Development of Modular Aerial reconfigurable Vehicles

Alexandre Silva, Magner Gusse
Orientador: Prof. Pedro Casau

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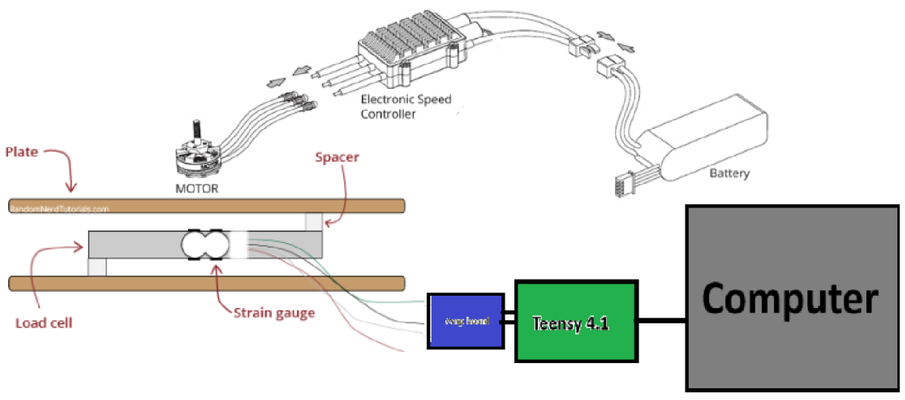
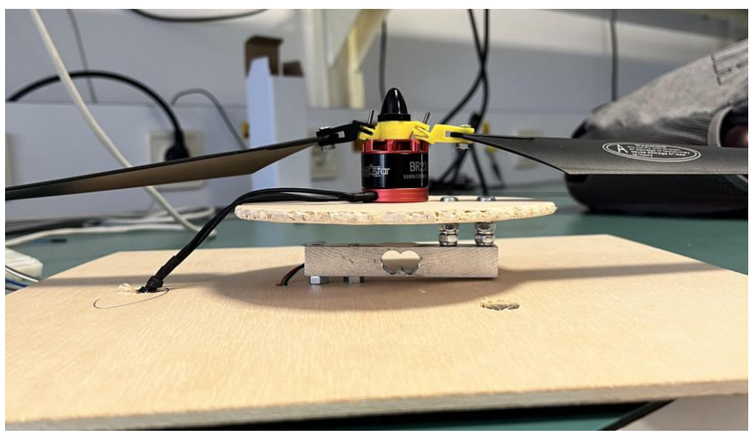
Abstract

This study proposes the development of a modular reconfigurable aerial vehicle. Simply, this project is proposes the creation of 2 aerial vehicles that can attach to each other. Some of the challenges and objectives of this study were the use of coaxial rotors using Swashplateless[1] system which was the focal point of this project.



a)



b)

Fig 1- Thrust Stand Setup
a)Schematic b)Actual setup

Methods

One of the objectives of this project was to implement coaxial rotors for propulsion and Swashplateless system for direction.

- It was necessary to use helicopter blades instead of regular drone blades, in addition, based on research over the configurations to implement on the model of the system
- The configuration chosen was 65º, which is considered the one that is easier to command and understand[2].

The steps towards determining the propulsion of the system, were to implement a thrust stand with a simple design, using a teensy 4.1 microcontroller, a load cell, wood plates, the motor, blades, the Swashplateless design and a breadboard for all electronics[Fig 1].

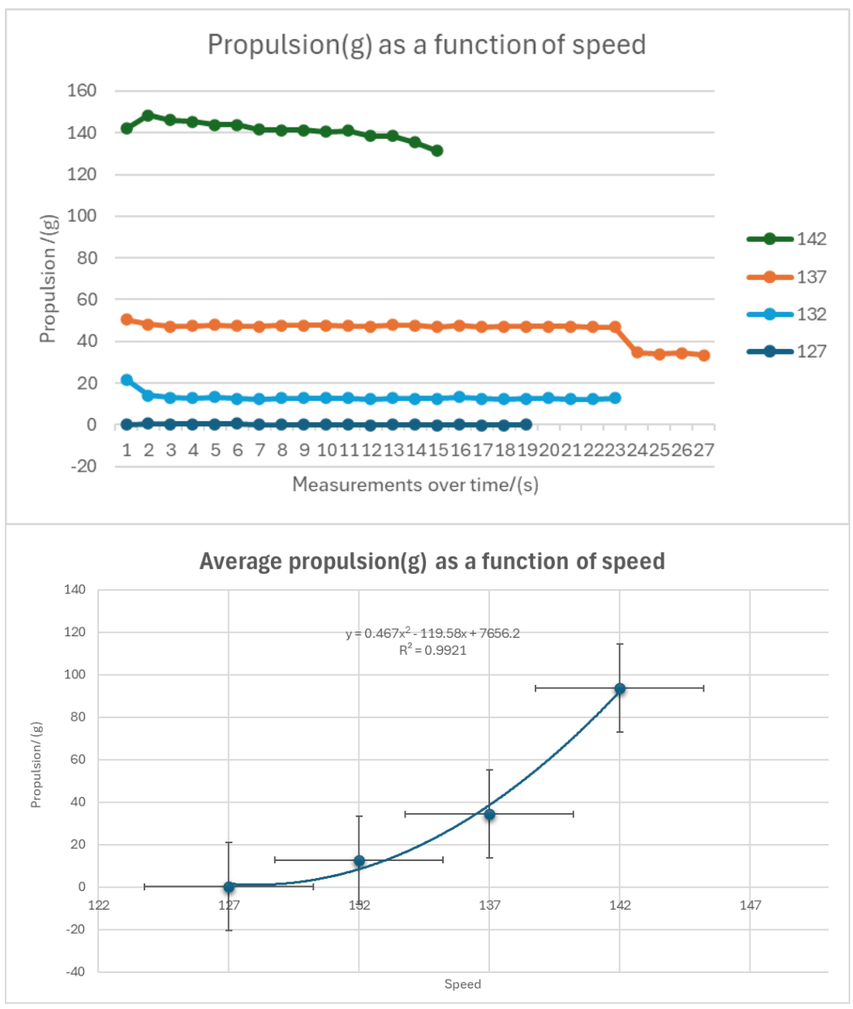


Fig 2- Thrust tests results.

With this setup it was possible to extract data from series of tests and determine the curve between the propulsion and the power of the motor, from which is possible to predict the maximum thrust possible with this combination of motor and propellers [Fig 2].
To further use the Swashplateless system , it is necessary to have a magnetic encoder to determine the motor angle which would further be used for the control of the pitch and roll movements of the system.

Conclusion

- It was possible to learn how the Swashplateless system can be implemented, by studying the necessary components and different model structures.
- The propulsion curve for the combination of motor and blades was determined using the thrust stand.

This project represents a great learning curve for the involved and sets stones for further implementations.

References

[1] Paulos, J., & Yim, M. (Year). Flight Performance of a Swashplateless Micro Air Vehicle.
[2] Stanton, T. (2020). *Drone Helicopter Hybrid* https://www.youtube.com/watch?v=d80oXSCcHTk

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theoria poiesis praxis

deti departamento de electrónica, telecomunicações e informática