INESC TEC

ANNUAL REPORT

2024

INESC TEC

ANNUAL REPORT 2024

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TO THE INESC TEC COMMUNITY AND ALL OUR PARTNERS

As we present this Annual Report, we take a moment to reflect on a year that challenged us in many ways and reminded us, once again, of the importance of knowledge, collaboration, and public purpose. In 2024, global uncertainty remained a defining feature of our context, and even more so did the pace of technological change and the urgency of societal transformation. In this landscape, INESC TEC kept growing, evolving, and working with focus and determination. What you will find in this report is the expression of a collective effort guided by our strategic commitments and animated by the people who bring them to life.

Academic Excellence and Innovation

In 2024, we reinforced our academic mission by deepening our collaboration with higher education, attracting new talent, and expanding our scientific output. We supported more than 280 PhD and 450 master's students, increased our directly employed research team by 16%, and saw a 3.5% rise in scientific publications, with stronger representation in top-tier journals and conferences. We welcomed over 5,500 participants to more than 90 scientific events. Through our projects, we collaborated with more than 68 SMEs and 128 large enterprises. Our growing engagement in Horizon Europe helped consolidate our international position, with 91 ongoing Horizon 2020 and Horizon Europe projects, including 13 under our coordination. Our international embedment also grew through initiatives like the Visiting Researcher Programme, which received record interest, and through joint actions with partners like NARLabs in Taiwan. We were proud to see two major initiatives approved: INESCTEC.OCEAN, Portugal's Centre of Excellence in Ocean Research and Engineering, supported by the Teaming for Excellence programme, and POEMS, the national Competence Centre in Semiconductors. With a record 42 active patent families and five new licensing agreements, including three international, we further strengthened our innovation and technology transfer mission. In education, we launched the Executive Master in Cybersecurity with Porto Business School and took initial steps toward a new student engagement initiative. Throughout 2024, we also completed key stages of the national R&D Unit Evaluation. Moreover, we were proud of several recognitions this year, most notably the 2024 EARTO Innovation Award in the Impact Expected category for our iLoF technology platform.

Tackling the Toughest Challenges

Our work in 2024 continued to reflect a strong sense of responsibility to science and society. More than 300 active projects addressed Sustainable Development Goals, especially in affordable and clean energy, industry, innovation and infrastructure, good health and well-being, life below water, and life on land. We contributed to the Smart Specialisation Strategy for Northern Portugal and were involved in 12 Clusters and 11 CoLABs working at the interface of knowledge and application. Collaborating with the Linha de Saúde 24h initiative in Guinea-Bissau, we helped bring healthcare to remote areas through digital innovation. Together with NOS, COTEC, and Porto Business School, we also launched the Industry Club, which has already brought together 250 members to promote digital transformation. Our Foresight and Public Policy Office expanded its scope, and we co-organised the first CoARA National Chapters Forum and a European event on RDI leadership in the AI era, which led to the 7th edition of our Science & Society magazine. We also renewed contacts with PlanAPP and secured several digital technology-based projects for public administration in areas such as health, infrastructure, environment, and transparency.

Integrating Across Disciplines and Ecosystems

The best results come when disciplines, institutions, and ideas connect. In 2024, we continued to strengthen this integrated approach through our participation in European initiatives like EIT Manufacturing. We also joined new international networks, including BDVA, GAIA-X, IAM-I, INOMMOB, and RISC-V. We supported the initial steps of ten spin-offs under development. Through the ATTRACT DIH high-level event, we helped convene public and private actors around AI, HPC, and industrial innovation. Our position paper on FP10, our contribution to the EARTO Economic Footprint Study, and our strengthened

MARIA DA GRAÇA BARBOSA, ANÍBAL MATOS AND GABRIEL DAVID (top) **JOÃO CLARO, CLARA GOUVEIA, LUÍS SECA AND LIA PATRÍCIO** (bottom)

participation in the TTO Circle reinforced our voice in shaping research and innovation policy. We were strongly involved in the renewal of Portugal's long-standing transatlantic collaborations with U.S. universities and advanced strategic cooperation with Brazil and Taiwan.

Fostering a Talented Community

Our community is our strength. In 2024, we continued to invest in our people through the ongoing development of a new Human Resources model and a new merit-based progression path for early-career researchers. With concern for the future prospects of our researchers, we co-organised a European workshop on research careers with FCT and DG RTD. Through the FCT-Tenure initiative, we helped secure 20 new professorships in our Associate Higher Education Institutions, as well as 14 new research positions at INESC TEC, aligned with key scientific domains such as AI, quantum, bioengineering, robotics, and energy. We also broadened participation in international programmes. Our Diversity and Inclusion Commission continued its important work, and we promoted internal cohesion through events like INESC TEC on Foot, Volunteer Day, and the Laughter Yoga workshop, and launched a new mobile app to support our community. We were proud to be the only R&D institution participating in the national 4-Day Week pilot. We also hosted the first two public sessions of the INESC TEC Talks on Ethics in Research and Defence, helping us reflect more deeply on the responsibilities that come with research.

Pursuing Operational Excellence

Operational strength is what makes everything else possible. In 2024, we reached €33.6M in activity, a 17% increase, with strong contributions from PRR initiatives and European programmes. We delivered 106 direct contracts and supported national transformation agendas with more than €11.7M in public funding. We moved forward with the implementation of a new ERP system, invested in improved internal tools, and launched a new Reporting Channel for Corruption and EU Law Breaches. We also made progress in environmental responsibility by building internal capacity for sustainability certification. Infrastructure remained a priority, with work on the Leixões Blue Hub, missions with the Mar Profundo vessel, and support for offshore renewable testing.

Looking ahead, we do so with confidence in our community and our shared purpose. The achievements of 2024 are important milestones and also key foundations for future progress in a changing world where we remain committed to excellence, collaboration, and responsible innovation. We extend our sincere thanks to all who contribute to INESC TEC's mission, researchers, staff, students, and partners. Your dedication, talent, and trust drive us forward as we continue to build a more sustainable, inclusive, and impactful future together.

The Board of Directors

PURPOSE

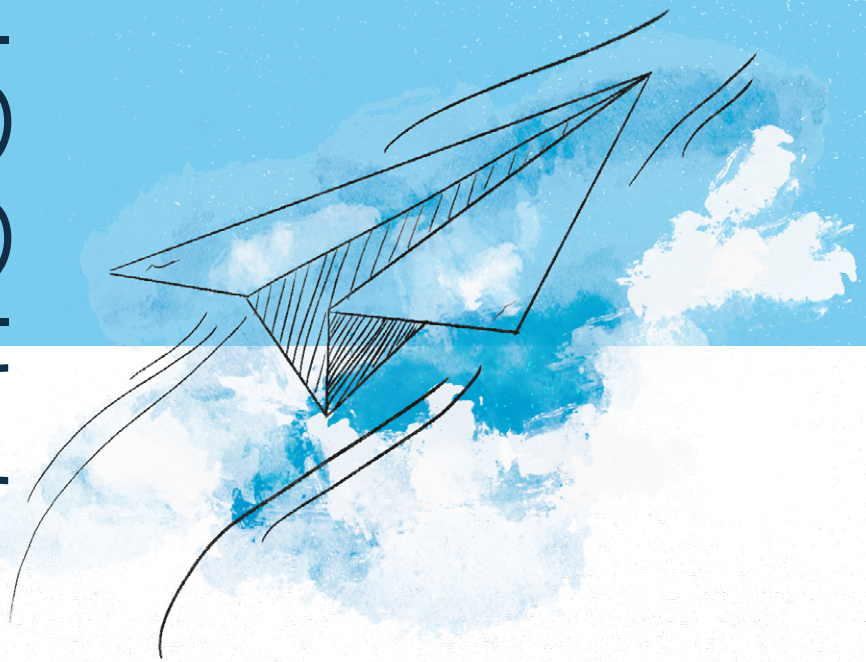
CREATING A FULFILLING AND SUSTAINABLE FUTURE THROUGH IMPACTFUL SCIENCE, TECHNOLOGY AND INNOVATION.

VISION

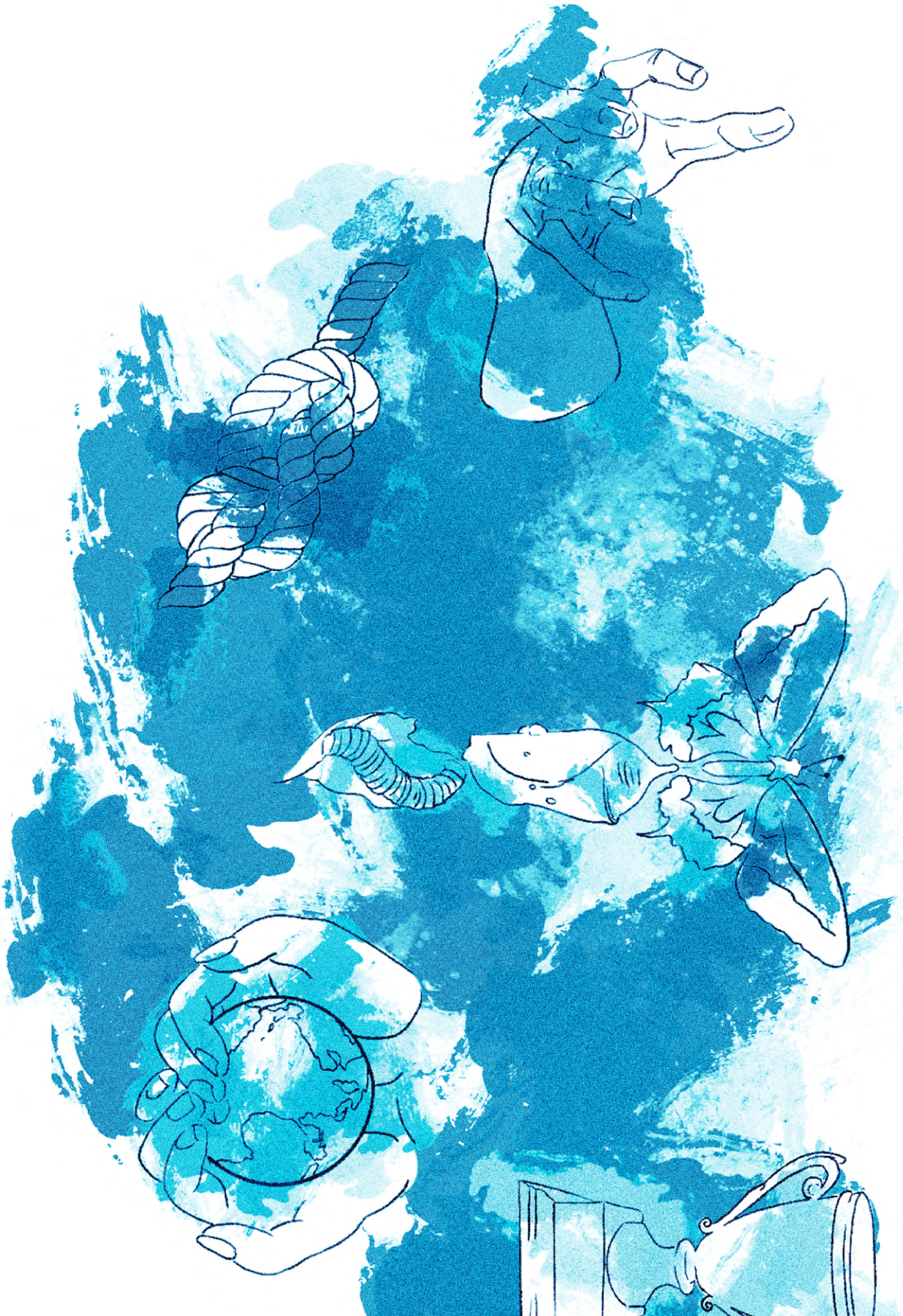
To be an inspiring and empowering force, driving the science and technology of digitally-enabled systems into overcoming society's challenges.

MISSION

As a free-thinking and diverse community, we take on bold science, technology, and innovation challenges, empowering talent, collaborative ecosystems, and public policies that make a difference in our economy and society.



VALUES



Rigour and Excellence

We thoroughly embed rigour in all our work, from ideation to realisation to evaluation.

Integrity, transparency and ethics

We are true to our principles and act with transparency and compliance with ethical standards.

Creativity, boldness, curiosity, and innovation

We explore new areas to advance science and innovation, with bold curiosity and accepting the risk of failing as intrinsic to creating new things.

Freedom to create and think

We are autonomous to pursue our intellectual agendas, free of unreasonable interference.

Collaboration

We share all our successes and challenges, with each other and our partners, as a cohesive community.

People-centredness and inclusion

We place people at the centre of all we do, as a community in which everyone is welcome and fully supported in their development.

3 2024 IN A REVIEW JAN – JUL

JANUARY

AI4Lungs, the **first European health project coordinated by INESC TEC,** was officially launched. Funded by Horizon Europe, this ambitious initiative unites 18 partners from 10 countries to develop cutting-edge, AI-driven tools aimed at enhancing the diagnosis and treatment of complex lung diseases.

FEBRUARY

We co-organised the first CoARA National Chapters Forum with FCT and Science Europe. Held in Porto, the event gathered 60+ stakeholders to advance.

Our PeT technology won second place at the IN3+ Award, securing a €250k prize. The solution balances privacy and transparency in digital services through advanced encryption and data management.

Modular-E earned second place at the World FIRA Forum, winning over 500 votes in the **"Best World Robot – Participants' Choice"** category, confirming its impact on precision agriculture.

MARCH

Once again, we reached the Patent Index 2024's Top 10, published by the European Patent Office (EPO) - a consistent position since 2017, reflecting our relevance in the national innovation ecosystem.

INESC TEC and UTAD strengthened their collaboration with a new protocol and the inauguration of the Human-Computer Interaction Laboratory (HCILab) at UTAD's School of Science and Technology.

APRIL

We **elected new Associative Bodies for the 2024–2026 term,** including a new Board of Directors. João Claro was appointed Chairman, succeeding José Manuel Mendonça after 19 years. Our new Board marked a renewed leadership cycle for the institution.

We also **signed our first R&D contract under France's Research Tax Credit (CIR) accreditation,** with the Humanitarian Logistics Cooperative, marking a milestone in the internationalisation of our applied research in humanitarian logistics.

INESC TEC, the University of Madeira, and ARDITI signed a protocol to establish a research centre in Madeira dedicated to the areas of marine science, energy, telecommunications, and computer graphics.

MAY

INESC TEC's Visiting Researcher Programme received a record number of applications, with over 90 international researchers seeking to develop their work at the institute.

We **joined the Industry Club** – an alliance with Porto Business School, COTEC, NOS, and the Kaizen Institute – **to promote digital transformation in Portuguese industry.**

We also **completed the first licensing of RECreation,** a software solution for managing and sharing electricity in renewable energy communities.

JUNE

Our spinoff Seedsight was selected among the **world's top 11 science-based spinoffs by the Nature Spinoff Prize.** Its platform analyses seeds and grains in under a minute, boosting food availability and reducing waste.

We co-organised the Brussels workshop "What is the Future of R&D Leadership in the Era of AI?", bringing together over 60 policymakers, industry leaders, and researchers to discuss Europe's AI leadership and integration into R&D systems.

JULY

INESC TEC **hosted the 33rd IAMOT Conference in Porto,** the first time the event was held in Portugal. Nearly 250 participants from 30 countries explored how human-centred technology management can drive sustainability.

We **joined the national GAPI network** through a protocol with the Portuguese Institute of Industrial Property (INPI), reinforcing our commitment to promoting and valorising intellectual property across the innovation ecosystem.

We initiated a **partnership with Critical Manufacturing** by signing a protocol to boost innovation in the industrial sector.

3 AUG – DEC

AUGUST

We **published the position paper "Shaping Europe's Future with FP10"**, outlining four key priorities for the next EU Framework Programme: strategic leadership, ecosystems, financing, and excellence in delivery.

INESC TEC **signed the consortium agreement for SEAGUARD,** a Horizon Europe project we coordinate to develop multi-domain technologies for enhanced maritime border surveillance.

SEPTEMBER

Nearly 300 members of our community gathered for the 2024 Strategic Meeting, **launching preparations for our 40th anniversary**. The event reflected on our legacy, strategic positioning, and future challenges in Portugal and Europe.

We participated in REPMUS (Robotic Experimentation and Prototyping with Maritime Unmanned Systems) 2024, the world's leading experimentation exercise with maritime unmanned systems, powered by NATO.

