

Optimization of a ducted fan prototype

A thorough reevaluation and redesign of a ducted fan prototype

Student



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Einleitung: In two previous theses, a Ducted-Fan-Prototype was developed. This prototype showed that an air vehicle based around an electronic ducted fan is possible to control. However, since the main focus was on demonstrating that the prototype could fly, the hardware and software development of the prototype was very basic. This project aimed to address these shortfalls and lay the groundwork for the subsequent project focusing on building a more reliable control system.

Vorgehen / Technologien: The shortfalls were addressed by completely redesigning the prototype. The new flight computer is based on two RP2040 microcontrollers. An FPGA was added to read and write PWM signals. Further, a new HC-12-based telemetry system was added to transmit the telemetry data in real-time. The updated mechanical design of the prototype is modular. It uses two types of joints to connect the parts; one is a clip mount that allows a part to be mounted without any screws. The second mount uses M2 screws to connect the components which makes the use of nuts unnecessary, thus drastically reducing the time that is needed to install this connector.

A new ground station application was developed to display the telemetry data in real-time.

Ergebnis: The updated version is a massive improvement compared to the previous prototype. It is easy to maintain, making changes or future repairs much more accessible thanks to the modular design. The improved flight computer has no flight time limitation and enables almost jitter-free execution of control algorithms.

Further, since many external dependencies have been replaced, the project is more straightforward to set up on another computer. Some issues will need to

be addressed in the next semester, which could not be solved in time. One main issue is that the telemetry computer can not log to the SD card and the telemetry antenna in parallel. This will be solved by adding another RP2040 to the flight computer board.

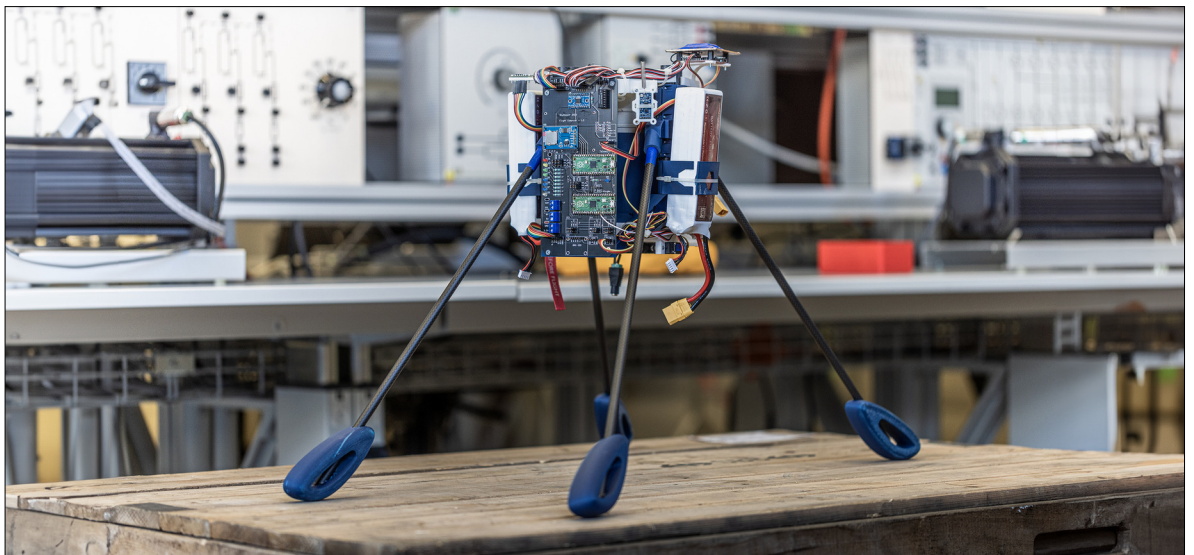
Original prototype
Eigene Darstellung



New ground station
Eigene Darstellung



Updated prototype
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