# Analytical study on university programs in the field of drones and avionics in the European area

Olga DARII[1], Marianna SAVVA*,[1]

*Corresponding author
[1]Moldova State University,
Institute of Applied Physics, Scientific Research Laboratory for Environmental Physics and Complex Systems Modeling,
Chisinau, Republic of Moldova, 60 Al. Mateevici Street,
olga.darii@gmail.com, olga.darii@usm.md,
savva.mariana90@gmail.com*, marianna.savva@usm.md*

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***Abstract:*** *This article presents a comparative analysis of university programs across Europe that focus on drone architecture and avionics. The aim of the analysis is to identify best practices, trends, and relevant development directions to support the update of the curriculum at Moldova State University. By comparing the structure, content, and orientation of these programs, the study seeks to align the educational offering with current labor market demands and sustainability requirements.*

***Key Words:*** *drones, avionics, curriculum, sustainability, higher education*

## 1. INTRODUCTION

In the context of the rapid advancement of modern technologies and the growing interest in sustainable solutions, the revision of university programs has become an urgent necessity. In this regard, the evaluation and reconceptualization of the "Drone Architecture and Avionics" curriculum, implemented at the Faculty of Physics and Engineering of the Moldova State University, should be carried out by aligning it with current demands in both the technological and environmental fields.
Adjusting the curriculum content to the needs of the labor market and to the imperatives of environmental protection represents a strategic priority.

In order to identify best practices, trends, and relevant development directions, we aim to analyze programs offered by universities in the European area that provide education in the field of drone architecture and avionics, focusing on their curricular structure, content, and orientation.

The study will include similar programs from European universities active in this domain, with the goal of identifying trends, good practices, and development directions in higher education. This analysis will provide a clear picture of how these programs are structured and designed in other institutions of higher education, facilitating a deeper understanding of the requirements and opportunities in the educational and technological market.

## 2. ANALYTICAL STUDY

**The first country analyzed in our study is Poland**, known for its significant progress in advanced technologies and the development of educational programs dedicated to drones. Studying Polish university programs provides a relevant perspective on how this field is approached in Central Europe, thereby contributing to the creation of a solid comparative framework for evaluating and improving our own curriculum. In Poland, the development of higher education in the field of drones is in a consolidation phase, characterized by the integration of these technologies within technical and computer science disciplines.

A representative example is **VIZJA University in Warsaw,** which provides a specialization in **"Drone Engineering" (Inżynieria Dronów) as part of its Bachelor's program in Computer Science.** The program has a duration of *4 years (8 semesters) and totals 245 ECTS credits,* being designed to train specialists with competencies in both software development and the design and operation of unmanned aerial systems. The curriculum *integrates core computer science subject*s - such as programming, computer architecture, operating systems, and software engineering - with applied areas specific to drones, including automation, robotics, applied mechatronics, aerodynamics, embedded systems, signal and image processing, artificial intelligence, and aerial navigation. This multidisciplinary structure supports the development of essential skills for designing, controlling, and integrating drones into complex data systems.

*The program is notable for its strong emphasis on practical training and hands-on experience in modern laboratories,* where students engage in team projects, internships, and the development of UAV applications. Additionally, the training includes an ethical and regulatory component regarding drone use, referencing European legislation and principles of social responsibility. Through this approach, the specialization contributes to educating a new generation of engineers capable of integrating emerging technologies into fields such as environmental monitoring, precision agriculture, smart logistics, and sustainable mobility [1].

**Another relevant example in this field is Austria,** which is continuously developing programs adapted to new UAV technologies.

**The** University of Applied Sciences FH Kufstein Tirol provides a **Bachelor's program in Drone Engineering**, *conducted entirely in English, with a duration of 6 semesters (3 years) and totaling 180 ECTS credits.*

The program leads to a degree of Bachelor of Science in Engineering (BSc) and is notable for its interdisciplinary structure which integrates aeronautical engineering, applied computer science, and data analysis.

