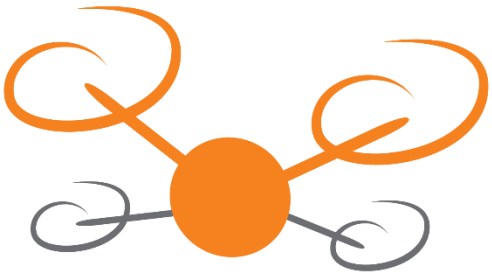


AeRoTwin

Twinning coordination action for spreading excellence in Aerial Robotics

TRAINING 1: DRONE LOCALIZATION AND MAPPING

18 and 19 February 2019

GRVC Lab premises at Seville, Spain

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 810321.

Imperial College London

1. TRAINING DETAILS

Date: 18 and 19 February 2019

Time: 8:15 - 19:30 h

Location: GRVC Lab premises at the School of Engineering of the University of Seville, Seville, Spain

2. PREREQUISITES FROM PARTICIPANTS

Description of prerequisites:

- Each student should bring their laptop with UBUNTU 16.04 and ROS KINETIC

3. TRAINING

DAY 1: 18TH FEBRUARY 2019, MONDAY

Time	Activity	Partner
08:30	START	
08:30-08:45	**Welcome and Presentation of the GRVC Lab**	US
08:45-09:45	**Lecture 1: Drone Localization and Mapping**	US
09:45-10:15	COFFEE BREAK	
10:15-11:30	**Lecture 2: EUROC Indoor Navigation System**	US
11:30-13:30	**Hands-on Workshop: ROS GRVC UAS Abstracion Layer**	US
13:30-15:00	LUNCH	
15:00-16:00	**Visit to the GRVC Labs**	US
16:00-16:30	**Transportation to the GRVC outdoor testbed**	US
16:30-19:30	**Outdoor perception demo. Drone navigation in complex scenarios. Includes set-up description, description and performance of the experiment.**	US
19:30	END OF TRAINING & TRANSPORTATION TO SEVILLE	

DAY 2: 19TH FEBRUARY 2019, TUESDAY

Time	Activity	Partner
08:30	START	
08:30-08:45	**Welcome and Presentation of the GRVC Lab**	US
08:45-09:45	**Lecture 1: Drone Localization and Mapping**	US
09:45-10:15	COFFEE BREAK	
10:15-11:30	**Lecture 2: EUROC Indoor Navigation System**	US
11:30-13:30	**Hands-on Workshop: ROS GRVC UAS Abstracion Layer**	US
13:30-15:00	LUNCH	
15:00-16:00	**Visit to the GRVC Labs**	US
16:00-16:30	**Transportation to the GRVC outdoor testbed**	US
16:30-19:30	**Outdoor perception demo. Drone navigation in complex scenarios. Includes set-up description, description and performance of the experiment.**	US
19:30	END OF TRAINING & TRANSPORTATION TO SEVILLE	

4. TRAINING DESCRIPTION

The objective of this training activity is to describe some advanced drone localization and mapping techniques developed by the GRVC Lab in the last years. The training focuses on theoretical aspects, as well as in practical and experimental issues.
This action includes 2 lectures, one hands-on workshop, presentation of systems in the GRVC Lab and real flight experiments in the GRVC outdoor testbed. The lectures summarize the scientific content of the drone localization and mapping techniques and show how these techniques were applied in the FP7 EUROC project. The hands-on workshop will describe UAL, a ROS tool developed by the GRVC Lab for drone perception and control. The hands-on workshop will first describe UAL and then the students will practice with UAL to perform some exercises.
The most practical component of the training will start with a visit to the GRVC Lab showing different implementations of the aforementioned methods in different platforms and applications. The training will finish with a visit to the GRVC outdoor testbed located at 30 km outside Seville and the performance of demo in which a drone will autonomously navigate in a complex industrial-like environment. If meteorological conditions do not allow performing the demo, it will be substituted with a hands-on workshop developing drone perception localization and mapping techniques in UAL.

