase the potential of positive energy buildings (PEB) in reducing energy consumption

and environmental impact, both in new constructions and renovation projects.



Fig. Innsbruck (Austria)- Young living apartment blocks



Fig. La Garriga (Spain) - Private apartment blocks



Fig. Cluj (Romania) - Renovation of students accommodations

At the TUCN pilot site, Marasti Student Campus, three hardware solutions were implemented: the Geothermal Wall, the BIPV system that uses recycled cells and a performant energy consumption monitoring system.

All these solutions could be scaled up to the entire Campus, thus beginning the process of transforming the Student campus into a Green and Positive Energy one.

Dissemination:

1. Mihaela Cretu; Mircea Lancranjan; Dan D. Micu: Assessing Vehicle-to-Grid as A Flexible Energy Storage Solution for Buildings: Case

Studies and Policy Outlook in Romania, 2025 IEEE PES Conference on Innovative Smart Grid Technologies - Middle East (ISGT Middle East), 23-26 November 2025, DOI: 10.1109/ISGTMiddleEast65737.2025.11314266.

2. N. Cobîrzan, G. Thalmaier, M. Cretu, M. Nasui, Dan D. Micu: Properties of n-Octadecane PCM Composite with Recycled Aluminum as a Thermal Enhancer, Materials, 2025, Volume18, Issue24, DOI10.3390/ma18245638

3. Mircea Lăncrănjan; Bogdan Țebrean; Călin Mureșan; Mihaela Crețu; Dan D. Micu: Development of a Modular Monitoring System for Smart Test Environments, 2025 International Conference on Future Energy Solutions (FES), 24-26 Sept 2025, DOI: 10.1109/FES65767.2025.11341801.

4. Mihaela Crețu; Levente Czumbil; Dorin Dacian Leț; Andreea Mihaela Leț; Andrei Ceclan; Alexis Polycarpou, **Dan D. Micu**: Analysis with regard to Research Building Conversion into Prosumer, 2025 60th International Universities Power Engineering Conference (UPEC), 02-05 September 2025, DOI: 10.1109/UPEC65436.2025.11279885

5. Timea Farkas, Andrei Ceclan, Levente Czumbil, Dan D. Micu, "Sustainable Future in a University Campus: A Comprehensive CO2 Emissions Analysis and Action Plan", 7th International Conference on Smart Energy Systems and Technologies, SEST 2024, Torino, Italia, 10-12 September 2024, <https://ieeexplore.ieee.org/document/10694227>

Financed through

The project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement n° 101103450.

Research center

Energy Transition Research Center - EnTReC

Research Team

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BLUEPRINT FOR NET-ZERO APARTMENT-BLOCK NEIGHBORHOODS - NZC Pilot Cities Programme

NZC-H2020-202209

Goal and short description of the project

NetZeroCities is part of the Horizon 2020 Research and Innovation Programme in support of European Union's Green Deal. NetZeroCities has been designed to help cities overcome the current structural, institutional and cultural barriers they face in order to achieve climate neutrality by 2030.

NetZeroCities supports the EU's Mission of "100 Climate-Neutral and Smart Cities by 2030" launched as part of the Horizon Europe programme. The project works as a service-oriented platform supported by world-class practitioners. It helps European cities by providing them with the support and solutions they need to achieve climate neutrality in a socially inclusive way.

New and existing tools, resources and expertise are developed and promoted into a one-stop platform accessible to all cities through an online portal. Dedicated services are designed to support cities that are part of the EU's Mission "100 Climate-Neutral and Smart Cities by 2030". In addition, NetZeroCities supports a series of Pilots to help drive rapid learning about how to achieve climate neutrality at city scale, and runs a Twinning Learning programme to enable peer-learning.

Project implemented by

Cluj-Napoca City Hall - Lead Organisation
Consortium Partners:

Technical University of Cluj-Napoca

Transylvania Energy Cluster

Cluj Metropolitan Area

Babeş-Bolyai University

Transilvania IT Association

Urbannect Association

Romanian Order of Architects Transylvania Branch

Implementation period

01.06.2023-31.05.2025 (ended)

Main activities

WP1 Toolkit for enhancing Climate Neutral Communities

Developing a toolkit for enhancing Climate Neutral Communities in high density multi-apartment neighborhoods.

WP2 Urban planning toolkit for climate neutrality

Developing an urban planning toolkit for achieving climate neutrality in high density multi-apartment neighborhoods

WP3 New local public policy tools to support climate neutral districts

Developing new local public policy tools to support the transition of high density multi-apartment neighborhoods to climate neutral districts Developing new local public policy tools to support the transition of high density multi-apartment neighborhoods to climate neutral districts, based on the deliverables from WP2

WP4 Communication, Dissemination and Scalability

Communication, Dissemination and Scalability This working package is aimed at promoting and providing scalability and integrative view of the results of the pilot projects and their transferability to other urban areas with similar challenges.

WP5 Project Management

The objective of this work package consists in ensuring a correct, transparent, smooth

and efficient overall project planning, coordination, control, monitoring and assessment.

Results

Early outcome

- ✓ Evidence-based substantiation of climate neutrality interventions Capacitated local ecosystem Central role held by condominiums in implementing any climate-neutrality policies at neighborhood level
- ✓ More affordable transport by EV
- ✓ Institutionalized systems for implementing and monitoring climate neutral policies
- ✓ Planning framework for accelerating the transition to climate neutrality
- ✓ Improved effectiveness and efficiency of multi-level governance for climate neutrality
- ✓ Improved visibility
- ✓ Innovative, data-based decision-making process
- ✓ Better informed citizens

Later Outcome

- ✓ Lower energy costs for households
- ✓ Savings for local budget
- ✓ Encourage more trips by public transport
- ✓ Cost of interventions is significantly reduced
- ✓ Reduce flight to suburbs by improving quality of living spaces in existing neighborhoods
- ✓ Increased innovation and technological progress



Dissemination:

Mission in Progress: Climate-neutral And Smart Cities Conference 2023, Brussels, 2023

Dissemination across two high schools as per project request.

Deliverables:

D.1.5.2 Knowhow and climate-neutral skills upgrading package (32 pages)

D.1.5.4 Guide for Enhancing the Capacity of Local Ecosystems to Plan, Implement, and Monitor Climate Neutral Policies at the Neighborhood Level (42 pages)

D.2.1. Set of urban planning principles for climate neutral interventions (29 pages)

D.2.2. Comprehensive masterplan model (44 pages)

D.2.3.1. Propunere detaliată pentru transformarea unei zone pilot în cartierul Mănăştur din Cluj-Napoca (specifically in Romanian as requested 18 pages)

D.2.3.2. Detailed proposal for transforming one pilot area (48 pages)

D.2.4. ToR model for the renovation of block of flats (63 pages)

Financed through

Funded by the European Union's Horizon 2020 Framework Programme, EIT Climate KIC HBV under the Initiative NZC-H2020-202209

Research center

Electric Mobility Applied Research Center - EMARC

Research Team

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<https://clujnapoca2030.ro/resources/>

BIO INSPIRED GEOTECHNICAL APPLICATIONS TO LAUNCH PAN- EUROPEAN SOLUTIONS – BIGALPS

HORIZON-EIC-2022-TRANSITION-01

Goal and short description of the project

BIGALPS is an EIC Transition project with the primary objective of advancing bio-cementation technology to revolutionize soil stabilization practices. The project builds upon previous results obtained through Advanced-ERC grant- BIOGEOS and Proof-of-Concept (POC) ERC grant – CEBREWA developed at EPFL, Switzerland. With BIGALPS the technology goes European thanks to the international consortium. Bio-cementation is an innovative nature-inspired soil improvement technique, based on the metabolic activity of microorganisms to produce calcium carbonate (CaCO_3) that binds the soil particles together. This technique offers a sustainable, nonpolluting and cost-effective alternative to traditional soil improvement techniques which rely usually on introducing chemicals in soils.

Project implemented by

Technical University of Cluj-Napoca – Coordinator
INSTITUT NATIONAL DE RECHERCHE POUR
L'AGRICULTURE, L'ALIMENTATION ET
L'ENVIRONNEMENT, FR – Partner
ECOLE POLYTECHNIQUE FEDERALE DE
LAUSANNE, CH

Implementation period

01.10.2023-30.09.2026

Main activities

WP1 - Management and coordination

Manage and monitor BIGALPS and ensure that the project technological and business objectives are met with high quality, in time and within the approved budget through efficient coordination and risk management.

WP2 - Business model development, adaption, and initial validation

Provide a concrete pathway for market uptake of the bio-cementation technology

Achieve an attractive and realistic business plan and investment proposition for future investors.

WP3 - Technology transfer and design of production units

To design production units for two different European markets (Romania and France),

Provide the engineering design of the soil treatment for each of the three pilot projects

WP4 - Technology maturation and adaptation for erosion – Pilot project France, PP1

a. Mature & validate the technology and assessing bio-cementation as a means to increase resilience of critical infrastructure to erosion.

b. Develop a business case and live-showcase the technology to potential future market up-takers

WP5 - Technology maturation and adaptation for landslide and foundation base – Pilot projects Romania, PP2, PP3

a. Mature & validate the technology for 2 major soil stability problems – foundation soil improvement and slope stability

b. Develop a business case and live-showcase the technology to potential future market up-takers

WP6 - Technology and business adaptation based on end user experience

a. Provide an analysis of the technical performance and economical costs incurred during the pilot projects and identify margins for potential improvement,

b. Validate the readiness of numerical models for bio-chemo-hydraulic processes in real geosystems,

c. Establish a set of guidelines and protocols for the technology implementation based on lessons learned, market needs and the regulations.

WP7 - Exploitation and Dissemination for scientific, social impact and market uptake

a. To enable and ensure the two-way communication about BIGALPS and its results to multiple audiences (stakeholders (public entities, private companies, etc.)) and show the impact and benefits of BIGALPS solution,

b. To enable use and uptake of results of BIGALPS and maximise the impact of EU funded research.

Results

Demonstration of the technology in real environment

In particular, 3 pilot sites in France and Romania will demonstrate the diversity of problems that the technology can address, the way it adapts to meet specific and local and regional needs and further reveal the R&D- and business model-related challenges to scale it up and commercialize it. The technical milestones will be pursued with the goal of demonstrating the technology for 3 specific soil stability problems: erosion, landslides and foundation soil improvement.

The proposed activities aim to exercise in real-life situations the applications of the developed technology of bio-cementation. Hence, they will fall under the typical commercial processes and paths to simulate future transactions spanning from product acquisition and production establishment to project design, execution and quality control.

