Title: Signal Processing and Fitting Method for Non-invasive Breathing Monitor

Invention: This non-invasive electronic device is worn on the body while monitoring vagus nerve activity in order to observe and obtain data about breathing patterns. The software filters and conditions the raw data by using a Fast Fourier Transform (FFT). The software proceeds to apply an error-reducing algorithm which finds the best fit for the conditioned data and transmits the final data set to a separate Bluetooth device for further analysis. This method converts the noisy, raw signal into a smooth, sinusoidal waveform in addition to adjusting for error such that the data accurately represents the time between breaths. The product can be used by health care practitioners, at-home users, athletes, and others generally interested in obtaining non-invasive information about their respiratory system.

Background: The American Psychological Association reports in its Stress in America™ survey that Americans consistently experience a level of stress that they believe is unhealthy. It is reported that six in ten Americans have attempted to reduce their stress level over the years 2007-2012. Wearable biosensors that provide consumers with their own health information are relatively new devices in this industry. The rapid increase of smart phone usage continues to drive growth in the market, innovating new ways that these devices can be used today.

Applications:

- Wearable devices
- Real-time processing and conditioning of noisy signal with minimized error for transmitting to remote device
- Accurately monitoring vagal tones in order to determine the best breathing exercises
- Up-and-coming technology that receives an analog signal that may be susceptible to undesirable noise
• Patient monitoring in hospitals and in the home (babies, children, adults, seniors)
• Athletic performance monitoring
• Biometric monitoring of humans in outer space and/or underwater
• General health care practitioners

**Advantages:**

• Provides reliable and accurate data set that is adaptable to a variety of sensors and easily configurable to suit user preferences
• Elegant solution to eliminating noise in a system
• Promotes relaxation to minimize stress and further to improve health conditions
• Non-invasive, continuous monitoring

**Related Publications:**

• 2015 IOT Developers Conference (submitted conference abstract on 02/02/2015)
• 12th Body Sensor Networks Conf. 2015 (submitted 6-page conference proceeding by 03/14/2015)

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