Flexible piezoelectric acoustic sensors for speaker recognition

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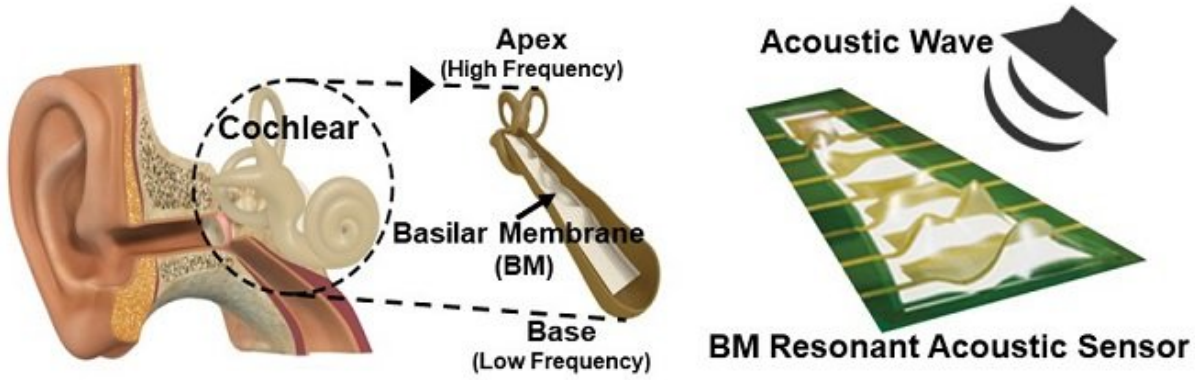

A flexible piezoelectric acoustic sensor mimicking the human cochlear. Credit: KAIST

A KAIST research team led by Professor Keon Jae Lee from the Department of Material Science and Engineering has developed a machine learning-based acoustic sensor for speaker recognition.

Acoustic sensors were spotlighted as among the most intuitive bilateral communication devices between humans and machines. However, conventional acoustic sensors use a condenser-type device for measuring capacitance between two conducting layers, resulting in low sensitivity, short recognition distance and low speaker recognition rates.

The team fabricated a flexible piezoelectric membrane by mimicking the basilar membrane in the human cochlear. Resonant frequencies vibrate corresponding regions of the trapezoidal piezoelectric membrane, which converts voice to electrical signal with a highly sensitive self-powered acoustic sensor.

This multi-channel piezoelectric acoustic sensor exhibits sensitivity more than two times higher and allows for more abundant voice information compared to conventional acoustic sensors, which can detect minute sounds from farther distances. In addition, the acoustic sensor can achieve a 97.5 percent speaker recognition rate using a machine learning algorithm, reducing by 75 percent error rate than the reference microphone.

AI speaker recognition is the next big thing for future individual customized services. However, conventional technology attempts to improve recognition rates by using software upgrades, resulting in limited speaker recognition rates. The team enhanced the speaker recognition system by replacing the existing hardware with an innovative flexible piezoelectric acoustic sensor. Further software improvement of the piezoelectric acoustic sensor will significantly increase the speaker and voice recognition rate in diverse environments.

Professor Lee said, "Highly sensitive self-powered acoustic sensors for speaker recognition can be used for personalized voice services such as smart home appliances, AI secretaries, always-on IoT, biometric authentication, and FinTech."

More information: Jae Hyun Han et al, Basilar membrane-inspired self-powered acoustic sensor enabled by highly sensitive multi tunable frequency band, *Nano Energy* (2018). DOI: 10.1016/j.nanoen.2018.08.053