Pilot Project 1 - Country of implementation: France, Focus: Erosion

Pilot Project 2 - Country of implementation: Romania, Focus: Landslide

Pilot Project 3 - Country of implementation: Romania, Focus: Foundation Soil Improvement

Dissemination:

Between the 27th to 29th of March 2024, the BIGALPS project was promoted at a prestigious event in Aix-en-Provence, France, focused on safeguarding systems against maritime and river floods.

Events

Nature-Based Solutions for Sustainable Ground Engineering, ALERT Workshop 2025, held in Aussois, France

BIGALPS Project promoting innovation and sustainability in soil stabilization, National Conference on Geotechnics and Foundations (#CNGF2025), held in Timișoara, Romania

Financed through

The project has received funding from the European Union's Horizon research and innovation program under grant agreement n° 101113081 and from Swiss Confederation.

Research Team

Project leader for TUCN: Assist. Prof. Dr. Eng. Iulia Consuela Prodan

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Assist. Prof. Dr. Eng. Olimpiu Muresan
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Research Assist. Octavian Bujor
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EPISTEMOLOGY IN SCIENCE, TECHNOLOGY, ENGINEERING, ARTS, AND MATHS -EPISTEAM

HORIZON-MSCA-2022-SE-01

Goal and short description of the project

EpisTeaM is a MSCA Staff Exchange project forming an interdisciplinary network of researchers building an innovative impact on knowledge construction

EpisTeaM aims to develop a team proposing an epistemology that is located within a genealogy of thinking that understands epistemology and technology as a mode of technē (technical practices that influence the way in which knowledge construction takes place), that possesses an irreducible political and social dimension.

Project implemented by

Technological University of Dublin – Coordinator
EU Partners:

Universidad Politécnica de Cartagena

Technical University of Cluj-Napoca

Darmstadt University

Technological University of Riga

Technological University of Cyprus

Technological University of Troyes

GSI Helmholtzzentrum für

Schwerionenforschung - Germany

APO 33 - France

Cluj Innovation Park - Romania

Instead Technologies for Helping People - Spain

Stitching BALTAN – Netherlands

Non-EU Partners:

Washington University – Seattle, US

University of Sarvajani – Surat, India

Implementation period

01.11.2023-31.10.2027

Main activities

WP1 — Digital Studies and Epistemology

This WP will study the impact of (digital) technology on human knowledge production.

WP2 — Digital Perception and Built Reality

This WP will explore the relationship between technology and the perception of the built environment.

WP3 — Sensing the Body

Sensing the body (Lead by UPCT) will study the current relationship between technology and human beings from the individual body perspective, based on the analysis of physiological signals that give rise to individual emotions and cognition, from interfacing the body with a prosthetic approach.

WP4 — Techné and the Experiment

This WP involves a historical analysis of the relationship between the techniques, technics and technologies of the experiment

Results

- International online seminar “Sensing the body” – UPCT
- International online seminar “Epistemic Crisis” – TUDublin
- 3rd ECT Lab Conference Cyprus 2023: Speculative Enquiries: Aesthetic, Ethical, and Epistemic Technologies
- 4th ECT Lab Conference Cluj 2024: Transdisciplinary Perspectives on AI: Extended Reality Alternative Histories, Current Practices and Possible Futures
- Seattle Summer School hosted by DXARTS, University of Washington: Rhetorical Machines and the Hyperlocal

- Darmstadt Conference hosted by Schader Foundation: Knowledge in the Age of Digital Re-/Production: Responsible Epistemologies
- 5th ECT Lab Conference Eindhoven 2025: Alchemy Today! Critical Perspectives on Digital Hermeneutics
- 12 months of secondments done by UTCN researchers and Ph.D. students

Dissemination:

- 2 Peer-reviewed articles
- 1 Book “Speculative Enquiries” – 2023 ECT Lab Proceedings
- 1 Book “Transdisciplinary Perspectives on AI” – 2024 ECT Lab Proceedings
- 1 Peer-reviewed article in Q2 Journal - Heritage

Financed through

Funded by the European Union’s Horizon Framework Program under the Grant Agreement number: 101129655

Research center

Future Living environments and Urban eXperiments Laboratory – FLUX Lab

Research Team

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Project website:

<https://episteamproject.eu/>

<https://ectlab.eu/project/episteam/>

SMART GRID-EFFICIENT INTERACTIVE BUILDINGS – EVELIXIA

HORIZON-CL5-2022-D4-02

Goal and short description of the project

EVELIXIA project aims to realize **Buildings as Active Utility Nodes (BAUNs)**, rendering the EU Building stock as:

- ✓ **Energy efficient**;
- ✓ **Connected**, by facilitating two-way communication between the grid and the occupants, capitalizing on flexible technologies;
- ✓ **Smart**, by utilizing analytics supported by sensors and controls to co-optimize efficiency, flexibility, and occupant preferences;
- ✓ **Flexible**, shifting or modulating energy use according to occupant needs, while considering utility signals.

Project implemented by

CENTRE FOR RESEARCH AND TECHNOLOGY
HELLAS – CERTH, GR - **Coordinator**

Partners:

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA, RO
RINA CONSULTING SPA, IT
COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX
ENERGIES ALTERNATIVES, FR
FUNDACION CIRCE CENTRO DE INVESTIGACION
DE RECURSOS Y CONSUMOS ENERGETICOS, ES
UBITECH ENERGY, BE
ELLINIKI ENERGEIAKIS OIKONOMIAS, GR
and other 29 partners

Implementation period

01.10.2023-30.09.2027

Main activities

1. Deliver a data and model-driven platform, offering B2G and G2B services, ensuring effective planning, operation, and maintenance of flexible assets for transforming buildings into active utility nodes (BAUNS)
2. Incorporate WEB3 technologies to collect and organize energy services and users into a federated blockchain based identity framework. This will improve the resilience and remove single points of failure existing in centralized systems, while simplifying and streamlining human to building interfaces.
3. Deliver novel cost-effective building level hardware technologies for increasing energy

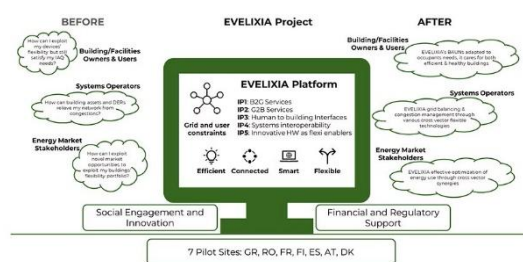
efficiency and systems coupling flexibility potential

4. Demonstrate and assess the sustainability of B2G solutions and user acceptance in seven pilot sites with exemplar buildings in terms of economic, environmental and social performance, which act as active utility nodes.
5. Enable the federation of heterogeneous data sources originating from multiple vendors, multiple vectors and devices through the EVELIXIA interoperability abstraction services.
6. Generate and validate sustainable business models targeting the uptake of B2G and G2B services in flexibility markets and attract financiers 'interest for the future transactive energy ecosystem.
7. Enhance the inclusiveness of the build environment by delivering an open innovation ecosystem fostering:
 - ✓ Cooperation and knowledge sharing between different stakeholders
 - ✓ Behavior changes
 - ✓ Impact maximization and geographical reach of EVELIXIA

Results

- ✓ More energy efficient building stocks supported by an accurate understanding of buildings' performance in Europe and of related evolutions.
- ✓ Long term (after 2030) energy savings that can be triggered by EVELIXIA ≥ 80 GWh/y

- ✓ Building stocks that effectively combine energy efficiency, renewable energy sources and digital and smart technologies to support the transformation of the energy system towards climate neutrality
- ✓ Support building digitalization: >2.8 M m² of floor area per year of EU building stock
- ✓ Higher buildings' performance with lower environmental impacts through increased rates of holistic renovations
- ✓ Support building stock decarbonization – Long-term GHG reductions triggered by EVELIXIA >25 ktCO₂eq/y
- ✓ Higher quality, more affordable built environment preserving climate environment and cultural heritage ensuring better living conditions.



Dissemination:

1. L. Meng, H Wang, S. Lu, Z. Yang, Z. Chen, H. Bevrani, S. Rehim, M. Xia, **Dan D. Micu**, F. Márquez, J. Yang: Wide-area damping control in renewable integrated power systems: A review on recent achievements and new challenges, **2025**, ENERGY CONVERSION AND ECONOMICS, IET, Volume 6, Issue 6, Page341-358, ISSN 2634-1581, DOI10.1049/enc2.70027
2. A.G. Berciu, **Dan D. Micu**, E.H. Dulf: Artificial Intelligence in Human-Centric Sleep Monitoring, INTELLIGENT AND FUZZY SYSTEMS, INFUS **2025**, VOL 3 Page737-744, DOI10.1007/978-3-031-98565-2_79
3. Adela-Ştefania Băldean; Alexandru-George Berciu; Dacian Ioan Jurj; Alexandru Mureşan; **Dan D. Micu**: Artificial Intelligence-Powered Image Analysis for Load Disaggregation via Fog Computing, 2025 International Conference on Future Energy Solutions (FES), 24-26 Sept 2025, DOI: 10.1109/FES65767.2025.11341755

4. Adrian Ilie Urda; Andrei Ceclan; **Dan D. Micu**; Radu Adrian Munteanu; Levente Czumbil; Mihaela Creţu: How far is the way to climate neutrality in Romanian cities, 2025 60th International Universities Power Engineering Conference (UPEC), 02-05 September 2025, DOI: 10.1109/UPEC65436.2025.11279727

5. Bogdan-Constantin Neagu; Andrei Ceclan; Gheorghe Grigoras; **Dan D. Micu**; Radu Porumb; Attila Simo: A Multi-Criteria Approach for Mitigating Energy Poverty in Romania, 2025 International Conference on Electromechanical and Energy Systems (SIELMEN), DOI: 10.1109/SIELMEN67352.2025.11260733.

6. A.G. Berciu, T. Farkas, A. Ceclan, L. Czumbil, Ş. Ungureanu, Dan D. Micu, „Energy Efficiency: From Desire to an Integrated Management Solution”, IEEE Conference on Technologies for Sustainability (SusTech), ISBN: 979-8-3503-9434-4, Portland, USA, April 14-17, 2024, DOI: 10.1109/SusTech 60925.2024. 10553562.

