

# R&D IN URBAN MOBILITY AT THE UPC

2023



Generalitat  
de Catalunya



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DE CATALUNYA  
BARCELONATECH



CoFunded by  
the European Union

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# 01 THE UPC

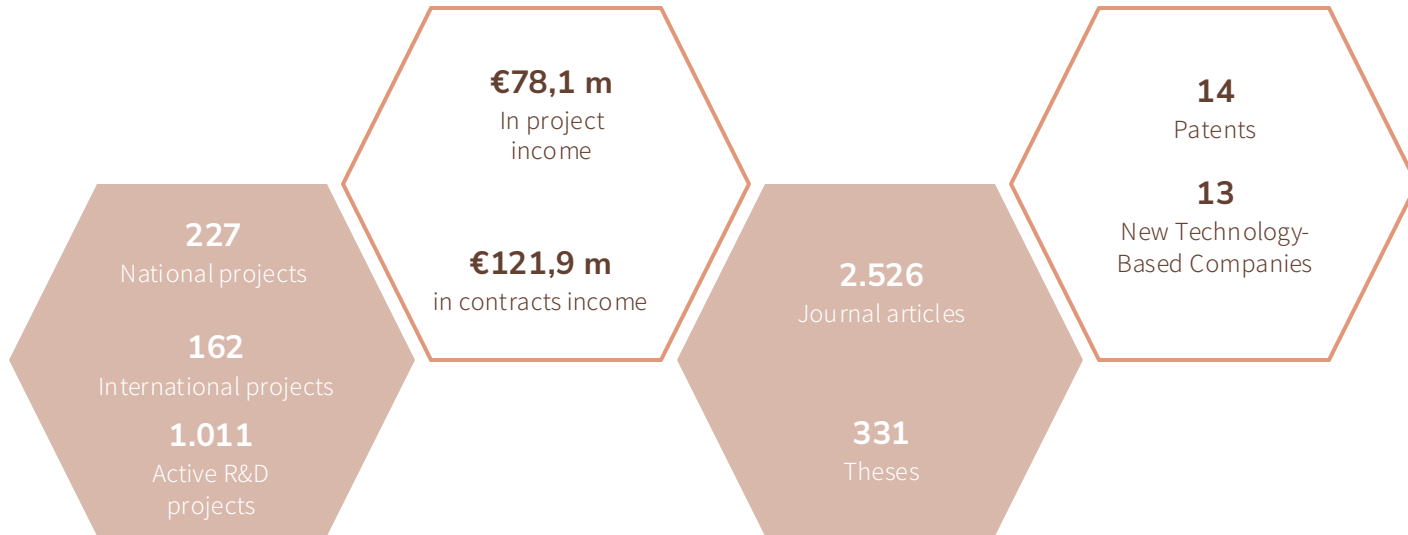
The Universitat Politècnica de Catalunya (UPC) is a public institution of research and higher education in the fields of engineering, architecture, sciences and technology, and one of the leading technical universities in Europe.

The UPC participates in the innovation system of Catalonia with projects and contracts for research, development, valorization of knowledge and commercialization of technology.



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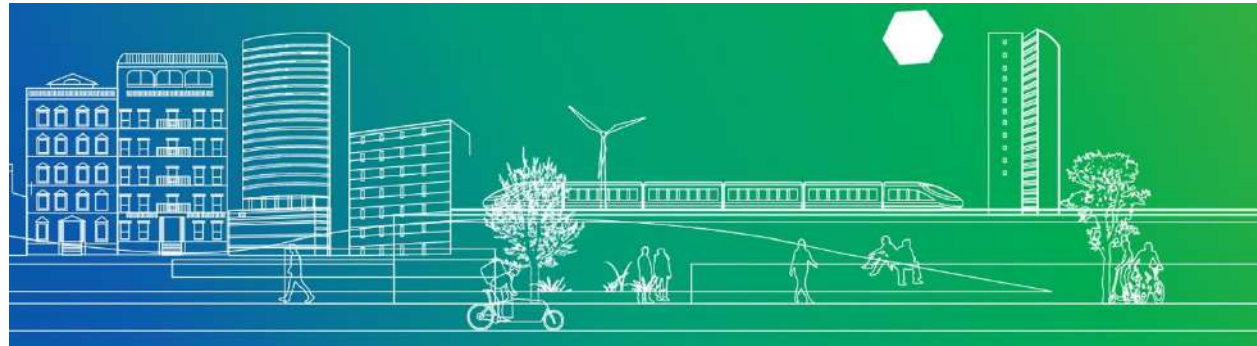
# RESEARCH, DEVELOPMENT AND INNOVATION ACTIVITY AT THE UPC IN 2022



