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i-Jishin Cloud System

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1. Introduction

Countermeasures against earthquake disaster needs to offer tools and systems that people can easily access information, surely recognize circumstances and quickly make decision to keep oneself safe. From well specialized sector; measurement of earthquake, to non-specialized sector; the public, it is necessary to provide correct information without any barriers of the specialty.

To eliminate the barriers, we try to develop a cloud system *i-Jishin* that people can join the measurement and can browse data without any difficulty.

Following the first generation network consisted of on-site recording type classical seismographs, the second generation is characterized by telemetering system. *i-Jishin* cloud system is a sensor network applying cloud environment. In addition, the system provides web services aiming collaboration in future with other social network services. These characteristics make *i-Jishin* a different network from usual one. *i-Jishin* is an experimental system for the third generation network.

2. *i-Jishin*

We develop a sensor network by iPhone, iPad and iPod touch. With an application named *i-Jishin*, the terminals can catch earthquake, record acceleration of three directions, save data in itself and upload data with geographical position to an virtual machine at cloud environment. Users can browse wave forms and power spectrum with their terminals. Analysis such as filtering and integration for velocity and displacement can be carried out by the application. The sampling rate is 100Hz with 10msec error from Coordinated Universal Time. The maximum acceleration; 2,000gal, the resolution; 1gal, the frequency range; 0.1Hz - 10Hz. The uploaded information such as the maximum acceleration, the calculated seismic intensity, the sensor position, and so on, is shown at the website with the world map.

To start measurement, *i-Jishin* can receive the trigger signal that the server sends to all terminals within 500km from the epicenter when the Early Earthquake Warning (EEW) alarmed. The farther terminal receives the later trigger time because the server adjust the trigger time for each terminal depending on the traveling time of p-wave. Therefore each terminal measures whole earthquake vibration at each site without wasting memory resources.

3. *www.geonavi.com*

We launch a website *http://www.geonavi.com/* to offer services to the public. Everybody can access the website to see active sensors connected to the server on a list as well as on a map. The timeline-map interface provides the view of the EEW occurrence with observation result. Also user can see the data of each site of each observation graphically and can download the data file to their own PC if needed.

There are notification services such as Apple Push Notification Service that send a signal after the occurrence of an event. In this case the server-terminal connection is made after the event. However, our cloud system makes the always-on connection between each terminals and the server. Using this connection and the EEW triggering, we can collect observation data without any process for event extraction. This is because the terminal sensor works only when earthquake waves certainly come. The profit of collecting event data from various sensors is supported by the server side process in our cloud server. Let us call the integrated system of terminal, server and website as *i-Jishin* cloud system.

We are planning to add services of mash up the disaster risk information that offered by government organization and other groups.

4. Conclusion

i-Jishin application has been downloaded more than 20,000 times since August, 2010. Users are now spreading to worldwide. The website is highly suggestive of possibilities in combined system of earthquake measurement with sensors and the cloud environment. Measurement is not far from ordinary public when cloud environment can connect both ends by user friendly services, as *i-Jishin* cloud system suggests.

Keywords: cloud, smartphone, earthquake observation network, social media