SRC/ SRF/ NSF Forum on Integrated Sensors for Cybersystems - FI SC 2030

Session VI: FI SC Perspectives: Research Needs and Potential Responses

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What We Do …

• Define industry research needs

• Coordinate research across the research ecosystem

• Provide early and easy access to university research results

• Facilitate interactions with faculty and students

• Provide access to students who are seeking jobs

• Leverage research investment
 SRC Numbers

SRC Research Programs

- $1.747B invested by SRC Members
- 3,225 contracts
- 9,195 students
- 2,025 faculty members
- 261 universities

Deliverables*

- 43,070 technical documents
- 377 patents granted
- 908 patent applications
- 944 inventor awards
- 677 software tools
- 2,944 research tasks/themes

Publication growth from SRC Universities

Inception through 2Q 2011 (updated 7/5/2011)
FISC Challenge:

Defining pre-competitive research that is:

- Critical to industry needs
- Adequately focused
  - Has a significant leverage research potential
  - Maximizes synergies
  - Minimizes conflicts of interest
  - Generates appropriately trained students
Example of an SRC center

**TxACE**
Texas Analog Center of Excellence

- Primary focus on design with UT-Dallas in a lead role
- Other faculty/universities participated in and out of Texas
- Startup funds from state, university, TI.
TxACE supported universities

- Arizona State
- Oregon State
- UC Berkeley
- Stanford
- Washington
- Minnesota
- Iowa State
- Iowa State
- Arizona State
- Illinois
- Ohio State
- New Mexico State
- Texas Tech
- Texas Tech
- Texas Tech
- SMU
- UT Austin
- Texas A&M
- Rice
- UT Dallas
- UT Dallas
- UT Dallas
- UT Dallas
- UT Dallas
- UMass
- CMU
- RPI
- Yale
- Columbia
- MIT
- Cornell
- Seoul National U
- Georgia Tech
- NUI Maynooth
- Cambridge
- UC Berkeley
- UMass
Some Potential Research Topics (1/4)

- New devices, tools, and techniques for power reduction
  - lightweight/small form factor power provision, and energy harvesting.

- Models for information extraction from multi-sensoric data
  - Need efficient frameworks for extracting information from data
  - Understand such frameworks from the perspective of low-power platforms

- Self-test for sensors

- New architectures and algorithms to meet security, throughput, and latency requirements of sensor networks (both the sensor itself and any network to which it connects).

- Given different/alternate sensor platform media, such as paper, new architectures and optimization for such
Some Potential Research Topics (2/4)

- Ambient Intelligence architectures
  - Standardized interfaces for ubiquitous sensors
  - Data management
- Networks for ubiquitous sensors
- NEMS scaling
  - Read-out schemes to minimize mismatch
  - Noise minimization
- Bio-sensors for (semi) permanent monitoring
  - Need breakthrough understanding of surface science, novel materials, etc. A multi-scale challenge
- nm-scale for gates for Si pore structures
- CAD for multi-scale sensor design
- Wafer-scale design/packaging technologies
Some Potential Research Topics (3/4)

- How to make long-term reliable (unattended) implanted biosensors that work for many years in harsh environments
- How to make good pumps and valves on chip (borrow ideas from nature)
  - Photo switchable materials – light activated valves
  - Electrostatic pumps
- Better modeling for all aspects of sensors, both physical and electronic, from nano-element level to system level
- Research in advanced functional materials – how to better functionalize various sensors
- How to deal with not only noise but element variability, selectivity, and “signal to interference”
Some Potential Research Topics (4/4)

- Information 'taming'; context-aware, real-time automated data management, to autonomically transform data into information, and subsequently, into knowledge.

- Standardization of design, fabrication processes, and materials utilized in sensor manufacturing to replicate the success of having a shared platform such as CMOS technology.

- Better integration of multiscale device simulation and design tools, sensor development tools 'from atoms to systems'.
A vision…

- Ambient Intelligence Technology – from sensors to dynamic swarms to mobile devices to cloud

Built from critical elements…

- Sensor self-testing
- CAD tools for sensor design
- Materials for sensors
- Energy efficient devices
- Secure and reliable operation
- Swarm OS
- ......