OCTOBER

INESC TEC received the EARTO European Innovation Award in the "Impact Expected" category, becoming the first Portuguese institution to win. The award recognised iLoF, our AI-powered photonics platform for personalised medicine.

We **launched an advanced training programme on industrial digitalisation**, in partnership with INEGI. The 36-hour course helps professionals plan and implement IoT, robotics, and data systems on the shop floor.

A **joint call for exploratory R&D projects with Taiwan's NARLabs** was launched, supporting short-term collaborations in AI, robotics, advanced computing, and green energy.

We **demonstrated a near-commercial mobile manipulator at Worten's warehouse**, as part of the EITM Moma-flex Project. The robot supports logistics operations like order picking and goods sorting.

NOVEMBER

INESC TEC **launched INESCTEC. OCEAN, Portugal's first Centre of Excellence in Ocean Research and Engineering**. Backed by over €30M from the European Union under the Teaming for Excellence programme and national funds, the centre will drive innovation in offshore energy, deep-sea monitoring, aquaculture, and the blue economy.

Seedsight won the 2024 Altice International Innovation Award, less than a month after being recognised by Crédito Agrícola. The **€75k prize** highlights its rapid grain-quality assessment platform for reducing food waste.

We **launched a new internal mobile app**, designed and developed in-house to streamline everyday tasks – such as clocking in – and improve employee well-being across the organisation.

DECEMBER

INESC TEC **held the first Energy Technology Open Day at FEUP**, with 150+ participants attending project pitches, demos, and a roundtable on smart grids, mobility, and renewables. A second edition is planned for 2025.

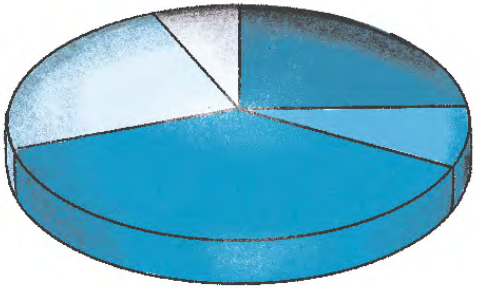
As leader of the HUB AZUL consortium, we **launched a €7.2M public tender for the main hangar at the Leixões Blue Hub**. Scheduled for completion in 2025, the facility will support ocean R&D and blue economy innovation.

We piloted our **Predico platform with Belgium's Elia Group**, enabling collaborative forecasting for offshore wind. The platform helps reduce prediction errors and supports more efficient grid integration of renewables.

OUR NUMBERS

OUR PEOPLE

TOTAL INTEGRATED HR
1135



Management, Administrative and Technical Employees
146

Employees
137

Academic Staff
9

Total Integrated PhD
403

Research Team
989

Employees
276

Academic Staff
188

Grant Holders and Trainees
454

Affiliated Researchers
71

OUR FUNDING

Total Activity
33.6M€ (+17%)

National Funding (Projects)
R&D Programmes – FCT
1.4M€

Cooperation Programmes with Industry
11.3M€

R&D Services and Consulting
National and International
2.9M€

EU Funding (Projects)
Framework Programmes
9.3M€

Cooperation Programmes – Other
0.6M€

Other (Projects)
Other Funding Programmes
0.8M€

OUR TECHNOLOGY

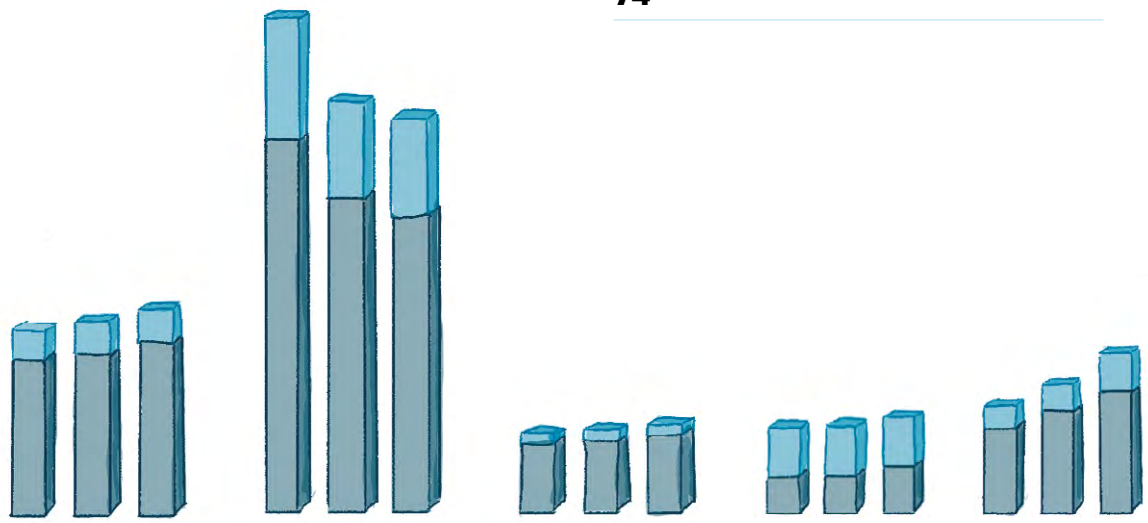
First Priority Patent Applications
9

First Patents Internationalisation
5

Spin-offs
1 Established
10 In development

Active patent families, including nine first-priority applications
42

Commercial Contracts (Licences, Options, Assignments)
5



OUR PUBLICATIONS

Indexed Articles in Journals
461

Indexed Articles in Conferences
482

Books (author)
3

Chapter/paper in books
21

PhD theses concluded by members of the Centre
45

Concluded PhD theses supervised by members of the Centre
74

OUR DISSEMINATION

Participation as principal editor, editor or associated editor in journals
109

Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)
59

International events in which INESC TEC members participate in the program committees
222

Participation in events such as fairs, exhibitions or similar
104

Conferences, workshops and scientific sessions organised by the R&D Centres
92

Participants in the conferences, workshops and scientific sessions organised by the R&D Centres
5596

Advanced training courses organised by the R&D Centres
19

OUR COMMUNICATION

Podcast and videocast
INESC TEC Science and Society

5 episodes

21 participants (hosts and guests)

More than **2 500** views on YouTube

Available on **Spotify**, **YouTube** and **BIP** INESC TEC Magazine

Podcast
INESC TEC Science Bits

11 episodes

12 guests

Available on **Spotify**, **YouTube** and **BIP** INESC TEC Magazine

Spotlight

6 editions on the Energy, Robotics, Artificial Intelligence, Smart Cities and Health topics

Available on
BIP INESC TEC Magazine

INESC TECWatch

New feature launched in 2024 to provide accurate information on current topics according to our scientific domains

4 episodes

11 guests

Available on **BIP** INESC TEC Magazine, **Substack** and **Medium**

INESC TEC BIP Magazine

More than **200** news published

Press Relations

640 news stories on national media

More than **30** different subjects

55 news stories on international media

Over **50 events** organised, such as:

INESC TEC Autumn Forum (around 500 people achieved), COARA, INESC Winter Meeting, The Shape of Energy to come

Social Media

5 social media accounts (LinkedIn, Instagram, X, Facebook and YouTube)

— Almost **1400** publications
— More than **1.8M** impressions
— Almost **50K** followers

Videos

More than **140** videos produced and disseminated

OUR MODEL

At INESC TEC, we follow a unique model that bridges scientific research, technological innovation, and public policy. Our activity begins with advanced research in eight scientific domains, driven by curiosity and a commitment to excellence. This knowledge is then translated into impactful innovation across six key application areas, where we collaborate with industry and society to develop solutions for real-world challenges. Ultimately, our work contributes to shaping public policies, reinforcing the role of science and technology in building a more sustainable, resilient, and inclusive future. This virtuous cycle – from knowledge generation to science-based innovation – defines who we are and how we act.

RESEARCH.

Artificial Intelligence

Bioengineering

Communications

Computer Science & Engineering

Photonics

Power & Energy Systems

Robotics

Systems Engineering & Management

INNOVATION.

TEC4 agro-food

TEC4 health

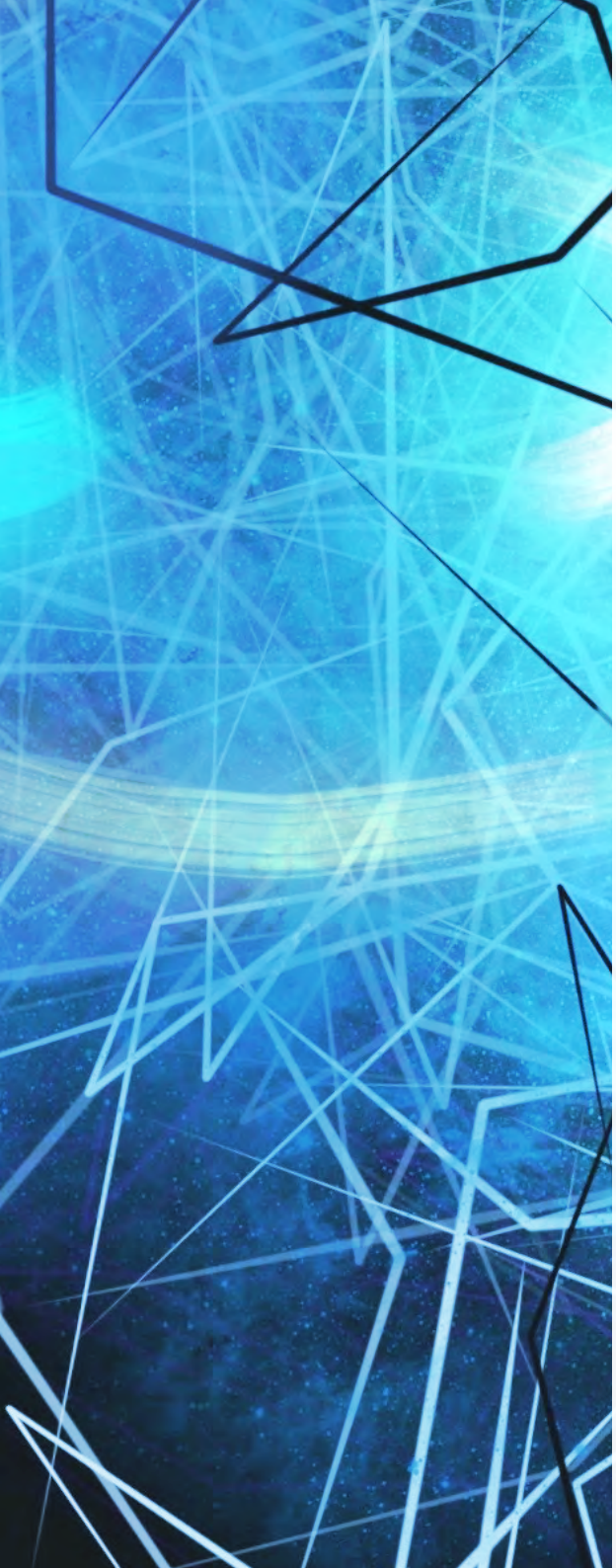
TEC4 energy

TEC4 sea

TEC4 industry

TEC partnerships

SCIENTIFIC DOMAINS



At INESC TEC, our commitment to scientific excellence translates into tangible impacts across diverse domains. In 2024, we continued to push the boundaries of knowledge, advancing research in eight key areas: Artificial Intelligence, Bioengineering, Communications, Computer Science and Engineering, Photonics, Power and Energy Systems, Robotics, and Systems Engineering and Management.

By covering the entire value chain of science - from fundamental to applied research - our work deepens understanding in these fields and strengthens the scientific foundations that support technological progress. Through collaboration and rigorous inquiry, we continue to expand the frontiers of science, fostering new perspectives and solutions with a lasting impact.

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Artificial Intelligence

Artificial Intelligence (AI) is shaping the future of multiple fields, from natural language processing to predictive modelling and decision-support systems. In 2024, our research advanced AI-driven language processing, biological data analysis, sports analytics, and environmental monitoring, reinforcing the impact on science, industry, and society.

This year, we developed new resources to enhance event extraction in Portuguese, introduced novel spatio-temporal predictive modelling techniques, and designed AI models capable of integrating multi-omics data for biological predictions. We also unveiled a transformer-based model for sports event simulation and leveraged AI for environmental protection, earning recognition for our work in detecting illegal landfill waste.

OUR MAIN ACHIEVEMENTS IN AI 2024

Advancing NLP for Portuguese

At SIGIR 2024, we introduced the corpus ACE-2005-PT, a Portuguese-translated and annotation aligned version of the ACE-2005 corpus, enhancing event extraction capabilities in this language.

Survey on Spatio-Temporal Modeling

Our paper "Spatio-Temporal Predictive Modeling Techniques for Different Domains: a Survey" was published in the prestigious journal ACM Computing Surveys, providing a comprehensive analysis of predictive modelling techniques across multiple domains.

AI for Biological Data Analysis

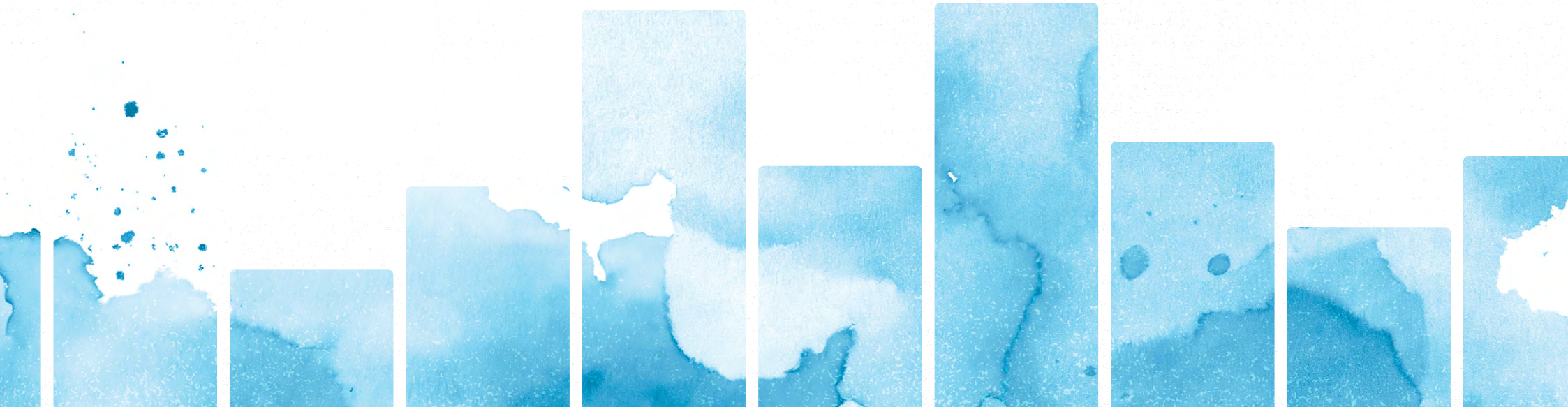
In a Machine Learning journal paper, our researchers introduced tissue-specific regression models for age prediction, integrating epigenomic, transcriptomic, telomere length data, and histological images from the Genotype-Tissue Expression project.

AI for Sports Analytics

Our Large Events Model (LEM), proposed in a Machine Learning journal paper, is a transformer-based model trained in in-game football events, enabling realistic event simulations and future action predictions.

Award-Winning AI for Environmental Protection

Our paper on AI-driven detection of illegal landfill waste received the PAIS Outstanding Paper Award at ECAI 2024 (European Conference on Artificial Intelligence) -recognising the impact on real-world environmental challenges.



