

## Continuous Monitoring of Asthma Control Progress Report 11

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**Date:** Friday, April 7th - Thursday, April 13th

### Problem Statement

Asthma patients often do not experience the the symptoms of asthma exacerbations, such as coughing, wheezing, and increased respiratory rate, for up to 2 days after it has begun. In severe asthma patients, where the exacerbations are more frequent, prolonged detection can lead to more serious symptoms, longer recovery times, and extended tissues destruction. These severe asthma patients only account for 5-10% of all asthmatics, but they account for a disproportionate amount of health-care costs, hospital admissions, doctor visits, and emergency services. By creating a device that can detect the symptoms of an asthma exacerbation earlier, the patients could be more promptly notified to start their asthma action plan (AAP). This could potentially save significant amounts of time, money and resources while also reducing the effects of the exacerbation.

### Restatement of Previous Team Goals

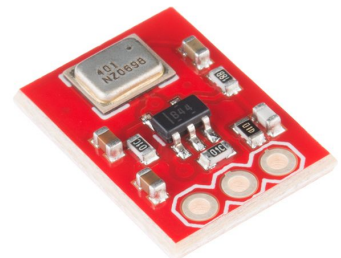
- Download labVIEW on a team members computer and begin preliminary testing.
- Download labVIEW on IRB laptop and confirm that the software runs correctly.
- Create chest strap and attach microphone casings.

### Summary of Team Role Accomplishments

- Luke (BSAC) - No BSAC updates to report.
- Tim (Leader/ Communicator)- Worked on/ submitted the progress report.
- Kelsey (BWIG/ BPAG)- Uploaded progress report to website.  
Ordered chest strap.

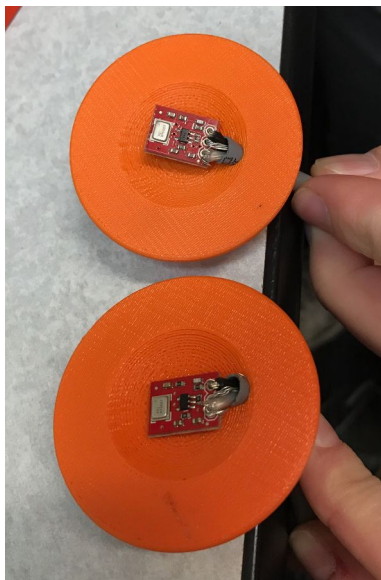
### Summary of Design Accomplishments

The team decided on an encased microphone design. First, it will feature a 3D printed casing in order to make the design slimmer/more ergonomic. In addition, the microphone be completely enclose in the new casing. The reduced bulk will increase patient comfort and enable the device to be more easily integrated into a shirt. The team will use the same microphone as last semester: Sparkfun MEMS Microphone Breakout-INMP401 (ADMP401). The idea behind this is that we know that microphone has worked well and it should be compatible with our code written last semester.



The team decided to use a two conductor shielded cable with drain wire (Digi-Key C2534-50-ND). This will allow one conductor for the audio signal, one conductor for the voltage supply, and the drain wire to be connected to ground. The team began to assemble and test the prototype today and will continue working on it later tonight.

