Pura Aer: A Low-Cost, Energy-Efficient Portable Air Purifier System Using Disposable Face Mask for Emergency and Daily Uses

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Pura Aer (PA) is an air purifier system that repurposes disposable face masks and integrates a peregrine falcon-inspired fan design. PA was developed in four phases, with design criteria set for purifier structure, fan, motor interface, and overall system, to reach key design objectives: portability, efficiency, power flexibility, and replicability. Variables changed were blade shape, number, and angle, which affect RPM and power consumption, impacting airflow and efficiency. Control was the propeller fan, and flow simulations were used to visualize and analyze airflow. After seven iterations, PA met some of the design objectives but required new fan designs. Lift-based fan design is required to generate high pressure. 28 new fans were developed. 30° blade angle generates the highest airflow while 15° has higher pressure from lift and less turbulence, leading to higher efficiency. 9-Blade designs operate at the highest RPM and efficiency. The best fan generates 1.19 ACPH in a standard room using 5W of power. PA lowers PM2.5 levels by 46% in 25min. Flow simulations show Control generates turbulence and low pressure while Lift-based fans generate laminar streams at higher velocity. Higher RPM correlates to higher pressure and efficiency. A companion app was developed to assist system users. Disposable face masks can be repurposed for low-cost, energy-efficient air purifiers. The recommended fan FWF-30D-9B combines high pressure from lift and high airflow from drag, creating optimal airflow generation and efficiency. Pura Aer can be deployed globally, reducing air pollution-caused health risks and extending face masks' useful life.

Awards Won:
Second Award of $2,000