

**Nume cadru didactic: SL dr. ing. NATSAKIS Tassos**

Nr.crt.	Titlu lucrare	Scurta descriere	Cerinte	Nivel
1	Low-level controller of a robotic arm	<p>The goal of this project is to implement a low-level controller for the robotic arm that we have in our laboratory (Cyton Gamma 1500). To achieve the low level control, the controller should be implemented in ROS (robotic operating system), a well know framework for working in robotics.</p> <p>By implementing a low-level controller, it is possible to fine tune the control parameters, optimize the controller for specific applications and to achieve types of controller (e.g. velocity or torque control), which is not available through the already implemented functions.</p>	Robotics, C++, Linux, ROS	Licența
2	Robotic rehabilitation using impedance mode control	<p>Using robots to perform physical rehabilitation is a valuable proposal as it can help minimize the time to rehabilitation, while alleviating the physical effort from the physiotherapists. Furthermore, it has the potential on improving the overall experience for the patients.</p> <p>However, using robots in the vicinity of humans has its dangers, therefore safety measures must be implemented. Impedance control has the advantage of providing compliance between the robot and the environment, therefore making robots safe to use close to humans.</p> <p>This project is about implementing impedance control using a UR5 robot that is available at our laboratory. The robot will be used and tested in a rehabilitation setup and a performance analysis should be presented at the end of this work.</p>	Robotics, C++, Linux, ROS, Control theory	Licența
3	Robotic prosthetic hand	<p>The goal of this project is to design and construct a robotic prosthetic hand, aiming at helping amputees perform basic every day tasks. The robotic arm should be lightweight and offer a level of dexterity so that the patient can grasp objects of different sizes and shapes. Appropriate modelling and control of the robotic hand should be developed.</p>	Robotics, 3D design, hardware	Licența
4	Lightweight gripper	<p>Gripping is one of the most useful and versatile functions of a robotic arm. A gripper</p>	Robotics,	Licența

	for a robotic manipulator	<p>can be used to pick and place objects of different shapes and sizes to assist in manufacturing or logistics.</p> <p>During the project, you will have to design and manufacture a gripper for a UR5 robot that we have at our laboratory. The gripper must be as light as possible, and able to handle objects of about 4kg weight. Further specifications (such as the budget) will constrain the design.</p>	3D design, hardware	
5	Pick and place application using depth camera data	<p>Picking and placing is one of the most used functions for a robotic arm. This has been the primary use for decades and most modern industrial robots are able to perform such a task with extreme accuracy.</p> <p>Picking and placing in an industrial environment is solved when the location of the objects to pick is known on beforehand, however when using collaborative robots with humans, small deviations on the position of the object to be picked are unavoidable.</p> <p>The goal of the project is to constantly monitor a human operator and detect where did he/she drop the object to be placed. The robot should be then instructed to pick the object and place it to its desired location.</p>	Robotics, C++, Linux, ROS	Licența
6	Human avoidance during robot operations	<p>Using a robot in the vicinity of a human is a common application, especially with the advent of collaborative robotics. Even though collaborative robots have inherent safety features, these mainly concerns force limits which are activated only after there is contact between the robot and a human.</p> <p>This project aims to improve this situation, by using a depth camera to detect the human and make sure the robot avoids him/her. This will make the robot even safer to operate close to humans.</p>	Robotics, C++, Linux, ROS	Licența
7	Online and real-time intention prediction of upper limb motion	<p>With the advent of collaborative robots, the opportunity to use robotic arms in the vicinity of humans has emerged. Human-robot collaboration is a rapidly developing field for industrial applications, but can also have significant impact on healthcare related applications, such as rehabilitation. However, in order to implement human-robot collaboration, there has to be real-time and objective communication to the robot about the intentions of the human.</p>	Matlab, Signal processing, ROS	Licența

		<p>The goal of this project is to implement in ROS an already existing algorithm for the prediction of the intention of motion. The training of the algorithm is happening currently offline, but it would be very beneficial to perform this online and in real-time.</p>		
8	Robotic controller for a surgical assistance robot	<p>One very elusive application for robotic arms, is for assistance during surgery. A specific application is when performing incisions or drilling for fixation of implants. Robotic arms can be more accurate and repeatable than a surgeon, and can be programmed on before-hand to assist in patient-specific operations.</p> <p>The goal of this project is to identify relevant cases where a surgery assistance robot can be used and implement the controller that will assist a surgeon in performing these operations. A specific example can be incision making, where the robot could guide the surgeon in making an accurate incision based on pre-surgical planning.</p>	Robotics, C++, Linux, ROS	Licența
9	Control a robot using a mobile device	<p>Mobile devices became incredibly popular during the past two decades, with several applications that were embraced both by the industry and the consumer population. The benefits of these lightweight portable computers are numerous and they have been used for communication, healthcare, safety, recreation and a multitude of other purposes.</p> <p>The goal of this project is to combine the advantages of robotics and mobile technology for automation applications. Some examples can be remote operation of robotics, or notification of a user when robot needs supervision. Eventually, it is up to the student to identify such use cases and opportunities to be explored.</p>	Robotics, web technologies	Licența
10	Integration of an industrial robot with ROS	<p>ROS (Robotic Operating System) is a rapidly developing framework for robot sensing, planning and control. It can be a great tool for learning and experimenting about robotics as well. We currently have an industrial robotic arm (FANUC M-6iB/HS) that is available for teaching purposes. However, with no intuitive control interface it is difficult to use it in a teaching environment.</p> <p>The goal of this project is to integrate ROS with the robotic arm in our laboratory. Experimental packages exist already, however they are not fully integrated and effort is required in bringing them to a level that would allow to be used for educational purposes (i.e. implement controllers for joint position/velocity control).</p>	C++, ROS, Linux	Licența

11	Modelling human-robot interaction in a rehabilitation setup	<p>One very elusive application for robotic arms, is for physical rehabilitation. The current trend is to use exoskeletons for such tasks, however the use of robotic arms can confer several benefits.</p> <p>The goal of this project is to investigate and model the interaction between a human and a robotic arm, when this is used as a rehabilitation device. This work will be performed within an existing research project.</p>	C++, Python, ROS, Linux	Master
12	Gesture and motion classification based on EMG signals and kinematics	<p>Gesture and motion classification has been used extensively in the gaming industry, where several vendors have created platforms that identify human motions using video cameras and allow control of their games. This workflow can be extremely useful in other areas, such as e.g. in physical rehabilitation.</p> <p>The goal of this project is to classify specific gestures and/or motions performed by human beings. The classification can be made based on EMG signals and kinematic data, from measurements that are currently available.</p>	Python, Signal processing, LabVIEW	Master