

# **UCLA**

## **Posters**

### **Title**

Networked Infomechanical Systems-NIMS

### **Permalink**

<https://escholarship.org/uc/item/95c2h8th>

### **Authors**

Roja Bandari  
Victor Chen  
Willie Chen  
et al.

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## Networked Infomechanical Systems (NIMS)

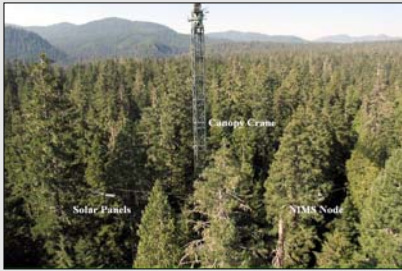
**NIMS Undergraduate Students:** Roja Bandari, Victor Chen, Willie Chen, Wendy Gwo, Eric Lin, Kris Porter, Rachel Scollans, Michael Stealey, Lynn Wang, Eric Yuen. **NIMS Graduate Students:** Maxim Batalin, Robert Gilbert, Jason Gordon, Aman Kansal, Xiangming Kong, Duo Liu, Chris Lucas, Richard Pon, Mohammad Rahimi, Nithya Ramanathan, Lisa Shirachi, Arun Somasundara, Jeffrey Tseng, Ashutosh Verma, Winston Wu, Yan Yu. **NIMS Faculty:** Richard Ambrose, Deborah Estrin, Michael Hamilton, Mark Hansen, Tom Harmon, Jenny Jay, William J. Kaiser, Gregory J. Pottie, Mani Srivastava, Gaurav Sukhatme, John Villasenor

### Introduction: Robotic Networked Wireless Sensing for Environmental Monitoring

- **New Requirements**
  - Measurement and detection in complex environments
  - Sampling of air, water, and soil.
  - Coverage of large spatial and temporal scales
- **Fundamental Challenges**
  - Unpredictable and large sensing uncertainty
  - Limited energy and operating lifetime
- **Research Goals**
  - Enable Sensor Diversity and Coordinated Mobility for *self-awareness* of sensing uncertainty and autonomous adaptation to maximize sensing fidelity.
- **Application Goals**
  - Distributed sensing in Natural and Civil Environments
- **Education Goals**
  - High School, Undergraduate, and Graduate programs

### Solutions: NIMS Nodes and Infrastructure

NIMS at the Wind River Canopy Crane Research Facility – September 2003



NIMS2 at the James Reserve



NIMS2 the James Reserve



NIMI at James Reserve



Imaging Phenology: Direct Growth Tracking



### Information Technology Research, Applications, and Education

#### Information Technology Research

- **Information Theory Foundations**
  - Hierarchical *System Ecology* of fixed and mobile nodes with infrastructure.
- **Sensor Diversity**
  - Diversity in sensor node location, orientation, and sensor type.
  - Enables distributed mapping of sensing uncertainty.
  - Enables distributed calibration of sensing channel
- **Coordinated Mobility**
  - Physical transport of nodes and modification of infrastructure.
  - Enables proactive methods for reducing sensing uncertainty through optimized diversity and sampling.
  - Enables reactive methods that bring optimized sensing resources to bear.
- **NIMS Tools**
  - NIMS System emulation
  - NIMS System Operation Authoring

#### Environmental Science And Public Health

- **Natural Environment**
  - Fundamental studies of ecosystems
  - Focus on meteorology, phenology, carbon budget, global change indicators
  - Sensing, imaging, and spectroscopy.
  - Sampling of atmosphere, water.
- **Public Health Environment**
  - Constantly vigilant monitoring and distributed detection of pathogens
  - Focus on coastal wetlands and urban water resources



#### Education Programs

- **Undergraduate and Graduate Courses**
  - Embedded Computing
  - Sensing and Imaging
  - Networked Robotic Systems
- **Undergraduate Research Programs**
  - Multidisciplinary undergraduate research teams
- **Grade 7-12 Education Programs**
  - Engage student and teacher communities in science and engineering
  - Real-time, remote Web access to active, controllable NIMS systems

