NOTICE

CALL FOR APPLICATIONS FOR A RESEARCH SCHOLARSHIP

Reference CRIARTE – PRBI/32/2025

The Polytechnic University of Coimbra opens a call for one research fellowships (BI), in the framework of the the CRIARTE project – Ref.: COMPETE2030-FEDER-01192200 - 17402, co-financed by the Portugal 2030 program – European Regional Development Fund (ERDF) through the Thematic Program Innovation and Digital Transition – Compete 2030, under the following conditions:

The scholarship aims to support the implementation and development of the following activities:

1. Sensor Integration and Robotic Perception
    a. Expertise in sensor fusion and sensor calibration;
    b. Experience with LiDAR, RGB-D/multimodal cameras, GNSS, IMU, UWB sensors, and IoT devices;
    c. Proficiency in ROS/ROS2 (Robot Operating System) and middleware for data integration;
    d. Knowledge of temporal and spatial synchronization of sensors and extrinsic/intrinsic calibration.
2. Computer Vision and 3D Pose Estimation
    a. Strong background in computer vision and machine learning applied to pose estimation and visual servoing;
    b. Experience with OpenCV, PCL (Point Cloud Library), PyTorch/TensorFlow, and 3D frameworks such as COLMAP and Open3D;
    c. Ability to develop algorithms for object detection and tracking, 3D reconstruction, and SLAM.
3. Advanced Control and Intelligent Robotics
    a. Solid knowledge of classical and modern control theory (PID, adaptive, robust, and fractional control);
    b. Experience with fuzzy logic and AI-based control (reinforcement learning, neuro-fuzzy systems);
    c. Skills in modelling and simulation of dynamic systems (MATLAB/Simulink, Gazebo);
    d. Familiarity with robotic manipulators and manipulator kinematics/dynamics.

4. Digital Twin Development and Simulation
    a. Experience in digital modelling of robotic systems and cyber-physical integration;
    b. Knowledge of digital twin tools such as Unity, Unreal Engine, Siemens NX, and MATLAB Simscape;
    c. Ability to represent complex kinematic and dynamic models, including noise and sensor uncertainties.
5. Applied Artificial Intelligence and Data Analysis
    a. Proficiency in multivariate analysis techniques (PCA, regression, clustering) and predictive risk models;
    b. Experience with artificial neural networks and fuzzy systems for KPI aggregation;
    c. Knowledge in data engineering, Python, and real-time data analysis.

Generic Scientific Area: Electrical Engineering or Computer Engineering

Specific Scientific Area: Automation and Robotics

Requirements:

Master's degree in Electrical Engineering or related fields; enrolled in a PhD program or a non-degree course.

Experience in:

a) ROS, programming in C++ and Python;

b) Modelling and control.

Work Plan:

The work plan is divided into five phases:

Phase 1 – Development of Software for Advanced Sensor Integration. Objective: Create a sensor integration infrastructure combining data from multiple sensors and human inputs. Activities: Survey and characterization of robot sensors (LiDAR, multimodal cameras, GNSS, IMU, etc.) and external sensors (CCTV, UWB, IoT); development of data acquisition, filtering, and preprocessing pipelines; implementation of sensor fusion algorithms for temporal and spatial integration; integration of human inputs from Augmented Reality (A3) devices and other collaborative sensors; validation tests in simulated and real environments.

Phase 2 – Design of AI Architecture for 3D Pose Estimation. Objective: Develop an AI architecture capable of estimating the 3D position and orientation of objects with robustness and adaptability. Activities: Implementation of visual servoing and 3D pose estimation algorithms; integration of adaptive control techniques, including fractional PID and fuzzy logic; development of modules to handle uncertainty and noise in visual data; performance testing under various construction scenarios and environmental conditions; dynamic adjustment of control parameters for maximum precision and robustness.

Phase 3 – Development of Control Architecture for Sandwich Panel Manipulation. Objective: Create an advanced and collaborative control system for precise and safe manipulation of panels. Activities: Modelling of panels and manipulation devices based on environmental sensors; implementation of visual servoing for dynamic control of panel position and orientation; application of advanced control methods (PID, fuzzy logic, fractional control) to reduce errors; integration of perception and control systems to adapt to obstacles and environmental variability; experimental validation of manipulation accuracy, safety, and efficiency.