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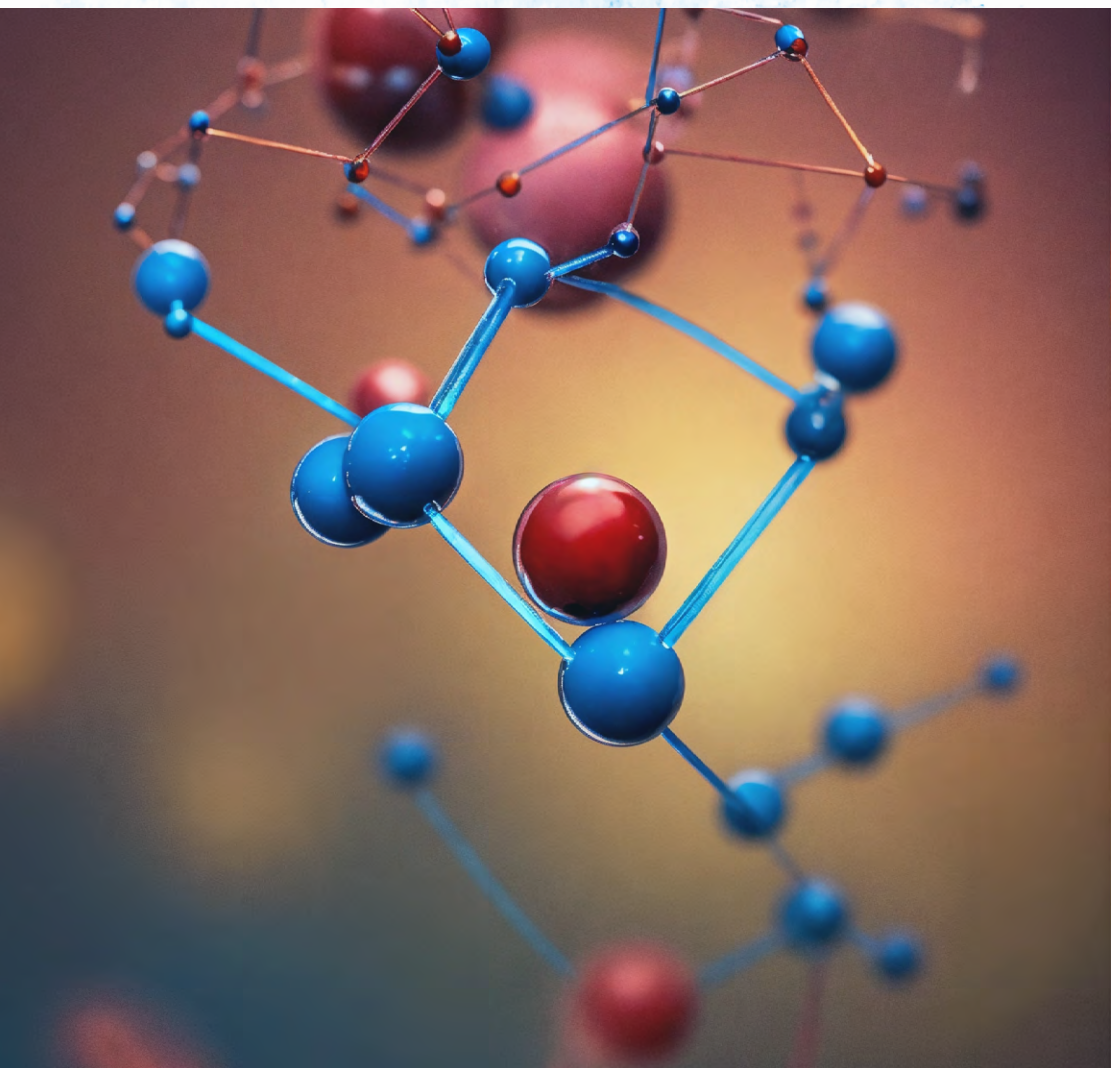
Bioengineering



Bioengineering bridges engineering and life sciences to develop innovative solutions that advance healthcare and biomedical technologies, while addressing environmental challenges. By combining advanced computational methods, biomedical imaging, biophotonics, and robotics, this field is driving progress in medical diagnostics, rehabilitation, and patient monitoring while also contributing to sustainability and industrial bioprocesses.

OUR MAIN ACHIEVEMENTS IN BIO 2024

Breakthrough in bio-micro & nano-photonics

We published a paper in the scientific publication "Nature Communications Engineering" and launched a patent – iLoF 2.0 - introducing a new method for extracting "bio-micro&nano-particles fingerprints" from laser backscattering photonic signals of bio-fluids (e.g. cell culture, plasma, CSF, etc.) with high sensitivity and robustness.

AI for gastrointestinal endoscopy

In liaison with multiple international entities, we co-authored the first practical guide (in high-impact Gut Journal) to standardise annotation and reporting of endoscopic images, promoting research and accelerating the clinical translation of AI tools.

Human motion analysis for movement-impair disorders

As part of a CMU-Portugal Affiliate Fellowship, our team – in collaboration with CMU researchers co-authored a paper on one of our key research areas in the bioengineering domain: movement video quantitative analysis and neurological impairment recognition (e.g. epilepsy seizures) in bed-bound scenarios both in hospitals and at home. This research received also the IEEE AI Research Hub Prize @GITEX Global 2024(the largest tech and startup exhibition in the world held in Dubai).

AI for Sports Analytics

Based on pathology slides imaging through a scalable AI combining mixed supervision, an efficient sampling strategy, and explainable predictions a ground-breaking method was published in the renowned journal Computers in Biology and Medicine that achieved high accuracy and robustness across multiple clinical datasets.

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Communications

Digital network communications are the backbone of the Internet and the vast array of services we rely on daily, playing a crucial role in enabling digital transformation. As connectivity demands continue to grow, advancements in wireless technologies, network intelligence, and radio sensing are shaping the future of communication systems.

At INESC TEC, our research in communications spans from next-generation wireless networks and reconfigurable intelligent surfaces to network security and edge computing. In 2024, we contributed to cutting-edge developments in human activity recognition using radio-frequency sensing and played a key role in strengthening international cooperation in 6G experimental infrastructures.

OUR MAIN ACHIEVEMENTS IN COM 2024

ANACOM URSI Portugal 2024 Award

Our study "Human Activity Recognition with a 6.5 GHz Reconfigurable Intelligent Surface for Wi-Fi 6E" received the ANACOM URSI Portugal 2024 Award, which acknowledges the best research work in radio science in Portugal. The research focused on human activity recognition (specifically gesture recognition) using radio-frequency data and machine learning. We developed a reconfigurable intelligent surface (RIS) to enable privacy-preserving sensing, offering an alternative to conventional image- or video-based approaches.

Strengthening EU-US Cooperation in Experimental Infrastructures Towards 6G

We co-organised, for the first time, a workshop at the European Conference on Networks and Communications (EuCNC & 6G Summit), titled "Strengthening EU-US Cooperation in Experimental Infrastructures Towards 6G." This initiative fostered transatlantic collaboration in the development of experimental infrastructures for 6G, reinforcing our role in shaping the future of wireless networks.

Energy-Efficient Flying Networks

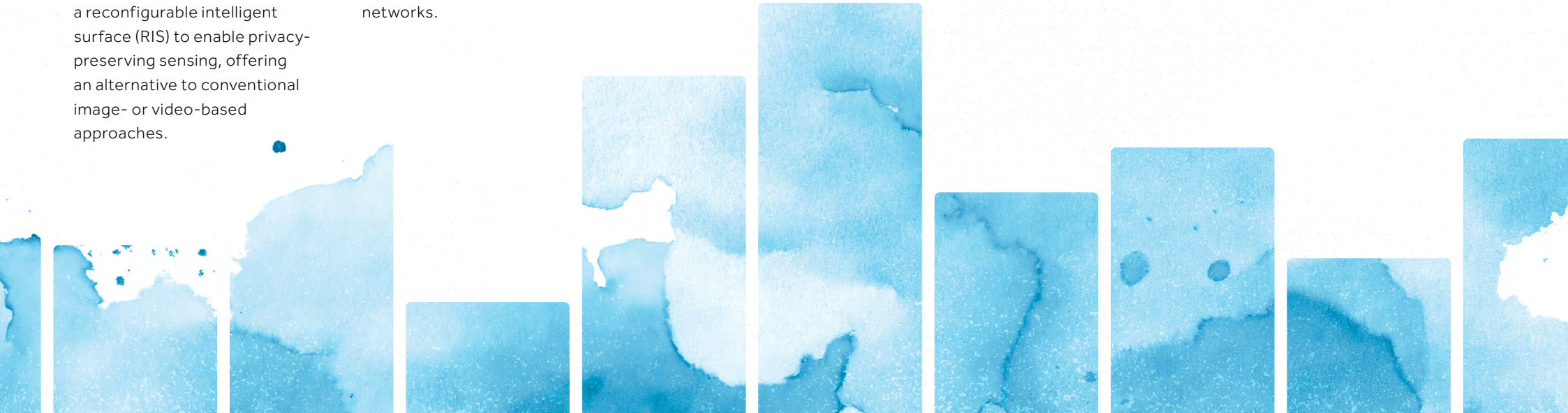
We proposed a sustainable multi-UAV placement algorithm that optimizes flight trajectories to reduce energy consumption while maintaining network performance. This research enhances the feasibility of long-duration flying networks and was presented at IEEE WiMob 2024 and published in the IEEE Access journal.

Advancing UAV-Based Autonomous Communications

We developed a Reinforcement Learning (RL)-based UAV positioning approach, optimizing network performance by dynamically adjusting UAV placement based on urban traffic and obstacles. This work contributes to more efficient, autonomous airborne networks and was published in the IEEE Access journal.

Enhancing Underwater Wireless Communications

We designed a multimodal underwater wireless communications manager, improving network performance by integrating multiple communication technologies to adapt to underwater conditions. The results were presented at IEEE MELECON 2024, contributing to more robust and efficient underwater communication networks.



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Computer Science & Engineering

Computer Science and Engineering (CSE) drives the continuous evolution of computing technologies, powering innovations across diverse sectors. As the demand for secure, efficient, and scalable systems grows, breakthroughs in hardware security, database management, and cloud solutions are paving the way for the next generation of computing.

At INESC TEC, our research in CSE covers key areas, including secure hardware for the Internet of Things, fault tolerance in storage systems, and cloud-based platforms for energy flexibility. In 2024, we achieved significant milestones with the development of LazyFS for data loss bug reproduction, advancements in IoT security with a publication in IEEE Communications Surveys & Tutorials, and the creation of GDBN, a cloud-based platform promoting energy flexibility.

OUR MAIN ACHIEVEMENTS IN CSE 2024

Hardware Security for the Internet of Things (IoT)

Our work on securing IoT devices led to the publication of the paper "Hardware Security for Internet of Things Identity Assurance" in IEEE Communications Surveys & Tutorials, a top-tier journal with an impact factor of 34. This paper addresses the critical need for robust security in the rapidly expanding IoT ecosystem.

LazyFS: A Tool for Fault Injection and Data Loss Bug Reproduction

In 2024, we further developed LazyFS, a tool designed to simulate faults and reproduce data loss bugs in storage systems, focusing on identifying the causes of data loss and validating protective mechanisms against said issues. Already in use by production systems like etcd, MongoDB, and PostgreSQL, LazyFS is helping improve the reliability of critical systems. This research was presented at the International Conference on Very Large Databases (VLDB), a major conference in database systems.

GDBN – A Cloud-Based Platform for Energy Flexibility

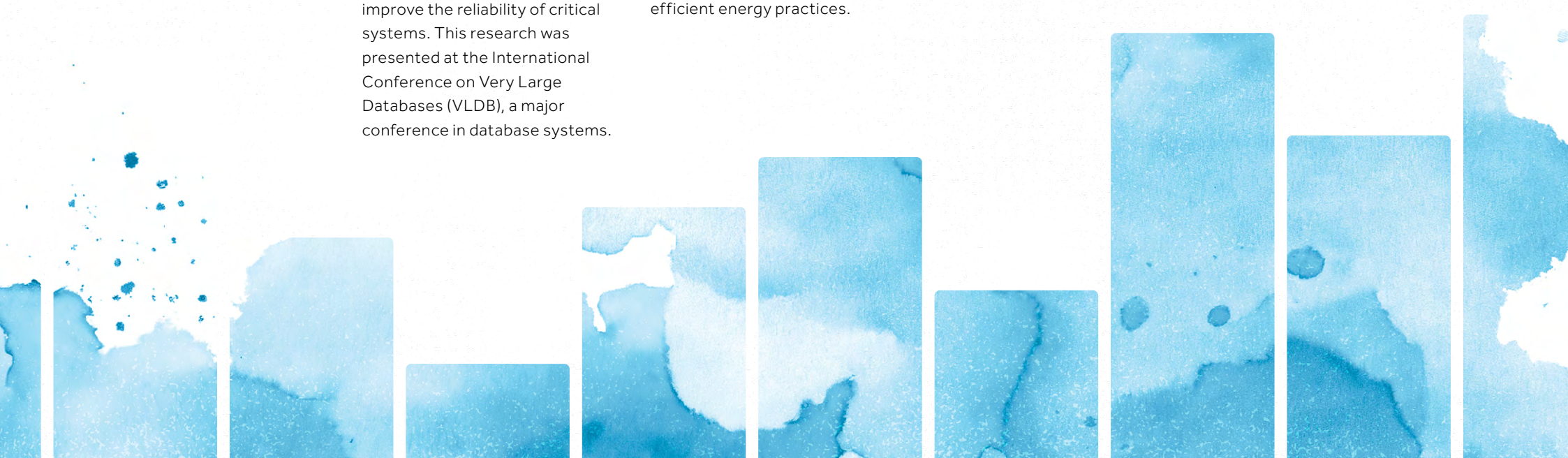
Our team developed the GDBN (Grid Data and Business Network) platform, a cloud-based solution that connects stakeholders in the energy sector to create new business services for energy flexibility. By enabling organisations of all sizes to actively engage in the flexibility value chain, GDBN fosters more sustainable and efficient energy practices.

Inno4Vac (IMI2/EU) project

Our team's key contribution has focused on the architecture, design and implementation of novel architectures using federated repositories and privacy-preserving mechanisms to support federated machine learning.

ICSE'24

Some of our team members played a key role in organizing major conferences like the top-ranked conference on the topic, the 46th International Conference on Software Engineering (ICSE'24), and others such as EuroPLoP'24, XP'25, and QUATIC'24.



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Photonics

Photonics plays a key role in addressing some of the most pressing technological challenges across various fields, including healthcare, telecommunications, and computing. By integrating signal processing and sensor fusion, photonics is driving innovation, revolutionising industries and unblocking new possibilities.

At INESC TEC, our research focuses on innovative applications, from quantum simulations to advanced sensing technologies. In 2024, we made significant contributions, including the deployment of a world-unique experimental setup for analogue quantum simulation and the development of cutting-edge sensors for methane, hydrogen, and concrete structure monitoring, and the development of new spectral imaging methodologies for mining and recycling industry.

OUR MAIN ACHIEVEMENTS IN PHT 2024

Analog Quantum Simulation of Quantum Fluids

We developed a groundbreaking experimental setup for analogue quantum simulation of quantum fluids using nonlinear optics. This setup, featuring unparalleled tunability and optical reinjection capabilities, was published in Physical Review Letters, one of the most prestigious journals in physics.

Methane and Hydrogen Sensors

As part of the PRR ATE WP9 initiative, we are developing advanced fibre optic sensors for remote detection in high-risk areas. For methane, a prototype has been built and is undergoing laboratory testing, using gas absorption bands for highly accurate quantification. For hydrogen, we are exploring different nanofabrication approaches to create multilayered structures for optimised detection, with a prototype currently in development for system validation and optimisation.

Sensors for Monitoring Concrete Structures

Under the PRR ATE WP7 initiative, we have developed fibre optic sensors combined with specific materials to monitor humidity and temperature in various environments, including inside concrete structures. These sensors are designed for floating systems, allowing real-time monitoring of the curing process during manufacturing and assessing the long-term seal integrity of these structures in oceanic environments.

New spectral imaging methodologies for robust performance in industrial environments

The combination of multiple spectral imaging modalities (e.g., LIBS, Raman, Hyperspectral) with automation and innovative processing methodologies enables the development of robust solutions that perform reliably in harsh industrial environments. A recently patented Spectral Knowledge Distillation method, which facilitates knowledge transfer between spectral systems and automated training, is driving innovative approaches in industry-related projects. Recently validated applications range from new tools for online characterization of cork stoppers to real-time detection of contaminants in glass and wood recycling.

INESC TEC

Power & Energy Systems

Power and Energy Systems research focuses on supporting the full decarbonisation of society, a key objective for the EU, by integrating renewable energy sources, energy storage and improving energy efficiency. Our work aims to create sustainable, efficient, and resilient energy systems that meet future demands while reducing carbon emissions.

At INESC TEC, our contributions to Power and Energy Systems in 2024 span key areas, including dynamic security assessment, offshore power plants optimisation, hydropower flexibility, and innovative energy management solutions.

OUR MAIN ACHIEVEMENTS IN PES 2024

Evolving Symbolic Model for Dynamic Security Assessment (DSA)

A novel methodology for generating highly interpretable data-driven models for dynamic security assessment (DSA), namely in system security classification and the definition of preventive actions. It revisits the classical simulated and expert systems, combining them for a data-driven evolution of a symbolic model template, enabling different cooperative learning schemes between humans and AI. Our work was accepted for publication in the Journal of Modern Power System and Clean Energy, and we had a patent requested in Portugal.

