Sleep Apnea Therapy Device – Progress Report #2

Client: Dr. John Webster
Advisor: Dr. Megan McClean
Team Members: Calvin Hedberg, Taylor Karns, Jen Rich, Ben Mihelich
Date: Jan 27th – Feb 2nd, 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

- Schedule our second team meeting to begin design brainstorming
- Meet with our advisor Friday at 1:30pm
- Meet with our client to reaffirm specifications and expectations

Summary of Team Role Accomplishments

- Calvin (Leader) - filled out the week's progress report
- Taylor (Communicator & BPAG) – contacted client via email for project supporting documents
- Jen (BWIG) – updated the team website
- Ben (BSAC) – attended BSAC meeting on Jan. 27th

Summary of Design Accomplishments

Individual research was done by each member to gain more background knowledge for the upcoming meeting in which we will determine our proposed designs. This research involved many documents that were sent to us by our client detailing all of the prior and ongoing work surrounding this project. Research was also done on existing and competing designs to gain new ideas for how to rework and complete our current prototype.

The first advisor meeting and client meetings took place this week giving the project a sense of improved direction. The advisor meeting on the 27th of January opened the door to such inquiries as patents, budget and plans for testing. The meeting with client on Sunday (1/29/2017) answered and expanded upon these topics. It is now known that a patent is already in the process of being approved and that our budget has been expanded from last semester. This leaves the main focus on testing. Designing tests to push the limits of our device as well as showcasing the requested specifications is the ultimate goal.

A meeting with the 2016 Fall advisor, Professor Rogers, was conducted on Wednesday (2/1/2017). This meeting offered feedback and criticism on the project as a whole from last semester. A short report in with Mehdi Shokoueinejad followed this meeting. From these meetings new design ideas where formed. Namely, creating an integrated circuit board from either Eagle or Altium and modifying the algorithm to detect apnea based on a percentage of normal tidal volume versus a simple threshold. These design ideas each warrant additional research and looking into.

This Week's Goals

- Meet on Sunday (2/5/2017) to brainstorm designs
- Create a design matrix from proposed designs
- Create a circuit on Altium or Eagle based on proposed designs

Difficulties with Project

The engineering career fair caused our second team meeting to be canceled which has slowed our progress. Independent work has been accomplished but designs and brainstorming have yet to come together in a team setting.

Activities

Date	Person(s)	Task	Time (hrs)	Semester Total
2/1/2017	Calvin	Meeting Prof. Rogers (Fall advisor) and Mehdi Shokoueinejad Researched Circuit Designer services	1.5	1.5
1/31/2017	Taylor	Researched existing sleep apnea treatments/machines	1.5	1.5
1/30/2017	Jen	Read project associated documents from client	1	1
1/31/2017	Ben	Read project associated documents from client	1	1
	Team			1.5

Project Schedule

Task	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Design Ideas												
Research	X	X										
Fabrication												
Client Meeting		X										
Advisor Meeting	X	X										
Team Meeting	X											
Testing												
Analysis												
Mid-semester Report												
Final Report												
Poster												

X = action completed/worked on

Expenses

None