The curriculum includes courses in drone design, propulsion, components and materials, aerodynamics, programming, artificial intelligence, sensors, and data analysis, along with modules on legal regulations, operational safety, and airspace management (U-Space/UTM) [2]. The program integrates *theoretical training with practical applications through laboratories, interdisciplinary projects, and an integrated internship of 500 hours (equivalent to 12.5 weeks of industry work)* [3], *followed by the development of a Bachelor Thesis. Courses such as Drone Programming and Sensor Evaluation, Swarm Programming, UAS Simulation, and Autonomous Systems* build competencies in cutting-edge areas of autonomy and smart mobility. With its focus on technological innovation and sustainability, the *program at FH Kufstein Tirol* trains specialists capable of designing, operating, and managing unmanned

aerial systems with applications *in logistics, urban mobility, precision agriculture, and environmental monitoring.*

These efforts are also reflected in the training initiatives launched in **Belgium,** where **VIVES University of Applied Sciences actively** develops educational and research programs in modern aviation through its **Expertise Centre for Smart Technologies – Aviation Research, focused on two major areas: Unmanned Aircraft Systems (UAS) and MRO – Maintenance, Repair & Overhaul.** Within the Aeronautical Engineering program, the university provides a *specialization in "Unmanned Aircraft Systems (UAS)", available both in Dutch and English, totaling 60 ECTS credits*. The curriculum includes modules dedicated to the fundamentals of flight, practical pilot training, drone design and construction, manufacturing and maintenance processes, as well as aspects related to economic applications and business projects. *Educational activities are supported by the DroneLab infrastructure, a laboratory dedicated to applied research and innovation in the field of drones.* Students participate in practical and research projects in collaboration with industry partners, addressing concrete applications such as precision agriculture (smart farming), environmental monitoring, infrastructure inspection, pollution detection, and SAR (Search and Rescue) interventions.

The program promotes a multidisciplinary approach, integrating technical, operational, legal, and aviation safety aspects. By combining theoretical instruction with applied and research activities, VIVES trains specialists capable of developing and implementing sustainable solutions in the field of autonomous aviation [4].

In addition to these examples, **Spain** provides a relevant perspective on how drone training can be integrated into the national education system. The country is notable for having a dedicated **master's program** in this field, offered by the **University of Santiago de Compostela,** highlighting its commitment to professionalization and specialization in UAV technologies.

The **Master's Degree in Unmanned Aerial Systems (UAS)** represents an advanced specialization within the Galician university network and is one of only two official programs of this type available in Spain. Students can choose courses focused on drone operation, organized by the University of Santiago de Compostela (at the Higher Polytechnic School of Engineering in Lugo), or disciplines dedicated to the design and development of these systems, offered by the University of Vigo (through the *School of Aeronautical and Space Engineering in Ourense)*. This master's program also provides the necessary training for obtaining a UAS pilot license and provides the possibility to continue studies through doctoral programs, including thesis work. *The program is supported by the Galician Innovation Agency (GAIN) and is implemented in partnership with the RPAS-UO group from the University of Oviedo.*

*Structured around 60 ECTS credits, the master's* integrates *theory with practical applicability and is designed to be followed alongside professional activity. It includes 24 mandatory credits in areas such as UAS, specific legislation, aerodynamics, and observation systems, and 18 elective credits covering applications in environment, engineering, architecture, control, and communications.* Courses are delivered both on-site at university centers in Lugo (USC) and Ourense (UVigo), as well as online. The program concludes with a mandatory internship and the preparation of a dissertation, each worth 9 credits [5].

Another relevant master's program in the field of drones is **"Unmanned Aircraft Systems and Associated Technologies" (MUSANTTA)**, offered by the Polytechnic University of Valencia. *This 1.5-year program, equivalent to 90 ECTS* credits, trains specialists in unmanned aerial systems and associated technologies through a modular structure that includes courses on drone design, construction, and operation, regulations and safety, as well as airspace management (U-space).The program also covers geospatial

technologies, data processing, and aerial mobility. Students have the opportunity to choose elective courses and are required to complete a final master's project. Through this combination of theory and practical application, the program trains professionals capable of using drones across various sectors impacting the environment and society, such as precision agriculture, cartography, environmental protection, logistics, and urban mobility [6].

**Italy** is notable for educational initiatives that combine technical training and aeronautical regulation in the field of drones. A significant example is the **PARS – Remote Pilot Aircraft Systems Master's program**, *offered by the University of Rome "Tor Vergata" in collaboration with ENAC (Ente Nazionale per l'Aviazione Civile), the Italian civil aviation authority*.

This Level I program features an intensive structure including 400 hours of theoretical training and 250 hours of laboratory and practical activities, focusing on training specialists in the design, development, operation, and certification of unmanned aerial systems. The courses cover topics such as propulsion and control systems, navigation and communications, aviation safety, and European regulations (EASA), as well as aspects related to certification and the integration of drones into civil airspace.

