

## **NOTICE**

### **CALL FOR APPLICATIONS FOR A RESEARCH SCHOLARSHIP**

CRIARTE– BI:1

**Reference: PRBI/30/2026**

A call is open for the award of two R&D Research Grants (BI) within the framework of the CRIARTE project – Ref. COMPETE2030-FEDER-01192200 - 17402, co-financed by Portugal 2030 through the European Regional Development Fund (ERDF), under the Thematic Programme for Innovation and Digital Transition – Compete 2030, under the following conditions:

#### **Purpose of the Grant**

The grant is intended for the implementation and development of the following activities:

##### **1. Sensor Integration and Robotic Perception**

- Knowledge of sensor fusion and sensor calibration;
- Experience with LiDAR, RGB-D/multimodal cameras, GNSS, IMU, UWB and IoT sensors;
- Proficiency in ROS/ROS2 (Robot Operating System) and middleware for data integration;
- Knowledge of temporal and spatial synchronization of sensors and extrinsic/intrinsic calibration.

##### **2. Computer Vision and 3D Pose Estimation**

- Knowledge of computer vision and machine learning applied to pose estimation and visual servoing;
- Experience with OpenCV, PCL (Point Cloud Library), PyTorch/TensorFlow, and 3D frameworks (COLMAP, Open3D);
- Ability to develop object detection and tracking algorithms, 3D reconstruction and SLAM.

##### **3. Advanced Control and Intelligent Robotics**

- Solid knowledge of classical and modern control (PID, adaptive, robust and fractional control);

- Experience in fuzzy logic and AI-based control (reinforcement learning, neuro-fuzzy);
- Skills in modelling and simulation of dynamic systems (MATLAB/Simulink, Gazebo);
- Familiarity with robotic manipulators and manipulator kinematics/dynamics.

#### 4. Digital Twins and Simulation

- Experience in digital modelling of robotic systems and cyber-physical integration;
- Knowledge of digital twin tools (Unity, Unreal Engine, Siemens NX, MATLAB Simscape);
- Ability to represent complex kinematic and dynamic models, including noise and sensor uncertainties.

#### 5. Applied Artificial Intelligence and Data Analysis

- Knowledge of multivariate analysis techniques (PCA, regression, clustering) and predictive risk models;
- Experience with artificial neural networks and fuzzy systems for KPI aggregation;
- Knowledge of data engineering, Python and real-time analysis.

**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:** Electrotechnical Engineering

**Specific scientific area:** Automation and Robotics

**Requirements:**

Holds a bachelor's degree in Electrical Engineering or a similar field, and is enrolled in a master's degree program in Electrical Engineering or a related area.

- With experience in:

- a) ROS, Programming in C++, Python;
- b) Modeling and Control.

### **Work plan:**

The work plan is divided into five phases. The first phase focuses on the development of software for advanced sensor integration; the second phase on the design of an AI architecture for 3D pose estimation; the third phase on the development of a control architecture for the manipulation of sandwich panels; the fourth phase on the development of the robot's Digital Twin; and the final phase on the integration of performance indicators.

#### **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 the robot's sensors (LiDAR, multimodal cameras, GNSS, IMU, etc.) and external sensors (CCTV, UWB, IoT). Development of acquisition, filtering and pre-processing pipelines for sensor data. Implementation of sensor fusion algorithms for the temporal and spatial integration of sensor data. Integration of human inputs from Augmented Reality (AR) devices and other collaborative sensors. Validation tests in simulated and real environments to ensure accurate and robust perception of the environment.

#### **Phase 2 – Design of an AI Architecture for 3D Pose Estimation**

**Objective:** Develop an AI architecture capable of estimating the position and orientation of three-dimensional 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 different construction scenarios and environmental conditions. Dynamic adjustment of control parameters for maximum accuracy and robustness.

#### **Phase 3 – Development of a Control Architecture for Sandwich Panel Manipulation**

**Objective:** Create an advanced and collaborative control system for the 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 calculus) 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's 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 behaviour under varying operating conditions. Optimization tests of the perception-action architecture. Predictive analysis of potential failures and continuous improvement of robotic performance.

#### Phase 5 – Integration of Key Performance Indicators (KPIs)

**Objective:** Create a data-based risk assessment system using 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 a mechanism for dynamically adjusting risk scores based on the actual execution status. Simulation and analysis of the evolution of risk levels during construction activities. Optimization of resource allocation and decision support based on integrated KPIs.

