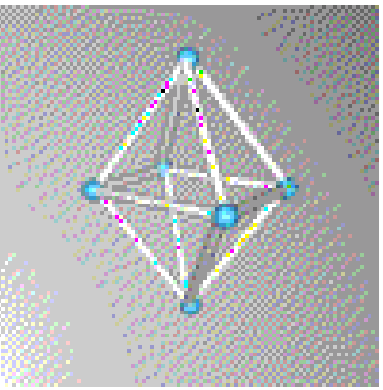
Experiments in Sensor Network Applications: *Kansei Testbed*



Anish Arora

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Motivation for experimentation

Our experience over the past five years in dealing with sensor network and their applications has been:

- progressive increase in scale :
  - from 10 $\rightarrow$ 100 $\rightarrow$ 10,000 nodes
  - concomitant increase in component depth and interaction complexity
  - comcomitant observations of “phase transitions”, whereby component fail to meet the demands of higher scale

- progressive increase in robustness, deployment, & reliability issues:
  - complex failure modes are emerging
  - limited node and network capacity imply nontrivial event loss
  - byzantine nodes

- simulations have been inadequate to validate solutions, experiments have been necessary

Kansei Testbed at Ohio State

- Testbed to be located in a 5800 square foot warehouse near the Ohio State campus, leased for us by OSU's College of Engineering

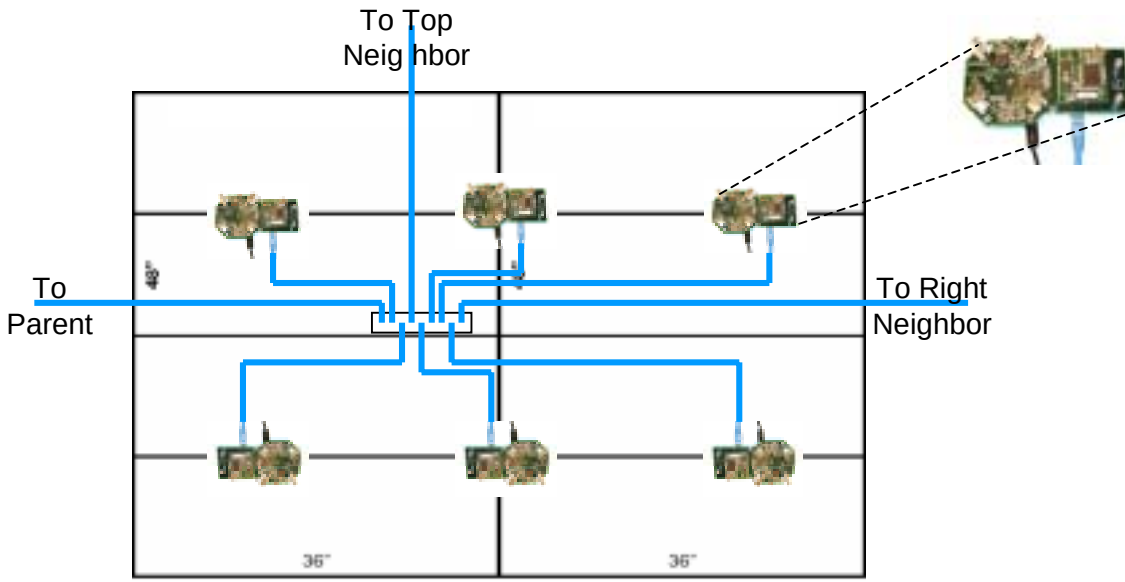
- Comprises a hierarchy of sensor node platforms:
  - Tier 0: "dumb" sensors, actuators, DAC modules
  - Tier 1: smart dust sensor nodes (200)
  - Tier 2: StarGate sensor nodes (200)
  - Tier 3: pursuer and evader robots (planned)
  - Tier 4: application servers (PCs) running .Net (3)

Testbed components

- Tier 0:
  - Sensors: CO_2, dissolved O_2, light, pH, relative humidity, temperature, conductivity, mold
  - Actuators: water heaters, pumps, emitters, bubblers, portable heaters, ultrasonic humidifiers, CO_2 generators
- Tiers 1 and 2:
  - Sensors: photocell, PIR, MIR, temperature, magnetometer, microphone, GPS
  - Actuators: buzzers

