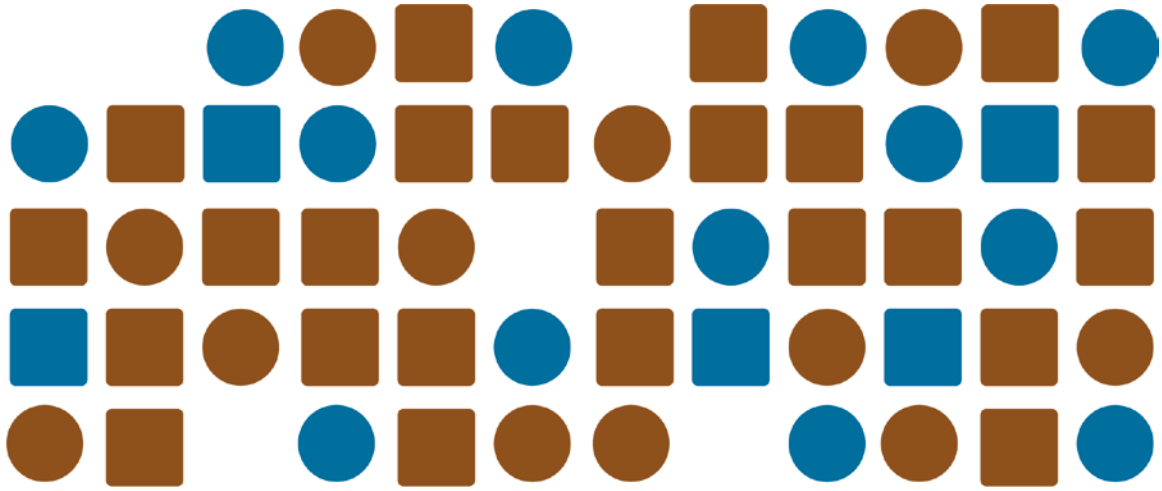


IOC

Institute of Industrial and Control Engineering

Activities Report 2023-2024

UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Institute of Industrial and Control Engineering

Table of contents

1. Organisational structure and governing bodies

Management

Director	ROBERT GRIÑÓ CUBERO
Assistant director	ANTONIN SEBASTIEN PONSICH
Secretary	BRUNO DOMÈNECH LEGA
Technical and Management Support Area - UTGAEIB	M. LOURDES DURANY VIDAL

The Board

Director	ROBERT GRIÑÓ CUBERO
Assistant director	ANTONIN SEBASTIEN PONSICH
Secretary	BRUNO DOMÈNECH LEGA
Representative of the **Control** division	OLM MIRAS JOSEP M.
Representative of the **Design and Optimisation of Processes and Services (DOPS)** division	LAIA FERRER MARTÍ
Representative of the **Robotics** division	RAÚL SUÁREZ FEIJÓO
Technical and Management Support Area - UTGAEIB	M. LOURDES DURANY VIDAL
Representative of teaching and research staff who hold a PhD	JAN ROSELL GRATACÒS
Representative of administrative and service staff	LEOPOLD PALOMO AVELLANEDA

The Council

Alfaro Pozo, Rocío	
Arias Pujol, Antoni	
Batlle Arnau, Carles	
Bautista Valhondo, Joaquin	
Biel Solé, Domingo	
Calleja Sanz, Gema	
Casanovas Rubio, Mar	
Domenech Lega, Bruno	Secretary
Dòria Cerezo, Arnau	
Durany Vidal, Ma Lourdes	Technical and Management Support Area UTGAEIB
Ferrer Martí, Laia	Representative of the Design and Optimisation of Processes and Services (DOPS) division
Fossas Colet, Enric	
García Villoria, Alberto	
Griñó Cubero, Robert	Director
Hatami, Sara	
Juanpera Gallel, Marc	
Lusa Garcia, Amaia	
Mas Casals, Orestes	
Mateo Doll, Manel	
Miró Valero, Enric	
Olivella Nadal, Jordi	
Olm Miras, Josep Maria	Representative of the Control division
Palomo Avellaneda, Leopold	Representative of administrative and service staff
Pastor Moreno, Rafael	
Peña Carrera, Marta	
Peña Pitarch, Esteban	
Ponsich, Antonin Sebastien	Assistant director
Repecho del Corral, Víctor	
Roig Fernández, Vicenç	
Rosell Gratacòs, Jan	
Suárez Feijóo, Raúl	Representative of the Robotics division
Zaplana Agut, Isiah	

2. Staff

GLOSSARY

DIVISIONS/SERVICE	CTL	Division of Automatic Control
	DOPS	Division Design and Optimisation of Processes and Services
	ROB	Division of Robotics
CATEGORY	AG/TU	Associate professor
	LT	Assistant professor
	BR	Research grantholder
	CU	Professor
	DI	Research supervisor
	PAS LAB	Technical staff

NAME		DIVISIONS/ SERVICE	CATEGORIES
Alfaro Pozo	Rocío	ROB	LT
Arias Pujol	Antoni	CTL	TU
Batlle Arnau	Carles	CTL	TU
Bautista Valhondo	Joaquin	ROB	CU
Biel Solé	Domingo	CTL	TU
Calleja Sanz	Gema	DOPS	LT
Casanovas Rubio	Mar	DOPS	LT
Domènech Lega	Bruno	DOPS	AG
Dòria Cerezo	Arnau	CTL	AG
Ferrer Martí	Laia	DOPS	CU
Figuerola Gil	Pol	DOPS	BR

NAME		DIVISIONS/ SERVICE	CATEGORIES
Fossas Colet	Enric	CTL	CU
García Villoria	Alberto	DOPS	AG
Griñó Cubero	Robert	CTL	TU
Hatami	Sara	DOPS	LT
Juanpera Gallel	Marc	DOPS	LT
Khamis	Mahmoud	CTL	BR
Leduchowicz Municio	Alba	DOPS	BR
Luciano	Ludovica	CTL	BR
Lusa García	Amaia	DOPS	CU
Mas Casals	Orestes	ROB	TU
Mateo Doll	Manuel	DOPS	TU
Miró Valero	Enric	SSR	PAS LAB.
Olivella Nadal	Jordi	DOPS	TU
Olm Miras	Josep M.	CTL	AG
Olvera Marín	Paula	ROB	BR
Palomo Avellaneda	Leopold	SSR	PAS LAB.
Pastor Moreno	Rafael	DOPS	CU
Peña	Marta	DOPS	AG
Peña Pitarch	Esteban	ROB	TU
Ponsich	Antonin Sebastien	DOPS	LT

NAME		DIVISIONS/ SERVICE	CATEGORIES
Rahimi	Leyla	CTL	BR
Raza	Muhammad Ilyas	ROB	BR
Repecho Del Corral	Victor	CTL	LT
Rosell Gratacòs	Jan	ROB	TU
Ruiz Celada	Oriol	ROB	BR
Sheikhsamad	Mohamad	ROB	BR
Shirzadi Maryan	Morad	ROB	BR
Suárez Feijóo	Raúl	ROB	DI
Urbaniak	Dominik	ROB	BR
Zaplana Agut	Isiah	ROB	LT

Other PhD Students

NAME		DIVISIONS/ SERVICE
Aguilar Gamarra	Harry Nick	DOPS
Alaeddin	Mojtaba	CTL
Codina Torras	Eloi	DOPS
Martrat Martí	Carlos Javier	CTL
Romero Sepúlveda	Arnau	ROB
Salvadó Benasco	Marc	ROB
Singh	Suhani	ROB
Urra González	Fernando	ROB

Visiting Staff

NAME	DIVISIONS	UNIVERSITY
Ahmed Muhay Ud Din	ROB	Khalifa University, Abu Dhabi, UAE
Hrdina Jaroslav	ROB	Brno University of Technology
Návrat Aleš	ROB	Brno University of Technology
Ortega Romeo	CTL	Institut Tecnològic Autònom de Mèxic
Peeters Jef	ROB	KU Leuven - University of Leuven
Pietro De Lellis	DOPS	Università degli Studi di Napoli Federico II
Vides Prado Andres David	DOPS	Universidad Tecnologica de Pereira

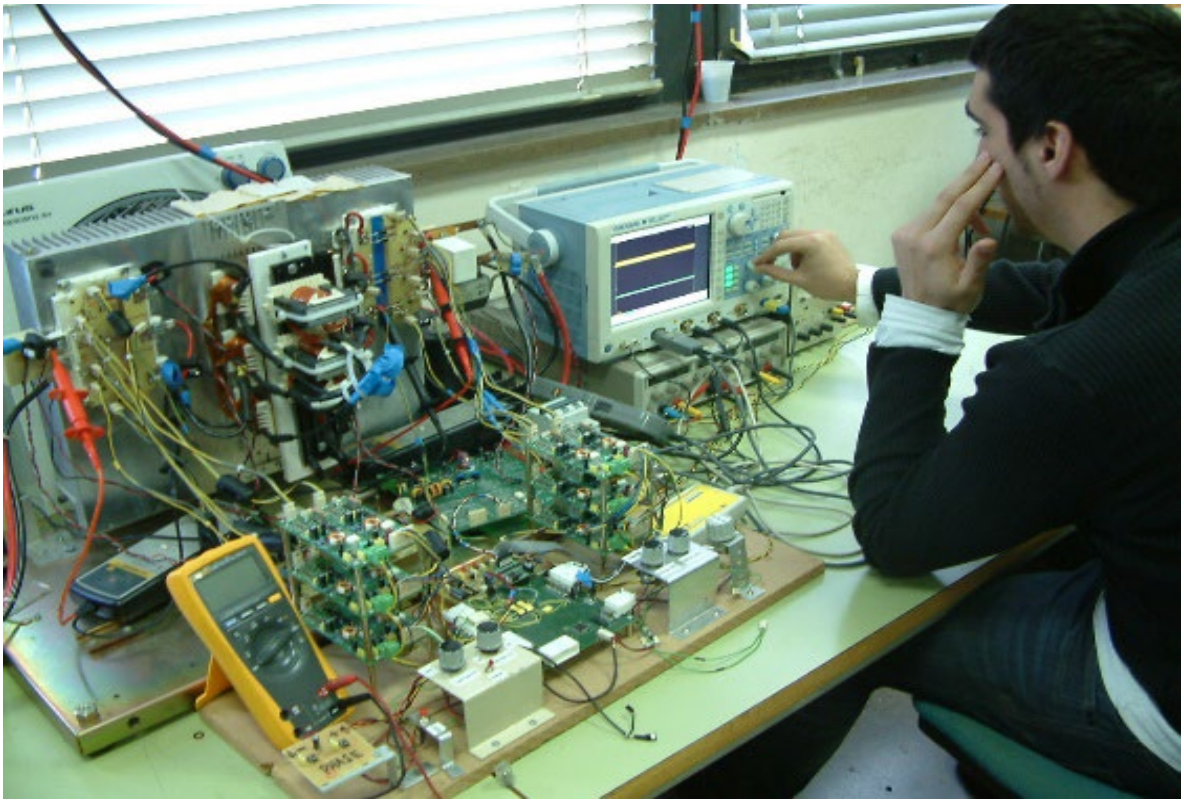
Incoming Students

NAME	DIVISIONS	UNIVERSITY
Roberto Aratri	CTL	Politecnico di Bari
Francesco De Astis	CTL	Politecnico di Torino
Mattia Tafuri	ROB	Università di Bologna
Lorenzo Giordano	CTL	University of Naples Federico II
David Alejandro Romero Yanez	ROB	Escuela Superior Politécnica del litoral
Johan Ricardo Gutiérrez Macías	ROB	Escuela Superior Politécnica del litoral
Anthony Daniel Lopez Uquillas	ROB	Escuela Superior Politécnica del litoral
Pouria Zakariapour Naeini	ROB	Università degli Studi di PADOVA

3. Divisions

Research at the IOC is conducted through three divisions:

Division of Automatic Control



The main projects in this division are set in the following thematic areas: Control Theory, Energy Systems and Automotive Applications.

