

Programming Autonomous Robots: Robotics Project

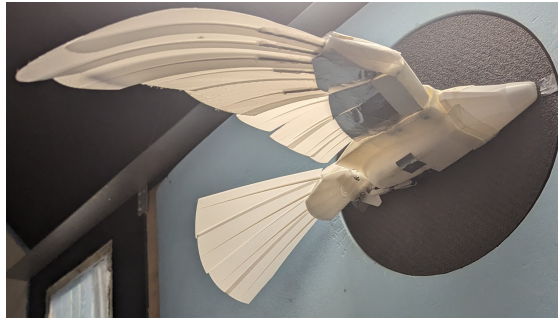
RMIT UNIVERSITY
SEMESTER 1 – 2024

Name	Student No.	Contribution
Matthew Ricci	s3785111	33%
Noah Solman	s3285661	33%
Bailey Vogt	s3906263	33%

Contents	1
1 Introduction	2
2 Related Work	2
3 Methodology	2
4 Results	2
5 Evaluation	2
6 Discussion	2
7 Conclusion	2
8 References	2
References	3

1 Introduction

Mapping and surveying, environmental monitoring, delivery, search and rescue are some of the current applications of Unmanned Aerial Vehicles (UAVs). Improving their ability to adjust to changes in wind conditions is a topic of much research [1] especially as work continues to allow UAVs to carry out increasingly complicated tasks autonomously like CSIRO's Hovermap an arial 3D mapping platform [2]. In Australia the height limit to operate a UAV



is 120m above ground level [3]. At these heights wind turbulence and gust conditions greatly impact the performance of UAVs, by changing its trajectory and expected current state potentially leading to drone damage. As a response to this, researchers have turned to nature as inspiration. Basing UAV design on birds has advantages over classical UAV designs (like multi-rotor or fixed wing drones) including increased aerodynamic efficiency, high manoeuvrability and stability in high-gust conditions [4]. In this project we build on existing work to develop

stable flight controllers for a novel platform the Kestrel robotic replica half-wing based on the Nankeen Kestrel with three degrees of freedom (wing extension, tail spread and tail pitch) [5] (Figure 1). As a novel design the wing cannot be controlled with existing software, prior work on the Kestrel half-wing focussed on utilising Deep Reinforcement Learning (DRL) to develop a flight stability controller. DRL has been shown to have superior response time, reduced error and ability to reject external disturbances. Additionally, development of a DRL controller does not require domain specific knowledge in controller tuning [6]. We will investigate the use of a

classical controllers on the novel Kestrel platform to directly compare it to the DRL controller. We aim develop a Proportional Integral Derivative (PID) controller for flight stability already shown to be effective in stabilising UAVs [7].

2 Related Work

3 Methodology

4 Results

5 Evaluation

6 Discussion

7 Conclusion

8 References

References