Optimisation Methods for Offshore Hybrid Power Plants

We developed optimization-based methods for the optimal sizing and energy management of offshore hybrid power plants, incorporating (a) uncertainty and its dependency structure and (b) multiple conflicting objectives. Our work enables offshore power plants to maximize energy delivery to the grid while, with power-to-x (e.g., including storage) integration, also reducing overall power fluctuations. We had this work published in Journal of Cleaner Production and Applied Energy.

Hydropower for Frequency Regulation Services

A comprehensive assessment of the large-scale deployment of hydropower on the provision of frequency regulation services, when equipped with extended flexibility solutions that were developed and/or tested within the scope of the XFLEX HYDRO project. Our main findings highlight the potential of hydropower inertia and of adopting a variable speed technology for enhancing frequency stability while contributing to a better understanding of the role of hydropower plants in future power systems. We published our work in the International Journal of Electrical Power & Energy Systems.

Optimisation-Based Virtual Power Plant (VPP) Dispatch with Power-to-Hydrogen (P2H)

We proposed an optimization-based approach for Virtual Power Plant (VPP) dispatch integrates Power-to-Hydrogen (P2H) with full AC Optimal Power Flow (OPF), optimizing green hydrogen use across CHP, industry, and local consumers. Our solution reduces electricity costs, boosts self-sufficiency, and enhances renewable integration. The model accounts for grid constraints, seasonal variations, and economic feasibility, demonstrating P2H's role in balancing supply demand and improving grid stability. We published our work in the International Journal of Hydrogen Energy.

Transmission System Operator (TSO) Settlement Scheme for Frequency Containment Reserve Cooperation

We developed a novel TSO settlement scheme for Frequency Containment Reserve cooperation in Europe's integrated electricity market. Our proposed approach ensures a fairer distribution of costs among TSOs without altering market clearing rules or Balancing Service Providers' revenue settlement. It addresses inequities in the current settlement mechanism, which may result in negative costs for some TSOs, by prioritizing local cost allocation before redistributing cross-border expenses. We tested the solution using real market data from 2019–2022, and this new scheme demonstrated improved cost equity among TSOs. Our work was published in Utilities Policy.

INESC TEC

Robotics

Robotics is transforming industries by providing innovative tools and paradigms that enable robots to operate in complex, dynamic environments, often alongside humans. Our research focuses on developing advanced robotics systems that enhance autonomy, safety, and efficiency across various applications.

At INESC TEC, our 2024 contributions to robotics have driven significant advancements in underwater mapping, path planning algorithms, and agricultural robotics.

OUR MAIN ACHIEVEMENTS IN ROB 2024

Underwater Space Mapping Using Sonar Data

We developed a technique for mapping underwater spaces through open-space modelling with sonar data. This method allows for the iterative construction of 3D underwater maps by interpreting real-time data collected from sonars. This work led to a paper presented at the ICRA 2024 conference in Japan, one of the most prestigious robotics conferences worldwide.

Direct-DRRT Path Planning Algorithm*

We proposed a novel path planning algorithm called Direct-DRRT*, which optimises path length, reduces memory usage, minimises execution time, and improves performance in 3D environments. Our results demonstrate that this algorithm outperforms traditional RRT-based methods, producing more efficient paths in complex, dynamic environments. This advancement is crucial for robotics, particularly in 3D path planning, where traditional methods often generate unnecessarily long or jagged paths.

AgroBPP-CA: Collision Avoidance for Agricultural Robots

We developed AgroBPP-CA, an advanced collision avoidance software for agricultural robots. Using an iterative approach with parametric Bézier curves, AgroBPP-CA ensures safe and efficient navigation through complex environments. By factoring in terrain inclination and the robot's centre of mass, this software enables adaptive obstacle avoidance, improving the reliability and autonomy of agricultural machinery, even in challenging off-road conditions.

Synthetic dataset generation framework for robotic bin-picking research

Our work addresses the challenge of generating labelled synthetic data for large-scale robotic bin-picking by introducing an automated framework for easy, customized data creation with precise labels derived from CAD models. The framework utilizes a photorealistic rendering engine integrated with physics simulations to reduce the gap between synthetic and real-world data. The models trained with the synthetic data produced by this framework demonstrated an impressive average accuracy of 88%, which is comparable to models trained on real-world datasets.

A hybrid imaging system for high-precision 3D inspection

Of submerged critical structures, validated through controlled trials and real-world deployment, achieving millimetric accuracy in volumetric reconstruction of sacrificial anodes and revealing biofouling layers, demonstrating its potential to enhance underwater vehicle situational awareness for offshore maintenance. Our work was published in Elsevier's Ocean Engineering.

INESC TEC

Systems Engineering & Management

Research in Systems Engineering and Management (SEM) aims to enhance decision-support systems, human-centred operations, intelligence, technology management, and innovation. In 2024, our work contributed significantly to multiple domains, including the circular economy, public transport management, customer preferences in home delivery, service ecosystem dynamics, energy management, and mobility pricing. These advancements translated into international publications, theses, and collaborative research projects, and reinforce our commitment to advancing decision support, optimisation, and management strategies across diverse sectors, from transportation and energy to supply chains and circular economy models.

OUR MAIN ACHIEVEMENTS IN SEM 2024

Circular Economy Research in Supply Chains

As part of the SoTecIn Factory, ReSChape, and Reneé EU-funded projects, our research in Supply Chain and Collaborative Networks and Technology Management in Industry explored various aspects of the circular economy. In 2024, this research led to five completed master's theses and multiple publications in international journals and conferences, focusing on partner relationships in supply chains and technology adoption in circular economy models.

Book on Public Transport Management and Sustainability

We contributed to the publication of the book "Sustainability and Social Inclusion in Public Transport Management: Decision Support Techniques", which compiles research from the opti-MOVES project (funded by FCT). This book highlights decision-support strategies for enhancing sustainability and accessibility in public transport.

Customer Preferences in Attended Home Delivery

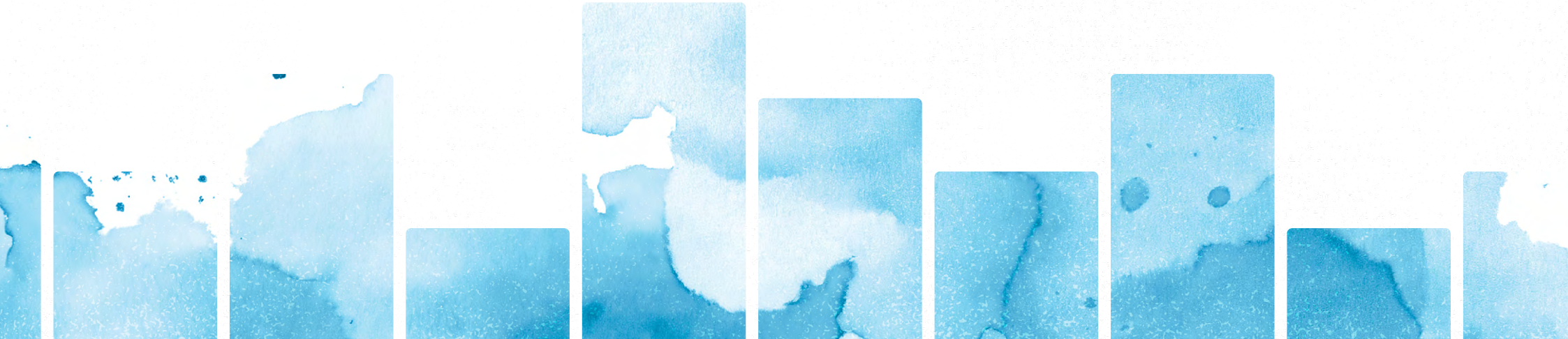
Our study "Customer Preferences for Delivery Service Attributes in Attended Home Delivery" (published in Management Science) analysed consumer behaviour in home delivery services requiring in-person reception. Findings show that, beyond speed, precision and availability are crucial factors. Additionally, customised time slots can increase revenue by approximately 9%.

Service Ecosystem Dynamics

Our research in service ecosystems, published in the Journal of Service Management, introduced a typology for understanding ecosystem interactions and transformations. The study identifies key dynamics that drive innovation and value co-creation, emphasising the importance of continuous adaptation in response to contextual changes.

Optimizing Multi-Attribute Pricing for Carsharing

Our work in mobility pricing, published in Transportation Research Part E, proposed an optimisation model for carsharing pricing plans with time- and location-dependent rates. Findings indicate that adapted pricing based on user profiles improves profitability compared to fixed-rate models. Additionally, sensitivity analysis highlights the impact of key parameters on customer choices and overall revenue.



INNOVATION AREAS

We leverage impactful science to develop innovative solutions, incorporating advanced technologies and fostering cross-sector knowledge transfer. Through our strong commitment to technology and knowledge transfer, we contribute to the qualification of the business sector, supporting companies in integrating cutting-edge scientific advancements into their operations.

We promote a market-driven innovation process, aligning our efforts with the priorities of regional and national innovation agendas. By mapping market needs with our scientific and technological expertise, we address sector-specific challenges in Agro-Food, Energy, Health, Industry, and the Sea. Our goal is to enhance the competitiveness of businesses by accelerating modernisation and supporting the adoption of digital solutions.

Moreover, we actively foster the circulation of knowledge, strengthening the link between research and industry to drive sustainable economic growth. In this section, we highlight our sectoral innovation outcomes.

5.2.1.

INESC TEC

TEC4 agro-food

Our mission is co-creating the digital (r)evolution in agro-food and forestry through research and technological development in digital technologies and robotics. In this sector, we have as main application areas Smart (digitalisation) Precision (“right time, right treatment, right amount, right place”) Agriculture and Forestry, Food Security and Bioeconomy. We may act in all phases of the smart precision agriculture/forestry cycle, from variability measurement to action with variable rate technologies (VRT), encompassing data analysis and decision and prescription map. We provide innovation services of advanced consultancy and research and technological development in the mentioned application areas.

OUR MAIN CONTRIBUTIONS TO AGRO-FOOD IN 2024

Our agricultural robot and technology acknowledged beyond borders

We participated in World FIRA 2024, the leading international event for agricultural robotics and autonomous solutions – reaching second place in the Best World FIRA Robot category with the Modular-E robot.
Our Modular-E – a modular robot that can carry several tools capable of performing different tasks, individually or simultaneously, with significant precision levels in agricultural contexts - was also awarded the Agriculture Innovation Award 2024, worth 10k€.

Our technology won first place at the Entrepreneurship and Innovation Awards

Pocket-Vet, winner at the 11th edition of the Crédito Agrícola Entrepreneurship and Innovation Awards, is a laboratory system based on smart spectroscopy. As it does not use reagents or require laboratory conditions, it enables the analysis of blood and milk on-site, allowing for early detection of inflammatory conditions and the health status of animals, with direct implications for milk quality. This is one of the first Point-of-Care applications in precision livestock farming.

We kicked off the Sensewater project

Provision of advanced consultancy services to TIS – Systems for the development of humidity sensing in the transport of biomass and eucalyptus wood.

We internationalised patent (PCT) SHARPMETRIX

A precision agriculture system for detailed productivity mapping, with flexibility for producing and analysing a wide range of metrics.

We organised the webinar series “Sustainable Energy Transition in Agriculture”

Under the Tools4AgriEnergy project, five sessions, five themes; over several months, in partnership with INIAV, and supported by the Tools4AgriEnergy project partners. The webinar series addressed topics like the introduction of photovoltaic systems in agriculture, robotics and IoT, energy efficiency and circular economy, as well as new business models and decarbonisation.

5.2.2.

INESC TEC

TEC4 energy

In line with the objectives and directives of the European Energy Policy, our focus is to contribute towards the decarbonization and the electrification of our society, supported by innovative digital technologies, enabling the secure integration of renewable energy sources and other low-carbon technologies, the implementation of a smarter and more resilient grid, and a fully integrated and user-centric energy market. We provide technical and technological support through R&D development, training and capacity building activities, fostering a competitive energy business ecosystem while supporting the implementation of national energy policy priorities.

OUR MAIN CONTRIBUTIONS TO ENERGY IN 2024

We licensed RECreation, which will be used by Capwatt

RECreation is a digital platform for the management of collective self-consumption and renewable energy communities. The platform features a human-machine interface that provides information on the self-sufficiency of energy resources, shared energy, emission reductions, and the economic savings of communities and their members. This solution also provides a billing guide that details the internal compensations resulting from energy settlement between the members of the energy community.

We developed the open-source Predico platform – a data market collaborative forecasting platform

Predico is a platform developed through the H2020 Smart4RES project and INESC TEC's seed project VALOREM. It enables the creation of analytics markets for renewable energy forecasting by leveraging data valuation and market-clearing mechanisms. Predico is designed to facilitate data and knowledge exchange among diverse data owners, addressing key barriers to data sharing and fostering collaborative analytics. In December 2024, a pilot project was launched in collaboration with Elia Group, involving more than 20 analytics service providers.

We launched EVFlex – a product outcome from the EU-funded H2020 InterConnect project, with a pilot at SONAE MC

EVFlex combines machine learning and operations research to define dynamic tariffs for electric vehicles charge, taking the form of discounts in a supermarket loyalty card. It combines multiple information such as photovoltaic generation forecasts, prices from the wholesale market and charger occupancy forecasts and defines day-ahead tariffs. The pilot is building data-driven behavioral models based on the reaction to these incentives.

Network renewable energy hosting capacity study

Assessment of the hosting capacity of the national power grid for integrating renewable energy sources to support industrial consumption, specifically for the production of hydrogen and ammonia. Service provided for Madoqua Renewables Holding.

We organised the "Shape of Energy to Come" and "Energy Technology Days" events

Mobilising more than 480 participants from the national energy sector to discuss the challenges and technologies to respond to the complexity of the future energy system and to disseminate our key technologies for future grids.

5.2.3.

INESC TEC

TEC4 health

Our main goal is to develop innovative science-based technologies and services to provide better care and improve health for all. We induce a market pull drive into R&D, targeting all the value chain actors and processes in the healthcare and well-being sectors. We address market challenges such as active and healthy ageing, personalised medicine and biomarkers, pharmacology, medicines and advanced therapies, digital health and medical technologies, and management and logistics in healthcare.

OUR MAIN CONTRIBUTIONS TO HEALTH IN 2024

We have an ongoing text processing solution in operation at IPO Porto and a patent application

We have been focusing on research in clinical text natural language processing (LLMs), particularly for automated labeling, data analysis, and decision support. Automatic annotation provides structured data for clinicians, reducing workload and improving outcomes. The solution in operation at IPO Porto led to a patent application submission for an annotation system for lung nodules in CT imaging, leveraging language-vision models, a promising avenue in this field.

We developed a free healthcare telephone service for the population of Guinea-Bissau

We collaborated with the NGDO VIDA, the Ministry of Public Health of Guinea-Bissau (MINSAP), Camões I.P., the United Nations Development Programme in Guinea-Bissau (UNDP-GB) and the United Nations Children's Fund (UNICEF) in Guinea-Bissau in the creation of the 24-hour Health Line, by developing a computer systema to support this free service. This is the first telephone healthcare contact centre in Guinea-Bissau, completely free of charge, operating 365 days a year, 24 hours a day.

Our innovation connecting AI and health was awarded beyond borders

We received the award for Innovation in Artificial Intelligence (AI) at the IEEE AI Research Hub competition – organised by IEEE Entrepreneurship and the IEEE Region 8 Entrepreneurship Committee, due to our research to classify epileptic seizures filmed with AI-powered 3D video technology.

We showcased a range of health-related technologies

At Encontro Ciência 2024, we featured wearable biomedical devices, AI solutions for medical imaging and clinical text processing, and a smart trap for agricultural pest monitoring, demonstrating our multidisciplinary approach to healthcare and the "One Health" concept.

We bridge technology and healthcare while fostering new connections with industry stakeholders

At the Atlantic Health Wellness Summit, we contributed to discussions on the modernisation of pharmacies and the adoption of advanced digital solutions in healthcare. The event was an opportunity to explore how cross-fertilisation from other sectors can drive innovation in health, with a focus on AI-driven automation, logistics optimisation, and IoT applications for inventory management.

5.2.4.

