

High-Precision Microphone for Body-Worn Devices

A high-precision and high-bandwidth accelerometer contact microphone (ACM) for body-worn auscultation devices

Researchers at Georgia Tech have developed a low noise, high bandwidth micro-gravity accelerometer that is used as a “contact microphone” in body-worn auscultation devices. This microchip is mounted on the chest to non-invasively record sounds produced in the thoracic cavity. It is only sensitive to vibrations from its contact surface and does not pick up airborne acoustic emissions. The recorded signals are filtered and processed to extract the heart sounds and ballistocardiogram (BCG) signals from the recorded data. Likewise, lung sounds and chest wall motion are extracted using data processing techniques that demonstrate the possibility of accurately capturing multiple types of acoustic and vibrational data from the body at the same time. A three-axis micro-gravity accelerometer can also be implemented in a single chip, which enables accurate monitoring of body motion in all three axes while recording acoustic sounds from inside the body. By using these microdevices in an array configuration, physicians can accurately localize the source of abnormal sound within the body for improved diagnosis.

Summary Bullets

- Wearable small form-factor (micro-chip technology)
- Increased sensitivity (micro-gravity sensitivity)
- Large bandwidth (DC to 10kHz) and wide dynamic range (120dB)

Solution Advantages

- Wearable small form-factor (micro-chip technology)
- Increased sensitivity (micro-gravity sensitivity)
- Large bandwidth (DC to 10kHz) and wide dynamic range (120dB)
- Low power

Potential Commercial Applications

- Wearable technologies
- Patient monitoring devices (cardiopulmonary conditions)
- Structural condition monitoring

Background and More Information

Cardiovascular and cardiopulmonary diseases are some of the leading causes of mortality globally. The interdependency of ones cardiac and pulmonary health makes continuous monitoring of cardiopulmonary parameters critical for accurate and timely diagnosis of associated illnesses. As such, there is a growing demand for high performance auscultation devices due to their ability to augment traditional clinical equipment and allow, for example, the opportunity for physicians to remotely diagnose and track patient health post-treatment. Typical electronic auscultation devices are limited by their size, susceptibility to environmental noise, and insufficient acoustic energy transfer. Therefore, there is a need to address these challenges by designing a miniature and more robust sensor that can be implemented in the form of a wearable auscultation device.

Inventors

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IP Status

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Publications

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