Head: JOSEP M. OLM MIRAS

Research fields:

- Advanced linear controllers (Resonant and repetitive control).
- Nonlinear control techniques (Passivity-based control, Adaptive control, Sliding mode control).
- Complex dynamical networks.
- Modelling and control of electronic power systems (generation and conversion).
- Control algorithms for an overall improvement of the vehicle performance.
- Autonomous and cooperative driving applications.

Division of Design and Optimisation of Processes and Services

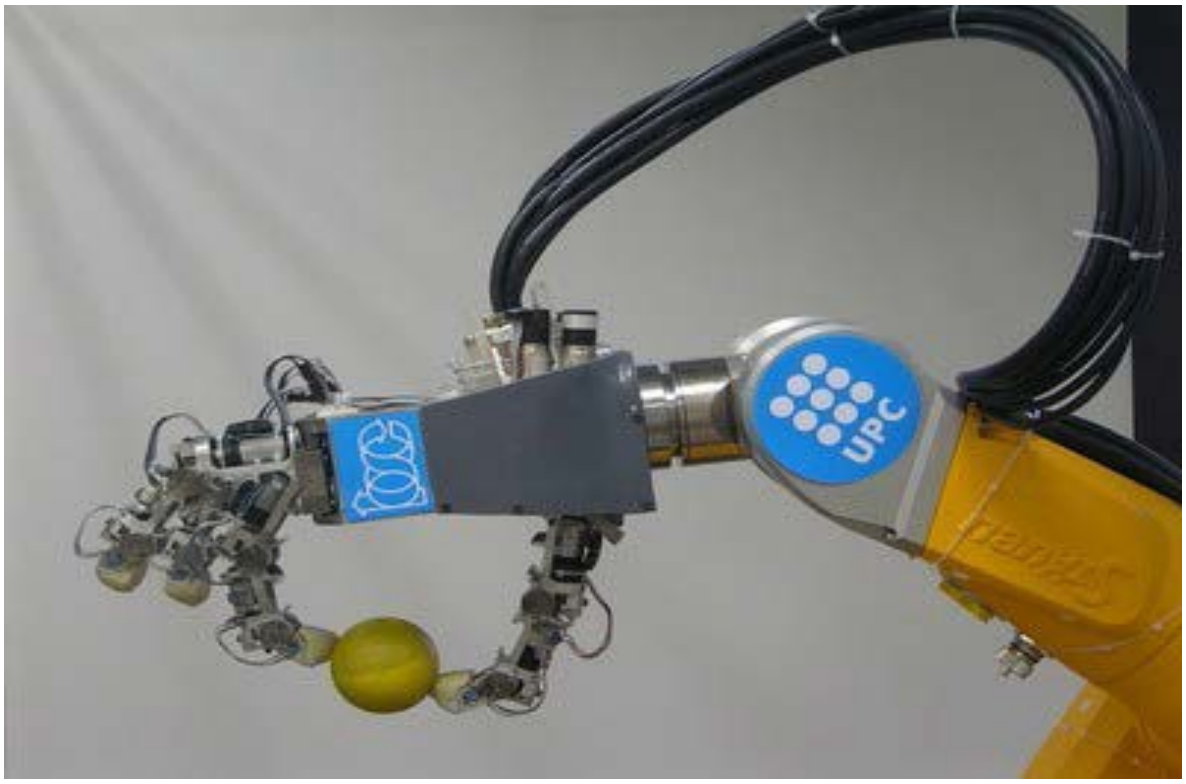
The Division of Design and Optimisation of Processes and Services covers the design and management of the supply chain, namely production and logistic Systems to generate goods and services, as well as the necessary techniques for solving efficiently its derived problems.

Head: LAIA FERRER MARTI

The division of Design and Optimisation of Processes and Services specializes in developing optimization models and decision-making support tools for supply chain design (production, distribution, recovery and remanufacturing or recycling). The aim of the group is to contribute to the improvement of the efficiency and sustainability, economic and environmental, of the organizations. The group's research has a highly applied approach to ensure that the results are directly applicable and easily transferable to productive and service organizations.

Fields of activity
Industry 4.0 in the field of the supply chain
Operations management
Urban distribution and mobility
Energy planning with renewable energies
Healthcare logistics
Circular and social economy

Division of Robotics



The Division of Robotics of the IOC deals with basic and applied research on different aspects of robotics, either considering the robot as a single machine or integrated with other elements and devices within a robotized system. The research extends to different application fields in both the industrial and service areas.

Head: RAÚL SUÁREZ FEIJÓO

Main fields of activity

- Task and motion planning
- Grasping and dexterous manipulation
- Mobile manipulators
- Robot co-workers
- Human-robot interaction
- Teleoperation and haptic systems
- Control and programming of robots
- Perception systems and sensor integration
- Computer vision
- Simulation of robotized systems
- Industrial applications of robotics
- Service robots

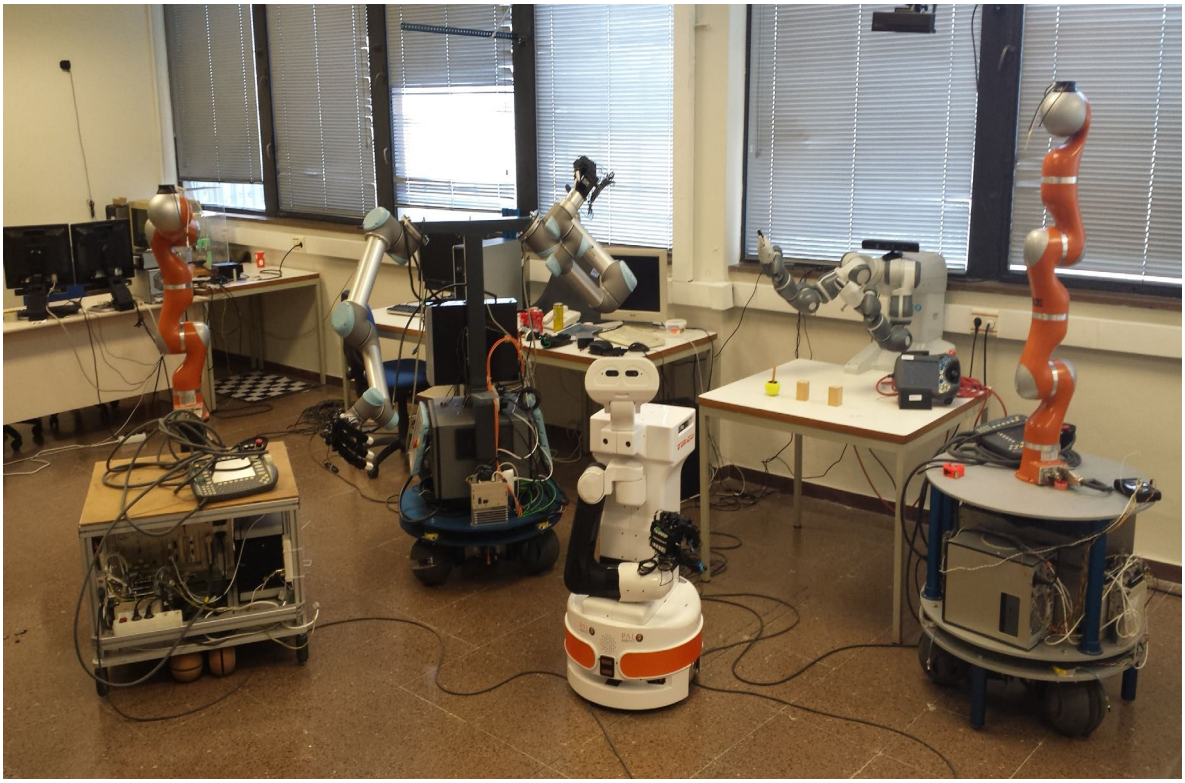
4. Facilities

The IOC is located on the 11th floor of building H of the Barcelona School of Industrial Engineering (ETSEIB).

The Institute has two robotics laboratories; a control and electronics laboratory; a logistics laboratory; a computer network equipped with servers, workstations, PCs; a WiFi network; a specialised library with around 6,000 books and numerous journals; a classroom that can hold 25 people; and a meeting room with videoconferences equipment, a digital blackboard and a projector with a capacity for 10 people.

Equipping research laboratories

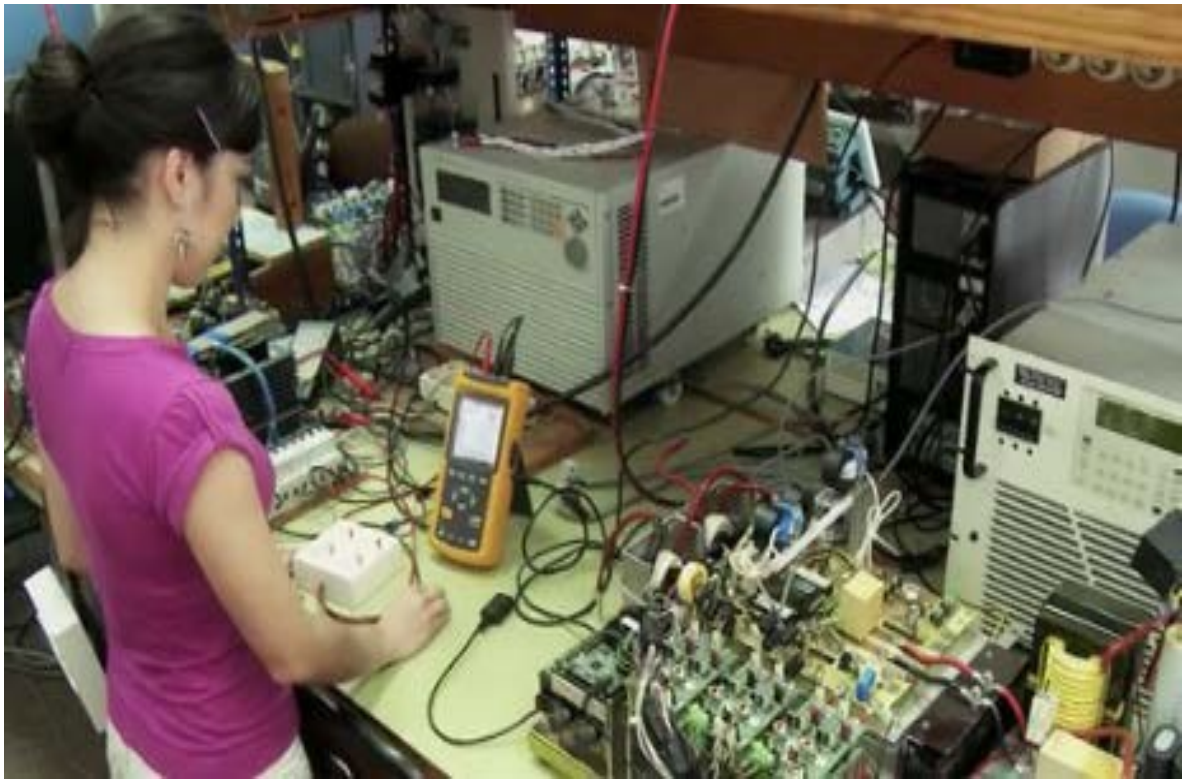
Robotics Laboratories



- 2 Stäubli TX90 robots, one is mounted on a motorized rail.
- 2 Kuka LWR robots with 7 axes, each one mounted on a mobile platform (BMM1 and BMM2).
- 1 Pal Robotics TIAGo equipped with two arms.
- 1 YuMi ABB robot.
- An omnidirectional mobile dual-arm robot (equipped with two Universal UR5 arms).