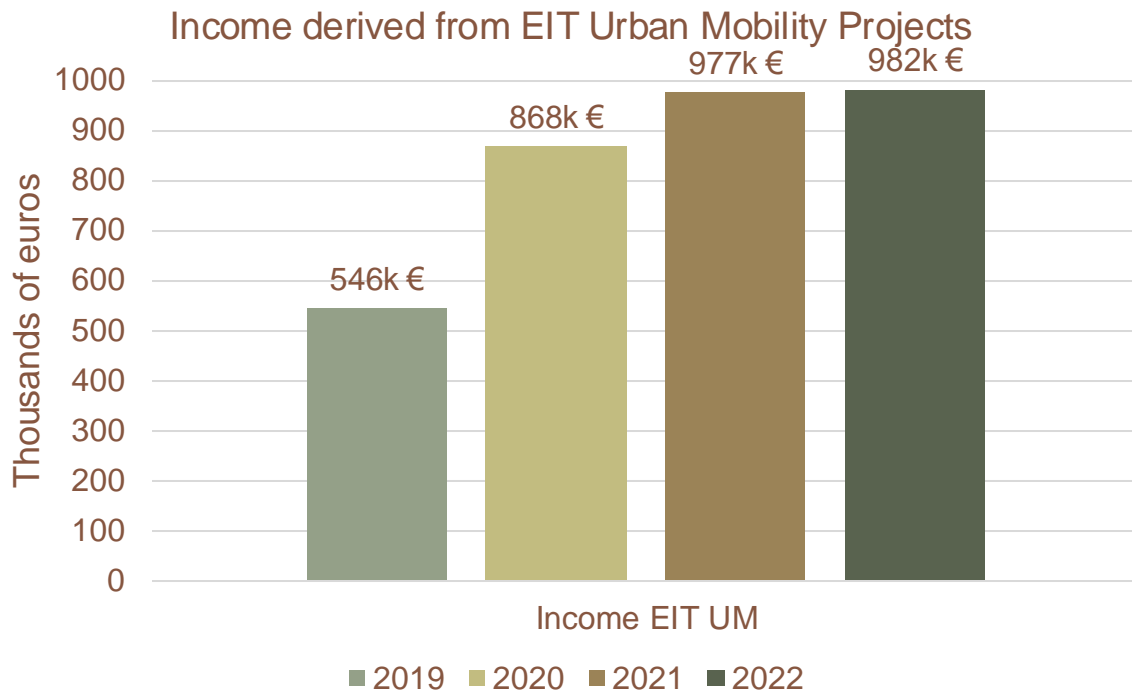
EIT Urban Mobility seeks to improve urban mobility in Europe with a budget of up to 400 million euros (2020-2026) from the EIT, a body of the European Union.

**Vision:** To demonstrate how new technologies can solve real problems in cities, by using cities as living laboratories, and thus, improve the transport of people, cargo and waste.

**Mission:** To work alongside industrial and university partners to implement intelligent mobility solutions in cities, through the experimentation and demonstration of new technologies in real situations.



