



DESIGN METHODS FOR UNMANNED VEHICLES

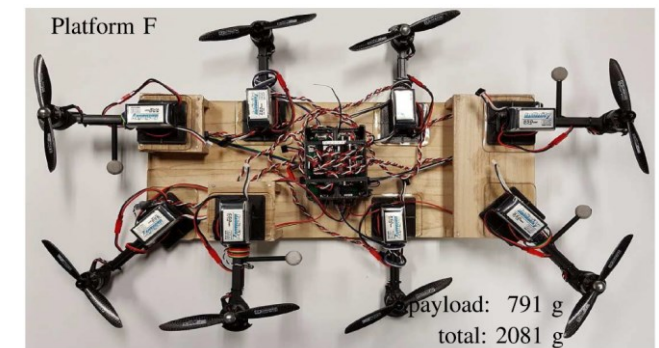
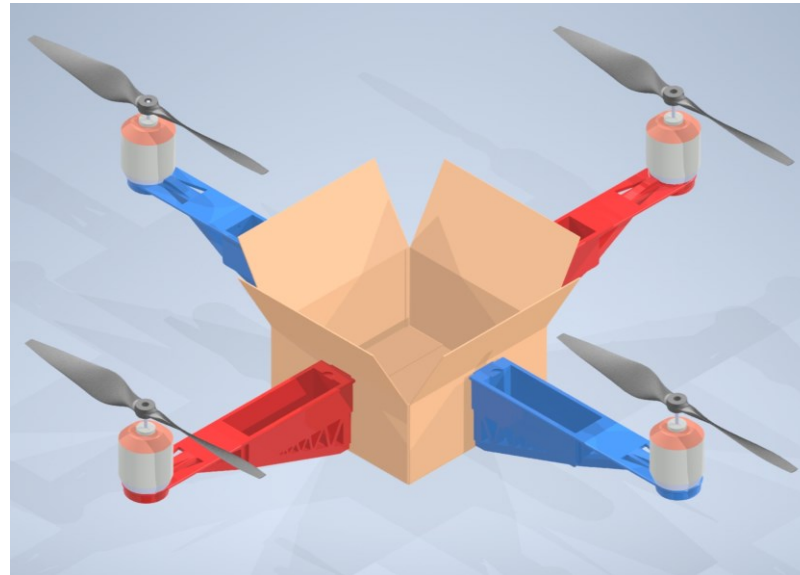
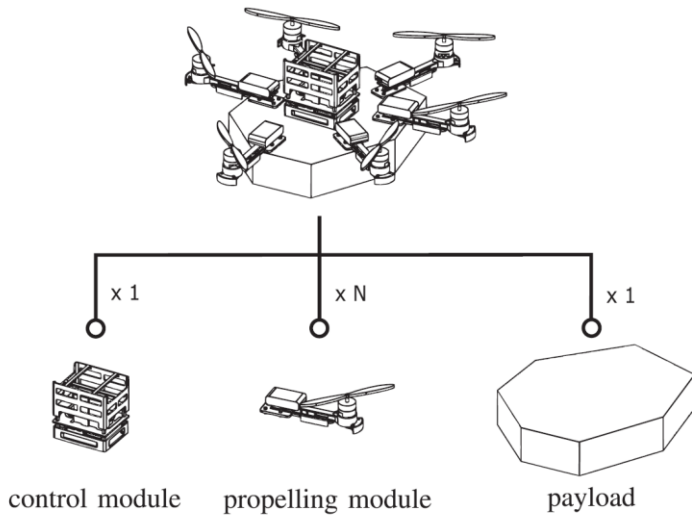
PROJECT LIST 2023



PROJECT #1

DYNAMIC IDENTIFICATION (ANYTHING IS A DRONE...)

