uc3m | Universidad **Carlos III** de Madrid

Interactive and ubiquitous systems

Academic Year: (2022 / 2023)   **Review date: 25-05-2022**

Department assigned to the subject: Computer Science and Engineering Department

Coordinating teacher: BELLUCCI , ANDREA

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

User Interfaces (Course: 3 / Semester: 1)

SKILLS AND LEARNING OUTCOMES

¿   Know and apply techniques for modeling, prototyping and qualitative and quantitative analysis
of interactive systems.
¿   Understanding the ubiquitous interaction paradigm, including multi-device, multi-sensory and
immersive   interaction.
¿   Apply user-centered design methods and ubiquitous programming techniques to devise
solutions that maximize utility and usability.

OBJECTIVES

The Interactive and Ubiquitous Systems course focuses on the design and study of those interactive systems that go
beyond the desktop computer and that are integrated into the fabric of our activities and multiple environments. In this
course students will design and develop prototypes of new technological possibilities so that people interact more
significantly with their physical and social environment.

The subject reviews the historical evolution of computing and human-computer interaction, from the mainframes to
ubiquitous computing. Likewise, current and future trends of ubiquitous technology are analyzed, focusing on key
concepts, such as interaction paradigms, computer technologies, and interaction techniques that make it possible for
the computer to "leave" the desktop computer to integrate into the physical and social world.

On the one hand, the new devices, technologies and interaction paradigms for ubiquitous environments, such as API
for Web distributed systems, sensor data and multi-touch, tangible and embodied interaction, are addressed.

On the other hand, classic as well as novel design, prototype and evaluation techniques of ubiquitous interaction
systems are studied and practiced to complete the user-centered design cycle.

Finally, aspects of security, ergonomics, usability and accessibility related to the integration of new interactive
technologies with the physical environment and daily tasks are analyzed.
Upon successful completion of this course, the student acquires the abilities to:
Know and apply techniques for modeling, prototyping and qualitative and quantitative analysis of interactive systems.
Understanding the ubiquitous interaction paradigm, including multi-device, multi-sensory and immersive interaction.
Apply user-centered design methods and ubiquitous programming techniques to devise solutions that maximize utility
and usability.

DESCRIPTION OF CONTENTS: PROGRAMME

1. - Evolution of human computer interaction and interaction paradigms.
  1.1. - Stages and paradigms in HCI
  1.2. - Fundamentals of ubiquitous computing
2. - Interaction and user experience in ubiquitous systems.
  2.1. - Interaction for ubiquitous environments: multi-touch, tangible and embodied, gestures, voice and multimodal.
  2.2. - Design process and tools.
  2.3. - Rapid prototyping techniques for ubiquitous environments

3. - Safety, ergonomics, usability and accessibility aspects.
  3.1. - Objectives for interactive design
  3.2. - Design requirements and guidelines
4. - Development and implementation of interactive ubiquitous systems.
  4.1. - Advanced aspects of JavaScript programming
  4.2. - Node.js and "server-side" JavaScript programming
  4.3. - Network architecture for ubiquitous systems
  4.4. - Web API for sensor-based interaction
5. - Evaluation of interactive ubiquitous systems.
  5.1. - Benefits and impact.
  5.2. - Objects, types, and evaluation environments.
  5.3. - Evaluation methods and techniques with and without users.

LEARNING ACTIVITIES AND METHODOLOGY

* Theoretical classes: 1 ECTS
- Purpose: to achieve the specific cognitive skills of the course
- Execution: master classes in which theoretical concepts on ubiquitous computing are presented.

* Practical classes: 1 ECTS
- Purpose: to achieve instrumental competences and develop attitudinal competences.
- Execution: practical laboratory classes in which technical topics will be exposed and practical examples related to the development of interactive and ubiquitous applications will be shown. Students will work on the resolution of problems.

* E-learning (SPOC): 1 ECTS
- Purpose: to achieve instrumental competences and develop attitudinal competences
- Execution: online learning activities through videos, self-assessment tests, code analysis and programming assignments. Thanks to the support of the SPOC course, some of the theory and practical classes will be oriented to deepen the online content.

* Group work on a case study: 2 ECTS
- Purpose: develop instrumental and attitudinal skills
- Execution: Design and implementation of a practical case through group work

* Final exam: 1 ECTS
- Purpose: complete the development of cognitive and procedural skills

* Tutorials: Individualized assistance (individual tutorials) or in group (collective tutorials) to students by the teacher.

METHODOLOGY
- Seminars and lectures supported by computer and audiovisual aids.
- Practical learning based on cases and problems, and exercise resolution.
- Individual and group or cooperative work with the option of oral or written presentation.
- Individual and group tutorials to resolve doubts and queries about the subject.
- Practice and directed laboratory activities.

ASSESSMENT SYSTEM

The evaluation will be distributed throughout the term and the final grade will consist of the following parts:

- (Individual) Two ubiquitous systems programming exercises 10%
- (Groups of 3) Project 50%
  + P1 - Ideation and Design 20%
  + P2 - Prototyping 25%
  + P3 - Evaluation 10%
  + Defense

End of term examination:
- (Mandatory, Individual) Final exam 30%

Minimum mark for the continuous assessment
- Project: 4/10

Minimum mark in the final exam to pass the subject: 4/10.

% end-of-term-examination: 30

% of continuous assessment (assigments, laboratory, practicals…):   70

BASIC BIBLIOGRAPHY

- John Krumm Ubiquitous computing fundamentals, Chapman & Hall/CRC Press, 2010

- Yvonne Rogers, Jenny Preece, Helen Sharp Interaction Design: Beyond Human-Computer Interaction, 5th Edition, John Wiley & Sons, Inc. , 2019

ADDITIONAL BIBLIOGRAPHY

- Bill Buxton Sketching User Experiences: Getting the Design Right and the Right Design, Morgan Kaufmann, 2007

- Don Norman The Design Of Everyday Things, Basic Books, 2013

- Paul Dourish Where the action is, MIT Press, 2004

BASIC ELECTRONIC RESOURCES

- Ilya Kantor . The Modern JavaScript Tutorial: https://javascript.info/

- Mark Weiser . The computer for the 21st century:
https://dl.acm.org/doi/pdf/10.1145/329124.329126?casa_token=DgxZ59SCR_wAAAAA:AsL-BIT9IutMF2UHImOwPbTXO6CbIoyUnG40otzi6NaEFYfwGoUC8fZWljZYPBXwbSrlmXDQqQ
- Mozilla Developer Network . Introduction to web APIs: https://developer.mozilla.org/es/docs/Learn/JavaScript/Client-side_web_APIs/Introduction