Robot Simulators

Academic Year: (2019 / 2020) **Review date: 08-05-2020**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: GONZALEZ VICTORES, JUAN CARLOS

Type: Electives ECTS Credits : 3.0

Year : 1 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Computer programming
Recommended: Industrial Robotics

OBJECTIVES

Learn about the different types of free and proprietary simulators, their components, architecture and modeling. Different programming methods are studied. Thanks to the subject project, the student learn different functionalities of a given simulator.

The objective of the subject is the introduction to Robot Simulators from both the theoretical and practical aspects. The importance of research and development is highlighted. It will allow students to acquire the basic knowledge of robot control and programming. To achieve this, we have tried to achieve a balance between the theoretical aspects, the study of the components that compose a robot (mechanical, computer and control), and applications.

With the proposed exercises, which are to be performed on free simulators, it is intended to reinforce the knowledge acquired in the most theoretical parts of the classes.
The practical component is completed with a simulation work in which a process or component has to be designed, programmed and analyzed.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to robot simulators
1.1. Introduction
1.2. Why use a simulator?
1.3. Components of a simulator
1.4. Free and proprietary simulators
1.5. Additional software tools
2. Robot Simulator: Gazebo
2.1. Introduction
2.2. Interacting with Gazebo
2.3. Gazebo Files
2.3.1. File formats
2.3.2. SDF
2.3.3. URDF
2.3.4. ROS launch file
2.4. Gazebo Plugins
2.4.1. Creating plugins for Gazebo
2.4.1. Creating Gazebo environments that load plugins
3. Robot simulator: OpenRAVE
3.1. Introduction
3.2. Interacting with OpenRAVE
3.3. OpenRAVE files
3.4. OpenRAVE plugins
3.4.1. Creating plugins for OpenRAVE

LEARNING ACTIVITIES AND METHODOLOGY

After the theoretical and practical parts of the subject, an analysis and implementation project is proposed. The evaluation is based on the continuous evaluation, the exhibition and the presented document.

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- Ivaldi, Serena, et Al Tools for simulating humanoid robot dynamics: a survey based on user feedback, 14th IEEE-RAS International Conference on Humanoid Robots (Humanoids 2014), 2014
- Joseph, Lentin Mastering ROS for robotics programming, Packt Publishing Ltd, 2015
- Newman, Wyatt A Systematic Approach to Learning Robot Programming with ROS, CRC Press, 2017
- Rosen Diankov and James Kuffner OpenRAVE: A Planning Architecture for Autonomous Robotics, Tech Report CMU-RI-TR-08-34. Robotics Institute, Carnegie Mellon University, 2008

ADDITIONAL BIBLIOGRAPHY

- Eckel, Bruce Thinking in C++ (2nd edition), Prentice Hall, 2000

BASIC ELECTRONIC RESOURCES

- (Wikipedia) . Robotics simulator: https://en.wikipedia.org/wiki/Robotics_simulator