- Several grippers and robotic hands: Schunk SAH, Schunk SDH and 3 Allegro hands.
- Haptic devices: Phantom Omni, Phantom Premium 1.5/6DOF and Phantom Premium 1.5/6DOF High force.
- Sensory systems such as video cameras, trackers, force sensors, tactile sensors and 3D cameras.
- A 3D projector with the corresponding glasses.
- Several servers, PCs, monitors.
- 2 virtual reality glasses Oculus Rift.
- 1 Drone DJI Phantom 2 Vision+.
- 1 Drone Parrot AR.Drone 2.0.

Control and Electronics Laboratory



- Oscilloscopes.
- Signal analyzer and signal generators.
- Sources and power loads (e.g. ac and dc power sources, and ac and dc programmable loads).
- Measuring instrumentation (multimeters, differential probes, current probes).
- Emulators for microprocessors and digital signal processors.
- Computers.
- Hardware and software for the design and implementation of electronic circuits.
- Tools and equipment for the realization of small-scale mechanical assemblies.
- Thermographic camera.

DOPS Computing Cluster

The DOPS Computing Cluster is a robust computational infrastructure comprising eleven interconnected units managed by SLURM (Simple Linux Utility for Resource Management), used in High Performance Computers. SLURM efficiently allocates resources and schedules job executions, ensuring optimal performance and equitable resource distribution across the center's units.

➢ **Equipment Configuration:**

- Four nodes with 4GB of RAM each.
- Five nodes with 16GB of RAM each.
- One node with 40 cores (Intel Xeon E5-2630 v4) and 64GB of RAM.
- One node with 128 cores (AMD EPYC 7543) and 256GB of RAM.

➢ **Additional Features:**

- Parallel Processing with OpenMP:/ Users can harness OpenMP for parallel processing, leveraging multicore architectures for efficient computation.
- Optimization with Docplex:/ The center supports Docplex, facilitating the resolution of complex optimization problems through mathematical programming.
- Python Virtual Environments (venv):/ Users can create and manage virtual environments within the Python environment (venv), ensuring isolation, compatibility and reproducibility for specific projects.
- Scheduled job Execution:/ SLURM enables users to schedule job executions at predetermined times, streamlining workflow processes and optimizing resource utilization.
- Customizable resources allocation:/ Users can specify the maximum RAM, CPU's size for their jobs, preventing resource contention and maximizing efficiency.
- Reproducibility and metrics:/ Users can run a program in a controlled environment to accurately measure its performance and execution time in a consistent manner. This helps avoid interferences and workload fluctuations, ensuring reliable measurements of the program under standardized CPU and memory conditions.

5. University masters

Master’s Degree in Automatic Control and Robotics

The Master's degree in Automatic Control and Robotics is an official degree adapted to European Higher Education Area (EHEA) offered by the Technical University of Catalonia (UPC) since the academic course 2006-07. The Masters is promoted by the Department of Systems Engineering, Automation and Industrial Informatics (ESAII) and the Institute for Systems and Control Engineering (IOC). It is a research oriented master in the area of Automatic Control and Robotics.

The Institute of Industrial and Control Engineering (IOC) was set up for the purposes of conducting research and training researchers to a high level of specialisation. It is actively involved in teaching master and doctoral degrees.

6. Master theses

Author: **Reig Grau, Martí**. **Integration of a Low-Inductive and Highly Dynamic Current Sensor into a GaN-Based Half Bridge**. 31/10/2023. Very Good. Supervisors: Biel, D.. Universitat Politècnica de Catalunya.

Author: **Monllonch I martí, Marc**. **Caracterització dels accidents de trànsit a França mitjançant clustering**. 14/05/2024. Very Good. Supervisors: Olivella, J.. Universitat Politècnica de Catalunya.

Author: **Saladrigues Jutglar, Arnau**. **Evaluación de procedimientos heurísticos basados en Relax and Fix para el diseño de comunidades energéticas**. 16/07/2024. A with honours. Supervisors: Ponsich, A.; Domenech, B.. Universitat Politècnica de Catalunya.

Author: **Alvis Montero, Nicolas**. **Modelado de los componentes básicos y simulación de flujos de un almacén automatizado con la herramienta de SW Plant Simulate**. 30/10/2023. Very Good. Supervisors: Ponsich, A.; Hatami, S.. Universitat Politècnica de Catalunya.

Author: **Lario Gómez, Carlos**. **Characterizing Traffic Accidents in Barcelona Using Association Algorithms**. 18/07/2024. Excellent. Supervisors: Olivella, J.. Universitat Politècnica de Catalunya.

Author: **Albán Pastorelly, Grace Valeria**. **Estudio de la integración de los sistemas de gestión ambiental, seguridad y salud en el trabajo. Un enfoque holístico para la sostenibilidad empresarial**. 04/07/2024. Excellent. Supervisors: Casanovas-Rubio, M.. Universitat Politècnica de Catalunya.

Author: **Giner Conde, Rocio**. **Driving Sustainability: A Cost-Benefit Analysis of Green Transportation in Evonik's Smart Materials Supply Chain**. 14/05/2024. A with honours. Supervisors: Alfaro, R.. Universitat Politècnica de Catalunya.

Author: **Domínguez, M.**. **Positive and negative sequence analysis of a voltage source converter**. 08/02/2024. Excellent. Supervisors: Griño, R.; Cheah, M.. Universitat Politècnica de Catalunya.

Author: **Domínguez, M.**. **Positive and negative sequence analysis of a voltage source converter**. 08/02/2024. Excellent. Supervisors: Griño, R.; Cheah, M.. Universitat Politècnica de Catalunya.

Author: **Ramos Marqués, Yago**. **Diseño y desarrollo de un sistema de planificación de gamas de mantenimiento para las líneas productivas de una empresa del sector alimentario**. 06/02/2024. A with honours. Supervisors: Lusa, A.. Universitat Politècnica de Catalunya.

Author: **Romero Plantalech, Marc**. **Reorganització del sistema productiu en una empresa de fabricació de material plàstic**. 05/02/2024. Excellent. Supervisors: Mateo, M.. Universitat Politècnica de Catalunya.

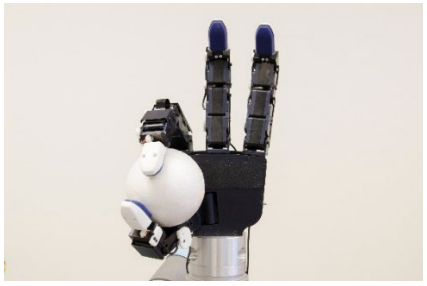
Author: **Romero Plantalech, Marc**. **Reorganització del sistema productiu en una empresa de fabricació de material plàstic**. 05/02/2024. Excellent. Supervisors: Mateo, M.. Universitat Politècnica de Catalunya.

Author: **Molist I puigdomenech, Marçal**. **Complex sliding modulation for permanent-magnet synchronous motors**. 05/02/2024. A with honours. Supervisors: Doria-Cerezo, A.. Universitat Politècnica de Catalunya.

Author: **Hernandez Escuer, Víctor**. **Single and Multi-objective Optimization Algorithms in Python applied to Vehicle Dynamics Simulations.**. 06/10/2023. Excellent. Supervisors: Ponsich, A.; Hatami, S.. Universitat Politècnica de Catalunya.

7. Doctoral degrees

Doctoral programme in Automatic Control, Robotics and Computer Vision (ARV)



The Doctoral programme in Automatic Control, Robotics and Computer Vision (ARV) emerged in 2006 from the fusion of the Doctoral programme in Advanced Automation and Robotics of the Institute of Industrial and Control Engineering (IOC) and of the Doctoral programme in Control, Vision and Robotics of the Automatic Control Department (ESAII), both with Quality Mention of the Spanish Ministry of Education (MEC). The fusion was fruit of an increasing thematic affinity and convergence between both programmes, and was carried out taking advantage of the opportunity to adapt the programme to the new syllabus of the Official Postgraduate Programmes in the framework of the European Higher Education Area.

The ARV Doctoral programme achieved from the beginning the Quality Mention, from the academic year 2007-2008 until 2010-2011. Then this award was replaced by the Excellence Mention by the Spanish Ministery of Education, with code MEE2011-0453. This mention was awarded from the academic years 2011-2012 until 2013-2014, and the programme ARV always obtained it.