7. G. Berciu, E. Dulf, D. Jurj, L. Czumbil, **Dan D. Micu**, „Energy Pulse: Competitive and Accessible Application for Monitoring Electricity Consumption”, *Springer Proceedings in Mathematics and Statistics*, pp. 107-117, **2024**, DOI: 10.1007/978-3-031-56492-5_8.

8. Y. Li, S. Su, M. Zhang, Q. Liu, X. Nie, M. Xia, Dan D. Micu, “Multi-Agent Graph Reinforcement Learning Method”, IEEE Transactions on Sustainable Energy, IF 8.6, 15(2), 2024, DOI: 10.1109/TSTE.2023.3330842.

9. Lancranjan M.N., Alexandru Muresan, Jurj Ioan Dacian, Berciu Alexandru - George, Polycarpou A., Czumbil Levente, **Dan D. Micu**: Overview of Load Disaggregation Models, Methods and Hardware. 2024 59th International Universities Power Engineering Conference, UPEC **2024**. <https://doi.org/10.1109/UPEC61344.2024.10892437>

Financed through

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 101123238.

Research center

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HOLISTIC APPROACH TOWARDS EMPOWERMENT OF THE DIGITALIZATION OF THE ENERGY ECOSYSTEM THROUGH ADOPTION OF IOT SOLUTIONS - HEDGE-IoT

HORIZON-CL5-2023-D3-01

Goal and short description of the project

HEDGE-IoT proposes a novel Digital Framework which aims to deploy IoT assets at different levels of the energy system (from behind-the-meter, up to the TSO level), to add intelligence to the edge and cloud layers through advanced AI/ML tools and to bridge the cloud/edge continuum introducing federated applications governed by advanced computational orchestration solutions. The HEDGE-IoT Framework will upgrade the RES-hosting capacity of the energy systems, unleash a previously untapped flexibility potential, leveraging on IoT solutions and will increase the resilience of the grid towards the digitalization of the energy sector, and the advancements in IoT standardization. The multi-dimensional framework of HEDGE-IoT comprises the following pillars:

- The Technology Facilitator Pillar will exploit computational sharing by offloading applications on the grid edge, towards providing a set of AI/ML federated learning and swarm computing applications adopting containerization, microservices and serverless computing approaches. The interconnectivity of the different IoT/edge/fog and cloud layers will implement computational, data and information sharing, assuring privacy preservation.
- The Interoperability Pillar, leverages on, adapts, evolves, and validates cutting edge interoperable architectures, in order to design and develop the HEDGE-IoT Energy-Data-Space (EDS)- aligned scalable middleware, which is proposed for the seamless integration of IoT infrastructure, federated-edge and cloud distributed platforms in a trustworthy manner, employing trust and sovereignty traits, applying semantic interoperability methodologies and integrating different energy vectors, such as electricity mobility and heating.
- The Standardization Pillar will enable all involved platforms, systems, tools and actors to seamlessly communicate and exchange data in standardized formats using well-known and widely used standards. Interaction with relevant standardization bodies and EU initiatives will be established.
- The Digital Energy Ecosystem Enabling Pillar will ensure that HEDGE-IoT will facilitate the increased integration of RES towards increased resilience. Liaisons with EU initiatives for IoT and digitalization will be established, and the engagement of stakeholders will be ensured by addressing IoT ethics and cultivating trust among end-users, promoting inclusivity. Scalability and replicability studies will be performed, assessing the impact of the HEDGE-IoT solutions and connections with innovators and SMEs will be established through an Open Call mechanism, strengthening the existing value chains.

Project implemented by

COORDINATOR: EUROPEAN DYNAMICS
LUXEMBOURG SA

PARTNERS: TECHNICAL UNIVERSITY OF CLUJ-
NAPOCA, RWTH AACHEN, DST, ICCS, INESC TEC,
TNO, TAMPEREEN KORKEAKOULUSAATIO SR, VTT,
TRIALOG, CYBERETHICS, STATE GRID SA,

INTERNATIONAL DATA SPACES EV, ELIA
TRANSMISSION BELGIUM, HRVATSKI OPERATOR
PRIJENOSNOG SUSTAVA D.D., CLUSTER
VIOOIKONOMIAS KAI PERIVALLONTOS DYTIKIS
MAKEDONIAS, F6S, SOCIAL OPEN AND INCLUSIVE
INNOVATION ASTIKI MI KERDOSKOPIKI ETAIREIA,
ABB, ENERVA OY, JARVI-SUOMEN ENERGIA OY,
DIMOSIA EPICHEIRISI ILEKTRISMOU ANONYMI

ETAIREIA, DIACHEIRISTIS ELLINIKOU DIKTYOU DIANOMIS ELEKTRIKIS ENERGEIAS AE, INDEPENDENT POWER TRANSMISSION OPERATOR SA, ELLINIKO HRIMATISTIRIO ENERGEIAS, HARDWARE AND SOFTWARE ENGINEERING EPE, QUE TECHNOLOGIES KEFALAIOUCHIKI ETAIREIA, ARETI, APIO, ACEA ENERGIA SPA, VOLKERWESSELS ICITY B.V., ARNHEMS BUITEN BV, STICHTING VU, COOPERATIVE ELECTRICA DO VALE DESTE CRL, REN - REDE ELECTRICA NACIONAL SA, MC SHARED SERVICES SA, ELES DOO SISTEMSKI OPERATER PRENOSNEGA, ELEKTROENERGETSKEGA OMREZJA, ELEKTRO GORENJSKA PODJETJE ZA DISTRIBUCIJO ELEKTRICNE ENERGIJE DD, OPERATO DOO, SVEUCILISTE U ZAGREBU FAKULTET ELEKTROTEHNIKE I RACUNARSTVA, INSTITUT JOZEF STEFAN, KONCAR

Implementation period

01.01.2024-30.06.2027

Main activities

To achieve its vision, HEDGE-IoT considers the adoption of an Incremental Minimum Viable Product approach. The proposed validation methodology will go through incremental stages. A full development cycle is implemented in each phase:

Phase 1 - Specification & Technologies adaptation M1-M18: The HEDGE-IoT development processes will start by collecting insights through users' / stakeholders' activities, as well as based on the analysis of the project's demos. The outcome of this activity is a set of relevant requirements. Technology deployment, asset assessment and exploratory experimentation will be carried out through proof-of-concepts and early technologies probes and will be used for investigating and determining problems and opportunities for data value generation. Hence, the HEDGE-IoT concept will be gradually fine-tuned, while reference architecture and blueprints will be consolidated to drive developments in all core technologies. At the end of the phase the initial Evaluation process will identify potential limitations and drawbacks.

Phase 2 - Product Integration & Fine Tuning M19-M28: Based on feedback from Phase 1, the developments and requirements will be refined, and a 2nd implementation of technological components will be released. This phase will focus on the delivery of technological enablers and their deployment on the demo sites. A demo validation campaign will take place, based on the intermediate release and further development of building blocks and technology enablers. Beyond full deployment of technology, standardization efforts to match data governance structures with a KPI collection and benchmark analysis will be performed.

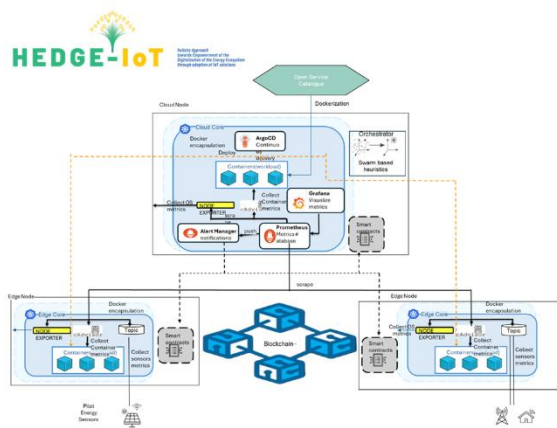
Phase 3 - Product Assessment & Market Uptake M29-M42: This phase will consider the evaluation results of Phase 2 and utilize them to enable the refinement of component and system level technology consolidation, through scalability-driven functionality enhancements. Overall, the final version of the HEDGE-IoT system will have been established and a final validation will be carried out focusing on: scalability and replicability analysis and delivery of the necessary benchmarks to perform business validation and impact assessment based on regulatory, social, and techno-economic assessment of each demo.

Results

The HEDGE-IoT Framework will be implemented, showcased and validated in a set of 6 diverse Large-Scale field Demonstrators in 6 European countries, featuring versatile geographic, climatic, regulatory and social conditions. Results will be evaluated, and solutions will be replicated across sectors and geographies proving the interoperability scalability and effectiveness of the distributed IoT-enabled Digital Solution in different environments.

The most important key exploitable results of the project will be: (i) A service orchestrator to facilitate computational sharing between the cloud and edge levels, (ii) A set of AI/ML tools for edge and cloud levels towards optimized planning, operation, resilience of interconnected assets, (iii) A set of IoT solutions deployed across the energy system offering intelligence at the edge level, (iv) An open App Repository to

populate edge/cloud and fog level AI/ML tools for energy stakeholders, (v) A set of semantic and ontology standards, for IoT-enabled grid digitalization, (vi) A concrete dissemination and communication plan including clustering activities and synergies with relevant European initiatives / projects and (vii) Best practices from demonstration of innovative solutions for the digitalization of energy system.



Dissemination:

Journals

L. Todorean, M. Daian, T. Cioara, I. Anghel, V. Michalakopoulos, E. Sarantinopoulos & E. Sarmas, Heuristic based federated learning with adaptive hyperparameter tuning for households energy prediction, *Nature Scientific Reports* volume 15 (2025) **WoS Q1**

Lazea, D., Hangan, A., & Cioara, T. (2025). Building Equi-Width Histograms on Homomorphically Encrypted Data. *Future Internet*, 17(6), 256. **WoS Q2**

G.I. Arcas, T. Cioara, I. Anghel, Whale Optimization for Cloud-Edge-Offloading Decision-Making for Smart Grid Services. *Biomimetics* 2024, 9, 302. **WoS Q1**

I.R. Martin, G. I. Arcas, T. Cioara, Reinforcement-Learning-Based Edge Offloading Orchestration in Computing Continuum. *Computers* 2024, 13, 295. **WoS Q2**

G.I. Arcas, T. Cioara, I. Anghel, D. Lazea, A. Hangan, Edge Offloading in Smart Grid. *Smart Cities* 2024, 7, 680-711. **WoS Q1**

V.R. Chifu, T. Cioara, C. Pop, H. Rusu, I. Anghel, Deep Q-Learning-Based Smart Scheduling of EVs for Demand Response in Smart Grids. *Appl. Sci.* 2024, 14, 1421. **WoS Q1**

Conferences

A. Rancea, I. Anghel and T. Cioara, "Performance and Energy Benchmarking of Edge ML Workloads" 2025 16th International Conference on Information, Intelligence, Systems & Applications (IISA), Mytilene, island of Lesbos, Greece, 2025, pp. 1-8

V. Ofirim, C. B. Frandes, T. Cioara and I. Anghel, "Cloud-Edge Continuum Orchestration for Containerized Workloads," 2025 IEEE International Workshop on Metrology for Living Environment (MetroLivEnv), Venezia, Italy, 2025, pp. 301-305

Arcas, G. I. and Cioara, T. (2025). Data Orchestration Platform for AI Workflows Execution Across Computing Continuum. In Proceedings of the 15th International Conference on Cloud Computing and Services Science - CLOSER; ISBN 978-989-758-747-4; ISSN 2184-5042, SciTePress, pages 103-110.

