EEW distribution network developed by Disaster Prevention Research Center, AIT

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1. Introduction

Disaster Prevention Research Center（DPREC）, Aichi Institute of Technology, Japan, has organized the Consortium with enterprises in Mikawa area. Main research of DPREC is to re-distribute the Earthquake Early Warning (EEW) developed by Japan Meteorological Agency. DPREC estimates seismic intensities and arriving time (or postponement time) by using EEW information and sends them to EEW terminals installed at plants, factories and offices in Mikawa area by using internet system several and dozens seconds before arriving strong motions. The system is useful for earthquake disaster reduction by performing workers-evacuation and stopping machines and line-system before arriving strong shaking.

However, accuracy of estimated intensity and arriving time are not so high because EEW information (estimated origin time, hypocenter, magnitude) and other empirical equations for calculation have errors. For example, amplification factor of soil is estimated from geological and topographical data of a target site, therefore includes also errors. So that accuracy of estimated seismic intensity must be checked for practical use. A seismometer network has been installed at the sites for observing seismic intensities for comparing with estimated seismic intensities by EEW.

DPREC developed the EEW terminal system which can receive EEW and estimates seismic intensity and arriving time at a factory or an office of a company. Animated P and S-wave propagating front from epicenter toward a target site is displayed on a monitor. Estimated seismic intensity and margin time before arriving strong motions are also displayed on the monitor. Seismic intensities observed by seismometers at sites are took back to the server at DPREC on time by internet system and send back the distribution map of seismic intensities to a monitor at companies.

The system developed by DPREC designed for practical use for evacuation and control of facilities or machines in a factory are installed at about fifty companies and offices in Mikawa area and EEW distributing service has already started.

2. Network System

Fig.1 shows a network system in Mikawa Area installed by DPREC. Triangular symbols show the sites (companies) where EEW receiving terminal system and E-catcher type small seismometers are installed. Open circles and squares show the places where ETNA type

seismometers and AIR type seismometers are installed respectively.

E-catcher type seismometer has real time communication function with the main server installed in the DPREC office for sending seismic intensity in Japanese scale Ij, maximum acceleration αmax and spectral intensity SI via PC terminal system by using internet. ETNA type seismometer does not have real time communication function, however can obtain high quality data with high sensitive sensors. The data are collected by PHS lately. AIR type seismometer has high sensitive sensor and send high quality on-line data to DIPREC server.

EEW terminals and three types of seismometers are installed every 20km in Mikawa Area, and connected mutually through the server in DPREC via internet. By using this network system (Ai-system), EEW and observed seismic intensities are distributed to users who can confirm arriving seismic motions on the monitor in the terminal system in their office and fabrics on-time.

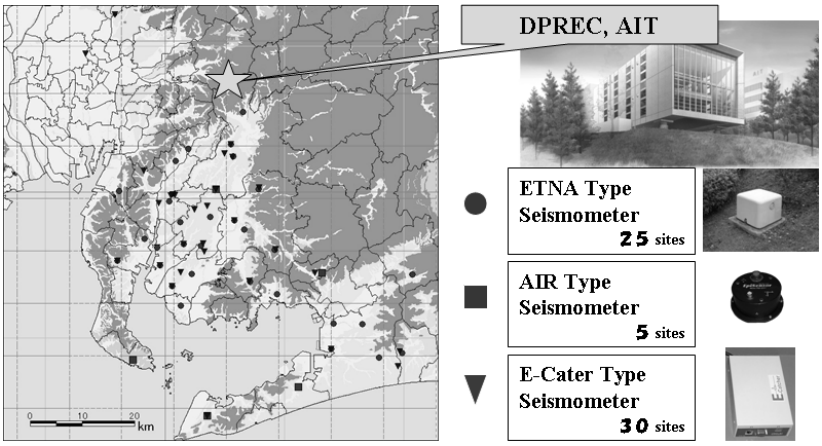

Fig.1 Network system in Mikawa Area installed by DPREC.

3. Terminal system

As shown in Photo 1, a terminal system is consist of a router, a main body of PC, a monitor, an alarm device, a contact box for controlling machines and facilities, digital cameras, a pair of E-catcher seismometers and a no blackout device by basic constitution.