#### Grant Period

The grant will have a duration of 12 months, renewable for six-month periods, on an exclusive basis, in accordance with the Order No. 5963/2020, of June 1, in its current wording (Research Grant Regulations of the Polytechnic Institute of Coimbra). The expected starting date is 1 January 2027, ending on the project's completion date, currently scheduled for January 2028.

### **Monthly Maintenance Allowance**

€1,090.98, in accordance with the FCT, I.P. table of Research Grant values in Portugal. Payment will be made monthly by bank transfer. An additional amount corresponding to voluntary social security contributions for the first tier will be provided if the candidate opts for enrolment. Personal accident insurance will also be provided.

### **Place of Work**

The work will be carried out at the Coimbra Institute of Engineering of UPCoimbra, under the scientific supervision of the Principal Coordinator, Professor Nuno Miguel Fonseca Ferreira.

### **Selection Criteria**

Applications will be evaluated according to the following criteria:

- Curriculum Assessment (70%)
- Interview (30%)

The Curriculum Assessment will consider:

- Absolute merit of the curriculum vitae (70%);
- Publications in conference proceedings and scientific journals (30%).

The interview will consider:

- Knowledge and profile suitable for the functions to be performed (50%);
- Availability and schedule flexibility (20%);
- Motivation and interest (30%).

### **Selection Committee**

The selection committee will consist of the following Professors:

Full members:



**Cofinanciado pela  
União Europeia**

- Professor Nuno Miguel Fonseca Ferreira;
- Professor Fernanda Madureira Coutinho;
- Professor Jorge Miguel Sousa Barreiros.

Alternate members:

- Professor Filipe Alexandre Almeida Ningre de Sá;
- Professor João António Pereira Almeida Durães.

### **Documents to be Submitted**

Applications must include the following documents:

- Application form available on the internet page for this competition at [https://www.ipc.pt/bupc/concursos/form/concursos\\_bolseiros](https://www.ipc.pt/bupc/concursos/form/concursos_bolseiros)
- Motivation letter;
- Curriculum vitae;
- Supporting documents for academic qualifications and other elements presented in the curriculum vitae.

### **Application Deadline:**

The application period will be 10 working days, **from 20 October 2026 to 2 November 2026**.

Candidates must access and register on the following website:

[https://www.ipc.pt/bupc/concursos/form/concursos\\_bolseiros](https://www.ipc.pt/bupc/concursos/form/concursos_bolseiros) and select the procedure for which they wish to apply. Applications must be submitted exclusively in digital format. The accompanying documents must be submitted in Portable Document Format (PDF), except for documents for which other digital formats are specifically required. The application must be completed through the sections available at the above-mentioned electronic address. When submitting the application, if it contains a document classified as containing commercial or industrial secrets, or secrets relating to literary, artistic or scientific property, the candidate must expressly indicate this reservation. Otherwise, the work may be freely accessed by other candidates when consulting the application process.

When submitting the application, candidates must provide only the personal data strictly necessary for this purpose under the terms of this notice and must conceal any personal data that may appear in the documents submitted. Otherwise, such data may be freely accessed by other candidates when consulting the application process.

### **Applicable Legislation and Regulations**

The award of the grant is based on the following legal provisions:

- Law No. 40/2004 of 18 August, in its current wording (Statute of the Scientific Research Fellow);
- Order No. 5963/2020 of 1 June, in its current wording (Research Grant Regulations of the Polytechnic Institute of Coimbra).
- Research Fellowship Regulations of the Foundation for Science and Technology currently in force ([www.fct.pt/apoios/bolsas/docs/RegulamentoBolsasFCT2015.pdf](http://www.fct.pt/apoios/bolsas/docs/RegulamentoBolsasFCT2015.pdf));

The grant agreement template, as well as the templates for the final reports to be prepared by the grant holder and the scientific supervisor, are those included in the annexes to the Statute of the Scientific Research Fellow referred to above.

### **Publication and Notification of Results**

The evaluation results will be announced within 90 working days from the application submission deadline, by email to the candidates. Following publication of the results, candidates will be notified and, if they so wish, may submit comments during the prior hearing procedure within a maximum period of 10 working days from that date.

At the end of this period, the selected candidates must declare their acceptance in writing and communicate the actual starting date of the grant. Unless there is an acceptable justification, failure to submit the declaration within the specified period will be considered a renunciation of the grant.

In the event that the selected candidate renounces or withdraws, the candidate immediately next in the ranking will be notified.

Coimbra, October 2026