Software

Confidence

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- *Sympathy* originally proposed to improve quantity of data (SenSys '05)
- http://www.lecs.cs.ucla.edu/~nithya/publications.htm
- Now, *Confidence* to improve **quality** and **quantity** of data
- Software that detects and diagnoses faults as they occur enable users to fix problems and validate questionable data that impact the quantity and quality of collected data
- TinyOS components of Confidence/Sympathy available as part of Emstar checkout

Tenet and Centroute

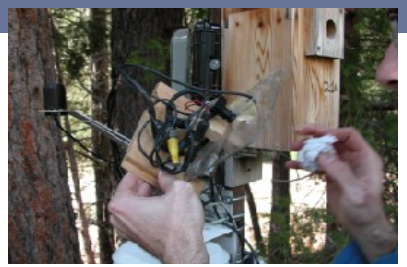
- Centroute: a centralised routing layer for tiered networks
  http://lecs.cs.ucla.edu/~thanos/papers/centroute.pdf
- Currently used in deployments at James Reserve and Botanical Gardens, UCLA, in conjunction with Extensible Sensing System (ESS)
  http://research.cens.ucla.edu/projects/2006/Systems_Infrastructure/ESS/
- Centroute is a perfect fit for Tenet (Architecture for Tiered Embedded Networks) http://enl.usc.edu/projects/tenet/
- Centroute being implemented to replace Multihop as routing layer

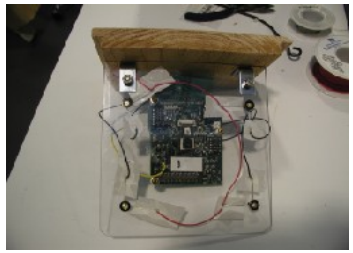
http://cvs.cens.ucla.edu/emstar

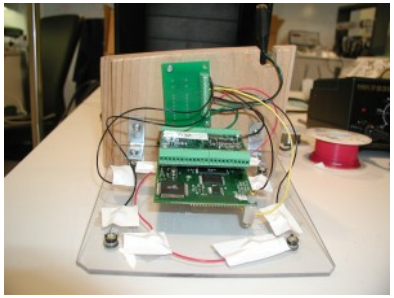
Hardware/Drivers

Cyclops

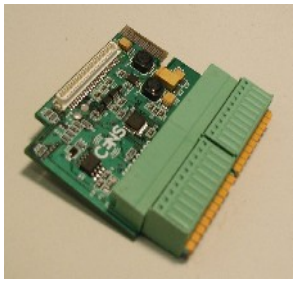
- Most recently, 25 node nest-box deployment at James Reserve, San Jacinto Mountains
- On the horizon:
- External flash support for Cyclops – prototype 500MB flash in testing





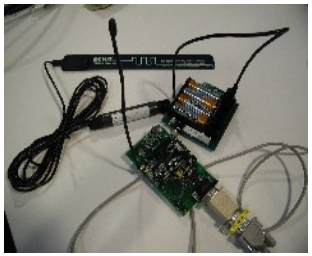


MDA2400



- 'New' MDA300
- Easier to attach sensors
- ATMega processor on board to delegate data acquisition
- Communication with board happens through UART
- More simple interface to acquire data, offloads building drivers

ONSET Mote



Collaboration with ONSET Computer Corporation
http://www.onsetcomp.com/

- Allows a Mica2 mote to query data loggers, communication over UART
- Highly desirable for the domain scientist:

  i. Familiar, trusted, sensors (incl. smart sensors)

  ii. Enables wireless data collection, ESS as data collection mechanism

  iii. Reliability (data can still be manually retrieved from logger)

  iv. Minimal disruption to existing deployments (James Reserve)

Real time system interaction to improve data integrity

CENTER FOR EMBEDDED NETWORKED SENSING

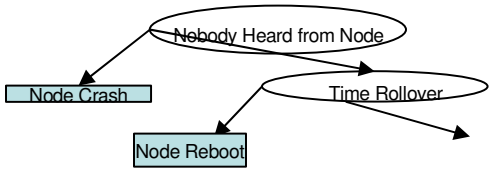
Hardware and software faults impact the quantity and quality of collected data

- - e.g. Mis-calibrated or bio-fouled sensors => low-quality data
- - e.g. Faulty network hardware and unreliable wireless channels => low quantity of data

Software that detects and diagnoses faults **as they occur** enable users to fix problems and validate questionable data that impact the **quantity and quality of collected data**

Sympathy to improve quantity of data

- Statically defined decision tree analyzes system metrics periodically collected from the network to detect and diagnose faults. Suggests actions users can take to fix the worst fault.



Conclusion: Static thresholds make system inflexible to changing environmental conditions or different deployments

Confidence to improve **quality and quantity** of data

- Each data point from a sensor is translated into a feature vector and mapped into the pre-defined feature space; data quantity features are similar to system metrics collected by Sympathy and data quality features are selected based on domain experience with sensors (e.g. gradient of sensor data).
- Similar vectors are grouped together using a simple on-line clustering algorithm
- Clusters that are far from the origin in this space or are located in unpopular (i.e. anomalous) regions in the space are faulty
- Confidence learns effective diagnoses by recording those actions that result in points moving from a faulty cluster to a good cluster.

Conclusion: Clusters enable notions of faults and diagnoses to adapt over time and place, and to different sensing modalities.

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