A ROS based communication architecture for UAV swarms

A thesis submitted in fulfilment of the requirements

for the degree of Master of Technology

by

Sai Aditya Chundi

DEPARTMENT OF ELECTRICAL ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY KANPUR

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Certificate

It is certified that the work contained in this thesis entitled "A ROS based communication architecture for UAV swarms" by "Sai Aditya Chundi" has been carried out under my supervision and that it has not been submitted elsewhere for a degree.

Ketan Rajawat

Professor

Department of Electrical Engineering

Indian Institute of Technology Kanpur

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Abstract

Name of the student: **Sai Aditya Chundi** Roll No: **Roll No.**

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UAVs have received considerable attention in the last decade, both in industry and academia. Potential applications are wide and varied, encompassing both military and domestic spaces. Search and rescue missions during disasters, environmental monitoring and surveillance, precision agriculture and farming are some of the domestic applications, while the scope of their usage in military space can be readily appreciated.

Communication is a critical component in realizing swarms of UAVs. There are two aspects of the communication architecture while considering UAV swarms. While there needs to be a reliable communication between the UAVs and a ground station, communication between individual UAVs is essential in enabling a distributed architecture for swarm applications. Wireless ad-hoc networks offer an appealing solution for inter UAV communication. While there have been works which used 802.11 based ad-hoc networks for the communication in multi UAV setups, these are short range links which are not suitable for the long range link between UAVs and the ground station. On the other hand, the commonly used 900 Mhz based radios for the communication between UAVs and the ground station in long range, are not well suited for inter UAV communication.

In this work, we present a novel communication architecture for UAV swarms, which

combines both the long range and short range architectures. Moreover, our communication architecture is based on Robot Operating System(ROS), which ensures that any distributed application can be easily integrated into, and extended by the capabilities of ROS.

Acknowledgements

I would extend my sincerest gratitude...

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Abbreviations

FEA	**F**inite **E**lement **A**nalysis
FEM	**F**inite **E**lement **M**ethod
LVDT	**L**inear **V**ariable **D**ifferential **T**ransformer
RC	**R**einforced **C**oncrete

Symbols

D^{el}	elasticity tensor
σ	stress tensor
ε	strain tensor

For/Dedicated to/To my…

Chapter 1

Introduction

1.1 Rise of Unmanned Aerial Vehicles

Unmanned aerial vehicles or UAVs have become ubiquitous in the past decade, both in research and industry. A myriad of applications involving UAVs in diverse fields has made them quite popular. Potential domestic applications include Environmental monitoring and surveillance [2], traffic management [4], remote sensing [5], precision agriculture and farming [1], disaster management [3], to name a few. The use of UAVs for defence purposes is only poised to grow in the next decade. It's not hard to see the appeal of UAVs in the defence sector with applications ranging from simple surveillance and reconnaissance missions to offensives like *search and destroy* missions and targeted hits.

Much of this rise of interest in UAVs can be attributed to associated advances in robotics, largely driven by the progress in robust and cheap sensors and communication technology. The emergence of scalable and extensible software architectures like the Robot Operating System(ROS), which enables easy integration of various subsystems further pushed the research in these domains.

1.1.1 Subsection 1

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1.1.2 Subsection 2

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1.2 Main Section 2

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Appendix A

Appendix A

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