A Wireless Seismic Sensing Array

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Introduction: Multihop Wireless Seismic Data Collection

Hardware

- **Mica2 motes as sensor nodes**
  Atmel ATMEGA128L Microcontroller,
  Chipcon1000 radio chip,
  vibration mote.
- **Wireless sensor data collection**
  Greatly simplify deployment.

Techniques and Software

- **Rate-limited Transmission**.
  - Sampling rate/Bandwidth adaptive transmission control.
  - *p-factor* scheme
- **Hop-by-hop Reliable Transmission.**
  - Application layer *NACK* mechanism.
  - Tree topology.

Goals

- Deploy 15 node network in the **Four Seasons forced vibration** testing
- Deploy 10 nodes on the **Factor building**

Problem Description: Multi-hop Reliable Transport

Large Data Volumes

128Hz sampling rate generates 256 Bytes data per axis per node per second.

Low Radio Bandwidth

Less than 3Kbps effective bandwidth experienced in Mica2, traffic congestion likely.

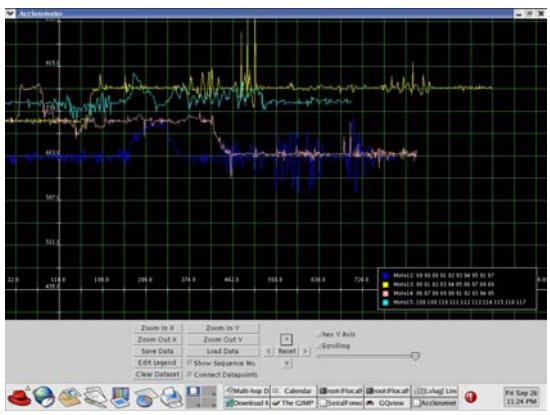
Poor Radio Link Quality

More than 10 percent packet loss rate per link is common.

Proposed Solution: Data Compression, Rate-limited, NACK-based Reliable Transportation

Assumptions

- Each node knows its parent and children, forming a delivery tree rooted at the base station.
- *p-factor* assumption: we assume that no more than *p* percent of the time there will be vibration.



Implementations

- **Data Compression**
  - Using run-length encoding for silence suppression.
  - Using Lempel-Ziv (LZ77) compression to reduce the size of vibration data set.
- **Rate-limited Transmission**
  p-factor rate-limited sending scheme: data rate is set to *p*2*r* bytes per second, where r is the sampling rate.
- **Application Layer NACK Reliable Protocol**
  - Hop-by-hop error recovery.
  - *NACK* piggyback in data packet.
- **Base Station**
  - GUI data visualization.
  - Mysql back-end database.