RobotCraft 2018

3rd Robotics Craftsmanship International Academy

A. Structure

Title

RobotCraft 2018: *3rd Robotics Craftsmanship International Academy*

Registration Fee

Category	***Early (Until 16th March 2018)***	***Regular (Until 18th May 2018)***
Higher Education Student	300€	350€
University of Coimbra Student* ***ESN Member****	250€	300€

* Requires the submission of a proof during the application process.

Disciplines:

Robotics; Mechanics; Electronics; Informatics.

Type of course:

Lessons (theoretical classes, seminars, workshops, etc.) (**T**): 48 hours (auditorium with all interns)
Laboratory (**L**): 64 hours (classroom with groups of up to 15 interns)
Homework (**H**): 64 hours

Extra crafts:

Introduction to Programming (**EC1**): 24 hours [+75 € | 26th to 29th June | 6 hours/day]
Introduction to Linux (**EC2**): 18 hours [+75 € | 3rd to 5th July | 6 hours/day]

Specific objectives

- To promote concepts and theorems for the introduction to robotics, describing the history of robotics and its evolution;
- To acquire basic 3D modelling and printing concepts, applied in the design of robotic platforms;
- To acquire basic electromechanical concepts, applied in the development of robotic platforms;
- To understand the potential use of Atmel microcontrollers, using the *Arduino* platform;
- To understand the potential use of the *ROS* framework;
- To acquire C/C++ programming skills;
- To understand the use of sensors (*e.g.*, range finders, encoders, cameras) and actuators (*e.g.*, servo motors, stepper motors, DC motors) used in robotics;
- To explore and apply the concepts of networks and different communications architectures to robotics;
- To explore and apply concepts of artificial intelligence in robotics;
- To consolidate concepts learned during the modules for the full design of a mobile robotic platform, including 3D design, electromechanical assembly, low-level and high-level programming, and artificial intelligence;
- To validate the design of the mobile robot platform under two scenarios, namely to solve a maze more and wrestle in a sumo competition.

Attendance

To obtain the certificate, the intern must comply with the following attendance:

- Lessons (theoretical classes, seminars, workshops, etc.): 36 out of 48 hours
- Laboratory: 48 out of 64 hours

Intern's attendance shall be checked using the unique RFID cards used as individual identification.

B. Program content [2nd July to 2nd September]

Craft #1 (C1): Introduction to Robotics (6h T | 8h L | 8h H)

- Presentation of lecturers, mentors and interns (**T**);
- Presentation of **RobotCraft 2018** and the different crafts it comprises (**T**);
- Introduction to robotics, describing the history of robotics and its evolution (**T**);
- Presenting mobile robot morphologies, namely sensors and actuators (**T**);
- Brief literature review related to robotics, presenting the necessary basic theoretical concepts (**T**);
- Critically discuss and prepare a presentation on an assigned scientific paper (**L** | **H**).

Craft #2 (C2): Mecatronics (6h T | 8h L | 8h H)

- Introduction to 3D modelling tools, namely *Blender* (**T**);
- Introduction to rapid prototyping, focusing on 3D printing with *MakerBot* (**T**);
- Learn how to model and print a 3D structure for the mobile robotic platform (**T**);
- Model and print a personalized 3D structure for the mobile robotic platform (**L** | **H**);
- Electromechanical assembly of the mobile robotic platform (**L**).

Craft #3 (C3): Arduino Programming (12h T | 16h L | 16h H)

- Introduction to C language applied to *Arduino* programming (**T**);
- Describe the features of *Arduino* solutions and *ATMEL* microcontroller (*e.g.*, hardware architecture, cycles, pin configuration, communications), using the *Arduino Mega* board (**T**);
- Identify the different wireless communication technologies used in robotics (*e.g.*, RF, Bluetooth, AdHoc, ZigBee) (**T**);
- Introduction to low-level algorithms, flowcharts and pseudocode (**T**);
- Acquire skills in the sensor and actuator practice used in robotics (**T** | **L**);
- Develop a typical differential kinematic application using *Arduino Mega* (**L** | **H**).

Craft #4 (C4): Robot Operating System (12h T | 16h L | 16h H)

- Introduction to *ROS* (**T**);
- Describe *ROS* features (*e.g.*, *stacks*, *publish-subscribe*, *topics*, *rosserial*), and provide specific examples and case studies (**T**);
- Present *ROS*-compatible simulators, such as *Morse*, *Stage* and *Gazebo* (**T**);
- Introduction to high-level algorithms, flowcharts and pseudocode (**T**);
- Follow *ROS* tutorial under *Morse* environment (**T** | **L**);
- Explore *ROS* features under *Raspberry Pi 3* environment (**T** | **L**);
- Explore *rosserial* for *Arduino Mega – Raspberry Pi 3* communication (**T** | **L**);
- Develop a typical remote sensing application using both *Arduino Mega* and *Raspberry Pi 2* (**L** | **H**).

Craft #5 (C5): Artificial Intelligence (12h T | 16h L | 16h H)

- Introduction to Artificial Intelligence, presenting different paradigms and some real applications (**T**);
- Introduction and importance of integrating biologically-inspired models in robotics (**T**);
- Formalizing a mobile robotic approach, devising biologically-inspired algorithms and finite-state machines (**T** | **L**);
- Develop a streaming architecture to exchange all necessary data between *Arduino Mega* and *Raspberry Pi 3* (e.g., sensor readings, encoders readings, actuators control, etc.) (**L** | **H**);
- Consolidate concepts learned over all crafts and test the mobile robotic platform under specific scenarios, both for maze solving and sumo wrestling (**L** | **H**).

C. Bibliography

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