The units responsible for the program are:

- Automatic Control Department (ESAII)
- Institute of Industrial and Control Engineering (IOC)

Doctoral Committee for the doctoral degree in Automatic Control, Robotics and Computer Vision (ARV)

- Dr. Vicenç Puig Cayuela (Coordinator PhD ARV)
- Dra. Alícia Casals Gelpí
- Dr. Andreu Català Mallofré
- Dr. Arnau Dòria Cerezo
- Dr. Robert Griñó Cubero
- Dr. Josep M. Olm Miras
- Dr. Jan Rosell Gratacòs
- Dr. Alberto Sanfeliu Cortés

Doctoral data 2023-2024

A. Program Coordinator	**VICENÇ PUIG CAYUELA**
B. Number of students	**110** (2023/2024)
Thesis presented during 2023/2024:	

Date	04/09/2023
Title	Safety and adaptation in physical interaction control for robotic applications
Author	SAN MIGUEL TELLO,ALBERTO
Thesis Director Thesis Codirector	PUIG CAYUELA,VICENÇ ALENYA RIBAS,GUILLEM
Qualification	Excel.lent Cum Laude

Date	28/09/2023
Title	LPV Lateral Control of Autonomous and Automated Vehicles
Author	MEDERO BORRELL, ARIEL
Thesis Director Thesis Codirector	PUIG CAYUELA,VICENÇ SENAME, OLIVIER
Qualification	Excel.lent Cum Laude

Date	29/09/2023
Title	Crutch gait patterns characterization through spatial and temporal parameters
Author	NARVAEZ DORADO, MARIEN CRISTINA
Thesis Director Thesis Codirector	ARANDA LOPEZ, JUAN
Qualification	Excel.lent

Date	31/10/2023
Title	Optimización de recursos intralogísticos en entornos industriales para su uso en vehículos autónomos
Author	VARGAS MARTIN, ELLIOT
Thesis Director Thesis Codirector	VELASCO GARCIA,MANUEL MARTI COLOM, PAU
Qualification	Excel.lent

Date	09/11/2023
Title	AI-enhanced Cyber-Physical Systems in Automotive Industry. Integration of CPS and Application Artificial Intelligence Technologies in Automotive Paint Shop Process.
Author	SANZ GRÀCIA, ELVIRA MARIA
Thesis Director Thesis Codirector	PUIG CAYUELA,VICENÇ BLESA IZQUIERDO,JOAQUIN
Qualification	Excel.lent

Date	16/11/2023
Title	Modeling and Reconstruction of 3D Humans
Author	CORONA PUYANE, ENRIC
Thesis Director Thesis Codirector	ALENYA RIBAS,GUILLEM MORENO NOGUER,FRANCESC D'ASSIS
Qualification	Excel.lent Cum Laude

Date	20/11/2023
Title	Contributions to LPV control under time-varying saturations
Author	RUIZ ROYO, ADRIAN
Thesis Director Thesis Codirector	MORCEGO SEIX,BERNARDO ROTONDO, DAMIANO
Qualification	Excel.lent

Date	30/11/2023
Title	Fault diagnosis in wind turbines using machine learning techniques
Author	PEREZ PEREZ, ESVAN DE JESUS
Thesis Director Thesis Codirector	PUIG CAYUELA,VICENÇ LOPEZ ESTRADA,FRANCISCO RONAY
Qualification	Notable

Date	15/03/2024
Title	Generative models for the automatic recognition of reactive and abnormal peripheral blood cells with diagnosis purposes
Author	BARRERA LLANGA, KEVIN IVAN
Thesis Director Thesis Codirector	RODELLAR BENEDE, JOSE JULIAN MERINO GONZÁLEZ, ANNA
Qualification	Excel.lent Cum Laude

Date	17/04/2024
Title	Control System Design and Implementation for PEMFC to Maximize the Efficiency and Minimize the Degradation in an Automotive
Author	MOLAVI, ALI
Thesis Director Thesis Codirector	SERRA PRAT, MARIA HUSAR, ATTILA PETER
Qualification	Excel.lent Cum Laude

Date	30/04/2024
Title	Agile aerial manipulation: an approach based on full-body dynamics and model predictive control
Author	MARTÍ SAUMELL, JOSEP
Thesis Director Thesis Codirector	SANTAMARIA NAVARRO, ANGEL SOLÀ ORTEGA, JOAN
Qualification	Excel.lent

Date	10/06/2024
Title	On the Design of Optimization-Based Controllers via Generalized Nash Equilibrium Seeking in Evolutionary Games over Networks
Author	MARTÍNEZ PIAZUELO, JUAN PABLO
Thesis Director Thesis Codirector	OCAMPO MARTINEZ, CARLOS AUGUSTO QUIJANO SILVA, NICANOR
Qualification	Excel.lent Cum Laude

Date	19/06/2024
Title	Contributions to Robust Motion Planning and Control of Autonomous Vehicles
Author	SAMADA RIGÓ, SERGIO EMIL
Thesis Director Thesis Codirector	NEJJARI AKHI-ELARAB, FATIHA PUIG CAYUELA, VICENÇ
Qualification	Excel.lent Cum Laude

Date	23/07/2024
Title	Incorporating Uncertainty into Neural Rendering for Interpretable 3D Modeling
Author	SHEN, JIANXIONG
Thesis Director Thesis Codirector	MORENO NOGUER, FRANCESC D'ASSIS RUIZ OVEJERO, ADRIÀ
Qualification	Excel.lent Cum Laude

Date	25/07/2024
Title	New methods for bridging symbolic-geometric reasoning, addressing uncertainty and action learning in task planning for robotics
Author	SUÁREZ HERNÁNDEZ, ALEJANDRO
Thesis Director Thesis Codirector	TORRAS GENIS, CARMEN ALENYÀ RIBAS, GUILLEM
Qualification	Excel.lent Cum Laude

Date	30/07/2024
Title	Research on signal and image denoising techniques
Author	WANG, CHUANSHENG
Thesis Director Thesis Codirector	GRAU SALDES, ANTONI GUERRA PARADAS, EDMUNDO
Qualification	Excel.lent

Doctoral programme Supply chain and operations management (SCOM)

The aim of the doctoral program SCOM (Supply Chain & Operations Management) is to promote and develop research into the supply chain and thus contribute to improve the economic and environmental efficiency of all kind of organizations.

Currently, the concept of supply chain, which includes and exceeds operations management and logistics, articulates the research on supply, production, distribution and recovery. Although, strictly speaking, the concept of supply chain management includes operations management, the fact of joining them in the name of the PhD program indicates which is the aspect of the SC management in which the program focuses most.

SCOM begins in 2016 with the participation of the academic staff of the Department of Management (OE) and the Institute of Industrial Engineering of Control (IOC) has recognized extensive teaching, research and thesis experience in the monitoring program. Moreover, the participation of these personnel in conferences, research projects and publications in high impact journals shows their own experience of research on the item of SCOM.

Doctoral Committee for the doctoral degree:

- Dr. Manel Mateo Doll (Coordinator PhD SCOM)
- Dr. David Agustin Ripoll
- Dr. Bruno Domenech Lega
- Dr. Laia Ferrer Martí
- Dr. Núria Gongora Mora
- Dr. Amaia Lusa Garcia
- Dr. Rafael Pastor Moreno
- Dr. Imma Ribas Vila

Doctoral data 2023-2024

A. Program Coordinator	**MANEL MATEO DOLL**
B. Number of students	**15** (2023/2024)
Thesis presented in 2023-24:	

Date	15/12/2023
Title	Multi-manned Assembly Line Balancing Problem con tiempos de proceso dependientes (MALBP-DTT)
Author	ANDREU CASAS, ENRIC
Thesis Director Thesis Director	PASTOR MORENO, RAFAEL GARCÍA VILLORIA, ALBERTO
Qualification	Excel·lent Cum Laude

Date	12/07/2024
Title	Addressing seasonal and uncertain demand in service companies through a triple labor flexibility strategy based on multiskilling, annualized hours, and overtime
Author	PORTO SOLANO, ANDRéS FELIPE
Thesis Directora Thesis Director	LUSA GARCIA, AMAIA HENAO BOTERO, CESAR AUGUSTO
Qualification	Excel·lent Cum Laude

Date	15/07/2024
Title	CAPACIDAD DE RESPUESTA DE LA CADENA DE SUMINISTRO: DEFINICIÓN DEL CONCEPTO Y MARCO PARA MEJORAR LA GESTIÓN
Author	DÍAZ Y PACHECO, RAÚL ANTONIO
Thesis Director	BENEDITO BENET, ERNEST
Qualification	Excel·lent Cum Laude

Date	02/12/2024
Title	Metodología para el rediseño de cadenas de suministro multinegocio
Author	ANICH GUTIÉRREZ, NICOLAS ENRIQUE
Thesis Director	MATEO DOLL, MANUEL
Qualification	Excel·lent

8. Projects and agreements

Public funding projects

Head researcher	CASANOVAS RUBIO, MAR
Title	Empowerment of low-income population for the self-construction of pavements by means of earthen paving: an experience in the Vitória community of the Moviment Sense Sostre in Diamantina (Brazil)
Funding institution	Centre de Cooperació per al Desenvolupament de la UPC
Reference	CCD-2023-A027
Start-up date	01/03/2023
Completion date	31/03/2025

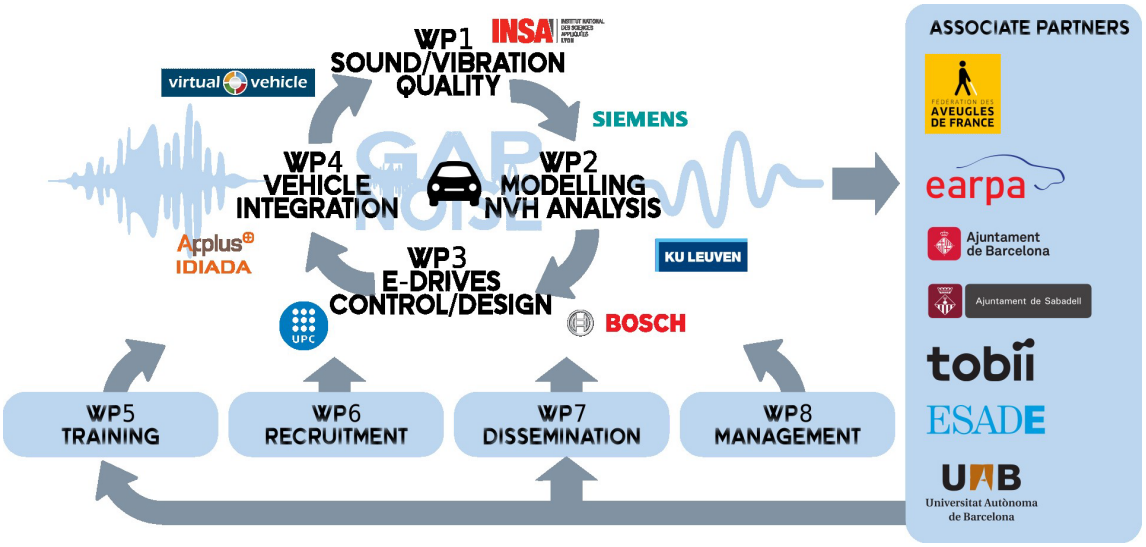
Summary

The aim of the project is to disseminate and support the initial implementation of a sustainable self-construction technique in order to improve the paving of the streets and homes of a low-income neighborhood located in Diamantina, state of Minas Gerais in Brazil. Through the collaboration of the Universitat Federal dos Vales de Jequitinhonha e Mucuri (UFVJM), a small factory for self-production of earth-cement slabs will be built consisting of a roof, floor and installation of equipment for self-production of the tiles. Subsequently, training workshops will be held so that the community can self-produce the tiles and learn how to install them. Initially, an outdoor space of 200 m2 will be paved where community dining rooms are located. Once the training workshops have been carried out, it is intended that the community itself can enjoy the benefits of these facilities for future improvements in the paving of common areas of the neighborhood and their own homes and can even use them to manufacture and sell tiles and generate a small income for the families of the community. Finally, dissemination will be carried out both within and outside the academic world so that this experience can be replicated in other communities.

