

# Adaptive compressive sensing techniques for low power sensors

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**Project Overview and Description** 

# Project Description

 investigate the need, benefits, and circuit techniques to implement adaptive compressive sampling schemes in sensors with compressive sensing techniques.

## Problem

- Most compressive sensing sensors assume the sparsity of sensor signals is relatively stable and hence use fixed compressive sampling schemes.
- The sparsity of certain sensor signals may exhibit significant fluctuations. Thus, adaptive compressive sampling potentially leads to more power-efficient implementations.

### Approach

- Perform system-level simulation with using realistic sensor signals (Multi-parameter Intelligent Monitoring in Intensive Care database) to study the fluctuations of signal sparsity.
- Based on system-level power models, study the potential power saving by adaptively adjusting the compressive sampling schemes.
- Develop new circuit techniques to address the challenges on implementing adaptive compressive sensing (ACS).

#### **Project Status**

- Study of signal sparsity fluctuation is completed. It shows the validity of adaptive compressive sensing
- The investigation on potential power saving is complete. It indicates significant power can be saved by ACS
- Matlab simulation package for checking the applicability of ACS and potential power saving is available for member companies
- Current work focuses on the design of analog circuits to be used in ACS

#### **Project Tasks/ Deliverables**

	Description	Date	Status
1	Investigating the applicability of adaptive compressive sensing and demonstrating the potential power saving	8/13	Completed
2	Improve and encapsulate the matlab programs into a simulation package	10/13	completed
3	Design of analog wavelet transform circuit	03/14	On-going
4	Establishing the relation between circuit output and desirable sampling size; evaluating its effectiveness	07/14	

#### **Executive Summary**

- Compressive sensing is emerging as a new technique in ultra-low power sensor design.
- Adaptive compressive sensing can potentially result in further power saving.
- The project investigates the **need**, **benefits**, and **circuit techniques** to implement adaptive compressive sensing schemes.
  - An interesting application area of the developed technique is in the design of biosensors that are parts of body area network and communicating with mobile devices



Source: Baheti, P.K.; Garudadri, H.; "An ultra-low power pulse oximeter sensor based on compressed sensing," Sixth International Workshop on Wearable and Implantable Body Sensor Networks, pp. 144-148, 2009.