

Jacob Farda¹, Andrew Runyon¹, Andrew Bokarev¹, Alexander Dyba¹, Julia Danon², Lauren Holt², Ashini Patel², Ben Boyarko², Ananya Suram²
Project Advisor: Dr. Pramath Nath, MD

¹ School of Biomedical Engineering, Science, and Health Systems, Drexel University, Philadelphia PA ² Drexel University College of Medicine, Philadelphia PA

Need

Pollen induced asthma is pronounced in children and over 50% of cases are thought to have an allergy component.

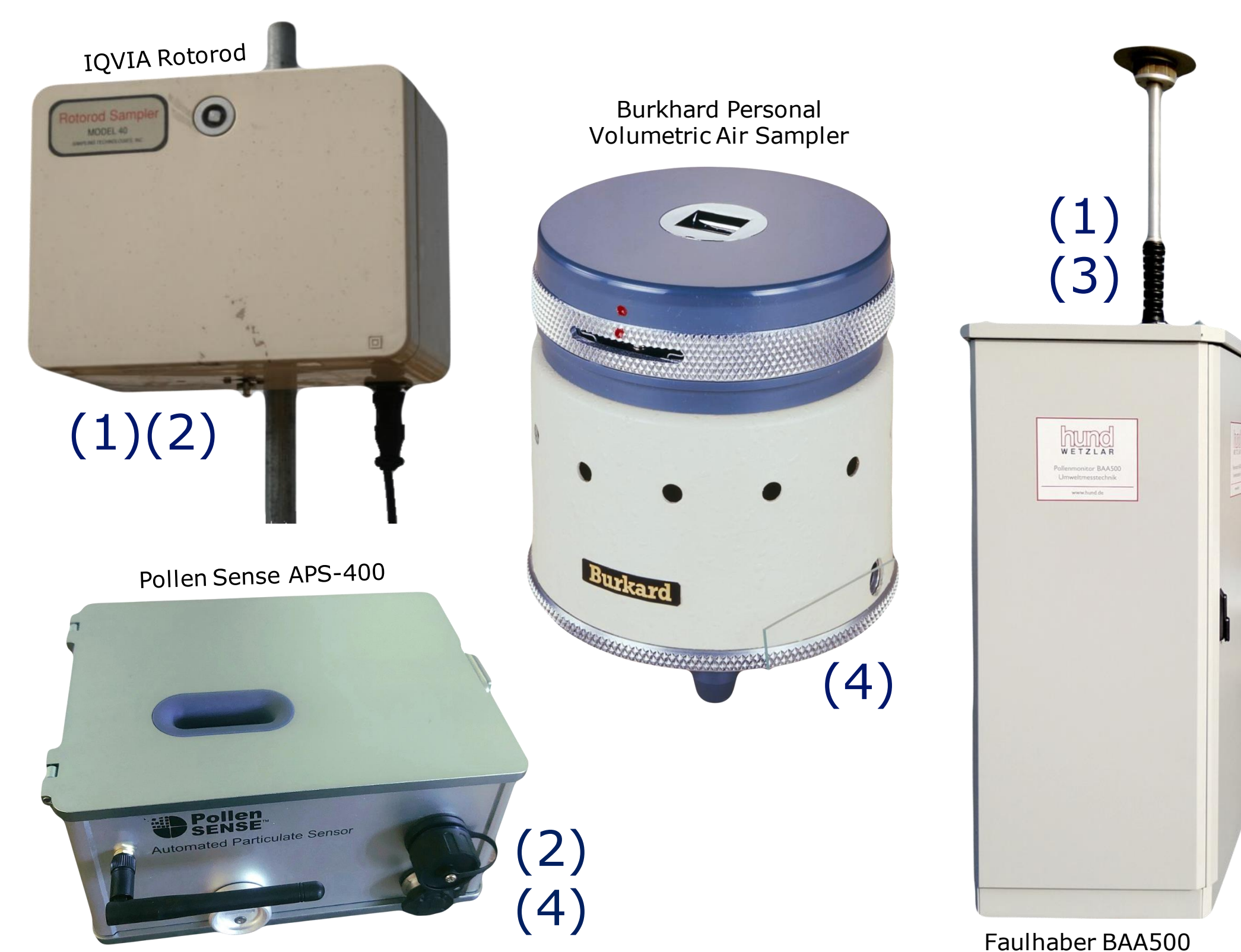
Increasing pollen levels and worsening pollution are leading to increasing incidence of allergies. A strong correlation between tree pollen levels and worsening asthma exists.