Head researcher	DÒRIA-CEREZO, ARNAU
Title	GAP_Noise, Global Acoustic interaction and Psychoacoustic impact of the autonomous vehicles in interior and exterior
Funding institution	Commission of European Communities
Reference	HORIZON-101073014-GAP Noise
Start-up date	01/03/2023
Completion date	28/02/2027

Summary

The goal of this Doctoral Network is to create an interdisciplinary research training network to address the major challenge of sound shaping for safety in electric vehicles. The research program would include research topics such as sound quality and NVH, advanced automatic control, multi-physics modeling, vehicle integration and functional safety, multi-disciplinary co-design, and multi-domain optimization.



Head researcher	FERRER-MARTÍ, LAIA
Title	Design and optimisation of processes and services
Funding institution	AGAUR. Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	
Start-up date	01/01/2022
Completion date	30/06/2025

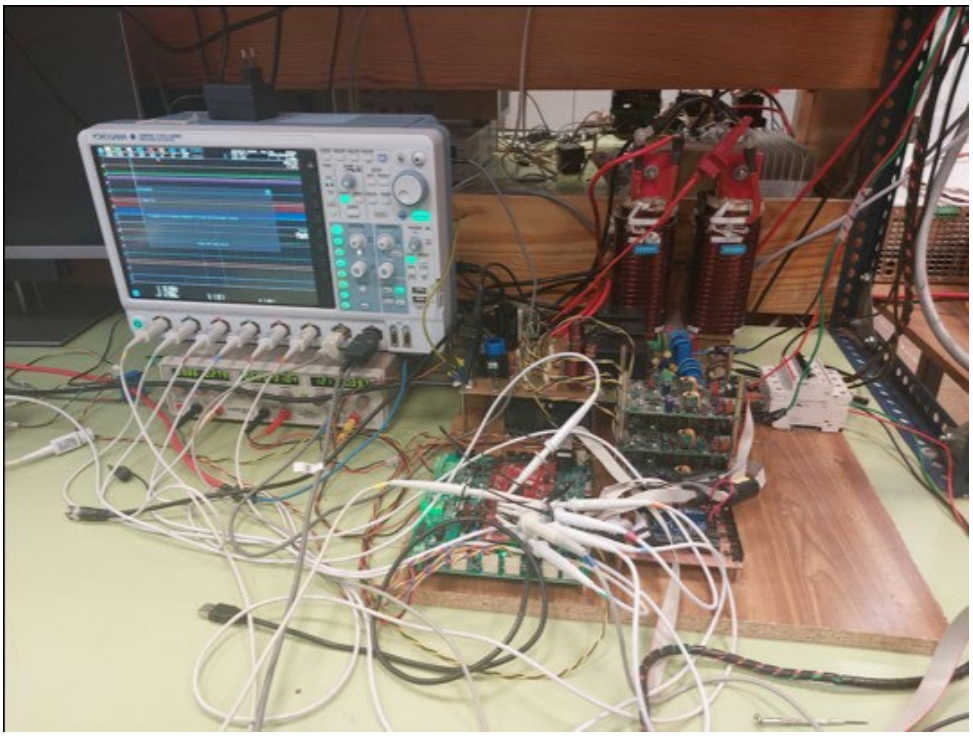
Summary

The group specializes in problems related to the design and management of the supply chain (Supply Chain), including the management of operations in the supply chain, in all types of organizations. The mission of the group is to promote and develop research on the Supply Chain and thus contribute to the improvement of the economic and environmental efficiency of organizations, specifically in the processes of supply, production, distribution, recovery and remanufacturing or recycling.

Head researcher	GRIÑÓ CUBERO, ROBERT- DÒRIA-CEREZO, ARNAU
Title	ACoCSI, Advanced control of single-phase and three-phase Current Source Inverters (CSI)
Funding institution	AGENCIA ESTATAL DE INVESTIGACION
Reference	PID2021-122821NB-I00
Start-up date	01/09/2022
Completion date	31/08/2026

Summary

The ACoCSI project aims to contribute to new control algorithms to improve the performance of the new generation of CSIs. The project will test CSIs in two different applications: the control of a permanent-magnet synchronous motor (PMSM) and PV power conversion systems. During the project, five different CSIs will be assembled: a drive for a PMSM to be tested with the electrical motors in the laboratory and single- and three-phase CSIs for PV applications for both isolated and grid-connected operation. To increase the performance of the power conversion, the project ACoCSI will adapt, according to the requirements of each application, advanced techniques for the design of controllers. The expected control advances along the project are not limited to CSIs, but they can also be useful for other converter topologies.



Head researcher	GRIÑÓ CUBERO, ROBERT
Title	Advanced Control and Power Electronics (ACaPE)
Funding institution	AGAUR. Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	2021 SGR 00376
Start-up date	01/01/2022
Completion date	31/12/2024

Summary

ACaPE is a research group with a long experience in the analysis, design and implementation of advanced control systems, with special emphasis on power electronic converters. The group's research focuses on the modelling and control of complex systems, and their application to problems related to the generation, conditioning, management and storage of electrical energy. New multilevel conversion techniques and modulation and control algorithms are also used to improve the performance of conventional renewable energy systems such as photovoltaic systems, wind power systems and electric and hybrid vehicles.

Head researcher	HATAMI. SARA
Title	Data Science for Informed Decision-Making in the Packaging Sector
Funding institution	AGAUR. Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	
Start-up date	08/01/2024
Completion date	07/01/2027

Summary

The project titled "Data Science for Informed Decision-Making in the Packaging Sector" is part of the Industrial Doctorates Program of the Government of Catalonia, in collaboration with the Polytechnic University of Catalonia (UPC). It is currently in its second year of development and has achieved significant progress toward its objectives.

During this stage, an in-depth analysis of the problems affecting the production process in the packaging sector has been carried out. This work has not only enabled the identification and classification of the different types of challenges to be addressed, but has also facilitated a clear representation of the existing workflows, serving as a foundation for designing the target process model the project aims to implement.

At the same time, the research plan has been successfully defended before the corresponding academic committee, consolidating the methodological foundations of the project and validating its scientific and industrial approach. These advances lay the groundwork for the development of data science and artificial intelligence-based tools aimed at optimizing decision-making in complex industrial environments.

Head researcher	HATAMI. SARA
Title Systems	Intelligent Algorithms, Data Analytics & Internet
Funding institution	AGAUR. Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	
Start-up date	01/01/2022
Completion date	30/06/2025

Summary

The IA-DAIS group (*Artificial Intelligence – Data Analytics and Intelligent Systems*) has been recognized as an SGR Group, certifying its excellence in research and development in the fields of artificial intelligence, optimization, simulation, and data analysis. Activities are focused on the application of these technologies to key sectors such as logistics, urban mobility, healthcare, and transportation, addressing complex challenges through innovative approaches.

Throughout 2023-2024, the group has made a notable impact on the scientific community, with more than 50 publications in highly prestigious international journals and conferences.

Among the group's highlighted research lines are:

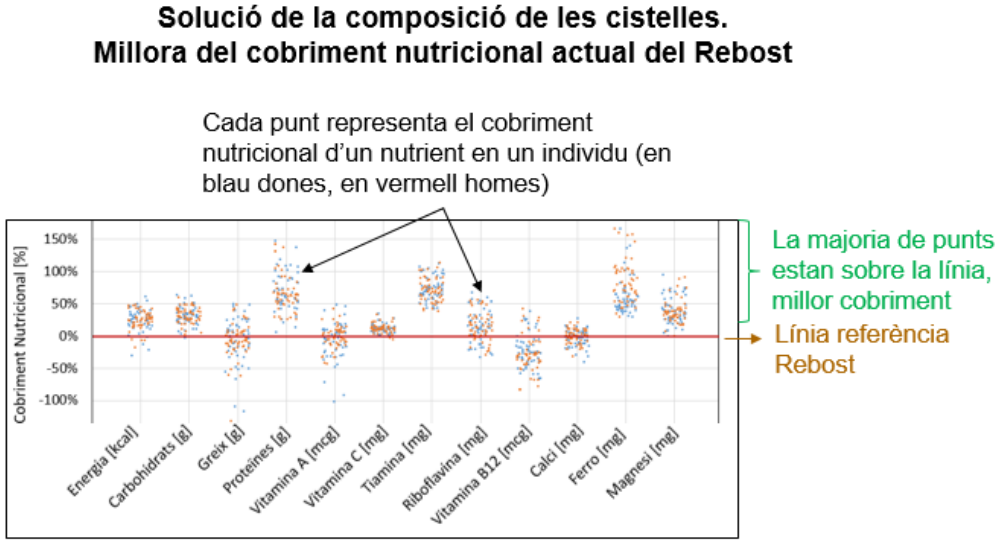
- Optimization and simulation in logistics and transportation: Application of simheuristics and learnheuristics to mobility problems, route planning, and resource management.
- Artificial intelligence and data science: Use of machine learning models for predictive analysis in sectors such as healthcare, smart cities, and energy.
- Human-machine interaction and conversational agents: Design of empathetic chatbots and pedagogical agents to improve teaching and user experience.

Additionally, as part of the group's activities, the Industrial Doctoral Thesis of Jonás Fuentes León was defended, titled: *"Simulation as a Key Element for Intelligent Algorithm Development in Complex Logistic Applications."* This thesis reflects the key role of simulation in the design of intelligent algorithms to solve complex problems in logistics and transportation.

Head researcher	JUANPERA GALLEL, MARC
Title	Optimising the social distribution of food: improving the nutrition of people in vulnerable situations.
Funding institution	Centre de Cooperació per al Desenvolupament de la UPC
Reference	CCD2023-B003
Start-up date	01/06/2023
Completion date	31/05/2025

Summary

According to the latest data from the United Nations, in 2021, it is estimated that 768 million people suffered from food insecurity worldwide. This problem mainly affects developing countries, but the numbers in countries of the global north are also becoming very relevant. This project aims to develop quantitative tools, based on mathematical models, to optimize the social distribution of food and improve the nutrition of vulnerable people. Efforts will focus on three levels. On a local level, the composition of the baskets distributed to families will be optimised, taking into account individual needs. On a state level, the food distribution from food banks to distribution centers will be optimized. On an international level, we will work together with the World Food Program to define a multi-criteria procedure to select the most appropriate intervention that a country like Nigeria can do to improve the nutrition of certain vulnerable groups, such as children, pregnant and lactating women or elderly people.



Head researcher	OLIVELLA NADAL, JORDI
Title	Integration of Knowledge Actions with Leaders of Indigenous Communities in La Guajira for Technology Implementation.
Funding institution	UPC's Centre for Development Cooperation

Reference	
Start-up date	01/07/2024
Completion date	28/02/2025

Summary

It was observed that cooperation projects, particularly the adoption of technologies, often had reduced long-term sustainability due to a lack of training for the local population. The project aimed to develop technical training activities in the fields of energy and process innovation and improvement, targeting leaders of indigenous communities in La Guajira, Colombia. These activities were carried out in conjunction with professors from the Universidad de La Guajira, so that in the future, these professors could develop them independently. Additionally, the methodology was tested for proposals in competitive calls. Finally, a teaching case study on the same topic was prepared: the need for training for the implementation of technologies in the context of development cooperation activities.

