240AR060 - Introducció a Ros

**Learning Outcomes:**
- Learn how to setup a Linux O.S. environment to work with ROS.
- Understand the ROS communications architecture.
- Use ROS in the different process layers, from sensing to control or actuation.
- Implement simple ROS projects with both simulation and real robots.

**Mandatory contents:**
- Install and setup ROS in a native O.S. Linux (Ubuntu).
- Know and understand the internal procedures of ROS and its modules functionalities (master, nodes, and so on).
- Identify and use the ROS tools and formats related to the internal communication between nodes (topics, actions, services,...).
- Use ROS visualization and debugging tools.
- Design and program C++ algorithms using ROS as a middleware.
- Use debugging tools to verify the compilation and the algorithm functionalities.
- Configure and use a simulation environment with the designed algorithms.
- Managing acquisition, analysis and display of data obtained from different sensors using ROS (cameras, IMU, and so on), both using simulation and real settings.
- Manage and send control commands to a robot using ROS (parrot ARdrone), both using simulation and real settings.
## Hores totals de dedicació de l'estudiantat

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<th>Dedicació total: 0h</th>
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# Introducció a ROS

**Descripció:**
What is ROS. Why, when and where to use ROS. Introduction to basic concepts of software processes, system and design of robotic architectures. ROS community. Pros and cons of using ROS in a robot. Overview of current famous robots using ROS.

**Activitats vinculades:**
Lectures and ROS wiki page.

**Objectius específics:**
Specific introduction to ROS characteristics. Presentation of the ROS community, forum and resources.

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# ROS environment configuration in a Linux O.S.

**Descripció:**
Installation of ROS in a Linux environment (Ubuntu).

**Activitats vinculades:**
Lectures and ROS installation tutorial.

**Objectius específics:**
How ROS uses the system, Which part is done by ROS and which by the underlying operating system. Installation of ROS main packages and dependencies as well as those uses during the course.

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# Introduction to ROS tools. Visualisation, analysis and debug. Practical application (using ?.bag? files).

**Descripció:**
Introduction to ROS developer tools. Command line tools and GUIs

**Activitats vinculades:**
Lectures and guided exercises.

**Objectius específics:**
# Introduction to ROS nodes and communications.

<table>
<thead>
<tr>
<th>Descripció:</th>
<th>Description of ROS communications scheme. ROS package (node) creation.</th>
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<tbody>
<tr>
<td>Activitats vinculades:</td>
<td>Lectures and guided exercises.</td>
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| Dedicació: 24h | |
| Grup gran: 6h | |
| Activitats dirigides: 8h | |
| Aprenentatge autònom: 10h | |

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# Configuration and use of a simulation environment.

<table>
<thead>
<tr>
<th>Descripció:</th>
<th>Presentation of the simulated environment to be used during the subject. Introduction to Gazebo. Overview of a simulated robot.</th>
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<tbody>
<tr>
<td>Activitats vinculades:</td>
<td>Lectures and guided exercises.</td>
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<tr>
<td>Objectius específics:</td>
<td>Use of Gazebo with a simulated robot and world. Definition of a robot (urdf) and sensors (plugins). Interaction between ROS and Gazebo. Robot control using created nodes.</td>
</tr>
</tbody>
</table>

| Dedicació: 9h | |
| Grup gran: 1h | |
| Activitats dirigides: 4h | |
| Aprenentatge autònom: 4h | |
### Managing acquisition, analysis and display of data obtained from different sensors.

**Dedicació:** 7h  
- Grup gran: 1h  
- Activitats dirigides: 2h  
- Aprenentatge autònom: 4h

**Descripció:**  
Use of ROS tools to acquire data from sensors (simulation and real setting).

**Activitats vinculades:**  
Lectures and guided exercises.

**Objectius específics:**  
Display of sensor data using a terminal or visualization tools. Use a simulated camera and detect markers in the image.

### Using ROS in a real setting (Robot).

**Dedicació:** 20h  
- Grup gran: 2h  
- Activitats dirigides: 2h  
- Aprenentatge autònom: 16h

**Descripció:**  
Final project presentation. Apply of acquired concepts during the course.

**Activitats vinculades:**  
Lectures, guided exercises and final project statement.

**Objectius específics:**  
Bibliografia

Altres recursos:
   Basic:
   Lectures slides.
   Description of case studies, exercises and guides.
   ROS wiki page: http://wiki.ros.org/

   Complementary:
   Representing Robot Pose, the good, the bad and the ugly. Paul Furgale, ETH Zürich. http://goo.gl/gcQSXn

A gentle Introduction to ROS, Jason M. O’Kane, 2013. http://www.cse.sc.edu/~jokane/agitr/

Enllaç web
   Nom recurs
   Recurs