Position: **Doctoral Candidate #4 (DC 4)**
Project: **Self-Diagnosis and Adaptive Systems for Field Robotics**
Host Institution: Ingeniarius, Lda.
PhD programme: Electrical Engineering and Intelligent Systems (University of Coimbra – Portugal)

Research project description

The PhD candidate will develop an autonomous diagnostic and predictive maintenance system for field robots, focusing on enhancing reliability, efficiency, and autonomy in agricultural operations. The research will involve designing a self-diagnosis toolkit that integrates real-time data synchronisation for multi-robot systems using advanced methods, like digital twins and blockchain. The candidate will analyse field robotic operations to identify challenges, implement solutions for secure information sharing, and validate findings through field evaluations in agricultural settings. This work will contribute to improving the sustainability and effectiveness of agricultural robotics, with results disseminated at leading conferences and in top journals.

Objectives:

1. To comprehensively analyse field robotics operations, namely in the agriculture domain, for the design of an autonomous diagnostic and predictive maintenance system.
2. To establish secure and efficient information sharing for collaborative field robotics.
3. To foster collaborative operations through real-time data synchronisation within multi-robot systems.
4. To develop and validate a self-diagnosis toolkit for field robots operating under the agriculture domain.

Expected Results:

- Systematically identify and document the operational requirements for deploying autonomous robots across multiple agricultural use cases, including, but not limited to, crop monitoring, precision farming, and automated harvesting.
- Translate these operational requirements into detailed technical specifications that will guide the development of a new generation of field robots, emphasising modularity, adaptability, and scalability to various agricultural settings.
- Provide a modular self-diagnosis toolkit designed for easy integration with both new and existing robotic platforms, which should include advanced algorithms for real-time monitoring, fault detection, and predictive maintenance, tailored to the unique demands of agricultural operations.
- Design and implement a comprehensive framework for run-time self-diagnosis capable of continuously assessing the operational state of all hardware and software components of robots.
- Develop APIs that supports run-time configuration adjustments based on diagnostic outcomes, facilitating dynamic response to detected issues or changing operational conditions.
- Integrate the developed self-diagnosis toolkit and associated software components into operational robot models, demonstrating the practical applicability and effectiveness of the developed solutions in real-world agricultural settings.
- Actively disseminate the research findings, methodologies, and developed technologies through publication in world-class international conferences and journals, ensuring the broader scientific and industrial communities are informed of the advancements in field robotics made through this project.
- Engage with stakeholders across the agricultural sector to promote the adoption and further development of the innovative solutions provided by this research, contributing to the global advancement of sustainable and efficient agricultural practices.

Keywords: ***self-diagnosis; predictive maintenance; multi-robot systems; digital twins***.

Funded by the European Union

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Secondments

The secondments planned for this research project are at:

- Harper Adams University (in UK) [4 months]
- AntoBot company (in UK) [3 months]

Desirable skills, qualifications and specific requirements

- Your application should respect the **AIGreenBots** general requirements and eligibility criteria as described here.
- You should have a valid MEng/MSc degree, or equivalent, in electrical engineering, mechanical engineering, mechatronics, computer science, mathematics, physics, or related fields.
- C++/Python programming skills, preferably within the Robot Operating System (ROS).
- Some experience on robotics, machine learning, AI, coding.
- Motivation, sense of responsibility, autonomy and problem-solving skills are highly desirable.

Benefits

- Very attractive salary - living and mobility allowance (gross): 33,611.64 €/year
- Excellent conditions including - social security tax, food allowance, PhD tuition fee, mobility allowance, family allowance (if eligible)
- Research, training and networking costs covered: Registration and attendance at international conferences.

How to apply

You should submit your application through this channel.

Deadline: 28 February 2025, 23:59.

Additional information

Supervisors of this PhD project: Dr. Micael Couceiro, Prof. David Portugal

Host institution and living conditions: Ingeniarius, Lda., located in Alfena, near the vibrant town of Porto (Portugal), offers a dynamic and cutting-edge environment for robotics research and development. As a tech-based R&D company at the forefront of field robotics, Ingeniarius provides a unique opportunity to work on real-world applications in challenging environments, from agriculture to forestry and beyond. The company's hands-on approach and strong industry connections ensure an immersive learning experience that combines innovation, creativity, and practical impact.

Alfena's proximity to Porto, a UNESCO World Heritage city, adds to its appeal. Known for its stunning architecture, lively cultural scene, and the iconic Douro River, Porto offers a perfect blend of historical charm and modern vibrancy. The region's warm climate, delicious cuisine, and welcoming community create an ideal setting for professional and personal growth. Ingeniarius offers an excellent opportunity to advance a career in robotics, while experiencing the richness of Portuguese culture and lifestyle in an inspiring and dynamic location.

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