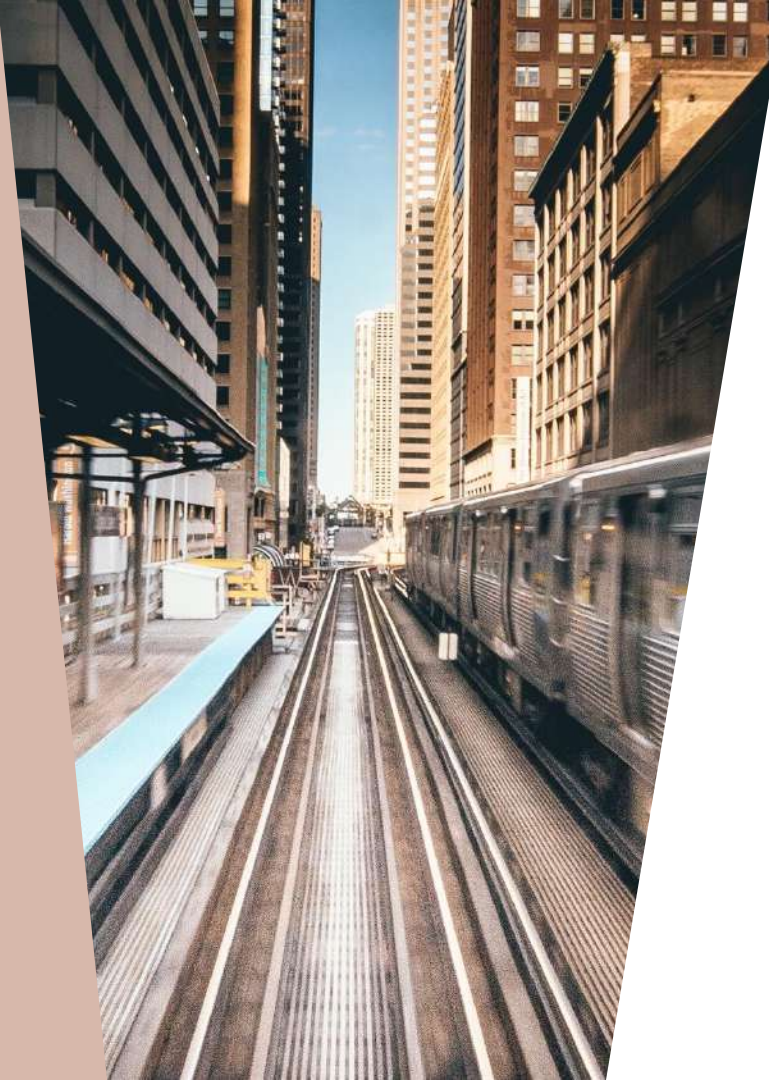
# INCOME FROM EIT URBAN MOBILITY PROJECTS AT THE UPC



# 02

## URBAN MOBILITY

Urban mobility refers to the movement of people and goods within urban areas, typically using means of transport such as walking, cycling or scootering, using public transport and private vehicles. It encompasses the various means of transport, infrastructure, policies and behaviors that shape how people move around cities and towns.



Urban mobility is a critical component of urban life that affects everything from economic productivity and environmental sustainability to social equity and public health. Effective urban mobility requires careful planning, investment and management to ensure that transport systems are safe, efficient and accessible to all citizens.



## Examples of activity I

Development of a support tool for public agents and suppliers of e-micromobiles to contribute to a urban, clean, safe, fast and accessible mobility.

Development of technologies in the field of **optical sensors** for short, medium and long range 3D detection for automotive and smart cities.

Development of shared micro-repositories for the **collection and delivery of urban waste** in order to prevent pollution and address inefficient uses of urban space.

Evaluation of mobility prospects in Europe by **identifying drivers, barriers and challenges** (regulatory policies, regulatory frameworks, etc.).

Establishment of **mobility strategies and governance models** in order to provide tools to policy makers.

Design of an intelligent optical metro infrastructure capable of supporting traffic coming from heterogeneous 5G access networks.

Development of new equipment to facilitate the integration of the microgrid with the distribution network to increase the reliability of the **battery charging** process.



## Examples of activity II

Development of means and tools for the evaluation and improvement of cleaning in shared vehicles, trains and trams.

Management of **electric vehicle fleets** for the reduction of costs and the impact of the service.

Routing and management of the flow of people in urban environments through **Mobile Crowdsensing (MCS)** where citizens use their mobile phones to collect, process and analyze locally georeferenced information.

New proposals for constructive solutions under the criteria of **energy efficiency** in the life cycle and the improvement of urban spaces in cities.

