PIEZOELECTRIC METAMATERIAL ARRAYS FOR DIRECTIONAL ACOUSTIC SENSING

Tech ID: 34640 / UC Case 2026-115-0

PATENT STATUS

Patent Pending

BRIEF DESCRIPTION

Determining the exact direction of a sound source typically requires large microphone arrays and significant computational power. Researchers at UC Berkeley have developed an intelligent acousto-electrical metamaterial system that simplifies this process. The technology utilizes a specialized acoustic transducer divided into multiple interconnected sections. Each section contains a unique arrangement of piezoelectric metamaterials designed to generate specific electric signals when stimulated by sound waves. Crucially, these sections possess distinct acoustic beam patterns—geometric sensitivities to sound—that allow the system to differentiate between incoming angles. Because the sections are in physical contact, they work in tandem to provide highly accurate "direction of arrival" (DOA) data within a compact, hardware-efficient form factor.

SUGGESTED USES

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Autonomous Vehicle Navigation: Enhancing the ability of self-driving cars or drones to localize emergency sirens or mechanical noises in noisy environments.

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Smart Home Devices: Improving voice command recognition by accurately pinpointing the user's location while filtering out background interference.

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Industrial Monitoring: Detecting and localizing specific acoustic signatures of failing machinery in factories to enable predictive maintenance.

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Underwater Acoustics: Implementing compact, high-sensitivity directional sensors for oceanic research or maritime navigation.

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Security and Surveillance: Providing localized sound detection for glass-break sensors or gunshot detection systems in urban settings.

ADVANTAGES

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Compact Footprint: Achieves high directional sensitivity without the need for the wide physical spacing required by traditional microphone arrays.

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INVENTORS

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OTHER INFORMATION

CATEGORIZED AS

» **Computer**

» Hardware

» **Engineering**

» Engineering

» **Sensors & Instrumentation**

» Physical Measurement

» Scientific/Research

RELATED CASES

2026-115-0

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Reduced Computational Load: The directional intelligence is "hard-coded" into the physical metamaterial patterns, reducing the need for complex digital signal processing.

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High Sensitivity: Leverages piezoelectric properties to convert subtle acoustic vibrations directly into measurable electrical signals with high fidelity.

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Passive Sensing Potential: The use of metamaterials can be optimized for low-power or self-powered sensing applications in remote locations.

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Robust Integration: The multi-sectional, contact-based design allows for a durable and scalable manufacturing process for various sensor shapes.

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Inverse Designing Metamaterials With Programmable Nonlinear Functional Responses
- 3D Printing High-Performance Piezoelectric Materials With Extreme Properties
- Large Area, High Resolution Projection Lithography System With Moving Optics
- Method To Inverse Design Mechanical Behaviors Using Artificial Intelligence

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