**Background & Motivations**

**Multiple missions**, each with different requirements, may share common sensors to achieve their goals.

**Perimeter defense**
- To have adequate sensors along the perimeter

**Target tracking**
- To have enough sensors along the track of the target

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**Sensor network monitoring**

- **Purpose**: continuously monitor sensors’ status (i.e., aliveness, battery state, etc.) and quickly detect coverage hole
- **Coverage hole detection**:
  - Use theoretical geographical techniques, e.g., Voronoi diagram, K-coverage
  - Require information about both sensor status and mission requirement

**Mobility assisted sensing**

- **Motivations for sensor relocation**
  - React to sensor failure
  - React to events (e.g., fire, chemical spill, incoming target): more sensors move to achieve a better coverage

**Challenges of sensor relocation**:
- It has strict time, power constraint
- Relocation should not affect other missions

**Part I: finding the redundant sensors**:
- Similar to the publisher/subscriber problem
- Flooding has too much overhead
- Use cascaded movement

**Part II: relocating redundant sensors**:
- Directly moving the sensor to the destination suffers from long delay and unbalance power consumption
- Use cascaded movement

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**Sensor network monitoring**

- **Mission oriented**: satisfy the coverage requirement of perimeter defense, but present a coverage hole for target tracking

**Previous work on sensor status monitoring**
- **Centralized approach**: sensor status is aggregated and sent to a base station
- **Distributed method**: each node is monitored by its one-hop neighbors. It only detects the isolated failure pattern
- **Based on network topology continuously learned**: large overhead for sensor networks

**Our solutions**: a distributed poller-pollee structure

- The sensors are organized into clusters, with cluster head to be the *poller* and cluster members to be the *pollees*
- Our objective is to minimize the number of pollers subject to the constraint of bandwidth allocated to the monitoring purpose

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**Co-Design of monitoring and coverage hole detection**

- **Coverage hole estimation** is executed by the sink whenever the mission requirement is changed
- **The sensor monitoring** is executed continuously, but should dynamically adapt to the mission within the area of interest

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**Prototyping**

- UC Berkeley: COTS Dust
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- Rockwell: WINS
- UCLA: WINS
- JPL: Sensor Webs

- Currently evaluate with ns.
- Considering prototype with commercial off-the-shelf component. Each -- robot is small (5” x 2.5” x 3”) and costs under $200 each
- Mobility, built from remote-controlled toy cars.
- Runs TinyOS, based on Berkeley Mica Motes, has processor and wireless communication.

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