INESC TEC

TEC4
industry

In this sector, we address market challenges such as digital transformation, decarbonisation, sustainability, and circularity. Our main goal is to create innovative science-based digital products and services for industry, contributing to the Portuguese economy's resilience and growth. We facilitate the creation of an innovative, responsive, and sustainable industry by promoting the convergence of multidisciplinary knowledge and differentiating skills of an organisation with decades of experience in research and development of unique solutions.

OUR MAIN CONTRIBUTIONS TO INDUSTRY IN 2024

We advanced TestBed 5G NOS

Regarding infrastructure services, 5G pilots took place to validate the use of 5G mobile communications for industrial applications, including remote video capture over 5G for cloud-assisted computer vision applications, and asset localisation and tracking through active tags and IoT portals with 5G support. For instance, the Flowbotic TestBed assessed the feasibility of 5G for teleoperation of autonomous mobile robots in an industrial environment, requiring latencies below 150ms. The performance of 5G was compared with Wi-Fi and 4G networks. The tests showed that teleoperation is possible on all networks, but none achieved latency below 150ms, highlighting the need for technological advancements for ultra-low latency scenarios.

We developed explainable AI under PRR PRODUTECH R3

We incorporated explainability techniques into computer vision-based quality control approaches. The main objectives were to continuously estimate the quality of vision models during their use in production (instead of benchmarks during the training process), as well as to further characterise defects found, particularly their area and shape (instead of just using bounding boxes, as is commonly done with these models).

We collaborated with PortugalFoods, developing a Roadmap for Decarbonisation in the Agri-food Sector

The project defined a strategic roadmap for the digitalisation and decarbonisation of the agri-food sector, focusing on technologies like IoT, AI, and robotics for efficiency and sustainability. The analysis revealed uneven digital maturity levels, with emerging technologies still being underutilised. This endeavour focused on efficient integration through IoT and automation, despite current investment and training barriers. The transition requires digital infrastructures, continuous training, and collaboration to boost sector competitiveness.

We participated in the development of a Twin-Transition (Digital and Green) Maturity Assessment model

Applied to 4 SME companies in the mechatronics sector, which included 4 sub-dimensions in the Circularity component (R-Strategies, Energy, Materials and D-Strategies) and 3 sub-dimensions in the Sustainability component (Economic, Environmental and Social).

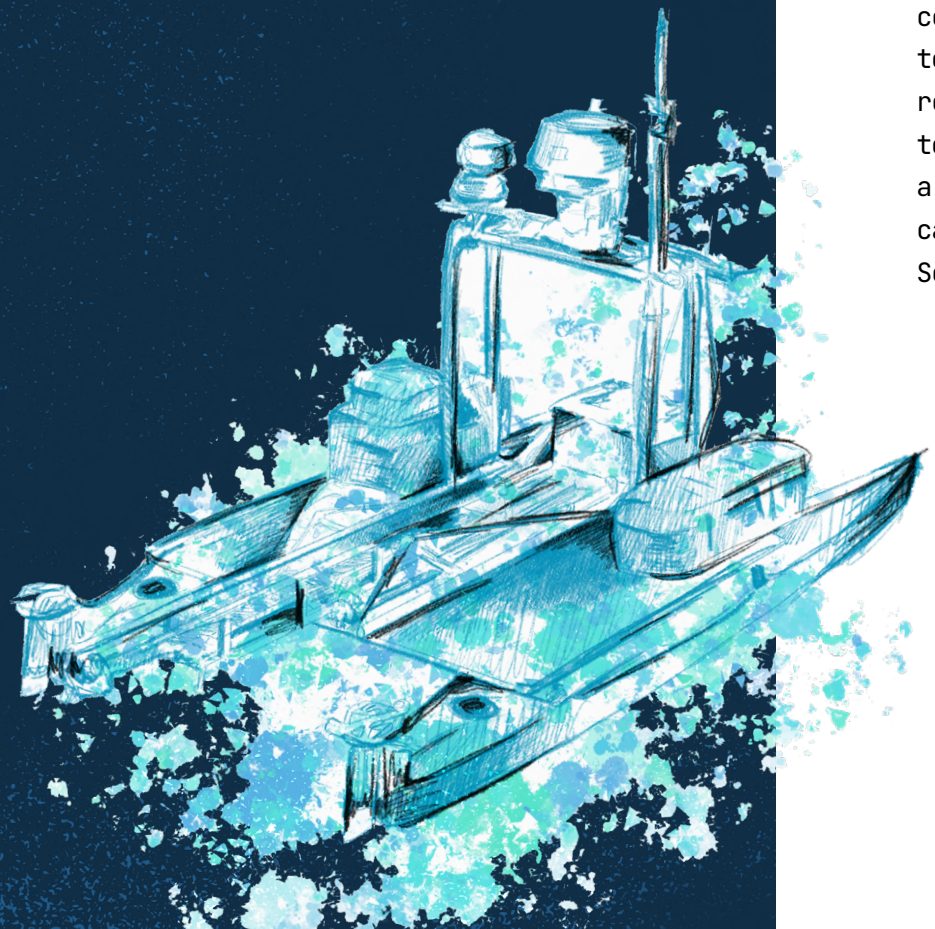
We signed a collaboration protocol with Critical Manufacturing

We leveraged innovation and research in the industrial sector. Critical Manufacturing is one of the global leaders in software solutions for production management. Our Industry and Innovation Laboratory (iiLab) will thus function as a testing infrastructure for demonstrations of various applications and as a place for training and capacity building for companies and skilled labour.

5.2.5.

INESC TEC

TEC4 sea



We address the Blue Economy sector, stimulating related industries and partners to overcome the future challenges and incorporating INESC TEC contributions and know-how. To this end, we bring together entities of the quadruple-helix (academia & research, business, civil society, and policymakers) to increase synergies and critical mass, raising up a north based Ocean Engineering Excellence Network capable of leading international initiatives in the Sea Economy.

OUR MAIN CONTRIBUTIONS TO SEA IN 2024

We were awarded a Teaming project to establish the first Centre of Excellence in Ocean Research and Engineering in Portugal

Synergistically addressing Marine Structures, Marine Robotics, Ocean Energy, and Ocean Data domains while developing R&D excellence from deep-sea to earth and space interactions, with a new knowledge transfer culture, and expanding innovation frontiers, this centre of excellence will fulfil the increasing technology and scientific needs of emerging markets in a broad set of "blue" and "green" economy applications, such as offshore renewable energies, offshore aquaculture, shipping and fisheries, deep marine resources exploration and bioprospection. INESCTEC.OCEAN is the name of this project.

We hosted the UN International Seabed Authority (ISA)

The workshop "Charting future horizons: harnessing advanced technologies for the protection and sustainable use of the international seabed area". Led by several experts, aimed to disseminate the latest technologies and research trends and the multiple autonomous robotic solutions for seabed observation, communication, monitoring, evaluation, and exploration. It was a unique opportunity to set goals, strengthen international partnerships and shape the future, confirming the commitment of Portugal and INESC TEC to the protection of the marine environment and underlining the commitment established by us and our partners in carrying out the Technology Monitoring Roadmap for the ISA – as indicated by the Portuguese Ministry of Foreign Affairs and the Portuguese Delegation to the ISA.

We participated in the NATO REPMUS 2024 naval exercise

Where we conducted experiments related to the protection and monitoring of critical infrastructures in deep waters.

We conducted a joint mission with a team from the Federal University of Santa Catarina in Brazil

where it was possible to test the acoustic localisation technology used in underwater robots. Regarding acoustic technology, we also conducted experiments off the Azores to monitor sea noise and locate cetaceans using synchronized acoustic sensors installed on buoys.

We participated in a mission on board the research vessel Mário Ruivo

Within the scoped of the TRIDENT project, we operated autonomous vehicles at depths exceeding 1000 meters.

5.2.6.

INESC TEC

TEC partnerships

Our main goal is to explore new sectors in markets where technological needs and roadmaps indicate significant potential for the application of INESC TEC's expertise and research lines. The main new markets addressed were Internet Market, Financial, Construction, Space, Defence and Mobility. As part of its mission, TECPARTNERSHIPS promote and coordinate project proposals that addresses the challenges posed by digital transformation, energy transition, and corporate sustainability, while also considering the broader context of international security and the pursuit of an internationalization strategy.

OUR MAIN CONTRIBUTIONS TO PARTNERSHIPS IN 2024

Fostering R&I in AI to support digital transformation of business processes

In the development of Human Resources Management solution, under the EASY4ALL Project. The project aims a no-code solution is being developed to improve Human Resource Management solutions using natural language. The approach includes a Conversational AI component powered by LLMs and Deep Learning. A transversal knowledge base will structure data to support language models, while a no-code development module will facilitate future product expansion. This initiative empowers non-programmers to build new features seamlessly, enhancing flexibility and accessibility.

We launched SEAGUARD Project (Horizon Europe – Cluster 3 – Civil Security for Society)

This project aims to develop an innovative and integrated approach to maritime cross-border surveillance that will enhance border security and management in Europe, combining multi-domain static and resident mobile platforms for multi-modal sensing in a seamless manner. SEAGUARD employs Unmanned Aerial, Surface, and Underwater Vehicles (UxVs) and static infrastructures to deploy a vast array of sensors, enabling the complementarity of information for extended periods of time. Fusion algorithms and command and control interfaces provide meaningful information to end-user authorities.

We supported the preparation of competitive funding proposals in the Defence sector

Leveraging from INESC TEC competencies in robotics, telecommunications and AI. An example is the coordination of European Defence Fund (EDF) proposal, mobilizing 21 European partners (17 beneficiaries and 4 affiliated entities) from 10 countries, including 10 large defence industry companies, 4 innovative SMEs and 7 leading RTOs. Participation in AED Days 2024 in Lisbon.

We concluded the first contract related with French agreement CIR accreditation

To develop advanced expense classification functions in the Supply Chain, with Humanitarian Logistics Cooperative- Hulo HULO pools logistical resources and connects humanitarian actors to optimize supply chain management and share humanitarian logistics expertise.

We developed PAPVI – Advanced Prediction of Real Estate Sale Prices for Confidencial Imobiliaria

The PAPVI project aims to enhance real estate price prediction by improving machine learning models and integrating additional relevant data. The approach includes developing advanced algorithms in Python, leveraging expert real estate knowledge, and incorporating contextual data, market segmentation, and qualitative information such as text and images. A web service will be created to provide accurate predictions, ensuring secure data access and continuous model updates.

5.3. PUBLIC POLICIES

In 2024, we reinforced our contribution to public policy by deepening our engagement with strategic agendas at regional, national, and European levels. Our actions aimed to bring scientific and technological knowledge closer to decision-making, strengthen the interface between research and policy, and support the definition and implementation of forward-looking policies. We combined the dissemination of policy-relevant insights with active participation in key policy processes, strategic dialogue with public authorities, and the promotion of collaborative approaches to societal challenges. These efforts reflect our ongoing commitment to ensuring that research and innovation contribute meaningfully to the public good.

One of the main highlights was the co-organisation of the first CoARA National Chapters Forum, together with the Foundation for Science and Technology (FCT), CoARA, and Science Europe. The event brought together national and international stakeholders to share experiences on research assessment reform and to explore the role of national chapters. We are proud to contribute actively to the Portuguese chapter and to the broader European discussion on the future of research evaluation.

We also took part in the EARTO Annual Conference, where we underlined the importance of the European Widening Programme in building stronger innovation ecosystems and promoting excellence through collaboration. As part of the broader European RTO community, we contributed to showcasing the role of research and technology organisations in delivering innovation, competitiveness, and societal impact, as reflected in EARTO's recent economic footprint study. In addition, we published a policy position paper on FP10, with concrete proposals to help Europe strengthen its role as a global innovation leader. Our recommendations focused on four areas: global strategic leadership, ecosystem development and sustainability, future-centred financing, and excellence in implementation.

We were also active in the European discussion on research careers. Together with FCT and the European Commission, we co-organised a workshop as part of the ERA Policy Agenda. The focus was on how to improve institutional conditions for research careers, mobility, and inclusion. We also joined the European Mutual Learning Initiative on Research Careers, contributing to the exchange of good practices among research organisations and public authorities.

We organised an event on RDI leadership in the AI era, in collaboration with the European Commission and the NCBR Office. It brought together researchers, administrators, and policymakers to discuss how artificial intelligence is changing leadership models in science and innovation. This event gave rise to

the 7th edition of our Science & Society magazine, dedicated to AI, governance, and leadership challenges.

We also contributed to discussions on the blue economy and ocean policy, hosting a delegation from the International Seabed Authority and participating in national and European initiatives to strengthen Portugal's position in ocean science. We launched the establishment of a Centre of Excellence in Ocean Research and Engineering, with support from a Teaming initiative, and we have continued to advocate for a balanced approach between innovation and sustainability in this domain.

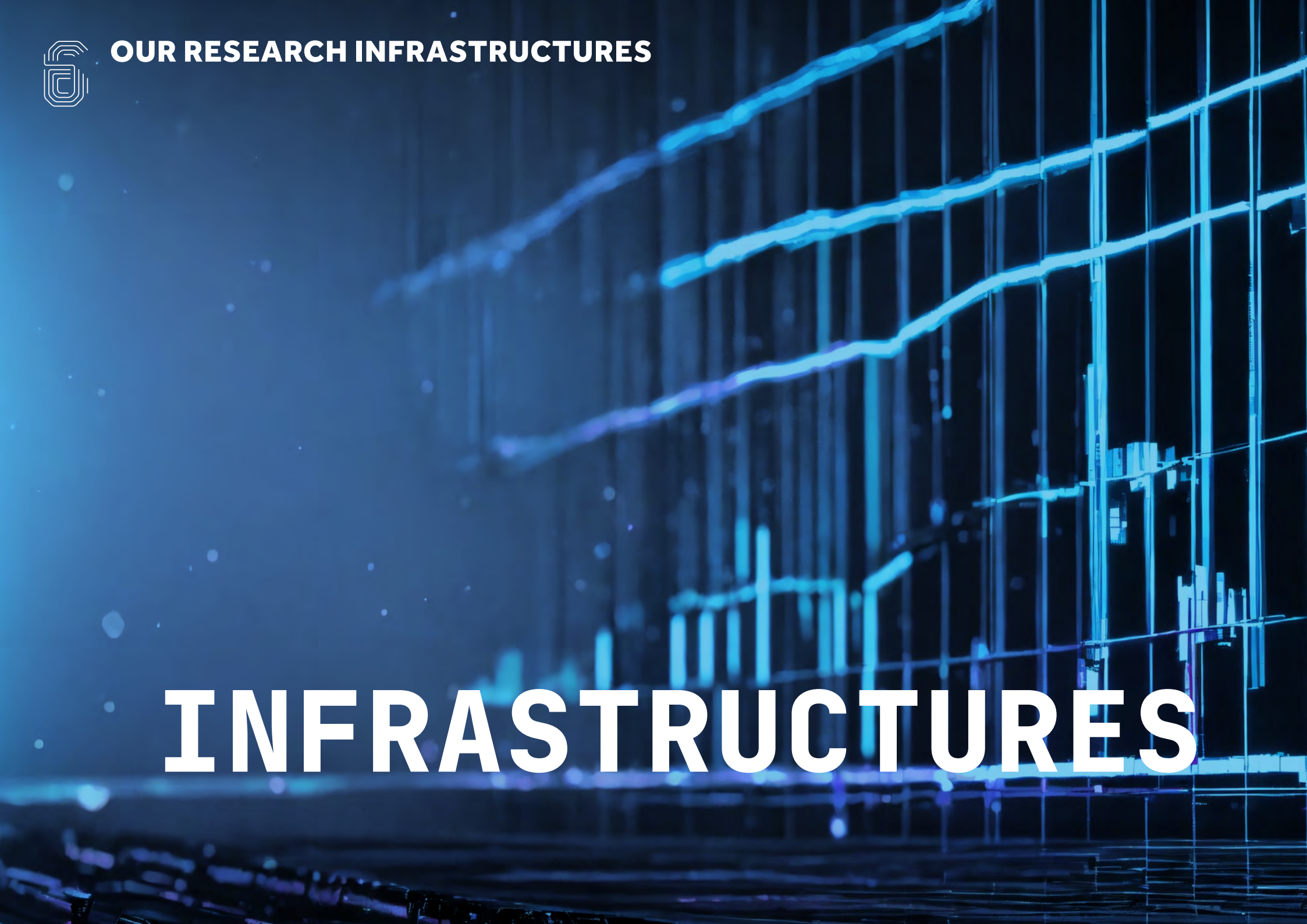
At the regional level, we worked closely with CCDR-N in its application to the Regional Innovation Valleys Initiative, helping define priorities for investment in research and innovation infrastructures. We led one of the eight working groups and contributed to several others, reflecting our commitment to regional development aligned with European policy goals.

