ETH zürich

Licensing Opportunity

Zero-power event detection for waking up smart devices

mechanical neural network Si / SiO₂ based

three

four

10 µm
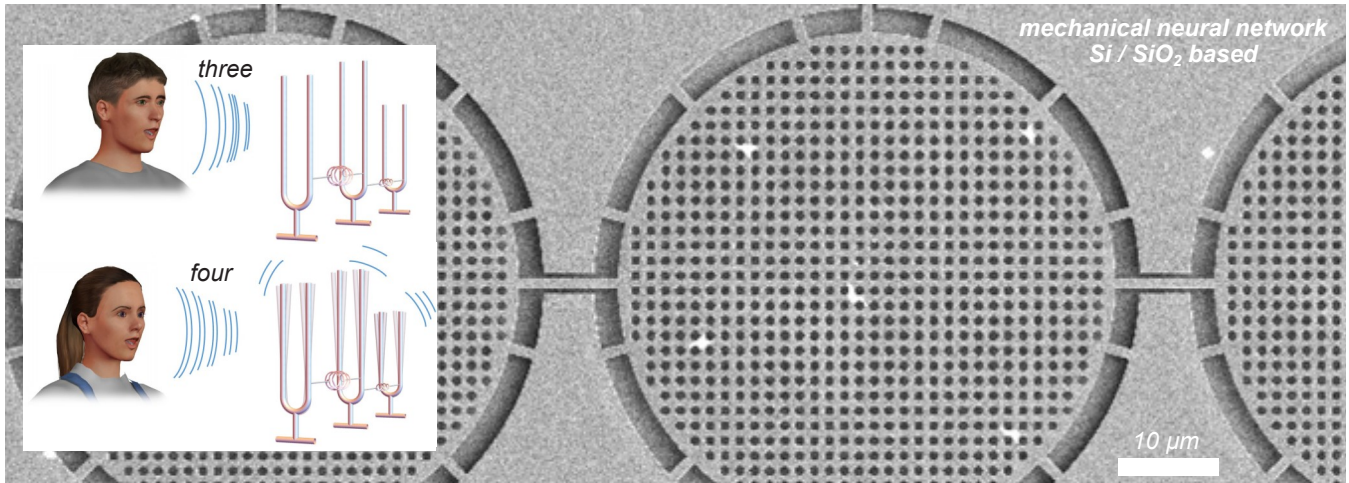
Application

This zero-power sensor transforms vibrations into electric signals. It activates smart devices which have been switched off completely using the energy of the trigger event. Smart devices with zero-power sensors, thus, save energy in their dormant state while remaining ready for relevant triggers. Examples comprise: Voice activated cell phones, vibration triggered monitoring devices in buildings, vehicles, or step counters. The application also extends to devices in remote, inaccessible locations like space or radioactive zones, where recharging devices is challenging.

Features & Benefits

- sensor selects relevant events by mechanical computing
- sensor fabrication process is robust and easily adaptable to new designs
- production scales to industrial quantities

Patent pending

Background

Smart devices such as step counters or pacemakers detect a trigger event by converting the stimulus into an electrical signal, which is processed and analysed by a computer to determine whether a particular event takes place. The detection task consumes power even in stand-by mode, thus reducing battery life or requiring access to a power grid.

Invention

A mechanical neural network passively detects a specific event with zero standby power consumption. The invention consists of a mechanical network of vibrating elements, where individual elements and their coupling mechanisms are designed to make the system respond to a highly-specific event such as individual spoken words. The response is triggered by the power of the input stimulus and, thus, consumes no energy as long as no event takes place. Once an event is detected, the response uses the input energy to feed an electric circuit.

Instead of simply filtering out ambient noises, the invention focuses on zero-power detection and passive information processing of complex events. For example, a mechanical neural network consisting of 81 elements is capable of distinguishing between individual wake-up words, like "three" and "four" (see fig.).

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Technology Readiness Level

1 2 3 **4** 5 6 7 8 9