I.R. Martin, T. Cioara, G. I. Arcas, I. Anghel, M. Bertoncini, Knowledge Graph Model for Computing Continuum over Smart Grid, *IISA 2024*, Grand Arsenali, Chania, Crete, Greece, July 17-19, 2024

Financed through

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Research center

Distributed Systems Research Laboratory - DSRL

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EO PLATFORM SUPPORTING CRITICAL RAW MATERIALS INDUSTRY IN EUROPE – GOLDENRAM

HORIZON-CL4-2023-RESILIENCE-01

Goal and short description of the project

The GoldenRAM project is developing an Earth Observation Platform which deploys the latest advances in IT, Cloud and AI technologies. The platform is designed to facilitate the exchange of accurate information on Raw Materials in Europe and partner countries to support mining companies, stakeholders in the mining industry, and the general public. It will utilize AI and Natural Language Processing alongside advanced AI “knowledge packs” to streamline complex computational workflows.

The GoldenRAM platform contributes to Europe’s CRM ambitions by providing Earth Observation-based tools to a variety of stakeholders in the mining industry such as mining companies, non-governmental organisations, and EU Member States, creating a platform for improved cooperation along the CRM value chain and between the EU and partner countries.

Project implemented by

TEKNOLOGIAN TUTKIMUSKESKUS VTT OY Finland
- Coordinator

Partners:

Technical University of Cluj-Napoca

OPT/NET BV, NL

BUNDESANSTALT FUER GEOWISSENSCHAFTEN
UND ROHSTOFFE, DE

GEOLOGIAN TUTKIMUSKESKUS, FI

EFTAS FERNERKUNDUNG

TECHNOLOGIETRANSFER GMBH, DE

And other 7 partners

Implementation period

01.01.2024-31.12.2026

Main activities

Exploration

- EO Mineral Mapping
- Drill Core Mineral Mapping
- Mineral Prospectivity Mapping
- Mapping Secondary Raw Materials Deposits

Production, Operations & Safety

- Open Pit and TSF Dam Stability Monitoring
- Tailings Storage Facility Monitoring
- Volume Change Monitoring

Environment

- Integrated Monitoring of Environmental Impacts
- Ground Water Level and Discharge Monitoring

Prospecting, Reporting & Exploitation

Mineral Resources Mapping in Ukraine

Technologies

AI Natural Language Processing

Engage with geospatial data via natural language queries.

AI Knowledge Packs

Modules streamlining data operations, enabling efficient handling and analysis of diverse datasets for informed decision-making.

Satellite Sensing

Satellite data offers numerous benefits, significantly improving operations, environmental monitoring, and exploration efforts.

Aerial Sensing

Drone imaging systems enabling mineral exploration and vegetation health monitoring, production, operation and safety applications.

Proximal Sensing

Enable the simultaneous mapping of rare earth minerals and their host minerals in drill core

samples, as well as calibrate and demonstrate novel data products.

Results

The platform will be demonstrated in 6 field trials, creating a compelling value proposition for implementation across the mining value chain and improving the responsible and sustainable supply of CRMS.

Abrud, Romania (Cupru Min) Cupru Min S.A.

Abrud is the only producer in Romania, whose main activity is the extraction of non-ferrous ores, the preparation of copper ores and the valorization of copper concentrate and precious metals.

Aitik, Sweden (Boliden)

World's most productive open-pit Cu mine. Exploration, operation in open pits, closure of depleted areas, and active as well as closed tailing areas.

Barroso, Portugal (Savannah)

High-grade, low-iron lithium project, the biggest spodumene lithium discovery in Western Europe in recent years, and valid for sufficient lithium production for approximately 0.5 million vehicle battery packs per annum.

Kevitsta, Finland (Boliden)

Kevitsa is a multi metal mine operating in Northern Finland with activities in exploration, operation in open pits, closure of depleted areas, and active as well as closed tailing areas.

Sokli, Finland (Sokli)

Sokli represents a test site for mineral prospectivity mapping, drill core mapping and a site for integrated monitoring of environmental impacts.

Ukrainian Shield, Ukraine (GIUA)

Provides the G-RAM platform with access to the databases and electronic maps of critical minerals' occurrence with detailed characteristics and geospatial information as well as areas of mining activity and wastes accumulation sites (tailings and dumps) in Ukraine.

Financed through

Funded by the European Union's Horizon Framework Programme under the Grant Agreement number: 101138153

Research Team

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Assoc. Prof. Dr. Eng. Ovidiu Cosma
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Research Assist. Drd. Eng. Cătălin Petruți
Research Assist. Eng. Beatrice Sillai
Research Assist. Eng. Monica Volner
Research Assist. Eng. Iulia Pop-Vădean
Research Assist. Eng. Dora Rus
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MOBILITY JUSTICE FOR ALL: FRAMING SAFER, HEALTHIER AND HAPPIER STREETS - JUST STREETS

HORIZON-MISS-2022-CIT-01

Goal and short description of the project

JUST STREETS is an international Horizon Europe project focusing on (re)developing streets that are sustainable, safe, and inclusive for all citizens. Scheduled from January 2024 to June 2027, it aims to link inclusive streets with supporting climate neutrality goals.

32 international partners collaborate to empower 12 cities in transforming existing streets into just, equal, and human-centered spaces for active mobility – subsequently sharing critical implementation learnings with interested cities from across Europe. JUST STREETS is not only about change; it is about a transformative and systemic shift in perspective when planning and designing public space in cities.

Project implemented by

FONDAZIONE LINKS - LEADING INNOVATION & KNOWLEDGE FOR SOCIETY - **Coordinator**

Partners:

Technical University of Cluj-Napoca
UNIVERSITEIT VAN AMSTERDAM, NL
POLITECNICO DI TORINO, IT
IT-UNIVERSITETET I KOBENHAVN, DK
HOGSKULEN PA VESTLANDET, NO
And other 21 partners

and resilient cities – as all its objectives help neighborhoods to move towards their climate neutrality goals.

WP1 - JUST COLLABORATE: Project Management and Coordination

WP2 - JUST ENGAGE: Framing active users' mobility needs and envisioning innovative solutions.

WP3 - JUST IMPROVE: Data analysis and measurement of risks

WP4 - JUST CHANGE: Pilots and followers in action.

WP5 - JUST EVALUATE: Evaluation and impact assessment.

WP6 - JUST SHARE: Dissemination, communication, policy recommendation and exploitation.

Implementation period

01.01.2024-30.06.2027

Main activities

Focus on Citizens

The project focuses on (re)developing streets shaped by active mobility that are both: sustainable and inclusive for all citizens. Realizing this shift from streets for the exclusive use by cars towards street space for more active modes of mobility will be led by prioritizing the needs and visions of social groups often under-represented in urban planning. This includes particularly women, migrants, the elderly, children, LGBTQI+ individuals, and people with disabilities.

Results

Implementation Experience

We will be supporting street transformations in 12 European cities, focusing on changing existing streets into just spaces for active mobility. As you can imagine, this will generate lots of hands-on experience. We are happy to share our learnings.

Challenges and Failures

From 'best practice' to what's best for you to learn. While we are happy to share learnings, we will not shy away from addressing challenges we

Climate impact

Inclusiveness is not an isolated goal. Instead, JUST STREETS will be fostering resilient communities

experienced and failures we had to deal with. We'd rather not see you repeat mistakes already made elsewhere.

Financed through

Funded by the European Union's Horizon 2020 Framework Programme, under the Grant Agreement no 101104240

Research center

Road Traffic and Traffic Security Research laboratory - RTTS

Research Team

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NOVEL TECHNOLOGIES FOR ON-SITE AND REMOTE COLLABORATIVE ENRICHED MONITORING TO DETECT STRUCTURAL AND CHEMICAL DAMAGES IN CULTURAL HERITAGE ASSETS – ChemiNova

HORIZON-CL2-2023-HERITAGE-01

Goal and short description of the project

ChemiNova aims to develop an intelligent computational system that goes beyond current technologies to improve the conservation, analysis and monitoring of European Cultural Heritage assets. Using a myriad of data, we will tackle structural and chemical damages, focusing on two specific human-induced threats: climate change and civil conflicts.

Inspired by the simplicity of a children's game, our value relies on the conviction that we will facilitate the work of heritage professionals. Using a single framework, they will be able to document, digitize, classify, and share information for cultural heritage conservation. Our impact lies in the fact that we will not build an ad hoc device, but a technology that is adaptable so that anyone can access it from anywhere. We will engage local communities, encouraging citizen participation in conservation practices, from providing data (citizen science) to raising awareness on the effects of climate change, natural and human hazards affecting cultural heritage.

Project implemented by

UNIVERSITAT DE VALENCIA - **Coordinator**

Partners:

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA, RO
INTERNATIONAL CENTRE FOR THE STUDY OF THE
PRESERVATION AND RESTORATION OF CULTURAL
PROPERTY (ICCRROM), IT
UNIVERSITA DEGLI STUDI DI PALERMO, IT
NATIONAL CONSERVATION AREA ST SOPHIA OF
KYIV (NCA-SSK), Ukraine
and 7 more partners

Implementation period

01.07.2024-31.01.2027

Main activities

WP1 – Project management and coordination

Provide efficient management and administration of the project; Ensure streamlined management of data and IP; Control the risk and contingency table, and safeguard gender dimension; Appoint and liaise with the External Expert Advisory Board.

WP2 – CH Requirements and Data Acquisition

Collect and acquire preliminary data; Define current inspection and analysis needs of CH end-users; Keep monitoring activities for the duration of the project.