Head researcher	OLIVELLA NADAL, JORDI
Title	Development of Teaching Materials on the Strategies and Development of Cooperation Activities Based on Water Supply Projects in El Salvador.
Funding institution	UPC's Centre for Development Cooperation
Reference	
Start-up date	01/06/2023
Completion date	31/05/2024

Summary

The project consisted of preparing teaching material based on the activities of the NGO ACUA in El Salvador, with the support of Engineers Without Borders, and related to water supply. This proposal aimed to continue the activity already initiated with a previous project in which a case study on energy supply in the Raqaypampa region of Bolivia was prepared. Information was collected about the case, focusing on the impact on people's lives, the difficulties in implementing sustainable solutions, and the impact on development. Video recordings of the area and interviews with people involved in the project were also made. With the material obtained, a case study was prepared for innovation, entrepreneurship, and technology management courses at ETSEIB. From the case, students debated the strategies and development of cooperation activities. The material was also used in a training course for people in El Salvador, which was being prepared in collaboration with ACUA and with the support of some UPC professors, among others.

Head researcher	OLIVELLA NADAL, JORDI
Title	Capacity Building in Higher Education ERASMUS+ project, Modernising Digital Education in Energy Transition for Circular Economy in Latin America. ERASMUS-EDU-2022-CBHE-STRAND-2 (101081473).
Funding institution	Commission of European Communities
Reference	EU-BEGP ERASMUS-EDU-2022-CBHE-STRAND-2
Start-up date	15/02/2023
Completion date	14/02/2026

Summary

In the EU-BEGP project nine universities in Latin America (Bolivia, Ecuador, Guatemala, Peru) will collaborate with two universities in EU (France, Spain) towards modernisation of courses and programs in the energy sector, with emphasis upon circular economy towards energy sustainability. The collaboration is inspired by two earlier successful Erasmus+ CBHE projects. It will re-use both the framework and learning material developed from these projects while developing and implementing specific new courses and programs adapted for the local conditions in the partner countries. More specifically it will significantly enhance capacity building on an educator-to-educator basis towards a significant modernisation of energy curriculum in the partner countries. The project will contribute on the paradigm shift towards global-but-local student-centred education in a digital and online learning environment.

The EU-BGEP project will allow collaborative creation of learning material to create/update programs and courses, which includes a baseline of 3 Master programs, 1 "Diplomado" program, 3 expert courses, 15 courses, and 7 short courses, with more than 1000 expected students to be trained at the end of the project in all the partner countries. Furthermore, 10 remote labs will be implemented, enabling real experimental experience to students in remote areas, and 10 entrepreneurial challenges will be run in collaboration with local industries, thus contributing to the employability of young professionals. A specific Quality Improvement Process, with transnational and global peer review, will be implemented throughout all the learning resources, ranging from individual modules through courses and full programs. A significant strength of the EU-BEGP project is that it is part of an intended global collaboration of online digital learning resources, courses, and programs in the energy sector (the "EXPLORE Energy Digital Academy").

All material developed will be included in this framework and the EU-BEGP consortium will have full access to all the already existing, and to be developed, high-quality material. Such global collaboration takes this Erasmus+ CBHE project to a higher level by projects building upon each other, strongly increasing the impact far beyond what an isolated CBHE project would reach.

Head researcher	OLIVELLA NADAL, JORDI
Title	Europe-Brazil-Bolivia-Cuba Capacity Building using globally available digital learning modules.
Funding institution	Commission of European Communities
Reference	618925-EPP-1-2020-BR-EPPKA2-CBHE-JP
Start-up date	15/01/2021
Completion date	14/01/2024

Summary

EUBBC is a digital education skills training project aimed at three Latin American countries with different needs and developments in digital education: Brazil, Bolivia, Cuba and five European Union participants.

Head researcher	OLM MIRAS, JOSEP MARIA
Title	Distributed control strategies for the traffic management of AGV-based in-house transportation systems.
Funding institution	AGAUR. Agència de Gestió d'Ajuts Universitaris i de
Reference	2021 DI 016
Start-up date	08/11/2021
Completion date	07/11/2025

Summary

The deployment of Automated Guided Vehicles (AGV) to carry out in-house transportation tasks is a key element to improve efficiency in the logistics of Industry 5.0-inspired smart factories. However, the standard requirements of logistics schemes such as flexibility, reconfigurability, reusability, scalability or energy-efficiency, pose a number of challenging open –from the optimality side– control problems to be addressed. The thesis will be focused on the development of distributed control strategies for the traffic management of AGV-based in-house transportation systems encompassing: (a) the task scheduling and route planning of the fleet in an integrated fashion and with a high level of decentralization, and (b) the route execution of the individual AGVs during operation in potentially mixed scenarios with improved collision avoidance and deadlock properties.

Head researcher	PEÑA CARRERA, MARTA
Title	Assessment and implementation of Agriculture and Life Science Universities' first Gender Equality plans in Widening Countries. HORIZON-WIDERA-2022-ERA-01 Coordination and Support Action 101094158.
Funding institution	Commission of European Communities
Reference	HORIZON-101094158-AGRIGEP
Start-up date	01/01/2023
Completion date	31/12/2025

Summary

Across the EU, the development of Gender Equality Plans (GEP) intends to address the problems at RPOs; however, the variability in capability, capacity, and expertise hinder the efficient implementation of the institutional GEPs. Additionally, there are specific GE issues within certain fields of study at research and education institutions. In this context, GE issues in the Science, Technology, Engineering and Mathematics (STEM) fields are well known and specific action plans have been developed. Within STEM, agriculture and life-science focused RPOs face very similar problems, but they lack sector-specific measures and mitigation plans. Furthermore, in agriculture, a large GE sector-specific imbalance exists in developing countries where a relevant proportion of RPOs' international students come from.

The AGRIGEP project, with the joint efforts of six consortium partners, aims to perform a responsible assessment of widening RPOs' current status on GEP implementation, improve capabilities through intensive capacity building, and develop and implement an agriculture and life-science targeted GEP with sectorial specific measures and strategies. These results could lead to long-term institutional reforms. Additionally, this project works to establish the inclusion of GE issues within the RPOs' educational system and professional training of students. The realisation of these objectives and the implementation of inclusive GEPs will enhance the inclusiveness, reputation, attractiveness, and research excellence of widening country RPOs. Moreover, it will promote the transformation of institutions and advance GE within the ERA as well.

Head researcher	PEÑA CARRERA. MARTA
Title	Social impact of STEM
Funding institution	AGAUR. Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	
Start-up date	01/01/2022
Completion date	30/06/2025

Summary

SOC-STEM research group aims to promote the STEM (Science, Technology, Engineering and Mathematics) disciplines from their social side. One way to achieve greater motivation of STEM students, from a didactic point of view, is through contextualization, illustrating the teaching of basic sciences through technological or engineering applications. On the other hand, it is well known that the STEM disciplines are fields where students have strong biases. It is necessary to know the reasons that cause a lower representation of certain groups and its historical basis (for reasons of gender, race, culture, economic level…) in order to design tools that contribute to equal opportunities. Likewise, it is intended to promote the study of scientific, technical and industrial cultural heritage with the aim of making visible the historical impact that science and technology have had on our society and as a basic tool for humanistic training in the STEM disciplines.

Head researcher	SEBASTIEN PONSICH, ANTONIN
Title	Sustainable solutions for the evaluation, design and planning of electrification projects in rural areas of South American countries.
Funding institution	Centre de Cooperació per al Desenvolupament de la UPC
Reference	CCD-2023-B009
Start-up date	01/06/2023
Completion date	31/05/2025

Summary

For more than 12 years, the DOPS group has been developing a research line to support rural electrification promoters in developing countries in the design of renewable energy projects. Currently, DOPS has extended this line to the evaluation of already implemented projects and energy planning at a regional or district level. The three types of problems (assessment, design and planning) are based on multi-criteria computational methodologies that take into account all dimensions of sustainability, with a particular focus on environmental protection and the promotion of gender equality. Projects are considered in three Latin American countries: Brazil, where national programs provide a multitude of case studies to evaluate; Colombia and Bolivia, in the energy development phase, where electrification plans and processes of evaluation and design of new systems are required. This project aims to identify relevant practices and conditions in order to extrapolate the results to other contexts around the world.

Head researcher	ROSELL GRATACÒS. JAN / ZAPLANA AGUT, ISIAH
Title	Investigación en nuevas tecnologías para impulsar una nueva industria nacional de soluciones autónomas robóticas
Funding institution	AGENCIA ESTATAL DE INVESTIGACIÓN
Reference	
Start-up date	01/01/2024
Completion date	31/12/2027

Summary

The CENTAURO project aims to improve productivity in Spain through the development of proprietary technology in the field of intelligent robotics, specifically in so-called "mobile manipulators"—autonomous robotic solutions capable of moving within a production environment to assist with or perform various tasks, including those that require skilled labor.
The objective is to develop autonomous and versatile robotic systems capable of navigating an environment and interacting with it by integrating advanced computing capabilities and ubiquitous communication, as well as through advances in distributed computing and the standardization of robot programming and communication technologies.

Head researcher	SUAREZ FEIJOO, RAUL
Title	Resilient manufacturing lines based on smart handling systems - Smarthandle
Funding institution	Commission of European Communities
Reference	HORIZON-101091792-SMARTHANDLE
Start-up date	01/01/2023
Completion date	31/12/2025

Summary

Manual and automated production lines must evolve to "produce more and diverse with less", however they need to address shortcomings such as:

- High product variants requiring tool level dexterity and resource level reconfigurability
- Lack of cognitive perception systems to allow autonomous reasoning and operation
- Absence of adaptable control to accurately handle a variety of workpieces and materials, and
- Inefficiency of planning systems in addressing holistically all hierarchical production levels.

SMARTHANDLE will research technologies to address these needs and support European industry, by implementing:

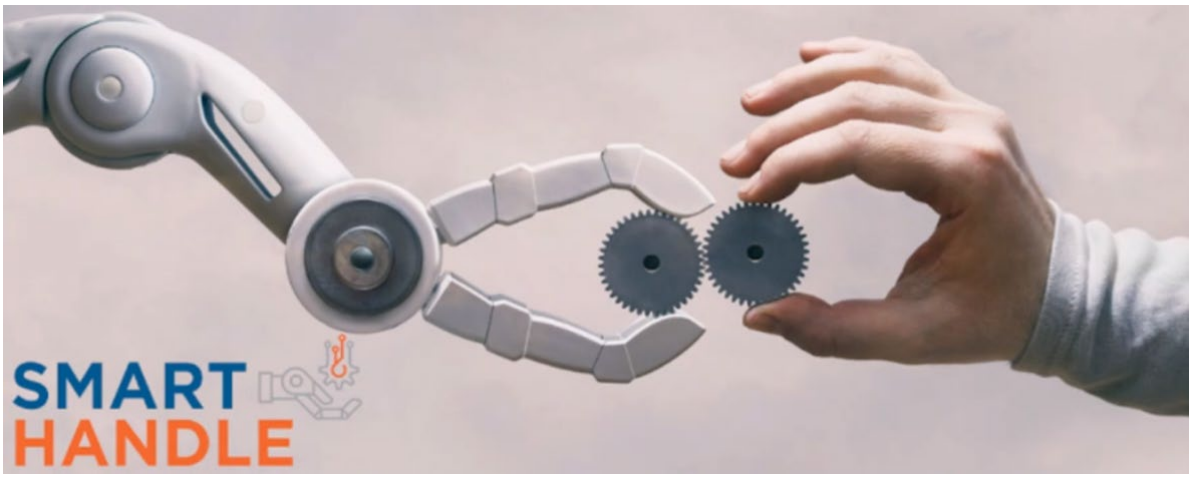
a) intelligent, reconfigurable agents to provide dexterity in a range of handling applications,

b) AI based reasoning enablers to optimize the flexibility potential of these agents

c) Higher-level planning and coordination mechanism to allow the successful and scalable deployment of such solutions in real life use cases.

