## 5.14 TASK 14
## Passive Vibration Sensor
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## Task 14 Technical Requirements

**Project Summary**

A project for collaboration with the UCSD and the Engineering Institute is proposed that develops a passive vibration sensor. The sensor is passive in that it does not require power to operate; it generates it own power. The passive vibration sensor envisioned uses an array of harmonic oscillators to measure vibrations of the environment. Each harmonic oscillator would essentially be an energy harvester tuned to a specific frequency range. More vibration energy around the natural frequency of a harmonic oscillator would generate more electrical energy from that oscillator. Sampling the electrical output of each harmonic oscillator would provide amplitude versus time information for a number of frequency ranges while simultaneously powering low-power electronics required to sample, for example, a clock. The bandwidth of each harmonic oscillator and the number of harmonic oscillators will depend on the application. Piezoelectric materials are envisioned to be the transducer of vibration to voltage, but may not necessarily the best option. There are a large number of issues that must be resolved, but they are highly dependent on the application of interest, which will come more into play in the second year. (This sensor is intended for applications where the quality of the vibration data is less restrictive and thus an accelerometer is overkill for the sensor needs and a drain on the available power. There are two primary applications that come to mind where a no power vibration sensor is needed, environmental monitoring and perimeter detection. In both cases, one is looking for general information capable of event detection, as opposed to high-fidelity waveforms. One or both of these applications will provide the specific project direction needed for success (as defined by the project).

**Project Scope and Deliverables**

The scope of the first year of the project is primarily focused on exploring designs for harmonic oscillators, transduction methods, and ways of nesting multiple oscillators. Ideally there will be some optimization work and proof of concept.

## Task 14 Deliverables

| | Task 14 - Deliverables | Delivery (days) |
|---|---|---|
| 7.1 | Submit a document outlining possible harmonic oscillator designs with transduction methods and high level pros and cons | 90 |
| 7.2 | Submit a document analyzing more in depth the various oscillator designs. (Hand calculations or modeling, with estimates of efficiency and frequency spectrum) | 120 |
| 7.3 | Submit a document identifying the design(s) to pursue further and the reasons for the choices | 270 |
| 7.4 | Demonstration hardware of a couple of the more favorable harmonic oscillator designs and report findings in quarterly report | 360 |