UAV Obstacle Collision Avoidance System

Subsystem integration for safer autonomous flights

By

Álvaro Melgosa Pascual

Department of Bioengineering and Aerospace Engineering
Universidad Carlos III de Madrid

September 2016

Abstract

The large growth that the civil Unmanned Aerial Vehicles (UAVs) market has experienced in the last decade is now triggering the urge of both professionals and enthusiasts to use this technology to perform tasks that would be more difficult to accomplish with their traditional procedures. However, many times these tasks require precision flight and do not allow the slightest physical contact with the UAV. Currently, very qualified pilots are needed since there have not been significant advancements on on-board obstacle detection technologies, and manual control is still a must.

The main goal of this thesis is to develop an affordable Obstacle Alert and Collision Avoidance System (OCAS) that can be easily deployed to a wide range of UAVs. The approach followed is to embark a series of ultrasonic rangefinders to continuously monitor the minimum distance of the vehicle with its surroundings. The data provided by the sensors is then processed on an onboard computer, and control commands are sent to the main controller board in the case that an obstacle is detected and a possible collision identified. The final result is an integrable payload subsystem that would improve the situational awareness capabilities of any UAV that integrates it, reducing the risk of collision with its surroundings.

Keywords: UAV, obstacle detection, collision avoidance, system integration, ultrasonic rangefinder, Ardupilot

Dedication and acknowledgements

Here goes the dedication.

TABLE OF CONTENTS

List of Figures

Figure **Page**

List of Tables

Table **Page**

CHAPTER 1

INTRODUCTION

Begins a chapter.

Appendix A

Begins an appendix

BIBLIOGRAPHY

[GS02] C. Grierson and J. Schiefelbein.
The Arabidopsis Book.
American Society of Plant Biologist, 2002.

[JS06] M. Jones and N. Smirnoff.
Nuclear dynamics during the simultaneous and sustained tip growth of multiple root hairs arising from a single root epidermal cell.
J. of Exp. Bot., 57(15):4269–4275, 2006.

[MS94] J. D. Masucci and J. W. Schiefelbein.
The rhd6 mutation of arabidopsis thaliana alters root-hair initiation trhough an auxin- and ethylene-associated process.
Plant. Physiol., 106:1335–1346, 1994.

[PG09] R.J.H. Payne and C.S. Grierson.
A theoretical model for rop localisation by auxin in arabidopsis root hair cells.
PLoS ONE, 4(12):e8337. doi:10.1371/journal.pone.0008337, 2009.

[RDH+01] S. Rigas, G. Debrosses, K. Haralampidis, F. Vicente-Angulo, K. A. Feldman, A. Grabov, L. Dolan, and P. Hatzpoulos.
Trh1 encondes a potassium transporter required for tip growth in arabidopsis root hairs.
The Plant Cell, 13:139–151, 2001.