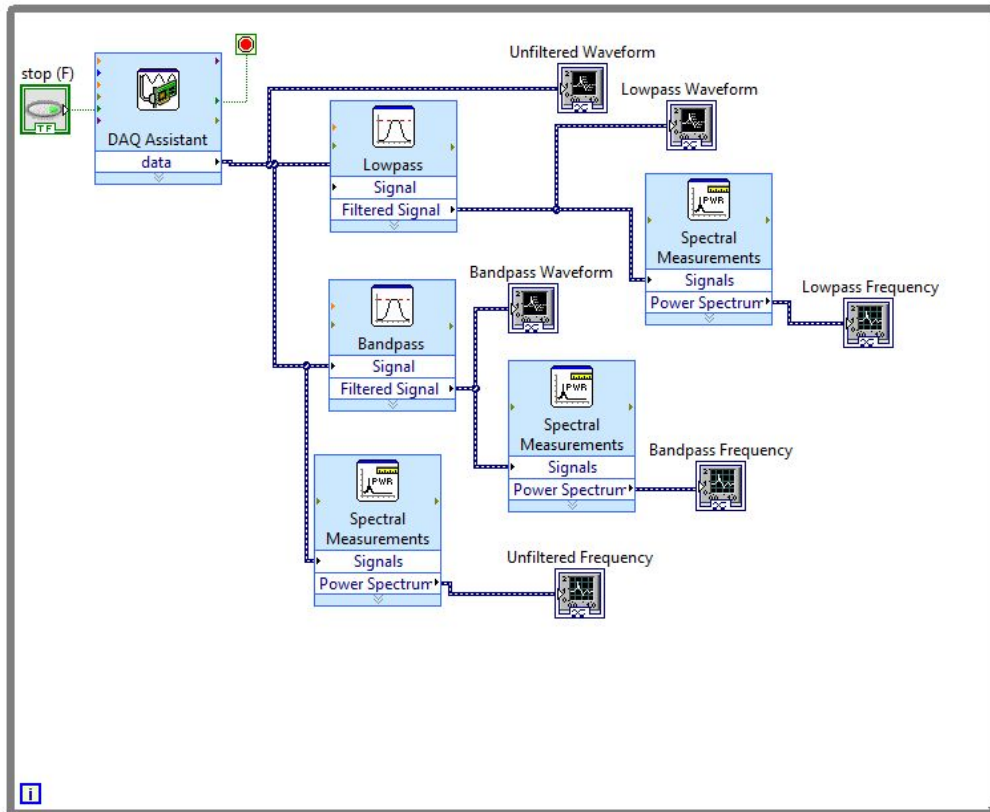
Below are images of the final prototype. We fed the cable through the hole in the casing. Once through we soldered the cable to the microphone. The black cable was attached to audio input, the white cable to the VCC power supply, and the drain wire was attached to the ground.



The team decided to integrate the microphones into a band that can be adjusted. This allows the device to fit a wide range of patients while eliminating the need for multiple shirts of different sizes. The cloth for the band will ship tomorrow, and the team will assemble the microphones into the band over the weekend. We will add a metal ring and velcro so that the band can be secure while also being easily adjustable.

This week we were able to begin testing. We set up an old, non-CAE computer so that we could download the necessary files. The NI-DAQmx software did not work with the 2010 version of LabVIEW that was previously on the computer. We downloaded the 2015 version of LabVIEW and the NI-DAQmx 16.0 instead. This will also help with compatibility since the laptop used for patient testing also has the 2015 version of LabVIEW.

