PTERA: Propeller Tilt Efficiency Rotor Aircraft

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My project explores a novel tri-copter design that uses a combination of a tilt-rotor mechanism, airfoil-shaped drone arms, and the yaw motion of the drone to generate a more energy-efficient lift. Typically, drones dedicate all motor thrust to generate vertical lift with the propellers. My design, however, involves using a center servo mechanism to tilt the drone arms and angle the motors. This causes the drone to naturally spin in the yaw direction which allows the airfoils on the drone arms to generate vertical lift. The result is that the tricopter is able to generate vertical thrust with less power usage, which leads to better overall energy efficiency than a traditional drone configuration. Throughout this project report, I will present the methodology in which I used to design my energy efficient tri-copter. The 3D printed parts were customized templates that were modified using SOLIDWORKS. The project involved integrating software concepts like PID control systems, altitude control, and filtering mechanisms with my drone hardware, specifically the Teensy 4.1. In my results, I analyze the significant power efficiency the drone achieved when hovering at a fixed height while spinning. Overall, my drone design explores a promising solution to generate a more energy efficient drone that can lead to longer battery life in time-critical applications such as rescue, surveillance, and delivery services.

Awards Won:

Shanghai Association for the Advancement of Science for Youths: Science Seed Award

University of Arizona: Renewal Tuition Scholarship