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Need

- 90% of children suffer from Allergy-Induced asthma with particulate matter (PM) triggers of:



Mold (2.5 µm) ≤ Dust < Pollen (10 µm)

- Lack of real time data leading to elevated exposure to PM, increase emergency department (ED) visits (Erbas, 2018).

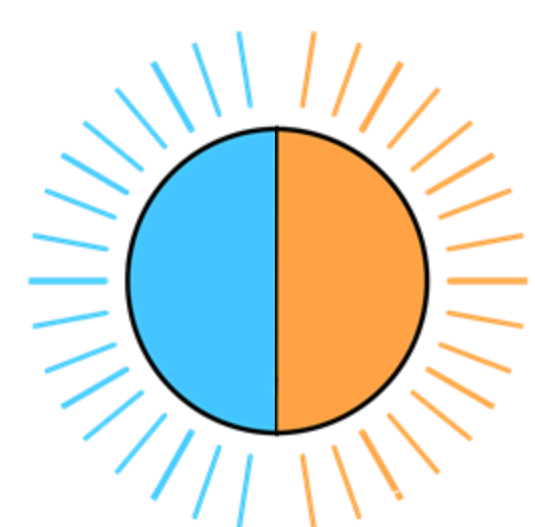
Objective

To develop a **low-latency particle detection device** to support parents of children with allergen-induced asthma by **alerting users** when **indoor particle counts are high**.

Design Inputs



Detect Particles
2.5 to 10 µm



Indicate Different Concentrations
Blue = Normal
Orange = High

PM2.5 is **>9.1 µg/m³**
PM10 is **>55 µg/m³**



Record Symptom Occurrence

Captures time, particle concentration, temperature, and humidity

Constraints

Budget, time, resources, sensor availability, testing location

Existing Solutions

AirVisual Pro



- **Lacks PM10** readings
- **Complicated visual** interface
- Users have reported **underreporting**

PurpleAir Touch



- **Charges users** for data access
- LED interface **lacks a mounting bracket**

Govee's Smart Monitor



- Users reported **sensor inaccuracies**
- Integrated app **lacks intuitiveness**

Verification

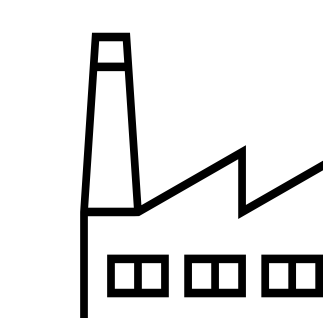
Scenario #	Time Interval	Pass/Fail
1	≤ 5 mins	Pass
2	> 5 mins	Fail

- The system has reliable, low-latency, and consistent data logging if the **time interval is ≤ 5 minutes**
- The system is reliable and functional in data processing if **all expected outcomes = actual outcomes**
- The device is portable if the **device is < 16.8 kg**
- The system can reliably detect, process, and report data if **all expected outcomes = actual outcomes**
- The system can reliably detect and log environmental temperature/humidity changes if **device readings and visual outputs match expected outcomes across all conditions**

Scenario #	Expected Outcome	Actual Outcome	Pass/Fail
1	Acceptable Concentration/ Temperature/Humidity	Acceptable Concentration/ Temperature/Humidity	Pass
2	High Concentration/ Temperature/Humidity	Acceptable Concentration/ Temperature/Humidity	Fail