WP3 – Building e3D Models: ChemiModel

Design radiometric calibration protocols and methods and apply them to the data; Co-register data from multiple platform positions in a common, metric reference frame (orientation); reconstruct the object shape as a watertight surface mesh with radiometric information; refine and enrich the model locally by maps computed from RTI data and simulate visual appearance of objects through interactive relighting;

WP4 – Advanced Data Analysis and Deep Learning: ChemiAI

Develop classification techniques for differentiating types of damage of artefacts, buildings and monuments based on the e3D models derived in WP 3 and using methods for

deep learning; Develop a methodology for analysing hyperspectral and RTI data in order to obtain information about damage; Integrate the classification methods for e3D models with RGB textures and additional sensor data for an improved prediction of damage.

WP5 – Design and Implementation of Interactive Tools: ChemiAnalysis, ChemiSensing, Chemi-Inspection & ChemiSee

Form a co-creation space that will feed WP3, 4 and 7 and where TA1 and TA3 will work together to better design the project's methods and tools; Ensure the project's methods and results are inclusive and accessible for citizens and stakeholders, in particular TA1 and TA7, with a special focus on gender; Design, implement and perform continuous testing and debugging of the interactive tools: ChemiAnalysis, ChemiInspection, ChemiSensing and ChemiSee.

WP6 – Data quality, interoperability and integration (lead by UTCN)

Design the data model; Specify the requirements of the data-sharing framework and of the interoperability layer; Implement the ChemiNova database and the interoperability layer; Ensure testing and debugging of the integration processes of all the system's modules; Create ChemiNova user-manual and technical documentation; Ensuring alignment with the ECCCH.

WP7 – Validation and testing

Validate the system performance, usability, dissemination among various audiences; Evaluate the integration of ChemiNova results on pilot case scenarios; Evaluate ChemiNova's impact on civil society.

WP8 – Dissemination, Communication and Exploitation

Manage IPR and knowledge generated by the project; Implement the dissemination, exploitation and communication plans. These plans will be gendered-balanced.

Results:

Deliverable D1.1 – Project Quality Handbook

This document will define the project success indicators, communication management, reporting, risk management and quality management plans.

Deliverable D1.3 – Policy brief of the 1st reporting period

First Policy Brief Deliverable that summarises intermediary results in a format specifically targeting policy makers.

Deliverable D2.2 – Pilot scenarios definition

A technical report about the pilot scenarios.

Deliverable D3.1 – Calibration methods and Protocols

Report describing the methods and protocols developed to radiometrically and geometrically correct the raw data (spectral RTI) before integration.

Deliverable D3.2 – e3D model generation

Technical report on methods allowing the production of the e3D models as meshes with RGB texture.

Deliverable D3.3 – Micro 3D from photometric stereo images (RTI)

Technical report on methods allowing reconstruction of fine 3D (microgeometry) based RTI data.

Deliverable D3.4 – An RTI acquisition system for inaccessible zones

A prototype using drones to embed light source, that could be multiplexed light source to permit HSI acquisition.

Deliverable D3.5 – e3D models including other modalities and multi-temporal data

Technical report on methods allowing the production of the e3D models including other modalities and the integration of multi-temporal data.

Deliverable D4.2 – Initial version of ChemiAI

First prototype of ChemiAI, the software for damage classification based on deep learning, only working with 3D meshes with RGB texture. Source code and a technical report describing the software design, its API and the results of an initial evaluation of the method.

Deliverable D4.3 – Damage detection by joint analysis of RTI and spectral data

Methods for fusing RTI and spectral data for damage detection. It takes the form of a report and prototypes of functions implementing the data structure and the algorithms of saliency detection.

Deliverable D5.1 – Mock-ups

A report with the mock-ups for the technological tools developed under WP5.

Deliverable D6.1 – Data model and functional requirements

Report on the data model and functional requirements for data sharing and interoperability.

Deliverable D6.2 – ChemiNova database

ChemiNova database, where pre-existing and new acquired data will be stored and shared among software modules.

Deliverable D6.3 – ChemiNova API

The ChemiNova API, along with a technical report that explains how to introduce new data.

Interactive testing of the ChemiNova tools



Dissemination:

Alba, E., Băcu, V., Bonazza, A., Botina, D., Cappello, F., Dobrzalski, E., Dorninger, P., Gabay, N., Geuter, J., Heidarianbaei, M., Jigyasu, R., Kordali, O., Luxman, R., Mansouri, A., Megna, B., Palla, F., Palma, B., Polsterer, H., Portalés, C., Rossé, M., Rottensteiner, F., Sardella, A., Solbes, Á., Ștefănuț, T., Tapini, L.–M., and Tymoshenko, N.

(2025). On the design and development of new technologies to detect damages in cultural heritage assets [Paper presentation]. In CHNT – ICOMOS Editorial board. Proceedings of the 29th International Conference on Cultural Heritage and New Technologies. Vienna, Austria.

Targa, L., Cano, C., Solbes, Á., Casas, S., Alba, E., & Portalés, C. (2025). Automated Edge Detection for Cultural Heritage Conservation: Comparative Evaluation of Classical and Deep Learning Methods on Artworks Affected by Natural Disaster Damage. *Applied Sciences*, 15(15), 8260. <https://doi.org/10.3390/app15158260>

Financed through

Funded by the European Union's Horizon Framework Programme under the Grant Agreement number: 101132442

Research center

Computer Graphics and Interactive Systems Laboratory - CGIS

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RECOVERING PAST STORIES FOR THE FUTURE: A SYNERGISTIC APPROACH TO TEXTUAL AND ORAL HERITAGE OF SMALL COMMUNITIES

RESTORY

HORIZON-CL2-2023-HERITAGE-01

Goal and short description of the project

The project builds synergistically upon textual and oral stories to explore the past of small communities, with the goal of restoring the public's emotional connection to discontinued traditions. In doing so, it pays greater attention to segments of cultural heritage that have long been overshadowed by monuments or sites of larger significance. Texts and interviews encapsulate expressions of collective agency, allowing current-day SSH academics to investigate those natural processes that gave prominence to the effective management of limited supplies of human and material resources.

With a focus on schooling, recycling practices, and affective-based communication of group agents, RESTORY intends to investigate the formation of sustainable attitudes and strategies, learn from the lessons of the past, and integrate them into the future configuration of commitments.

Project implemented by

BABES-BOLYAI University - **Coordinator**

Partners:

Technical University of Cluj-Napoca

HASKOLI ISLANDS – Iceland

CENTRE NATIONAL DE LA RECHERCHE
SCIENTIFIQUE CNRS – France

UNIVERSIDADE DE COIMBRA – Portugal

HELSINGIN YLIOPISTO – Finland

And other 14 partners

Implementation period

01.01.2024-31.12.2026

- Digitization of cultural heritage assets from small local communities in 3D format;
- Digital restoration of incomplete/damaged cultural heritage assets;
- Dissemination of local cultural heritage assets through digital VR/AR/MR technologies;
- Dissemination of research results in Web of Science Q1 and Q2 indexed articles.

Main activities

WP1 - Project Management

WP2 - Investigation of local communities' cultural heritage

WP3 - Education, training and networking

WP4 - Communication Dissemination and Exploitation of results

WP5 - Identifying needs, piloting and replicate the model

Activities of the UTCN team within the project

Results

A total of 38 3D scanned cultural heritage objects and corresponding photographic records were created. Each object's digital representation includes, at minimum, the following file formats: the proprietary *.csf file from Creaform's VXelements software, the *.blend file from Blender, and the widely compatible *.obj file. From the 3D scanned objects, a total of 32 digital objects were uploaded to the Sketchfab platform. These models are available at:

https://sketchfab.com/Project_Restory.

Project members were engaged in the development of augmented reality (AR) and virtual reality (VR) applications designed to enhance the presentation of 3D scanned cultural heritage objects, which are the subject of research conducted by other project partners. The AR application is accessible for Android smartphone and tablet users at: <https://restory-heritage.eu/cincu-neighborhoods-ar/>. The VR application is installed on the headset available at the museum in Cincu at the moment.

Presentation at the ICCAUA2024 conference, held in Alanya, Turkey, with the title: Cluj Napoca - benefits and risks of urban development, authors Smaranda Todoran and Cristina Modoi. The paper studies the relationship between urban memory and sustainability. The work was published in the book Innovative Approaches to Cultural Heritage and Sustainable Urban Development: Integrating Tradition and Modernity, Hourakhsh Ahmad Nia and Rokhsaneh Rahbarianyazd, Cinius Yayınları, Eds, Cinius Yanları, Istanbul, 2024 ISBN: 978-625-6072-93-0. DOI:

10.38027/N10ICCAUA2024EN0179.

A published Q2 scientific article: Comes, R., & Buna, Z. L. (2026). Virtual Reality in Cultural Heritage: A Scientometric Analysis and Review of Long-Term Use and Usability Trends. Applied Sciences, 16(2), 1013. <https://doi.org/10.3390/app16021013>.

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Research center

Dassault Systèmes Solutions Center
<https://dssc.utcluj.ro/>

Research Team

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Educational campuses as the drivers for Positive Energy Districts

EDUPED

COFUND-DUT-EDUPED-1

Goal and short description of the project

eduPED (2024–2027) is a European research and innovation project that accelerates the transition to **Positive Energy Districts (PEDs)** by rethinking how university campuses and their surrounding urban areas are designed, refurbished, and governed.

The project uses a **systemic, research-oriented approach** grounded in urban morphology, combining technical innovation with inclusive co-creation processes. Educational institutions, due to their sizeable public assets, knowledge capacity, and stakeholder connectivity, are positioned as the **main orchestrators** of PED transitions.

The project contributes directly to key EU priorities, including the Mission 100 Climate-Neutral and Smart Cities, the Renovation Wave, and the goals of the Strategic Energy Technology (SET) Plan. Through a combination of applied research, stakeholder co-creation, and transnational exchange, eduPED provides replicable frameworks for sustainable urban transformation.

Project implemented by

Technical University of Cluj-Napoca
The Hague University of Applied Sciences
Politecnico di Torino
Universitat Politècnica de Catalunya
Graz University of Technology
Asociația Romania Green Building Council
DiLT Analytics GmbH

Implementation period

01-01-2025 - 31-12-2027

Main activities

Main objective: The eduPED project aims to accelerate the creation of Positive Energy Districts (PEDs) by leveraging urban morphology in sustainable regeneration and renovation processes. The core of the strategy lies in educational institutions: thanks to their extensive real estate assets, they become drivers of change and knowledge hubs, facilitating the expansion of Urban Living Labs at the scale of the entire city.

