Zephyrus Air Quality Monitor

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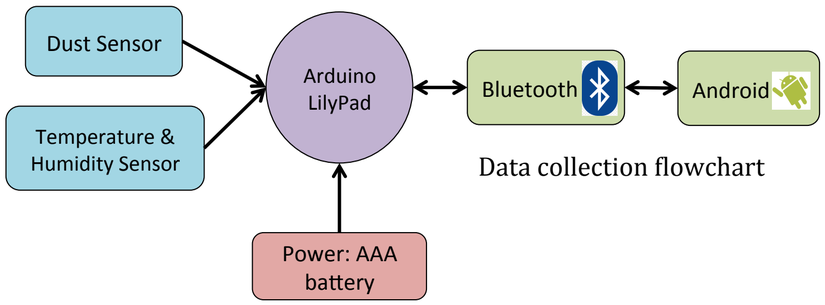
Website: http://zephyrustech.wix.com/home; **GitHub**: https://github.com/Duke-Medical-Instrumentation/Zephyrus

Asthma and Allergies

Asthma affects more than 25 million people in the US[1]. Rapid changes in temperature, humidity, and particulates can trigger asthmatic attacks[2]. Allergies are agitated by dust, mold, or pollen, and affect at least two out of ten Americans.

Objective

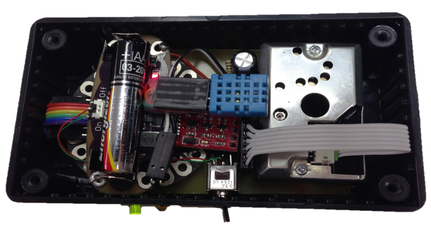
Zephy is a small, portable air quality monitor that provides real-time feedback of temperature, humidity, and dust density.



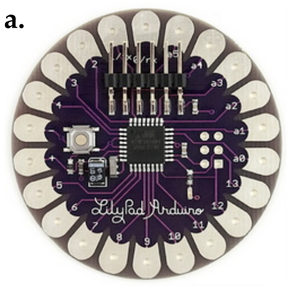
Data collection flowchart

Hardware Design

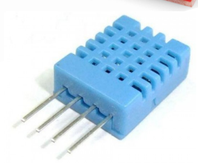
a. Arduino LilyPad microcontroller, chosen for its thin design and ability to power Bluetooth.
b. Bluetooth Mate Silver, allows for wireless data transmission between Android and Arduino LilyPad.
c. DHT11 temperature and humidity sensor, capable of measuring 20-90% Relative Humidity, 0-50°C, response time ranges from 6s to 30s.
d. Sharp GP2Y1010AU0F optical dust sensor, yields dust density readings in $\mu g/m^3$.



Arrangement of components inside Zephy

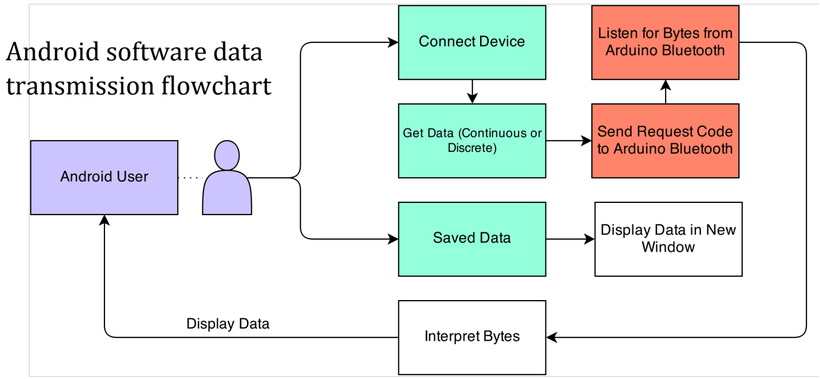
a.


b.


c.


d.


Software Design

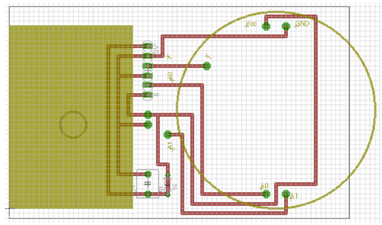


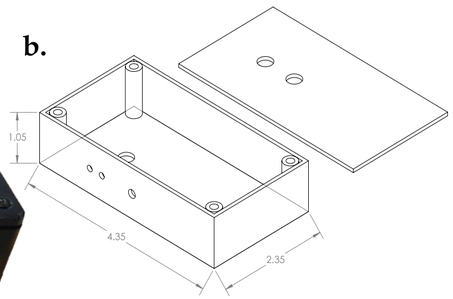
- An Android application displays data received over Bluetooth from Zephy.
- Through the GUI (*Figure 1*), the user can selectively acquire a single data point or customize continuous collection of data.
- The user can toggle data saving function as well as access and manage saved data.

Figure 1. Android Graphical User Interface (GUI)

Physical Design

- AAA battery, easily accessible to the user.
- A single-sided printed circuit board (PCB) connects sensors to the Arduino LilyPad.
- A lightweight, durable, and compact plastic box to house electronics.

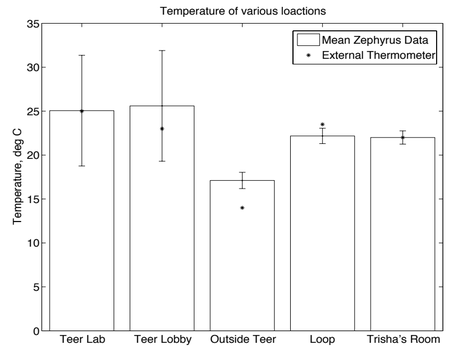
a.


b.


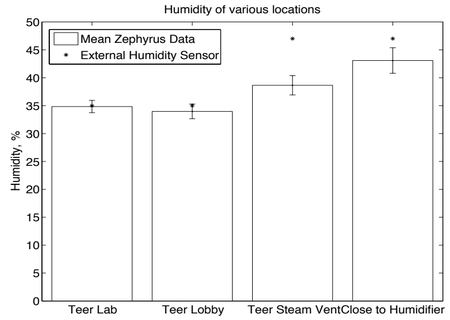
c.


a. Etched PCB, serves as the base for mounting all other electronics
b. Dimensions of Zephy **c.** Outside view of Zephy

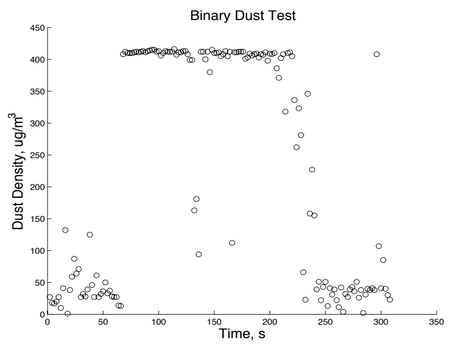
Results



Temperature data of Zephy compared to external glass thermometer. Paired t-test yielded a p-value of 0.3509 indicating no statistical difference between the mean temperatures.



Humidity data of Zephy compared to Oregon Scientific RGR126 humidity sensor. Paired t-test yielded a p-value of 0.1656 indicating no statistical difference between the mean humidity values.



A binary dust test to evaluate detection of particulate matter. Dust density of talc powder was agitated at 58s, which correlates with an increased dust density measurement.

Acknowledgements

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References

1. "What is Asthma?" *NHLBI.* NIH, 15 June 2012. Web. 18 Nov. 2013.
2. "Reduce Asthma Triggers." *Lung.org.* American Lung Association, n.d. Web. 18 Nov. 2013.