Fig. 2 shows the monitor screen which can display the information as follows.

(1) An epicenter and dynamic state of propagating P-wave (yellow) and S-wave (red) front from an epicenter to predicting site marked by a triangle symbol. Numerical values are seismic intensities at five sites described in (3)(upper central).

(2) Estimated seismic intensity and a margin time before arriving strong motions at the site predicted (upper left).

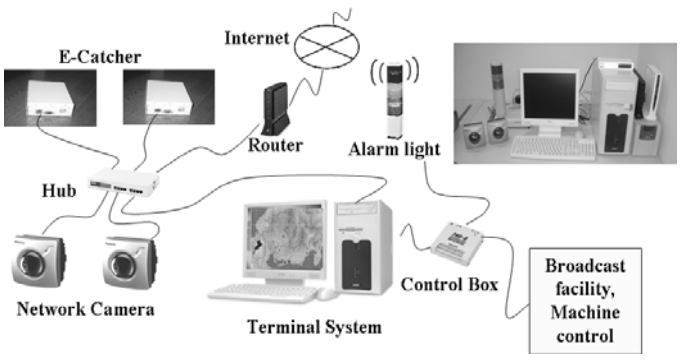

Photo 1 Terminal system installed at sites.

(3) On-time data of acceleration and seismic intensity observing by AIR type seismometers installed at five sites (central left).

(4) Time histories of seismic intensity, acceleration and SI value at the site predicted where E-catcher seismometers are installed. Two lines show values observed by two seismometers at different positions (bottom left).

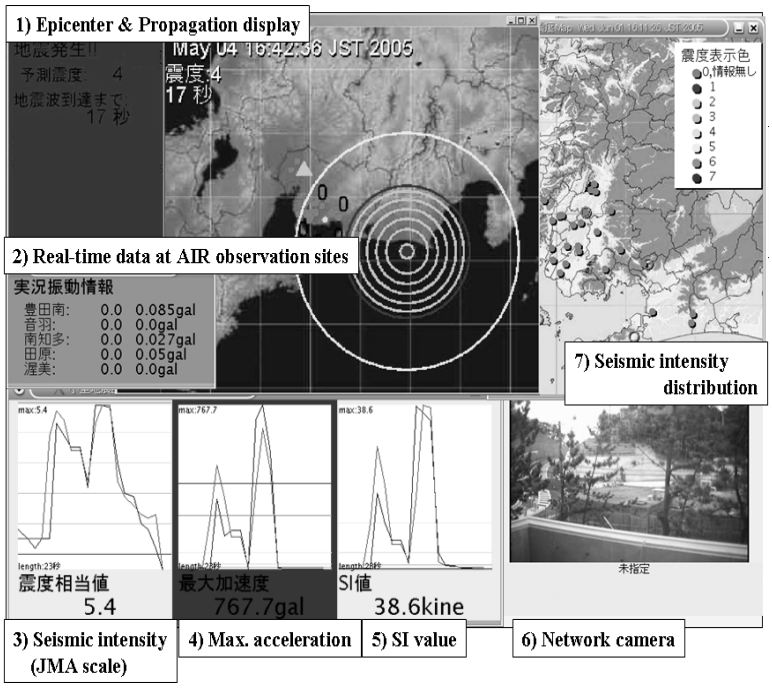

Fig.2 The monitor screen which can display the information.

(5) Outside state monitoring by cameras (bottom right).

(6) Seismic intensity distribution observed by E-catchers at other companies marked by circles. Color shows maximum intensity observed by that time at that site. Changes and increasing of seismic intensities are displayed at other companies. Propagation of strong motions in this area can be also understood (upper right).

4. Summary

Disaster Prevention Research Center, Aichi Institute of Technology, Japan, developed the re-distributing system of Earthquake Early Warning distributed by Japan Meteorological Agency and started to inform about thirty companies in Mikawa Area, central Japan, of estimated seismic intensity at the company site via internet line several or dozens seconds before arriving strong motions. The companies are making use of that system for employees-evacuation, controlling facilities, stopping machines, etc. The system developed in this study should be very useful for earthquake reduction not only at companies but also at other organizations such as schools, hospitals, social institutions, etc.

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