Financial Impact

\$ 776 million



Manufacture cost: \$150
Price of good: \$225

US Pediatric Allergy diagnostic and therapeutic market

Goal to reach 0.5% of target audience

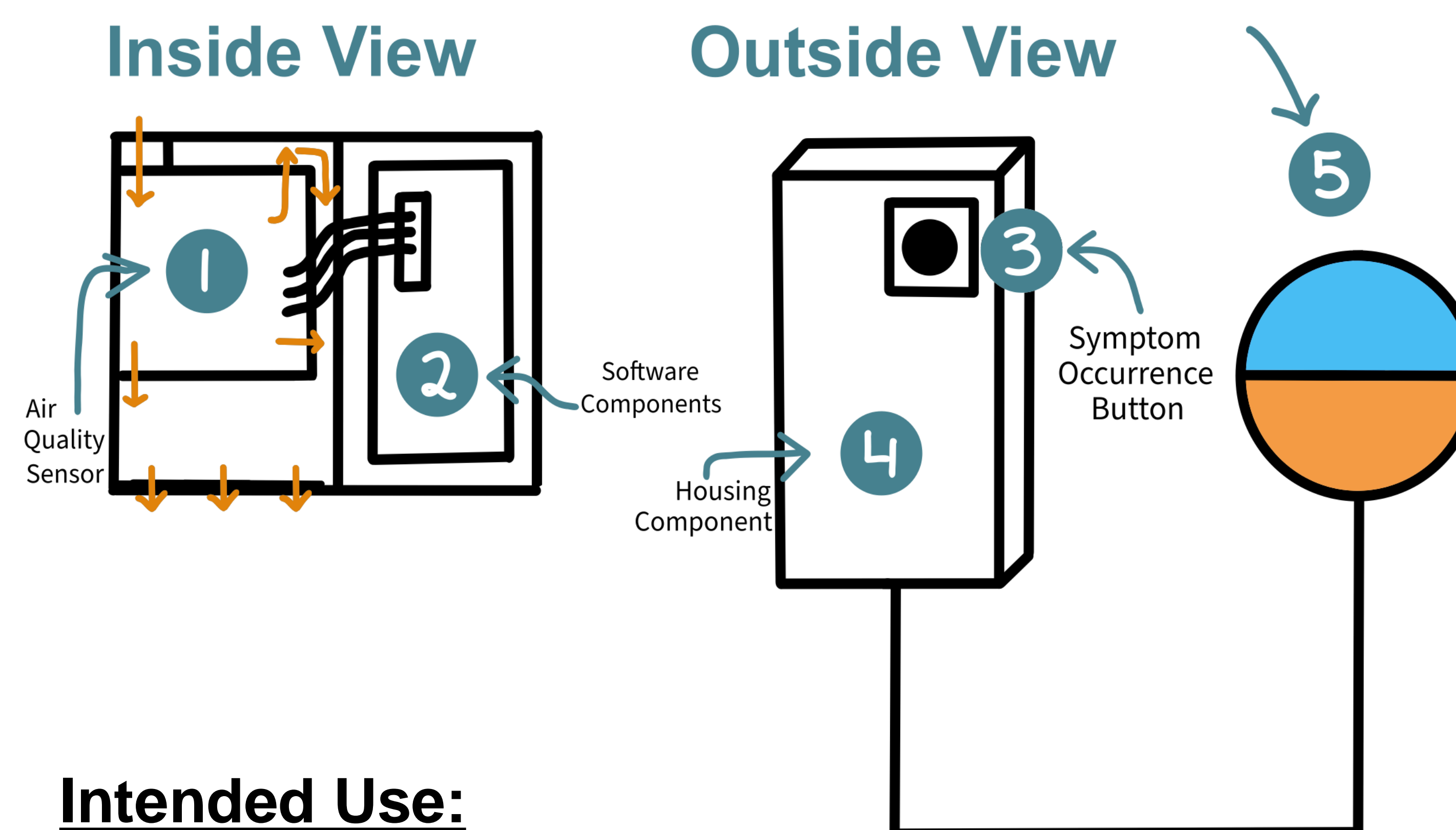
Conclusion and Impact

The team developed a low-latency, accessible air quality monitoring system for asthma management. The device provides **notifications and visual alerts** for unsafe air quality levels. This helps parents take **action to prevent asthma exacerbations**. Additionally, there is a button to **log data during symptoms** for medical review. The detection range is for particles between 2.5 µm and 10 µm, with potential for expansion.

Acknowledgements: Thank you Dr. Sarver and Dr. Nath for advising our project, as well as DrExcel Health and our DrExcel Health Medical Student Team!

Prototype

Assembly:



Intended Use:

Case 1: When the device detects and displays a high particulate count, it alerts the family to administer preventative asthma treatments.

Case 2: If the patient experiences asthma symptoms, they will press the symptom occurrence button, which records the current particulate count, temperature, and humidity levels to be given to the patient's physician.