Development of decision support systems for the **optimal charging of batteries** for a given city and quantify the impact of the electric service.

Design of urban air pollution sensors.

Demonstrators at city scale to illustrate the impact of **Software as a Service decision support systems** in urban space.

## Examples of activity III

Creation of a mobility market (open data) supported by blockchain technology.

Boosting the quality of urban space through the application of "**Crowd Monitoring Decision-support Systems**".

Design of a concept for forecasting **urban air pollution**.

Design of **radomes** that allow the radar to be hidden, maintain the style of the car and not degrade the performance of the radar.

Integration of intelligent systems for the energy management of the **low-voltage electrical distribution network** in order to avoid congestion in the network due to renewable generation and large consumptions such as electric chargers.

Development of **fuel batteries** to improve the efficiency and reliability of automobiles by reducing costs and presenting a stable supply chain.

Development of **anonymization technologies** for mobility data in order to provide protection and use urban mobility data and share it privately.

## Examples of activity IV

Development of Intelligent Speed Assistance (ISA) systems to automatically detect speed alerts.

The **carsharing** service that offers free-floating services (trips from A to B) but based on street parking stations.

Development of **autonomous vehicles**.

Inter-bus power management and AC/DC charging functionality using control strategies for multi-bus and multi-port power converters.

Design of an **autonomous delivery system** consisting of a central autonomous vehicle that works in cooperation with smaller autonomous delivery devices.

Design of prototypes of **wind generators** connected to the grid and to the traction system of an electric vehicle.

**Garbage detection** based on **artificial vision** and **smell sensors**.

# 03

## RESEARCH & INNOVATION



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### R&D

Through the research groups distributed by its Schools and Faculties, the UPC has facilities and resources to provide its own services, in the areas of diagnosis, advice, development, demonstration, training, promotion and support to industry, the public sector and civil society in the promotion and deployment of urban mobility technologies.

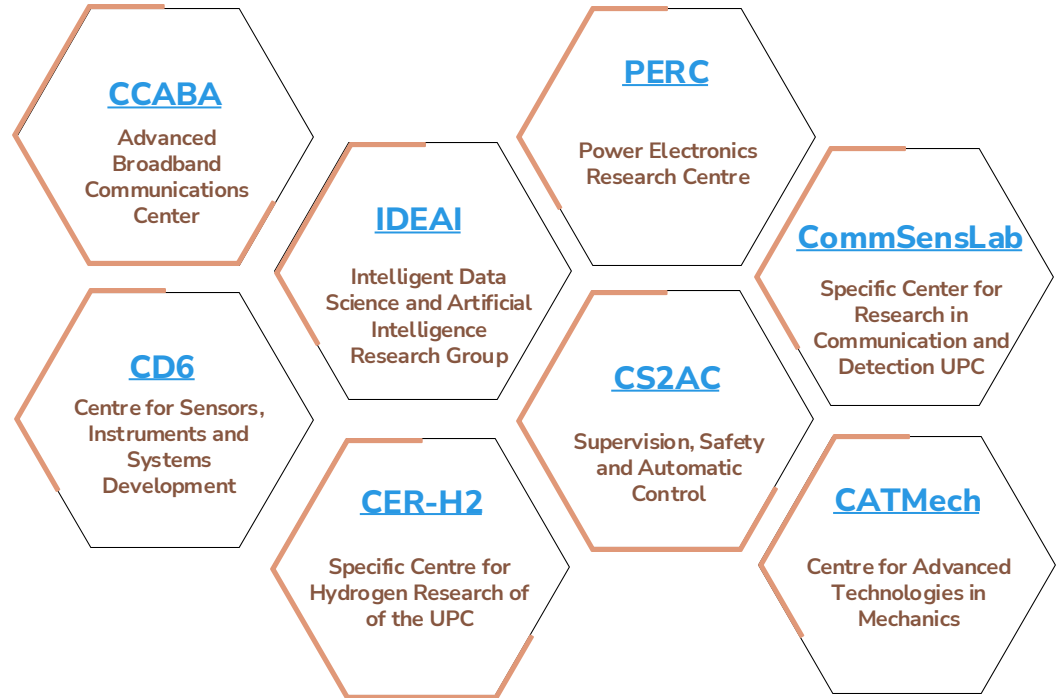
# URBAN MOBILITY GROUPS AND RESEARCH CENTERS AT UPC

# 32

RESEARCH GROUPS (25),  
RESEARCH SUBGROUPS (7)