Through direct collaboration between the university and the national aviation authority, the program ensures a balance between theoretical preparation, practical training, and compliance with international standards in the field. Graduates are prepared to take roles in the design, testing, operation, and regulation of RPAS systems, contributing to the development of a modern and sustainable aeronautical sector in Italy [7].

Continuing in the same direction of advanced training in aeronautics and unmanned systems, **France** stands is recognized for the program offered by the **Institut Polytechnique des Sciences Avancées (IPSA)**, which provides a **Master's Degree in Aerospace and Aeronautical Engineering**, **accredited by the Commission des Titres d'Ingénieur (CTI).** *The program is equivalent to 120 ECTS credits, conducted over two years at the Ivry-sur-Seine campus (Paris)* [8].

The program is designed for bachelor's graduates in technical fields such as aerospace engineering, mechanics, electronics, or mechatronics, and aims to combine solid engineering science training with practical applications and industrial projects. The curriculum covers diverse areas — from embedded systems, propulsion, mechatronics, and advanced structures to telecommunications, composite materials, artificial intelligence, and flight safety — offering two major study tracks: Vehicles and Signals & Systems, with multiple specialization options such *as Mechanics and Structures, Energetics and Propulsion, Space, Launchers and Satellites.*

*The program is delivered in both English and French, with minimum language requirements of B2 in English and B1 in French for obtaining the engineering diploma.* Students complete theoretical courses (up to 99 hours per semester in engineering sciences) and modules on engineering ethics, corporate law, cybersecurity, and sustainability, followed by two mandatory internships: a minimum 8-week placement at the end of the first year and a 6-month internship in the second year, often leading to professional integration in the industry.

The program develops integrated competencies in design, structural analysis, numerical simulation, and aeronautical project management, preparing engineers capable of innovating in drones, avionics, and sustainable aerial mobility.

In addition to this master's program, **IPSA** also provides a **5-year integrated program in Aerospace Engineering, accredited by the CTI.** This program integrates foundational training in exact sciences (mathematics, physics, computer science) with applied disciplines such as avionics, aeronautical systems, mechatronics, and space engineering.

Structured in two cycles - a bachelor's degree (3 years) and an engineering cycle (2 years) - the program emphasizes learning through projects, applied research, and annual internships, offering the possibility to specialize in Avionics or Aeronautical Systems Design in the final years. Teaching is conducted in a bilingual environment with an international outlook and strong industrial partnerships, reflecting European trends toward integrating sustainability, digitalization, and autonomy in the education of aerospace engineers [9].

A notable example in the baltic region is **Lithuania, where Vilnius Gediminas Technical University (VILNIUS TECH),** through the **Antanas Gustaitis Aviation Institute (AGAI), supports aeronautical education by offering a Bachelor's degree in Aviation Mechanics Engineering.** The program, equivalent to *240 ECTS credits and spanning four years, is taught in both Lithuanian and English.* Part of the **Aerospace Engineering** field, the program integrates theoretical training in mathematics, applied physics, mechanical engineering, and electronics with practical education carried out in aviation laboratories and industrial internships. The curriculum includes subjects such as aerodynamics, aircraft structures, functional flight systems, space technologies, and numerical methods (Finite Element Method), as well as the specialized course *"Unmanned Aerial Vehicles and their Systems",* which integrates training in the design, operation, and maintenance of drones within the classical engineering curriculum.

In the final year, students undertake a professional internship and complete a thesis focused on technological applicability, acquiring skills in diagnostics, design, and aeronautical regulation. The program trains specialists capable of blending traditional engineering knowledge with emerging technologies of autonomous and sustainable systems and is recognized as a best practice example in the modernization of European aviation education [10].

At the advanced studies level, Vilnius **Gediminas Technical University**, through the **Antanas Gustaitis Aviation Institute (AGAI),** also provides a **Master's program in Aerospace Engineering,** delivered *over two years (120 ECTS)* in both Lithuanian and English. The program takes an interdisciplinary approach, combining aerospace engineering, electronics, mechatronics, and IT, with a focus on applied research and prototype development. Students attend courses such as *Microsatellite Engineering, Remote Monitoring, Computer-Aided Engineering (CAE), Astrodynamics, and specialized modules including Introduction to UAV Technology, Unmanned Aerial Vehicle Systems, and Autonomous Control of UAVs,* integrating training in drones and autonomous systems. The program encourages innovation through projects in emerging fields — industrial drones, nano-satellites, and 3D printing applied in aviation — training specialists capable of developing sustainable solutions for aerial mobility and unmanned technologies [11].

