THESIS SUMMARY

"CONTRIBUTIONS REGARDING THE DEVELOPMENT OF LSS (LOW, SLOW, SMALL) DRONE DETECTION AND LOCATION SYSTEMS"

Author: Eng. Dan-Florin Mototolea
e-mail: *mototoleadan@gmail.com*
Ph.D. supervisor: Proffesor Ioan Nicolaescu, Ph.D.,Eng.

The rapid evolution of relatively inexpensive and easily operated flying drones represents a new type of challenge for the protection of public and private spaces. Whether the operator is a negligent hobbyist or a malevolent person, an undetected drone can pose a significant safety or security threat. In this context, the thesis aims to bring solutions regarding the development of techniques used to detect, locate and counter LSS UAVs.

Chapter 1 begins with the presentation of the basic concepts regarding anti-drone systems, continues with the argumentation and at the same time the need to research new methods of surveillance and interdiction adapted for UAVs, and finally presents the objectives, respectively the structure of the doctoral thesis.

Chapter 2 presents a summary of the latest research published in the literature on the techniques used to detect and locate drones.

Chapter 3 presents a theoretical analysis regarding the communication links within the UASs, with all that they imply (types of communication links, frequency bands used, modulation schemes used, etc).

Chapters 4 and 5 present the project developed in cooperation with the NATO Communications and Information Agency, from The Hague, Netherlands, during a research stage conducted between September and December 2017. During this period, two research directions were pursued: the first one aimed at creating a system capable of providing the tools needed to decode a communication protocol used by UASs, and the second direction of the research was to develop a drone location system. Both systems were created with "commercially off-the-shelf" parts and components.

Chapter 6 presents the results of the research carried out during the stage at the University of Western Brittany, in Brest, France, from September to December 2018. The aim of the research stage was to develop a new method for detecting LSS drones. Starting from a detection idea presented in an article published in the literature, a new method has been developed. The method is capable of detecting drone-controller communications characterized by Frequency-Hopping Spread Spectrum Gaussian Frequency-Shift Keying (FHSS-GFSK) signals.

Chapter 7 presents a new method for detecting drone-controller communications characterized by FHSS-GFSK signals. This chapter maintains the idea of compressive sampling for digitizing the signal of interest (technique used in the previous chapter), but proposes a completely different approach for detecting and retrieving data bit sequences. Unlike the approach proposed in the previous chapter, which involved the use of a Viterbi detector, the data bit sequences are detected using discriminant characteristics derived from RSI (Reduce Spectral Information) and by using a detection algorithm implemented specifically for this purpose. The performance of the proposed approach is assessed in terms of bit error rate and compared with that of a Viterbi detector and a neural network-based detector.

The thesis ends with the presentation of the conclusions regarding the studies performed, the experimental results obtained and the simulations performed in the MATLAB environment. In the end, the contributions made in the field of C-UAS are presented along with the future steps planned to be taken.