Specific objectives:

Transformation through education: Accelerating the transition towards Positive Energy Districts

(PEDs) by using educational institutions as hubs for innovation and coordination.

Structural efficiency: Defining regeneration strategies based on urban morphology (the form of buildings and public spaces).

Deep renovation: Reducing energy consumption through deep retrofitting architecture and building systems on campus and district scale.

Energy synergy: Maximising the use of renewable energy resources, energy flexibility, and smart grids.

Climate resilience: Protecting districts against extreme temperatures and increasing user comfort.

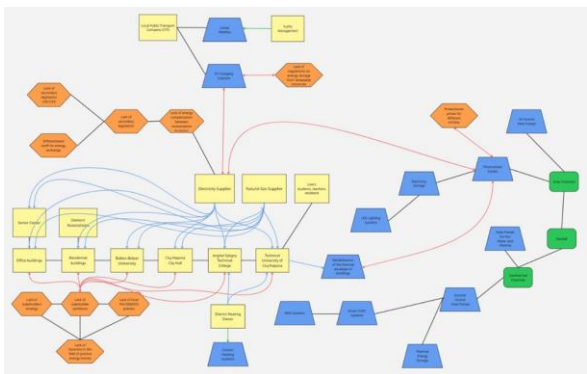
Results

The 2025 stage of the **eduPED** project focused on establishing the analytical and data foundations for future simulation and intervention strategies. Key achievements include.

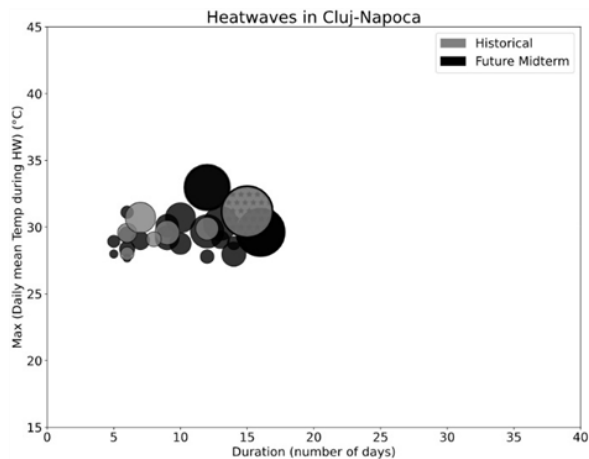
Defining parameters that link urban spatial configuration to energy performance and climate adaptation.



Labs – Aims to accelerate PED transitions through stakeholder involvement.



Climate database – Creating a practical framework to evaluate PED energy resilience under shifting climate conditions.



Dissemination:

1. Scientific publication – The publication of a research article in the journal *Sustainable Futures* (ISI indexed, Q1 quartile):

Moldovan, R. P., Rus, T., Beu, D., Albu, H., Domnița, F., & Moldovan, A. M. (2025). *From assessment to action: A strategic approach to carbon management for climate neutrality in higher education*. *Sustainable Futures*, 10, 101354.

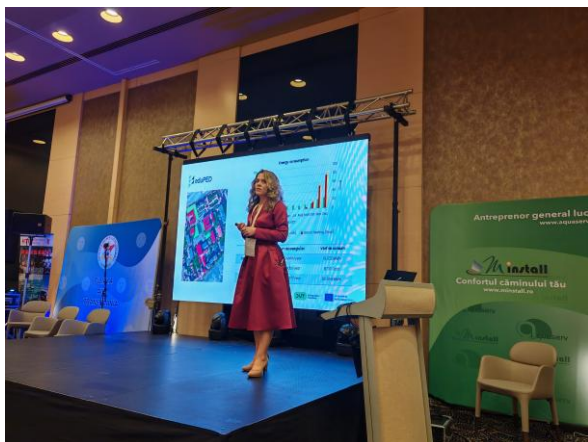
2. eduPED at World Energy Efficiency Day

In March 2025, the **eduPED** project was featured at the 2nd "Sustainability and Energy Efficiency" event, hosted by **UTCN's Faculty of Materials and Environmental Engineering**. Assoc. Prof. Tania Rus presented the project's core vision: leveraging educational campuses as primary drivers for **Positive Energy Districts**.



3. eduPED at the Technical Intersections Forum

UTCN participated in the inaugural "Technical Intersections" forum on November 20, 2025, in Cluj-Napoca. Organized by **AIIR** (Transylvania Cluj and Braşov branches), the event featured Assoc. Prof. Tania Rus, who presented the **eduPED** research project during the Energy Efficiency session.



Financed through

The project is funded by the Executive Agency for Higher Education, Research, Development and Innovation (UEFISCDI) and co-funded by the European Commission through the European and International Cooperation Programme, Horizon Europe subprogramme.

Project leader for TUCN: Assoc. Prof. dr. Eng. Tania Rus

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SMART DIASPORA 2025

WORKSHOP SESSIONS

Workshop 13 - Energy Transition and Green Cities: Academic Perspectives for a Sustainable Future

Host Institution:

Technical University of Cluj-Napoca



Coordinators:

Radu Porumb, National University of Science and Technology POLITEHNICA Bucharest

Gheorghe Grigoras, Technical University Gheorghe Asachi, Iași

Valentin Ilea, Politecnico Milano

Ioana Pisica, Brunel University of London

Dan Micu, Technical University of Cluj-Napoca

Description:

The energy transition represents a major challenge, but also a strategic opportunity for modern societies in the context of climate change, accelerated urbanization, and the urgent need for decarbonization. Cities, which are large consumers of energy and major generators of emissions, are becoming key focal points in the transformation toward a sustainable, smart, and resilient future.

The workshop aims to highlight the contribution of the academic environment to this complex process by presenting the latest research, technological solutions, and best practices in areas such as energy efficiency, integration of renewable energy sources, green mobility, network digitalization, and community participation in this process.

The event provides a platform for dialogue between r

esearchers, academics, students, public authorities, and industry, facilitating the exchange of ideas and the creation of synergies for future projects. The focus is placed on an interdisciplinary and collaborative vision, essential for building green and sustainable cities, in line with the objectives of the European Green Deal and the 2030 Agenda.

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Location:

Technical University of Cluj-Napoca, HUB-UTCN

Barițiu street, no. 4-6

Room BRD – 3rd Floor

Workshop 14 - Cybersecurity in the Context of Current Geopolitical Challenges

Host Institution:

Technical University of Cluj-Napoca



Coordinators:

Ioan CONSTANTIN, Orange Romania, Bucharest

Assoc.Prof. dr. Emil SIMION, National University of Science and Technology "Politehnica" Bucharest

Cornel PAMPU, CORNEL-Tec. Berlin, Germany

Diana MOLDOVAN, ASOS

Prof. dr. eng. Virgil DOBROTA, Technical University of Cluj-Napoca

Description:

Cybersecurity plays an essential role in protecting civil society, especially in the context of current geopolitical challenges. Cyberattacks increasingly target the civilian population, in addition to critical infrastructure (communications, energy, transport, healthcare) and public institutions. In today's fragile geopolitical environment, such attacks can be used as tools to influence public opinion or disrupt everyday activities within a community.

For society, cybersecurity ensures the continuous functioning of essential public services, prevents manipulation through online disinformation, and protects personal data. As attacks grow in both scale and sophistication, the scientific community is developing new technologies, methods of prevention, protection, monitoring, and ways to counter attackers.

Artificial intelligence (AI) can play a significant role in strengthening cybersecurity by analyzing large datasets, enabling early detection of attacks, supporting predictive analysis of existing geopolitical trends, and identifying disinformation.

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Room 3.01 – 3rd Floor

Workshop 15 - The Future of Romanian and European Microelectronics: Major Initiatives and the Contribution of the Diaspora to the Romanian Microelectronics Ecosystem

Host Institution:

Technical University of Cluj-Napoca



Coordinators:

Prof. dr. eng. D. Hc. Paul Svasta, National University of Science and Technology Politehnica of Bucharest

Dr. Adrian Dinescu, INCD IMT Bucharest

Mihai Lazar, PhD (HDR), Université de Technologie de Troyes

Prof. dr. eng. Ovidiu Aurel Pop, Technical University of Cluj-Napoca

Description:

Europe is at a pivotal moment where technological security, strategic autonomy, and digital transformation are converging, with microelectronics becoming an absolute priority. Recent European-level initiatives, such as the “Chips Act,” along with new directions within European funding programs, highlight the urgent need to rapidly develop advanced capabilities in semiconductor design and manufacturing.

Romania is an active participant in this collective effort. Through substantial allocations from the National Recovery and Resilience Plan (PNRR) for digitalization, and through its involvement in major European partnerships (KDT JU, IPCEI ME/CT), our country is defining a clear role in shaping the new European technological landscape. The Romanian microelectronics ecosystem includes high-performing research centers, an innovation-driven industry, and a valuable scientific diaspora that can play a key role in accelerating progress.

The workshop organized within

the SmartDiaspora 2025 conference aims to identify technological directions in which Romania, through close collaboration between local researchers and Romanian specialists abroad, can make meaningful contributions. The topics addressed cover both fundamental challenges in the field—such as new semiconductor materials or the limits of miniaturization—as well as emerging applications: cyber-physical systems, smart sensors, Edge AI, and 3D integration at the boundary between chip design and packaging.

Strengthening a competitive Romanian microelectronics ecosystem cannot take place outside international networks of expertise, and the diaspora represents a natural bridge for connectivity, knowledge transfer, and collaboration. Bringing together Romanian researchers from within the

country and abroad creates the conditions for launching joint projects, gaining rapid access to advanced infrastructure, and positioning Romania as an active partner in European innovation value chains.

The main objective of this workshop is to strengthen the links between Romanian research and the European innovation ecosystem, aiming to align with the European Union's strategic priorities and to consolidate an active and sustainable Romanian presence in next-generation microelectronics. The workshop also seeks to create a concrete framework for dialogue between academia, industry, and policymakers, in order to transform scientific potential into applicable solutions and real economic impact.

