A Modular Ionic Wind Cooling System Based on High-voltage Pulse Generator and Sensors

Hu, Alex (School: Tabor Academy)

This project aims to engineer the next-generation cooling device using ionic wind technology. This system consists of a high-voltage emitter and collector electrodes that generate and attract, propelling ions and creating airflow without mechanical parts. Due to the non-mechanical nature of this design, while achieving the same performance as traditional fans, it allows for flexible, compact designs along with longevity and quiet operation noise lower than typical ambient noise. Furthermore, electrodes' shapes and placements can be customized to enable more direct airflow, minimizing turbulence and boosting efficiency. As a result, the device reduces energy waste and carbon emissions due to its strong flexibility and adaptability. This project is mainly focused on laptop scenarios, where silence and compactness are critical. However, broader applications could also include climate control in confined spaces and thermal management of medical or industrial systems. The project uses modeling and 3D printing to prototype, followed by a rigorous science process to assess performance metrics such as airflow, heat dissipation rate, noise, and energy use. Results are expected to show that ionic wind cooling offers a viable, more efficient alternative to traditional fans.

Awards Won: