

Samantha Caballero

Robotics Engineer | Validation, Simulation & Control Systems | MSc Erasmus Mundus

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EXPERIENCE

Beta Robots, Barcelona — *Robotics Perception Engineer intern*

February 2026 - present

- Delivered a classical geometric RGB-D perception pipeline for autonomous pallet pickup by industrial mobile robots, recovering pose from depth sensor processing, and integrated into the company's robot software stack.
- Built test cases to validate the pipeline across scenarios in simulation, with further Rosbag validation.

HAULOTTE, Lyon FR — *Simulation & Validation Engineer (R&D)*

February 2023 - July 2023

- Defined and executed stability test campaigns on production machines to derive acceptance criteria, including FMEA. Investigated discrepancies between simulated/measured behaviour.
- Exported physics models via FMI/FMU into the Unity game engine to validate machine behaviour in VR pre-hardware prototype.

System control and simulation intern

October 2021 - December 2022

Development of multiphysics models with MBC (model-based control) and simulation for articulated boom lifts, supporting the transition from hydraulic to electromechanical actuation with feedback-controlled stability systems.

- **Digital twins:** built dynamic and kinematic models of articulated machines using multiphysics simulation (mechanical, hydraulic, electrical) for virtual validation and optimization.
- Designed **PID closed-loop control** architectures for precise motion and stability.

EDUCATION

MSc in Intelligent Field Robotics

Dual degree full-ride Scholarship Erasmus Mundus Programme

University of Girona & ELTE Eötvös Loránd Faculty of Informatics (Budapest)

September 2024 - July 2026

- Field robotics. Hands-on with AMRs and manipulators (AgileX SCOUT, TurtleBot 2, Staubli, UR3), across SLAM and EKF localization, 3D mapping and perception, motion planning, exploration, and task-priority manipulation control.
- Machine learning for perception: object detection, classification, and segmentation with deep neural networks. Alongside 3D sensor fusion and mobile robot navigation and control.

BSc in Automotive Engineering | Arnhem, Netherlands

HAN University of Applied Sciences - Holland Scholarship

- Specialization in vehicle electronics & control systems. Thesis grade: 9.0
- Co-founder of the HAN4L project: a second-semester build turning a Renault 4 desert-ready for the "4L Trophy" rally from France to Morocco. Developed the Arduino-based engine-monitoring system with CAN communication.

SKILLS

• Control Systems

Optimization and model-based

• Numerical Simulation

AMESim, Simulink, ANSYS

• Validation & FMEA

• Root-cause Analysis

• Robotic Manipulation

• Motion Control

• System Modelling

• Machine Learning

Deep Networks (CNNs)

Reinforcement Learning

• Autonomous Navigation

Motion planning

exploration, SLAM

• Sensor Fusion (Kalman)

• 3D Simulation

Simcenter 3D, Solidworks

• Python, C++, MATLAB, Git

• Linux, ROS 1

• OpenCV, PyTorch, YOLO

• CAN communication

LANGUAGES

Spanish (native)

English (bilingual)

French (fluent)

Catalan (intermediate)

REFERENCES

Andreu Corominas - Beta Robots
andreu@beta-robots.com

Jean-Baptiste Doray
Haulotte Systems Engineer
jdoray@haulotte.com

ROBOTICS PROJECTS

Autonomous Parking Inspection on AgileX Scout (ROS) — ELTE Budapest

Outdoor AMR navigating a parking lot to detect vehicles and read license plates: EKF localization (GNSS + IMU + LiDAR/KISS-ICP odometry), RRT planning, dual YOLO + OCR perception, and Octomap mapping. Built the 3D mapping module; tested indoor and outdoor.

Feature based EKF SLAM using XY ArUco marker point features

2D SLAM using an Extended Kalman Filter fusing wheel odometry, IMU heading, and ArUco marker observations, with Mahalanobis-gated data association for landmark matching. Tested in simulation and on the real robot.

Vehicle Manipulator Kinematic Control — *University of Girona*

Implementation of a pick-and-place mobile operation for a Kobuki Turtlebot 2 equipped with a 4-DOF manipulator arm, based on task-priority kinematic control and a behaviour tree. Developed in ROS, tested in Stonefish simulator, and validated on the real robot, the robot used ArUco marker-based pose estimation to move to an object, pick it up and drop it at another marker.

Custom CNN for Object Detection — *ELTE Budapest*

Developed an object detection pipeline by generating a synthetic dataset, training a custom CNN for classification and bounding box prediction, achieving excellent performance (mAP, IoU, F1-score) and benchmarked against a fine-tuned YOLO model using PyTorch and WandB platform.

Backtracking Coverage Algorithm for TurtleBot2

Online coverage system, combined a backtracking algorithm for local exploration with RRT-based global planning, navigating with obstacle avoidance on a LiDAR-generated occupancy map. Implemented and tested in simulation and on a real TurtleBot2, achieving efficient and adaptive coverage in unknown indoor environments.