SMARTHANDLE is a research and innovation action (RIA), nevertheless, it acknowledges that such technologies can be meaningful only if they lead to solutions that address real life needs. Thus it has engaged 3 use cases from the consumer goods (handling of deformable, delicate and high precision parts: contact lenses), Metal Industries (packaging of large variable section materials: aluminum profiles) and automotive tier-1 suppliers (disassembly of complex products: batteries) involving dexterous operations that are not possible to implement with the existing technologies. SSH aspects will be addressed, demonstrating benefits for workers by reducing their involvement in unsafe and unhealthy tasks, improving their working conditions when working in areas where the SMARTHANDLE reconfigurable solutions will operate.

The SMARTHANDLE consortium is made up of 14 European Partners from Belgium (1), Germany (2), Greece (3), Luxemburg (1), Netherlands (4), Spain (3):



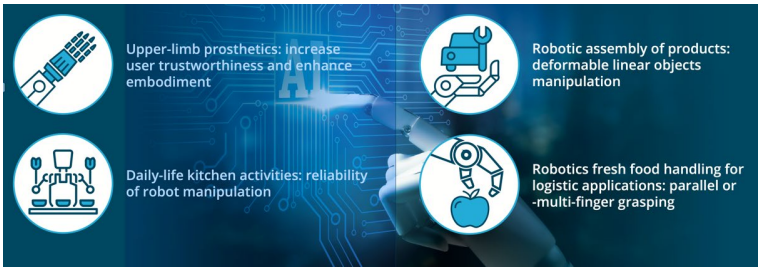
Head researcher	SUAREZ FEIJOO, RAUL
Title	AI-Powered Manipulation System for Advanced Robotic Service, Manufacturing and Prosthetics - Intelliman
Funding institution	Commission of European Communities
Reference	HORIZON-101070136-IntelliMan
Start-up date	01/09/2022
Completion date	28/02/2026

Summary

A key challenge in intelligent robotics is creating robots that are capable of directly interacting with the world around them to achieve their goals. On the other hand, robot manipulation is central to achieve the promise of robotics, since the definition of robot requires that it has actuators that it can use to change the world. In the last decades, a substantial growth has been observed in research on the problem of robot manipulation, which aims to exploit the increasing availability of affordable robot arms and grippers to create machines capable of directly and autonomously interacting with the world to implement useful applications. Learning will be central to such autonomous systems, as the real world contains too many variations for a robot to have an accurate model of human requests and behaviour, of the surrounding environment, the objects in it, or the skills required to manipulate them, in advance.

The main objective of the IntelliMan project is focusing on the question of "How a robot can efficiently learn to manipulate in a purposeful and highly performant way". IntelliMan will range from learning individual manipulation skills from human demonstration, to learning abstract descriptions of a manipulation task suitable for high-level planning, to discovering an object's functionality by interacting with it, to guarantee performance and safety. IntelliMan aims at developing a novel AI-Powered Manipulation System with persistent learning capabilities, able to perceive the main characteristics and features of its surrounding by means of a heterogeneous set of sensors, able to decide how to execute a task in an autonomous way and able to detect failures in the task execution in order to request new knowledge through the interaction with humans and the environment. IntelliMan further investigates how such AI-powered manipulation systems are perceived by the users and what factors enhance human acceptability.

The IntelliMan consortium is made up of 13 European Partners from Germany (3), Italy (4), Slovenia (1) and Spain (2), Switzerland (2) United Kingdom (1)



Head researcher	SUÁREZ FEIJOO, RAÚL
Title	Service and Industrial Robotics - Operation, Production and interprise.
Approval institution	AGAUR. Agència de Gestió d'Ajuts
Reference	
Start-up date	01/01/2022
Completion date	30/06/2025

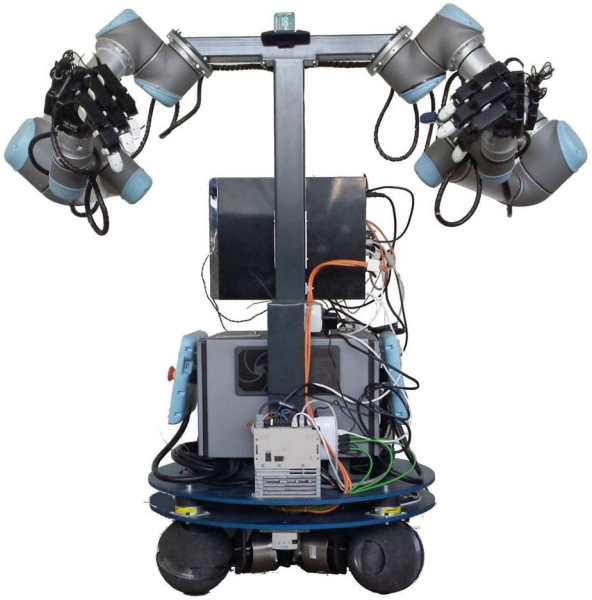
Summary

The research activity of the group is focused in three main lines, which even having their own particularities are not disjoint, this allows interactions and sharing the way the problems are addressed. One line of research is focused on industrial and service robotics, particularly on dexterous manipulation and task and motion planning, considering bimanual mobile manipulators with anthropomorphic structure and artificial intelligence techniques. Another line is focused on the model, management and control problems in the chain of productive operations in various industrial sectors, considering the influence of the human factor and uncertainty on production. Finally, the third research line is focused on rehabilitation and simulation of stroke survivors, and the development of medical devices.

Head researcher	SUÁREZ FEIJOO, RAÚL/ ROSELL GRATACOS,JAN
Title	Core Capabilities for Robot Co-workers (CaRo)
Funding institution	Agencia Estatal de Investigación
Reference	PID2020-114819GB-I00
Start-up date	01/09/2021
Completion date	31/08/2025

Summary

"Full automation" with "fully autonomous, intelligent and dexterous robots" is commonly presented as the ultimate goal of robotic automation. However, there are examples that show that robots have not yet achieved the intelligence and skills needed to solve some tasks, particularly when uncertainty (from different sources) is significant, or, if the robots can solve the tasks, they are very inefficient. This has led to the concept of robot co-worker, a robot "sufficiently skillful and intelligent" and "sufficiently autonomous" destined to work as a collaborator of the human being, who has the necessary knowledge and capabilities to seek for solutions to solve the tasks in certain situations.



The concept of robot co-worker is not new, and it is more and more significant in the current state of robotics, although many different technical requirements are still far away from being solved. A robot co-worker should be prepared to work jointly with the human in work spaces not adapted to it (at least not fully) but rather adapted to the human, and the robot should be able to act in such a way that the efficiency of the work done jointly with the human is greater than that of the work of both working separately. This implies that the robot co-workers must have specific capabilities (regarding intelligence and skills) to be autonomous enough during their collaboration with humans. In this line, the general objective of the project is to advance in the development of core capabilities for dual-arm robot co-workers, developing tools to provide the robots with manipulation capabilities that make them: a) able to work in semi-structured human environments and cope with uncertainty in the knowledge of the state of the environment and in the action outcomes; b) able to successfully execute a sequence of actions despite potential variations in the environment; c) able to fluently interact with other robots and with humans, trying to perform human-like movements to facilitate the interaction, d) able to exploit the dexterity given by two mechanical hands. Following this general objective, the project aims to contribute according to the following specific objectives: a) Development of tools for perception and reasoning, from the point of view of the information processing to understand the environment and the current situation of the task to be solved; b) Development of adaptive and dynamic methods for planning tasks and movements taking into account the uncertainty in the state of the environment, generating plans that can be adapted flexibly and quickly to the real situation of

the environment to avoid replanning; c) Development of robust strategies for bi-manual grasping and manipulation, with particular emphasis on in-two-hand manipulation; and, d) Exploit the current fast state-of-the-art communication technologies, like 5G, in the communications between an operator and a robot, between robots, or between a robot and a distributed computer system. The proposed solutions will be validated in a real experimental setup specifically prepared in the project, including a dual-arm robot with dexterous capabilities that will be used as robot co-worker. Finally, as in all the developments of the group, the problems will be addressed looking for general solutions valid for industrial as well as for service robotics.

Head researcher	SUÁREZ FEIJOO, RAÚL (at IOC)
Title	Industrial Doctorate Training Network on Future Wireless Connected and Automated Industry enabled by 5G.
Funding institution	Commission of European Communities
Reference	H2020-956670-5GSmartFact
Start-up date	01/03/2021
Completion date	28/02/2025

Summary

5GSmartFact is an MSCA-ITN project funded by the EU whose objective is to study, develop, optimize and assess the deployment of 5G networks that target the IIoT requirements (in terms of availability, ultra-low latency, reliability, amount of supported devices, localization accuracy and energy efficiency) in factory environments, and exploit them to integrate factory applications (especially those related to robot-control and robot navigation) which might lead to a complete redesign of networked robot architectures and hence to a leap forward in the industry automation .

5GSMARTFACT

Head researcher	BENEDITO BENET, ERNEST
Title	Customer Quality 4.0
Funding institution	Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	2019 DI 033
Start-up date	16/09/2019
Completion date	25/09/2023

Summary

We carry out a comprehensive evaluation of technical queries to ensure the excellence of the final products of SEAT. With the help of emerging technologies such as Internet of Things, Big Data & Analytics, Artificial Intelligence and Blockchain, among others, new services and applications of Customer Quality can be created. The main goal of this project is to develop new technological solutions that allow SEAT to streamline the process of analysis and resolution of technical queries in Customer Quality department.

Agreements with companies

Head researcher	ARIAS PUJOL, ANTONI
Title	Technical support in the control of a three-phase four-wire Active Filter
Funding institution	VECTORTECH SLU
Reference	
Start-up date	15/12/2023
Completion date	12/12/2025

Summary

The object of the contract is to carry out the services of advice and technical support in:

- Resonant control by active power filters
- Analog hysteresis current control for Active Power Filters
- techniques of fundamental wave isolation and harmonic content through frequency tools
- Supervisory of the development of controls and multilevel modulators (3L) on DSP platforms (TI).

These technical services, are framed within the main objective of designing control and implement (initially) at the simulation level a multilevel active (3n) three branches active three -phase filter.

