Group 3

3.6 Adaptive Compressive Sensing Techniques for Low Power Sensors, Pis: H. Wang, S. Tragoudas, SIUC

Center for Embedded Systems

An NSF Industry/University Cooperative Research Center

Adaptive compressive sensing techniques for low power sensors

PIs: Haibo Wang and Spyros Tragoudas
Students: Naresh Mudhireddy, and Adam Watkins

Dept. of ECE
Southern Illinois University Carbondale

SIU Southern Illinois University CARBONDALE

NATIONAL SCIENCE FOUNDATION

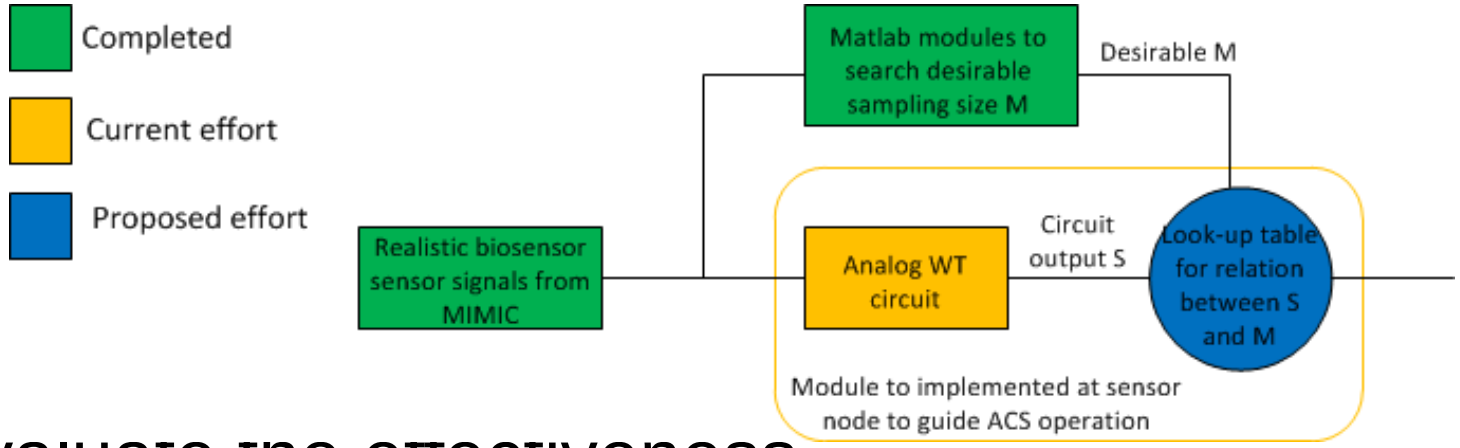
ASU Ira A. Fulton Schools of Engineering ARIZONA STATE UNIVERSITY

Project Overview and Description

- Project description:
  - Early phase of the project 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 savings by system-level simulation (ACS sensor power estimator being developed in the current efforts will be used in this task)

Project Status

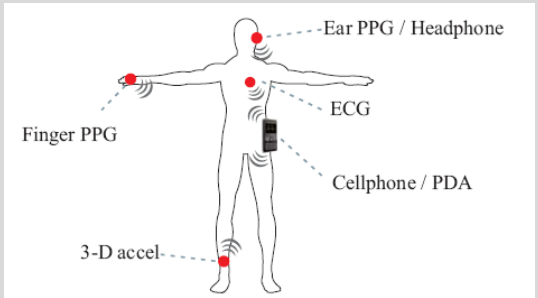
- Study of signal sparsity fluctuation is completed. It shows the validity of adaptive compressive sensing
- The investigation on potential power savings is complete. It indicates significant power can be saved by ACS
- Matlab simulation package for checking the applicability of ACS and potential power 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	Select a set of wavelet functions to be implemented	**10/14**	
2	Obtain stable transfer function and start analog WT circuit development work	**01/15**	
3	Complete the development of analog WT circuits	**04/15**	
4	Establish the relation between analog WT circuit output and signal sparsity	**06/15**	
5	Investigate the effectiveness of the proposed approach	**07/15**	

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.