Modeling and Control of Aerial Dynamic-Topologies Multi-agent System
Project Proposal

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Context

Unmanned aerial systems (UAS) swarms, or aerial multi-agent systems (AMAS), have recently experienced an important growth/surge due to the enormous potential application scope either for civilian or military sectors. Swarm-based applications unveiled a wide variety of applications, where the industrial sector is the main beneficiary. These include the parcel recovery and transport, reconfigurable mobile sensor networks, construction assessment, mapping and enhanced environmental monitoring.

The complexity of the task that aerial multi-agent systems may face is difficult to solve with pre-programmed behaviors. Agents must discover a solution using learning. Therefore, bio-inspired models derived from machine learning emerge as an alternative to design the autonomy of agents. In particular, the postural scheme of the body (Body schema) is presented as a suitable bio-inspired approach capable of associating the perception of the human being and the motor capacity as a function of the interaction with the environment. This association is described in the architecture of a self-organizing neural network that emulates the cortical map of the parietal cortex. This is how this synchrony between the perception and configuration spaces allows to design the control of agents in terms of machine learning and potential fields.

Mission

The ultimate goal of the actual proposal is to come up with a swarm control strategy to perform a robust synchronized flocking/schooling. A training stage is envisioned It is expected that the candidate conducts mainly an experimental stage. The outcomes/tasks expected to be achieved

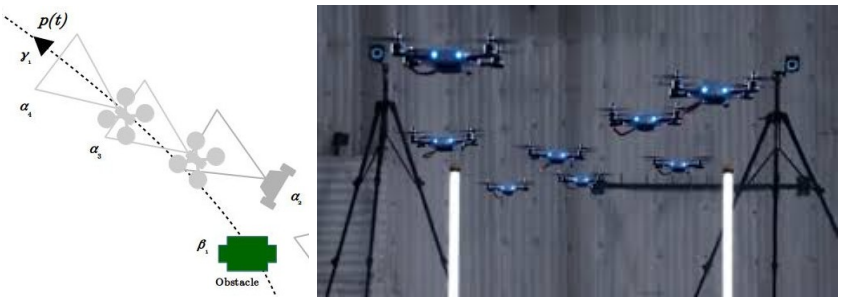

Figure 1: Example of coordinated flight

by the student are:

1. To get familiar with the diverse sensing modules/devices (optitrack, ULBs, Lidar) involved in the MAS flight implementation.
2. Analyse and propose a basic control towards a basic fleet formation of micro-quadrotors (Crazyflie) via ROS
3. Synthesize the robust version of the existing controllers.
4. Facilities & equipment: an instrumented test arena and a set of operational aerial vehicles (Crazyflie, Bebop, Domestic models) are available to carry out the experimental stage.