COURSE SYLLABUS

1. Program information

Faculty	Faculty of Electrical Engineering and Computer Science
Department	Computer Science
Field of study	Computers and Information Technology
Cycle of studies	Master's Degree
Study Program	Artificial Intelligence & Social Robotics Applied to Global Health

2. Course information

Course name		**NATURAL HUMAN-COMPUTER INTERACTION**				
Year of study	1	Semester	2	Type of assessment	Ongoing assessement	
Course regime		Course category by educational content: DF – Fundamental, DS – Specialization, DC – Complementary				DS
		Course category by optionality: DOB – Compulsory, DOP – Optional, DFA – Elective				DOB

3. Total estimated time (hours allocated to teaching activities)

I a) Number of hours per week	3	Lecture	2	Seminar	-	Laboratory / practical work	1	Project	-
I b) Total number of hours per semester according to curriculum	42	Lecture	28	Seminar	-	Laboratory / practical work	14	Project	-

Distribution of time allocation per semester (hours)	No. hours
II. Individual study	103
III. Examinations	5
IV. Other activities (specify):	-

Total individual study hours (II+III)	108
Total hours per semester (I.b+II+III+IV)	150
Number of credits	6

4. Specific competencies acquired

Transversal competencies	-
Professional / general competencies	CP1 – perform scientific research CP2 – develop product design CP3 – design prototypes CP9 – prepare scientific reports CP10 – conduct research across disciplines

5. Learning outcomes

Knowledge	**Skills**	**Responsibility and autonomy**
The student/graduate identifies and uses, as the basis for original research, specialized concepts and methods at the forefront of the field of human-computer interaction.	The student/graduate designs and implements natural user interfaces based on the acquisition and recognition of user gestures. The student/ graduate designs and evaluates interactive command vocabularies by applying a user-centered methodology.	The student/graduate assumes responsibility for the design, implementation, and evaluation of human-centered interactive solutions.

6. **Course objectives** (derived from the grid of specific competencies acquired)

General objective of the course	Development of advanced competencies in concepts and techniques specific to scientific research in the field of human-computer interaction for the design and implementation of natural modalities of interaction and communication, such as gestures; preparation of scientific and technical papers in this field.

7. Teaching and learning content

Lectures	No. of hours	Teaching methods	Remarks / Notes
1. Introduction 1.1. Concept of natural interaction for human-computer dialogue. 1.2. Examples of applications, systems, and user interfaces for the design of natural interactions 1.3. Notable figures in the field, relevant international scientific events, and prestigious research laboratories in natural human-computer interaction	2	Lecture, discussion, exemplification, demonstration	
2. Natural interaction with computer systems using gestures 2.1. Use of gestures as commands for controlling interactive applications and systems. 2.2. Taxonomies of gesture-based interaction. Connections with studies in psychology and psycholinguistics regarding the characteristics of gestural communication.	4		
3. Scientific communication in the field of natural human-computer interaction 3.1. Elements of communication in natural interaction. 3.2. Examples of representative scientific papers. 3.3. Case study.	2		
4. Natural interaction with computer systems using touchscreens 4.1. Touch and multitouch gesture input for touchscreen devices. 4.2. Algorithms for gesture representation and processing in touch-based interactions. The family of gesture recognition algorithms: $1, $N, $P, $Q.	4		
5. Natural interaction with computer systems through mid-air gestures 5.1. Mid-air gestures for interaction with mobile and wearable devices. 5.2. Algorithms for representation, processing, and recognition of interactions based on mid-air gestures. 5.3. Case studies and examples of interactive systems from the scientific literature in the field.	4		
6. Natural interaction with computer systems using the whole body 6.1. Whole-body gestures and on-body user interfaces. 6.2. Algorithms for representation, processing, and recognition of whole-body gestures. 6.3. Evaluation measures of whole-body gestural interaction. 6.4. The iFAD space for gesture execution.	4		
7. Design of natural interactions 7.1. The end-user elicitation method for natural interactions. Measurement and analysis of consensus among user preferences in natural interaction. 7.2. Case study for gestural interactions and interactions performed using natural language.	4		
8. Alternative interaction paradigms 8.1. Reality-based interaction design. 8.2. Non-natural interaction design.	4		

Recommended minimal bibliography

1. Radu-Daniel Vatavu. (2025). Non-Natural Interaction Design. *Proceedings of CHI '25, the CHI Conference on Human Factors in Computing Systems.* ACM, New York, NY, USA, Articol no. 435, 16 pages. https://doi.org/10.1145/3706598.3713459
2. Radu-Daniel Vatavu. (2024). Gesture-based Interaction. In: C. Stephanidis, G. Salvendy (Eds.) *Interaction Techniques and Technologies in Human-Computer Interaction,* Chapter 6. CRC Press, Taylor & Francis, 24 pages. https://dx.doi.org/10.1201/9781003490678-6
3. Radu-Daniel Vatavu. (2023). iFAD Gestures: Understanding Users' Gesture Input Performance with Index-Finger Augmentation Devices. *Proceedings of CHI '23, the CHI Conference on Human Factors in Computing Systems.* New York, NY, USA: ACM, Article no. 576, 17 pages. https://doi.org/10.1145/3544548.3580928
4. Nathan Magrofuoco, Paolo Roselli, Jean Vanderdonckt. (2021). Two-dimensional Stroke Gesture Recognition: A Survey. *ACM Comput. Surv.* 54, 7, Article no. 155. https://doi.org/10.1145/3465400
5. Daniel Wigdor, Dennis Wixon. (2011). *Brave NUI World: Designing Natural User Interfaces for Touch and Gesture*, 1st Ed. Morgan Kaufmann, San Francisco, CA, USA. https://doi.org/10.1016/C2009-0-64091-5

