Title
Networked Infomechanical Systems (NIMS)

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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

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