IMPERIAL

Module Specification

Basic details

			Earliest cohort	Latest c
UID		Cohorts covered		

Long title	Human-Centered Robotics

New code	ELEC70015	New short title	

Brief description of module *(approx. 600 chars.)*	The aim of the module is to teach you the theory and design of robotic systems capable of intelligent interaction with humans, and their application in industrial, medical and assistive settings. Through project work you will get the chance to experiment with research robots to develop systems capable of interacting with humans. Prerequisites: good software engineering skills.
	380 characters

Available as a standalone module/ short course? No

Statutory details

	ECTS	CATS	Non-credit		
Credit value	5	10	N	HECOS codes	
FHEQ level	L7				

Allocation of study hours

	Hours	
Lectures	20	
Group teaching	0	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	1	
Other scheduled	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	104	*Incl. wider reading/ practice, follow-up work, completion of assessments*
Placement	0	*Incl. work-based learning and study that occurs overseas.*
Total hours	125	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed? No

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Spring	Other	

Ownership

Primary department	Department of Electrical and Electronic Engineering
Additional teaching departments	0

Delivery campus South Kensington

Collaborative delivery

Collaborative delivery?

External institution

External department

External campus

Associated staff

Role	CID	Given name	Surname
Module leader		Yiannis	Demiris
		0	0
		0	0
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		0	0

Learning and teaching

Module description

Learning outcomes

Upon successful completion of this module, you will be able to:
1. build multimodal interfaces (e.g. one or more of (a) computer vision (RGB & RGB-D cameras), (b) speech recognition toolkits (c) wearable sensors (e.g. IMUs), haptic joysticks, virtual and augmented reality systems) to allow robotic systems to perceive human state information (e.g. body pose, 3d trajectories, intended action).
2. design and develop computational models of human actions (e.g. spatiotemporal sequences, or stochastic context free grammars), and use the computational models to recognize human actions using acquired human data from the multimodal interfaces above.
3. select and apply adaptive shared control methods to assist users in the control of robotic devices (e.g. the control of a robotic wheelchair to navigate safely)
4. select and apply machine learning algorithms (e.g. reinforcement learning, classification or regression) to improve the performance of the assistive robot over time.

Module content	Part A - Fundamentals: Types of Human centered robotics; Contact free sharing of workspace, shared manipulation and control, cooperative assembly; Direct physical human-machine contact in medical and rehabilitation robotics; Requirements and performance metrics for human-centered robotics; Safety, flexibility, and adaptability to users. Part B - Perception of user state: Interface modalities: visual, audio, haptic interfaces. Action recognition and intention prediction using vision; Design and representation of computational models of human actions. Part C - Control & Learning: Variable autonomy and adaptive shared control methods; Interactive Programming of Robots; Task learning by demonstration; Robot Learning algorithms Part D - Applications: Medical and Healthcare robotics; Manipulation, Mobility and Cognitive Aids.
Learning support	GTAs; MS Teams channel with online discussion forums; MS teams repository with examples of previous design and final reports
Pattern of learning and teaching	2 lectures a week, typically scheduled together in one slot
Learning and Teaching Approach	The module follows a research-led learning approach: while lectures focus on conveying the fundamental theory underlying robots capable of interacting with humans, the module emphasises project work as the main vehicle for understanding how to design, implement and evaluate an interactive robot system. The module's approach focuses on the 3R concept: real robots, real environments, interacting with real people. The module is 100% assessed by coursework and requires you to work in a group throughout the module. You will have access to a variety of research equipment used in the Personal Robotics Research lab including sensors, mobile robots and software libraries.
Assessment Strategy	The module is 100% assessed by project work and requires you to work in a group to design and build an interactive robot. You will have access to a variety of research equipment used in the Personal Robotics Research lab including sensors, mobile robots and software libraries. You will need to address group logistics (e.g. how the different team members will work on the required tasks), consider the purpose of your robot, the hardware and software infrastructure required, how you will judge success, and deployment ethics. You will need to take responsibility for one or more of the hardware or software components of your group's robot, and for its integration with the other components of your group. Your group will produce a design paper (20%), and a final research paper (60%) reporting on the implementation and evaluation of your robot and its components. You will also demonstrate your robot to the module leader and module GTAs, as well as present (as a group) your work to the whole class. You will also be individually orally assessed on the progress of your component through a demonstration (20%).
Feedback	Your group will receive written feedback and a provisional letter grade from the module leader for each of the group deliverables, within 10 working days, or (typically) less.
Reading list	No specific reading is required

Quality assurance

Office use only

Date of first approval		QA Lead	

Date of last revision February 2022
Date of this approval July 2025

Department staff
Date of collection

Date exported
Date imported

Module leader Yiannis Demiris

Notes/ comments

Template version #####

Assessment details

		Pass mark
Grading method	Numerical	50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Coursework	Group project to design an interactive robot: group report on proposed design	20%	50%	N
Practical	Oral presentation and demonstration of hardware or software component (10-15 min)	20%	50%	N
Coursework	Research paper on findings	60%	50%	N
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
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