

# Proposal for the online course on IoT and Multiagent Systems

Teacher: Prof. Paulo Leitao

Total hrs: 24

Target: Postgraduate research students

Weeks: 6

Period: start 2<sup>nd</sup> Nov., end 7<sup>th</sup> Dec.

Lecture: 6 hours

Seminars/workshops: 18 hours

Nº students: 20-30

Assessment: final presentation 10 min + 5 min feedback and questions

Coursework: to be performed during workshops

Summary:

In the fourth industrial revolution context, smart products, processes and systems emerge of applying cyber-physical systems, complemented with emerging ICT and Artificial Intelligence technologies. This course aims to enhance the participants' knowledge in the field of Internet of Things (IoT) and multi-agent systems (MAS), providing the basic concepts, technologies and industrial applications, as well as providing hands-on knowledge to develop simple IoT and MAS applications.

Lecture content:

Week 1. Introduction to IoT technologies [2 hours]

Definitions and applications. Computational platforms for IoT. Communication technologies for IoT (MQTT (Message Queuing Telemetry Transport), CoAP (Constrained Application Protocol) and OPC-UA (OPC Unified Architecture)).

Week 2. Data collection, aggregation and visualization [1 hour]

Definitions and technologies. Need of data analysis and data visualization. Node-RED platform for integrating heterogeneous data sources and development of IoT applications.

Week 3. Introduction to Multi-agent systems (MAS) [2 hours]

Definition of agent and MAS. Architectures and principles. Modelling individual behaviours. Interaction protocols. Data models. Applications and case studies.

Week 5. Embedding intelligence in MAS [1 hour]:

MAS to distributed AI algorithms. Integration of IoT and MAS (smart IoT nodes, increase of autonomy of IoT nodes, etc.).

Seminars/workshops content:

Week 1. Practical work [2 hours]: Development of IoT applications using MQTT.

Week 2. Interactive Seminar [1 hour]: Discussion of IoT technologies and case studies.

Practical work [2 hours]: Development of IoT applications for data aggregation and visualization using the Node-RED platform.

Week 3. Practical work [2 hours]: Development of IoT applications using MQTT and Node-RED.

Week 4. Interactive Seminar [1 hour]: distributed thinking and how can be applied to students' research works

Practical work: [3 hours]: Introduction to JADE platform and development of simple MAS applications (Hello World agent, registration of skills in DF, cyclic behaviour, search of skills in DF).

Week 5. Practical work [3 hours]: Development of MAS applications using JADE (interaction among agents, negotiation, use of JADE's debugging tools).

Week 6. Practical work [2 hours]: Deployment agents in Raspberry applications (MAS/IoT integration).

Interactive Seminar [2 hours]: Presentation of developed applications + discussion