Field Robots

Academic Year: (2023 / 2024) **Review date: 07-06-2023**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: BALAGUER BERNALDO DE QUIROS, CARLOS

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Knowledge of basic industrial robotics.

OBJECTIVES

The objective of the subject is to transmit to the students knowledge about field robots. Contrary to industrial robots, which work in closed spaces and structured environments, field robots operate in open and normally unstructured environments. This fact leads to rethink, among others, the issues of locomotion, control, sensors and decision making. Many of the techniques used in classical robotics do not work in these environments where uncertainty is very high.

The types of autonomous robots that will be studied in this course are divided into four groups: 1) ground robots that include, among others, quadruped robots of the Spot © type from Boston Dynamics or ANYmal © from Anybotics; its sensors, learning and control structures will be presented, as well as its main applications; 2) civil infrastructure inspection and maintenance robots (roads, bridges, tunnels) that allow complex tasks in large outdoor environments (RoboSpect and TunConstruct robots) and underground robots (Badger robot) where the environment supports the robot and they are needed GPR-type sensory systems; 3) agriculture and agrifood robots for tasks, on one hand, planting, pest control and harvesting (Sweeper robots) for precision agriculture, and, on the other hand, milking and cattle care (Astronaut © robots by Lely), and 4) marine and underwater robots with special attention to the marine environment where communications must be with USBL-type acoustic sensors (Giron500 robot © from IQUA Robotics) in autonomous guidance applications for exploration of the seabed, inspection of marine cables and pipes, and ecological control of marine fauna.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to field robots
2. Ground robots (Ground Autonomous Robots)
2.1 Autonomous ground robots (AGVs)
2.2 Quadruped robots and their control
2.3 Learning systems for cross-country locomotion
2.4 Rescue robots
3. Infrastructure inspection and maintenance robots
3.1 Road inspection robots
3.2 Bridge inspection robots
3.3 Tunnel inspection robots
3.4 Underground robots
4. Robotics for agriculture and agriood
4.1 Precision agriculture
4.2 Smart indicators of vegetation quality
4.3 Collection robots and their data sets
4.4 Cattle care and milking robots
5. Marine and underwater robots
5.1 Shipping 4.0 concept
5.2 Autonomous control of ships
5.3 Underwater robots (ROV, AUV)
5.4 Control of autonomous underwater robots

LEARNING ACTIVITIES AND METHODOLOGY

The activities will be divided as follows:

- Theoretical classes in the classroom
- Practical classes in the classroom
- Laboratory
- Presentation of papers and simulation

In addition, students will have to do and prepare a work related to the contents of the subject.

The schedules of the tutorials will be public.

ASSESSMENT SYSTEM

The evaluation system will be:

- 10% for class attendance
- 30% class work
- 30% simulation
- 30% exam

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

BASIC BIBLIOGRAPHY

- Varios Proceedings IEEE/RSJ IROS, IEEE, Varios

BASIC ELECTRONIC RESOURCES

- Carlos Balaguer . Robots de campo: http://Aula global