Our participation in policy dialogues also included contributions to the AI roadmap for power systems, the European Commission's Expert Group on Technology Infrastructures, and the organisation of the Autumn Forum on resilience of critical infrastructures.

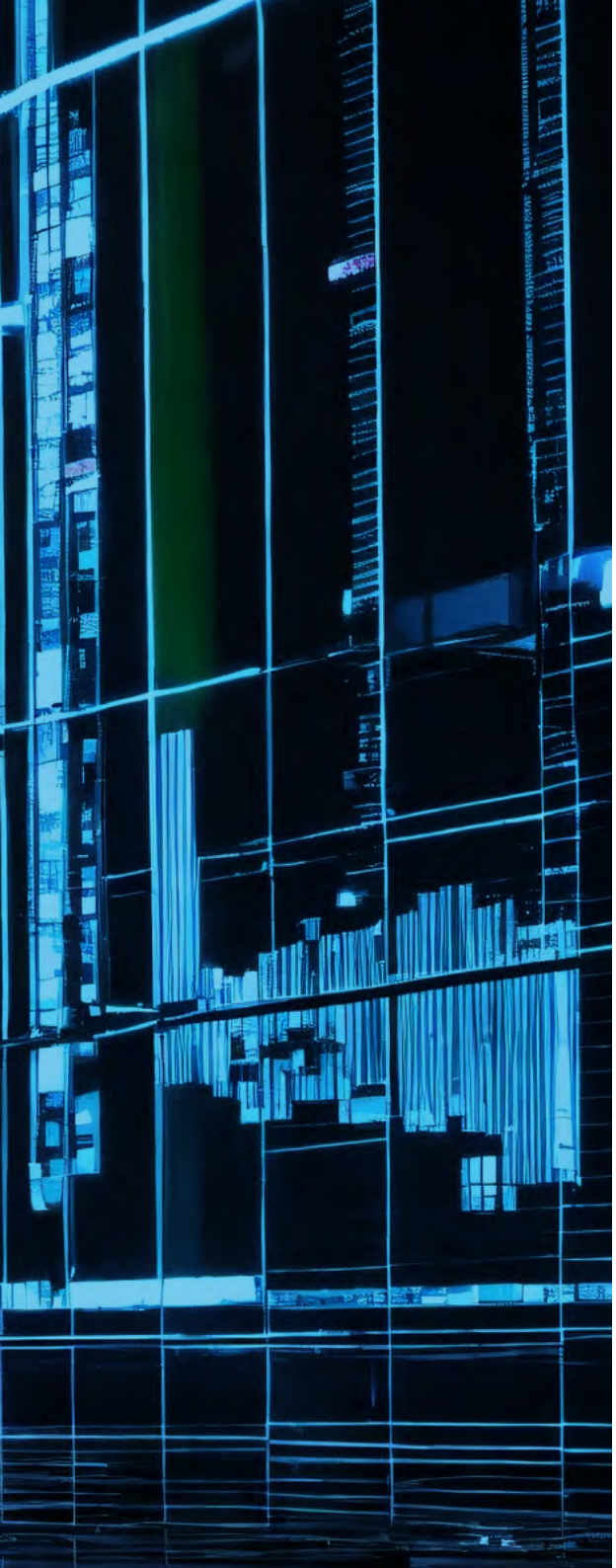
Another important contribution was our active involvement in the renewal of strategic international partnerships, particularly with UT Austin and Carnegie Mellon University (CMU). We participated very actively in the preparation of the next phases of the UT Austin Portugal Program and the CMU Portugal Program, contributing to strategic discussions, bilateral visits, and high-level meetings. With the renewal of these partnerships officially confirmed, we reinforced our role in the internationalisation of national R&I policy and in promoting long-term transatlantic collaboration in advanced areas of science and technology.

Throughout the year, we welcomed several important policy visits to our institute, including from the Ministers of Science and Education, the Secretaries of State for Economy and Maritime Affairs, and the European Commissioner for Cohesion and Reforms. These moments allowed for direct exchange on policy priorities and the role of science and technology in addressing societal challenges.

We also launched INESC TECWatch, a new initiative that provides timely, research-based insights on key technological and societal issues, including artificial intelligence, robotics, and data science. With this effort, we want to contribute to better-informed decisions by making scientific knowledge more accessible to policymakers and the general public.



INFRASTRUCTURES



Our research and development activities are supported by ten main research infrastructures, where the scientific experiments are performed and the technological outcomes are perfected and tested.

These infrastructures feature advanced, high-quality facilities, equipped with cutting-edge materials and staffed by highly qualified professionals. They boost our research work and enhance our ability to design technologies that address societal changes and market needs.
At our research infrastructures, we push the boundaries of science and innovation.
In 2024, our facilities provided the foundation for research, development and testing of equipment for maritime, industrial agricultural and forestry environments; we also developed solutions for power and energy systems, communications and microfabrication technologies. Additionally, we advanced research in computer science and virtual reality technologies, focusing on neurosciences and neurological diseases.

INESC TEC

brain lab

Neuroengineering
& Advanced Human Sensing

The Neuro-Engineering Laboratory, a.k.a. BRAIN (Biomedical Research And INnovation) has a strong focus on researching new biomedical engineering methods for neurosciences & neurological diseases (e.g., Parkinson's, Alzheimer's, autism or epilepsy) and is organised in 5 main research lines: 1) Brain imaging and signals; 2) Man-machine symbiosis with edge-AI (e.g. brain-computer interfaces); 3) Multimodal computer vision analysis for neurological diseases; 4) Neurosurgery aiding systems; and 5) Macro-to-nano bio(neuro)sensing.

Location
INESC TEC headquarters

HIGHLIGHT

A key equipment is the Stim-BRAIN Lab which is an advanced Brain Imaging infrastructure (that offers scientific services to third-parties, besides our own research projects) with an f-MRI simulator (mock scanner) fully equipped with synchronized 64ch video-Electroencephalogram (EEG) medical systems from Micromed, wearable EEG devices, video cameras, MRI compatible pads and audio system to simulate f-MRI experiences and prepare stimulation protocols to be deployed in MRI scanners at the CHUSJ or any other clinical center. This infrastructure is used for fMRI and Video-EEG-fMRI paradigms development and testing for neuroscience projects with our clinical partners and students.

2024 TOP ACHIEVEMENTS

- Breakthrough in bio-micro&nano-photonics: we published a high-impact paper at “Nature Communications Engineering” and launched a patent - iLoF 2.0 - introducing a new method for extracting “bio-micro&nano-particles fingerprints” from laser backscattering photonic signals of bio-fluids (e.g. cell culture, plasma, CSF, etc.) with high sensitivity and robustness.
- New Startup (#4): SeedSight.io became the 4th startup stemming from the lab. It is focused on taking our AI bio-photonic-sensing patented methods to the food tech market. This startup has raised its seed round and provides 5 highly differentiated employment positions. Seedsight.io has a contract with our lab for scientific assistance and equipment usage.
- IEEE AI Research Hub Prize @GITEX Global 2024: Our UP-CMU PhD Student Tamás Karacsony won this prize promoted by IEEE at the largest tech and startup exhibition in the world held in Dubai with his work on AI for neurology video processing.

INESC TEC

cloudinha lab

The CLOUDinha laboratory plays a crucial role in INESC TEC's research and innovation endeavours, supporting the sharing of scientific knowledge and promoting its transfer to both the scientific community and the broader society.

Our CLOUDinha laboratory provides computational support to research and development activities of INESC TEC and University of Minho. It offers bare-metal and virtualized environments, along security features such as trusted hardware.

The heterogeneous hardware nature of the cluster is important for supporting different research projects that may require specific hardware features (e.g., different storage or network technologies, access to trusted hardware capabilities).

Location
INESC TEC site placed in University of Minho

HIGHLIGHT

The cluster consists of 106 microATX servers spanning multiple hardware generations, including Haswell, Kaby Lake, Comet Lake, Coffee Lake and Raptor Lake.

These servers are built on Intel Core i3,i5, and i9 CPUs, with different memory configurations and heterogeneous storage, including HDDs, SSDs, and NVMe devices.

They also feature programmable network cards from Intel and Netronome and are connected via 1 Gb or 10 Gb networks.

Additionally, the cluster includes four rack servers based on Intel Xeon hardware, supporting up to 192GB of memory and heterogeneous storage devices, including SSDs, NVMe, and persistent memory.

These servers are connected through a 10 Gb network, with some of them featuring programmable network capabilities (DPDK).

To enable accurate energy consumption analysis, the cluster is equipped with power metering devices.

2024 TOP ACHIEVEMENTS

- In 2024, our laboratory provided the computational infrastructure for developing, optimizing, and testing software prototypes developed across several research topics, such as distributed systems and data management; storage systems and operating systems; privacy and security; blockchain, dataspaces, and Internet of Things; energy efficiency and sustainability; and bioinformatics.
- These software prototypes were developed as part of INESC TEC's research and innovation projects, as well as PhD and MSc theses. Our Laboratory supported, as the main computational infrastructure, the research of 12 ongoing and 2 completed PhD theses, 10 concluded and 23 ongoing MSc theses, and 1 research project within INESC TEC's Visiting Researcher program.
- The work conducted at our research infrastructure led to the development of 21 software prototypes, collectively requiring thousands of hours of computation. Among them, LazyFS, a fault injection tool for assessing consistency properties of critical data applications, is already used in production by leading data management companies, being integrated with the Jepsen fault injection framework, as well as the etcd and MongoDB database systems.
- Regarding scientific outcomes, the work developed at our laboratory resulted in two journal publications, one conference paper and one workshop paper.

INESC TEC

comlab Communications Laboratory

The Communications Laboratory (CommsLab) at INESC TEC serves as an infrastructure for communications research, bridging simulations and experimentation.

Our Communications Laboratory (CommsLab) was established to push the boundaries of communications and sensing technologies. CommsLab is also dedicated to training the next generation of researchers and engineers, offering them hands-on experience with cutting-edge technology.

Location
INESC TEC headquarters

HIGHLIGHT

Optical and electronic test equipment for R&D in electronics and micro-electronics.

Optical and RF communications equipment, incorporating an anechoic chamber for precise antenna characterisation up to 170 GHz.

Support for a broad spectrum of research from 5G and 6G technologies and human sensing to satellite communications.

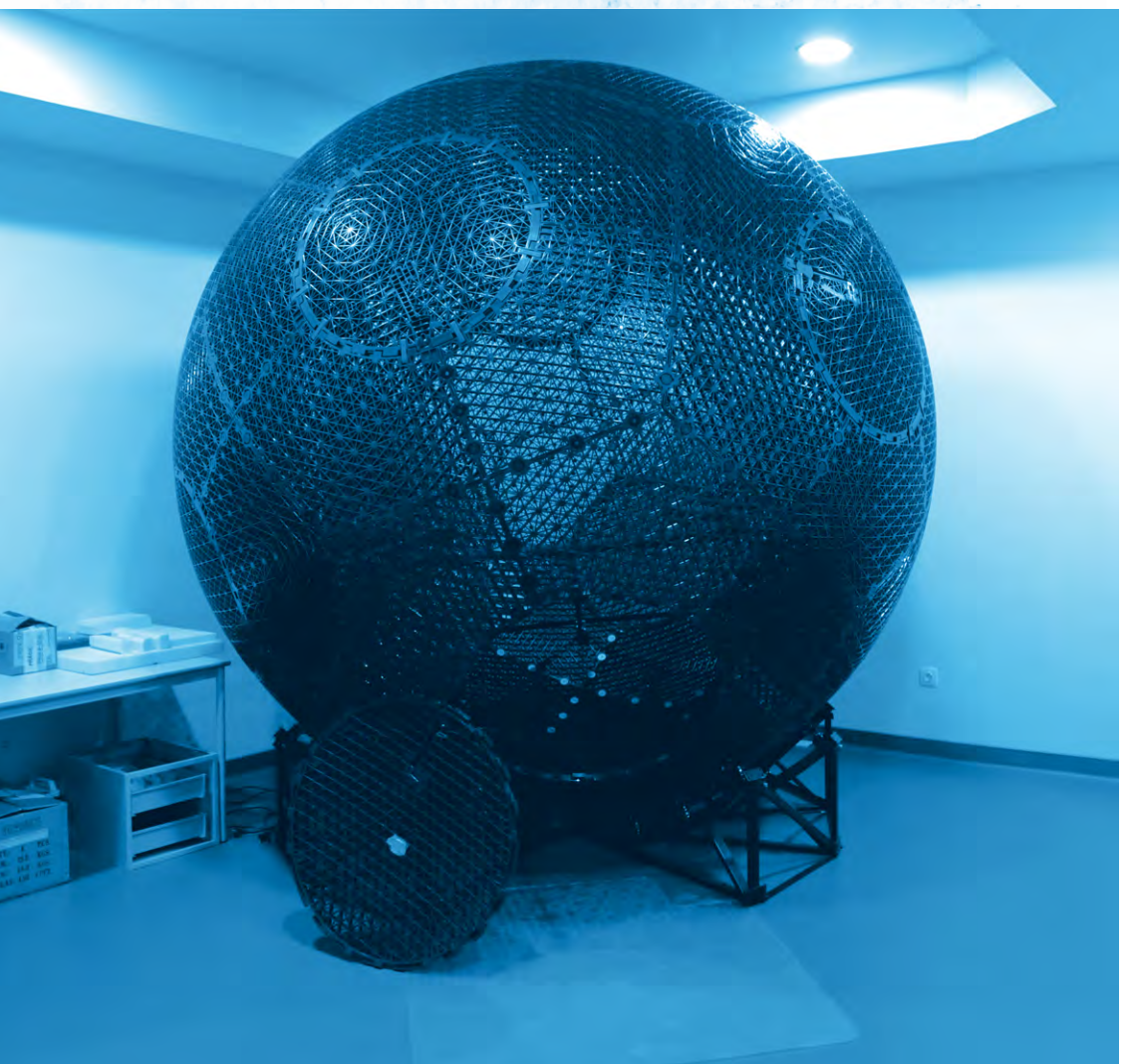
2024 TOP ACHIEVEMENTS

- Finalisation of an initial prototype of a reconfigurable intelligent surface at 6.5 GHz suitable for human activity sensing, which supported an innovative demonstration of Hand Gesture Recognition distinguished with the ANACOM-URSI Portugal award.
- Long-term performance evaluation of a Low Earth Orbit (LEO) Satellite communications gateway in the laboratory, proving feasible the support for new Wi-Fi and 5G-based backup communications solutions for emergency/disaster management scenarios.
- Implementation of additional capabilities in the mobile 5G cell prototype, including new xApp implementing object-aware capabilities, useful for predictive Line-of-Sight blockage detection which then can trigger proactive mitigation actions such as positioning, link adaptation, RIS configuration or handovers.
- Development of a multimodal underwater wireless communications prototype, giving support for multiple ongoing research activities in this field.
- Establishment of an initial simulation-assisted prototype using Semantic Communications, tailored for enabling broadband-like user experience when acquiring images through long-range acoustic links.

6.4.

INESC TEC

graphics lab
Computer Graphics & Interactive Digital Media



Our lab is focused on the development of interactive technologies for authoring and collaborating in immersive environments. It is composed by two physical labs: GIG (Porto) and MASSIVE (Vila Real) and each one promotes distinct contributions in the area of Immersive Media/XR.

MASSIVE is a cutting-edge lab studying virtual reality technologies' relationship with human performance. Here, human-technology interaction is explored to create multisensory, immersive, authentic experiences. Focused on training, education, and certification, we ensure that skills acquired in VR seamlessly transfer to real-world applications.

Our GIG laboratory is to advances multidisciplinary scientific research in the fields of Computer Graphics, Human-Computer Interaction and Digital Games, with particular emphasis on Immersive Environments. Our laboratory has developed several innovative computational tools. We also study of human augmentation, with a view to improving the processes associated with the application areas of Industry 4.0, Health, Ocean and Earth, Tourism, Culture and Education.

We have more than 18 active human resources. In 2024, we made an investment of approximately 70k euros in equipment in this infrastructure.

HIGHLIGHT

Optitrack tracking system with 12 cameras

Ambisonics sound system

3D sound capture

Scent machines

Omnidirectional walkways

Haptic simulators

Eye trackers

Scent capture

A multisensory room, equipped with cutting-edge virtual reality technologies that allow the 5 senses to be stimulated.

