Energy-Sensitive Vision-Based Autonomous Tracking and Landing of a Quadrocopter on a Moving Platform

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***Abstract*—abstract**
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I. Introduction

In the last years UAVs, especially multicopter drones, are used for various commercial applications such as monitoring, surveillance, transportation of small payloads and agricultural applications. One of the biggest constraints, is their limited flight range due to the battery or fuel capacity. It is therefore seen that to further extend that range, the UAV will have to land in order to change/charge its battery or refuel. Furthermore implementing energy efficient algorithms onboard of the UAV, especially computer vision ones, will further reduce the energy consuption during flight and increase the overall flight range.

Concerning the autonomous landing, it is not energy or time efficient for the UAV to fly back to its base. Instead the UAV should land as close as possible to its current location. Constructing and supporting many landing locations scattered around a wide area is considered as a non cost effective solution. Instead it is suggested that the UAV should land on other bigger ground vehicles that are close to its current location, to recharge and then take-off again to continue its mission.

The use of GPS signal for autonomous landing is not considered as a safe option. The noise and errors of the GPS signal are not predictable and can be further increased by signal reflections from buildings, multipathing errors, bad weather conditions or even by the position of the satellites on a given hour of the day. Also, GPS signal jammers may be used to hack the drone and guide it to a non-safe location or even crash it. Therefore a vision-based autonomous landing system is considered as a more optimal option. A drone equipped with a camera can extract information from the scene, in order to find the location of the landing site and guide itself accordingly. Such a system is more suitable for guidance and navigation in GPS-denied locations and is more robust towards hacking attempts.

In this project an agricultural case of a quadrocopter tracking and landing on a moving tractor will be studied. Furthermore, the detection and tracking of the moving ground vehicle for inspection purposes will also be studied.

II. State of the Art

TODO: Georgios: Autonomous landing

III. Energy-Sensitive Control of Tracking and Landing

Idea: fairly short section painting the overall picture of our concept for making the UAV control be energy sensive. First describe energy sensitivity as a concept, based on powprofiler (QoS-¿energy prediction) and the other IEEE RC paper as an example. Then describe the overall tracking and landing algorithm abstractly (pseudo code outline of what it does) and what the relevant QoS levels are (i.e., rate at which the marker detector runs). Include also a “black-box” workload representing whatever other work is being done as whatever QoS, this will be the CNN.

IV. Vision-Based Autonomous Tracking and Landing

TODO: Georgios: your key contribution here

V. Evaluation

A. Use case: agricultural safety

Briefly describe the use case and simulation, including the use of CNN to detect

B. Experimental setup

How the experiment will be done concretely, i.e., time to land as a function of QoS and wind or whatever.

C. Results

Results of the experiments

D. Discussion

Discussion of the results

VI. Conclusion and Future Work

What we did, why it was exciting, and what we want to do.

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