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Wearable Respiratory Behavior Monitor & App

According to the World Health Organization, there are hundreds of millions of people suffering from chronic respiratory diseases (CRDs), including asthma, COPD, sleep apnea, pulmonary hypertension and more. Measuring and characterizing lung functionality is an essential step toward diagnosing, monitoring and treating these respiratory conditions. The current gold standard for characterizing respiratory behavior is spirometry, which requires the use of a bulky, expensive, and complicated machine known as a spirometer. In addition to requiring a trained provider to operate, spirometers are incapable of continuous monitoring of respiratory behavior, which is critical for assessing CRDs.

Researchers at Arizona State University have developed a wireless wearable sensor capable of continuous monitoring of respiratory behavior. The sensor consists of three subsystems, an ultrasound emitter, an ultrasound receiver and a data acquisition and wireless transmitter. It has a 40x35x6 mm3 footprint and weighs a mere 6.5g, which includes a 2.7g battery. Clinically relevant respiratory information, obtained by the sensor, is sent to a portable device, such as a smartphone for ease and convenience of the wearer. A custom designed app then generates volume-time and flow rate-volume loop graphs, which are standard respiratory analysis plots. The sensor was tested with volunteers and demonstrated reasonable performance even with possible user-induced error regarding sensor placement and temperature sensitivity. Data from the volunteers showed the mean deviation of FEV1/FVC ratios in the range of 0.00-4.25% when benchmarked by the spirometer.

The ability of this sensor to continuously measure respiratory parameters and provide clinically relevant information via a convenient user interface demonstrates a new tool for CRD monitoring and proper treatment or medical intervention.

Potential Applications

- Respiratory behavior sensing
  - Diagnosing and monitoring CRDs, particularly asthma
  - Military – monitoring soldier health/performance
  - Law enforcement – monitoring officer health/performance

- Sports – monitoring athlete health/performance
- Infant monitoring

Benefits and Advantages

- Compact – 40x35x6 mm3 footprint, 6.5g weight
- Easy application and use - the device allows for possible user error
- Compatible with portable devices – transmits and interprets data into standard plots
- Low cost
- Capable of continuous monitoring unlike current technology
- Direct conversion and recording of relevant data
- Can be used on wide range of patients, particularly children
- Mean deviation of FEV1/FVC ratios in the range of 0.00-4.25%

For more information about this opportunity, please see

Chen et al - ACS Sens - 2019

For more information about the inventor(s) and their research, please see

Dr. Chae's laboratory webpage