

# Environmental Energy Management in Sensor Networks

Aman Kansal, Dunny Potter, Mani Srivastava  
NESL – <http://nesl.ee.ucla.edu>

## Introduction: Exploit Environmental Energy to Increase System Lifetime or Performance

### Energy Harvesting

- Battery life and performance can improve with extra energy
- Ample opportunity in real deployments



### Managing Environmental Energy

- In Distributed Systems: Performance improves if tasks are intelligently shared
  - Richer nodes take more load
- Learn the energy environment
  - Looking at the battery status is **not** enough

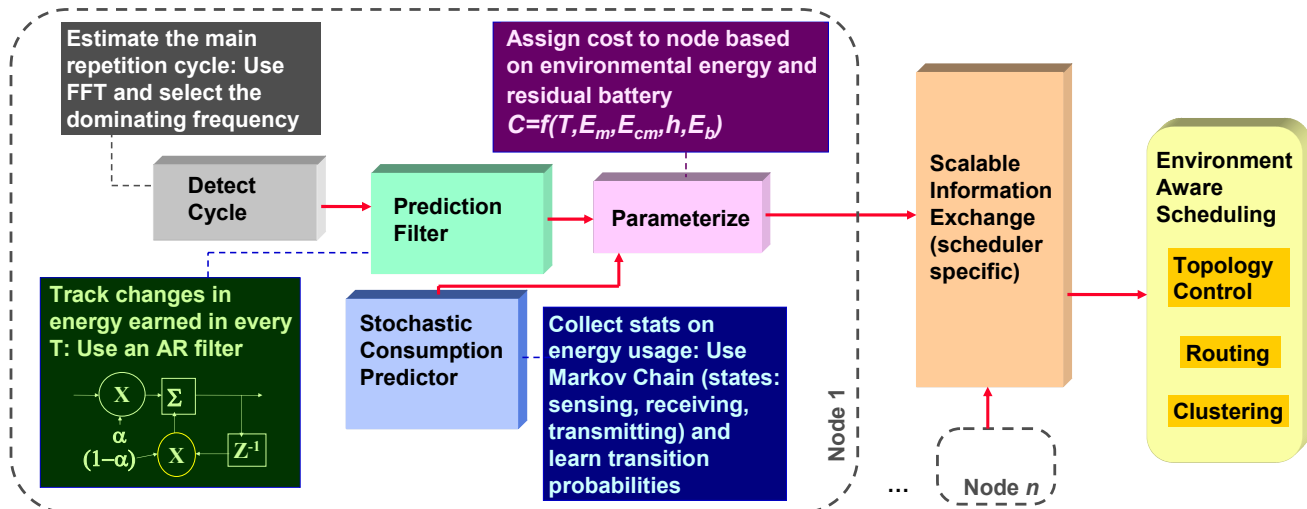


## Problem Description: Get maximum work from the available energy

- Need distributed method to learn the environmental energy opportunity at all nodes
- Global task sharing among the nodes to optimize performance in locally learnt environment

## Proposed Solution: Locally measurable cost metric with distributed scheduling algorithm

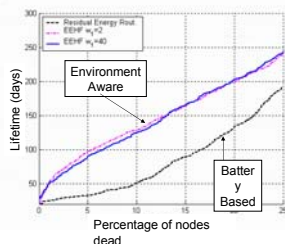
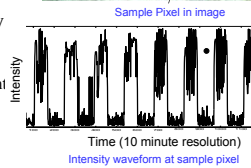
### Overall Framework



### Simulation Studies

James Reserve Data:

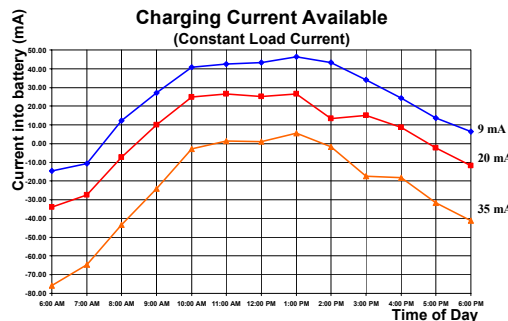
- Pixel intensity used to approximate the light intensity at a node
  - Solar cell current varies approximately linearly with light intensity while voltage stays constant
- Data collected at 10 minute resolution for 40 days



### Hardware Implementation

#### • HelioMote test-bed

- Recharge batteries from solar energy
- Track energy received from sun
- Provide residual battery status
- Provide constant voltage to load as battery voltage degrades



- Routing and distributed environment aware scheduling being tested on hardware
- Developing theoretical bounds on the performance for a given environment