Motion planning of a fixed wings Uav through an hybrid approach based on artificial potential fields and RRT.

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I. Introduction

Wᴇ will present a work made for an international challenge[1] that every year involves several accademic teams.

This report respects the following structure :

in section II, we will present the problem statement and in section III we will give tecnical informations on the hardware at our disposal, finally in section IV, the adopted solution will be discussed.

II. Problem Statement

All the joining teams to the challenge will have to compete on several tasks concerning on actual problems in the governance of Unmanned Aerial Vehicles.

Each team will bring its prototype of UAV on a common flight ground and try to score the greatest number of points among all the tasks proposed which are:

- Autonomous Flight
- Obstacle Avoidance
- Object Detection
- Object Classification
- Object Localization
- Air Delivery

This will be the first partecipation at a competition of this kind for the team Sapienza, in fact the previous challenges in which our university has already been involved required a human controlled guidance system. Therefore the autonomous flight constraint has to be faced without previous insights on the matter.

i. Starting Points

The areonautical research department, in the past decade, has spent a big effort working to an autonomous guidance system, that has been thinkered, designed and implemented by master students in theyr thesis.

This system allows to control the complex aerodynamics of the vehicle from an higher level of abstraction, its main high level control mode uses a series of way points that describes a trajectory. In this way the aircraft will likely follow a path made of lines that intersects subsequent waypoints.

The system is designed to work on an on-board computer and to communicate with a ground station that will continuously send to and receive from the judges's server, telemetrical data and mission objectives.

We will use a fixed-wigs radio controlled aircraft model commonly used in hobby modeling. It is a scaled reproduction of the YAK (TODO)

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[1]The challenge is the AUVSI-SUAS hosted in united states in summer 2018.

ii. Our task

III. Hardware components

i. Structural design

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ii. On board computing

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iii. Sensing instruments

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iv. Communication devices

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v. Auto pilot framework

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IV. Hybrid planner

i. RRT

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ii. Artificial potentials

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iii. Implementation

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V. Conclusion

$$e = mc^2 \tag{1}$$

References

[Figueredo and Wolf, 2009] Figueredo, A. J. and Wolf, P. S. A. (2009). Assortative pairing and life history strategy - a cross-cultural study. *Human Nature*, 20:317–330.