Inefficient and inaccessible pollen sampling methods that currently exist create a barrier for personal use by patients.

Objective

Design a **user-friendly, accurate, and accessible personal** pollen counter. The device should provide quantitative feedback, differentiate between several allergens, provide accurate results of the local count sampled, and be suitable for everyday use.

Existing Solutions



- (1) **Long sampling times** complicate the collection process and delay results
- (2) **Bulky devices requiring professional installation** prevent portability and limit results to one locale
- (3) **Complex interfaces** confuse users
- (4) **Third party analysis** reduces utility in day-to-day life and increases cost (especially when users must **subscribe to an analytic service**)

Design Inputs

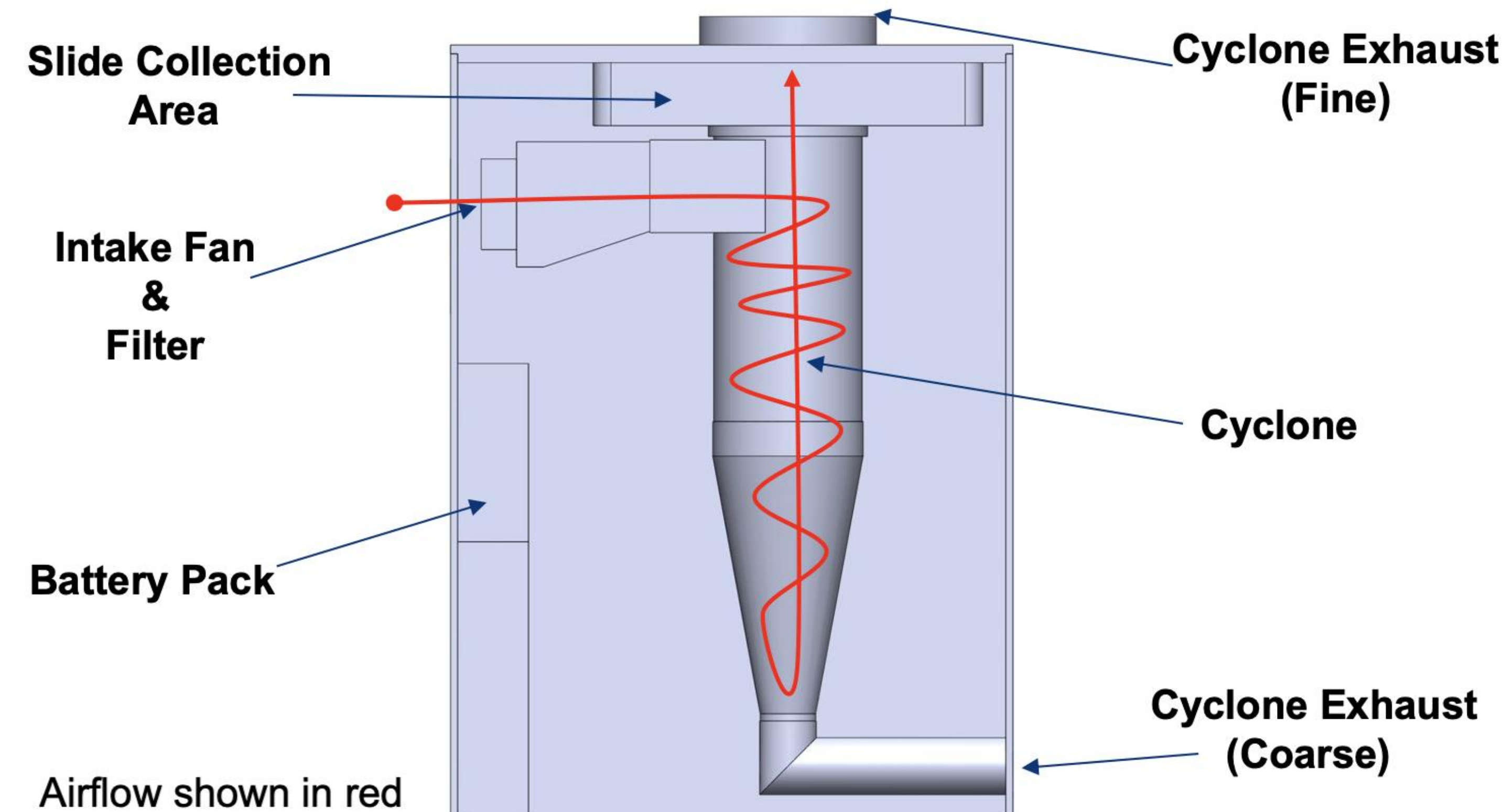
Constraints

- **Time:** 3 ten-week terms spent on project
- **Budget:** Drexel BME Budget
- **Resources:** Drexel facilities
- **Policy:** Testing protocols must follow all Drexel Lab safety protocols and biological safety manual
- **Time to Sense:** 1 hour time limit
- **Portability:** Maximum weight of 11.3 lbs, 46 x 25.5 x 46 cm dimensions

