Project 30 Team M14

# Educational Seating System with Air Filtration

San Diego State University
Mechanical Engineering

Figure 1: Team Level Diagram

## PROBLEM SOLUTION

Our goal is to bring back in-person learning for students enrolled in K-12 (and hopefully college-level) by introducing an air purifier in classrooms. This air filtration system must reduce the risk of airborne viruses in school, should be modular, easily-maintained, and safe for kids.

## INITIAL DESIGN

When brainstorming the design for this project, we initially wanted to have a standalone system (no clamp) and designed it to filter air through one end and out the other. Upon further discussion, we decided to change the design from horizontal filtration to 360-degree filtration to ensure the air the students are breathing are constantly being filtered.

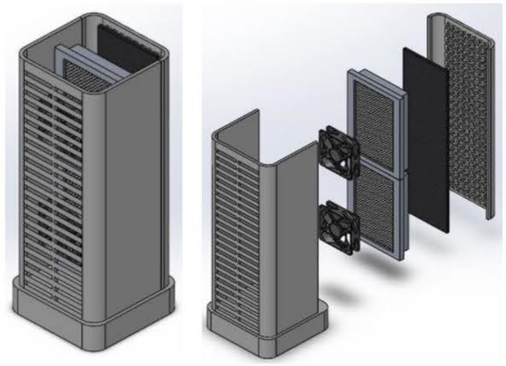
Figure 2: Initial design of horizontal filtration

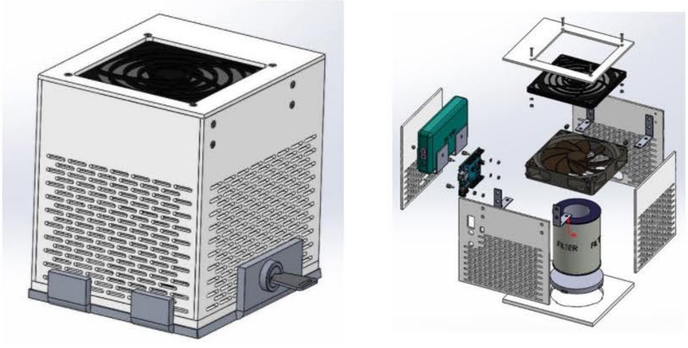
Figure 3: Prototype design of 360° filtration

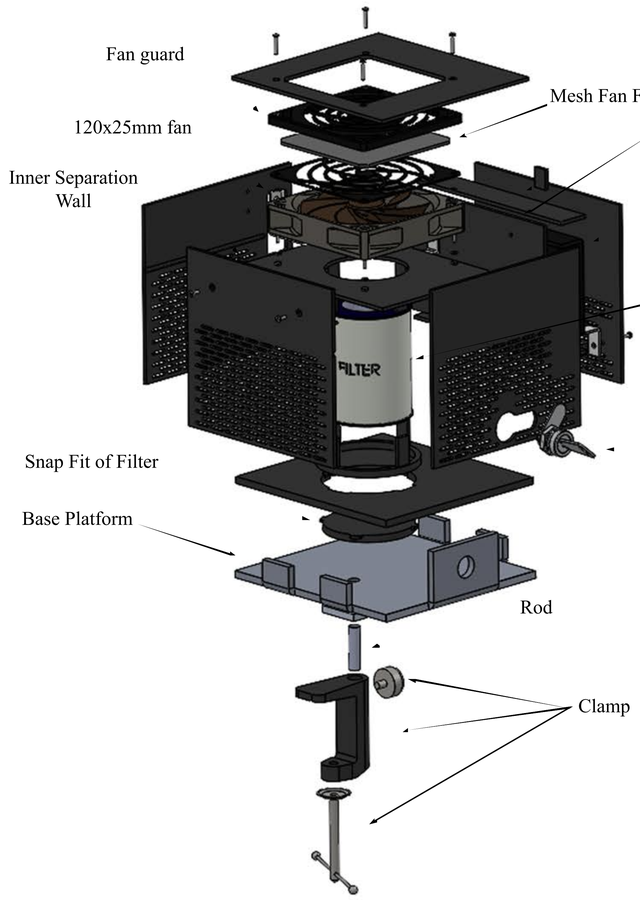

Figure 4: Final design exploded view with labels


Figure 5: Final design default view

Table 1: Key Design Components and Functions

| Component | Function |
|---|---|
| Fan Guard & mesh filter | Protects the system from foreign object entering |
| 120x25mm Fan | Offers 11 Air Changes Per Hour in a 6x6x8 ft. space |
| Battery Compartment Walls | Isolated the battery from all other components |
| Inner Wall Separator | Separates the HEPA filter from the fan for efficient air flow |
| Rechargeable Battery | Allows system to be standalone and rechargeable |
| HEPA Filter | Filters 99.98% of air particles |
| Lock and Key | Ensures device is secure on the clamp |
| Snap-Fit of Filter | Allows easy access to the filter |
| Base Platform | Connects the device and the clamp |
| Rod | Threaded to connect the clamp and the platform |
| Clamp | Connects the clamp to the desk, asjustable for modularity |

## MANUFACTURING PHASE

Table 2: Build Parts Method and Tools Used

| Parts to be Manufactured | Materials Needed | Machining Method |
|---|---|---|
| Casing of Ventilation System | ABS (0.125 in thick for side and top panels) ABS (0.25 in thick for bottom panel) | The casing will be created with CNC machining and milling at the SDSU Machine Shop. |
| Internal Separation Walls | ABS Plastic (0.125 in thick) | The casing will be created with CNC machining and milling at the SDSU Machine Shop. |
| Platform for Clamp Mechanism | Aluminum 3003 Sheet (0.25 in thick) | The platform for the clamp mechanism will be created with a WaterJet machine at the SDSU machine shop. |

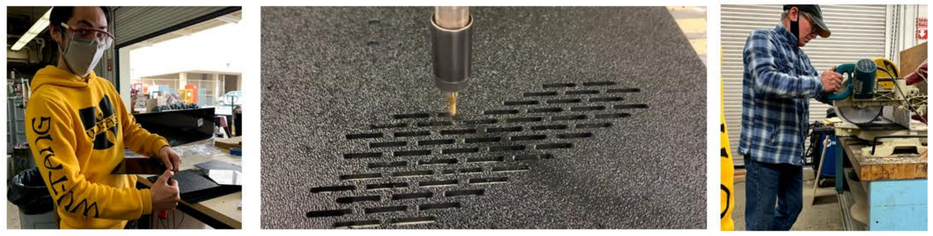
Figure 6: Damian Orozco (left) and Michael Lester (right) machining ABS plastic

## TESTING AND ANALYSIS

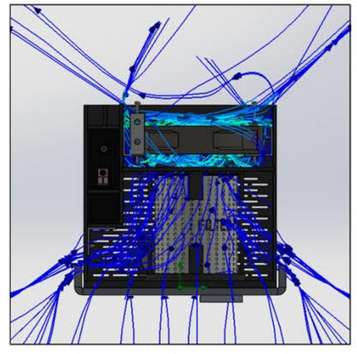
Figure 7: Flow Analysis

We measured the battery life to be greater than 35 hours (7 hours a day, 5 days a week) and a full battery charge to be 7 hours. To ensure our device is not distracting to students, we set a requirement of a sound level of 40 dB and our device passed at 35 dB.

To measure our device's air quality, our team purchased an air quality monitor to measure the particles in the air before and after our device was introduced. To measure our device's air flow, we used smoke candles to track how air flows through our system.

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