Development of earthquake early warning system using low cost seismometer

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Palert - Features

- **Pd technology embedded**
- **PGA PGV PGD output**
- Network streaming ability
- **NTP time synchronize**
- Four kinds of trig modes
  - PD, PGA, STA/LTA, Displacement
- Support both TCP server and client
- Noise performance < 0.1 gal
- Intensity meter
iTowch for backup power (4 hrs), display and sound warning
For both onsite & regional early warning purposes
Palert EEW Networking System

- EEW Server 1
- EEW Server 2
- NTP Server
- Router
- Hub
- Industrial HMI
- Modbus TCP
- Modbus RTU
- RS-485
- Internet

Intensity 5
- P Wave & Pd > 0.5cm
- -5 seconds

Intensity 4
- -10 seconds
- -11 seconds
- -12 seconds

Intensity 3
- -15 seconds
- -17 seconds
More...

- Two D/Os for equipments control or alarm
- Serial port RS-485 connectivity
- Recording data is possible by using PC Utility
- FTP upgrade firmware is possible
Palert Install location

PC Utility & Demo

![Seismic data](http://www.cwb.gov.tw/eng/seismic/quake_index.htm?)
System configuration

FIELD

Data Acquisition

- Triggering
  - TCP/IP
- Acceleration
  - Pd
  - Tc

CENTER

NTU Server

Data Clustering

Shared Memory

Data Processing

TcPd.c

Mpd location

Report
Currently installation in Taiwan
Result of the recently M5.9 earthquake

CWB EARTHQUAKE REPORT
Earthquake No.: 100029
Origin time (Taiwan Standard Time: GMT+08:00):
3/20/2011 16:05:08
Location: 22.42N, 121.40E
i.e. 45.3 km SE of Taitung County
Depth: 16.3 km
Magnitude(ML): 5.9
Local Largest Intensity:
- Taitung County: 4
- Kaohsiung City: 3
- Tainan City: 3
- Chiayi County: 3
- Yunlin County: 3
- Chiayi City: 3
- Pingtung County: 2
- Hualien County: 2
- Nantou County: 2
- Changhua County: 2
- Taichung City: 1
- Miaoli County: 1
- Penghu County: 1

LEGENDS  ★: Epicenter, Number: Intensity
Next step

• Within two years 300 sets *Palert* will install in elementary schools of Taiwan region. It will be helpful for the education of seismic hazard mitigation to our young generation.

• Not only for earthquake early warning! Real-time shaking map could be achieved for rapid reporting purpose by using *Palert* array.
Mw = 1.95 Log A + 0.006 P - 1.619
Determination large earthquake magnitude using real-time shaking map!
Thanks for your attention!