iRoboCity2030 Summer School 2026 on "ROS2: AI and Field Robotics"

The **iRoboCity2030 Summer School 2026**, entitled "ROS2: AI and Field Robotics", offers undergraduate students from all over the world an intensive one-week experience focused on the technologies driving the new generation of autonomous and intelligent robots.

The program combines theoretical and practical training in **ROS 2 (Robot Operating System 2)**, **Artificial Intelligence**, and **Field Robotics**, guided by researchers from leading universities and technological centers in Madrid: Universidad Rey Juan Carlos (URJC), Universidad de Alcalá (UAH), Universidad Politécnica de Madrid (UPM), Universidad Autónoma de Madrid (UAM), Universidad Complutense de Madrid (UCM), Universidad Carlos III de Madrid (UC3M) and Consejo Superior de Investigaciones Científicas (CSIC).

Over five days, participants will advance both theoretical knowledge and practical skills, from the fundamentals of ROS 2 to the application of AI techniques in different field robotics domains.

- **Monday – ROS 2 Fundamentals and Introductory Concepts**
  The opening day lays the technical foundations of the course. Participants will become familiar with the ROS 2 ecosystem, its architecture, nodes, topics, and development tools. Through plenary sessions and hands-on practice, they will learn how to configure environments, enable inter-process communication, and run basic simulations. This first day provides a common baseline that will allow participants to confidently tackle the advanced applications covered during the rest of the week.

9h-10h	*Why ROS2 and Field Robotics?*, José M. Cañas (URJC), Francisco Martín (URJC), Carlos Balaguer (UC3M)
10h-11h	Plenary talk, Steve Macenski
11h-11:30	Coffee break
11:30-13:30	*ROS2 basics*, Francisco Martín (URJC)
13:30-15h	Lunch
15h-17h	*ROS2 basics (Hands on Learning)*, Francisco Martín (URJC)

- **Tuesday – Autonomous Vehicles**

  Dedicated to the field of autonomous mobility, this day addresses the principles of perception, planning, and control in intelligent vehicles. Modular architectures for

autonomous driving will be explored, along with the application of artificial intelligence to perception and decision-making, as well as integration with realistic simulators. The hands-on sessions will allow participants to experiment with machine learning algorithms and navigation in virtual environments, preparing the ground for interaction with physical robots.

9h-10h	*Introduction to AI for Autonomous Vehicles*, Luis Miguel Bergasa (UAH)
10h-11h	*Imitation Learning for autonomous vehicles*, José María Cañas (URJC)
11h-11:30	Coffee break
11:30-13:30	*Hands-on Perception for Autonomous Vehicles using CARLA Simulator*, Fabio Sánchez (UAH) and Miguel Antunes (UAH)
13:30-15h	Lunch
15h-17h	*ROS2 for Scaled Autonomous Racing Cars*, Santiago Montiel (UAH) and Rodrigo Gutiérrez (UAH)

- **Wednesday – Quadrupedal Robots**

This block provides an overview of quadrupedal robotics, combining fundamentals, current trends, and experimental practice. Throughout the sessions, the challenges of operating in unstructured environments, the principles of legged locomotion, and the key role of artificial intelligence in perception and decision-making will be addressed. In addition, hands-on activities will be included, allowing participants to work with state-of-the-art robotic technologies and explore how quadruped robots can operate autonomously and safely in complex scenarios.

9h-10h	Search & Rescue - Field Robotics, Christyan Cruz (UPM)
10h-11h	Quadrupedal Robots at the glance, Christyan Cruz (UPM)
11h-11:30	Coffee break
11:30-12:30	Quadrupedal Robots Walking, Christyan Cruz (UPM)
12:30-13:30	Quadrupedal robots (Hands on learning), Christyan Cruz (UPM)
13:30-15h	Lunch
15h-17h	Perception for quadrupedal robots (Hands on learning), Christyan Cruz (UPM)

- **Thursday – Agricultural Robotics and Natural Environments**
  This day is dedicated to showcasing how artificial intelligence and ROS 2 can be applied to agricultural robotics from a practical perspective focused on the real challenges of the sector. The sessions will cover advanced perception in variable environments, integration and control of intelligent implements, autonomous navigation in crops, and manipulation strategies adapted to different agricultural tasks. Through real-world examples and hands-on workshops centered on sensor integration and intelligent algorithms, participants will gain first-hand insight into how robots operate in unstructured conditions, with uneven terrain, dense vegetation, and the dynamic nature of agricultural environments.

9h-10h	*AI and Robotics for agricultural applications*, Roemi Fernández (CSIC)
10h-11h	*Reinforcement Learning for Robot Control in Dynamic Environments and ROS2*, Raúl Fernández (UCM)
11h-11:30	Coffee break
11:30-13:30	*AI and agricultural robotics I (Hands on learning),* Hugo (CSIC) and Dionisio Andújar (CSIC)
13:30-15h	Lunch
15h-17h	*AI and agricultural robotics II (Hands on learning),* Luis (CSIC) and Roemi Fernández (CSIC)
20h	Summer School Dinner

- **Friday – Final Project and Closing Session**
  The final day is devoted to AI explainability in robotics, an aerial robotics session, and the presentation of the ROS 2 projects developed throughout the week. Student teams will present their results and share their learning experiences in a collaborative environment, concluding the program with a discussion session, the award of diplomas, and a farewell social activity.

9h-10h	*AI explainability in Robotics*, Juan Jesús Roldán (UAM) José Luis Jorro (UAM)
10h-11h	Plenary talk, Davide Faconti
11h-11:30	Coffee break

11:30-12:30	*ROS2 projects*, José María Cañas (URJC)
12:30-13:30	*ROS2 for multiagent areal robotics,* Fernando Quevedo (UC3M)
13:30-15h	Farewell party & Diplomas

In addition to the academic program, the summer school will feature **two plenary lectures** delivered by internationally recognized leaders in the ROS 2 ecosystem. The first will be given by **Steve Macenski** (OpenNavigation), lead developer of the Nav2 system, widely regarded as the reference standard for autonomous robot navigation in ROS 2. The second will be delivered by **Davide Faconti**, creator of BehaviorTrees.CPP and Groot, tools that are extensively used for developing robotics applications based on Behavior Trees.

The school's pedagogical approach is strongly practical and collaborative: participants will **learn by doing**, combining knowledge of **artificial intelligence, control, and perception** with their direct application in **ROS 2**, both in simulation environments and on real robotic platforms. Beyond its technical dimension, the school promotes intercultural collaboration and international teamwork, creating a dynamic environment for learning and experimentation.

This summer school is part of the iRoboCity2030 initiative, the robotics innovation network of the Community of Madrid, and represents a joint effort by the region's leading universities and research centers to promote advanced training and knowledge transfer in robotics and artificial intelligence.