6-months Master Thesis project :

Design of an Embedded Arm for Aerial Hooking

At LAAS-CNRS – Toulouse, France

Context: The navigation of unmanned aerial vehicles (UAVs) is highly affected by possible (desired or not) physical interactions, in particular when moving in a cluttered environment. For this reason, the integration of physical interactions into the control schemes of UAVs is gaining an increasing importance. One way to explore this idea consists in studying the behavior of a UAV when experiencing a contact with its environment, and trying to exploit the resulting particular dynamics in order to navigate in a more efficient way. We envisage an agile multi-rotor concept aiming at studying and implementing this kind of navigation scheme, for the specific case of a quadrotor equipped with an arm and able to either freely fly or to establish a contact, the combination of both resulting in enhanced motion capabilities.

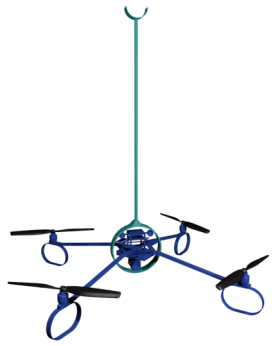

Figure 1: The Quadrotor, quadrotor with an arm

Goal of the master thesis: The goal of this master thesis project is to design and develop a mechatronic solution for the implementation of an aerial vehicle equipped with a rotating arm, and capable of hooking at a horizontal ladder. Two main parts of the system shall be investigated and developed:

- *The actuated joint between the aerial vehicle and the attached arm*
- *The end effector of the arm, able to hook/grasp an bar and rotate around it*

The following approach will be employed to do so:

- *Review of the possible solutions*
- *Optimization of a parametric design*
- *Development of an/several experimental prototype(s)*

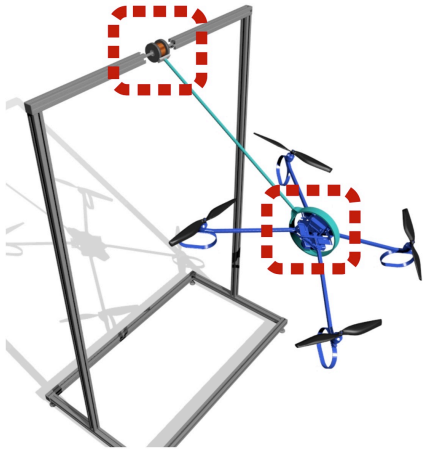

Figure 2: Two parts are to be developed, the actuated joint between the arm and the quadrotor, and the end effector.

Requirements:

- Study in the field of mechanical/mechatronics engineering in particular in the conception, design, and realization fields
- A strong background in design of mechanical systems and robotics
- Modeling skills in CAD software, with design evaluation (by simulation and experiment)
- Motivation to work in an interdisciplinary project and inter-laboratory environment
- Good English skills

Application: In order to apply, please send an e-mail to af-applicants@laas.fr including:
1) your **CV**, 2) your **Ms transcripts**, 3) your **Bs transcripts**, and
4) the mail tag **[mtp-AerialArmHook]** in the subject of the e-mail

Lab and Advisors: LAAS/CNRS (https://www.laas.fr/public/en) is an interdisciplinary research institute located in the aeronautic/aerospace scientific area of Toulouse/France. LAAS is involved in the EU Project 'AEROARMS', http://www.aeroarms-project.eu/, whose goal is the development new mechatronic designs and control methods are needed to implement the aerial robots with several arms for grabbing and flying operations. The master thesis project will take place within the 'Robotics and Interactions'-group (www.laas.fr/public/en/ris) and will be supervised by Antonio Franchi http://homepages.laas.fr/afranchi/robotics/ a permanent scientist at CNRS active in the topics of multi-robot and aerial robot control.