- Build a quadrotor structure
- Identify the UAV dynamics through identification procedure based on standard estimation tools



Contact reference:

- 1) Prof. Daniele Fontanelli
- 2) Prof. Davide Brunelli

PROJECT #2

FOLDABLE/DEPLOYABLE DRONE

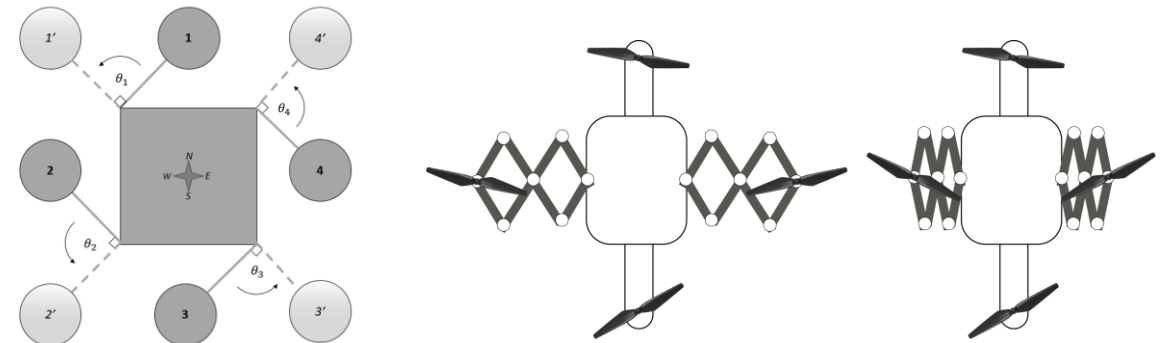
Concept generation/design, preliminary assessment of a concept of foldable/deformable drone that can adjust its asset to avoid obstacles and fly through narrow gaps

Tasks:

- Conceptualization of a folding mechanism (kinematics, actuation, locking system)
- Preliminary design (structures, choice of actuators)
- Dynamic/stability analysis in different configurations

Contact reference:

- 1) Prof. Giacomo Moretti
- 2) Prof. Daniele Fontanelli
- 3) Prof. Davide Brunelli



References:

- Falanga, D. et al. (2018). The foldable drone: A morphing quadrotor that can squeeze and fly. *IEEE Robotics and Automation Letters*, 4(2)
- Tothong, T. et al. Morphing Quadcopters: A Comparison Between Proposed and Prominent Foldable Quadcopters. *IEMCON 2020*

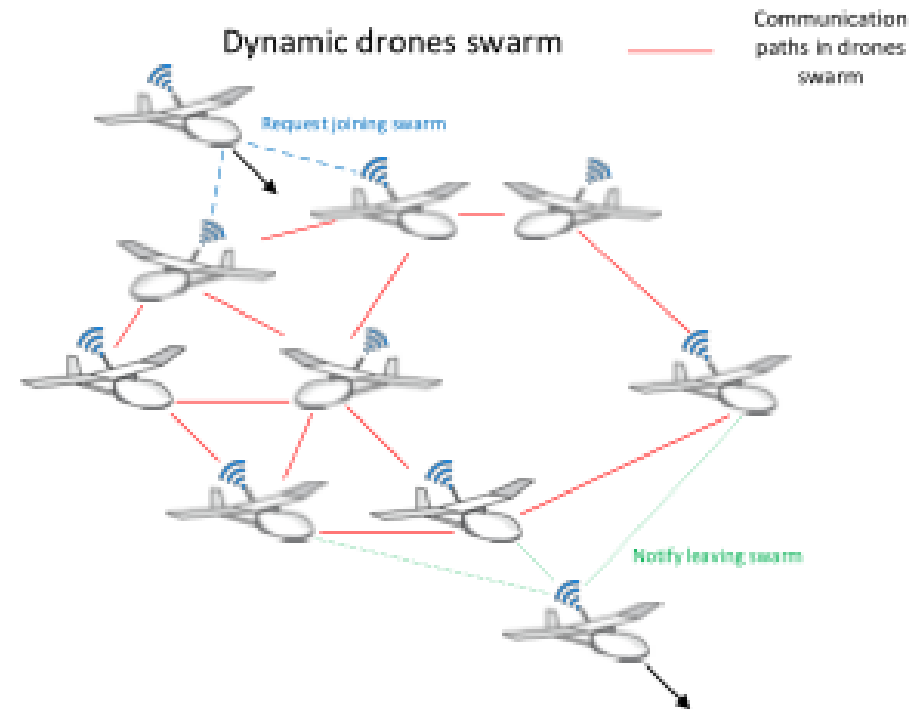
PROJECT #3

UAV SPATIAL CONFIGURATION

- Apply the Multi-Dimensional Scaling (MDS) algorithm to reciprocal ranging measurements to derive the UAV 3D configuration
- OPTIONAL: apply the controlled motions (to be determined) to remove ambiguities