Location
Porto (GIG @ FEUP)
Vila Real (MASSIVE @ UTAD)

2024 TOP ACHIEVEMENTS

- Authoring tool for developing immersive training scenarios in INCLUDING project.
- Improvements to the Immersive Agroforestry Simulator for training.
- Virtual Reality flame test training application.
- Improvements to the application for teaching English using Virtual Reality.
- Haptic devices for better 3D interaction.
- DeskVR interaction solutions.
- Co-authoring solutions for serious game design.
- Immersive platforms for studying ocean behaviour.
- Research on interoperability standards for virtual choreographies for integration into virtual environments.

INESC TEC

iilab Industry & Innovation

INESC TEC iiLab – Industry and Innovation laboratory offers an integrated capacity to simulate, prototype, and test solutions in different areas of industry: Cyber Physical Systems, Internet of Thinks (IoT), Business Intelligence & Decision Support Systems, Advanced Automation & Industrial Robotics, Mobile Robotics & Internal Logistics, Industrial Vision Systems for inspection and quality control, Industrial data Management & Information Systems.

iiLab mission is to disclose the state-of-the-art in advanced production technologies through the demonstration of research, experimentation and advanced training results. iiLab supports technology-based innovation in public and private organisations, thus contributing to the development of their skills in the development, adoption and implementation of advanced production technologies, leading to a sustainable competitiveness in the circular economy context.

Location
INESC TEC site placed in PORTIC

HIGHLIGHT

Industrial mobile robots

Industrial manipulators

Programmable, flexible matrix transfer system

Hyperspectral cameras for recycling and waste management

5G infrastructure

2024 TOP ACHIEVEMENTS

- Implementation and deployment of a dedicated 5G infrastructure, coupled with Network Operating System (NOS). Within this initiative, we have developed and demonstrated seven pilot cases in the scope of the NOS 5G & Digital Transformation TestBed, in close collaboration with the following national SME technology companies: Flowbotic, Infinite Foundry, Neadvance, Azitek, FoodinTech, Azevedos, and SARKKIS.
- Hosting eighteen R&D projects carried out in cooperation with industry, both at national and international level, contributing to a better alignment of the R&I carried out at INESC TEC with the needs and interests of industry.
- Support licensing to industry technology-based products and services.Design and implementation of a training roadmap to guide individuals and companies through the complexities of digital transition and empower the companies' workforce with the skills needed to thrive in the digital age. Two executive and senior training programmes ("Programa Avançado em Industry 4.0" and "Digitalização shopfloor"), with a strong practical component based on research results, were held, attended by 24 people from industry; in the scope of the EIT Winter School, Innovat ED project, a simulation workshop was held in the iiLab training room.
- Organization of a high-visibility international events like Hybrid Workshops on Mari4_YARD project.

INESC TEC

photonics lab
Microfabrication & Photonics

The Microfabrication and Photonics laboratory explores non-traditional microfabrication techniques based on femtosecond laser direct writing processes. For example, microfluidics and optofluidics chips are produced to implement biosensors and micro and nanostructures. First order Bragg gratings are made by laser point-by-point direct writing leading to the development of better and more reliable sensing heads. Laser marking and surface treatment is also possible.

Location
INESC TEC site placed in Faculty of Sciences of University of Porto

HIGHLIGHT

The Bragg and long period gratings fabrication set-up went through a renovation process, that included new drivers and air-bearing X-Y stages, re-written control software, and improved optical hardware. Since the laser was also sent to the suppliers for a major renovation, the development of this system, as well as all the other activities relying on the femtosecond laser, are stopped since the beginning of November.

The fabrication capabilities are complemented with equipment available at CEMUP – MNTEC. The cleanroom is a service providing laboratory managed by University of Porto that was supported since its creation by INESCTEC which made its micro/nanofabrication equipment available on this infrastructure for widespread use.

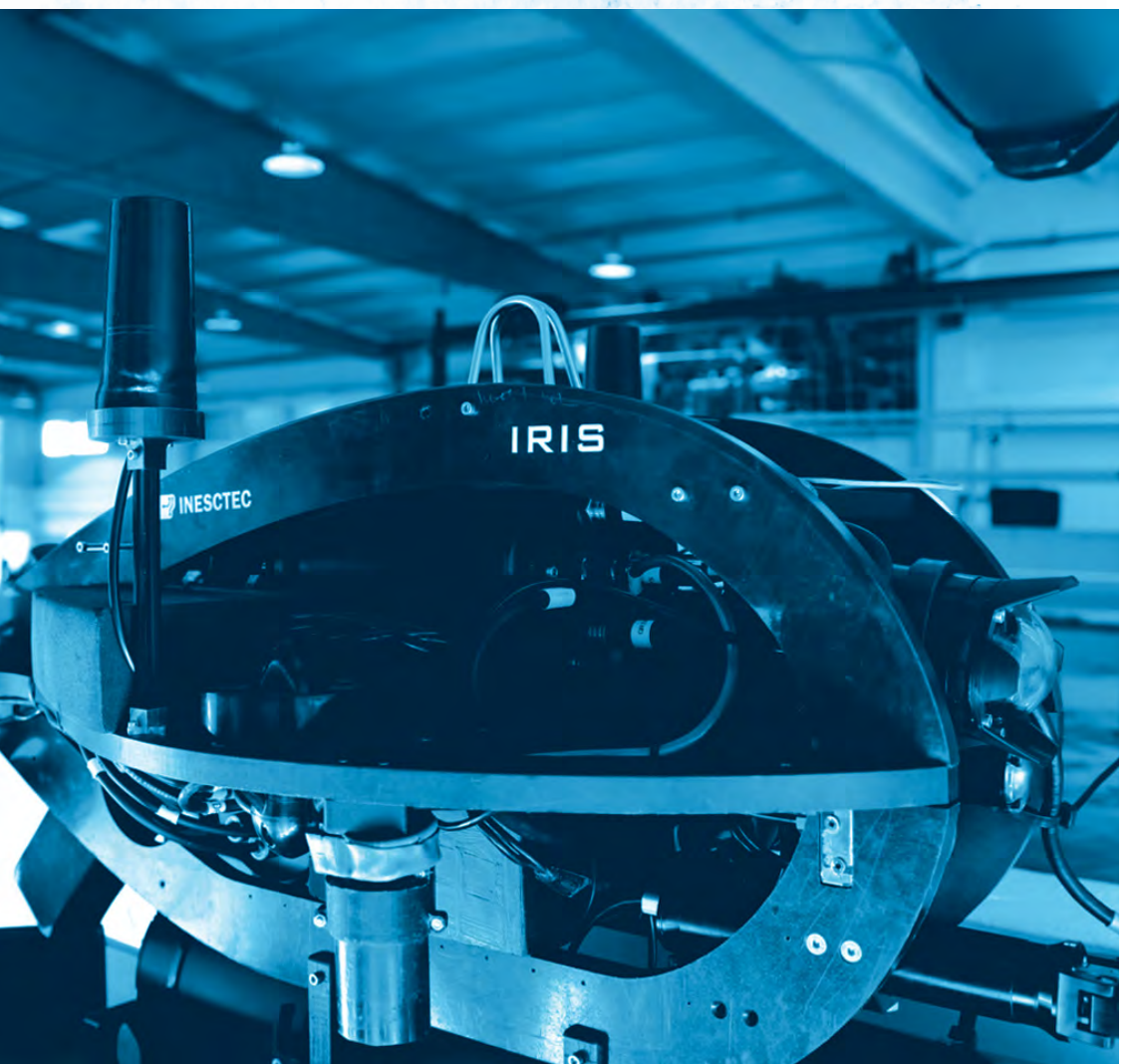
2024 TOP ACHIEVEMENTS

- Fabrication of microfluidic devices for 2D and 3D hydrodynamic flow focusing; demonstration of laser trapping and sorting within a microfluidic channel.
- Machining of Ultra Low Expansion (ULE) glasses; demonstration of high finesse Fabry-Perot cavities for temperature referencing.
- Optofluidic based on glass capilaries machining and incorporation of optical fibers (patent submitted).
- Fabrication of microfluidic and optofluidic devices using FLICE techniques for sensing applications.
- Fabrication of Bragg gratings in planar format.
- Fabrication of tunable integrated optics devices by the incorporation of surface heaters; the objective is to address the fabrication of complex chips to perform neuromorphic operations.

INESC TEC

robotics lab

Robotics
& Autonomous Systems



The mission of INESC TEC Robotics and Autonomous Systems Laboratory (RAS) is the research of excellence in Autonomous Systems, enabling the observation and operations in complex, unstructured and harsh environments.

The main objective of our laboratory is to provide equipment and conditions to develop R&D activities at all levels of research. To this end, we have tanks available where it is possible to test the capabilities of prototypes and check their resistance to pressure in hyperbaric chambers. The laboratory is distributed in two campuses: ISEP and FEUP, with a total area that exceeds 1000m2. In the overall facilities, there are conditions to receive external entities, partners and the scientific community linked to robotics, carrying out equipment demonstrations.

Location
INESC TEC site placed in Faculty of Sciences of University of Porto and in Faculty of Engineering of University of Porto

HIGHLIGHT

The overall facilities include two test tanks, the largest of which is 10mx6m and 5m deep, and a prototyping workshop.

The laboratory's infrastructure includes a large set of robotic platforms (underwater, surface, aerial, and terrestrial), most of which are ready to operate in real environments.

It also includes many sensors and auxiliary equipment that can be operated independently or integrated into larger systems.

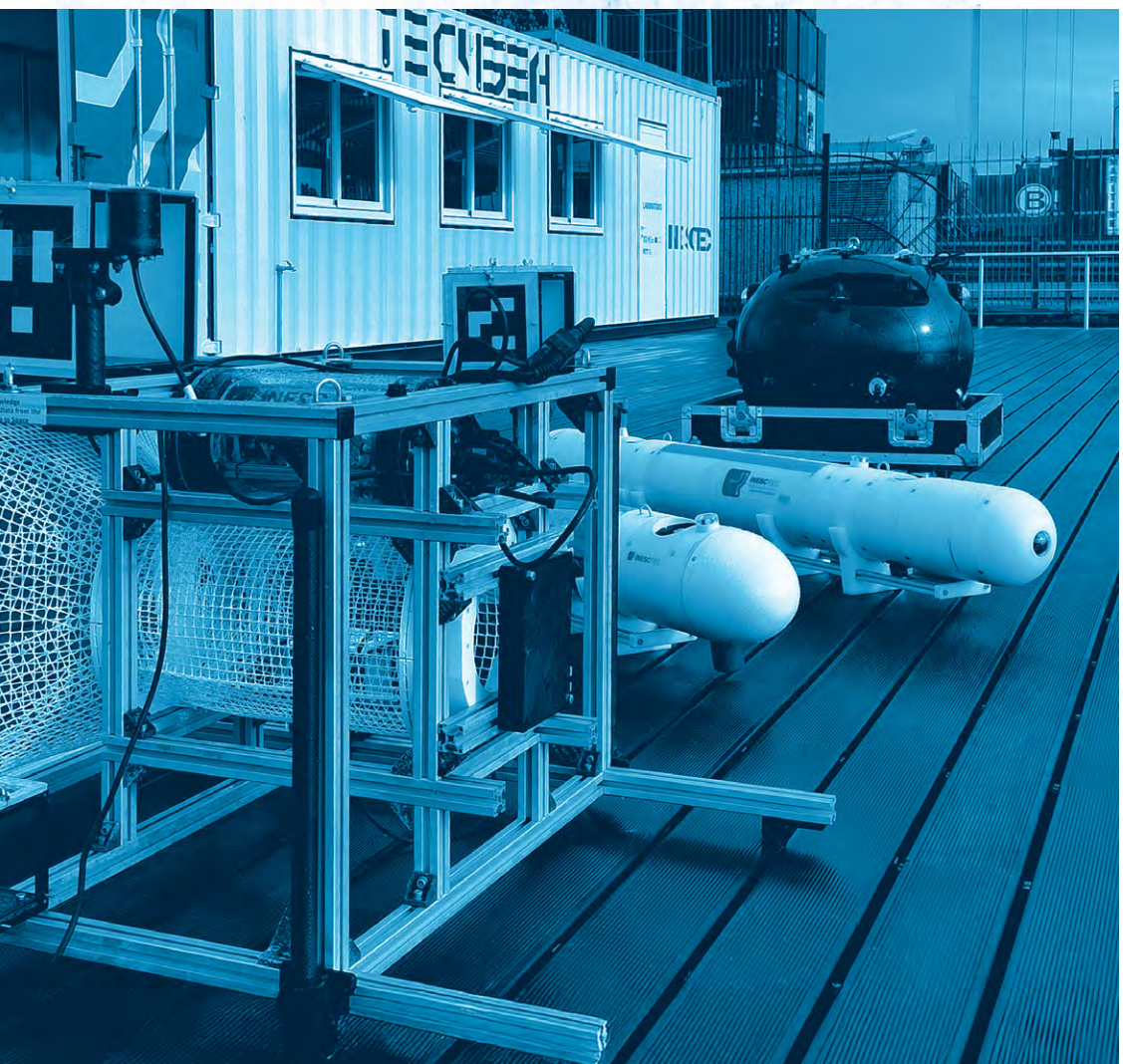
These assets contribute to great operability and have been key to establishing national and international partnerships.

2024 TOP ACHIEVEMENTS

- A joint mission with a team from the Underwater Technology Laboratory – LASUB – at the Federal University of Santa Catarina, in Brazil, where it was possible to test acoustic localization technology used in underwater robots.
- During participation in the NATO Naval exercise REPMUS 2024, exercises related to the protection and monitoring of critical infrastructures in the deep sea were carried out.
- The mission under the TRIDENT project, on board the ship Mário Ruivo operating vehicles at 1000 meters depth.
- The action of monitoring sea noise and locating cetaceans off the Azores using synchronized acoustic sensors installed on buoys.

INESC TEC

tec4sea lab
Technology for Sea Infrastructure



The TEC4SEA scientific infrastructure continues to fulfil its primary purpose: support the external scientific and industrial sectors concerning research, development, and testing of equipment for maritime environments, enabling these entities to operate at sea by leveraging the capabilities and know-how provided by this infrastructure.

Our research infrastructure expertise and resources range from pure conceptual research to field deployment missions, with strong industrial and logistic competences in prototype production and an eclectic set of laboratories, testbeds, equipment, and support facilities for experiments in controlled and real environments. It can thus support researchers in all phases of technology development, from conception and theoretical analysis to prototype development, field deployment, and technology validation.