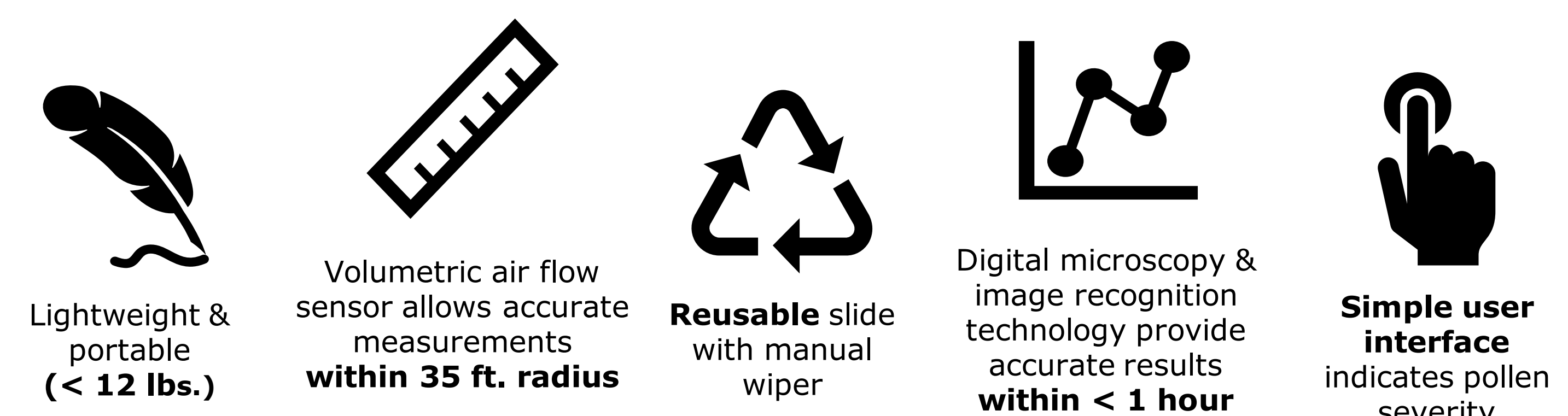
Requirements

- Quantify amount of specific allergen
- Differentiate specific allergen from other particulate matter
- Accurately inform user to current pollen count
- Quantify volume of air through system
- Quantify pollen within a predefined area (localization volume)

Prototype



Product Specifications



Verification Testing

- **Fan Output Test:** Maintain optimal flow to ensure ideal cyclone conditions and separate the particulate from air
- **Slide Retainment Test:** Verify the microscope slide's ability to retain the particulate matter on its surface
- **Assembled Solution Run Test:** Confirm the assembled device's ability to detect "high pollen" levels
- Early confidence testing has been positive for slide retainment and assembled solution run

Conclusion and Impact

Developed a portable, relatively inexpensive, easy-to-use pollen counter that allows families of pediatric patients to collect samples from **indoor and outdoor environments**.

Families can **collect baseline data** at home, school, and other environments. Using this information, they can **understand triggers** for asthma attacks and implement interventional methods to **minimize them**.

Expanded versions of the device aim to include the ability to **analyze and record the pollen count in real time (<1 hour)**.

Current version focuses on particulate matter specific to the size and density of ragweed (a common allergen in the region) and **future devices should focus on other allergens**.

Financial Impact

The allergy diagnostic and monitoring industry was worth **\$4.8 billion in 2021** and is poised to reach **\$8.2 billion by 2026** (CAGR of 11.1%).¹

Current use of mobile health tools is limited, creating untapped opportunities for affordable point-of-care monitoring devices in commercial markets.

Acknowledgements:

Dr. Pramath Nath, Dr. Joseph Sarver, Dr. Marek Swoboda, Delores Conover, DrExcel Health, Drexel School of Biomedical Engineering

References:

¹ Mordor Intelligence. (2023). Allergy Diagnostics Market Size & Share Analysis - Growth Trends & Forecasts (2024 - 2029). <https://www.mordorintelligence.com/industry-reports/allergy-diagnostics-market>