ACaPE, ACES, ADBD, ANTENNALAB, BIT,  
CDEI, CIEFMA, CITCEA, CTTC, DAMA-UPC,  
DOPS, ENMA, GCO, GPI, GREO, GREP, GRU,  
IMP, InLab Fib, KEMLG, MCIA, MICROTECH  
LAB, RAIG, RSLAB, SAC, SEPIC, SISCOM,  
SPCOM, TIEG, ViRVIG, VIS, WNG

## SPECIFIC RESEARCH CENTERS



# URBAN MOBILITY SPIN-OFF/UPC

- Beamagine



- Mitic Solutions



- eRoots Analytics, SL



- Vitsolc



- Energy Aware Solutions, SL



- Teknocea



- Ludium Lab



- Sparsity



# URBAN MOBILITY CHAIRS (Càtedra) AT UPC

Càtedra SEAT - UPC d'Excel·lència i Innovació en Automoció per a la Mobilitat Sostenible



Càtedra d'Accessibilitat: Arquitectura, Disseny i Tecnologia per a Tothom

Càtedra UNESCO de Sostenibilitat

Càtedra Batlleiroig



# FUTURE MOBILITY RESEARCH HUB



[CARNET](#) was founded in 2015 with the aim of building on the excellent bilateral relations (eg the establishment of the headquarters chair in 2007) of the three founding institutions towards a public-private partnership with other industrial partners and authorities

Founding institutions:



**UNIVERSITAT POLITÈCNICA  
DE CATALUNYA  
BARCELONATECH**

**VOLKSWAGEN**  
AKTIENGESELLSCHAFT



**SEAT S.A.**



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# 04 UPC EXCELLENCE PROJECTS

In this document are considered excellence projects those in which:

- The scientific process is rigorous and complex with high quality standards.
- They are strategic and tractors.
- They acquire a commitment to both social aspects and to great scientific and socioeconomic impact.
- They have repercussions on the territory.
- They comprise the different entities participating in the quadruple helix, so that the projects remain multidisciplinary.

The UPC excellence projects are financed by various programs, such as the State Plan or Horizon Europe.



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# UPC EXCELLENCE PROJECTS



## MOBILITYTICS - Anonymization technology for AI-based analytics of mobility data

Cities face new challenges to become healthier, more sustainable and safer places to live and work. Urban mobility is one of these challenges and new data technologies and personal mobile devices can help to better understand traffic patterns and design effective strategies to reduce pollution and improve mobility. However, there are also privacy concerns regarding the collection of personal data.

The MOBILITYTICS project seeks to develop mobility data anonymization technology that can guarantee both the privacy and the usefulness of the data for urban mobility applications.

UPC research group involved: [SISCOM](#)

# UPC EXCELLENCE PROJECTS



## [GREENWHEELS](#) - Driving the decarbonization of the transport sector through advanced technologies based on hybrid energy storage solutions on lithium-ion batteries and supercapacitors

The project seeks to develop advanced energy storage solutions for electromobility using hybrid technologies of lithium-ion batteries and supercapacitors to improve the energy efficiency, autonomy and technical performance of electric vehicles.

The main objective of the project is to provide new methods and technologies for the promotion of electro-mobility.

UPC research group involved: [SISCOM](#)

# UPC EXCELLENCE PROJECTS

## CITYTHON

Citython is an event where multidisciplinary teams compete to provide innovative solutions to urban mobility challenges defined by cities, for example challenges of accessibility, pollution, space management and transition to a sustainable city.

The aim is to create attractive, functional and real proposals that generate new business ideas, technological concepts or prototypes to be implemented in cities. It also seeks to involve citizens and create a community of students, professionals and entrepreneurs capable of positively transforming the urban reality.

