Course guide
220315 - 220315 - Design and Use of Uav for Remote Sensing of the Environment

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree: MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN SPACE AND AERONAUTICAL ENGINEERING (Syllabus 2016). (Optional subject).

Academic year: 2023 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: Manel Soria Guerrero

Others:

PRIOR SKILLS

Previous concepts include basic electronics, programming skills and familiarity with the use of computing tools for engineering given in any bachelor?s degree in aerospace engineering and reviewed in previous subjects of this Master?s degree, as well as familiarity with the use of computing tools for engineering.

TEACHING METHODOLOGY

Classroom lectures combined with assignments to be solved during the class with the help of the professor

LEARNING OBJECTIVES OF THE SUBJECT

Understand how different types of sensors operate (LIDAR, thermal imaging, IMU, multispectral cameras...) and how they can be used to gather useful information about the environment.
Obtain a panoramic of the current applications of UAVs for civilian applications.
Acquiere a hands-on experience with the use of sensors on board of drones, as well as a the capability to read and post-process their data.
Acquiere a good knowledge of artificial vision techniques and how they can be implemented in systems on-board of UAVs

STUDY LOAD

Type	Hours	Percentage
Self study	48,0	64.00
Hours large group	27,0	36.00

Total learning time: 75 h

CONTENTS

Module 1: UAV Sensors

Description:
The main sensors currently used by UAVs in civilian applications will be described, in theory and practice. Within the possible, the sensors will be brought to the classroom and tested. Students will be encouraged to experiment with them, using low cost data acquisition systems, in order to acquire hands-on experience with them. The sensors to be described are:
-Distance sensors:
-Ultrasonic
-LIDAR
-Temperature and pressure sensors:
-Ambient temperature
-Thermal imaging systems
-Single point IR sensors
-Barometric pressure sensors
-Imaging sensors (cameras)
-Visible light
-Multispectral cameras
-Inertial Measurement Units
-Solid state accelerometers
-Solid state gyros
-GPS sensors
-Solid state memory systems

Full-or-part-time: 25h
Theory classes: 9h
Self study : 16h

Module 2-Image processing and artificial vision techniques

Description:
-Assembly of multispectral images
-Artificial vision techniques
-Panoramic imaging techniques
-Photogrammetry

Full-or-part-time: 25h
Theory classes: 9h
Self study : 16h

Module 3: Guided project

Description:
The students will select the subject of their project in agreement with the professor. It can either be:
-A bibliographic or theoretical study concerning a particular sensor or application
-A software development project
-A practical project involving the design, construction and testing of a sensor or its implementation in a UAV.

Related activities:
Some examples of possible practical projects are:
-Automatic control of landing position and orientation based on artificial vision techniques
-Low cost platforms for on board artificial vision systems
-Design and implementation of a low mass GPS system for photogrammetry with micro UAVs
-Characterization of a micro UAV camera
-Can inertial measuring systems survive a crash ?
-Comparison of ultrasonic and LIDAR systems: accuracy, reliability

Full-or-part-time: 25h
Theory classes: 9h
Self study : 16h

GRADING SYSTEM

Assignments 30%
Project 40%
Exam 30%
Students with a grade below 5.0 in the assignments or the project, will be able to do an additional exam in order to compensate for the poor results. The new grade will replace the original only if it is higher. The maximum grade that can be obtained with this additional exam is 5.0.