Project Title: Intelligent Compliant Robot Manipulator for Safe Human Interaction (Master Thesis)	
Supervisor's Name: Dr. Riadh Zaier	
Co-Supervisor(s): *(if already known)*	
Sources of Fund:	

Research Field(s): Robotics, Control, AI

Summary and Problem Statement:

Recently, robot manipulators have been coexisting with human in different fields. They work side by side and share workspace with humans. Therefore, safety issues must be well considered. One of the major requirements that should be taken into account when approaching such a problem is to come up with a proper structure of the manipulator in terms of dimensions, shape, and material. Moreover, for given class of tasks, programing of the manipulator, interfacing with sensors and smart control method based on certain strategy are required to deal with different human interaction and preventing injuries and damages.

Keywords: Robot manipulator, compliant control, Motion Task, ROS (optional)

Objectives:
To build a Compliant Robot Manipulator that can be used for several tasks such as wiping, pickup-and-place etc. The robot should be smart enough to deal with objects of different materials and shapes. Also it should be able to handle this interaction in a smart way while preventing injuries and damages.

Tentative Methods of Approach:
- Design the mechanical structure of the robot
- Conduct the simulation and propose a control algorithm (Motion generation, sensory feedback and obstacle avoidance)
- Build the robot with a gripper for a particular task
- Implement the control algorithm, collect the data and discuss the result, etc.
- Finalize the proposed control method

Required backgrounds and skills

Backgrounds:
Recently, robot manipulators have been coexisting with human in different fields and therefore, safety issues must be well considered. One of the major requirements that should be taken into account when approaching such a problem is to come up with a proper structure of the manipulator in terms of dimensions, shape, and material. Moreover, for given class of tasks, programing of the manipulator, intelligent control method and interfacing with sensors are required to deal with different human interaction.

Computing Skills: C or C++ or python, Matlab,

Other requirements: Solidworks or any other design tool

References:
1. Zaier R. (2018) Reflex Control. In: Goswami A., Vadakkepat P. (eds) Humanoid Robotics: A Reference. Springer, Dordrecht. ISBN 978-94-007-7194-9.
2. Zaier R. (2011). Bio-Inspired Locomotion Controller Design for Legged Robots", The 14th International Conference on Climbing and Walking Robots, Paris
3. Zaier R., "Appartus and Method for Robot Control", US patent N0 8,761,926 B2, Issued in Jun 24, 2014.
4. Rehan M. AhmedAnani V. AnanievIvan G. Kalaykov "Compliant Motion Control for Safe Human Robot Interaction" https://link.springer.com/chapter/10.1007/978-1-84882-985-5_24