PUBLIC SUMMARY

DESIGNING A UAV FOR GREENHOUSE IMAGING

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The goal of this thesis was to further the development of the Corvus drone. The main goal being to reduce its weight as well as increase its durability in the event of a crash. While many factors influence these metrics the frame was the main focus of this thesis. Injection molding was also chosen to be the main manufacturing method of the drone.

By utilizing the Engineering Design methodology of Pahl and Beitz this thesis was approached in a systematic way and developed through four phases: task clarification, conceptualisation, embodiment, and detail design.

Designing a mechatronic system such as a drone is inherently difficult as it involves multiple components. Each component influences one another, further increasing the complexity. In order to successfully design the drone, all components were identified and considered throughout the design process.

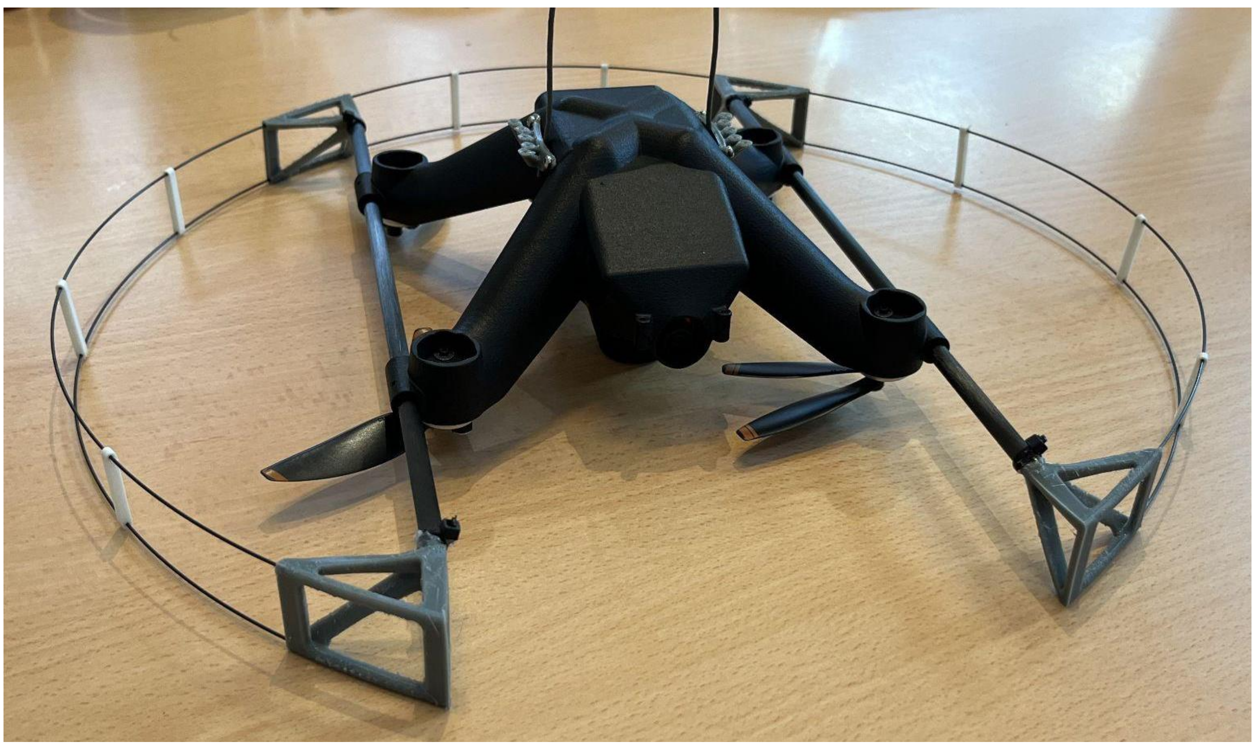
Through research and discussion a multitude of new insights were gained and applied to the future design. Aspects such as safety, durability, stability, and flight time all had new insights found to improve the performance of the Corvus drone. From rotor orientation and angle to frame bluntness and resonance to bicopter and blimp configurations every relevant aspect was researched and considered.

In order to reduce the frame weight to under the goal of 250 grams, new motors and batteries as well as changes to PCB layouts were done. Once all components were finalized and all necessary insights into frame design were compiled the detailed design and prototype phase began.

