

Motivation

Surgical plume is an airborne byproduct of electrosurgery that presents health risks for both the patient and the surgical team.

- Existing smoke evacuation systems used for plume capture are bulky and must be located outside the sterile field
- Plume capture tubing running across the OR presents trip and entanglement hazards
- Absent regulations, cost is a barrier to adoption for many hospitals



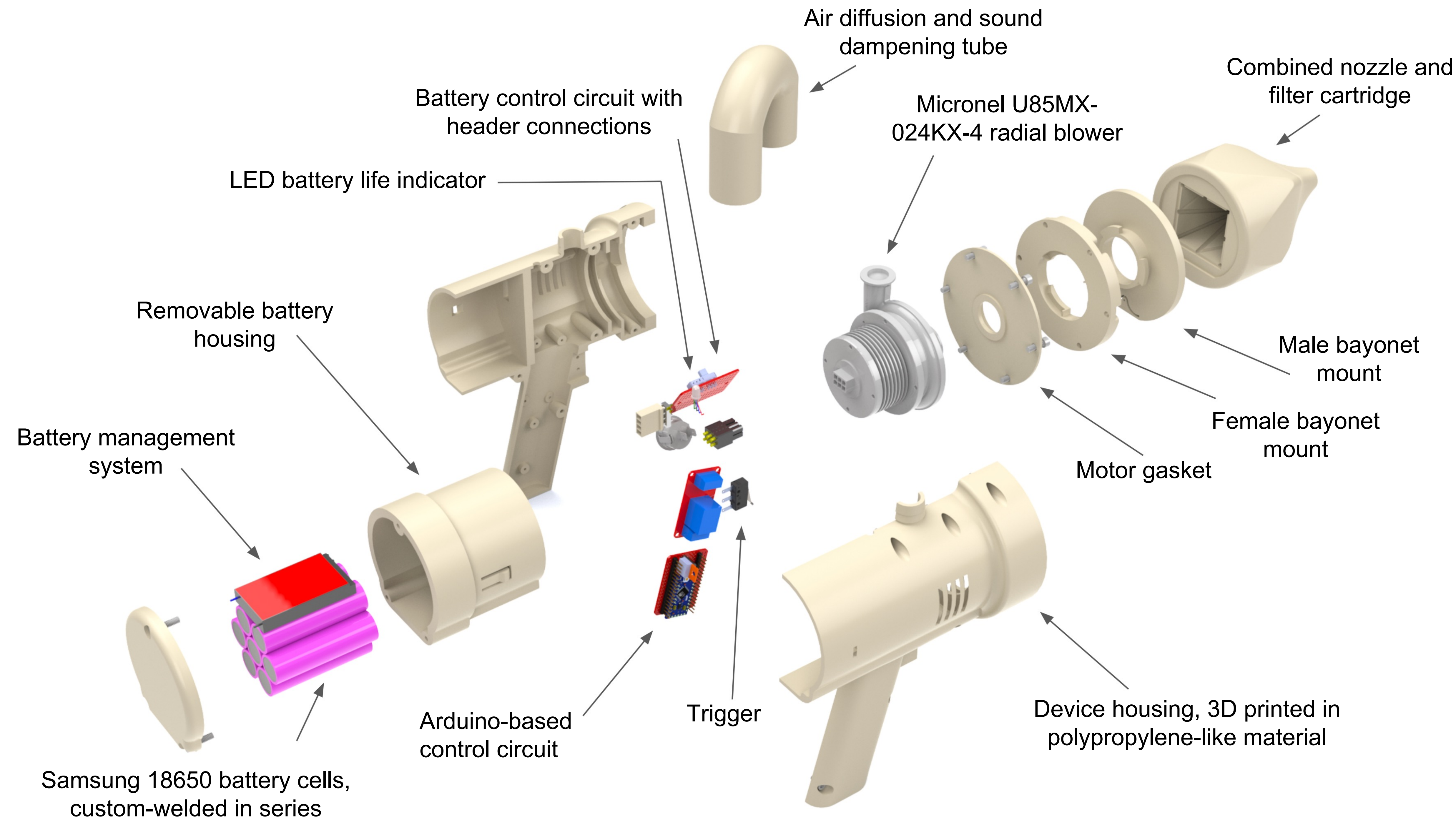
Medtronic's RapidVac Plume Capture System

Project Objective

Design, build, and demonstrate a **hand-held, battery-powered plume evacuation device** that resides entirely within the sterile field.

