Master project 2015

Laboratory: LAAS-CNRS (Gepetto), Toulouse, France

Thematic: Robotics

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Title: Intelligent teleoperation for complex micro drones

The objective of this project is to design a "smart" teleoperation mode to control complex micro unmanned aerial vehicles (μUAV) to achieve precise tasks in complex environments, such as in an obstacle fields. By complex μUAV, we intend typically quad-copters carrying a load on a crane, or aerial manipulators combining a manipulator arm attached to a helicopter. We have proposed in [1] a generic solution to control such systems while taking into account close-by obstacles. The objective is to emphasize this methodology and use it to build a full application.

We consider a typical applicative setup: the μUAV is driven by a human; it must achieved a particular mission (such as dropping or catching a load at a particular location, or reaching a particular position) for which the human teleoperator is skilled. However, the mission should also be achieved while taking into account the complex dynamics of the μUAV, the presence of nearby obstacles and possible external perturbations (such as wind or sensor mis-measurement). We therefore propose to build an optimal control that would make a trade-off between the input of the human teleoperator (such as a direction or a mean velocity for the μUAV to track) and the dynamic capabilities of the μUAV in its environment.

In practice, the work will be to define the context of a demonstration to be achieved, design the controller using the tool developed in [1], and build the applicative environment to demonstrate the capabilities of the solution. All developments would be based on the existing optimal-control framework used for [1]. The work may typically lead to a scientific publication in one of the dedicated conferences of our field. It also may be broadcasted through our industrial network and lead to an industrial product.

Reference:

[1] M. Geisert, N. Mansard, "*Trajectory generation for quadrotor-based systems using numerical optimal control*", submitted to IEEE Int. Conf. Robotics and Automation 2016 (http://projects.laas.fr/gepetto/index.php/Publications/2016GeisertIcra)

Requirements:

- A strong mathematical or control background is desirable
- Good programming skills in C/C++
- If possible, any knowledge or practical interest in robotics would be relevant

Environment:

Located in the University town of Toulouse, in the south-west of France, the Gepetto group belongs to the CNRS-LAAS, laboratory for the analysis and architecture of systems, a 640 man-strong research center with about 90 people working in robotics. Among our robot fleet, we have access to HRP-2, the only full-size walking humanoid robot in France, while two other humanoid robots are expected within the year. The laboratory benefits from strong connections to the adjoining universities and the space and aeronautics industry.