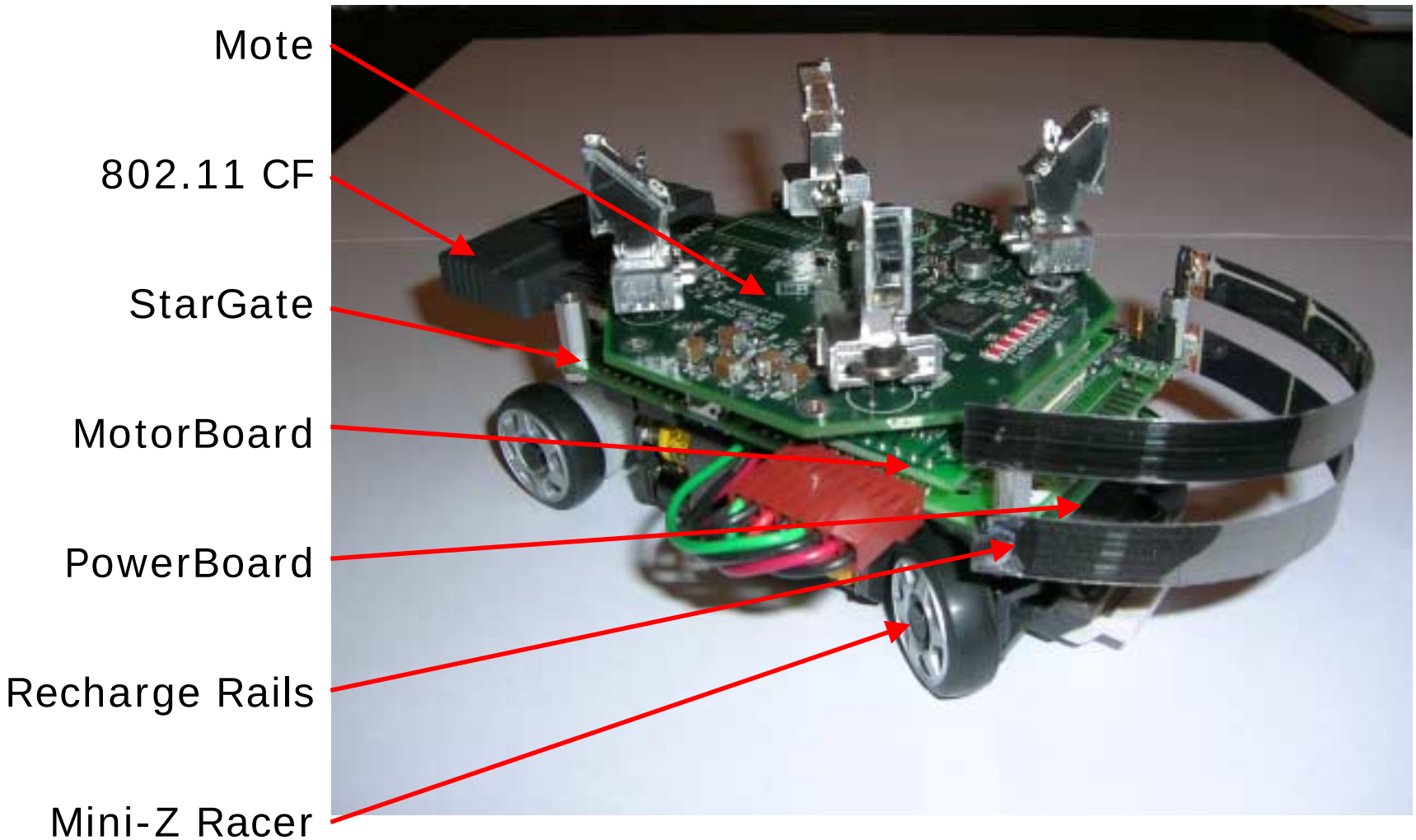
Tier 1 & 2 nodes will be on an off-floor deck

- For physical reconfiguration, nodes partitioned into modules
  - abutted to form various desired planar topologies



- Nodes powered & out-of-band monitored using Ethernet

Tier 1 & 2 nodes will eventually be mobile: Mote-on-Wheels



Tier 3 robots will be on the second deck

Some other testbed features

- Remote instantiation of experiments
- Hybrid simulation and experimentation:
  - can drive experiments through field-recorded sensor stimulus
- Recording and playback of results through out-of-band network