220144 - Uav Sensors & Applications

**Coordinating unit:** 220 - ETSEIAT - Terrassa School of Industrial and Aeronautical Engineering

**Teaching unit:** 220 - ETSEIAT - Terrassa School of Industrial and Aeronautical Engineering

**Academic year:** 2015

**Degree:**
- BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Teaching unit Optional)
- BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)

**ECTS credits:** 3  
**Teaching languages:** English

### Teaching staff

**Coordinator:** Manel Soria

### Prior skills

Previous concepts include basic electronics, programming skills and familiarity with the use of computing tools for engineering, acquired in previous subjects of the degree.

### Teaching methodology

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

### Learning objectives of the subject

To 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.

To obtain a panoramic of the current applications of UAVs for civilian applications.

To acquire a hands-on experience with the use of sensors on board of drones, as well as the capability to read and post-process their data.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>40.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Self study:</td>
<td>45h</td>
<td>60.00%</td>
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# 220144 - Uav Sensors & Applications

## Content

<table>
<thead>
<tr>
<th>Module 1: UAV Sensors</th>
<th>Learning time: 25h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Self study : 15h</td>
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### 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

<table>
<thead>
<tr>
<th>Module 2: UAV Applications</th>
<th>Learning time: 25h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
</tr>
<tr>
<td></td>
<td>Self study : 15h</td>
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</tbody>
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### Description:

A panoramic of the current non-military applications of UAVs will be given. This part of the subject will be done in collaboration with industry experts of different fields, who will provide a practical point of view. Among the applications to be covered:

- Aerial imaging and video for industrial, commercial and architectural applications
- Photogrammetry
- Archeology
- Precision Agriculture
- Forestal fire prevention and control
- Ecology research
Module 3: Guided project

Learning time: 25h
- Theory classes: 10h
- Self study: 15h

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

Some examples of possible bibliographic works are:
- Historical evolution of thermal imaging systems (cost, weight, resolution, shutterless systems)
- Band-pass filters for multispectral imaging systems
- GPS vs. GALILEO vs. GLONASS. Current state of satellite navigation systems.

Some examples of possible practical projects are:
- 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

The students will work in groups. Each group will submit a report of the project, as well as a video presentation of their work. By agreement with the students, the first and second assignments can be related with the project.

Qualification system

First Assignment: 30%
Second Assignment: 30%
Project: 40%

Bibliography