The next country analyzed is **Estonia.** The Master's program **Environmental Governance and Adaptation to Climate Change (EGACC),** jointly offered by the **University of Tartu and Estonian University of Life Sciences,** lasts *two years (120 ECTS)* and is taught *entirely in English*. Structurally interdisciplinary, the program trains specialists capable of developing policies and solutions for climate change adaptation, in line with the *principles of the European Green Deal.* Courses cover fields such as environmental management and governance, climate policies, ecotoxicology, circular economy, ecological technologies, and environmental law, complemented by applied modules in remote sensing, environmental monitoring, and ecological engineering. *Students may choose specialization submodules in Climate, Atmospheric Processes and Remote Sensing; Ecotechnology and Water Management; or Circular Economy and Waste Valorisation, combining scientific research with practical activities and training internships.* Through this structure, EGACC

forms professionals able to lead sustainability projects, apply green technologies, and contribute to international climate governance [12].

Within this European educational landscape, **Germany** is recognized for programs focused on applied research and advanced training in UAS. The **University of Stuttgart,** through the **Institute of Aircraft Design (IFB),** is notable for its research and training activities in the field of **Unmanned Aerial Systems (UAS),** integrating advanced engineering expertise in design, avionics, systems integration, and aeronautical testing. *The UAS research group develops and tests experimental aerial vehicles and payload systems with applications in agriculture, mapping, infrastructure inspection, environmental monitoring, and critical infrastructure safety* [13, 16]. Major projects include:

- NACRE (New Aircraft Concept Research) – European FP6 project focused on the development of research drones for testing innovative aircraft configurations; the resulting UAV features a wingspan of 4.16 m, two JetCat turbines, and a maximum weight of 145 kg [14].
- VELAN și eMission – Projects dedicated to reducing energy consumption through distributed electric propulsion and regenerative propeller systems; they aim to develop emission-free and energy-efficient flight concepts [15].
- AMI-PGS (Air Mobility Initiative – Positioning and Guidance System) – A program investigating radar-based solutions for precise navigation of eVTOL aircraft in urban spaces (U-Space), conducted in collaboration with Airbus Urban Mobility and TUM [17] .
- OptiDeV – A project for measuring aerodynamic conditions in free flight, using drones as "flying wind tunnels", aimed at validating electric propulsion technologies [18].

Through these initiatives, IFB **(Institute of Aircraft Design)** directly contributes to the advancement of sustainable aviation and the integration of autonomous systems in modern air transport. The institution's activities combine applied research, experimental testing, and the development of innovative UAVs, providing a benchmark educational and technological framework in Europe for drones and smart aerial mobility [16].

**Hochschule Ansbach** - a public university of applied sciences in **Bavaria, Germany,** recognized for its practical focus and close collaboration with industry - is recognized for its initiative, the **Bavarian Drone Academy (BDAN).** Through this, the institution has created a **center of excellence dedicated to training and applied research in civil aerial robotics**, *located at the Feuchtwangen campus.* The academy has an interdisciplinary character, bringing together the faculties of media and technology, and provides *courses such as "Basics UAV: Use of Drones (Theory)",* thermography, photogrammetry, and aerial videography. Additionally, *Hochschule Ansbach is an authorized body for issuing the European pilot certificate A2 (EU Remote Pilot Certificate A2), ensuring internationally recognized training.*

BDAN's activities go beyond the technical training of operators, including applied research and partnerships with industry, authorities, and regional organizations in emerging fields such as hydrogen propulsion, aerodynamic simulations, plant vitality, and artificial intelligence integration. Through this integrated approach, the academy significantly contributes to the digitalization and sustainability of the construction, energy, and environmental protection sectors, **strengthening Germany's role as a European leader in civil drone innovation** [19].