Phase 4 – Development of the Robot Digital Twin. Objective: Create a detailed digital model of the robotic platforms for simulation, analysis, and optimization. Activities: Nonlinear kinematic and dynamic modelling of mechanical components (rotary and linear joints); integration of accurate sensor models (LiDAR, multimodal cameras) including associated errors; simulation of robot behavior under various operational conditions; optimization tests of the perception-action architecture; predictive analysis of potential failures and continuous performance improvement.

Phase 5 – Integration of Key Performance Indicators (KPIs). Objective: Create a risk assessment system based on data from assets, humans, and robots to support decision-making. Activities: Definition of a multidimensional matrix of KPIs and risk levels; development of indicator aggregation techniques (weighted average, direct sum, PCA, multivariate regression, fuzzy logic, ANN); implementation of dynamic risk score adjustment based on the actual execution state; simulation and analysis of risk evolution during project execution; optimization of resource allocation and decision-making support using integrated KPIs.

Scholarship Duration:

The grant has a duration of 12 months, possibly renewable for identical periods on an exclusive basis, according to the Research Grant Regulations of the Polytechnic Institute of Coimbra – Order No. 5963/2020, of 01/06, with expected start after 16th January 2026.

Monthly Allowance:

€1.309,64, in accordance with FCT scholarship tables (https://www.fct.pt/wp-content/uploads/2025/02/Tabela_valores_SMM_2025.pdf) , paid monthly via bank transfer. Optional social insurance for the first tier may be subscribed, as well as personal accident insurance.

Workplace:

Instituto Superior de Engenharia de Coimbra (ISEC), an organizational unit of IPC, under the scientific supervision of Nuno Miguel Fonseca Ferreira.

Selection Criteria

- Curriculum Evaluation (70%) and Interview (30%).
    - Curriculum Evaluation: Overall merit of CV (70%);
    - Publications in conference proceedings and journals (30%);
    - Interview Evaluation:
        - Knowledge and suitability for the role (50%);
        - Availability and schedule flexibility (20%);
        - Motivation and interest (30%)

Selection Committee:

President: Nuno Miguel Fonseca Ferreira, Principal Coordinating Professor at ISEC

Members:

José Manuel Meireles Marinho, Adjunct Professor at ISEC

Nuno Alexandre Cid Martins, Adjunct Professor at ISEC

Alternate Members:

Filipe Alexandre Almeida Ningre de Sá, Adjunct Professor at ISEC

João António Pereira Almeida Durães, Coordinating Professor at ISEC

Applications must include the following documents:

Candidates must access and register on the website https://www.ipc.pt/sobre/rh/a-decorrer-bolseiros/ to submit their application, selecting the scholarship they wish to apply for.

The application must be submitted exclusively in digital format, in portable document format (pdf), with the exception of documents that must be submitted in other digital formats.

The application must be completed by completing the sections available at the aforementioned electronic address.

The application must be accompanied by the following documents:

1. Identification, address, identification document number and tax identification number;

2. Letter of motivation from the candidate;

3. Updated Curriculum Vitae (CV);

4. Proof of enrollment, in the academic year.

5. Other documents relevant to the evaluation.

When submitting an application, if the application contains a classified document that reveals a commercial or industrial secret, or a secret relating to literary, artistic or scientific property, the candidate must expressly indicate such a reservation, otherwise the work in question may be freely accessed by any of the other candidates, in the context of the process consultation.

When submitting the application, the candidate must provide the data strictly necessary for this purpose, in accordance with this notice, and must hide any personal data that may exist in the submitted documentation, otherwise this data may be freely accessed by any of the other candidates, in the context of the process consultation.

Application Deadline:

10 working days, from 24/11/2025 e 09/12/2025

Applicable legislation and regulations:

The award of the scholarship is based on the:

- Law No. 40/2004, of August 18, in its current wording (Statute of the Scientific Research Fellow);
- Order No. 5963/2020, of June 1, in its current wording (Regulation of the Research Fellow of the Polytechnic Institute of Coimbra)

The model of the grant contract and the final reports to be prepared by the grant holder and the coordinators are those contained in the annexes of the Scientific Research Grant Holder Statute referred to above.

Publication/Notification of Results:

Results will be announced within 90 working days from the application deadline via email. Candidates may submit comments in a prior hearing within 10 working days. Selected candidates must confirm acceptance in writing and indicate the start date of the scholarship. Failure to respond within the deadline constitutes withdrawal. In case of withdrawal, the next ranked candidate will be notified.

For further information contact:

Nuno Miguel Fonseca Ferreira – nunomig@isec.pt

Coimbra, November 21, 2025