

# **Sleep Apnea Therapy Device – Progress Report #12**

**Client:** Dr. John Webster

**Advisor:** Dr. Megan McClean

**Team Members:** Calvin Hedberg, Taylor Karns, Jen Rich, Ben Mihelich

**Date:** April 14th – April 20<sup>th</sup>, 2017

## **Problem Statement**

Clinically significant sleep apnea is a sleep disorder characterized by interference of breathing during sleep. Those who suffer from sleep apnea experience interrupted sleep which develops an increased risk of heart attack, high-blood pressure, arrhythmia, stroke, and diabetes. Continuous Positive Airway Pressure (CPAP) machines are the current standard for treatment. However, approximately half of all patients suffering from sleep apnea do not adhere to it well due to complications such as nasal congestion, headaches, and continued tiredness. Continuous dead space rebreathing is an alternative that has been researched and shown to stabilize central respiratory output in patients with mild to severe obstructive sleep apnea without the complications of CPAP. Thus, our team has been assigned the task of designing and fabricating a variable dead space device based on guidelines and research conducted by our client Dr. John Webster. This includes developing an algorithm such that the device can detect sleep apnea and consequently regulate the amount of dead space for proper respiration.

## **Last Week's Goals**

- Assemble Prototype
- Begin Testing
- Work on Final Report

## **Summary of Team Role Accomplishments**

- Calvin (Leader) - filled out the week's progress report
- Taylor (Communicator & BPAG) – n/a
- Jen (BWIG) – updated the team website
- Ben (BSAC) – prepared for BSAC meeting April 21<sup>st</sup>

## **Summary of Design Accomplishments**

The final prototype is now assembled and the final device circuit constructed. The circuit has been made completely detachable from the device for ease of storage and testing. The motor is embedded in the inner tubing of the device within the expanded dead space reservoir while the flow sensor is located within the outer adaptor piece at the proximal end of the reservoir. Both have wires that extend from them that must be plugged in to the external circuit to have the device function.

Comfort testing will be under way throughout the weekend. This is simply a test of comfort between wearing the mask and being able to breathe through the device with all of the components in place. This type of testing is passive as the device will not be connected to the circuit. Active testing of the device will also be conducted on our individual group to test the effectiveness of the circuit operating the motor and slide. This will be done under observation of the group as well as with a few members attempting to sleep with the device. Calibration of the slide will have to be done before this step. Additional testing includes massing the device and testing for air flow through the individual slits to observe how much air is diverted into the dead space reservoir based on the degree the slide is open.

Once our device is properly calibrated and initial tests are complete, our client is free to test our device. Dr. Webster has expressed interest in the past of testing the device and may do so by next week if all goes well.

## **This Week's Goals**

- Active and Passive Device testing
- Additional testing
- Work on poster and final report

## **Difficulties with Project**

Fabrication was difficult to complete as many minor issues arose. Extra time was required to finish the prototype than was expected. Additional problems in construction may arise.

## Activities

Date	Person(s)	Task	Time (hrs)	Semester Total
	Calvin			10.0
	Taylor			3.5
4/19/2017	Jen	Fabrication of Prototype	2.0	6.0
4/19/2017	Ben	Fabrication of Prototype	2.0	15.5
4/19/2017	Team	Fabrication and circuit building	2.0	17

## Project Schedule

Task	January		February				March				April				May		
	19	29	2	9	16	23	2	9	16	23	30	6	13	20	27	4	11
<b>Project R&amp;D</b>																	
Research	X	X	X	X			X										
Brainstorming			X	X	X	X		X									
Prototyping							X	X	X			X	X	X			
Testing								X			X	X	X	X			
Cost Estimation											X	X					
<b>Deliverables</b>																	
Progress Reports	X	X	X	X	X	X	X	X	X		X	X	X	X			
PDS		X															
Mid-Semester					X	X											
Final														X			
<b>Meetings</b>																	
Client		X		X									X				
Advisor	X	X	X	X	X	X	X	X	X		X	X	X	X			
Team	X	X		X	X	X	X				X		X	X			
<b>Website</b>																	
Update	X	X	X	X	X	X	X	X	X		X	X	X	X			

Filled boxes = projected timeline  
X = task was worked on or completed

## Expenses

Part	Cost	Supplier
Body – Tupperware water bottle	17.51	Tupperware
5V Stepper Motor and Driver	13.04	Amazon.com
1" PVC and 2 x 1" PVC Adaptor	2.91	Home Depot
<b>Total</b>	<b>33.46</b>	