Requirements

- ✓ Does not cross out of the sterile field
- ✓ Weighs less than 5.1 lbs (2.3 kg)
- ✓ Battery life of at least 15 minutes
- ✓ Noise production below 85 dBA (OSHA)
- ✗ Volumetric flow rate of 256 LPM
- ✓ Filtration efficiency of at least 90%
- ? Filter life of at least 15 minutes



Final Specs

Metric	Value
Weight	3.38 lb
Runtime	23 min
Flow Rate	230 LPM
Power Draw	183 W
Suction	11.4 kPa
Sound (at 12 in.)	80.4 dBA
Battery Voltage	25.5 V
Filter Efficiency	92%
Cost	\$525

Impact

Prototype

- Establishes that a hand-held form factor is feasible with existing off-the-shelf technology
- Proof-of-concept designs for tool-free exchange of battery pack and filter
- Meets all but two client requirements; sets a baseline for future teams to continue development

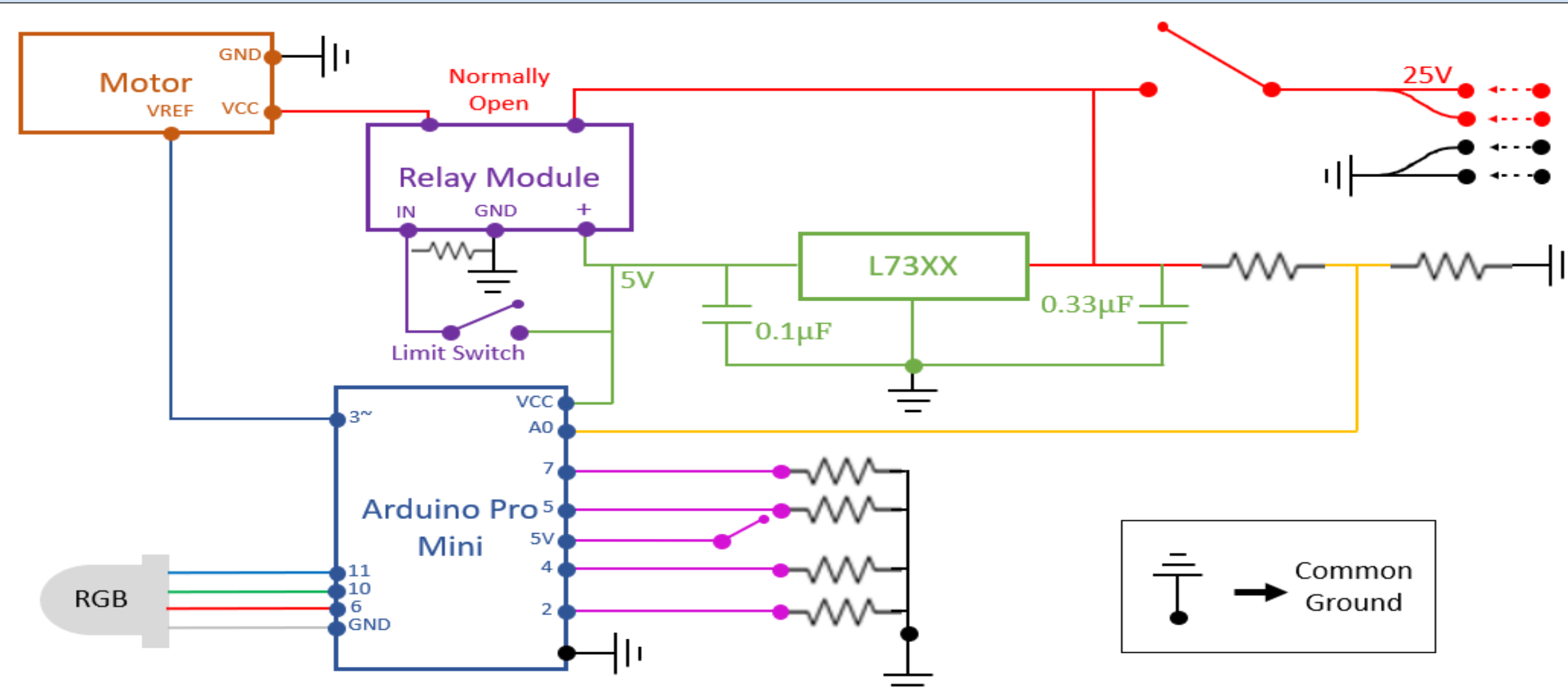
Technology

- Trade studies of alternatives for key components (blower motor, battery)
- Identification of opportunities for future integrations (remote triggering)

