Project Goal

Study motion of a FWMAV mathematically, experimentally, and through design; implement and test our own active pitching mechanism of flight both in a single bird configuration and in a quadflapper.

Specifications

Less than 15 cm in length, width, and height
• More than 1 minute hover time
• 2 DOF : Upward and Pitch
• Pitching angle fixed by the mechanism

Innovation and Progress

ULB Design and Fabrication

This design features a motor-driven central shaft. The central shaft then drives a top and bottom level that drives the active pitching motion.

Quadcopter vs Quadflapper Analysis (Passive Pitching Angle)

Physical tests to be complimented with program-aided analysis using BetaFlight.

Thrust Equation and Finalized ODE Equations of Motion

MatLab and Mathematica used to analyze EOM’s and generate thrust equation

Simulate in Constant Thrust Conditions (e.g. y(t))

Next Steps

Mechanical Design:
Redesign ULB design to produce wider pitching angle and decrease friction between moving parts

Quadflapper: Continue TinyWhoop Quadflapper testing. Become familiar with BetaFlight program.

System Identification: Simulate motion of wing in MatLab using governing equations.

Contact Information

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Background

Micro Air Vehicles (MAV) are a class of mini UAV’s that have a size restriction. They are used for commercial, research and military purposes. A motivation to use them would be where the environment is blocking access for ground vehicles.

Future Implications

The active pitching angle flapping mechanism could offer better efficiency and/or more maneuverability than a traditional aircraft vehicle. Its small size is useful in military application/reconnaissance.

Budget

Budget: ~$900 (15 members, 9 SDP Members $100 fee each)