In northern Europe, **Sweden** *contributes to specialist training through programs supporting the use of drones in geospatial contexts.* **Stockholm University** provides **a Master's program in Geomatics with a specialization in Remote Sensing and GIS** — *a two-year program equivalent to 120 ECTS credits, taught entirely in English.* This program prepares experts capable of applying modern geospatial technologies in environmental

analysis, natural resource management, and sustainable planning. The curriculum includes core courses such as *Applied Remote Sensing and GIS for Landscape Analysis, Geographic Analysis and Visualization in GIS, Advanced Remote Sensing, and Scientific Methods in Physical Geography,* totaling 60 mandatory credits. Students can then choose thematic electives according to their interests and complete the program with a Master's thesis (30–60 ECTS) based on applied research. The program emphasizes *the use of advanced remote sensing, spatial modeling, and AI-assisted geographic analysis for monitoring environmental changes and ecosystems.*

Practical activities include working with data from satellites, drones, and aerial sensors, integrating methods of digital cartography, spatial analysis, and 3D visualization. Graduates become skilled in developing geoinformatics solutions for global challenges related to climate, urban planning, smart agriculture, and environmental protection, thereby contributing to the promotion of sustainable air mobility and resource management [20].

Another notable university example in **Sweden is the KTH Royal Institute of Technology (Kungliga Tekniska Högskolan)** in Stockholm, which provides the Master's program in **Environmental Engineering and Sustainable Infrastructure** — *one of the most comprehensive programs in Europe focused on sustainable infrastructure and environmental technologies.* Structured over two years (120 ECTS), the program integrates engineering sciences with the analysis of ecological systems and urban planning. It is divided into seven competency profiles: *Water Technology, Environmental Geology and Hydrogeology, Water and Wastewater Technology, Environmental Information Analysis and Management, Sustainable Infrastructure, Environmental Systems Analysis, and Sustainable Societies.*

Students take courses such as Environmental Impact Assessment, Applied Hydrology, Life Cycle Assessment, Urban Infrastructure, Resilience Thinking in Sustainable Planning, and Governance of Land and Water Resources, developing practical skills in the design and evaluation of sustainable systems. The program adopts an interdisciplinary approach bridging engineering, urban planning, circular economy, and environmental policy, emphasizing resilience, green-blue infrastructure, and water resource management. The final semester is dedicated to the master's thesis (30 credits), integrating applied research in collaboration with industrial and institutional partners [21].

Besides the examples from Sweden and Germany, **Portugal** contributes to the development of skills in remote sensing and GIS through a dedicated program at the University of Porto. **The University of Porto – Faculty of Sciences (FCUP)** provides **a Master's program in Remote Sensing,** *a two-year course (120 ECTS)* focused on integrating remote sensing technologies and geospatial analysis in environmental research and management. The program, *taught in English,* includes a first year of theoretical and applied courses (60 ECTS) and a second year dedicated to a scientific dissertation or research internship (54 ECTS), complemented by an academic writing module (6 ECTS). The curriculum integrates mandatory subjects such as *Fundamentals of Remote Sensing, Digital Image Processing, Airborne Sensors and Photogrammetry, GNSS Applications, and Geographic Information Systems* with thematic electives that allow specialization in areas like precision agriculture, oceanography, coastal zones, meteorology, or SAR interferometry. The flexible structure of the program — with some activities held partially on weekends - facilitates the participation of active professionals. The Master's program trains specialists capable of using data from satellites, drones, and airborne sensors for environmental monitoring, climate change analysis, and the development of sustainable solutions based on geospatial technologies [22].

In **Norway** is notable for applied research activities carried out at **the Norwegian University of Science and Technology (NTNU). At NTNU, within the Department of**

**Cybernetics and Autonomous Systems (Institutt for teknisk kybernetikk), the Unmanned Aerial Vehicles Laboratory (UAV-Lab) operates** — an academic infrastructure serving as a reference point for research and training in autonomous aerial systems. The laboratory supports educational and research activities in master's and doctoral programs in fields such as autonomous systems, guidance and control, robotics, and mechatronics, being integrated into NTNU's advanced engineering education platform. UAV-Lab is equipped with modern facilities for testing and training — simulators, control systems, sensors, and dedicated flight zones (at Agdenes Airport and other testing sites) — and supports the development of practical skills in navigation, mission planning, fault-tolerant control, UAV-to-ground communication, and operation in extreme environmental conditions. By combining theoretical training with experimental applications, NTNU provides a comprehensive educational framework for specialization in autonomous drones and sustainable aerial mobility [23].

