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Title
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Center for Embedded Networked Sensing

Water Quality Sensing & Sampling

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Introduction: Watershed Health and Water Quality

Anthropogenic Influences

- **Landscape Changes**
  Developments cause physical changes in streams and the surrounding watershed. These alterations result in noticeable changes in stream dynamics. Some alterations include: reduction in tree cover, changes in stream substrate, channelization of runoff, and widening of stream basins.
- **Nutrient and Pollution Loading**
  Streams receive nutrients and chemicals through runoff and subsurface flow. In developed areas, nutrients and other pollutant loads increase. Some pollutants include: nitrate, ammonia, phosphates, heavy metals.

Ecological Response

- **Algal Blooms**
  Algae responds quickly to fluctuations in stream conditions. Changes in nutrients, light, substrate, etc. can enable increased algal production. ***Algal blooms*** can cause a variety of negative effects: fish/invertebrate kills, foul odors, reduction in ecosystem quality, aesthetic degradation, toxicity, and loss of recreational waters.
- **Other Water Quality Effects**
  Waste waters can also carry harmful bacteria and toxic chemicals, which can be an significant public health risk in recreational waters.

Problem Description: High Resolution Spatial and Temporal Water Sensing

Algal blooms and other negative stream conditions result from dynamic, interrelated factors. Understanding complex biotic and abiotic interactions require multi-scale, high-resolution measurements. Stream conditions can change rapidly. Conventional low-resolution field sampling may miss important system dynamics.

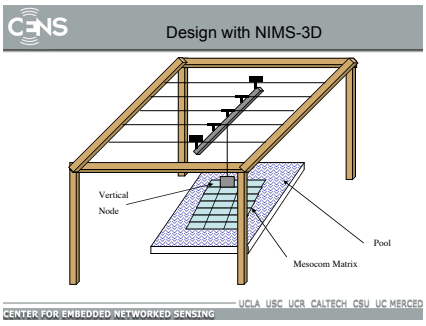
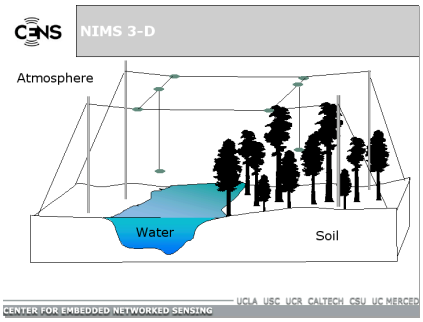
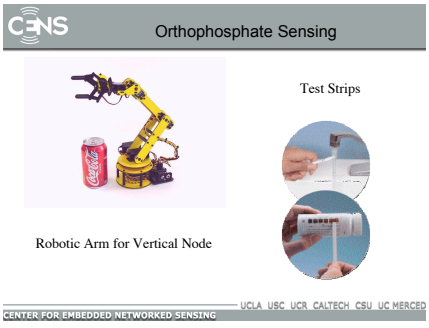
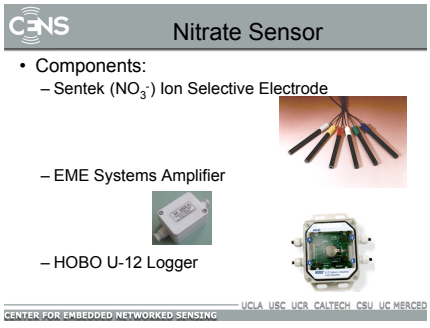
Proposed Solution:NIMS-2D & 3D high resolution sensing and sampling

Water sensing with NIMS:

- ISE nitrate sensor: virtually continuous nitrate readings
- Orthophosphate test strips: remote phosphate testing
- Algal cover: quantifying algal type and density using digital PTZ camera
- PAR sensor: light regime mapping through continuous light readings

Future possibilities:

- Other water quality measurements: DO, pH, temp, conductivity, turbidity.
- NIMS node networked with fixed aquatic sensors
- Node taking grab samples for lab analysis.

Lab system and Field System:

- NIMS-3D Lab system: stream can be monitored under controlled lab conditions.
- Field System: Deployment of NIMS at the Ballona freshwater wetland next spring.