

Adaptive compressive sensing techniques for low power sensors

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Project Overview and Description

Project description:

 Our current research indicates adaptive compressive sensing (ACS) is an attractive power saving technique for low-power biomedical sensors; The proposed efforts investigate circuit techniques to implement ACS at sensor nodes

• Specific problem to be addressed:

 How does a *simple* sensor node decide *when* and *how* to adjust sampling size in ACS

Proposed Solution:

 Using *low-power & low-accuracy* analog wavelet transform circuit to monitor signal sparsity variations

Target Applications:

 Low-power biomedical sensors that form a body area network and communicate with mobile devices, such as smartphones.

Approach

- Develop the proposed circuit using a 0.13µ
 CMOS technology
- Establish the relation between circuit output and desirable sampling size M



- Evaluate the effectiveness
- Demonstrate power saving by system-level simulation (ACS sensor power estimator being developed in the current efforts will be used in this task)

Project Tasks/ Deliverables

	Description	Date	Status
1	Design of analog wavelet transform circuit	12/13	
2	Design of integrator- and counter-based circuits for generating sparsity indication signal	03/14	
3	Establishing the relation between circuit output and desirable sampling size; Evaluating the effectiveness	05/14	
4	Demonstrating power saving by using the proposed circuits with ACS techniques	06/14	
5	Investigating the lower power bound for the proposed approach	07/14	

Technical Detail

Analog wavelet transform circuit

– Using a group of filters which correspond to the wavelet functions with different scale σ values



- Difference between ours and others' approaches (why can we make it ultra-low power?)
 - Use circuit outputs as indicators for signal sparsity, don't reconstruct the original signal from circuit outputs
 - Relaxed accuracy requirement; don't have to be always on
 - Tolerance to "false positive results" (indicating signal dense, but sparse)

Technical Detail

Generating sparsity indication signal



Focus of the investigation:

- Circuit design
- The relation between circuit outputs and desirable sampling size
- evaluation of its effectiveness
- Investigating its lower bound on power consumption; comparing the power consumed (by the proposed circuit) and the power saved (by ACS)
- New circuit design techniques