**The United Kingdom** represents another relevant example in our analysis, due to its strong academic tradition and substantial investments in drone research and advanced technologies. The Environmental Drone Remote Sensing master's program at Swansea University (duration: 1 year, 120 ECTS) is one of the most specialized in Europe in integrating remote sensing, GIS, and drone operation for environmental applications. The course integrates technical and practical training in UAV usage with geospatial data analysis and the development of applied research skills. Students receive training accredited by the **Civil Aviation Authority (CAA) and obtain the official General Visual Line of Sight Certificate (GVC), required for professional drone operation in UK airspace**. Core modules (compulsory, 80 ECTS):

- ✓ *Environmental Remote Sensing (GEGM10)* – Capture and processing of multispectral images [24];
- ✓ *Drone Accreditation and Remote Sensing (GEGM03)* – Practical training for UAV licensing [25];
- ✓ *Geographical Information Systems (GEGM22)* – Spatial analysis and geospatial data integration [26];
- ✓ *Ecosystems: Ecology, Conservation & Resource Management (BIOM32)* – Environmental applications of remote sensing [27].

Optional modules (40 ECTS): Students can choose from advanced courses such as Environmental Modelling (GEGM04), Climate Change – Past, Present and Future (GEGM21), or Advanced Techniques in Biodiversity Assessment (BIOM22), which offer opportunities for fieldwork and applied research. The final thesis (60 ECTS) – Environmental Drone Remote Sensing Dissertation (GEGM06C) – integrates the technical and analytical skills acquired by developing an independent research project.

The program is offered within the School of Biosciences, Geography and Physics, in collaboration with the Global Environmental Modelling and Earth Observation (GEMEO) research group, preparing graduates for fields such as ecological remote sensing, precision agriculture, climate analysis, or sustainable infrastructure management [28].

## 3. CONCLUSIONS

The analysis of European university programs in the field of drones and avionics highlights a diversity of academic approaches and strategic directions, adapted to the technological, economic, and research contexts specific to each country. At the European level, there is a notable conceptual and methodological variety in the structure of these programs, reflecting local priorities in aviation, engineering, and emerging technologies. In France (Institut

Polytechnique des Sciences Avancées – IPSA) and Lithuania (VILNIUS TECH), avionics and aerospace engineering are predominantly integrated within engineering programs.

The academic training targets disciplines such as aerospace structures, propulsion, mechatronics, and embedded systems, correlated with modules dedicated to operational safety and aviation sustainability. These directions indicate an advanced technological orientation, aligned with international standards of the aeronautical industry.

In Austria (FH Kufstein Tirol) and Poland (VIZJA University), the architecture and design of unmanned aerial systems (UAS) represent distinct curricular components within bachelor's programs, further developed at the master's level in institutions from Spain (Universidad de Santiago de Compostela – USC, Universidad Politécnica de Valencia – UPV) and Italy (University of Rome Tor Vergata – PARS program). These programs emphasize regulation, certification, and professional operation of drones, as well as their integration into controlled airspace and regulated industries.

Institutions such as VIVES (Belgium) and Hochschule Ansbach – BDAN (Germany) adopt an educational model centered on applied training and cooperation with the industrial environment. They promote acquiring concrete skills, obtaining European pilot certifications (e.g., EU A2 Certificate), and conducting educational activities in partnership with relevant economic actors. Thus, they facilitate the rapid transition of graduates to the labor market by strengthening technical and operational abilities.

Advanced research and technological innovation are essential priorities for centers of academic excellence such as the University of Stuttgart – IFB (Germany) and the Norwegian University of Science and Technology – NTNU (Norway). Here, programs include applied research in areas like autonomous systems, electric propulsion, and sustainable aerial mobility solutions, supported by specialized infrastructures – UAV laboratories, testing platforms for eVTOL vehicles, and simulation centers.

The ecological and sustainability dimension is significantly integrated into university programs in Sweden (Stockholm University, KTH Royal Institute of Technology), Portugal (University of Porto), Estonia (University of Tartu and Estonian University of Life Sciences – EMÜ), and the United Kingdom (Swansea University). In these contexts, drones are primarily used for environmental monitoring, climate analysis, and natural resource management, within programs focused on remote sensing, GIS systems, sustainable infrastructure, and ecological governance policies. Overall, a clear European trend emerges toward integrating autonomous technologies with the principles of sustainability and digitalization. Educational programs in this field successfully combine engineering, applied research, and practical training, reinforcing the role of drones as essential tools for innovation, energy efficiency, and environmental protection.

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