GeoNet: a platform for rapid distributed geophysical sensing

Igor Stubailo, Dustin McIntire, Martin Lukac, Paul Davis, William Kaiser, John Wallace, Deborah Estrin
University of California, Los Angeles

Developing GeoNet and Field Tests

- Technical objective - collaborate with Reftek to construct a new generation digital acquisition system (DAS) based on the CENS developed LEAP (low-power energy aware processing) hardware. Design a versatile modular instrument to accommodate needs of scientists with different requirements.

- Very efficient 24-bit ADC with built-in GPS receiver and storage. Ability for sleep scheduling allows using much smaller batteries. ADC system: 3-6 channels of 200Hz data.

- Lifetime of at least 1 Month on internal lead-acid 12AH battery and case sized solar panel.

- Data time stamping with GPS and with wireless network time synchronization.

- Low power 13 Mhz duty cycle mode to collect data and run event detect. 10-15 VDC, 750mW with RX/TX active, 200mW without.

- System detects events and store them in internal flash memory and periodically sends data via wifi to a central data center.

- The data logger is compatible with passive and active sensors like L4Cs and Episensors.

- CPU, USB, CF, Ethernet, Bluetooth, RAM, ROM, 802.11bg, GPS (internal and external), Linux, DSP.

- Science Objectives and Deployment Benefits, FlexiRAMP

Science Objectives

Use a rapidly installable wirelessly linked seismic network to make near-real time unaliased observations in aftershock or volcanic zones.

- Frequency of aftershocks determined by size of initial shock (Omori’s Law).
  Small quakes -> aftershocks for a few weeks.
  Large quakes -> aftershocks for a few years.

- Opportunity to study earthquake propagation (branching) in the near field and separation of a source from path effects.

- Measuring strong shaking from the largest aftershock for both science and engineering objectives.

- Deployment on erupting volcanoes where early access to data and analysis is important.

- Earthquakes early warning.

- Use in both, RAMP and flexible array (FlexiRAMP), experiments.

Deployment Benefits

- Lightweight instruments allow for a rapid deployment.

- Capable to schedule entire system for communication and collaborative event detection.

- Rapid deployment on a 0.5 – 1 km grid in urban area. Geophone network of 100+ nodes.

- Battery recharged with a small solar panel. Independent of power, communications infrastructure.

- Automatic wireless configuration. Complex routing algorithm and in-network collaborative processing.

- Use of 802.11 wifi as well as cell technology for data delivery and communication.

- Provides high resolution seismic network in the near field of earthquake.

- Metric that integrates link quality and available disk space. Real-time visualization.

- Have two working prototypes.

- Tested GeoNet instruments in the field environment near Salton Sea for 3 days with earthquakes as source.

- Collected active source data near Palmdale.

- Used L4C geophones connected to GeoNet units and Kinematics’ Q330 for comparison (figure above).

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Palmdale, 02.2010