UPC research groups involved: [GPI](#), [IDEAI-UPC](#) (research center)



# UPC EXCELLENCE PROJECTS



## **AUDEL** - Autonomous package delivery in urban areas

The growth of the urban population and e-commerce have led to an increase in the transport of goods, especially in last-mile deliveries. This causes congestion, pollution and safety issues.

The AUDEL project seeks to develop autonomous devices for last-mile deliveries, reducing emissions, congestion and costs. Improvements in algorithms and technology are still required to operate safely in complex urban scenarios.

The project focuses on the autonomous navigation of delivery devices under challenging conditions and in realistic city scenarios, using the research team's expertise in robust motion estimation, detection and tracking of vulnerable road users and predictive control.

UPC research group involved: [RAIG](#)

# UPC EXCELLENCE PROJECTS



## CELESTE - Dynamic speed limits compliance for optimised traffic management

Intelligent Speed Assistance (ISA) systems, which will be mandatory for all vehicles sold in the EU from 2022, enable speed alerts and, in some cases, automatic speed reduction and compliance.

However, there are issues to be resolved for their correct use, such as determining appropriate speed limits, adapting to changing conditions and real-time enforcement. The CELESTE project seeks technological solutions and evaluation tools to complement existing traffic management centers, delivering functional prototypes.

UPC research groups involved: [GREC](#), [IDEAI-UPC](#) (research center)

# UPC EXCELLENCE PROJECTS

## WalCycData - A data infrastructure for vulnerable road users

The aim of this international consortium is to develop and test in pilot cities the URBAN-i Box - a special sensor for bicycles that monitors the interaction of cyclists, pedestrians and cars in a dynamic urban environment through video, GPS and other sensors.

An important part of the project is the creation of a platform, based on the CIGO! system of UPC, for the evaluation and analysis of data in crisis or accident situations.

UPC research groups involved: [GREO](#), [DAMA-UPC](#)



# UPC EXCELLENCE PROJECTS

## INDUSTRIAL DOCTORATES

### Future human-machine (AI) Interaction for in-car/mobility experience ([link](#))

The thesis will define the user experience and service requirements for specifically designed vehicles, as well as examine the potential of fleet operations through the integration of vehicles and technology.

Finally, a first prototype will be created, analyzing the service pilot and deducing the requirements of the next generation.

### Open Data based real-time urban mobility for car fleets ([link](#))

The aim of the thesis is to study open and closed data to improve vehicle mobility, analyze cooperative routing and navigation, test a prototype and finally contribute to the standardization and technology road map for SEAT and Volkswagen.

### Development of a Multimodal Image platform based on 3D Lidar ([LIDAR+](#))

The thesis discusses the expansion of 3D lidar imaging systems due to the growing need for autonomous vehicles, which provide significant advantages over current sensors such as radar and imaging sensors.

### Future urban mobility purpose service-design vehicles ([link](#))

The thesis focuses on: connectivity, electrification, autonomous driving and shared mobility, with a special emphasis on car sharing and robotaxis. The aim is to develop future vehicle concepts linked to urban mobility services.



**05**

**EDUCATION**



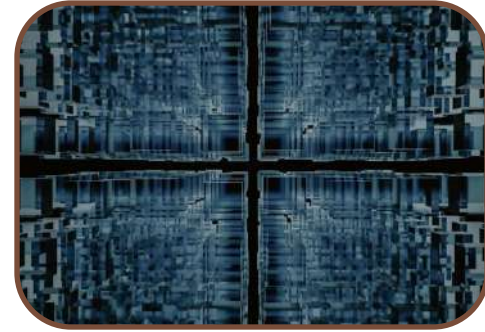
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# EDUCATION – BACHELOR'S DEGREES



## Telecommunications Engineering

- [Bachelor's degree in Data Science and Engineering](#)
- [Bachelor's degree in Telecommunications Systems](#)
- [Bachelor's degree in ICT Systems Engineering](#)
- [Bachelor's degree in Electronic Engineering and Telecommunications](#)
- [Bachelor's degree in Telecommunications Technologies and Services Engineering](#)
- [Bachelor's degree in Telematics Engineering](#)
- [Bachelor's degree in Geoinformation and Geomatics Engineering](#)