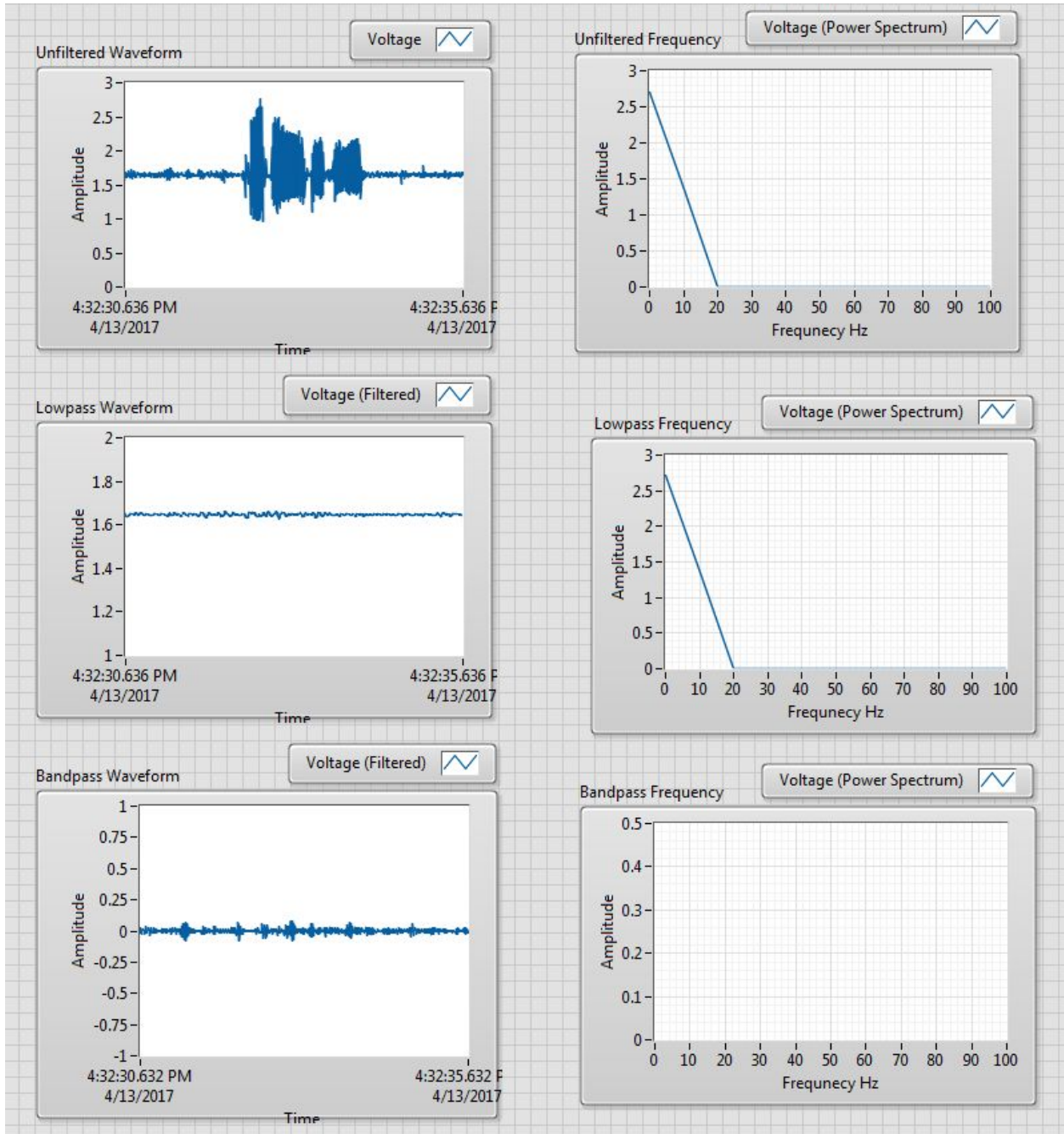
To begin testing, the team built a LabVIEW program that was almost identical to the program used for testing last semester (shown below). This features 3 waveform graph to plot the input voltage over time and 3 waveform charts to plot the frequency in real time. We applied a 10Hz lowpass filter on 2 of the signals, a 20-40Hz bandpass filter of another 2 signals, and left 2 of the signals unfiltered.