Head researcher	ARIAS PUJOL, ANTONI
Title	Extension of contract for stability analysis and design of control algorithms for power electronics converters.
Funding institution	UNIVERSIDAD DEL PAIS VASCO
Reference	
Start-up date	30/10/2021
Completion date	30/06/2025

Summary

The purpose of the contract is to design digital algorithms to control for power electronics converters working in "Flexible Power Links (FPL)". The project is still on-going and hopefully will bring experimental results in the next year.

Head researcher	GRIÑÓ CUBERO, ROBERT
Title	Redesign of the current loop controllers of three-phase VSI converters connected to extremely weak electrical networks.
Funding institution	FUND. TECNALIA RESEARCH&INNOVATION
Reference	
Start-up date	28/04/2023
Completion date	28/02/2024

Summary

The objective of the project is the structural and parametric redesign of the controllers of the current control loops of three-phase (3-wire) VSI converters connected to the grid, in order to maintain correct operation with extremely weak electrical networks (short-circuit ratio, SCR in [1, 20]).

Head researcher	LUSA GARCIA, AMAIA
Title	Chair agreement Vanderlande Industries España, S.A.U.
Funding institution	Vanderlande Industries España,S.A.
Reference	
Start-up date	01/05/2022
Completion date	30/04/2025

Summary

Chair with Vanderlande Industries España, S.A.U.-UPC to promote training, research, research transfer and scientific dissemination in the field of logistics process automation (especially in airports and warehouses). The activities of this Chair project include training sessions for students, visits to Vanderlande's factory in Santpedor and the Aeroport Josep Tarradellas Barcelona - El Prat (handling structures and processes), Bachelor and Master thesis challenges and the collaboration with the eRacing ETSEIB team (https://eracingetseib.upc.edu/). More information can be found on the Chair website: https://catedravanderlande.upc.edu

Head researcher	ESTEBAN PEÑA PITARCH
Title	Copropietat patent pelvic floor muscle strength measuring device'.
Funding institution	FUNDACIÓ ALTHAIA
Reference	
Start-up date	25/03/2011
Completion date	25/03/2031

Summary

Device for measuring pelvic floor muscle strength, comprising a speculum (1) formed by two pivoting coupled parts (11, 12), each of said parts with a grip area (31, 32) and a front area (41 , 42) intended to be inserted into the vagina, where a displacement sensor (2) is attached to the front area (31, 32) of the speculum of surface electrodes, with a spring (21) of known constant K, where said spring (21) has a wire diameter between 0.5 and 1 mm, and associated with a displacement reading module (50). It also has a parasitic force measurement system through surface electrodes (52) associated with a force reading module (51).

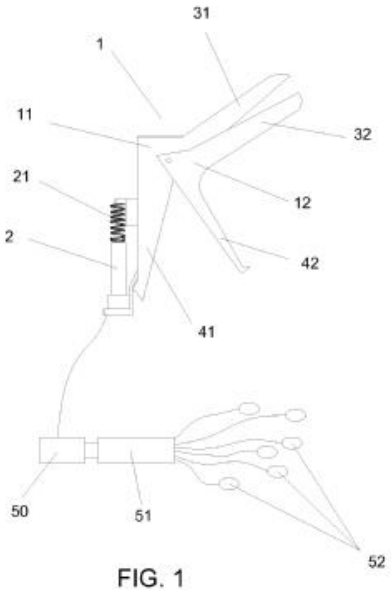


FIG. 1

9. Publications

Journals articles

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Books

1. Bautista, J.; Mateo, M.; Lusa, A.; Pastor, Rafael. **Proceedings of the 17th International Conference on Industrial Engineering and Industrial Management (ICIEIM) – XXVII Congreso de Ingeniería de Organización (CIO2023)**. 2024. ISBN/ISSN: 978-3-031-57995-0. https://link.springer.com/book/10.1007/978-3-031-57996-7.

2. Bautista, J.. **Planificación y control de stocks. Modelos de optimización**. DEXTRA Editorial S.L.. 2023. ISBN/ISSN: 978-84-10026-03-2. https://www.dextraeditorial.com/comprar/239/.

Book chapters

1. Anich, N.; Mateo, M.. **Quantitative Procedure for the Redesign of a Multiple Supply Chains Based on Synergies**. *Proceedings of the 17th International Conference on Industrial Engineering and Industrial Management (ICIEIM) – XXVII Congreso de Ingeniería de Organización (CIO2023)*. Springer. 2024. Pages: 336 ~ 341. ISBN: 978-3-031-57995-0. https://link.springer.com/book/10.1007/978-3-031-57996-7.

2. Bautista, J.. **Heijunka Mixed Model Sequencing Problem with no Buffers and Work Overload Minimization**. *Proceedings of the 17th International Conference on Industrial Engineering and Industrial Management (ICIEIM) – XXVII Congreso de Ingeniería de Organización (CIO2023)*. Springer. 2024. Pages: 214 ~ 219. https://link.springer.com/book/10.1007/978-3-031-57996-7.

3. Bautista, J.; Batet, L.; Mateo, M.. **Minimax Thermal Load in the Spent Nuclear Fuel Cask Loading Problem**. *Proceedings of the 17th International Conference on Industrial Engineering and Industrial Management (ICIEIM) – XXVII Congreso de Ingeniería de Organización (CIO2023)*. Springer. 2024. https://link.springer.com/book/10.1007/978-3-031-57996-7.

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5. Muñoz, C.; Calleja, G.; Olivella, J.. **Exploring Internet of Things (IoT) Adoption: Drivers, Enablers and Barriers**. *IoT and data science in engineering management. CIO 2023. Lecture Notes on data engineering and communications technologies*. Springer. 2024. Pages: 122 ~ 129. ISBN: 978-3-031-27914-0. https://link.springer.com/.

6. Marzabal-Gatell, A.; Zaplana, I.. **Closed-form inverse kinematics solutions for a class of serial robots without spherical wrist using conformal geometric algebra**. *Advances in Mechanism Design IV: proceedings of TMM 2024*. Springer. 2024. Pages: 231 ~ 240. ISBN: 978-3-031-70251-8. https://link.springer.com/book/10.1007/978-3-031-70251-8.

7. **The cyclic inventory routing problem and Energy-aware production scheduling**. Dr. Birger Raa i Dr. Stijn de Vuyst. Professors del Department of Industrial Systems Engineering and Product Design a la Ghent University, de Gant (Bèlgica). Seminari de recerca que va tenir lloc dimecres 05/06/2024 a les 11h al seminari de l'IOC.

10. Seminari from external researches

Seminar: The future of drone and innovative last mile deliveries: innovations, opportunities, and challenges ahead. Dr. Miguel Andres Figliozzi is a Professor in the Civil and Environmental Department at Portland State University. Apr 29, 2024

Seminar: Robotic re-&demanufacturing in an industry 4.0 for a circular economy. Prof. Jef Peeters is an assistant professor at KU Leuven and co-chair of the Lifecycle Engineering research group at the Department of Mechanical Engineering and is responsible for the Re- and Demanufacturing Lab. His applied research focuses on (eco)design and rework, reuse, repair, remanufacturing, and recycling and targets the development of innovative products and processes for a circular economy. Jul 12, 2024

Seminar: Vehicle Dynamics. Exploring the interrelation between vehicle dynamics model complexity and Handling performance Dr. Roberto Aratri. Vehicle Dynamics Toolbox for Objective Ride Analysis Dr. Francesco de Astis. Sep 12, 2023

Seminar: Artificial Intelligence by Dr. Jordi Ollé. Nov 07, 2023

11. Awards or distinction

1. Juanpera, M.; Gil-Figuerola, P.; Koenen, M.F.; Kuri, S.; Damu, C.; Ferrer-Martí, L.. **XVIII International Conference on Industrial Engineering and Industrial Management - XXVIII Congreso de Ingenieria de Organización (CIO2024)**. 2024. *Optimising diets: quantitative methods for guiding transition towards healthy diets*. **First prize**. DOPS - Disseny i Optimització de Processos i Serveis.

2. Shirzadi Maryan, M.; Zaplana, I.; Suarez, R.. **29th International Conference on Emerging Technologies and Factory Automation**. 2024. *Article del tipus Work-in-progress, que va estar reconegut com el millor de tots els articles de la mateixa categoria (al voltant de 100). L'article, que també apareixerà a les proceedings de la conferència, té el títol: Analytical approach to reorient unknown objects via in-hand manipulation, i els autors són: Morad Shirzadi, Isiah Zaplana i Raúl Suárez, tots de la UPC i de l'Institut d'Organització i Control de Sistemes Industrials (IOC-UPC).*. **First prize**. SIR-OPE - Service and Industrial Robotics - Operation, Production and Enterprise.

12. Extracurricular activities

Master executive in Lean Supply Chain Management. Direcció d'Operacions I Logística - Master's degree. Face-to-face.

Academic management: Rúa Costa, Carles; August Casanovas.

Presentation

16th year

Traditional functions in companies such as production, distribution, planning or logistics have evolved with the change in economic cycles. The productive function has adapted to the new needs of markets, incorporating new trends such as Lean Manufacturing¿ and embracing quality control, training or staff motivation as part of its tasks. Likewise, logistics have also changed, and the concept Integrated Logistics has come to comprise all the value chain between the customer and the supplier, as well as the flow of information and materials.

Integrated management of the distribution chain, production and supplies is now known as Supply Chain Management. The emergence of logistics has forced governments to work on improving and updating infrastructures roads, railway, ports and airports and this, together with staff training and research and innovation as key aspects to increase the level of competitiveness in the business fabric.

This Master's Degree aims to be unique and exclusive, a reference point for all professionals aiming to develop their career in the areas of logistics, distribution, supplies and, in general, Year aspect relating to the supply chain management and design. To make this possible, the course has included prestigious professionals from the main European universities (CRANFIELD) and leading schools in specific areas (European Short Sea Shipping School). For this Masters we also have the collaboration of managers from the leading logistics companies in Spain, who will transmit their experiences to the students.

AIMS

- TO PUT INTO QUESTION, THE CURRENT ORGANISATIONAL AND MANAGEMENT SYSTEMS IN THE LOGISTICS CHAIN.
- TO STRATEGICALLY ANALYSE, ORIENT AND DEFINE THE ENTIRE LOGISTICS CHAIN AND ALL OF ITS DIFFERENT SECTORS, IMPLEMENTING AND ADAPTING NEW TECHNOLOGIES TO BOOST COMPANIES LOGISTICS SERVICES.
- TO DESIGN AND IMPLEMENT NEW SYSTEMS AND METHODOLOGIES TO IMPROVE THE MANAGEMENT OF THE RELATIONSHIPS AMONG PROVIDERS, BUSINESSES, OPERATORS AND END CLIENTS.
- TO EFFECTIVELY MANAGE PERSONNEL TEAMS THAT NEED TO COLLABORATE WITH THE CULTURAL CHANGE IMPLIED IN IMPLANTING AN INTEGRATED STRATEGY OF SUPPLY CHAIN MANAGEMENT

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