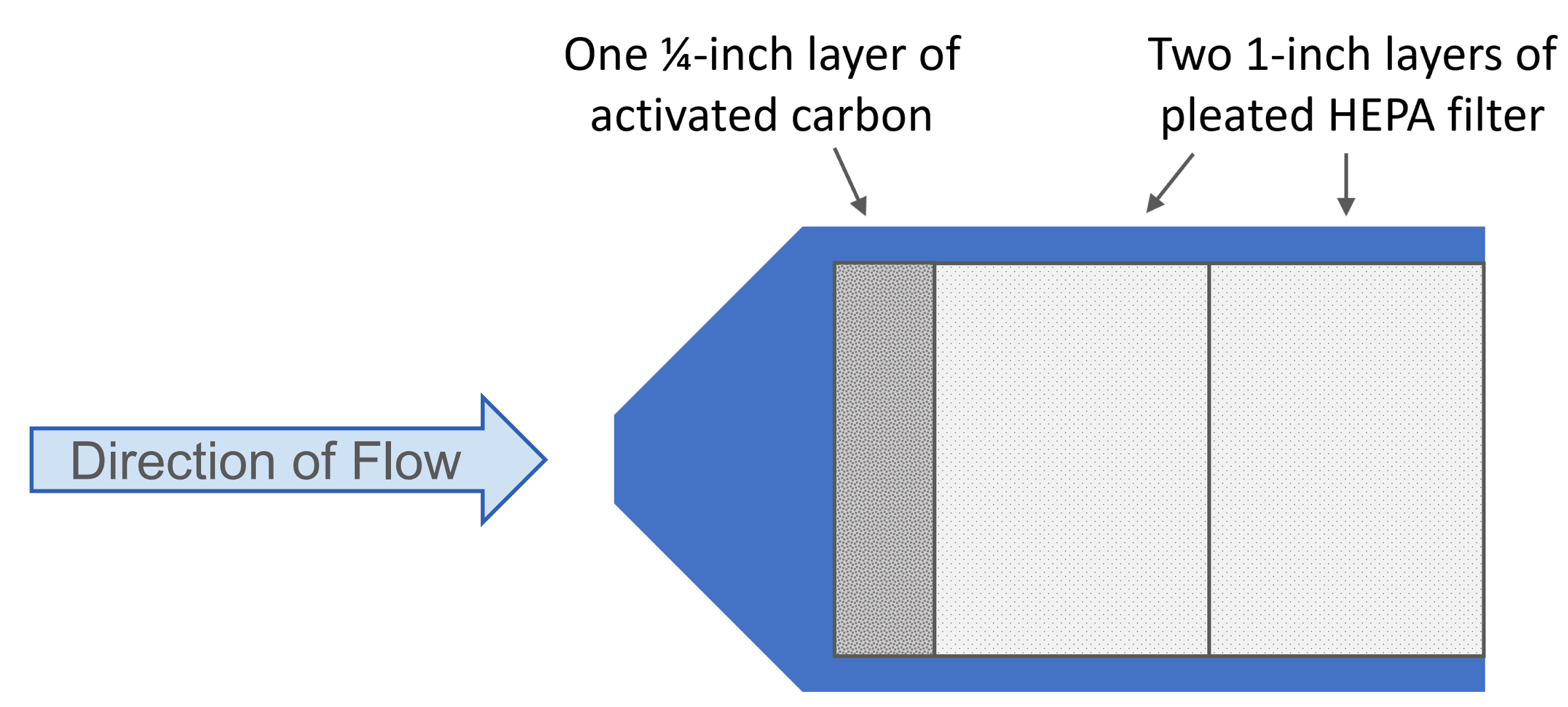
Analysis

- Preliminary costing estimates for device
- Summary of user feedback for future improvements

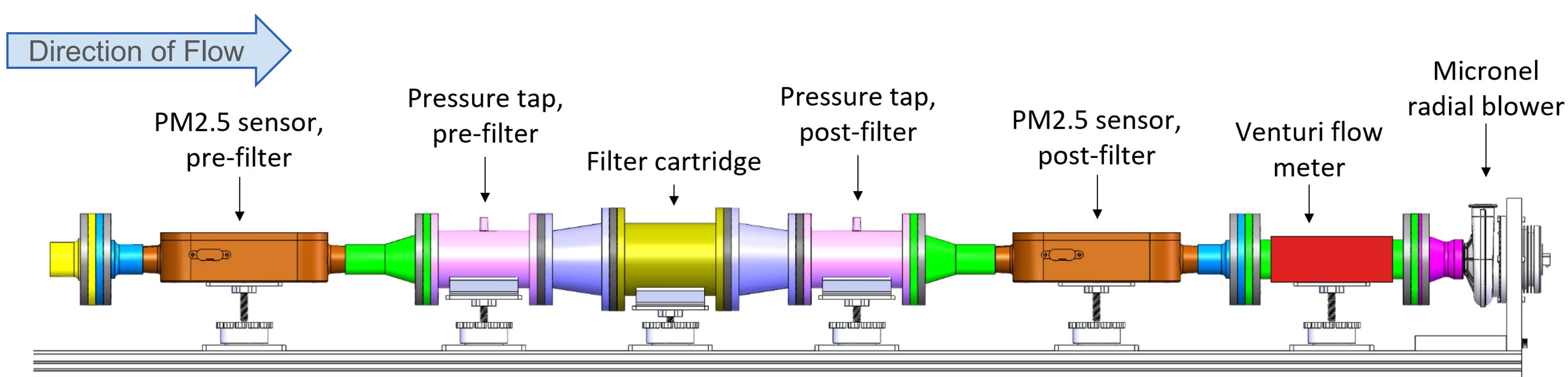
Circuit Diagram



Filter Contents



Test Bench



Testing Data