Block Diagram LabVIEW code

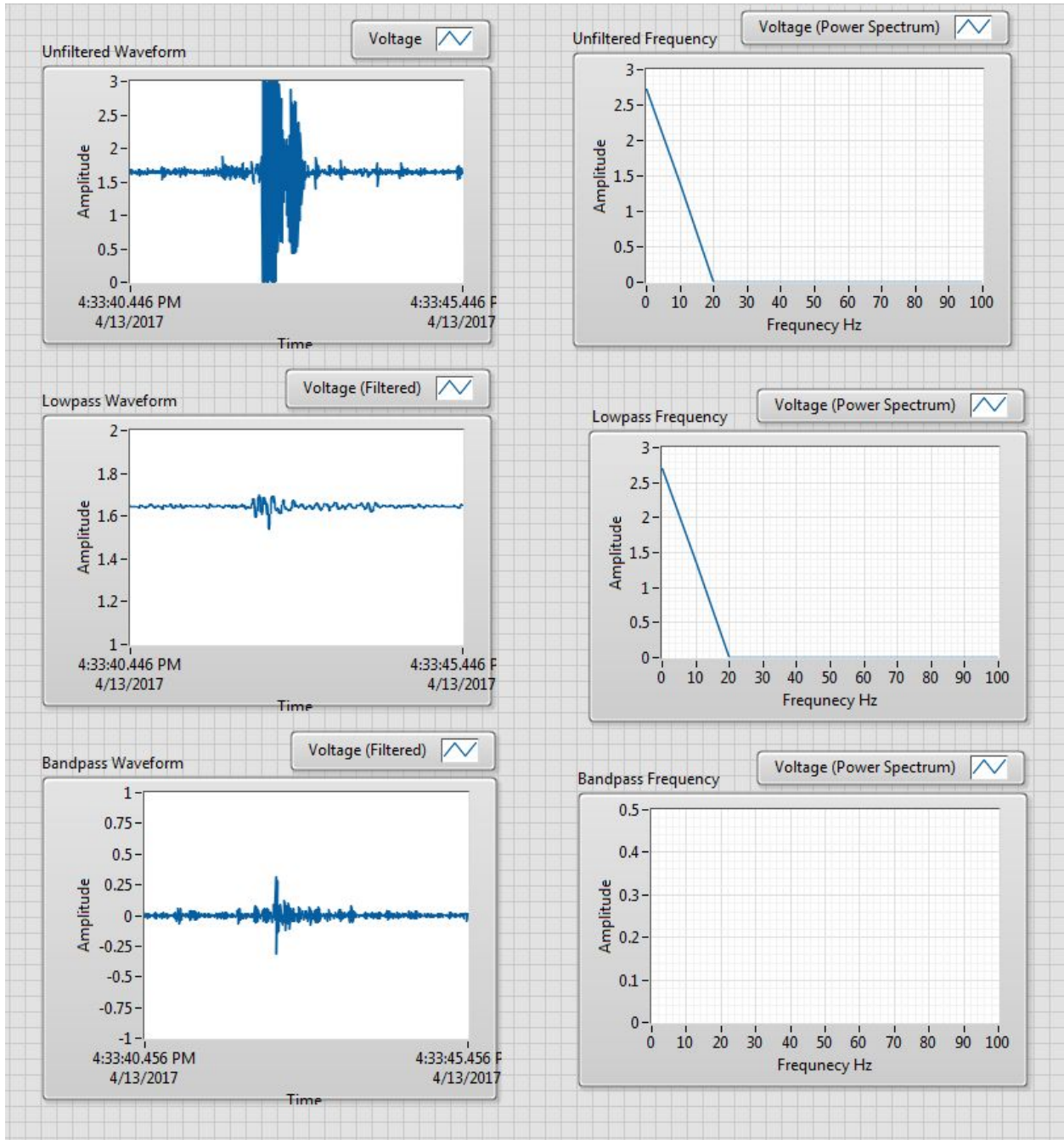
For initial testing, we only used a single microphone, placing it near the middle of the subject's back. In order to determine how well the device isolated coughing and wheezing, we first tested whether the microphone would pick up ambient noise from the room or talking from the subject. We then had the subject cough to see if that signal was correctly isolated.

The images below show the front panel from the LabVIEW software during testing. The first one shows the output while the patient was talking. The lowpass and the bandpass filters both nearly blocked out the entire signal when compared to the unfiltered data. The second image shows the outputs while the subject was coughing. This signal was picked up by both of the filtered outputs. This shows that the software was able to detect coughs while accurately blocking out other noise.



Output of talking





Output of coughing

### Activities

Date	Member	Task	Time (hrs)	Week Total	Sem Total
4/9	All	Worked on Executive Summary	1	1	
4/11	Tim,	Set up equipment for testing	1	2	



Preliminary Report/Notebooks					X										
Final Presentation															
Final Report/Notebook/Evals															
<b>Team Goals</b>															
Select 3 final design ideas				X											
Design Matrix				X											
Presentation Powerpoint					X										
Decide on final design						X									
Presentation poster															
<b>Meetings</b>															
Team	X		X	X	X	X	X			X	X	X			
Advisor	X	X	X	X	X	X	X				X	X			
Client	X					X					X				
<b>Website</b>															
Update info	X	X	X	X	X	X	X	X		X	X	X			

**Expenses**

Date	Item	Cost
3/8/17	Digi-Key 2 conductor Shielded Cables with drain wire (C2534-50-ND)	\$41.64
3/16/17	Microphone casings	\$9.51
4/11/17	6" Cotton Elastic Bandage	\$13.95