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Sleep Apnea Therapy Device

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Outline

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Problem Statement

- Sleep Apnea
 - Sleep Disorder characterized by interference of breathing during sleep
 - Frequent waking often prevents those afflicted from reaching deep sleep
 - Increased health risk
- Design a variable dead space device to combat sleep apnea based on guidelines and research conducted by our client Dr. John Webster
- Develop an algorithm to detect sleep apnea



Background

- Sleep apnea
 - An inability to reach deep sleep caused by frequent interruptions in breathing (Young, et al, 2002)
 - Affects roughly 10% of the US population (Young, et al, 2013)
- 3 Primary types
 - OSA (Obstructive sleep apnea)
 - CSA (Central sleep apnea)
 - Combination (Morgenthal, et al, 2006)



Current Treatment

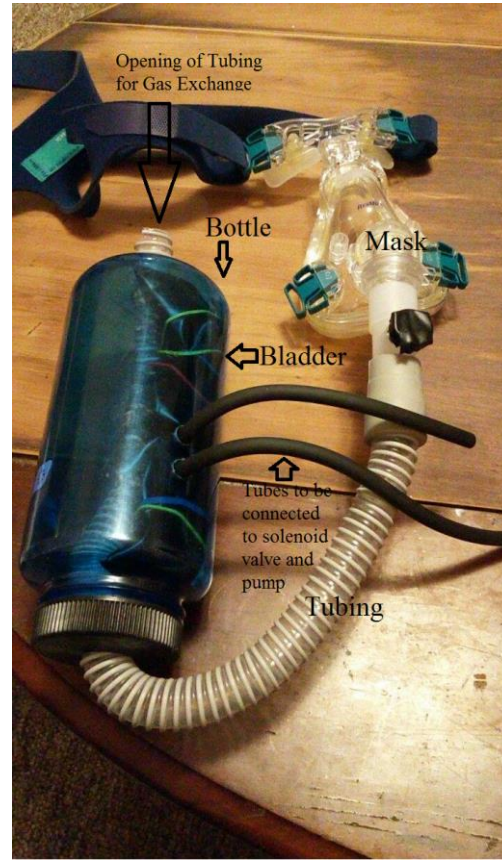
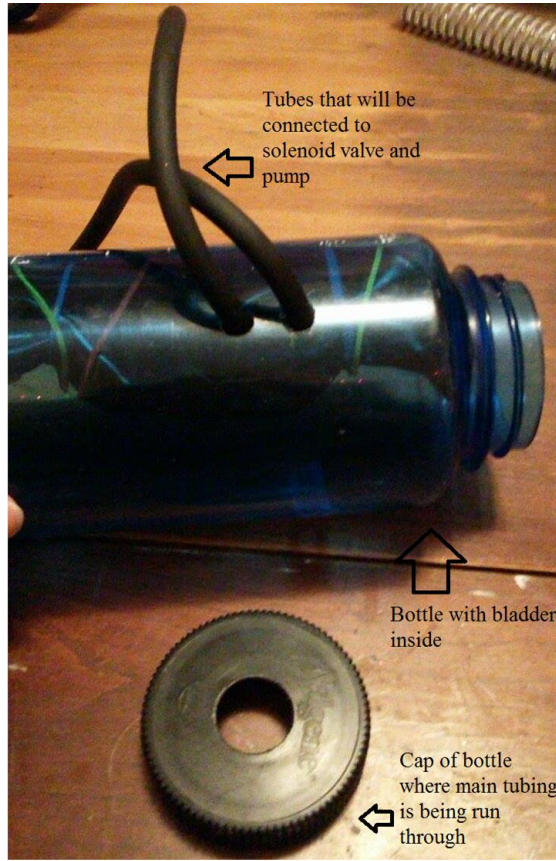
- Continuous Positive Airway Pressure (CPAP) Machine
 - Discomfort, dryness, congestion, and pain
 - Up to 50% user rejection rate (Catcheside 2010)
 - Causes complications such as nasal congestion, headaches, and continued tiredness



