1ST SYMPOSIUM OF APPLIED RESEARCH

Collaborative Navigation for Flying Robots

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BACKGROUND: In recent years, there has been an increasing interest in the development of autonomous vehicles. An autonomous flying robot must be able to take off, carry out a mission and land when a mission ends without any human interaction. The use of multiple robots within the same system allows a new range of missions possibilities, that are not possible using a single robot.

OBJECTIVES: This project aims to use multiple UAVs (Parrot AR.Drone 2.0) guided by computer vision algorithms to perform cooperative tasks in interaction with the surrounding environment. The main contributions of this dissertation will be the creation of real-time image processing algorithms to obtain spatial coordinates, implementation of a control feedback mechanism to be able to control the position of the robot(s) and a method to navigate and synchronize the movements of the UAVs inside buildings, where GPS technology is not accurate.

METHODOLOGY: In order to complete this dissertation, each quadcopter must be configured to communicate with the PC through a wireless access point. The official Software Development Kit (SDK) of AR.Drone 2.0 has to be modified to be able to control all communications between the robots and the PC. The image processing algorithms, programmed in C# with the EmguCV libraries, will be used to create a stand-alone system guided by computer vision. The spatial positioning system is based on a rug filled with squares divided in 4 segments with different color combinations to determine the position of each robot in three-dimensional space, in order to create flight trajectories and avoid collisions with other quadcopters during the accomplishment of the cooperative tasks.

RESULTS AND CONCLUSIONS: The results of this dissertation, proves that it is possible to create a fairly accurate and robust spatial system using real-time image processing algorithms on a relative cheap UAV (around 250€) available for purchase to everyone on the market. All the image processing algorithms and control mechanics can be implemented to other quadcopter models, as long as they are equipped with an camera.

Keywords: UAV, Computer Vision, Cooperative Flight, Real-Time Image Processing, Autonomous Robot