# JOSE SEBASTIAN ROJAS-ORDOÑEZ

**PhD Researcher | Robotics Systems | Autonomous Agents | Edge AI & Sim-to-Real**

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## PROFILE

PhD researcher and robotics systems engineer working at the intersection of autonomous agents, embedded AI, sim-to-real validation, and model-based engineering. First author of five peer-reviewed publications (four journal articles and one conference paper) spanning LLM-augmented robot navigation, AI-driven robotic systems, natural-language control, and embedded FMI workflows. Builds end-to-end systems from simulation and software architecture to deployment on physical robots and constrained hardware using ROS 2, Linux, Jetson, C/C++/Rust/Python, PyTorch/ONNX, Gazebo, Isaac Sim, and MuJoCo. Experienced in benchmarking, deterministic fallback design, cross-platform validation, and low-level embedded toolchains.

## TECHNICAL SKILLS

**Robotics & autonomy:** ROS 2 Humble, TurtleBot3, RealSense D435i, navigation, FSM-based autonomy, perception pipelines, sim-to-real

**AI/ML & agentic systems:** PyTorch, ONNX, LLM/transformer inference, edge AI, CNN/YOLO perception, asynchronous agent integration, validation/fallback policies

**Simulation & model-based engineering:** Gazebo, Isaac Sim, MuJoCo, FMI 2.0/3.0 (Model Exchange, Co-Simulation, Scheduled Execution), Modelica, MATLAB/Simulink, MIL/SIL/PIL/HIL

**Systems & embedded:** C, C++, Rust, Python, resource-constrained Linux, GCC/Ninja, ESP32-C6, STM32F411, RP2350/Pico 2W, NVIDIA Jetson AGX Orin, bare-metal HAL, UART/SWO

## RESEARCH & ENGINEERING EXPERIENCE

**Research Engineer / PhD Researcher — Embedded Systems** Aug 2024 – Present | Arrasate, Spain

*IKERLAN Technology Research Centre / University of the Basque Country (UPV/EHU)*

- Develop robotics and cyber-physical system workflows combining distributed co-simulation, FMI/FMU interoperability, edge computing, and physical deployment for industrial validation.
- Built a ROS 2 agentic navigation framework in which an asynchronous on-device LLM proposes velocity refinements while a deterministic FSM retains control authority; deployed on a TurtleBot3 with RealSense D435i and Jetson AGX Orin and validated in Gazebo and on hardware.
- Profiled and benchmarked the on-device ROS 2/LLM stack while preserving a deterministic 50 Hz control loop with a sub-5 ms fallback path; published experiments reduced final position error from 0.246 m to 0.159 m and improved trajectory efficiency from 0.821 to 0.901 without increasing control-loop latency.
- Develop and evaluate open interoperability workflows spanning FMI 2.0/3.0, Modelica, MATLAB/Simulink, ROS 2, ONNX-based AI components, and cloud/edge co-simulation architectures.

**Visiting PhD Researcher — GreenLSI Group** May 2026 – Jul 2026 | Madrid, Spain

*Universidad Politécnica de Madrid (UPM)*

- Developed the unified fmi-embedded framework to execute FMI 2.0/3.0-derived C models across x64 host and low-cost MCU targets, with a shared core and portable platform layer for ESP32-C6, STM32F411, and RP2350/Pico 2W.
- Demonstrated bit-exact host-to-MCU reproducibility across 80/80 automated tests plus 8/8 validation scenarios, and built a seven-stage control benchmark from basic I/O through cascaded position control with automated numerical equivalence checks.
- Implemented multi-platform embedded infrastructure including a portable HAL, GCC/Ninja toolchains, bare-metal POSIX stubs, encoder/PWM drivers, and UART/SWO/USB-serial data capture; validated real hardware on three MCU families and contributed framework documentation to GreenLSI's open-source codebase.
- Extended openSeRo MBD with FMI 3.0 import/export and Scheduled Execution, ME+CS+SE packaging, MuJoCo/XIL integration, and 257+ automated tests; also built an FMI 3.0 co-simulation orchestrator in Rust with custom bindings and MCU deployment pipeline.

**Robotics Research Intern — IKSAFECOLAB** Feb 2024 – Jul 2024 | Arrasate, Spain

*IKERLAN Technology Research Centre*

- Contributed to the first autonomous version of a mobile-manipulator demonstrator for canteen logistics, integrating a mobile base and robotic arm while defining an architecture extensible to future human–robot collaboration.

## SELECTED PEER-REVIEWED PUBLICATIONS

*First author on all five publications.*

- Rojas-Ordoñez, S., Segura, M., Yarza, I., Mendoza, V., & Zulueta, E. (2026). "Plug-and-Play LLM Knowledge Extraction for Robot Navigation: A Fine-Tuning-Free Edge Framework." Machine Learning and Knowledge Extraction, 8(2), 49. DOI
- Rojas-Ordoñez, S., Segura, M., Arboleda, J., & Zulueta, E. (2026). "An FMI-centric open-source and interoperable framework for AI-driven robotic systems: a model-based methodology for integrating physical and AI models." Mathematical and Computer Modelling of Dynamical Systems. DOI
- Rojas-Ordoñez, S., Segura, M., Yarza, I., & Zulueta, E. (2026). "Bridging the Embedded Execution Gap: A Review of the Functional Mock-up Interface for Actuator-Centric Execution Workflows in Industrial Embedded Systems." Archives of Computational Methods in Engineering. DOI
- Rojas-Ordoñez, S., Segura, M., Mendoza, V., Fernandez, U., & Zulueta, E. (2025). "Natural-Language Relay Control for a SISO Thermal Plant: A Proof-of-Concept with Validation Against a Conventional Hysteresis Controller." Applied Sciences, 15(24), 12986. DOI
- Rojas-Ordoñez, S., Segura, M., & Zulueta, E. (2025). "Integration of Physical and AI Models Using Open and Interoperable Standards: A Model-Based Methodology for Autonomous Robot Development." Proc. 16th International Modelica & FMI Conference. DOI

## EDUCATION

**PhD in Control Engineering, Automation and Robotics** Sep 2024 – Present | Vitoria-Gasteiz, Spain

*University of the Basque Country (UPV/EHU)*

- Research focus: autonomous robotics, embedded/edge AI, digital twins and co-simulation, open interoperability, and model-based engineering.

**MSc Mechatronic Engineering — Erasmus Mundus (EU4M)** Sep 2022 – Sep 2024 | Europe & Egypt

*EU4M Consortium: Universidad de Oviedo (Spain) · Nile University (Egypt) · Hochschule Karlsruhe (Germany)*

- Erasmus Mundus Scholarship, EACEA / European Union. Focus on robotics, control, automation, automotive engineering, and mechatronic systems.

**MSc in Artificial Intelligence** Sep 2020 – Nov 2022

*Universidad Internacional de La Rioja (UNIR)*

- Thesis on convolutional neural network architectures for diabetic retinopathy classification; coursework in deep learning, computer vision, NLP, and robotics.

**BSc in Mechatronic Engineering** Feb 2014 – Dec 2019 | Colombia

*Unicomfacauca University Corporation*

- Outstanding Graduate; thesis on multispectral-image-based assessment of crop water status.

## HONOURS & LANGUAGES

**Honours:** Erasmus Mundus Scholarship Awardee (EACEA, European Union); Outstanding Graduate, Mechatronic Engineering.

**Languages:** Spanish (native) · English (C1) · Portuguese (B1) · German (A1–A2).