## Informatics Engineering

- [Bachelor's degree in Informatics Engineering \(FIB\)](#)
- [Bachelor's degree in Informatics Engineering](#)
- [Bachelor's degree in Artificial Intelligence](#)



# EDUCATION – BACHELOR'S DEGREES



## Architecture, Urbanism and Building Construction

- [Bachelor's degree in Landscape Architecture](#)



## Industrial Engineering

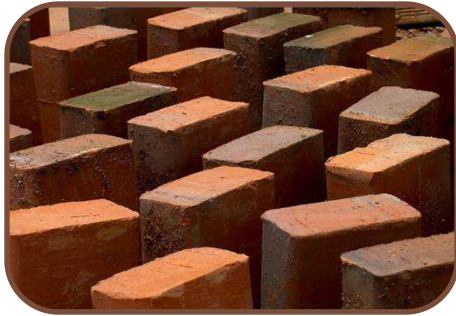
- [Bachelor's degree in Automotive Engineering](#)
- [Bachelor's degree in Energy Engineering](#)
- [Bachelor's degree in Industrial Electronics and Automatic Control Engineering](#) (EEBE, EPSEVG, EPSEM, ESEIAAT).
- [Bachelor's degree in Industrial Technology Engineering](#) (ETSEIB, ESEIAAT).




## Civil Engineering

- [Bachelor's degree in Civil Engineering](#) (ETSECCPB, ETSECCPB, EEABB, EPSEB, EPSEM).

# EDUCATION – MASTER'S DEGREES

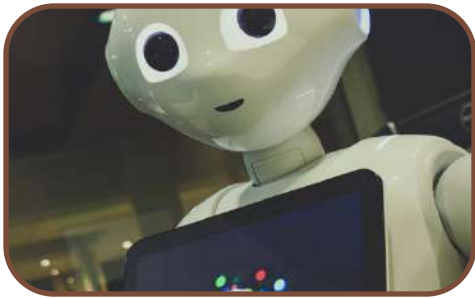


## Industrial Engineering

- [Master's degree in Urban Mobility](#) 
- [Master's degree in Automatic Systems and Industrial Electronics Engineering](#) (ESEIAAT, EPSEVG)
- [Master's degree in Automotive Engineering](#)
- [Master's degree in Energy Engineering](#) (linked to the InnoEnergy programme)
- [Master's degree in Industrial Engineering](#) (ESEIAAT, ETSEIB)
- [Erasmus Mundus master's degree in Dynamics of Renewables-based Power Systems](#)
- [Erasmus Mundus master's degree in Decentralised Smart Energy Systems \(DENSYS\)](#)
- [Master's degree in Automatic Control and Robotics](#)
- [Master's degree in Electric Power Systems and Drives](#)



# EDUCATION – MASTER'S DEGREES



## Informatics Engineering

- [Erasmus Mundus Master in Big Data Management and Analytics \(BDMA\)](#)
- [Master's degree in Informatics Engineering](#)
- [Master's degree in Artificial Intelligence](#)
- [Master's degree in Data Science](#)
- [Master's degree in Innovation and Research in Informatics \(MIRI\)](#)



## Architecture, Urbanism and Building Construction

- [Master's degree in Sustainable Intervention in the Built Environment \(MISMeC\)](#)
- [Master's degree in Landscape Architecture \(MBlAndArch\)](#)



## Civil Engineering

- [Master's degree in Urban Mobility](#)



# EDUCATION – MASTER'S DEGREES



## Telecommunications Engineering

- [Master's degree in Advanced Telecommunication Technologies](#)
- [Master's degree in Telecommunications Engineering \(MET\)](#)



## Environment, Sustainability and Natural Resources

- [Master's degree in Sustainable Intervention in the Built Environment \(MISMeC\)](#)



## Applied Sciences

- [Master's degree in Computer Vision](#)



# EDUCATION – DOCTORAL PROGRAMMES



[Architecture, Energy and Environment](#)



