Please complete the following document with the content related to your courses.

Administrative information	
UE	UE22 Robotique
UE referent contact	Amodsen Chotia
Course name	Introduction to Robotics
Teacher(s)	Jonathan Grizou, PhD, CRI Fellow. Kevin Lhoste, PhD, Head of MakerLab. Amodsen Chotia, PhD, CRI Labs Director.
ECTS credits	4
Schedule	30h total 20h (5*4h - robot programming workshop - Jonathan Grizou) + 10h (soft-robotics workshop - Kevin Lhoste)
Semester	S1

Course description	
Course description	*Brief description of the course. This description will be added to the Master AIRE booklet.* Introductory course to robotics. Robotics is about building machines that can act in the real world and often substitute human action. Together, students and teachers will decipher how robots work and why engineers built them the way they are. The course will be based on hands-on manipulation of robots to learn basic concepts related to sensing, acting, and planning.
Course objectives	*What do the students will understand by following the courses? What are their primary learning goals and objectives?* By manipulating robots, students will discover what robots are made of and understand how each component works. In small teams, students will program robots to complete simple tasks such as line following, obstacle avoidance, and automated drawing; which will help them understand some of the basic concepts of robotics: feedback loops, odometry, trajectory planning, direct and inverse model. The final project will be a robotic sumo competition.

Key concepts	*Keywords separated by ;* sensors; actuators; planning; feedback loop; odometry; inverse model; soft robotics	
Examples of work that you will ask during your course	*Lectures, reverse classroom, workshop, case studies, challenges, discussion about documents (articles, video), etc.* Workshops, challenges, case-studies and discussion around concrete robotic challenges. The final project will be a robotic sumo competition organised between student teams.	
Evaluation process	*Written test, presentation, project, by groups, etc.* Individual and group evaluations through workshops and presentations. A percentage of the evaluation will be based on students peer reviewing of their respective work.	
Evaluation distribution	Type of evaluation	50% continuous evaluation of workshop projects
		20% students peer evaluation
		30% final project presentation
Bibliography / Course Material	• *Add a few bibliographical references useful for the students.* • *Or any tools, or materials, which will be used during the courses.* • Main robots used in course: https://www.pololu.com/category/129/zumo-robots-and-accessories • Programming via Arduino IDE: https://www.arduino.cc/en/main/software in C++ • A second custom made drawing robot will be used and programmed in Python (Jupyter Notebook) • Students will have access to the slides used during the course by the teachers	

Skills badges	When new knowledge merges with experiences and projects, students increase skills. This year, we start to offer skill badges, independently of the internal evaluation of each course. From your point of view, what are the nodal skills that students should target, regarding the field your course opens up? To obtain each skill badge, they will have to offer a project-based proof. This proof definitely can come from the Master program, and also from extra-curriculum action (internship, personal activity, CRI project).
Knowledge skills	*Fill in 3 to 5 skills taught by this course related to the knowledge in that domain.* Closed loop control Trajectory planning Odometry Inverse model Decision making Software interruptions
Operational skills	*Fill in 3 to 5 skills taught by this course related to operational know-how in that domain.* C++ and Python programming Design of algorithms Practical understanding of the types of sensors and actuators available and their operating principle.
Reflective skills	*Fill in 3 to 5 skills taught by this course useful to develop critical thinking and to implement a scientific method in various areas.* Understand the links between scientific concepts and disciplines Hypothesis-Prediction-Experiment-Test-Refinement Loop
Cooperative skills	Fill in 3 to 5 skills taught by this course useful to develop communication between students, to help them to collaborate, to manage conflict and to achieve better decision-making. Team management Group problem-solving Collaborate together towards a common goal

This courses' planning is designed to help you to coordinate, as the UE referent, with the other teachers. It will not be transmitted to the students, except if you ask so.

Planning		
N°	**Type (CM/TP/TD) & hourly rate**	*Describe here the content of each session.*
1	workshop / 4h	Manipulation and observation of robots. Identification of sensors, actuators, and how they work. Installation of programming environment. First program uploaded on the robot.

2	workshop / 4h	Project: Obstacle avoidance. We demo the behavior, think about how it can be made, and implement it. Concepts: motor/motion control, Decision making, IF/THEN behavior,
3	workshop / 4h	Project: Follow-line behavior. We demo the behavior, think about how it can be made, and implement it. Concepts: Feedback loop, closed loop control.
4	workshop / 4h	Project: Return home. We demo a robot that can move randomly and then get home in straight line. We brainstorm about odometry, and implement it. We finally break students intuition by considering curved surfaces and questions what additional sensors could improve localisation. Concepts: Rotary sensors, Interruption, Odometry
5	workshop / 4h	Project: Draw a square. A drawing robot is demoed. We model it mathematically and code the direct and inverse model on a jupyter notebook in Python. Then we learn how to draw more complex shapes than lines, and model a circular trajectory and try to follow it with the robot. Concepts: direct + inverse model, trajectory planning
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