Applications (Laboratory)	No. of hours	Teaching methods	Remarks / Notes
The practical activities consist of designing, implementing, and presenting an interactive software application that implements a user interface centered on natural interactions. For this purpose, each new laboratory session will involve updating the application by implementing new functionalities.			
Introductory session on the design and development of user interfaces centered on natural interactions. Defining objectives, identifying work steps, and establishing validation procedures.	2	Practical work, experiment, discussion, case study	
Design of a natural interaction vocabulary. Elements of creativity in designing vocabulary based on the analysis of interactions elicited from end users.	2		
Design and implementation of a software application with a natural user interface.	4		
Reporting results in the form of an academic paper.	4		
Project presentation and evaluation.	2	Demonstration	
Attendance at compulsory activities is regulated by USV's "Framework Regulation on Student Assessment". Make-up for mandatory practical activities scheduled during the semester is carried out in accordance with the provisions of this regulation. Practical activities scheduled throughout the semester may be replaced by the completion and presentation of high-complexity projects from the course syllabus, with the approval of the practical work instructor.			

Recommended minimum bibliography

1. Santiago Villarreal-Narvaez, Arthur Sluÿters, Jean Vanderdonckt, Radu-Daniel Vatavu. (2024). Brave New GES World: A Systematic Literature Review of Gestures and Referents in Gesture Elicitation Studies. *ACM Computing Surveys* 56(5), Article no. 128, 55 pages, ACM. https://doi.org/10.1145/3636458
2. Radu-Daniel Vatavu. (2023). *Gesture-based Interaction*. In J. Vanderdonckt, P. Palanque, M. Winckler, M. (Eds.) Handbook of Human Computer Interaction. Springer, 47 pages. https://doi.org/10.1007/978-3-319-27648-9_20-1
3. Haijun Xia, Michael Glueck, Michelle Annett, Michael Wang, Daniel Wigdor. (2022). Iteratively Designing Gesture Vocabularies: A Survey and Analysis of Best Practices in the HCI Literature. *ACM Transactions on Computer-Human Interaction* 29, 4, Article 37 (August 2022), 54 pages. https://doi.org/10.1145/3503537
4. Radu-Daniel Vatavu, Lisa Anthony, Jacob O. Wobbrock. (2012). Gestures as point clouds: A $P recognizer for user interface prototypes. *Proceedings of the ACM International Conference on Multimodal Interaction.* ACM, 273-280. http://dx.doi.org/10.1145/2388676.2388732
5. Jacob O. Wobbrock, Andrew D. Wilson, Yang Li. (2007). Gestures without libraries, toolkits or training: A $1 recognizer for user interface prototypes. *Proceedings of the 20th annual ACM symposium on user interface software and technology* (UIST '07). ACM, New York, NY, USA, 159-168. https://doi.org/10.1145/1294211.1294238

8. Evaluation

Type of activity	Evaluation criteria	Evaluation methods	Weight in final grade
Final evaluation	Correct understanding and critical analysis of specialized concepts and methods used in scientific research for designing natural human-computer interactions. Correct application of methods specific to natural human-computer interaction. Degree of novelty and originality of the proposed solutions for designing natural human-computer interfaces and interactions.	Written test, followed by oral verification of the extent to which the requirements in the written work are met.	50%
Evaluation of ongoing practical actvities	Correct design and functional implementation of an application with a user interface that supports natural interaction, highlighting scientific creativity. Active participation in practical activities relevant to the specific objectives of the course. Assumes responsibility for decisions made and results of one's own activities, including the responsable and ethical use of AI tools. In exceptional circumstances, at the student's request and with the approval of the practical work instructor, the laboratory activity may be fully or partially substituted by the	Project evaluation, systematic observation	50%

	completion and presentation of high-complexity projects covering topics from the course syllabus or by the preparation and presentation of a complete research paper.		

Physical accessibility: activities are conducted in classrooms and laboratories accessible to wheelchair users via ramps/lifts (USV buildings C/D); **Accessibility of teaching materials:** documents are available in digital PDF format with selectable text and slides with large fonts; **Evaluation accessibility:** ongoing evaluation through projects; possibility of extended time for the written tests and oral verification.

Date	Academic title, Name, Surname, Signature of Course Instructor	Academic title, Name, Surname, Signature of Practical Work Instructor
23.09.2026	Prof. univ. dr. ing. Radu-Daniel VATAVU	Dr. Mihail TERENTI

Date of approval	Academic title, Name, Surname, Signature of Program Coordinator
24.09.2026	Prof. univ. dr. ing. Radu-Daniel VATAVU

Date of departmental approval	Academic title, Name, Surname, Signature of Head of Department
24.09.2026	Prof. univ. dr. ing. Ovidiu-Andrei SCHIPOR

Date of Faculty Council Approval	Academic title, Name, Surname, Signature of Dean
25.09.2026	Prof. univ. dr. ing. Laurentiu-Dan MILICI