Development of a Novel Unmanned Aerial Vehicle (UAV): Nanoscale Transverse Tilt-rotor Helicopter

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Transverse tilt-wing design has currently not been experimented within the nano class of Unmanned Aerial Vehicles and has applications in defense, wildlife conservation, crop agriculture, security, and search and rescue. Tilt-rotor design is capable of pinpoint movement and greater helicopter agility. It was hypothesized that a radio controlled transverse tilt-rotor helicopter Nano Air Vehicle (NAV) could be developed smaller than a 7.5cm cube. The first phase was spent modeling a 3D Computer Aided Design (CAD) model of the airframe. The motors and propellers were modeled in CAD to determine motor placement and to avoid propeller gap turbulence. Carbon Fiber/Kevlar wrapped balsa wood was used for the airframe and a successful prototype was built. The second phase was spent reducing weight on the NAV. The airframe utilized a lighter material structure. The electronic control system weight was reduced by integrating multifunctional components, to include a polyimide flex Printed Circuit Board (PCB) instead of a traditional fiberglass board. The final phase involved designing an Electronic Speed Controller circuit in PCB design software and integrating it into a custom designed Flight Controller System that was fabricated and assembled on a PCB. This system will communicate wirelessly via Bluetooth utilizing code and have control over the NAV. With finalization of the NAV continuing at its current pace, this NAV is on the fast track to be further advanced and field-tested. A successful prototype was completed for flight tests in the near future. The NAV design took longer than expected to develop due to electrical issues, but based on current design analysis this NAV still conforms to the original specs and is ready to be flown and eventually produced.

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