[Urban and Architectural Management and Valuation](#)



[Architectural, Building Construction and Urbanism Technology](#)



[Architectural, Civil and Urban Heritage and Refurbishment of Existing Buildings](#)



[Urbanism](#)



[Computational and Applied Physics](#)

# EDUCATION – DOCTORAL PROGRAMMES



[Civil Engineering](#)



[Artificial Intelligence](#)



[Signal Theory and Communications](#)



[Sustainability](#)



[Automatic Control, Robotics and Vision](#)



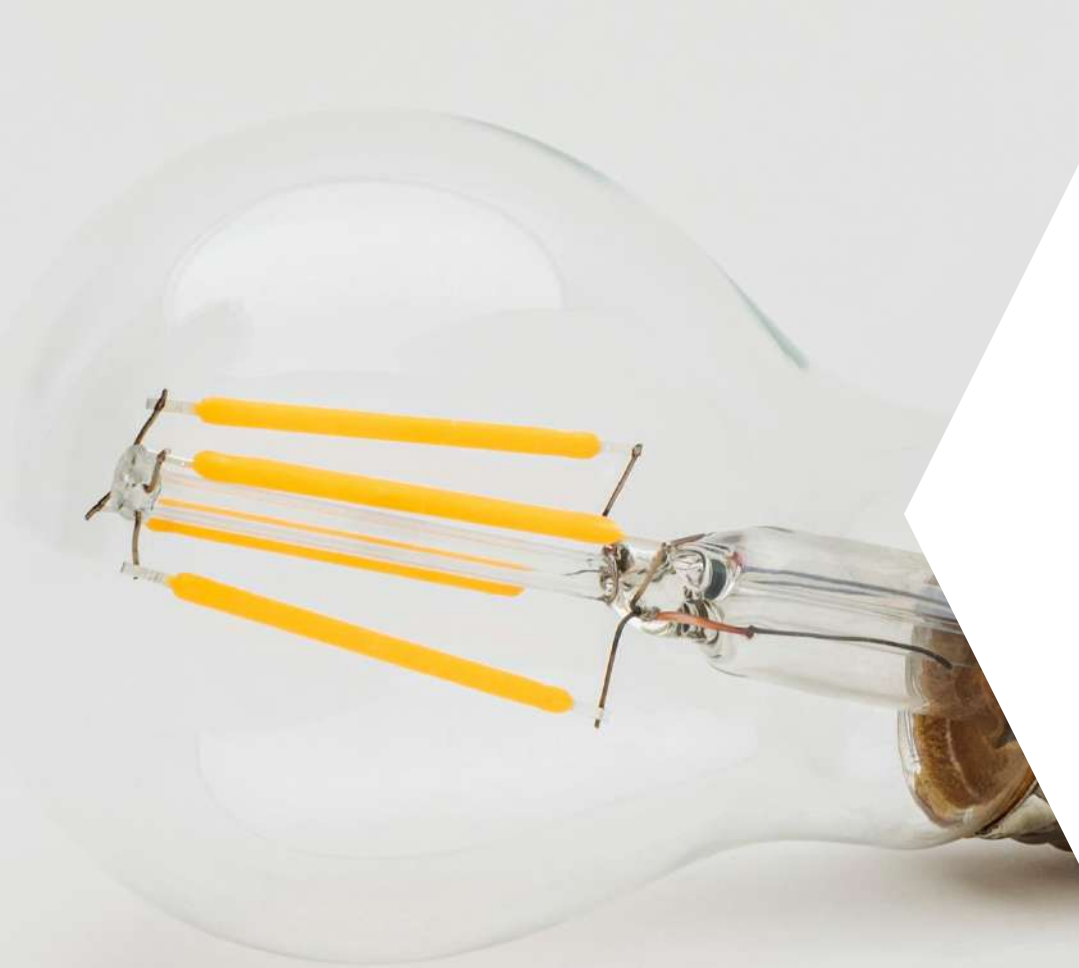
[Electric Energy Systems](#)



[Doctoral Training Network – EIT Urban Mobility](#)







# RESEARCH AND INNOVATION SUPPORT SERVICE

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