5. DESCRIPTION OF PARTNER'S INSTITUTION

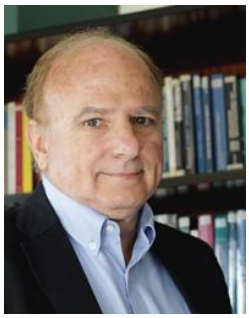
The Robotics, Vision and Control Group (GRVC) is a large group consisting of more than 75 members, including 13 professors from the Universities of Seville and Pablo de Olavide, researchers and engineers. GRVC plays a relevant international role in robotics, and particularly in aerial robotics and unmanned aerial systems. GRVC combines scientific research with technology development, technology transfer to companies and applications in collaboration with these companies.
The GRVC head, Anibal Ollero, has recently obtained the European Research Council (ERC) Advanced Grant GRIFFIN (General compliant aerial Robotic manipulation system Integrating Fixed and Flapping wings to INcrease range and safety) on new aerial robotic systems with unprecedented flying, perching and manipulation capabilities.
In the last 5 years the GRVC members of the Group have authored more than 170 publications, including about 60 papers in SCR Journals. Moreover, the members of the Group have authored or edited 20 books. The GRVC researchers have been distinguished with 18 national and international awards. In the last 10 years the GRVC has presented 16 Theses that have obtained 6 awards. In the last 5 years, GRVC has had more than 55 research projects and contracts from the European

Commission, companies, the Spanish Research Programme and Regional Research Programme in the topics:

- Unmanned Aerial Systems (UAS) and aerial robotics
- Autonomous systems for aerial, ground and marine vehicles
- Unmanned Ground Vehicles (UGV)
- Distributed systems and wireless sensors and actuator networks
- Robotics for aircraft manufacturing and other manufacturing applications
- Social robotics

More info on GRVC can be found at https://grvc.us.es/.

6. LECTURERS' BIOGRAPHIES



Anibal Ollero (USE). Full Professor at the Univ. of Seville, head of the GRVC Group. He was professor of Univ. Santiago and Malaga in Spain and researcher at the Robotics Institute, CMU (USA), and LAAS-CNRS (France). He is author of >650 publications, including >150 SCI papers, and leader or participant of >150 projects, including > 27 EU projects (leading 6). He has been the advisor of 37 PhD Theses. He obtained 17 international and national awards. He is currently member of the euRobotics Board of Directors and coordinator of the Aerial Robotics Topic Group and co-chair of the IEEE Technical Committee on Aerial Robotics and Unmanned Aerial Vehicles.

J. Ramiro Martinez de Dios (USE). Full Professor at the Univ. of Seville. His R&D activities include aerial robot perception, multi-robot cooperation, robot localization and mapping and sensor fusion. On these topics he has authored or co-authored > 130 publications. He has coordinated 16 R&D projects and participated in other 60 R&D projects, including 18 projects funded by the European Commission. He has been recipient or co-recipient of 5 international awards.

Arturo Torres González (USE) Post-doc researcher at the Univ. of Seville. His R&D activities have been focused mainly on robot localization and mapping aerial robot perception and multi-robot cooperation. On these topics he has authored or co-authored 20 publications. He has participated in 11 R&D projects, including 6 projects funded by the European Commission. He has been co-recipient of one international award.

Francisco del Real (USE) Researcher at the Robotics, Vision, and Control Group at the Univ. of Seville. He has developed and integrated software and hardware in a wide variety of aerial and ground robots in more than 15 robotics projects. His research is focused on reactive behaviours for autonomous navigation.

Julio López Paneque (USE) PhD. candidate at the Univ. de Sevilla. He has been awarded an FPU spanish national scholarship to research on multisensor techniques for aerial robot perception in complex, GNSS-denied environments. During 3 years he has worked on several H2020 European projects (AEROARMS, AEROBI, EUROC) and the ERC project GRIFFIN, developing innovative solutions for drone localization and navigation. He has been co-recipient of the international award "First EU Drone Awards. Best drone based application".