Contact reference:

- 1) Prof. Daniele Fontanelli
- 2) Prof. Davide Brunelli



PROJECT #4

DRONES AUTONOMOUS NAVIGATION WITH GESTURE

Use a ML algorithm for gesture recognition to suggest high level action to drones.

Tasks:

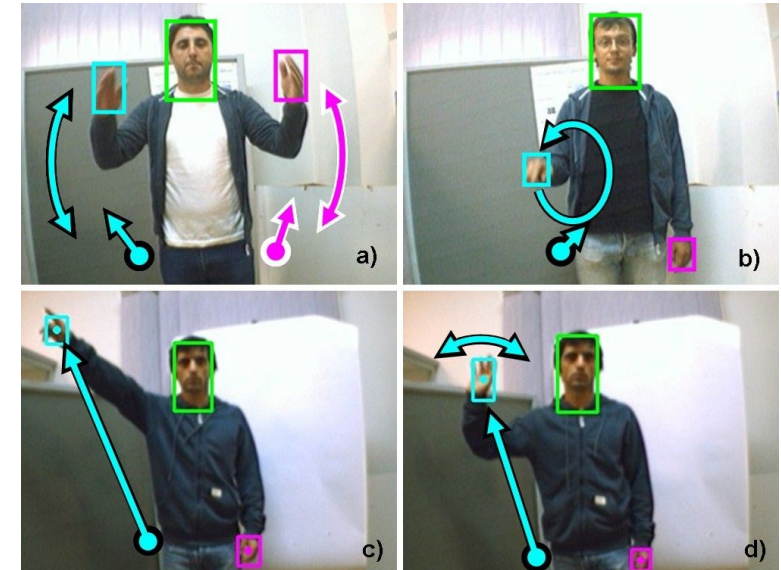
- Train and test NN for gesture recognition
- Optimize it to fit camera resource constraints

Resources:

Asanka G Perera et al “UAV-GESTURE: A Dataset for UAV Control and Gesture Recognition”

Contact reference:

- 1) Prof. Davide Brunelli
- 2) Prof. Daniele Fontanelli



PROJECT #4

AUTOMATIC LANDING

Implement a visual guidance system for helping drones landing.

Using video data coming from on board camera sensor, develop an object recognition algorithm able to recognize the typical “H” landing sign.

Contact reference:

- 1) Prof. Davide Brunelli
- 2) Prof. Daniele Fontanelli



PROJECT #5

SMALL WIRELESS DRONE

Investigation of the well-known Open Source Crazyflie project, or Mambo Parrot or DJI Tello

<https://www.bitcraze.io/>

<https://www.parrot.com/global/drones/parrot-mambo-fly>

<https://www.dji-store.it/tello/>



Topics:

- 1. Indoor localization and positioning of multiple drones (with UWB)*
- 2. Cooperative fly (swarm of drone)*

Contact reference:

- 1) Prof. Davide Brunelli
- 2) Prof. Daniele Fontanelli



PROJECT #6

A MOTHERSHIP FOR SMALL DRONES

Building a mothership for small drones

- *Design the carrier for small drones*
- *Implement an efficient mechanism for uDrones release and landing.*
- *Model the vehicles under the “mother frame”*

Contact reference:

- 1) Prof. Davide Brunelli
- 2) Prof. Daniele Fontanelli



PROJECT #7

UAV FOLLOWER

Exploiting localization capabilities provided by UWB radios, the main goal of this project is to develop a smart robot swarm that track and follow a leader.

Starting from a working UWB localization system, you will have to undertake all the necessary step to control the dynamic of the robot, integrating the UWB system into the navigation functionalities of your unmanned vehicle

Contact reference:

- 1) Prof. Davide Brunelli
- 2) Prof. Daniele Fontanelli