Location
Porto de Leixões (Leça da Palmeira)
CINTAL Gambela Campus (Algarve)

HIGHLIGHT

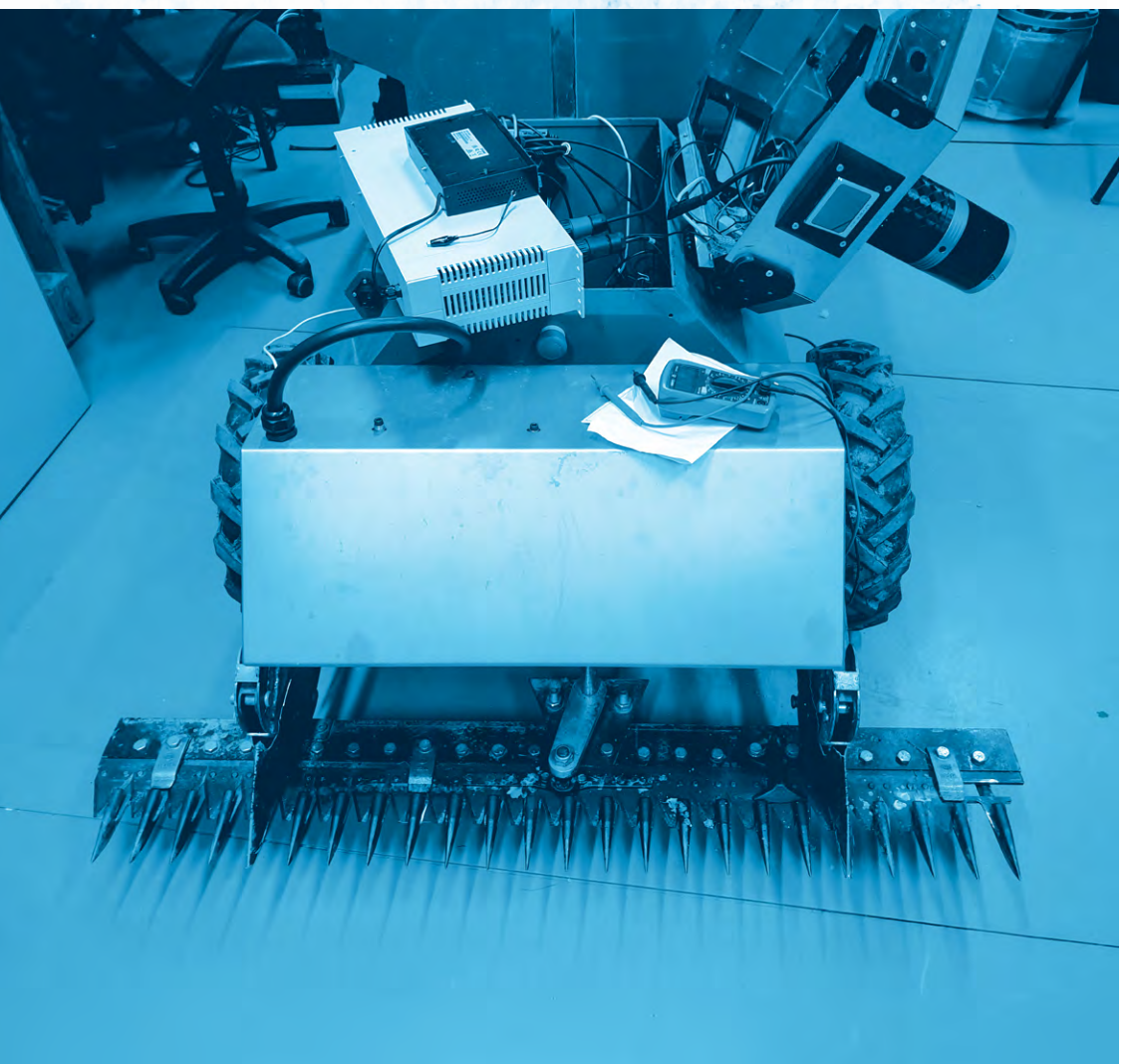
Our main—and more requested—asset continues to be the Research Vessel RV Mar Profundo. In fact, this vessel has been designed to occupy a niche in the capabilities–size binomial that has no parallel in the national landscape. As such, it is a very useful and desired asset and, thus, an important element in the infrastructure services portfolio.

2024 TOP ACHIEVEMENTS

- As part of its support for external public and private entities that need to operate at sea, INESCTEC's research vessel NI Mar Profundo carried out a total of six missions in 2024. These missions successfully supported various activities, from assessing marine fauna and habitats to evaluating the maintenance and conservation status of submerged infrastructures.
- The RV Mar Profundo, together with several of INESCTEC's robotic platforms and unmanned vehicles, supported multiple research projects (Trident, EU-SCORES, EU-AIRSHIP), governmental entities, and participated in the joint international robotic exercise REPMUS24, the largest international drone exercise, involving 2000 participants from 30 different countries, where drone innovation is presented and tested.
- At the end of the year, the RV Mar Profundo underwent an upgrade to equip it with an autonomous dynamic positioning capability, an increasingly essential feature given the nature of the vessel's missions. This upgrade also enhanced its autonomy, allowing its operational range to include the Azores Archipelago.

INESC TEC

tribe lab
Robotics & IoT
for Smart Precision
Agriculture and Forestry



INESC TEC TRIBE LAB – Laboratory of Robotics and Internet-of-Things (IoT) for Smart Precision Agriculture and Forestry – has a clear mission: to pioneer robotics, automation, and IoT-based solutions. Our aim is to revolutionize smart precision agriculture and forestry, ensuring that operations are conducted at the “right time, right tool/product, right amount, right place” for optimal outcomes.

Our TRIBE lab focuses on enhancing profitability, sustainability, and automation across three primary environments: permanent crops, forest biomass harvesting, and protected cultivation (greenhouses and controlled environment agriculture).

Location
INESC TEC site placed in Faculty of Sciences of University of Porto

HIGHLIGHT

Cluster of 3D printers to enable fast prototyping

Access to CNC and mechanical lathe to enable fast prototyping

Advanced oscilloscopes, and logic analyzers for troubleshooting

Soldering stations and PCB assembly tools

Cooperative Robotic arms and advanced 3D sensors

Workstations with high-performance GPUs for simulation and AI training

2024 TOP ACHIEVEMENTS

- Our TRIBE LAB team placed 2nd in the Hackathon Grand Défi Robotique Agricole.
- We developed 28 software and hardware prototypes, reaching an average TRL of 7 and progressing toward real-world deployment.
- Projects included Orioos and Modular-X, were designed to simplify technology transfer and meet industry needs - these innovations contributed to major Horizon Europe, H2020, and PRR-funded projects, such as NOVATERRA, WATSON, Agenda transForm, Vine&Wine, InsectERA, and Blockchain.PT.
- We organised five public demonstration sessions, reinforcing the practical applications of its robotic solutions.
- Three PhD candidates defended their theses, alongside 27 peer-reviewed publications and five master's theses.
- We participated in key events like EPIA 2024, ROBOT 2024, IROS 2024, World FIRA 2024, and the European Robotics Forum 2024, where research developments and prototypes were showcased.
- We had a representation at the EuropaAmerica 2024, strengthening international collaborations.

INESC TEC

x-energy lab
Smart Grids
& Electric Vehicles

INESC TEC x-Energy lab offers an integrated capacity to simulate, prototype, and test solutions in different areas of power and energy systems: electric mobility, hybrid AC/DC power grids, protection architectures, hydrogen integration, energy management, interoperability, and AI for energy.

Our x-Energy lab provides services to business and industrial partners to generate applied results, supports research activity regarding experimental demonstration capabilities targeting several TRL, and serves not only our researchers but also temporarily I&D researchers external to the infrastructure (national and international), whilst ensuring financial stability from newer sources and revenue opportunities.

In 2024, we had 19 human resources working with us – 12 employees and 7 grant holders, pursuing their MSc or PhD studies, while investing approximately 230k in this infrastructure.

Location
INESC TEC headquarters

HIGHLIGHT

Smart electric vehicle charging

- Hybrid ac/dc microgrid with flexible DER
- Grid automation and protection test system, with real-time digital simulator
- Power Hardware In the Loop Platform for DER testing

2024 TOP ACHIEVEMENTS

» Nearly 30 prototypes developed, highlighting:

- Continued development of a laboratory-scale validation facility, including hydrogen-producing electrolyzers (PRR H2DRIVEN). The PEM electrolyzer was commissioned and delivered, and the electronic power converter interface is currently under construction, with completion expected in 2025.
- Further improvement of the hybrid AC+DC microgrid, with two new high-power DC power sources and two new 1000V DC cable emulators purchased and already operational. The technical specifications for a DC electric panel to enable seamless integration and control of a DC grid are completed, and its procurement is underway. The development of the hybrid AC+DC microgrid is expected to continue through 2025, aiming to reach a high readiness level by the end of that year.
- Expansion of the EV charging testbed with new AC (prototypes and commercial) and DC (prototypes) EV chargers, as well as new charging locations, to implement and validate new control strategies using EV chargers deployed in the field (H2020 POCITYF, HE Green.Data.AI, PRR ATE projects).
- Development of a system in the loop test system for advanced grid Automation and Protection testing, that integrates virtualized Protection units, under PRR ATE project. Supports development and testing of new applications for distributed Automation and control solutions, in collaboration with GE Vernova.The existing HIL/PHIL platform based on the OP5600 real-time digital simulator was updated with the newer OP5707XG model
- Reinforcement of the x-Energy microgrid with the installation and successful testing of two additional controllable battery inverters. These upgrades aim to further develop the lab testing capabilities for power converters and microgrid energy management solutions.
- Reinforcement of x-Energy prototyping capabilities with the purchase of a new 3D printer and a reflow soldering oven machine.
- Development of a new roadmap for the x-Energy lab, aiming to define core guidelines for its scientific activities, services for industry, human resources capacitation, and infrastructure management.

OUR PEOPLE

Our distinctive activities reflect our values in several ways.

We promote people-centredness and inclusion.

We stand for integrity, transparency and ethics.

7.1. OUR COMMISSIONS

DIVERSITY & INCLUSION

We embrace Diversity and Inclusion, by prioritising three key areas: gender equality, interculturality and accessibility.

2024 highlights:

Training sessions and other major events organised:

- Workshop “Embracing Cultural Diversity”
- 2nd Workshop “Self-defence for ALL”
- Workshop “Promoting Health Work Environments”
- “Sensorial Experience” by ACAPO (Association of Blind and Visually Impaired People of Portugal)
- Eid al-Fitr – marking the end of the Ramadan
- “Breaking Barriers in Technology: Women in Computing at Carnegie Mellon and Global Perspectives”
- “Porto Summit Women in Tech – WiT Kids”
- “EIT Manufacturing fostering a more inclusive industry”

Key communication campaigns:

- Video celebrating the "World Day for Cultural Diversity for Dialogue and Development"
- Internal initiative through our Book Club to share a reading list of books on diversity and inclusion
- Awareness campaign for the "LGBTQ+ Pride Month"
- Awareness campaign for the "International Day for Elimination of Violence against women"
- Opinion pieces published on BIP Magazine

Award application:

- To the "Accessibility Awards, Best Practices" award, promoted by Associação Salvador, within the scope of the "Accessibility Award" and "Deaf Accessibility Award"

SOCIAL RESPONSIBILITY

We support our people and our community, addressing social and environmental questions in our processes.

2024 highlights:

External initiatives:

- We served as official nominator for the “Earthshot Prize” – a global environmental platform dedicated to finding and growing impactful solutions to preserve our planet within this decade. We received 10 applications and endorsed 2 solutions focused on the “fix our climate” Earthshot category.
- We promoted the initiative “INESC TEC takes Science to IPO Porto”, aiming to share our research among young children undergoing hospital treatment.
- We joined the consortium “Escolhas com Futuro”, aiming to promote social integration, inclusion and equal opportunities in education and employment.
- We enrolled in the “Heatlhy Workplaces Campaign 2023-2025 – Safe and healthy work”, promoted by the European Agency for Safety & Healthy at Work in the digital age.
- We organised a donation campaign to support firefighting corporations in the northern and central region of Portugal.
- We supported six institutions in the northen region of Portugal during the “International Volunteer Day”.
- We organised a blood donation campaign with Hospital de Braga.
- We ran a campaign that collected over 90 products for pregnant women and babies at risk (supporting Associação Vida Norte) and close to 70 products for people in need (Red Cross).

ETHICS COMMITTEE

We uphold ethics as a fundamental value in our scientific achievements, promoting standards of integrity, honesty and responsibility across all activities.

Internal initiatives:

- We organised several activities dedicated to physical and mental health to celebrate World Mental Health Day, including a nutrition workshop, an awareness session on the importance of sleep, and a Pilates class.
- We launched an awareness-raising campaign related with the Childhood Cancer Awareness Month.
- We continued our internal collection of Nespresso capsules to be recycled, thus contributing to the "Reciclar é Alimentar" project.

2024 highlights:

- Through the Ethics Committee, all research projects raising ethic concerns or involving human subjects, personal data, artificial intelligence, or autonomous systems – are subject to an initial ethic assessment.
- A new issue arose in 2024, due to new opportunities of funding defence-related research projects. To discuss the ethical issues involved, we organised the series "INESC TEC Talks on Ethics in Research and Defence" with two conferences in 2024:
  - "My Facial Recognition System is 100% Accurate—Is It Good News?"
  - "Balancing Innovation and Social Responsibility."

7.2. AWARDS AND RECOGNITIONS

2024 was a remarkable year for our institution, distinguished by numerous awards that celebrated the excellence of our research, technological development, and innovation. These national and international recognitions reflect the transformative impact of our work across diverse fields such as artificial intelligence, healthcare, energy, agriculture, mobility, and digital security.

Our commitment to advancing knowledge and developing practical solutions was recognised by leading institutions, industry bodies, and scientific communities. From innovative applications of AI in medicine to pioneering advances in sustainable mobility and agricultural robotics, our technologies embodied scientific excellence, societal relevance, and entrepreneurial achievement.

Beyond institutional recognition, our spin-offs reached significant milestones of their own, earning international acclaim for their contributions to deep-tech innovation and industry transformation. These accomplishments reinforce our mission to bridge the gap between research and real-world application, while strengthening Portugal's position in the global innovation landscape.

The following awards – received by both our institution and our spin-offs – showcase the breadth and impact of our work. Grouped by international and national recognitions, they illustrate our contributions across sectors and geographies.

INTERNATIONAL AWARDS:

— **European Innovation Award (EARTO)** – Our "intelligent Lab-on-a-Fiber" (iLoF) technology was distinguished with the Impact Expected award, making us the first Portuguese institution to receive this recognition. iLoF enables non-invasive patient stratification through biomarker analysis, using advanced photonics and AI to identify unique biological patterns.

— **Innovation in Artificial Intelligence Award (GITEX GLOBAL 2024)** – Our research on classifying epileptic seizures using AI-powered 3D video technology was honoured at GITEX GLOBAL 2024, the world's largest technology and startup event. This recognition highlights the potential of our AI-driven solutions in advancing medical research and diagnostics.

— **Best World FIRA Robot** – 2nd Place, Participants' Choice (FIRA 2024 – World Agricultural Robotics Forum) – Our Modular-E robot earned second place in the "Participants' Choice" category at the world's leading event for agricultural robotics. This cost-efficient, modular autonomous platform supports multiple precision farming tools, enabling the execution of diverse tasks – individually or simultaneously – with high accuracy.

— **Award from the Spanish Statistics and Operations Research Society and BBVA Foundation** – Our research on kidney paired donation was recognised for its contribution to improving transplant programme effectiveness. The work enhances outcomes for all participants by encouraging patients to bring additional donors into the system, thereby increasing compatibility and expanding transplant opportunities with greater precision and equity.

NATIONAL RECOGNITION:

— **1st Place – Crédito Agrícola Entrepreneurship and Innovation Awards (2024)** – Our AI-powered Pocket-Vet technology won first place in the "Food and Nutrition Security" category at the 11th edition of this national competition. In the "Transition and Carbon Neutrality" category, our Orioos robotic solution was among the finalists, and our spin-off Seedsight received the "Born from Knowledge" honourable mention, awarded by ANI.

— **Portugal Digital Award (2024)** – Our EVFlex solution for electric vehicle charging was recognised for its contribution to sustainable mobility. By integrating dynamic pricing and user incentives, EVFlex supports more efficient and flexible charging. The solution is already in use at several Continente stores across Portugal, accessible via the supermarket's Continente Plug&Charge app.

— **Agricultural Innovation Award (2024)** – Our Modular-E robot was also recognised nationally with the Agricultural Innovation Award, promoted by Timac Agro in partnership with Expresso and SIC Notícias. This award celebrates technological innovation in the agro-food sector and reinforces the impact of our solutions in advancing precision agriculture.

— **2nd Place – IN3+ Award (One Million for Innovation)** – Our PeT – Privacy and Transparency project was awarded second place in the fourth edition of the IN3+ Award. The initiative recognises disruptive ideas with strong innovation potential, and PeT was distinguished for its approach to enhancing transparency and privacy in digital services.

SPIN-OFFS ACHIEVEMENTS:

— Named Among the **World's Top 11 Deep-Tech Startups by Nature** – Our spin-off Seedsight was selected by Nature as one of the 11 most promising deep-tech companies worldwide. This prestigious recognition highlights its leadership in translating cutting-edge science into impactful technological innovation.

— Winner – **Altice International Innovation Award 2024** – Seedsight was awarded the top prize in this prestigious competition, which recognises breakthrough technologies with high innovation potential. The award confirms Seedsight's position at the forefront of digital innovation and scientific entrepreneurship.

— AutoTech **Breakthrough Award 2024** – Our spin-off Ubirider was internationally recognised as the "Public Transportation Technology Solution of the Year." The award celebrates its transformative impact on urban mobility through smart, user-centric transportation solutions.

7.3. **OUR COMMUNITY**

At INESC TEC, our people are our greatest asset. Throughout 2024, we dedicated moments to our community, promoting connection, collaboration and recognition. These events reflect our commitment to those who made our achievements possible, because behind every scientific breakthrough, there is a team that drives it forward. Thank you all! We are Science, we are Technology, we are Innovation, we are INESC TEC.

WE ARE SCIENCE.
WE ARE TECHNOLOGY.
WE ARE INNOVATION.
WE ARE INESC TEC.


INESC TEC
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AND COMPUTER ENGINEERING,
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