

Expansion of open-source drone software to include wind analysis

Students

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Initial Situation: Wind plays a major role in every aspect of aviation. It dictates many decisions and can even be dangerous, especially for smaller aircraft like paragliders. Knowing the current wind conditions is therefore of vital importance. Paragliding sites often lack accurate or up-to-date information, especially if the launch site is chosen spontaneously.

Modern drones (UAVs) are equipped with a variety of sensors which allow them to fly autonomously and maintain stable flight even in challenging wind conditions. The sensors provide data to correct the flight path, which should therefore in reverse also be usable to measure wind and turbulence.

Israel Leuenberg

This project aims to develop a small and portable solution that can be carried by paragliding pilots even to remote launch sites to retrieve accurate information about the wind speed, direction and level of turbulence in real-time.

Approach / Technology: To proof the feasibility using a small UAV to measure wind and turbulence, the project is divided into three areas, which are developed and researched in parallel to create a proof of concept solution:

Pietro Lehmann

- Constructing a UAV capable of carrying the required hardware
- Developing a connected software system that retrieves and processes the UAV's data in real-time
- Finding methods to translate the measured data into reliable wind and turbulence estimations

Result: A prototype UAV supporting the required hardware was successfully built from scratch. The UAV is capable of sending telemetry data wireless in real-time.

The connected software system is capable of receiving data from the UAV in real-time and process it together with reference data from nearby weather stations.

The system compares the unified reference data against the telemetry data of the UAV and finds possible correlations between them.

Several methods of using the UAV to measure wind and turbulence have been considered, two of which proved to be the most reliable:

- Estimating turbulence based on the UAV's accelerations
- Estimating wind speed from the attitude required to compensate for wind drift

The project successfully implemented a prototype of the intended solution and thereby demonstrates the feasibility of this approach.

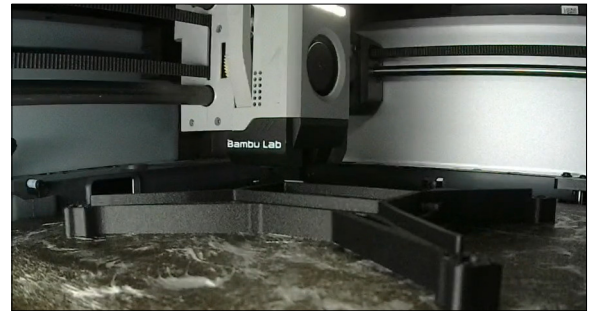
Advisor

Thomas Letsch

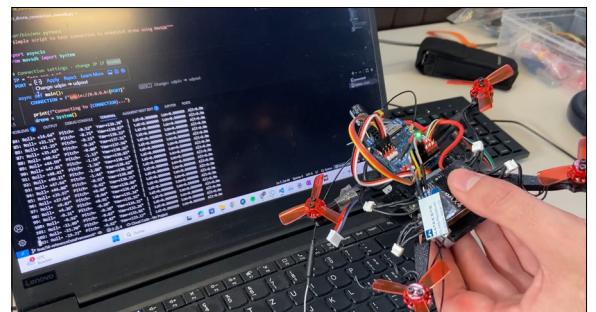
Subject Area

Software, Software Engineering, Data Science, Miscellaneous

3D-print of the UAV frame
Own presentation



Real-time data transmission from the UAV to the connected software
Own presentation



Test flight
Own presentation

