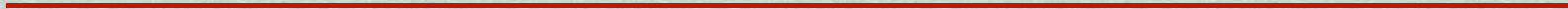



Continuous Monitoring of Asthma Control

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School of Medicine and Public Health
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Advisor: Professor Chris Brace, PhD
Department of Biomedical Engineering

Overview

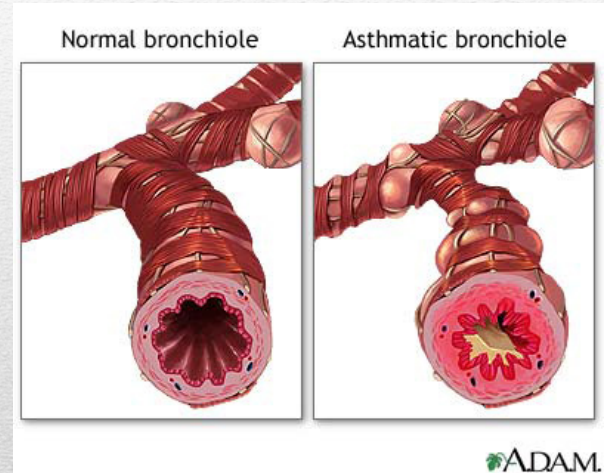
- Problem statement
 - Background material
 - Design specifications
 - Design features considered
 - Design matrix
 - Future work
 - References and acknowledgements
-

Problem Statement

- 26 million people, \$60 billion annually
 - Don't experience symptoms for two days
 - Normal lung function could take a month to return
 - Refining asthma shirt from last semester
 - Device will measure wheezing and coughing
 - Warn patient of incoming exacerbation
-

Background: Asthma

- Chronic disease where bronchioles constrict
- Inflammation and mucus build up
- Coughing, wheezing, shortness of breath, and chest tightness
- Anti-inflammatory drugs relieves symptoms
- Increase in overall Asthma patients around the world



Background: Target Patients

- Top 10% of asthmatics
 - More intense and more frequent symptoms
 - Extended recovery time/ tissue destruction
 - Account for large percent of medical costs
-

Design Specifications

- Focus on listening to lung sounds
 - Coughing, wheezing
 - Integrate into shirt
 - Less bulk
 - Weight less than 1 lb
 - Run and collect data for 4 hours
 - Test on asthma patients
 - Refine microphone system to reduce noise
-

Design Alternatives

Methods:

- Stethoscopes
- Spirometry/FEV1

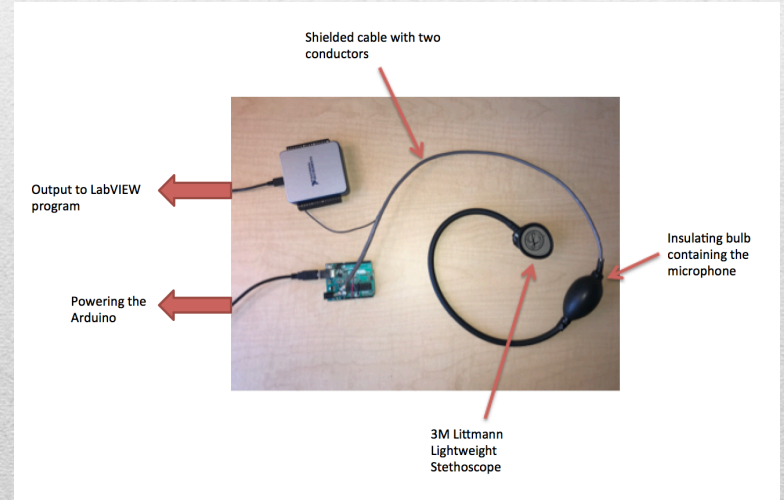
Limitations:

- Not continuous monitoring
- Generally used after symptoms are felt
- Usually done in hospitals/ clinics