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Workshop 16 - Frontiers in Artificial Intelligence: Challenges and Perspectives

Host Institution:

Technical University of Cluj-Napoca



Coordinators:

Daniela Rus, Massachusetts Institute of Technology (MIT)

<https://www.csail.mit.edu/person/daniela-rus>

Radu Grosu, Vienna University of Technology (TU Wien)

<https://informatics.tuwien.ac.at/people/radu-grosu>

Ciprian Dobre, National University of Science and Technology POLITEHNICA of Bucharest

Rodica Potolea, Technical University of Cluj-Napoca

Tudor Cioara, Technical University of Cluj-Napoca

Adina Magda Florea, National University of Science and Technology POLITEHNICA of Bucharest

Sergiu Nedevschi, Technical University of Cluj-Napoca

Description:

The workshop aims to bring together researchers and experts from Romania and the diaspora to explore emerging directions in artificial intelligence (AI). The event gathers distinguished graduates of Romanian universities who currently hold prestigious positions in both academia and industry, at a time when Foundation Model technologies are radically transforming the way we interact with information, generate knowledge, and shape digital reality.

New research directions and opportunities are opening up:

- Natural language understanding and the ability of models to build complex, context-sensitive semantic representations;
- Coherent and adaptive content generation through multimodal approaches;
- Automated reasoning, combining statistical learning with formal logic (neurosymbolic AI);
- Intelligent autonomous agents and human-machine interaction;
- AI efficiency and sustainability under limited resources, with a focus on scalability;
- Explainability, accountability, and AI ethics, aiming to prevent bias and algorithmic discrimination;
- Other relevant research directions in the AI landscape beyond those already mentioned.

The workshop will provide a space for interdisciplinary dialogue, addressing key questions about the future of AI in research, society, and industry, as well as fostering knowledge exchange between Romania and the scientific diaspora, and contributing to the positioning of Romanian research within the global AI ecosystem.

Day I – Contemporary Dynamics in Artificial Intelligence: Theoretical Challenges and Emerging Applications

The first day is dedicated to discussing current research directions in the field of artificial intelligence. The presentations will address both the theoretical foundations of AI and its multidisciplinary applications, with a focus on the methodological, ethical, and technological challenges arising from the integration of artificial intelligence into contemporary society.

Day II – Artificial Intelligence in the National Research Ecosystem: Contributions from the Romanian AI Hub

The second day brings together works focused on projects and initiatives developed within the Romanian Artificial Intelligence Hub. It highlights scientific and technological contributions resulting from national collaborations, emphasizing the integrative potential of AI within national innovation and digitalization strategies.

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Workshop 17 - Hydrogen: A Versatile Energy Solution for the Future

Host Institution:

Technical University of Cluj-Napoca



Coordinators:

CHIRIAC Radu, National University of Science and Technology “Politehnica” Bucharest

ATANASIU Mirela, Clean Hydrogen Partnership

BURNETE Nicolae Vlad, Technical University of Cluj-Napoca

VARGA Bogdan Ovidiu, Technical University of Cluj-Napoca

Description:

The workshop “Hydrogen: A Versatile Energy Solution for the Future” aims to highlight the strategic role of hydrogen in the European energy transition, emphasizing both the policy and institutional dimension, as well as the technological and applied progress achieved at regional and national levels.

At the opening of the session, the Clean Hydrogen Partnership will be presented—an essential European Union initiative supporting the innovation and deployment of hydrogen-based technologies. In 2024, this public-private partnership allocated €154 million to 26 selected projects, also contributing through Project Development Assistance (PDA) to strengthening local capabilities in priority regions, including Cluj-Napoca.

The next section will address concrete examples of technological scaling through the European JIVE/JIVE2 project, which supports the deployment of fuel cell bus fleets. With 142 vehicles already in operation across 9 European cities and another 160 currently being introduced, the initiative demonstrates economic feasibility and the gradual reduction of costs for zero-emission public transport.

At the national level, the workshop will highlight the Cluj Hydrogen Valley initiative, an integrated project that includes the construction of Romania’s first green hydrogen production plant (installed capacity of 2.5 MW, production of over 1 ton/day). The hydrogen produced will serve a broad ecosystem that includes fuel cell buses, light vehicles, the future metropolitan train, and, in a later stage, the district heating system—directly contributing to the decarbonization of both the energy sector and urban mobility.

In parallel, the Technical University of Cluj-Napoca, through the Ro-HydroHub project, contributes to

the development of the scientific infrastructure needed for testing and validating hydrogen technologies. The investment of over €1.5 million supports the modernization of a specialized laboratory for testing fuel cells and hydrogen-powered engines, thereby facilitating the development of technical expertise, standardization, and workforce preparation for industry.

The workshop will bring together representatives from public authorities, industry, and academia to explore the convergence of European funding, technological demonstrations, local infrastructure development, and research excellence. These four strategic directions can transform hydrogen into a key pillar of a sustainable, flexible, and resilient energy system.

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Workshop 18 - Robotics Without Borders – Innovative Approaches in Industry, Medicine, and Services

Host Institution:

Technical University of Cluj-Napoca



Coordinators:

Prof. univ. dr. eng. Daniela TARNIȚĂ, Craiova University

Prof. univ. dr. eng. Daniel CONDURACHE, Technical University Gheorghe Asachi Iasi

Prof. univ. dr. eng. Erwin LOVASZ, Politehnica University of Timișoara

Prof. dr. Cristian MAHULEA, University of Zaragoza, Spain

Dr. Vladimir MARTINUȘI Senior lecturer, The Stephen B. Klein Faculty of Aerospace Engineering
Technion -- Israel Institute of Technology Haifa, Israel

Prof. univ. dr. eng. Doina PÎSLĂ, Technical University of Cluj-Napoca

Description:

In modern society, robotics plays an extremely important role in transforming the way people live, work, and take care of their health. From industrial automation to innovations in medicine and services, robotic technologies open new horizons and provide innovative solutions to current and future challenges.

Within the BRIDGE international workshop, participants will have the opportunity to explore the latest research in the design and applications of robotic systems, advanced control and manipulation techniques, as well as collaborative and service robots.

The workshop will focus on disseminating the newest results in the development of human–robot interfaces, vision systems, various types of mobile robots, bio-inspired structures, swarm robotics, and micro- and nanorobots designed for terrestrial, aerial, aquatic, or space environments.

In addition, BRIDGE will cover specific fields such as holonic manufacturing, medical robotics, bionic prosthetics, intelligent technologies for cognitive robots, process automation, integration of artificial intelligence, as well as the ethical, legal, and social aspects of their use.

BRIDGE presents current developments and technological advances in robotics through contributions from renowned experts from the Romanian diaspora, as well as other internationally recognized experts, addressing specialists and young researchers alike, with the aim of inspiring and motivating them to further contribute to innovation and development in industry, medicine, and services.

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PAPERS IN ISI JOURNALS

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RESEARCH PATENTS

LIST OF PATENTS

1. PATENT OSIM NR. RO132908 - B1/ 28.03.2025

TITLE RO/EN: Aparat si metoda pentru liniarizarea caracteristicii cod de comanda-frecventa de oscilatie al oscilatoarelor controlate numeric multibanda, si particularizarea aparatului pentru o bucla calata pe frecventa / APPARATUS AND METHOD FOR LINEARIZATION OF CONTROL CODE-OSCILLATION FREQUENCY CHARACTERISTIC FOR MULTI-BAND DIGITALLY CONTROLLED OSCILLATORS AND APPARATUS CUSTOMIZATION FOR A FREQUENCY-LOCKED LOOP

INVENTOR(S): KIREI BOTOND-SANDOR, TOPA MARINA DANA, GROZA ROBERT-GHEORGHE, FARCAS ADRIAN-CALIN

ABSTRACT: The invention relates to an apparatus and a method for the linearization of the control code-oscillation frequency characteristic for digitally controlled oscillators. According to the invention, the apparatus comprises: a digital frequency converter (23), a control algorithm (27) and a block (29) for linearization of the control code - oscillation frequency characteristic of a digitally controlled oscillator (20), where the mentioned block (29) may have multiple operation modes, namely: a calibration or activation mode and an ordinary operation mode, where the operation mode may be selected by a calibration or activation block (44) by controlling a multiplexer (42). In the calibration operation mode, the multiplexer (42) activates a signal path (43), all the control code values being successively applied on said signal depending on the minimum distance of the counting base, which may be performed with an accumulator (31) consisting of a register (36) and an adder circuit (35) and a constant (34) which maintains the minimum distance of the counting base, for each control code applied, the value for the signal provided by the frequency converter (23) and the value of the control code (41) being memorized in a table (38), the so-obtained table (38) reflecting the control code - frequency characteristic of the oscillator (20), and after setting the characteristic, a sorting core (39) arranges the content of the table (38) in the ascending order of the memorized frequencies and stores the result in a second table (40). In the ordinary operation mode, the calibration/activation unit (44) controls the multiplexer (42) to select a signal (45) coming from the second table (40).

2. PATENT OSIM NR. RO137477-B1 / 30.05.2025

TITLE RO/EN: Metodă de selecție a materialului compozit termoplast pentru alimentarea unei linii automate de termoformare / METHOD OF SELECTING THE THERMOPLASTIC COMPOSITE MATERIAL FOR FEEDING AN AUTOMATIC THERMOFORMING PRODUCTION LINE

INVENTOR(S): CIUPAN CORNEL, FILIP IOAN, CIUPAN EMILIA, CIUPAN MIHAI

ABSTRACT: The invention relates to a method of selection of the thermoplastic composite material for feeding an automatic thermoforming production line intended to manufacture pieces with complex surfaces, using technical-economical criteria. According to the invention, the method consists in separating the products in classes having a representative piece, conducting classic

studies using the finite element method, determining the minimum thickness of a wall, so that the requirements of safety and admissible deformation are simultaneously met for each admissible composite material, determining the cost of the representative piece for each available material and selecting the composite having the minimum cost and, for any other piece of the representative piece group, conducting FEA analysis only with the material selected for the representative piece and determining the wall thickness that satisfies the technical requirements, after which the number of overlapping layers is determined and the data are sent to the automatic thermoforming production line.

3. PATENT OSIM NR. RO134724-B1 / 30.07.2025

TITLE RO/EN: Dispozitiv pasiv de ventilare a unei baterii ce echipaaza un vehicul electric / PASSIVE VENTILATING DEVICE FOR AN ELECTRIC VEHICLE BATTERY

INVENTOR(S): MARIASIU FLORIN EMIL, VARGA BOGDAN OVIDIU

ABSTRACT: NOVELTY- The invention relates to a device for ventilating a battery of an electric vehicle, by automatically maintaining the temperature inside the battery housing within preset limits. According to the invention, the device consists of a coil spring (1) made of bimetallic materials, fixed in its lower part to the battery housing (2), by means of a mechanical system (3), and in its upper part to a mobile flap (4), by means of a fastening system (5) allowing it to rotate freely, the mobile flap (4) being connected to the battery housing (2) by a hinge (6) which allows it to describe a rotational movement leading to the opening and closing a ventilation slot, respectively.