Product Design Specifications Summary

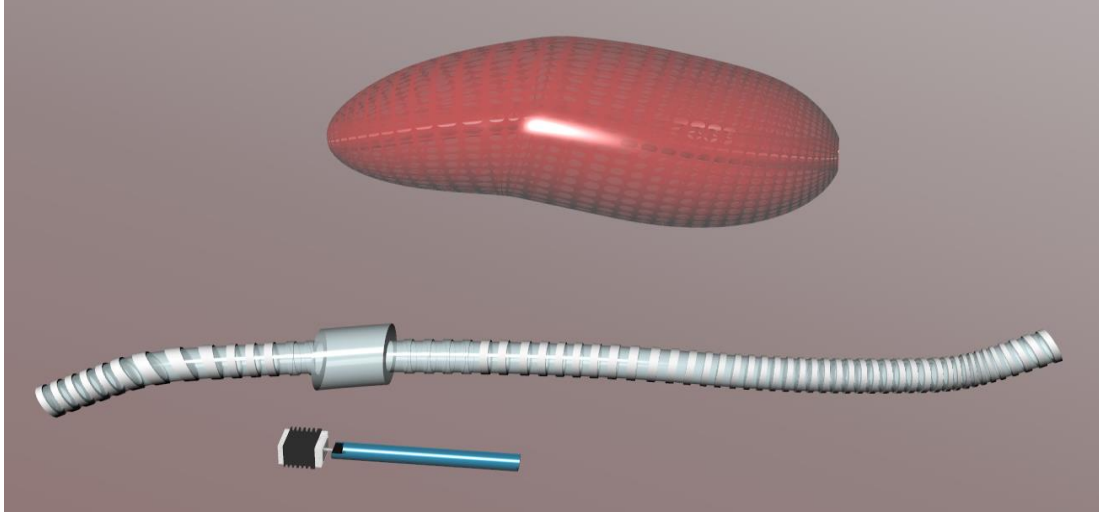
- Lightweight (under 1 kg)
- Compact (80mm diameter and 200mm length) and circular
- Comfortable application of mask to the face and device to the chest
- Battery Operated
- Durable (3-4 months for 8-10 hours per day)





Design Alternatives- Original Design

Design Alternatives

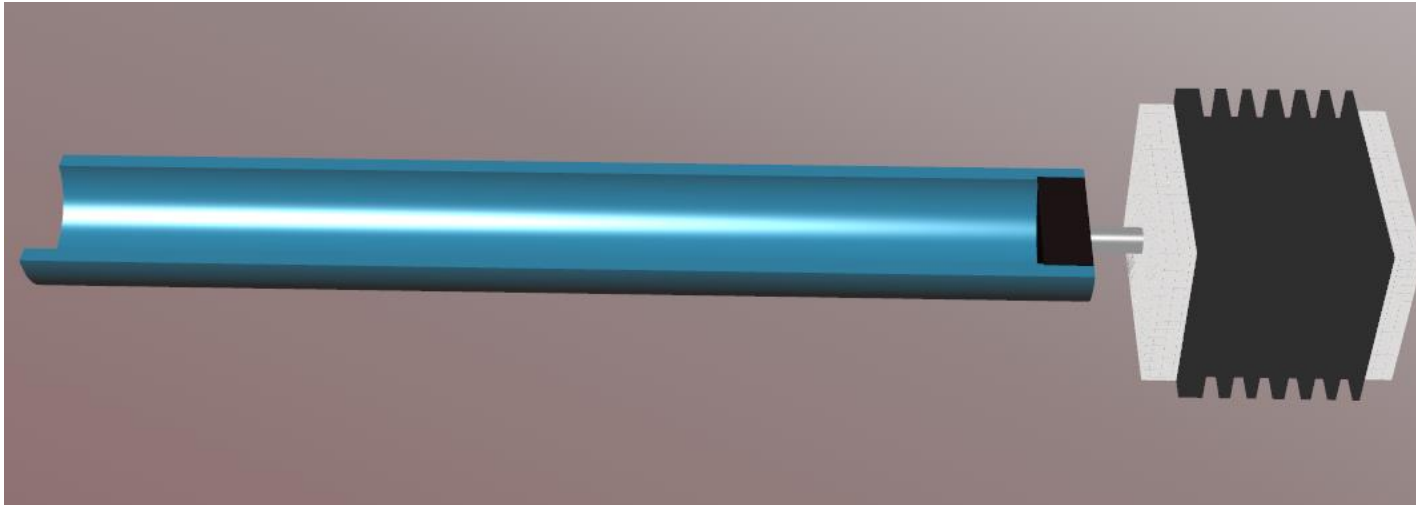


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Design Alternatives



Design Matrix

	Hard bodied with pump	Soft body with pump	Soft body with rotation
Brief Description	Professor Webster's original design	Original design modified to have a soft body container	Uses a mechanical motor vary dead space levels
Dead Space Variability (15)	(4/5) 12	(4/5) 12	(5/5) 15
Durability (15)	(5/5) 15	(5/5) 15	(5/5) 15
Ease of Fabrication (15)	(5/5) 15	(3/5) 9	(3/5) 9
Comfort (15)	(3/5) 9	(5/5) 15	(5/5) 15
Weight (15)	(4/5) 12	(5/5) 15	(5/5) 15
Safety(10)	(5/5) 10	(5/5) 10	(5/5) 10
Cost (10)	(5/5) 10	(5/5) 10	(5/5) 10
Power Consumption (5)	(5/5) 5	(4/5) 4	(4/5) 4
Total (100)	88	90	93



Future Work

- Fabricate new design (soft body with rotation)
 - Finish ordering parts and assembling
- Testing
 - Test machine for comfort and functionality
 - Test air flow and dead space variability
 - Take empirical data
 - Mass
 - Power Consumption
 - Dimensions



Acknowledgments

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Questions?



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