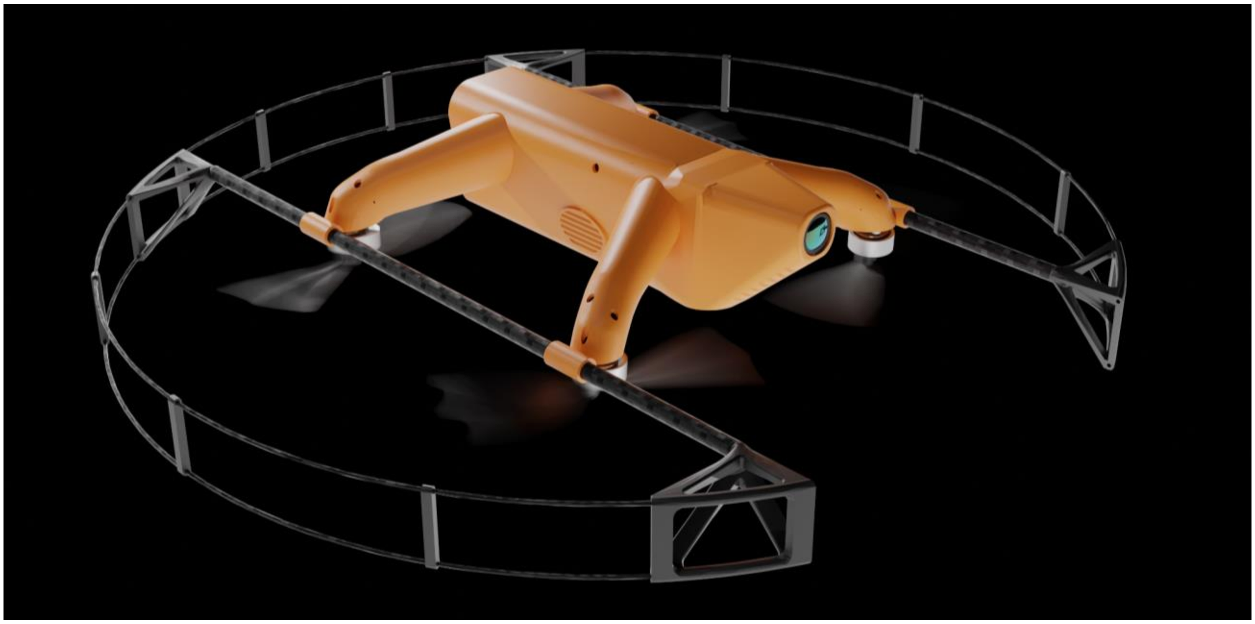
A prototype was designed and tested in house. Flew multiple flights and was drop tested from heights of 2.5 - 5 meters to observe durability. Testing revealed a successful first prototype. The frame flew stable, the propeller guard deflected well, and durability met the requirements set, however it was heavier than desired. With many new insights and lessons learned a revision of the design was proposed.

The latest revision featured many improvements in the manufacturability, strength, assembly, and weight of the drone. The main features in the final revision were a wrap-around unibody frame to eliminate stress concentrations from split bodies. The body and arms of the drone are separate injection molds simplifying the mold design. The four arms are then mated to the body using ultrasonic welding for strong uniform material connection. All components are assembled on a “skeleton” that is slid into the body of the drone to aid in assembly/disassembly as well as maintenance. While the final revision is untested it provides Corvus with a concept to further their research and development into the best UAV design for greenhouse imaging.

In conclusion, this bachelor thesis successfully addresses the design challenges associated with developing a UAV optimized for greenhouse crop imaging. Considering the challenge of a flying mechatronic system, it is quite the accomplishment to have had a successful flying prototype within 3 months. The research identified critical aspects such as safety, durability, stability, and flight endurance. With these aspects researched, a well-founded conclusion was reached on an optimal UAV configuration. By focusing on reducing the drone's weight and enhancing its structural integrity, the final prototype demonstrates significant improvements over the existing drone. Overall, the findings of this thesis provide valuable insights for the continued advancement of greenhouse agricultural UAV technology.



Fully assembled prototype.



Latest design revision.