SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Automation and Computer Science
1.3	Department	Automation
1.4	Field of study	Systems Engineering
1.5	Cycle of study	Master of Science
1.6	Program of study/Qualification	Cyber-Physical Systems (English);
1.7	Form of education	Full time
1.8	Subject code	15.00

2. Data about the subject

2.1	Subject name		Human-Robot Interaction				
2.2	Subject area		Systems Engineering				
2.2	2 Course responsible/lecturer		Şl. dr. ing. NATSAKIS Anastasios – <u>tassos.natsakis@aut.utcluj.ro</u>				
2.3	3 Teachers in charge of seminars				Şl. dr. ing. NATSAKIS Anastasios – <u>tassos.natsakis@aut.utcluj.ro</u>		
2.4 Y	ear of study	2	2.5 Semester	1	2.6 Assessment		E
2.7 Subject Formative category				DA			
category Optionality				DI			

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	0	3.3 Laborator	1	3.3 Proiect	0
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	0	3.6 Laborator	14	3.6 Proiect	0
3.7 Individual study:										
(a) Manual, lecture materi	al and	notes, bil	oliograpl	ny						28
(b) Supplementary study in the library, online and in the field							14			
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays							14			
(d) Tutoring							0			
(e) Exams and tests								2		
(f) Other activities							0			
3.8 Total hours of individual study (summ (3.7(a)3.7(f))) 58										
3.9 Total hours per semester (3.4+3.8)100										
3.10 Number of credit points 4										

4. Pre-requisites (where appropriate)

4.1	Curriculum	Robot modelling, computer programming
4.2	Competence	Research objectives definition

5. Requirements (where appropriate)

5.1	For the course	Reading research papers provided before the lecture

5.2	For the applications	Presence is mandatory
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6. Specific competences

Professional competences	The students will be able to identify the components necessary in applications requiring human- robot interaction. They will be able to connect the components for creating meaningful applications. They will be able to navigate the literature on the field of human-robot interaction.
Cross	Creativity, Critical thinking, Media and information literacy, Reasoned Decision-Making,
competences	Application Skills

7. Discipline objectives (as results from the key competences gained)

		Acquire knowledge on designing and developing robotic systems
7.1	General objective	that interact with humans. Develop skills for interpreting
		research articles on the topic of HRI.
	Specific objectives	Exercise the creation of specific ROS packages for HRI
		applications. Compare different approaches to establishing
7.2		human robot communication. Distinguish various methodologies
		for ensuring a safe operation of robots close to humans. Study
		literature of the HRI field.

8. Contents

8.1 Locture (cullabus)	Number	Teaching	Notos
o.i. Lecture (synabus)	of hours	methods	Notes
Definitions: robots, humans, interactions	2		
Robot modelling	2		
Human modelling	2		
Non verbal communication: intention detection	2		
Non verbal communication: intention expression	2		
Verbal communication	2	Presentation,	
Decision making (Markov decision processes)	2	Examples,	
Learning human behaviour	2	Practical	
Task sharing between a human and a robot	2	applications	
No contact applications: Manufacturing	2		
Contact applications: Rehabilitation	2		
Safety and ergonomics	2		
Experimental design and validation, control	2		
Ethical considerations and recap	2		

Bibliography

- *Probabilistic Robotics*. Thrun, Burgard, & Fox, MIT Press, 2005.
- *Computational Human-Robot Interaction.* Thomaz, Hoffman, & Cakmak, Foundations and Trends in Robotics. Vol 4: No. 2-3. Now Publishers, 2016.
- *Human-Robot Interaction: Safety, Standardization, and Benchmarking.* Barattini, Vicentini, Singh Virk, & Haidegger, Routledgeg 2019.
- *Cooperative inverse reinforcement learning*. Hadfield-Menell, Russell, Abbeel, & Dragan. 2016, Advances in neural information processing systems, 29
- Human-robot cross-training: Computational formulation, modeling and evaluation of a human team training strategy. Nikolaidis & Shah, 2013 8th ACM/IEEE International Conference on Human-Robot Interaction (HRI)
- *A Human Aware Mobile Robot Motion Planner*. Sisbot, Marin-Urias, Alami, & Simeon, 2007, IEEE Transactions on Robotics
- *Predicting Intention of Motion During Rehabilitation Tasks of the Upper-Extremity.* Natsakis & Buşoniu, 2021, 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC).

9.2 Laboratory	Number	Teaching	Notos
	of hours	methods	Notes
Introduction to ROS	1		
RViZ visualization system	1		
Gazebo simulator	1		
Defining realistic scenarios using the ROS4HRI	1		
Gesture recognition	1	Dractical	
Programming an engagement detector	1	applications	
Engagement detection with real data	1	literature	
Voice commands	1	analysis	
Actions definition and decision making	1	anarysis	
Reinforcement learning	1		
Trajectory planning	2		
Controller design	1		
Experimental design	1		
Bibliography			

- Programming Robots with ROS: A Practical Introduction to the Robot Operating System. Quigley, Gerkey, & Smart, O'Reilley, 2015.
- ROS4HRI framework. http://wiki.ros.org/hri

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The students will be able to practise the development of human-robot interaction applications, which is an important application area in more and more industries.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the
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			final grade			
	Demonstration of					
10.4. Course	understanding of the role	Writton overside	70%			
10.4 Course	of each HRI component	whiten examination				
	and how to combine them					
	Ability to develop					
10.5 Laboratory	example applications for	Computer examination	30%			
	human-robot interaction					
10.6 Minimum standard of performance						
Final mark (course and laboratory) ≥ 5						

Date of filling in: 16.03.2023		Title Surname Name	Signature
	Lecturer	Şl. dr. ing. NATSAKIS Anastasios	
	Teachers in charge of application	Şl. dr. ing. NATSAKIS Anastasios	

 Date of approval in the Department of Automation
 Head of department

 Prof.dr.ing. Honoriu Valean

 Date of approval in the Faculty of Automation and Computer
 Dean

 Science
 Prof.dr.ing. Liviu Miclea