UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Inclusive Multimodal Interaction

2627-2-F9202P031

Aims

Creating interactive technologies for persons with special needs is particularly challenging because users' abilities and contexts vary widely, requiring highly accessible interaction modalities, as well as carefully crafted functionality and content that address their complex and diverse needs. In this course, students will learn how to address these challenges and create inclusive multimodal interactive applications that incorporate multiple interaction paradigms and can be highly personalized to effectively meet the complex requirements of persons with special needs.

Specific objectives with respect to the Dublin Descriptors (DD)

DD 1: Learning outcomes
Students will learn to integrate theoretical and practical knowledge to address complex, real-world problems through inclusive interactive technologies.
More specifically, they will learn different interaction paradigms involving a range of affordances and input modalities, including touch, text, voice, gestures, and full-body movement. They will understand the advantages and limitations of these paradigms, particularly in relation to persons with special needs, and will learn methods for designing and evaluating inclusive multimodal interactive applications.
In addition, students will acquire foundational knowledge and practical skills for prototyping such applications across various domains, including health and well-being, education and learning, and cooperative work. The prototypes will involve technologies such as the Internet of Things, virtual, augmented, and mixed reality, and generative AI, including large language models.

DD2: Ability to Apply Knowledge and Understanding
After completing this course, students will be able to apply the knowledge, understanding, and practical skills they have acquired to:
• Elicit and analyze requirements that address the salient needs of end users across diverse domains;
• Translate user and system requirements into coherent and effective UX design solutions;
• Develop and implement interactive applications that embody innovative interaction

paradigms and integrate Generative AI components for enhanced functionality, and are accessible, easy to use, and useful to their intended users.
• Design, conduct, and interpret empirical studies to evaluate the quality, usability, and real-world benefits of interactive technologies.

DD3: Making informed judgments
Students will develop a critical and reflective attitude toward the potential, limitations, and risks of interactive technologies. They will learn to make informed and responsible judgments in selecting appropriate methods and technologies to address real-world problems. Moreover, they will be able to evaluate interactive products in terms of their human impact, benefits, and underlying values, demonstrating awareness of ethical, societal, and sustainability considerations.

DD4: Communication Skills
Students will develop strong collaboration and communication skills, particularly those required to:
• Summarize and present project outcomes effectively at all stages of development, from requirements analysis to UX design and implementation;
• Produce clear, accurate, and well-structured UX design documentation;
• Prepare precise and technically sound technology specification documents;
• Create compelling video pitches that communicate the developed application's key features and value proposition to diverse audiences.

DD5: Learning skills
The project activities, carried out in teams, will strengthen students' ability to continue learning both independently and collaboratively

Contents

The course covers two main subject areas:

• The interaction design cycle, including the main activities involved in analysing users' needs and designing inclusive multimodal applications, together with systematic methods for carrying out these activities.

• Interaction paradigms and related technologies, with a focus on:
o tangible interaction, based on the physical manipulation of digitally enhanced objects equipped with sensors and actuators;
o full-body interaction in smart spaces;
o interaction in virtual, augmented, and mixed reality environments;
o conversational interaction using generative AI technologies, such as large language models.

Each interaction paradigm is examined from multiple perspectives, including its rationale, underlying vision, and design principles, as well as current implementation technologies and off-the-shelf development tools.

Detailed program

Topics

• Introduction to inclusive multimodal application – discussion of case studies
• The Interaction Design Cycle

• Eliciting and representing User Requirements: the UNG (Users Needs Goals) Model
• Interaction Paradigms - Tangible Interaction, Full-body Interaction, Conversational Interaction, Interaction in Virtual, Augmented, and Mixed Reality – and their enabling technologies
• Generative AI for multimedia content production
• Communicate your project: How to give an “elevator pitch”, how to write a good project documentation, how to write a good scientific paper

Learning Approach and Project Work

The course adopts both a project-based learning approach, in which students learn by developing a project, and a problem-based learning approach, in which project work begins with real-world case studies involving complex user needs and requirements.

Project activities are carried out in teams of up to four students. Individual projects are permitted only in exceptional circumstances and for reasons of force majeure.

A list of project topics will be presented at the beginning of the course. Students will form groups independently and indicate their preferences for three topics. The instructor will then assign a project topic to each group. Project work will begin approximately in the third week of the course. Tutoring will be provided during class, with weekly supervision by the instructor and the teaching assistants. For organisational reasons, tutoring cannot be offered after the end of the semester. Students are therefore strongly encouraged to complete the entire project during the course so that they can benefit from the support of the instructor and the teaching assistants.

Project activities will also benefit from ongoing collaborations with external stakeholders, such as educational and therapeutic centres. Domain experts from these institutions may give presentations to the entire class about their experiences with interactive technologies. They may also contribute to students’ projects by helping them better understand users’ needs and requirements and by providing feedback on their work.

Most projects may be further developed into a master’s thesis. Students who complete particularly strong projects may also be invited to participate in national or international student competitions or to prepare scientific papers based on their work for submission to leading international conferences.

Prerequisites

Depending on the assigned project topic, prior knowledge of UX design, web development, JSON, JavaScript, C#, Unity, generative AI, and basic DIY electronics, such as Arduino, may be helpful but is not strictly required.

Teaching form

The course consists of lectures and interactive activities, during which students will carry out and discuss projects aimed at applying and assessing the knowledge acquired, under the supervision of the instructor and tutors.

The course will be delivered as follows:

28 hours of instructor-led teaching through in-person lectures.
18 hours of project-based laboratory activities delivered in an in-person interactive teaching format.

The course is taught in English.

Textbook and teaching resource

Course material (slides, including links to online resources)

Scientific papers

Suggested readings:
Jonathan Lazar, Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in Human-Computer Interaction, Editore: Elsevier Science & Technology, Anno edizione: 2017
Jennifer Preece, Helen Sharp, Yvonne Rogers, Interaction Design, Editore: Wiley, Anno edizione: 2015 http://www.id-book.com/

Semester

First Semester

Assessment method

The assessment approach ensures comprehensive coverage of the Dublin Descriptors, evaluating students' mastery and application of knowledge (DdD1–2), their ability to make informed and critical judgments (DdD3), their communication skills in multidisciplinary contexts (DdD4), and their capacity for autonomous learning and reflection (DdD5).

Specifically, the evaluation is based on the following components:
• Project design and development process
• Project deliverables: the source code of the developed prototype, comprehensive design and technology documentation, a user manual, a set of slides and a video for the final 20-minute presentation, and, when applicable, an empirical evaluation report. All deliverables can be reported in Italian or English
• Final oral presentation

Specific evaluation criteria include:
• Effort invested in the project activities;
• Active participation in tutoring sessions;
• Originality, complexity, and richness of the design and technological solutions;
• Methodological and technical correctness of the UX and technological outcomes (including consistency with the requirements);
• Critical analysis of the risks and limitations of the developed solutions;
• Accuracy and completeness of the final documentation;
• Communication quality of all deliverables and of the final oral presentation

Office hours

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | INDUSTRY, INNOVATION AND INFRASTRUCTURE | REDUCED INEQUALITIES