LABORATORY OF AUTONOMOUS VEHICLE DESIGN AND DEVELOPMENT (LoVeD)

Required/expected prior knowledge: NONE

<table>
<thead>
<tr>
<th>Class(es)</th>
<th>Lanzotti A.</th>
<th>Renno F.</th>
<th>Savino S.</th>
<th>Strano S.</th>
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COURSE OBJECTIVES (teoriche e pratiche)

To achieve creative and technical skill about system integration of new autonomous vehicles from new ideas to functional simulation. To know methods for concept generation and concept selection, evaluating and improving usability and safety. To face real problem of AV innovation.

To provide the student with the fundamentals of motion planning and control of mechanical systems to develop a system with autonomous guidance.

Development of autonomous vehicle prototypes through simulations and experimental tests.

TABLE OF CONTENTS

I) Concept design of new vehicle (ING-IND/15)
- The product design and development process from an innovative idea to functional prototype.
- Design principle: Axiomatic Design theory.
- Systematic approaches to innovation
  - TRIZ tools to enhance creativity into design process.
  - International Patent Classification. (3 CFU)
- Methods for functional requirement definition and development.
  - Model-Based Systems Engineering (MBSE) approach to the designing of smart mechanical systems.
  - UML and SysML.
  - Black Box & White Box Analysis.
  - Directed graphs and Functional modelling.
- Functional Requirement Definition.
- User centered design of smart systems. (3 CFU)

II) Autonomous Vehicle Simulation and Experimental testing (ING-IND/13)
- Motion planning.
- Minimum actuation time. Scaling of the laws of motion.
- Planning of laws of motion and trajectories of a mobile system.
- Path following and Trajectory tracking.
- Laboratory experiences to visualize the trajectories. (3CFU)
- Integration between sensors and autonomous vehicles.
- Vision systems in motion planning applications.
- Simulations and experimental verifications of autonomous driving control strategies.
- Laboratory experiences. (3CFU)

EDUCATION METHOD

The teamwork experience contributes the developing of new creative ideas that are submitted to a participatory evaluation to win a classroom contest. Communication skill, open discussion with stakeholders. The project evaluation is carried out both by a panel of internal experts and a jury of students. CAD/CAE and virtual prototyping tools are used. Learning by doing.

TEXTBOOKS AND LEARNING AIDS
Course materials.

**ASSESSMENT**

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<th>Assessment will be</th>
<th>Written and Oral</th>
<th>Written Only</th>
<th>Oral only</th>
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<tbody>
<tr>
<td>In case of written assessment, questions are</td>
<td>Multiple choice tests</td>
<td>Open questions</td>
<td>Numerical exercises</td>
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<td>Other (es: project development, computer test ...)</td>
<td>Project development during the semester discussed with an internal and external committee. Communication and presentation of the work using many software tools. Presentation of the virtual and physical prototype.</td>
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