4. PATENT JP7728904 -B2 / JP2024021948-A / 25.08.2025

TITLE RO/EN: Metoda pentru o masina termica cu de doua ori trei timpi / METHOD FOR A COMBUSTION MACHINE WITH TWO TIMES THREE STROKES

INVENTOR(S): KOPP ANDRE, BARAC-ZBIRCEA OVIDIU, BURNETE NICOLAE VLAD

ABSTRACT: NOVELTY - The method involves supplying fuel mixture to combustion chamber (14) of cylinder (10) during movement of piston (20) from second top dead center to first bottom dead center. The air-fuel mixture is compressed in the combustion chamber of cylinder during movement of piston from first bottom dead center to first top dead center, and burned during movement of piston from first top dead center to second bottom dead center. A gas mixture present in combustion chamber is compressed during movement of piston from second bottom dead center to first top dead center. The gas mixture present in combustion chamber is expelled during movement of piston from first bottom dead center to second top dead center. A portion of gas in combustion chamber is flushed out of combustion chamber when piston is passed through second bottom dead center. USE - Method for operating internal combustion engine (claimed) such as four-stroke engine and petrol engine of motor vehicle. ADVANTAGE - The process reduces emissions and fuel consumption compared to two-stroke engine, and increases the reliability and durability of engine. The process optimizes the operation of internal combustion engine in improved manner.

5. PATENT OSIM NR. RO135013- B1 / 30.09.2025

TITLE RO/EN: Dispozitiv de control activ al managementului termic al unei baterii ce echipa un vehicul electric / DEVICE FOR ACTIVE CONTROL OF THERMAL MANAGEMENT OF AN ELECTRIC VEHICLE BATTERY

INVENTOR(S): VARGA BOGDAN OVIDIU, MARIASIU FLORIN EMIL, BUIDIN THOMAS-IMRE-CYRILLE

ABSTRACT: NOVELTY- The invention relates to a device for the active control of the thermal management of an electric vehicle battery. According to the invention, the device consists of a mechanical system comprising a rack bar (3) driven by a stepper motor (4) and fixed to the housing (7) of the motor vehicle battery (2) by means of two guides (8), the linear movement of the rack bar (3) being transmitted to some toothed circular sectors (5) of venting orifices (1) on the battery housing (7), leading to the opening or closing, respectively, of some mobile slots (6) for the control of the hot air output to be discharged, the temperature control inside the battery being achieved by temperature sensors (9) which transmit information to a controller (10).

6. PATENT OSIM NR. RO138196- B1 / 30.09.2025

TITLE RO/EN: Compozit cimentos armat cu fibre pva și cenușă zburătoare ca înlocuitoare de agregate naturale și procedeu de obținere / COMPOSITE REINFORCED WITH PVA FIBERS AND FLY ASH AS SUBSTITUTE FOR NATURAL AGGREGATES AND PROCESS FOR ITS PREPARATION

INVENTOR(S): NEGRUTIU CAMELIA-MARIA, SOSA PAVEL-IOAN, CAMPIAN CRISTINA MIHAELA, POP MARIA-ILEANA

ABSTRACT: The invention relates to a cement composite reinforced with polyvinyl alcohol (PVA) fibers and fly ash as a substitute for natural aggregates and to a process for preparing the same. According to the invention, the cement composite consists of a quantity of type II cement ranging between 350...450 kg/m³, 70...90 kg/m³ silica powder, 450...500 kg/m³ fly ash from the local coal power plant, a quantity of 7...9 kg/m³ PVA fibers with a diameter of 0.20 mm and a length of 12 mm, with a relative density of 1300 kg/m³, a water amount of 192...248 kg/m³ and acrylic superplasticizer modified for concrete, in an amount of 4.5 kg/m³. The claimed process has the following stages: a. in a forced-draught mixer, the quantities of cement, fly ashes and fibers are mixed for 5 min., b. the water and the superplasticizer are mixed in a container and are progressively added over the mixture in the mixer, leaving them to be mixed for another 8 min., c. the so-obtained concrete is cast from the mixer into the forms, d. the concrete surface which is in contact with the atmosphere is coated with an insulating substance or with a polyethylene foil in order to prevent water evaporation, e. the concrete is dismantled after 24 h since casting, f. the concrete is kept in a climatic room at a temperature of 20°C and a relative humidity RH=50% until the age of 28 days.

7. PATENT OSIM NR. RO134940-B1 / 30.10.2025

TITLE RO/EN: Instrument medical automatizat cu mai multe ace inserate pe traiectorii paralele pentru brahiterapie interstitiala / AUTOMATIC MEDICAL INSTRUMENT WITH A PLURALITY OF NEEDLES INSERTED ON PARALLEL TRAJECTORIES FOR INSTERSTITIAL BRACHYTHERAPY

INVENTOR(S): BIRLESCU IOSIF, GHERMAN BOGDAN-GEORGE, BURZ ALIN DORIN, PISLA DOINALIANA

ABSTRACT: The invention relates to an automatic medical instrument with a plurality of needles inserted on parallel trajectories, for interstitial brachytherapy. According to the invention, the instrument consists of three modules: a module for insertion, charging and release of brachytherapy needles, a needle storage module and a needle tip guiding module, the first module comprising two rotary motors (1 and 2) where, when actuated, the first motor (1) transmits a rotary motion to a screw (6), using two belt pulleys (4) driven by a belt, one of the pulleys (4) being mounted on the shaft of the first motor (1) and the second one on the end of the screw (6) and the rotation thereof makes a nut (7) describe a linear movement along the axis of the screw (6), the movement of the nut (7) being limited by a slide (8) sliding along a rail (9), said slide (8) having mounted a mechanism for charging the brachytherapy needles (18), an element (10) being mounted directly onto the slide (8), the needles (18) being charged from the needle magazine by means of another element (11) which is so arranged that it is aligned with the groove of a sleeve (15) positioned within a tubular element (16) constrained and centered in a casing (12) by means of some bearings (14), and which is rotated by means of some cables (17) which pass through the casing (12) by two holes and are wound on a drum (5), the needles (18) being guided by an element (13).

8. PATENT OSIM NR. RO132965- B1 / 28.11.2025

TITLE RO/EN: Instrument medical automatizat pentru ablatie prin radiofrecventa / AUTOMATED MEDICAL INSTRUMENT FOR GUIDING NEEDLE SPECIFIC TO MEDICAL RADIO-FREQUENCY THERMAL ABLATION PROCEDURE, INSERTS ABLATION NEEDLE AND ACTUATES HANDLE OF ABLATION NEEDLE FOR INSERTING ANTENNAS IN ORDER TO CARRY OUT ABLATION PROCEDURE

INVENTOR(S): PISLA DOINALIANA, VAIDA LIVIU CALIN, BIRLESCU IOSIF, CRACIUN CRISTEA FLORIN, GHERMAN BOGDAN GEORGE, GRAUR FLORIN, PLITEA NICOLAE

ABSTRACT: NOVELTY - The instrument two degrees of freedom, one for inserting and retracting the ablation needle and the other for inserting and retracting the antennas from inside the needle cannula. The two degrees of freedom are of translation, guided by two slides mounted on a rail and actuated by some rotary motors, by screw-nut gearings. By mounting two elements for supporting the ablation needle on the two slides, the instrument is capable to insert the ablation needle and to actuate the handle of the ablation needle for inserting the antennas in order to carry out the ablation procedure. USE - Automated medical instrument for guiding needle specific to medical radio-frequency thermal ablation procedure.

9. PATENT OSIM NR. RO137263- B1 / 28.11.2025

TITLE RO/EN: Metoda pentru estimarea normalelor pentru camere cu informatie de distanta si de spectru color, folosind retele neuronale convolutionale / METHOD FOR AUTOMATICALLY CALCULATING NORMALS ON SURFACES LOCATED ON THREE-DIMENSIONAL SCAN CREATED BY CAMERAS WITH TIME OF FLIGHT (TOF) SENSORS, INVOLVES OBTAINING CLOUD OF POINTS BY COMBINING NORMALS IN THREE-DIMENSIONAL SPACE TOGETHER WITH DISTANCE INFORMATION OBTAINED FROM INPUT IMAGES

INVENTOR(S): MOLNAR SZILARD, KELENYI BENJAMIN, TAMAS LEVENTE

ABSTRACT: NOVELTY - The method involves using convolutional neural networks to calculate the normals from a cloud of points with spectral data, where the cloud is created by a ToF camera and stored as a depth image completed with spectral information. The depth and color spectrum image are taken over by the camera and a set of data necessary to train the neural network is created. The depth images are synchronized with the color spectrum images for training a feature pyramid network (FPN) type model. The FPN neural model for multimodal data is carried out. The neural model is exploited for the estimation of normals, coded in the RGB space, and a cloud of points is obtained by combining the normals in the 3D space together with the distance information obtained from the input images. USE - Method for automatically calculating normals on surfaces located on three-dimensional (3D) scan created by cameras with Time of flight (ToF) sensors.

10. PATENT OSIM NR. RO137574- B1 / 28.11.2025

TITLE RO/EN: Microinverter electronic pentru conversia energiei de la panouri fotovoltaice / ELECTRONIC MICRO INVERTER FOR USE IN E.G. PHOTOVOLTAIC PANEL, FOR EXTRACTING ELECTRIC ENERGY FROM RENEWABLE SOURCES AND INJECTING ENERGY INTO LOCAL/PUBLIC AC VOLTAGE SYSTEM, HAS STEP-UP CONVERTER DETECTING POINT OF MAXIMUM POWER OF PANELS

INVENTOR(S): TEODOSESCU PETRE DOREL, SUCIU VASILE MIHAI, SZEKELY NORBET CSABA, PACURARU ALEXANDRU MADALIN, BOJAN MIRCEA

ABSTRACT: NOVELTY - The micro inverter has a first stage comprising a set of DC voltage step-up converters. A second stage performs DC-to-AC voltage conversion, where the DC voltage step-up converter in an intercalated structure is utilized with three output voltage levels that are alternately utilized by a half-bridge inverter stage for connecting to an AC voltage system when a value of a voltage from a renewable energy source is low. The DC voltage step-up converter detects a point of maximum power of photovoltaic panels. USE - Electronic micro inverter for use in an equipment i.e. photovoltaic panel, for extracting an electric energy from renewable sources and injecting the electric energy into a local/public AC voltage system.



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