High-Speed Sports Camera Drone (Falcon)

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INTRODUCTION

- **Research Question:** How can we design and build a drone that can keep up with high-speed motorsport vehicles, such as Formula 1 cars, while delivering stable and immersive footage?
- **Background:** Traditional camera systems often fail to follow the speed and agility of modern race cars. As drone and camera technology evolve, there's a need for specialized aerial systems in sports broadcasting.
- **Why It Matters:** Viewers expect dynamic, real-time footage that matches the thrill of the race. Our drone aims to deliver that experience.
- **Context:** Inspired by innovations like the Red Bull FPV Drone, our project contributes to ongoing research in autonomous tracking, lightweight design, and flight stabilization.
- **Visual Approach:** We incorporate CAD designs, component diagrams, and track test results to illustrate how our drone accomplishes the task.

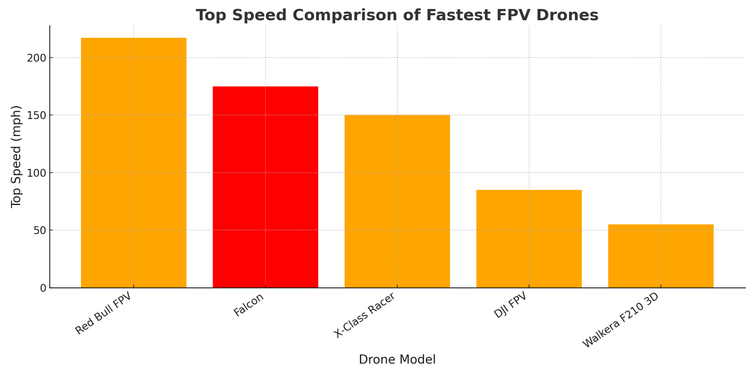
METHODS

- **Preliminary layout –** Quadcopter, 5 in X-frame with four arms.
- **Component selection –** Carbon-fiber frame, radio receiver, flight controller, power-distribution board, ESCs, brushless motors, Li-Po battery, HD camera, video transmitter, 3-D-printed canopy & propellers.
- **Fabrication & assembly –** 3-D-print canopy/props; mount hardware; solder all electronic boards and wiring.
- **PID tuning –** Adjust P, I, D gains to maximize responsiveness and stability.
- **Test procedure –** Fly the drone on a makeshift Formula 1 course; record top speed, lap times, and stability; log battery endurance.
- **Iterative cycle –** Analyze test data → revise propeller layout or canopy design → re-test until objectives are met.

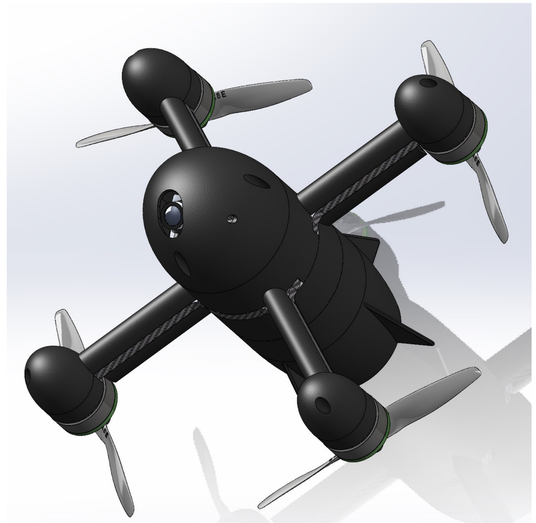
RESULTS/DISCUSSION

- **Performance goal –** Minimum top speed ≥ 120 mph with high stability.
- **Agility requirement –** Must follow rapid turns and accelerations typical of Formula 1 tracks.
- **Expected footage quality –** Fixed wide-lens camera streams clear video at racing speeds.
- **Key design choice –** 3-D-printed canopy/props to cut drag while keeping weight low.
- **Next milestone –** Complete first full-speed test and compare lap times to earlier configurations.

Top Speed Comparison of Fastest FPV Drones



3D CAD Design



CONCLUSIONS

- Proposed build–test–iterate plan positions the team to achieve 175-mph speed target while maintaining video stability.
- 3-D-printed aerodynamic components and careful PID tuning are critical to meeting both speed and agility requirements.
- **Future work:** add autonomous vehicle-tracking (YOLO/OpenCV) and extend flight time for longer motorsport coverage.

REFERENCES

- **Ward, T. (2024, Feb 27). "How the World's Fastest Filming Drone Was Built." Red Bull.**
- **Drone Launch Academy. (2024, September 4). What is the fastest drone in the world in 2024? Drone Launch Academy. https://dronelaunchacademy.com/resources/what-is-the-fastest-drone-in-2024/**

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