MoteLab: A Web-enabled Sensor Network Testbed

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Sensor Net Testbed for the Masses

Web access to a permanently-deployed sensor net testbed
- User logs into Web page
- Uploads binaries and descriptions of message types to log
- User schedules job for open slot, with time limits
- Back-end reprograms nodes at the appropriate time

Automatically log messages from every node
- Create database tables for each run
- User supplies MIG-generated Java classes describing message formats
- Data logging, debugging, visualization

Access data in real-time or from archive after run
- Connect to live database to receive data in real time
- User can download complete dump of database tables after run

eMote - Ethernet-connected mote
Crossbow, Inc.

- All data sent to mote’s serial port available on TCP port
- Another TCP port used for reprogramming with uisp
- Power-over-Ethernet possible

Next Steps

Integrate in-situ power monitoring
- Ethernet-connected digital multimeter attached to one eMote
- Capture high-resolution amperage traces
- Trigger trace based on mote I/O pins

Roll out to other research groups
- Intel Research Berkeley, MIT, UCLA, Crossbow
- Public CVS access available soon

http://motelab.eecs.harvard.edu

MoteLab Architecture

Web front-end implemented in Apache and PHP
- Clean mechanism for scripting access to job description database

Perl program for maintaining job schedules
- Check job schedule database periodically
- Reprogram nodes according to next job on schedule
- Launch database logger daemon

Java-based database logger daemon
- Creates database tables for each message type
- Based on inspection of MIG-generated classes provided by user
- Reads and parses messages read from each mote’s serial port
- Log each received message to database

Harvard Student Projects

35 students captured RSSI traces in CS building
- Low correlation of distance and RSSI
- Node and antenna orientation, doors/walls, etc. more significant

Power-adaptive, secure multihop routing
- Basis for in-hospital vital sign monitoring project
- Tune transmit power of CC1000 to achieve optimal connectivity
- ECC-based key distribution scheme on top of TinySec

MoteTrack: RSSI-based localization scheme
- Use RSSI “signatures” to profile connectivity
- Able to track mobile node location to 2-3 m

Current Deployment at Harvard

20 nodes currently deployed, moving up to 40
- Bottleneck: Finding available network ports

Radio Connectivity Map

Default transmit power, 50% receive rate for link

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