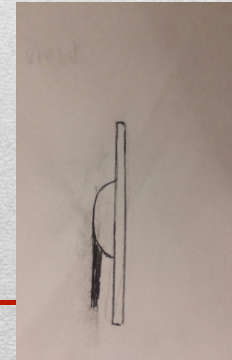
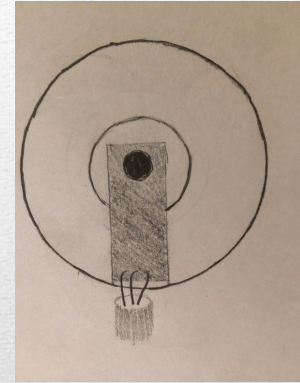
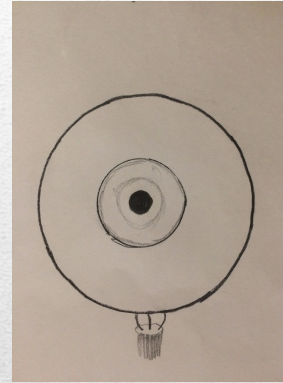
Stethoscope Design

- Continue use of stethoscope
- Move microphone closer to stethoscope head
 - Reduces noise
- Ensures receiving reliable data



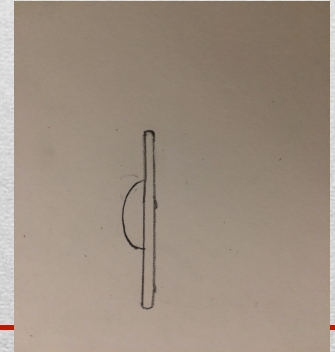
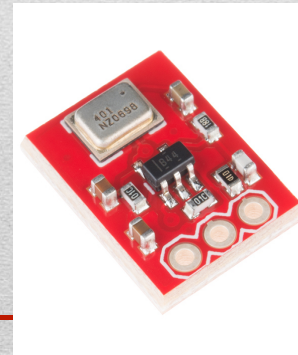
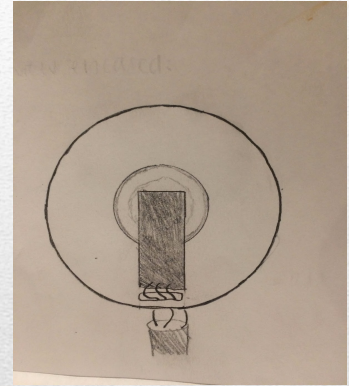
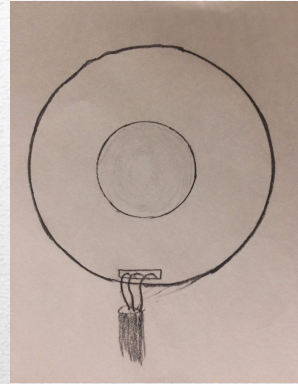
Diaphragm Microscope Design

- Diaphragm microphone
- Similar to stethoscope head
- Plastic circular disc
 - Lightweight
 - Customized
- Two conducting plates



Encased Microphone Design

- Use flush microphone
- Microphone encased within plastic circular disc
 - Previously used with code
 - Increased patient comfort



Design matrix

Design Criteria (weight)	Stethoscope		Diaphragm Microphone		Encased Microphone	
Patient comfort (25)	2/5	10	4/5	20	5/5	25
Effectiveness (20)	5/5	20	4/5	16	4/5	16
Ease of Use (20)	3/5	12	4/5	16	4/5	16
Cost (15)	3/5	9	5/5	15	5/5	15
Adjustability (10)	3/5	6	4/5	8	4/5	8
Safety (10)	4/5	8	3/5	6	4/5	8
Total		65		81		88

Future Work

- Building new microphone casing
 - Create thresholds for wheezing diagnosis
 - Incorporating into t-shirt
 - Resistor bands for respiratory rate
 - 24/7 application of device
 - Include Wireless monitoring
-

References & Acknowledgements

- S Holgate and R Polosa MD. (2006, Aug 26). The Mechanisms, Diagnosis, and Management of Severe Asthma in Adults [Online]. Available: <http://www.sciencedirect.com/science/article/pii/S014067360669288X>
 - American College of Allergy, Asthma, and Immunity (2014). Asthma Information Overview [Online]. Available: <http://acaai.org/asthma/about>
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Questions?
