

TECHNICAL UNIVERSITY OF CRETE

DIPLOMA THESIS

---

# Design and Implementation of a Low Cost Embedded System for Localization of Drones Flying in Swarms

---

*Author:*

Christos SPYRIDAKIS

*Thesis Committee:*

Prof. Apostolos DOLLAS (Supervisor)

Asst. Prof. Eftychios KOUTROULIS

Asst. Prof. Panagiotis PARTSINEVELOS



*A thesis submitted in fulfillment of the requirements  
for the diploma of Electrical and Computer Engineer  
in the*

School of Electrical and Computer Engineering  
Microprocessor and Hardware Laboratory

November 11, 2020



TECHNICAL UNIVERSITY OF CRETE

# *Abstract*

School of Electrical and Computer Engineering

Electrical and Computer Engineer

**Design and Implementation of a Low Cost Embedded System for  
Localization of Drones Flying in Swarms**

by Christos SPYRIDAKIS

TODO: English . . .



ΠΟΛΥΤΕΧΝΕΙΟ ΚΡΗΤΗΣ

## Περίληψη

Σχολή Ηλεκτρολόγων Μηχανικών και Μηχανικών Υπολογιστών

Ηλεκτρολόγος Μηχανικός και Μηχανικός Υπολογιστών

Σχεδίαση και Υλοποίηση Ενσωματωμένου Συστήματος Χαμηλού  
Κόστους για Εύρεση Θέσης μη Επανδρωμένων Αεροσκαφών που  
Πετούν σε Σχηματισμό

από τον Χρήστο ΣΠΤΡΙΔΑΚΗ

TODO: Ελληνικά ...



# *Acknowledgements*

TODO: Add Acknowledgements





# Contents

<b>Abstract</b>	<b>iii</b>
<b>Abstract</b>	<b>v</b>
<b>Acknowledgements</b>	<b>vii</b>
<b>Contents</b>	<b>ix</b>
<b>List of Figures</b>	<b>xi</b>
<b>List of Tables</b>	<b>xiii</b>
<b>List of Algorithms</b>	<b>xv</b>
<b>Physical Constants</b>	<b>xvii</b>
<b>List of Symbols</b>	<b>xix</b>
<b>List of Abbreviations</b>	<b>xxi</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Motivation . . . . .	1
1.2 Scientific Goals and Contributions . . . . .	1
1.3 Thesis Outline . . . . .	1
<b>2 Theoretical Background</b>	<b>3</b>
<b>3 Related Work</b>	<b>5</b>
3.1 Thesis Approach . . . . .	5
<b>4 Design Features and Implementation</b>	<b>7</b>
<b>5 Applications and Usage Examples</b>	<b>9</b>
<b>6 Experiments and Results</b>	<b>11</b>



# List of Figures



# List of Tables



# List of Algorithms





# Physical Constants

Speed of Light  $c_0 = 2.997\,924\,58 \times 10^8 \text{ m s}^{-1}$  (exact)



# List of Symbols

$a$	distance	m
$\omega$	angular frequency	rad



# List of Abbreviations

MCU    MicroController Unit

MPU    MicroProcessor Unit



*Dedicated to those people who have helped me be the  
person I am today...*





# Chapter 1

## Introduction

TODO

### 1.1 Motivation

TODO καλησπέρα

### 1.2 Scientific Goals and Contributions

TODO

### 1.3 Thesis Outline

TODO

- Chapter 2 - Theoretical Background:
- Chapter 3 - Related Work:
- Chapter 4 - Design Features and Implementation:
- Chapter 5 - Applications and Usage Examples:
- Chapter 6 - Experiments and Results:
- Chapter 7 - Conclusions and Future Work:



## Chapter 2

# Theoretical Background

"Let no one ignorant of  
geometry enter"

---

*Plato*



## Chapter 3

# Related Work

### 3.1 Thesis Approach

This should be the last section



## Chapter 4

# Design Features and Implementation

”

---





## Chapter 5

# Applications and Usage Examples



## Chapter 6

# Experiments and Results



## Chapter 7

# Conclusions and Future Work

